

EXPERIMENTAL GAUGES AT STRATHFIELD TURGISS RECTORY, HANTS.

A YLOR.

BRITISH RAINFALL, 1868.

ON

THE DISTRIBUTION OF RAIN

OVER THE

BRITISH ISLES,

DURING THE YEAR

1868,

AS OBSERVED AT ABOUT 1500 STATIONS IN GREAT BRITAIN

AND IRELAND,

WITH REMARKS ON VARIOUS EXPERIMENTS,
AND ILLUSTRATIONS.

COMPILED BY

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(Member of the Scottish Meteorological Society.)

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1869.

NOTE.

The Author being very anxious to make these Tables as complete as possible, will be obliged by information of, or from, any persons who record the fall of rain in the British Isles, but who have not hitherto communicated their observations to him. He also desires to be informed of any registers of the fall in previous years, however remote the place or period of observation, or however long discontinued.

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ERRATA IN BRITISH RAINFALL 1867.

- Page 19.—Seathwaite.—The ratios for 1864 and 1865 have been transposed.
 „ 63.—Great Torrington.—for “Newton,” read “Merton.”
 „ 67.— „ „ for “35·24,” read “39·24.”
 „ 96.—“Heydon [Royston]” should be “ „ (Audley End),” the figures are correct.
 „ 102.—Belvoir Castle.—for “27·01,” read “27·06.”
 „ „ —Sawley.—for “25·47,” read “25·57.”

ERRATA IN BRITISH RAINFALL, 1868.

- Page 44.—First line.—for “Eastern,” read “Western.”
 „ 100.—For “Vrnwy,” read “Vyrnwy.”

NOTE.—If correspondents will be kind enough to write distinctly, and make their figures unmistakable, it will curtail the table of errata, and save much time. I am sure they will excuse this hint.

BRITISH RAINFALL, 1868.

PARTLY from the considerably increased number of returns, partly from redoubled efforts to ensure accuracy, and partly from the additional completeness of the daily, monthly, and yearly abstracts, this work appears somewhat later than on any previous occasion. This, I am well aware, is undesirable ; but the progress of rainfall knowledge involves the application of modes of examination and analysis, which, when this Annual was first published, were quite unknown. Indeed two months is not an unreasonably long period in which to collect, examine, tabulate, and analyze returns from fifteen hundred stations, and, finally, to carry 150 pages of tabular matter (every figure of which is thrice read) through the press.

G. J. SYMONS.

62, Camden Square, N.W.

March 1st, 1869.

REPORT.

It has been my custom for several years to devote the earlier pages of this annual to a brief *resumé* of the principal subjects to which attention has been devoted during the preceding year. The practice is beyond all question a sound one, because it not only acts as a spur to continued progress, but also affords an opportunity for all to criticize my proceedings and point out, as I trust they always will, errors either of omission or commission.

If, however, there is one subject more than another dependent on the observance of continuity, that subject surely is meteorology, and if any one branch thereof more than any other, that branch is rainfall; and if so, then this report must inevitably either be almost identical from year to year, or four-fifths of the work must be left unnoticed.

In the past year, for instance, the only matters of any great importance which occupied much time, *in addition to the ordinary routine*, were—

(1) The concentration of the experimental rain gauges at Strathfield Turgiss, Winchfield, Hants, under the charge of the Rev. C. H. Griffith, consequent upon the removal of Colonel Ward from Calne, and of the Rev. T. E. Crallan from Framfield Lodge. A general view of the rectory grounds, showing most of the instruments *in situ*, forms the frontispiece, and the arrangements are described in such detail as their importance demands in several subsequent pages.

(2) Some very heavy computations respecting the extent and period

of fluctuations in the annual fall of rain in various localities in past years. They are not, however, yet in a fit state for publication, and it will, therefore, be inexpedient to describe their nature at present.

According to my ordinary practice, the "Report" proper would end with the above few words, but I cannot help thinking that it may be wise just for once to supplement the notice of the one-fifth by a short statement of what constitutes "four-fifths" of the work necessary to keep our rainfall knowledge in a permanent yet continually progressive condition.

The year of rainfall work may be said to begin with December, during which month envelopes are directed to each of 1300 observers; and a printed circular requesting returns, &c., placed in each, together with a number of blank forms, proportioned to the number of gauges worked by each person, two extra forms being always sent, for the following reasons, (1) in case of a mistake being made in filling one that another shall be at hand for a fair copy, erasures and altered figures being very liable to lead to mistakes; (2) that every observer shall have a form to send to any friend who may be observing and not previously in communication with me. The envelopes being kept in alphabetical order, are then checked against the address book, and their contents being found to be correct, they are posted. I am sorry to say that three or four returns generally arrive by the morning post of January 1st, thus indicating that the senders have made up their accounts before the termination of the rainfall year. (See rule IX. at the commencement of the general tables, where they will be reprinted annually.) The promptitude of these observers, therefore, involves the necessity of reminding them of the rule. Possibly some of the recipients may think this very tyrannical, but every departure from accuracy and uniformity is a step on the road to uselessness, and I can assure them that it is quite as unpleasant for me to point out errors as it can be for the observers to have them detected.

During the first week in January about 500 returns are received on the forms previously issued. The following is a specimen correctly filled up in every respect, which will serve as a text for the enumeration of all the various errors at any time, and by any person committed, in filling them up, and also for sundry hints which may be useful to those few who are guilty of any of the various irregularities which I proceed to enumerate. Let no one, however, think they are of general or frequent occurrence; on the contrary, they are rarities gathered from ten years' experience—say from 9000 returns.

It is requested that this form be filled and returned as soon as possible to

G. J. SYMONS, Esq.,
62, CAMDEN SQUARE, LONDON, N.W.

Additional Copies of this Form will be supplied with pleasure.

RAINFALL IN 1868,
At THE GROVE, HAMPTON WICK, MIDDLESEX.

Rain Gauge { Diameter of Funnel, 5 in.
 { Height { Above Ground, 1 ft. 1 in.
 { of Top { Above Sea Level, 27 ft.

Month.	Total Depth.	Greatest Fall in 24 hours.		Days on which 01 or more fell.
	Inches.	Depth.	Date.	
Jan.	3·58	·72	22	22
Feb.	·53	·24	3	10
March	1·57	·45	1	19
April	1·44	·29	21	15
May	1·66	·85	30	10
June	·37	·16	22	5
July	2·15	1·30	12	5
August	2·39	·64	18	14
Sept.	1·09	·38	19	7
Oct.	2·35	·52	4	13
Nov.	1·21	·48	23	11
Dec.	4·87	·48	28	26
Total	23·21			157

(Signed,)

T. J. NELSON.

[Please write any remarks on the other side. Details of position of Gauge will be acceptable.]

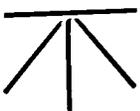
The date of the year is sometimes omitted, and sometimes entered in advance ; when the return is being made up, the year is (say) 1869, but the amounts fell in 1868 ; it is mere forgetfulness, and leads to no error, as it is invariably detected, and the returns cannot possibly be entered in advance. If the mistake occurred in the opposite direction, and 1868 was entered as 1867, it would be detected with equal ease, not only by the want of correspondence with adjacent stations, but because 1867 would have been previously entered.

Name of station.—The writing of this, and indeed of the whole return, should be as legible as possible ; the name should be explicit and sufficiently precise to prevent any possibility of confusion with other returns. The difference of the observers' names is generally a sufficient clue, but it is always better to err by employing too much precision rather than by too little. For instance, "The Grove, Hampton Wick," is better than "Hampton Wick" alone.

Diameter of funnel.—Given correctly 99 times out of 100 ; the errors, when any, arising from entering from memory instead of measurement, and in one amusing instance from the observer mistaking diameter for circumference.

Height of top of rain gauge above ground.—In a few cases the words "above ground" are crossed out, and the words "on the ground" inserted. Of course if the *top* of rain gauge is *on* the ground, the whole must be sunk in it, and if a pit surround the gauge, there is no harm in this arrangement ; if there is no pit, the return would be so outrageously in excess that it could hardly escape detection. If there is a pit so arranged that the top of the gauge is level with the ground, the return should be filled in "0 ft. 0 in.," but generally it turns out that the observer meant that the gauge *stood* "on the ground," the *top* being perhaps one foot above it. I entirely disapprove of this "pit" arrangement.

Height above sea level.—The only error under this head arises from the difficulty of ascertaining it. The one and only reliable base is that of the Ordnance Survey. During nearly thirty years that department has been continuously engaged in levelling in all parts of the country, and all their altitudes are referred to the mean level of the sea at Liverpool, *not to high or low water, spring or neap tides, but to the mean level.* I am thus explicit because often asked what the Ordnance datum is. At many thousand points of which they have determined the true altitude, marks of this shape have been cut—on churches,



mile-stones, toll-gates, &c. Wherever these "bench marks" are found, the height of the horizontal line above the mean level of the sea at Liverpool can be ascertained. A large

proportion of the altitudes given by my observers have been determined by careful spirit levelling from one or other of these marks, and year by year the proportion increases. Many others are ascertained by means of barometers, aneroid or mercurial, the process being very easy unless the distance of the gauge from the bench mark is excessive or the difference of height very great. If the bench mark and the gauge are not more than two miles apart, and their difference of altitude is under 400 feet, the process is simply this :—place the aneroid or mercurial barometer (if the latter, its reading must be corrected for temperature) level with the rain gauge, read it, say 30·17, then place it level with the bench mark, and read it, say 30·01, then take it back to the gauge and read it again, say 30·15. All that is necessary is to take the mean of readings at the gauge—

Reading at gauge	30·17		
" " 	30·15		
	60·32		
Sum.....	60·32	Altitude of bench mark...	492 ft.
Mean	30·16	Deduct difference	135 ft.
Reading at bench mark...	30·01		
	15	Height of gauge	357 ft.
Difference ...	9		
	135 ft.		

and multiply the difference in hundredths between the mean at the gauge and that at the bench mark by 9 ; the result will be the difference in feet, which must be *added* to the elevation of the bench mark if the barometer there was *higher* than at the gauge, and *deducted* if it was *lower*. Of course each repetition of the process increases the accuracy, but ordinarily once is sufficient. The height of about 50,000 bench marks has been published, and I shall at all times be happy to forward the altitude of any one of which it may be required.

I have enlarged considerably on this subject, because I know some few of the altitudes cannot be correctly returned, and I hope that during the present year *all observers* who are in any doubt as to the altitude of their gauges will take the requisite steps to remove that doubt, and I readily promise them every help in my power.

Rain columns.—The headings of these columns are so explicit that it is very rare any error is committed in filling them up. The only ones, besides mistakes in the amount, that occur to memory, arise from improper modes of entering the amount measured, viz., in the omission of cyphers, resulting in both cases from wrong modes of notation. Some observers look upon the divisions on the measuring glasses as “parts,” of which one hundred go to the inch, and they enter the total fall in September (see specimen, 1·09) as 1 9 ; others, taking them as decimals,

enter the maximum in July (1·30) as 1·3, often omitting the decimal point. It will remove all possibility of error if those who have been accustomed to count them as “parts” will *always* prefix a cypher when the number is *less* than ten, *e.g.*, ·01, ·02, ·03, ·04, &c., ·09, ·10, ·11, &c.; and if those who consider them as decimals will *always* place *two* figures after the decimal point. Every column of the observer’s own book should be cast *twice*, the total first made being covered until the second casting is complete, and the same remark applies to the first and the last column of their annual return.

It is true that the foregoing irregularities are rare, but inasmuch as they sometimes exist, every return has to be most closely examined—a process requiring great care and occupying much time, so much indeed that little else can be done during January beyond verifying them and grouping them, ready for forming the annual general tables. February is the busiest month of the year; in the first week the whole list of stations (1720) is called over, and those observers (about 150 generally) who have failed to send in their returns receive a “second application;” the various tables in this volume have to be compiled, and the proofs read over three times, in order to secure the greatest possible accuracy. During these two months I rarely answer a letter, and believe I have more than once incurred censure for not doing so; as it is, my working hours average 16 out of 24, and I put it to my censors whether that should be increased sufficiently to allow of individual answers to about 400 letters on all branches of meteorology. I think it wiser to reserve these letters for reply in March and April, when the main work is over. During the remainder of the year the returns for the previous year are copied into their proper volumes, and the originals fastened together and put away for reference, in case at any time required. The library of the British Museum is searched for records of rainfall in long past years, the observers in various parts of the country are visited and their gauges tested, (as explained last year); work has to be done for the British Association, and a report prepared for their annual meeting; the various books—“address book,” in which the observers are entered in alphabetical order, and “county book” list of stations in geographical order, &c., are made perfect, and observers obtained in districts which by deaths or removals have become destitute thereof. These are some of the routine items which, as I previously said, constitute four-fifths of the work, of which, as trenching on the egotistical, I have never written before, and in all probability never shall write again.

RAIN GAUGE EXPERIMENTS AT STRATHFIELD TURGISS, READING.

Lat. $51^{\circ} 20' 23''$ N. ; Lon. $1^{\circ} 2' 30''$ W. ; Height above Sea, 209 feet.

BY THE REV. C. H. GRIFFITH, F.M.S., &c.

[WE trust our readers (including Mr. Griffith) will not disapprove of a short preface to the following able paper. We shall confine ourselves to succinctly stating the history of the various gauges up to the dates of their respective removals to Strathfield Turgiss, and this historical sketch will explain the cause of certain variations in construction noticed by Mr. Griffith.

When planning the experiments so long and ably conducted by Colonel Ward, we resolved that the ten gauges intended to ascertain the variation in the amount collected produced by elevation above the ground should be uninfluenced by *any* other cause—that is to say, that they should be free from the influence of buildings, and identical in pattern. The magnitude series, on the other hand, were, in some respects necessarily, not strictly uniform. Up to that time (1863) small rain gauges had never been provided with cans, the funnel simply rested more or less tightly on a glass or earthenware bottle, and therefore it was held that the representatives of these small gauges must be of that pattern ; similar gauges of larger sizes almost always rested on and were provided with cans of the same diameters as their receiving surfaces, and for this reason the larger gauges were so made. An additional but very strong reason for the adoption of this pattern was that large funnels would inevitably be blown away in a gale if perched only on a bottle neck. During the first 30 months of the Calne experiments, the magnitude series were, therefore, not absolutely identical in pattern, but differed as shown by the following drawings. In order to guard against the possibility of any error from this source, and yet to avoid interrupting the series of observations, Col. Ward employed a local tradesman to fit with cans all gauges not previously fitted therewith ; it was not easy to do this, and is therefore not

surprising that, as remarked by Mr. Griffith, these funnels do not fit so well as those originally made in the complete form. These magnitude gauges also differed in material, the smaller ones being generally made of copper and the larger ones of zinc or tin ; the usual practice was rigidly followed, the smaller ones were made of copper, and the large ones of zinc ; but in 1868, in order to eliminate the effect of different material, *all* received a coat of paint.

In the spring of 1868 Colonel Ward removed from Calne, and finding it impossible to continue the experiments, most generously placed all the instruments at our disposal, to be employed how, when and where we thought best. We must now again go back to 1863, for in that year Messrs. S. W. Silver & Co. supplied us with our first ebonite rain gauge, and from that time to the present we have been more or less engaged in endeavouring to ascertain the best material for rain gauge funnels. During the first few years we had the gauges under our own care, but finding we had not time to work them properly, lent them in 1866-67 to the Rev. T. E. Crallan, of Framfield Lodge, Sussex, whose report has already been printed.* At the end of 1867 he removed, and the gauges were then sent to Mr. Griffith, who arranged and worked them so well, that when Colonel Ward made the offer above-mentioned, we at once communicated it to Mr. Griffith ; he accepted it, and thus he now has Colonel Ward's, the material series, and several others which have since been added.—ED.]

IN detailing the results obtained during the past year from the elaborate set of rain gauges entrusted to my care, I feel it but just and due to myself first to observe that I have no preconceived idea of what perfection in a rain gauge should be, nor yet any pet theory to foster, nor any favourite form of gauge to recommend, and therefore, although I determined fearlessly and honestly to give the exact results obtained here, I started clear of all bias which could in any way affect me. I must confess the work proved a matter of far greater difficulty than I had supposed, not from the mere labour that it inflicted, for nothing done without trouble is worth much, but on account of the great nicety and exactness absolutely necessary. My first difficulty was the maintaining a perfectly correct level for the receiving aperture of the gauges, as I soon found by a series of independent experiments conducted with a duplicate 8 in. gauge, that inequalities of level caused as much variation in the results as, if not more than, was to be obtained from

* *British Rainfall*, 1867, p. 45.

differences of form and construction or exposure. To meet this difficulty, Mr. Symons very cleverly designed, and the Messrs. Casella very ingeniously constructed, a double spirit-level, or rather, perhaps I should say, two levels at right angles to one another combined on a brass stand, giving the correct level both ways at once, and avoiding the difficulty previously experienced in the use of the ordinary single level, where-with the level first obtained across the one diameter is lost in the attempt to get the other level correct at right angles. I have adopted also Col. Ward's measuring table, whereon to rest the glass in the act of reading—not trusting to the hand, as considerable error is likely to ensue from the glass not being held exactly perpendicular, in my endeavour to eliminate every source of error or of difference in result, except that arising from the formation of the gauge or its elevation. As regards the reading of the rain in the measuring glass, it appears I have worked upon an incorrect principle, reading the quantity collected from the lower level of the water in the centre of the glass, supposing the higher levels on the sides to be due only to capillarity. My own experience in this matter induces me to think that it is better to measure the water in the glass from the lower level, instead of from some indefinitely defined line, midway between the lower level and the upper capillarity edge, because as the glasses for measuring water collected in gauges of various sizes themselves differ very much in diameter, the attraction of the glass differs also in like ratio, the 1 in. glass, with its narrow bore, attracting water to the extent of at least $\cdot 01$, whilst the 24 in. measuring glass does not affect the water more than to about the extent of $\cdot 003$; but as the same method of reading has been adopted throughout the whole course of the experiments, no considerable difference is likely to arise from this course of proceeding. Again, as 16 of the gauges of one series have had to be measured with one glass, I have adopted an expedient calculated to prevent the possibility of difference from drops of water of one gauge first measured remaining in the glass by adhesion, augmenting the quantity in the next read, that is to say, I have always read the gauges in an irregular order, the one day beginning with No. 1 to the end of the series, another day commencing with a different number, and taking them in irregular order to avoid influence from that cause. I have also set up a very simple but very efficient draining stand for the measuring glass to be inverted into during the act of returning the bottle and closing the gauge, to facilitate the escape of the adherent drops of water, with a view to avoid error from the same source. I may as well also state that having 42 gauges at work, each gauge has its own number painted on it, with a corresponding number on its bottle or can, to

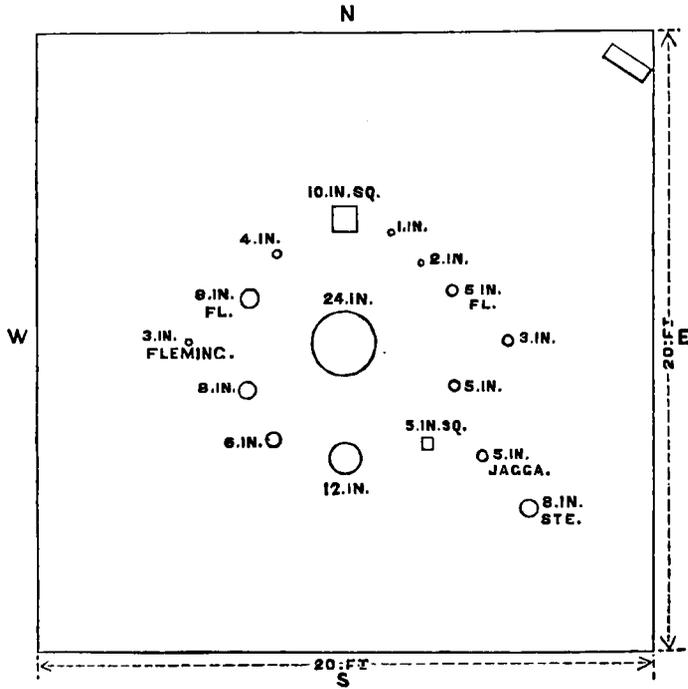
prevent the possibility of error where so many cans and bottles are in use. In a word, every precaution has been taken to secure reliable results, so that I am able confidently to assert that all existing differences arise from the peculiarities of the gauge itself, and not from the manner of treating it. All ground gauges have been securely fastened by three or more oak pegs, driven firmly into the ground, and further secured by zinc wire—the material series being also in addition secured by a firm wooden frame, with a bricked floor, each standing 12 inches every way clear of his neighbour; and I think myself exceedingly fortunate in having had no casualties of any kind whatever, either by way of upsets, overflowings, or breakages, during the whole year with any one of the set. The position chosen for the erection of the gauges is in a portion of the glebe of about 18 acres, perfectly free from trees or local influence of any kind, the large or timber trees being at a considerable distance, and the ornamental trees or shrubs being low and distant from the site selected. The land itself is perfectly level as far as the glebe extends, and has a gentle rise towards it on all sides save to the N.E., in which direction the ground rises a few feet at several hundred yards distance, so that a more fair or more open exposure could hardly have been selected.

The frontispiece to this volume represents very faithfully the position of the various instruments, which will be readily identified by the following letters :—

A 8 in. roof gauge on bracket.	K Symons's storm gauge.
B 8 in. ditto in gutter.	L Griffith's thermometer stand.
C 8 in., barn, top gauge.	M 5 in. gauge at 3 ft.
D 8 in. ditto, N.W. side.	N 8 in. at 1 ft.—Intermediate.
E 8 in., 1 ft., Material Series.	O Anemometer.
F 8 in. ditto ditto, read monthly.	P 5 in. gauge at 20 ft.
G Radiation thermometers.	Q 8 in. ditto ditto.
H 5 in. gauges, Material Series.	R Magnitude enclosure—(see plan.)
I Crallan's disc gauge.	S Morris's thermometer stand.

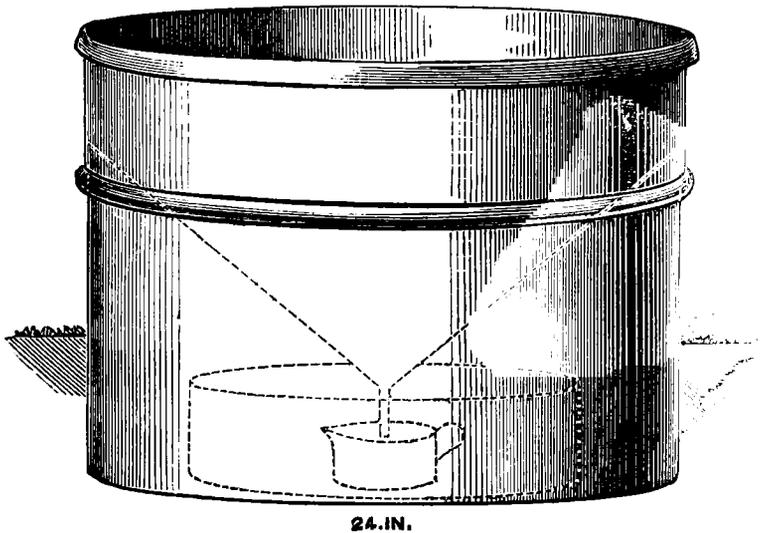
The gauges, 42 in number, naturally resolve themselves into five groups : first, the magnitude series ; secondly, the elevation series ; thirdly, the roof series ; fourthly, the material series, and lastly, those with various angles of rim. The first, or magnitude series, is composed of the 13 gauges belonging to Colonel Ward, removed from Calne to this place. To this series has been added a 3 in. gauge, as suggested by Mr. Buchan in his *Handy Book of Meteorology*, as well as a Fleming's staff gauge, one of Stevenson's, and one of Jagga Rao's, making 17 in all. These are set up in a square plot of grass land, 20 ft. by 20 ft., to the south-west of the rectory house, enclosed by a light but strong iron fence 4 ft. high, and surrounded by wire

game netting to prevent interference by rabbits or vermin, each gauge standing from one to three feet distant from his neighbour, as shown on the following plan. Since January 1st, 1869, an additional space of about 200 square feet has been added on the E. side, as subsequently explained.

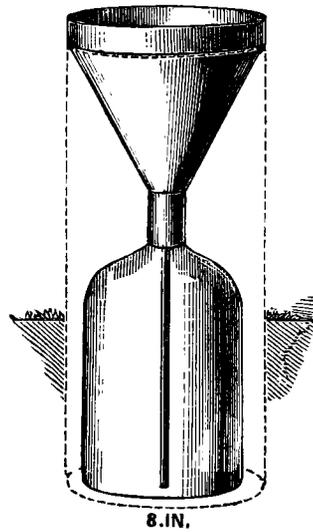
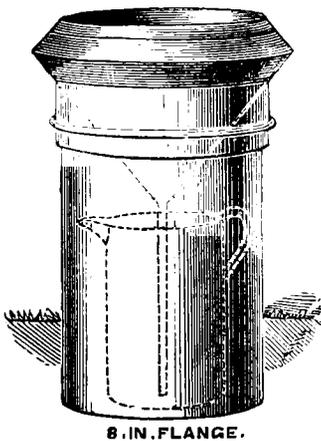


Ground Plan of Magnitude Enclosure.

From the observation of this magnitude series, I am able to speak of the care and honesty with which Col. Ward conducted his experiments, as the results here differ very little from those obtained at Calne. The



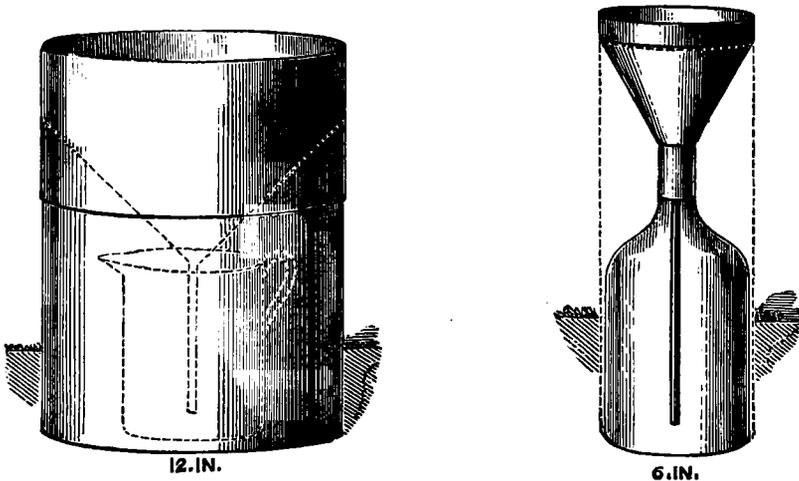
24 in. gauge has collected the greatest amount of the series, but only in excess to the extent of $\cdot 162$ during the whole 10 months, and this excess I am inclined to attribute not to any peculiarity of the gauge as a rain collecting instrument, but, as my own actual observation tells me, simply from a greater deposition of dew caused by the greater surface of exposed metal. Next to the 24 in. the 8 in. flange reads the highest; the cause of this is to my mind undoubtedly the flange itself; as has been before observed by Mr. Crallan, the rain-drops accumulate on the windward side of the flange, and are blown over and in to the gauge, and so augment its reading. This gauge, the 8 in. flange, always reads



in excess of the others, wherever it is placed. In the magnitude enclosure it stands near an 8 in. upright rim gauge, and very often reads $\cdot 025$ higher, the deep flange again contributing to this excess. In all cases where flanges have been used in these experiments, the gauges so constructed have read in excess of their neighbours, proving conclusively the fallacy of the appendage; thus we find that next in order to the 8 in. flange the 5 in. flange reads the highest of the series,



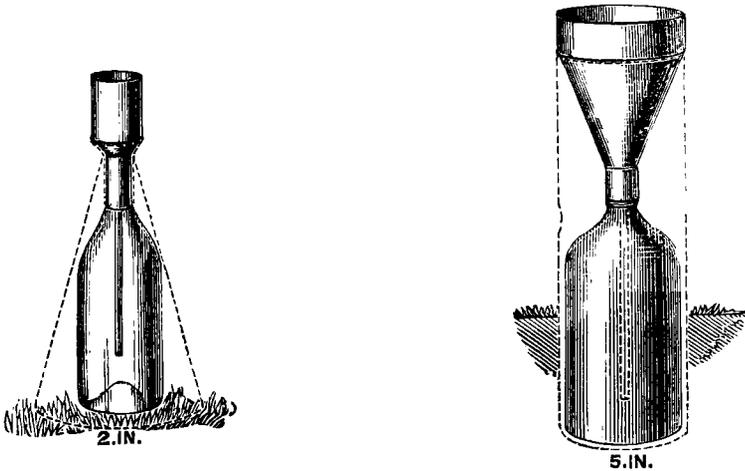
and as I can only suppose for the same reason. Next comes the 4 in. ; this gauge has a somewhat deep rim or upright edge, and this style of construction contributes considerably to the high amount collected, as it entirely prevents outsplashing, and is at the same time very much to be preferred to the retreating angle of the flanged gauges designed for the same purpose, as it saves loss of the rain, without the objectionable and unfair collection of rain-drops blown over and into the receiver. The 6 in. comes next in order, and, as the result of these experiments would show, is a very fair gauge in every way ; it has a sufficiently elevated rim to prevent outsplashing, and has a deeply receding receiver and long narrow pipe to prevent evaporation. The size and length of the receiver pipe appears to me to be of the greatest importance, as it so greatly hinders evaporation ; but it is also liable to one peculiar difficulty ; on three several occasions I have had the long



pipe of rain gauges very effectually stopped by one of the *genus Megachile*, or leaf-cutter bee, building its nests in the pipe ; on one occasion no less than nine separate cells, each with an egg in it, were found in the pipe of the 5 in. gauge ; had I not fortunately detected the intruding builder the next observation might have been lost.* Next comes the 12 in. : this also is an admirable gauge, of good size, large enough to satisfy the most inveterate advocate of huge gauges, and with a good plain upright rim, three inches deep ; this gauge also closes well, with an overlapping edge to the receiver case, thus preventing the possibility of rain getting into the inner bottle, and also making it a safe monthly gauge, as nothing can find its way into the outer case of the receiver but through the pipe of the funnel. Several of the other gauges are not so well guarded in this respect, and require care to prevent the

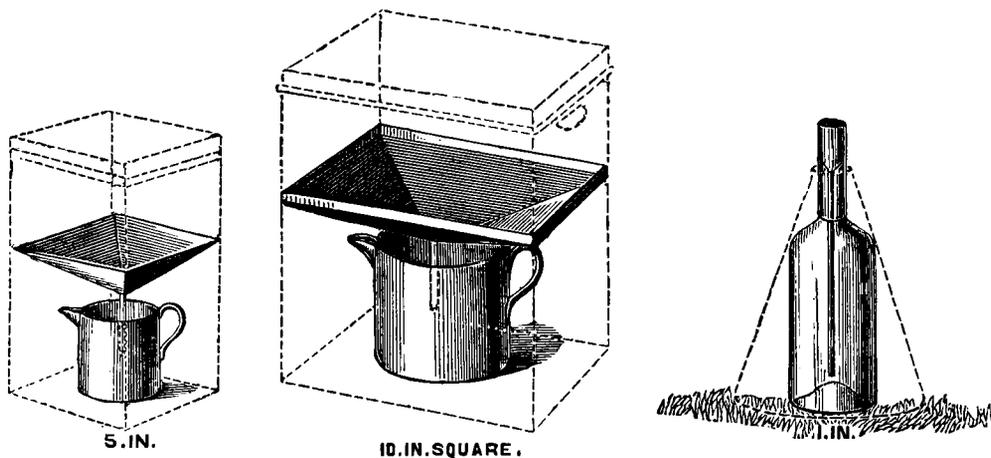
* See *Meteorological Magazine*, vol. i., p. 66.

bottle overflowing, as then it would be impossible to know how much of the overflow came in through the pipe or found its way in between the outer and lower edge of the receiver and the outer case. So far my results coincide almost exactly with those of Col. Ward; but now we come to the next in order, we somewhat differ. In my experiments the 2 in. gauge gives a result equal to nearly all the others, and



superior to the 5 in. upright rim gauge. I believe this result entirely depends upon the gauge being retained in a perfectly level condition; so long as it is level it reads equally well with the others, even with the 24 in., but in a gale, unless great care and strong pegs be used to fix it perfectly secure, it gets blown on one side, and the least inequality of level entirely destroys the result—in fact if the gauge be tipped over half an inch it is virtually closed altogether, the exposed orifice being so small hardly any rain gets in. I firmly believe, from my observations, that even the 1 in. gauge would collect nearly as much as its huge neighbour if all conditions were identical; if the two gauges were designed upon precisely the same model, and the various conditions of relative size and exposure accurately calculated and observed, the 1 in. would not be far behind; whatever affects the large gauge would equally affect the small in a proportionate degree, whether it be rim, eddy, or insplashing or outsplashing, the same fall of rain, with the same kind of gauge, must produce the same results in a proportionate degree, provided only that all conditions, shape, height, material, and conformation, be the same in every case. The next gauge to which we come, following the order I have selected in taking them according to their collecting powers, is the 5 in. square gauge, and here we have an instrument of a totally different character. This gauge, at a depth of four inches, has a flat or slightly inclined funnel resting on

a narrow slip or bar of copper, soldered to the sides of the outer can or case, with a very short pipe in the centre conducting the rainfall into a copper pot beneath. Now if the inner copper vessel be intended as the receiver, this is a very bad form of gauge, and should be placed at the very bottom of the list, as the rain when in the least degree driven by the wind strikes the side walls of the outer can, and trickling down never gets into the receiver at all, so much so, indeed, that on almost every occasion half would be lost. My method of registering has been to measure each quantity separately, and enter them thus $\begin{array}{r} 456 \\ 123 \\ \hline 579 \end{array}$, the upper line of figures indicating the amount fairly collected in the copper pot receiver, the second line the amount in the bottom of the can, and the lower line the total amount. If the amount in can and receiver be both intended to be measured, I see no use in the receiver at all, except to inflict the double trouble of two measurements to secure one result. The next in order, the 5 in., has not collected so much with me in proportion as at Calne—why, I cannot say, but the fact is so. I have been most careful to maintain a perfect level, and to assure myself that that level has been maintained. I have always of



late ran the spirit level over the gauges before measuring, to assure myself their position had not altered after the levelling I invariably make as soon as the gauges are read. I cannot, however, but think this 5 in. gauge, with its upright sharp rim of one and a half inches and deep funnel, long pipe and narrow-necked stone bottle, one of the very best of gauges, and see so entire an absence of fault in it, that I should be quite prepared to receive it as a standard, and as near perfection in every way as possible. Of the 10 in. square, the next in the series, I can only repeat what I have said of the 5 in. square, the

same faults being common to both, except that in the case of this gauge the flat funnel fits more loosely than that in the 5 in., and therefore the fault is considerably exaggerated. In the case of this gauge, too, the sides are very liable to be bulged out or in, and consequently the exact square is more difficult to be maintained. The next gauge is a duplicate of No. 2, with all its faults, but has been read monthly ; its amount is less, because it is only that of seven months' collection. Of the 1 in. gauge I have already spoken ; I need only add that I am certain its readings would have been higher had it been possible to maintain its level more accurately, but from its small size this is a matter of the greatest difficulty, hence I believe has arisen its lesser amount ; its measuring glass also is very small, and from this cause a large amount is lost by the capillary attraction of the glass, and if read immediately the water is poured in it reads much too little.

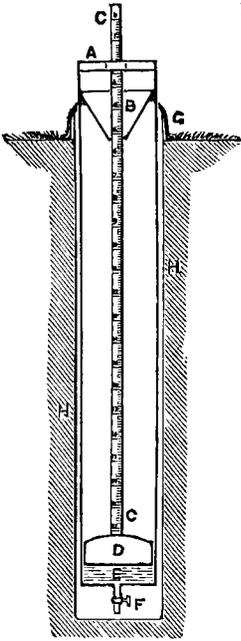
The 3 in. I have had so short a time, that it has hardly had a fair trial, but as far as I can judge it does not seem to be a whit behind its huge neighbour, although of this gauge I wish to speak with a certain degree of reservation, as Mr. Symons on testing the glass supplied by Mr. Casella found it to be somewhat in error, so that a new glass is to be substituted.

Mr. Symons has also added lately a gauge on Jagga Rao's principle, wherein the one-tenth of an inch equals one fluid ounce, an advantage perhaps to medical men keeping the gauge, as in case of the fracture of the glass its readings could be taken with their medicine glass, but of no other great use that I see, except per-



haps the weight of rainfall might be more readily calculated from its readings. The glass supplied with this gauge, by the Messrs. Bryson, of Edinburgh, is graduated with extreme precision, although not with the finished workmanship of the Messrs. Casella. It is difficult to say what the diameter of this receiver is ; Mr. Buchan, in his *Handy Book of Meteorology*, gives it as 4.697 inches, but this receiver cannot be induced to show that measurement, indeed it is almost impossible to assign a true diameter to it, as its edge is bevelled on both sides, giving a beautifully fine knife edge, but not an easy rim to measure correctly, it appears to be 4.67, and yet the glass is correctly divided on the assumption of 4.697 in. This gauge was referred to at some length in a recent number of the *Meteorological Magazine* ; it simply consists of a funnel and measuring glass ; the observer has to find a bottle adapted for holding it firmly, and there is no protection from frost. The bottle will probably break, if care be not taken, and the funnel is liable to be blown out of the bottle across the enclosure.

The last gauge in this series is Fleming's, a kind of staff gauge, cylindrical, of copper, read by means of a float attached to a rod. A is a strip of metal crossing the top of the cylinder, the object of which is, to retain the graduated rod c c in its proper position ; B is a funnel through which the rod passes, and which, jointly, nearly close the cylinder ; E is the rain ; D is the float ; the parts A, B, C, D, E, F, and G, are all lifted together when it is necessary to empty the gauge, the outer cylinder H alone remaining in the ground. The gauge is emptied by the tap, F. I have used the word "emptied;" but this gauge never should be "emptied." The water should be allowed to run out until the float stands at 0. G is a collar which drops over H, and prevents any rain getting between the two cylinders. The chief objection to this form of gauge is that when there is any considerable amount of water collected, the rod being elevated catches a great deal of rain which ought to blow over the gauge, giving therefore an exaggerated result.



Great care is also required to adjust this gauge when emptied at the end of the month, as a certain amount of water must be retained to poise the float ; if this be neglected the result is vitiated ; this gauge also only reads to tenths, and does not give, therefore, very accurate measurements.

Stevenson's gauge has also been added for the new year's work. Of this gauge I cannot speak, as I have not yet read it ; it is buried in the ground up to its neck, and is read by a graduated glass tube attached outside the case. I should think this arrangement would read greatly in excess, as rain and dew drops would be plentifully blown in from the surrounding grass. Mr. Stevenson proposes a kind of circular bottle-brush arrangement to avoid this, but as I have not tried it I cannot give an opinion on the point ; I am afraid, however, that the glass tube will break with the first frost. In concluding my notice of the magnitude series, I can only express my entire conviction that the size of a gauge, provided all other things are equal, has no effect whatever upon the results obtained ; the differences, when accurately observed, are so slight as not to be worthy of remark ; on very many occasions there has been a difference of barely $\cdot 005$ of an inch between the whole series, excepting only the square and flange gauges, although this has been a most trying year for rain gauge experiments, the extremely hot summer, followed by the extraordinarily

wet and stormy December, adding considerably to the difficulties of observation. If I were asked, therefore, what size I should recommend for ordinary use, my answer could only be, "any size you like, provided there be no flange, and adopt by all means upright sharp edges in preference to shelving angles, to diminish wind eddies and to prevent resilience of rain drops; and whatever you do, above all things keep the gauge absolutely and entirely level." In order, however, to make these experiments thoroughly exhaustive, it is intended this next year to continue the observations under precisely the same conditions in every respect, except that the gauges are to be read monthly, or at long intervals, to see if these same results continue, or are in any way influenced by the fresh arrangement.

The next set of which I have to speak is the elevation series, and consists of three gauges at the height of 1 ft. (E, N, R), one at 3 ft. (M), one at 11 ft. (D), one at 16 ft., two at 20 ft. (P, Q), one at 23 ft. (C), one at 29 ft. (B), and one at 39 ft. (A). These gauges are of the pattern shown on p. 17, flanged with a deep set-off below the exposed aperture, and, therefore, as I have myself observed, liable to an inner eddy inside the rim, which also influences their readings. They have also an outside rim or ledge, into and upon which the lower edge of the funnel receiver rests—theoretically a good idea, as it is supposed to close the gauge tightly, in practice a very useless and troublesome appendage, as there is no real good obtained by so closing the gauge; it does not hinder the bad effects of evaporation, as I often find the water streaming upon the insides of the outer can and lower surface of the funnel; and it is open to two grave objections: first, it sometimes closes the gauge so tightly that owing to the absence of any outlet for the confined air, some of the rain is retained in the outer funnel, and so is evaporated; and secondly, the water clings to the lower edge of the rim as it is raised to empty the gauge, and drops into the receiver below, adding unduly to the amount collected.

The elevation series should be divided into two sets, as five of them are essentially roof gauges, and demand a separate word or two, as they were set up for a different purpose from merely ascertaining the difference of results at various heights. This has been done so well by Col. Ward, and the result is so clear and unmistakeable, that I may at once dismiss the 20 ft. gauges (P, Q), which are set on poles of that elevation, with the simple remark that the observations here have most clearly shown the existence of the now well understood law of decrease of collection with increase of height, and have also tended to show the care and attention with which Col. Ward conducted his experiments at Calne. The roof gauges, however, demand a distinct account, as

they were set up to show the effects obtained from a gauge put in a bad situation, and truly they have given that result to perfection. The first I shall mention is erected at the height of 11 feet, on the lower edge of the N.W. side of my barn (D), having a sloping thatched roof running up 12 feet to the S.E. ; this gauge nearly always reads in excess, sometimes reading even higher than those on the surface of the ground ; this result is derived doubtless from the effects of the wind eddies, running along and over the roof, and so driving undue quantities of rain into the receiver. This gauge and that at 29 ft. (B) are identical with those at 1 ft.

The next roof gauge is at an elevation of 16 feet, and is on the other, or S.E. side of the roof of the barn, at about one-third of its height ; this gauge reads less than I should have supposed, chiefly because it is on the E. side of the roof, the side on which least rain comes, and also because it is sheltered, as it were, by the intervening roof on its weather side. The gauge at 23 feet is perched on the extreme point of the pitch of the roof (C), and gives about the result we should expect, taking into consideration its height from the ground ; it is thoroughly exposed to wind and weather in every direction. This, the preceding, and the bracket gauge (A), are all provided with gas tubing, to bring the water into positions where its measurement is practicable.

The gauge at 29 feet (B) is placed in the central square gutter of the four roofs of the rectory house, and reads with all the irregularity of a roof gauge, at one time considerably in excess, at another much less in proportion ; it is affected by every wind that blows, and in full summer gets very nearly melted from direct and reflected solar heat. The bracket, or 39 feet gauge (A), reads not quite so irregularly as the latter, but still with so much irregularity that I can never be sure of the amount likely to be in the other gauges from its single indication, as with E. winds its comparative reading is low, with W. and N.W. it is high ; in a gale of wind its reading is very low, indeed roof gauges generally are very much more affected by gales of wind than those on the ground or near it, countenancing the old idea that an increase of velocity of wind as we ascend causes to a great extent the diminished readings of elevated gauges, although it is by no means true, as has been stated, that in calm weather we collect equal or even nearly equal amounts at all heights. It is intended this next year to make independent observations with this elevation series, of all important rain storms, with especial reference to the effect of wind-force in connexion with their results.

The next set which have to be noticed is the material series ; of

these also I propose speaking in order according to the amount collected, and first, and *facile princeps*, is the ebonite. This gauge has surpassed all others, as it did in the hands of Mr. Crallan : it is undoubtedly an admirable material for the receiver of a gauge ; it stands well, does not alter in surface or conducting condition, and is certainly to be recommended highly. After the ebonite, and closely treading upon its heels, comes the copper funnel and earthen bottle ; I find copper a most excellent material for the receiver of a rain gauge ; when quite new it is not quite so good, but as soon as it becomes oxidised no better material could be desired ; it very quickly wets with the rain, and offers no hindrance to its speedy fall. Next to the copper stands the glass receiver : this is also a capital material, its exceeding smoothness, its cleanliness and never altering condition, give it a high rank as a good receiver ; the only fault to be found with it, is its liability to breakage, but this in careful hands ought never to occur. Then follows Casella's black japanned funnel : this gauge has an admirable piece of japanned tin as a receiver ; it is so very smooth and neatly laid on that although, as my experience tells me, it is in general a bad material, this is certainly an exception. How it will stand I do not know ; I suspect not well, but intending to speak of things as I find them, I must speak well of this. Next in order comes Casella's long felt-protected gauge : a very capital form of gauge, the best principle of all the lot, but the receiver is bad, as the paint has perished a good deal, and holds the water considerably at the commencement of a shower ; the protection from evaporation, however, afforded by this kind of gauge is very good, as in the hottest day in summer the bottle is always cool to the touch. Next to this comes the wet sand protected : this is a good form of gauge, and has collected a large amount, but is liable to be burst in winter by frost, and the large flanged top is decidedly objectionable. It is also difficult to keep this top on, the wind has so much power over it ; several times it would have been blown off had it not been secured with wire. Next in order comes the earthenware or pot funnel : a very good material, very smooth, and offering no resistance or attraction to the rain, and very clean ; this funnel, however, has several objectionable raised ridges on its surface, which somewhat hinder the flow of rain ; I do not think it was originally constructed as a rain gauge receiver at all ; it looks like a druggists' earthenware funnel, and the rain rather clogs where these ridges are ; had the receiver been constructed without them, I believe it would have occupied a yet higher place, as the material is undoubtedly good. Next in order comes the gauge with no bottle ; but this I consider ought not to have read so high, and it has arisen simply because it is

impossible to prevent a certain amount of rain oozing in between the receiver and the can, and is not at all due to the merits of the gauge, of which I think very little indeed, as the bottle is certainly a grand protection against evaporation. Indeed I believe from experiments I have already made that the narrow-necked earthenware bottle has very decided advantages over the open-mouthed metal can in preventing evaporation, but as it is not expedient to advance an opinion without due and adequate trial, it has been considered advisable to set up this year two gauges near each other, identical in every respect, save that one has a bottle and the other a metal can ; for the purpose of ascertaining what difference of result will ensue.

Next comes the white can : the color is decidedly good ; both Casella's long protected and the sand-protected are white, a decided advantage, as these attract less heat from the sun's rays ; but as most rain fell this year when there was the least solar heat, (in thunder stormy periods this is not the case), this gauge has not had a fair trial of its non-evaporating qualities. The next gauge has no pipe ; this is decidedly bad, as the pipe cannot be too long, and cannot be too narrow in bore, except for the reason above stated, page 18 ; the pipe is an immense protection against evaporation ; a well fitting cover, and a long narrow pipe, are infinitely superior to the outside water ridge of which I have already spoken, and have no counterbalancing objection. Indeed, in order to sift this matter yet more thoroughly, the pipe aperture of the receiver of this gauge has been enlarged to the extent of half an inch in diameter, in the endeavour to ascertain from the next twelve months' observation whether this new arrangement will influence the result obtained.

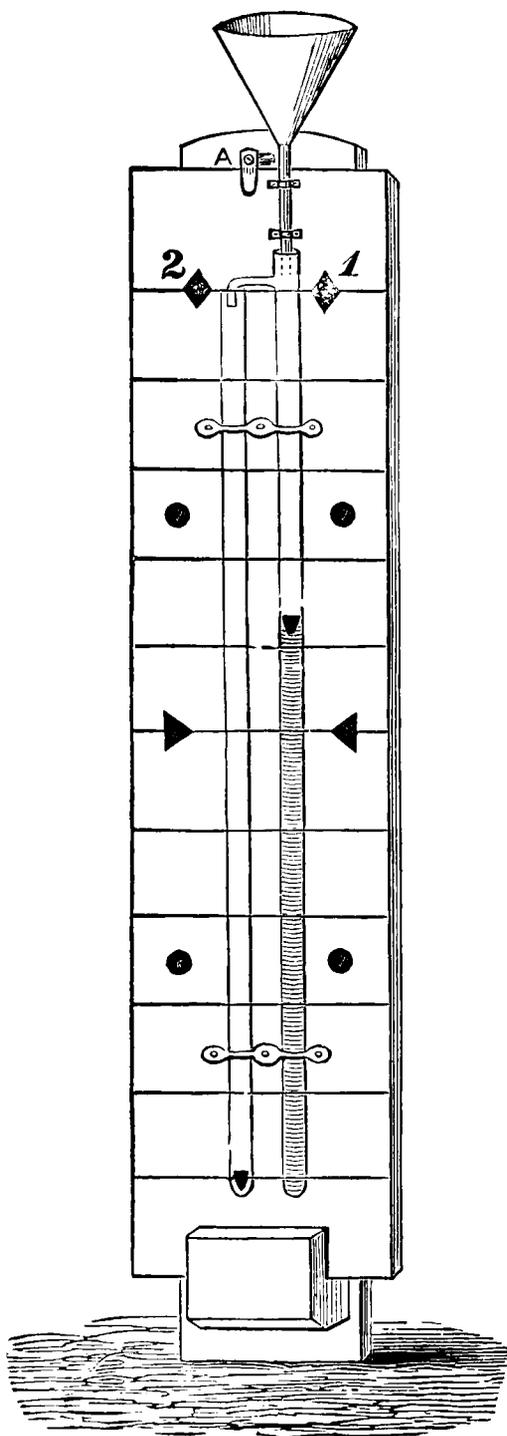
The next gauge is that read monthly ; this reads lower than the others, chiefly I believe because the receiver has been painted in the middle of the summer ; I do not consider paint a good surface material—when new the water clings in globules, which evaporate before entering the bottle, and with constant exposure its surface alters very much, quickly perishing, and when old, pulverizing and retaining the water to a great extent. The next gauge is Apps' japanned tin funnel, with a tin pot receiver ; this gauge stands at an elevation of 3 feet, so that its comparative conditions are altered. The last gauge of this series is Mr. Crallan's zinc disc-surrounded gauge ; this gauge has collected a large amount of rain, too much in fact proportionally, and this excess has arisen from the peculiarity of its construction ; it is a circular 5 in. gauge, having an upright rim of three-quarters of an inch, enclosing a flat, sparsely perforated, zinc plate, and this again surrounded by a disc of zinc 2 ft. 4 in. in diameter,

(including the inner or receiving circle) ; the object of this conformation is to provide a balance of surfaces outside and inside the gauge, to counterpoise outsplashing by insplashing, a difficult point truly, and I fear Mr. Crallan has not adequately calculated the proportion of its parts, as a surrounding disc of $11\frac{1}{2}$ inches in depth is too great a compensation for the outsplashing of a circle of five inches diameter, therefore the insplashing is in excess, hence its high reading. To my mind this would have been a capital gauge without the disc and without the inner circle of perforated zinc ; a low sunk funnel with a good sharp upright rim would have saved the complications herein entailed, and would, I believe, have given a good result. All the gauges of this series have been measured with one glass, certified by Mr. Symons to be correct to within 20 grains, or 0.004 at every point. If I were asked what form and "what material would you recommend as the result of this inquiry?" I should answer, I am of opinion that an ebonite receiver fitted on to a Casella's long felt-protected gauge with a bottle receiver would drive every other competitor out of the field.

The last series comprises a set differing in angle of rim ; all these angles of rim are, as my experience unquestionably shows, a serious mistake ; they encourage the collecting of rain drops on their surfaces, these are blown over and into the gauge, and the results vitiated. The rim cannot be too upright nor with too sharp an edge—at least this is undoubtedly the result of my experience. All gauges with rims or flanges read in excess ; of these the rim of 45° from the perpendicular collected the most, that at $22\frac{1}{2}$ the next, and that at $67\frac{1}{2}$ the least, but the edge of that at 45° is rather the more blunt, hence perhaps the difference in order ; the rims themselves are very narrow, had they been made wider the errors would have been yet more apparent. It has been determined to maintain this series also throughout this next year, under the same conditions, excepting only the substitution of a *monthly* instead of the previous *daily* reading.

The last concluding item in my already long list is the evaporator, and a most unsatisfactory conclusion it is. I have endeavoured to maintain a somewhat similar condition of exposure in Casella's so-called evaporator, but with the long-continued drought and heat of summer, and the constant heavy rains of December, I have had more trouble and less satisfactory results with it than with all the other 42 rain gauges put together. However, such as it is, I have appended it to my report.

I have also lately added one of Mr. Symons' storm gauges (κ), for the independent registration of showers and storms, and a very capital



gauge it is, not of course for accurate scientific admeasurements, for this it is not intended, but for noting as it falls, minute by minute, the rate of rainfall. To a 4 inch receiver are attached double glass tubes, each calculated to show an inch of rain extended to a length of 2 feet, so that its gradual rise can be seen in the tube a long way off; there are also white floats in the tube, these, rising on the black board, render the progress of the storm very conspicuous. It is a very excellent gauge for its purpose, and if more extensively used would give us a better knowledge of the rate and progress of rain storms.

In order to place the entire set of gauges resting on the ground under exactly identical conditions as far as it is possible to do so, the sixteen forming the material series have been removed for the new year from their original position in the rectory garden to the open field enclosure, in which the magnitude series only were at first disposed, the railing having been enlarged sufficiently to afford a clear space of 3 ft. in every direction between each gauge, and the same uniform height of rim at one foot from the ground accurately maintained.

ABSTRACT OF RAINFALL FOR THE YEAR 1868 AT STRATHFIELD TURGISS, HANTS.

NOTE.—All these gauges are 5 inches diameter, and with the exceptions noted, are black can gauges with glass bottle receivers, and the funnels 1 ft. above the ground; their position is shown on the frontispiece by the letters H, I.

Numbers attached to each gauge ...	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	XV.	XVI.	Totals
Description of gauge.	3 ft above ground, tin pot receiver.	Long white protected	Earthenware funnel.	White cap, wet sand, protected.	Rim at 4 ^o	Rim at 6 ^o	No pipe.	Copper funnel, earthen bottle.	No bottle.	Black Ebonite.	White cap, upright rim.	Rim at 2 ^o	Black can	Glass funnel.	Duplicate of No. 5, Read monthly.	Crallan's, On the ground.	B vaporator.
Months.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January	4·240	4·340	4·260	4·320	4·170	4·270	4·190	4·280	4·270	4·350	4·270	4·120	4·260	4·290	3·970	4·600	1·920
February	1·590	1·690	1·640	1·700	1·610	1·690	1·580	1·690	1·710	1·710	1·680	1·610	1·640	1·700	1·590	1·920	1·420
March	1·277	1·372	1·359	1·377	1·348	1·353	1·313	1·433	1·356	1·419	1·340	1·303	1·302	1·376	1·350	1·545	1·909
April	2·350	2·427	2·541	2·453	2·489	2·446	2·395	2·484	2·403	2·496	2·401	2·433	2·433	2·440	2·356	2·623	2·720
May	·874	·896	·928	·918	·941	·912	·913	·980	·903	·967	·904	·897	·916	·931	·882	·957	3·750
June	·495	·497	·501	·508	·511	·498	·498	·516	·501	·581	·488	·497	·511	·498	·395	·544	5·234
July	1·931	2·009	2·023	1·984	1·959	1·979	1·943	2·053	1·960	2·014	1·972	1·990	2·017	1·990	1·993	2·273	6·810
August	3·181	3·263	3·218	3·230	3·347	3·221	3·291	3·357	3·258	3·370	3·210	3·308	3·373	3·385	3·227	3·513	5·346
September	3·622	3·692	3·700	3·647	3·671	3·640	3·672	3·772	3·629	3·785	3·653	3·692	3·708	3·732	3·660	4·179	4·950
October	2·302	2·338	2·294	2·323	2·475	2·294	2·331	2·414	2·454	2·459	2·343	2·445	2·467	2·458	2·277	2·503	1·712
November	1·857	1·858	1·712	1·832	1·911	1·826	1·843	1·927	1·872	1·901	1·854	1·872	1·909	1·879	1·898	2·021	1·974
December	4·838	5·104	5·057	5·095	5·117	5·084	4·971	5·263	4·950	5·290	5·076	5·133	5·059	5·164	5·090	5·621	1·991
Totals	28·557	29·486	29·233	29·387	29·549	29·213	28·940	30·169	29·266	30·342	29·191	29·300	29·595	29·843	28·688	32·299	39·736

STRATHFIELD TURGISS EXPERIMENTS—(continued.)

ELEVATION SERIES.

Description of gauge.	ON THE GROUND.				ROOF GAUGES.					POST GAUGES.		
	Mag.	Inter-mediate.	Mat. Series.	Mean.	House.		Barn.					
					Brack't.	Centre.	N.W. side.	Top.	S.E. side.			
Elevation	1 ft.	1 ft.	1 ft.	1 ft.	39 ft.	29ft.	11 ft.	23 ft.	16 ft.	20 ft.	20 ft.	3 ft.
Diameter	8 in.	8 in.	8 in.	8 in.	8 in.	8 in.	8 in.	8 in.	8 in.	8 in.	5 in.	5 in.
Month.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
March (pt. of)	0·514	·558	·611	·561	·285	·455	·571	·315	·505	·501	·489	·507
April	2·482	2·507	2·490	2·493	1·722	1·915	2·321	1·812	2·160	2·265	2·221	2·350
May.....	·939	·947	·947	·944	·695	·630	·899	·792	·863	·901	·844	·874
June	·511	·509	·511	·510	·438	·408	·505	·450	·489	·508	·491	·495
July	1·966	1·987	1·993	1·982	1·827	1·614	1·989	1·864	1·570	1·951	1·876	1·931
August	3·212	3·241	3·256	3·236	2·921	2·954	3·244	2·849	3·061	3·118	3·054	3·181
September ...	3·597	3·633	3·648	3·626	2·993	3·255	3·475	3·168	3·327	3·463	3·347	3·622
October	2·242	2·321	2·313	2·292	1·789	1·963	2·292	1·929	2·138	2·082	2·141	2·302
November ...	1·810	1·918	1·912	1·880	1·240	1·579	1·723	1·333	1·672	1·756	1·691	1·857
December ...	5·031	5·163	5·187	5·127	3·394	3·542	4·845	3·933	4·464	4·514	4·300	4·838
Totals	22·304	22·784	22·868	22·651	17·304	18·315	21·864	18·445	20·249	21·059	20·454	21·957

MAGNITUDE SERIES.

Diameter	1 in.	2 in.	4 in.	5 in.	5 in. flange.	6 in.	8 in.	12 in.	24 in.	5 in. square.	10 in. square.	8 in. flange.
Elevation.....	1 ft.	1 ft.	1 ft.	1 ft.	1 ft.	1 ft.	1 ft.	1 ft.	1 ft.	1 ft.	1 ft.	1 ft.
Month.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
March (part of)	·450	·489	·515	·482	·500	·482	·508	·502	·535	·470	·472	·514
April	2·420	2·406	2·445	2·411	2·446	2·419	2·459	2·411	2·495	2·394	2·358	2·482
May.....	·834	·878	·917	·923	·937	·941	·911	·919	·960	·899	·888	·939
June	·510	·494	·510	·507	·520	·508	·495	·501	·512	·505	·499	·511
July	2·063	2·028	1·939	1·818	1·934	1·886	1·943	1·916	1·896	1·944	1·903	1·966
August.....	3·086	3·087	3·181	3·120	3·144	3·182	3·167	3·164	3·211	3·151	3·076	3·212
Sept.....	3·494	3·537	3·550	3·506	3·558	3·570	3·539	3·553	3·687	3·464	3·542	3·597
Oct.....	2·152	2·142	2·215	2·186	2·217	2·229	2·219	2·225	2·250	2·181	2·185	2·242
Nov.....	1·714	1·738	1·782	1·737	1·780	1·747	1·807	1·752	1·834	1·758	1·790	1·810
Dec.....	4·659	4·790	4·983	4·943	5·028	4·996	4·967	4·986	5·083	4·897	4·904	5·031
Totals	21·382	21·589	22·037	21·633	22·064	21·960	22·015	21·929	22·463	21·663	21·617	22·304

C. H. GRIFFITH, F.M.S.

RAIN GAUGE EXPERIMENTS, BOSTON RESERVOIR,
ROTHERHAM.

Lat. 53° 25' N., Long. 1° 20' W. 381 ft. above the Sea Level.

FOR THE YEAR 1868.

FIVE MOUTHED GAUGE. INCLINED ROTATING GAUGES.

Height above ground.	5ft.					5 ft.				
	Facing East.	Facing North.	Facing West.	Facing South.	Horizon Centre.	22½°	45°	67½°	90°	Tipping
January	·719	·736	·860	1·235	1·664	2·501	2·926	3·187	2·719	2·098
Feb. ...	·251	·883	2·092	1·280	1·851	2·482	3·219	2·953	2·591	2·605
March..	·022	·324	1·538	·866	1·293	1·795	2·119	1·996	1·557	..
April ...	1·096	1·754	·434	·594	1·683	...	2·723	...	2·061	2·790
May ...	·064	·031	·037	·214	·668	·734	·646	·480	·180	·750
June ...	·006	·000	·021	·086	·326	·343	·288	·198	·042	·338
July ...	·005	·050	·018	·000	·213	·240	·210	·137	·056	·223
August.	·403	·484	·223	·542	1·809	2·130	2·112	1·637	·897	2·157
Sept. ...	2·387	1·138	·312	·339	2·712	3·735	4·119	3·864	3·115	4·103
October	·163	·444	1·118	·949	2·377	2·991	2·991	2·625	1·674	3·056
Nov. ...	·210	·500	·983	·477	1·047	1·626	1·823	1·885	1·318	1·581
Dec. ...	2·111	2·098	2·235	2·747	6·549	8·441	9·325	8·407	6·290	8·952
Totals..	7·437	8·442	9·871	9·329	22·192	...	32·501	...	22·300	...

ELEVATED GAUGES.

Height above ground	1 ft.			5 ft.			10 ft.		
	Read Daily.	Read Mnthly.	Diff.	Read Daily.	Read Mnthly.	Diff.	Read Daily.	Read Mnthly.	Diff.
January.....	1·862	1·896	+·034	1·675	1·647	-·028	1·437	1·466	+·029
February	2·025	2·020	-·005	1·871	1·836	-·035	1·689	1·683	-·006
March	1·429	1·477	+·048	1·326	1·324	-·002	1·215	1·236	+·021
April	1·852	1·857	+·005	1·723	1·714	-·009	1·622	1·673	+·051
May	·711	·703	-·008	·676	·660	-·016	·646	·671	+·025
June	·336	·315	-·021	·326	·315	-·011	·315	·310	-·005
July	·234	·143	-·091	·218	·238	+·020	·209	·173	-·036
August	1·911	1·959	+·048	1·806	1·793	-·013	1·764	1·812	+·048
September.....	2·877	3·009	+·132	2·725	2·745	+·020	2·762	2·829	+·067
October ...	2·559	2·617	+·058	2·365	2·385	+·020	2·316	2·311	-·005
November....	1·222	1·240	+·018	1·068	1·064	-·004	·970	·988	+·018
December	6·792	6·793	+·001	6·413	6·439	+·026	6·294	6·308	+·014
Totals	23·810	24·029	+·219	22·192	22·160	-·032	21·239	21·460	+·221
11 months.....	21·899	22·070	31·171	20·386	20·367	-·019	19·475	19·648	+·173

ROTHERHAM EXPERIMENTS—(continued.)

ELEVATED GAUGES.

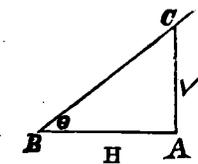
Height above ground	15 ft.			20 ft.			25 ft.		
	Read Daily.	Read Mnthly.	Diff.	Read Daily.	Read Mnthly.	Diff.	Read Daily.	Read Mnthly.	Diff.
Months.									
January.....	1·387	1·395	+·008	1·334	1·318	—·016	1·302	1·298	—·004
February	1·644	1·647	+·003	1·596	1·551	—·045	1·578	1·510	—·068
March	1·171	1·186	+·015	1·147	1·130	—·017	1·090	1·064	—·026
April	1·663	1·670	+·007	1·562	1·614	+·052	1·599	1·616	+·017
May	·632	·643	+·011	·637	·685	+·048	·626	·629	+·003
June	·308	·294	—·014	·305	·290	—·015	·295	·285	—·010
July	·195	·120	—·075	·191	·160	—·031	·185	·162	—·023
August ... ..	...	...	...	1·748	1·797	+·049	1·745	...	...
September... ..	2·645	2·674	+·029	2·636	2·726	+·090	2·647	2·580	—·067
October	2·269	2·311	+·042	2·260	2·272	+·012	2·207	2·217	+·010
November	·951	·992	+·041	·918	·954	+·036	·874	·902	+·028
December	6·239	6·298	+·059	6·177	6·236	+·059	6·176	6·219	+·043
Totals .....	...	..	...	20·511	20·733	+·222	20·324	...	...
11 months... ..	19·104	19·230	+·126	18·763	18·936	+·173	18·579	18·482	—·097

R. CHRIMES.

ROTHERHAM EXPERIMENTS.

[One insuperable difficulty in the preparation of this work is the necessity of promptitude of publication, and, therefore, the limited time available for elaborate work. The ordinary returns ought always to be published at the earliest period consistent with completeness and strict accuracy, but if so there is no time available for the discussion of the experimental researches of the previous year. Thus it happens that I have not been able to examine Mr. Chrimes's splendid observations for the year 1868. I hope, however, next year to give accurate drawings and descriptions of the instruments, and an analysis of the results obtained during 1866-7 and 1868. Two friends having been kind enough to go through the 1868 returns, the deficiency on my own part is more than supplied. I append their notes in the order of arrival—*verbatim et literatim.*]

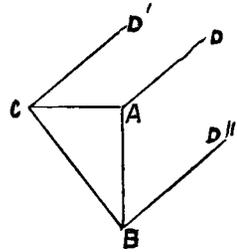
DISCUSSION OF RAINFALL IN ELEVATION.



IF the line BC represent the direction in which the rain falls, AB the quantity gathered in the horizontal gauge, which call H, and AC the quantity in the vertical gauge, which call V, the angle θ , which the falling rain makes with the horizon, may be computed by the

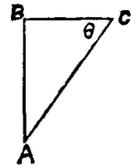
formula $\cotan \theta = \frac{v}{H}$. The angle from the vertical θ has been computed by the formula $\tan \theta = \frac{v}{H}$.

Let the lines CD' , AD , and BD'' represent the direction in which the falling rain meets the horizontal and vertical mouthed gauge, AC the quantity gathered by the horizontal = H , and AB that by the vertical = v , the section $BC = s$ may be computed by the formula $s = \frac{H}{\sin \theta}$, θ being the angle which the falling rain makes with the horizon as computed by the preceding formula; s may also be computed by the formula $s = \frac{v}{\sin \theta}$, θ being as before the angle from the vertical. The results are given in the third column, headed "computed section;" the remaining columns require no explanation.



DISCUSSION IN AZIMUTH.

If the rain collected by the E. mouth be represented by AB , that by the W. by AB' , that in the N. by BC , and that in the S. by BC' , the angles from the N. and S. may be computed by the following formula:—N.—E., $\tan \theta = \frac{AB}{BC}$; S.—E., $\tan \theta = \frac{AB}{BC'}$; S.—W., $\tan \theta = \frac{AB'}{BC'}$; N.—W., $\tan \theta = \frac{AB'}{BC}$. The azimuths have been computed by these formulæ.



For the quantities the readings of the four vertical mouths have been reduced to that of the vertical, face to wind, and means taken to bring the reduced readings to an approximation to the quantities received by the rotating gauge.

1868.	Mean angle from vertical.	Computed section.	Quantity collected.			Angle collecting largest amount.	Differences.		Rain at 100 ft. at 25 ft. =	Mean velocity of wind on rainy days.
			Tipping.	Inclined.	in.		in.	Tipping.			Inclined.
Jan.	58° 32'	3·187	2·098	3·187	67½°	-1·089	0·000	70	156	
Feb.	54 27	3·185	2·605	3·219	45	-0·580	+0·034	78	225	
Mar.	50 18	2·024	...	2·119	45	...	+0·095	76	206	
April	50 46	2·661	2·790	2·723	45	+0·129	+0·062	86	177	
May.	15 5	·692	·750	·734	22½	+0·058	+0·042	88	80	
June	7 20	·329	·338	·343	22½	+0·009	+0·014	88	66	
July	14 45	·220	·223	·240	22½	+0·003	+0·020	79	93	
Aug.	26 23	2·019	2·157	2·130	22½	+0·138	+0·111	91	126	
Sept.	48 57	4·130	4·103	4·119	45	-0·027	-0·011	92	146	
Oct..	35 9	2·907	3·056	2·991	45	+0·059	-0·006	86	139	
Nov.	51 32	1·688	1·581	1·885	67½	-0·102	+0·202	71	151	
Dec.	43 51	9·081	8·952	9·325	45	-0·129	+0·244	91	161	

1868.	AZIMUTHS.				QUANTITIES.				
	N.E.	S.E.	S.W.	N.W.	N.E.	S.E.	S.W.	N.W.	Sums.
	deg.	deg.	deg.	deg.	in.	in.	in.	in.	in.
January..	44	30	35	49	·557	·748	·802	·612	2·719
February	16	11	59	67	·326	·440	·969	·856	2·591
March ...	4	1	61	78	·098	·251	·681	·527	1·557
April.....	32	62	36	14	·757	·449	·273	·582	2·061
May.....	64	17	10	50	·025	·072	·065	·018	·180
June.....	90	4	14	90	·001	·017	·020	·004	·042
July.....	6	90	90	20	·021	·002	·007	·026	·056
August..	40	37	22	25	·241	·257	·207	·192	·897
Sept.....	65	82	43	15	1·314	1·017	·243	·541	3·115
October..	20	10	50	68	·190	·348	·647	·489	1·674
Nov. ...	23	24	64	63	·216	·209	·443	·450	1·318
Dec... ..	45	38	39	47	1·440	1·662	1·705	1·483	6·290
Totals ...	...	...	...	...	5·186	5·472	6·062	6·780	22·500

W. R. B.

Let θ be the inclination of the falling rain to the horizon, c the quantity which would be received in a given time in a gauge whose radius is R , so placed that its axis coincides with the direction of the rain, then c would vary as R^2 .

Now the rain which would fall into a similar gauge whose axis is vertical would be all contained in an oblique cylinder whose axis coincides with the direction of the rain, and whose base is the horizontal mouth of the gauge. The transverse section of this cylinder would be an ellipse, whose longer diameter is $2R$ and shorter $2R \sin \theta$, and therefore its area would vary as $R^2 \sin \theta$, and the quantity of rain received in the gauge would be $c \sin \theta$. Similarly, the quantity in a gauge whose axis is horizontal and mouth at right angles to the wind, would be $c \cos \theta$. If then, H be the quantity of rain in horizontal gauge, and v that in the vertical, we have the two equations—

$$H = c \sin \theta, \quad v = c \cos \theta,$$

and therefore $\tan \theta = \frac{H}{v}$ and $c = H \operatorname{cosec} \theta = v \sec \theta = \sqrt{v^2 + H^2}$

c , H , and v have been considered above as cubical quantities, but as the mouths of the gauges are all of the same area, c , H , and v may stand for the linear measure of the rain. This value of c is represented in the third column of the table on page 33, headed "computed section." The mean deviation of the rain from the vertical, derived from the entire series of observations (not the mean of the monthly means) is $45^\circ 9'$.

The mean azimuth of the rain for each month may be computed in the same manner as the mean deviation from the vertical.

Mean Monthly Horizontal Direction of the Rain, measured from the Meridian.

January.....	S.	15° 47'	W.
February... .	S.	77 50	W.
March	S.	70 20	W.
April	N.	29 43	E.
May.....	S.	8 24	E.
June.....	S.	9 53	W.
July.....	N.	14 34	W.
August.....	S.	72 8	E.
September.....	N.	68 56	E.
October	S.	62 8	W.
November.....	N.	73 26	W.
December.....	S.	10° 49'	W.
<hr/>			
Mean of all values	S.	69° 59'	W.

GREENWICH OBSERVATORY.

Amount of Rain collected in different gauges in each month of the year 1868.

Position of Gauges ...	MONTHLY AMOUNT OF RAIN COLLECTED IN EACH GAUGE.						
	Self-registering Gauge at Osler's Anemometr	Second Gauge at Osler's Anemometer.	On the roof of the Octagon Room.	On the roof of the Library.	On the roof of the Photographic thermometer stand.	Crosley's.	Cylinder partly sunk in the ground. read daily.
	in.	in.	in.	in.	in.	in.	in.
January	2·14	2·07	2·89	2·78	3·54	3·48	4·19
February	·60	·53	·77	·55	1·01	1·09	1·28
March	·27	·25	·54	·42	·80	·91	1·07
April	·98	·93	1·15	1·05	1·61	1·60	2·08
May	1·08	1·21	1·34	1·18	1·41	1·27	1·67
June.....	·34	·33	·44	·35	·46	·45	·47
July.....	·58	·62	·73	·74	·90	·88	1·06
August.....	1·40	1·56	2·09	1·99	2·32	2·20	2·61
September....	·81	·81	1·15	1·09	1·27	1·20	1·52
October	1·20	1·24	1·78	1·72	2·16	2·07	2·59
November ...	·36	·36	·57	·51	·83	·85	1·16
December.....	3·15	3·13	3·77	3·21	4·35	4·25	5·45
Sums	12·91	13·04	17·22	15·59	20·66	20·25	25·15

The heights of the receiving surfaces are as follows :

	Above the mean level of the Sea.		Above the Ground.	
	ft.	in.	ft.	in.
Registering gauge at Osler's Anemometer, receiving surface				
10 in. by 20 in. ...	205	6	50	8
Second do., 12 in. diameter ..	205	6	50	8
Glaisher's 8 in. Gauge on the roof of the Octagon Room ...	193	2½	38	4½
Troughton's 6 in. Gauge on the roof of the Library ...	177	2	22	4
Glaisher's 8 in. Gauge on the roof of the Photographic Thermometer Shed ...	164	10	10	0
Crosley's Gauge ...	156	6	1	8
The Cylinder Gauge, partly sunk in the ground ...	155	3	0	5

JAMES GLAISHER, F.R.S.

ON SOME RESULTS OF RAIN GAUGE EXPERIMENTS.

We think it is highly satisfactory to find that the results obtained by all who have taken part in the conduct of experiments as to the effect of elevation, size, and material, upon the indications of rain gauges, are fairly consistent. Ebonite funnels have been worked by ourselves for nearly six years, and our first is as true in its figure and smooth in its surface as when first used. Exposure to sun and frost, smoke, snow, and fog, for six years is not a bad test of the permanency of a surface. Ebonite gauges have been tried by Mr. Crallan and Mr. Griffith, and each speaks in the highest terms of the material.

Mr. Crallan noticed the wind blowing rain-drops up the sloping rims of some of the gauges, and thus most unfairly increasing the registered amount. Mr. Griffith finds the same defect, intensified by a circular eddy in those gauges having flanges, and both concur in believing that truth can only be obtained by a sharp-edged upright rim.

We do not remember that either of them have referred to the angle of the funnel, but to us it seems certain it should be steep, for at least two reasons: its steepness ensures (1) the rapid passage of rain into the bottle, and (2) the retention of more hail and snow than if flat.

Mr. Crallan insisted that the tube should be as long and narrow as possible. Mr. Griffith has proved that if the tube be removed, a loss of quite 1 per cent. ensues. At present we have no evidence as to whether a japanned can or a glass bottle is the better to hold the water, our impression, and we believe Mr. Griffith's also, is that the bottle is to be preferred. The question will be tested.

During the hottest part of 1865 we placed a 5 inch can gauge inside an 8 inch can, and filled the intervening space with wet sand, the object being to prevent undue heating and evaporation of the rain inside. Mr. Casella at our suggestion improved upon this primitive arrangement, and substituted non-conducting boiler felt for the wet sand; both have been in operation in 1868 (Nos. II. and IV.), but the resultant benefit is very slight, though, as Mr. Griffith observes, "the bottle was always cool, even on the hottest day." We presume the reason no great benefit is derived, is that in all well-made gauges, however hot the water may become, the vapour cannot get out.

With respect to size, Colonel Ward's observations had led us to conclude that, with two or three exceptions, there was no variation of more than 1 per cent. produced by size. Mr. Griffith, by an almost unlimited, zeal, care, and delicacy, has reduced these exceptions, and

we think almost proved that size has no influence, except when the gauge is so small you cannot get the water out, or so large that it acts as a refrigerator, and condenses dew for its own measurement.

As to the elevation most proper for rain gauges, we see no grounds to alter our recommendation of a uniform height of one foot; six inches answers well, but a foot is beyond all suspicion, and we hope *all* new beginners will adopt it.

In this matter, and in determining the corrections to be applied to the records of gauges slightly elevated above the ground, all our experimental authorities agree very closely, and their result may be thus briefly tabulated :—

Height of Rim of Gauge above Ground	2 in.	4 in.	6 in.	8 in.	10 in.	1 ft.	1ft.6in.	2 ft.	2ft.6in.	3 ft.	4 ft.	5 ft.
Factor } 8 in gauge	1.050	1.034	1.021	1.011	1.004	1.000	.994	.990	.985	.980	.970	.962
Factor } 5 in gauge	1.050	1.034	1.021	1.011	1.004	1.000	.990	.978	.969	.960	.946	.934

Therefore it is only necessary to divide the fall observed at any height by the factor corresponding to it, in order to obtain the equivalent fall at the standard height of 1 foot. Let us take an example. At Cockermouth, in 1867, two 8 in. gauges, one 6 in. above the ground, the other 6 ft. 6 in. collected respectively 38.35 and 36.29, then—

$$\begin{array}{r}
 \text{8 in. gauge at 6 in.} \dots\dots\dots 38.35 \\
 \text{Factor} \dots\dots\dots 1.021 \\
 \hline
 \text{And 8 in. gauge at 6 ft. 6 in.} \dots\dots\dots 36.29 \\
 \text{Factor} \dots\dots\dots .953 \\
 \hline
 \end{array}
 = 37.56$$

$$\begin{array}{r}
 \hline
 \text{And 8 in. gauge at 6 ft. 6 in.} \dots\dots\dots 36.29 \\
 \text{Factor} \dots\dots\dots .953 \\
 \hline
 \end{array}
 = 38.08$$

whence it appears that there is half an inch (about 1½ per cent.) difference between the results of the gauges, no very serious quantity when we remember—(1) we are only dealing with *one* year's observations; (2) that it is possible some of the readings may be incorrect; (3) that the gauges may not have identically the same index errors; (4) that the lower gauge may be slightly sheltered; (5) that if its height has been reported only three inches too little, the two gauges would be in perfect accordance. Thus, assuming it to be nine inches instead of six, we have—

$$\frac{38.35}{1.007} = 38.08, \text{ and } \frac{36.29}{.953} = 38.08$$

Again, take from Mr. Griffith's table for 1868 the fall in the 5 in. gauge at 3 ft., and in (No. XIII.) the one of identical pattern 1 ft. above the ground, we have—

$$\begin{array}{r}
 \text{5 in. gauge, 3 ft.} \dots\dots\dots 28.557 \\
 \text{Factor} \dots\dots\dots .960 \\
 \hline
 \end{array}
 = 29.75 \text{ computed.}$$

The observed fall was 29·595 in. The difference here is only ·155 in., or $\frac{1}{640}$ th of the whole quantity.

It will be noticed that different factors are given for 5 in. and 8 in. gauges ; those 8 in. gauges which have been used in the experiments whence these values have been deduced are of the flanged pattern shown on page 17. It is not impossible that this flange may at considerable heights above the ground have the effect of increasing the quantity collected in it ; or it may be that the larger area has some special advantage of which we know nothing at present ; but this much is certain, that at heights of 10 ft. or 20 ft. above the ground, 8 in. gauges catch 3 or 4 per cent. more than 5 in. ones.

EVAPORATORS.—Not the slightest progress has been made in the investigation of this subject, and no new experiments have been devised or organized. We adhere to the suggestion on p. 10 of "*British Rainfall, 1867*," as most promising of trustworthy results ; but in the interim would offer another, which seems to us by no means unpromising, is excessively simple, very inexpensive (three or four shillings), and no trouble. The plan is this :—obtain a cylinder of painted tin or zinc, closed at one end, the diameter 5 inches, the length two-thirds of the annual rainfall of the place (*e. g.*, for London, with 24 in. of rain, about 16 or 18 inches would be the length of cylinder) ; obtain also a rule divided to tenths of inches ; bury the cylinder in the ground, so that its rim is 6 inches above the grass ; thus arranged it will catch all the rain that falls, and can lose it only by evaporation, and the total depth of water in the cylinder measured by dropping the rod vertically into it on the 1st of each month, will, by comparison with the register of the rain gauge, probably afford some useful results. At any rate we intend to try it.

RAINFALL IN CERTAIN DISTRICTS IN 1868.

EASTERN LAKE DISTRICT.

IN *British Rainfall*, 1867, we devoted considerable space to a sketch of the origin, progress, and present state of our knowledge of the rainfall of the Lake District. The following are the principal subsequent changes in the instruments and stations :—

- I. The establishment of a gauge at Crosby Ravensworth by the Rev. G. F. Weston. It is about half way between Wet Sleddale and Appleby, and the returns of the six months it has been at work afford a most satisfactory corroboration of the high values reported from Wet Sleddale—a place evidently most appropriately named. Crosby Ravensworth is about three miles east of Shap, and consequently beyond the limits of the accompanying map, and is 600 ft. above the level of the sea. We welcome the returns as from a most important out-post.
- II. The abandonment of the stations at Greenside, consequent upon the removal of the observer, who promised much and did little.
- III. The removal of the Greenside and Greenside mines gauges to the summit of Kirkstone Pass, to replace the gauge there, which had become leaky.
- IV. The visit of a weak-minded individual to three or four of the gauges, with a view to spoiling the returns, in which we are happy to announce he by no means succeeded so well as he anticipated.

The article above referred to contained, as the result of careful computation, the mean annual rainfall at 46 stations, and there are insuperable difficulties in the way of determining if the values therein assigned are to be modified by the experience of 1868, as will be seen from the following pages. With a view to eliminating them, we have decided on having certain of the gauges kept in operation for some time longer. This will, of course, involve some trouble and some expense, but we think it will be a wise expenditure of both.

The amount of rain at most English stations in 1868 was, as will be shown further on, very near the average; in the north-western, or rather perhaps the north-north-western districts, it was generally about ten per cent. above the mean, but in the Eastern Lake District the excess rose to 20, 30, and even 40 per cent., culminating in 42 per cent. at the head of Ullswater, and 37 per cent. at the head of Haweswater. This remarkable irregularity, confined to a small space, and decreasing on an average 10 *per cent.* for each three miles from the points just mentioned, renders it quite impossible to deduce any trustworthy mean values from this year's returns. It is sufficiently singular that within *ten miles* two stations should have, one 11 per cent., the other 42 per cent., above their respective mean values. This phenomenon is not a casual or doubtful one, as the following table will prove:—

No. on Map.	STATION.	Altitude.	Rainfall in 1868.	Excess in 1868. per cent. of mean
		feet.	in.	
35	The Howe	470	82·77	6·4
19	Langdale	380	118·25	10·5
28	Matterdale	1400	96·50 ?	10·9 ?
16	Keswick	270	65·72	12·3
24	Loughrigg	1050	78·00	13·0
A	Easedale	1175	111·00	14·4
42	Wet Sleddale	1500	108·75 ?	16·9 ?
27	Low Nook	170	88·88	18·5
13	Watendlath	867	99·24	19·6
21	Birkside	1800	112·50	22·3
17	Greta Bank	400	67·33	22·4
37	Watermillock	720	67·70	25·4
44	Great Strickland	647	48·37	27·3
B	Barrow House	270	84·60	28·2
39	Swarthfell	1000	59·00 ?	28·3 ?
41	Measandbecks	1200	69·75 ?	29·2 ?
20	Wythburn	574	115·75	31·5
36	Hallsteads	480	69·20	33·1
40	Mardale Green	800	123·08	36·7
33	Patterdale	500	106·14	41·5

The stations in this table, as will be seen, are arranged according to their excesses above the mean. The question then arises—Is it possible to determine the cause of these unusual and excessive variations? Let us first break the table in half; we then have—

	Mean Altitude.	Rain in 1868.	Excess.
	feet.	in.	per cent.
First ten stations	908	96·16	12·3
Second ditto	659	81·09	30·4
Mean of twenty	784	88·63	21·4

which suggests that though, as we have said, the excess is greater in the mountainous lake district than elsewhere, yet in that district the

higher and wetter stations were not so much in excess as the lower and drier ones. In order to test this, let us take—

Six wettest stations ...	1038	.....	114·89	.....	22·0
Eight medium ditto...	741	.....	88·24	.....	20·9
Six driest ditto ..	586	.....	62·89	.....	24·8

From this it is clear it does not depend on the largeness of the fall, and seems probable that it does not depend upon the height of the station, but to test this we will compare—

Six highest stations ...	1354	.....	96·08	.....	17·8
Eight medium ditto...	698	.....	86·06	.....	30·4
Six lowest ditto	327	.....	84·59	.....	16·4

This seems to show that it really does depend on the altitude, but to test it in another form, we will group the returns in zones of 250 ft., omitting the total amounts of rain, which appear to have nothing to do with the present question.

Altitude.	Number of Stations.	Mean.	Per Centage.		Min.
			.....	Max.	
0 to 250 ft.....	1	18·5	.....	18·5	18·5
251 ,, 500	7	22·1	.....	41·5	6·4
501 ,, 750	3	28·1	.....	31·5	25·4
751 ,, 1000	3	28·2	.....	36·7	19·6
1001 ,, 1250	3	18·9	.....	29·2	13·0
1251 ,, 1500	2	13·9	.....	16·9	10·9
1501 ,, 1750	0	.	.....	.....	.....
1751 ,, 2000	1	22·3	.....	22·3	22·3

Here again the per-centage varies with the height, so that it would seem we must acknowledge that there is some connection between the altitude of the stations and the abnormal excesses in 1868, and that that influence was greatest at about 750 feet. Before leaving the question of the influence of altitude, let us extract the results in one more form, which completely overthrows all that has been so clearly proved (!)

Per Centage Excess.	Altitude.	Range of Altitude.
10 to 13	380, 1400, 270, 1050 feet	1130
14 ,, 17	1175, 1500	325
18 ,, 21	170, 867	697
22 ,, 25	1800, 400, 720	1400
26 ,, 29	647, 270, 1000, 1200	930
30 ,, 33	574, 480	94
34 ,, 37	800	0
38 ,, 41	500	0

Surely where the range is so excessive as this shows it to be, averages are of no use, and altitude can have little influence on the matter. The suggestion may be dismissed with the double fact that the highest and lowest stations only differ 3·8 per cent., and that the greatest and least per-centages are at two stations whose altitude only differs 30 ft.

We ought, perhaps, to apologize for printing so long a statement leading to nothing. The proper destination of the above calculations would have been the waste-paper basket, but figures are so often made

plausibly to prove anything, that we have retained the above calculations as a specimen of the process, and a caution against hasty theorizing.

We may probably safely assume it to be proved that the abnormal excess is not connected with the ordinary relative wetness of the stations, nor with their altitude. Let us then try if it is due to their geographical position; reference to the map will at once show that, with few exceptions, the stations on the outskirts had about 12 per cent. more than their average, and those in the centre 30 or 40. If the district be divided into squares of 25 miles area each, the result is—

12	17	11	29	27
10	28	42	33	...
10	13	16	...	17

Similar results are obtained if the squares are drawn with their sides S.W.—N.E., instead of S.—N.; and still more markedly by describing circles of $2\frac{1}{2}$, 5, $7\frac{1}{2}$, and 10 miles radius round a point two miles N. of Brotherswater, the actual values are—

Under $2\frac{1}{2}$ miles	.....	42	.....	Mean.	42
Over $2\frac{1}{2}$ and under 5	.....	37, 33, 29, 28, 25, 22	.....		29
„ 5 „ „ $7\frac{1}{2}$	.....	32, 19, 14, 11?	.....		19
„ $7\frac{1}{2}$ „ „ 10	.....	28, 22, 20, 17?, 11, 6	.....		17
„ 10 „ „ $12\frac{1}{2}$	.....	27, 12, 10	.....		16

It would be absurd to expect that these excesses should decrease gradually in any regular figure, whether a square, circle, or ellipse, in a district the surface of which is so irregular as the Lake District. Hence we accept it as a fact that the excess increased gradually from the outskirts of the district to its centre, and was greatest at the head of Ullswater and Haweswater.

It seems hopeless to detect the cause of the irregularity by discussing the yearly totals; we must examine the monthly falls, and see if they throw any light upon the subject. The only satisfactory mode of doing this is by computing for each station the per-centage of the total yearly fall, registered in each month of 1868. Few observers are aware how strict a check this process is upon the accuracy and regularity of their observations. As illustrating at once the facility of this mode

of checking, the regularity of the distribution of rain even in this irregular tract of country, and the peculiarities of the past season, we print the resultant per-centages in detail. Prefixed to the table is a column (for which we are indebted to Mr. Gaster's paper in *British Rainfall* 1867, p. 35), giving the per-centage of the yearly total which ordinarily falls in the Lake District, and at the end is another giving the averages in 1868.

Months.	Ordinary Per-centage.	Patterdale.	Mardale.	Hallsteads.	Wythburn.	Measandbecks	Swarthfell.	Barrow Ho.	Gt. Strickland	Watermillock.	Greta Bank.	Birkside.	Watendlath.	Low Nook.	Wet Sleddale	Easedale.	Loughrigg.	Keswick.	Matterdale.	Langdale.	The Howe.	Mean Per Cent. in 1868.
J.	14	11	14	14	13	11	16	14	14	9	15	13	14	11	13	12	10	15	14	10	8	12·6
F.	9	13	11	13	11	11	7	11	8	13	9	10	11	11	12	12	8	11	11	12	14	11·0
M.	6	13	12	9	13	11	11	13	11	11	13	13	13	12	12	15	11	12	12	17	15	12·4
A.	6	6	6	9	6	7	8	6	7	7	6	6	6	6	6	5	6	6	8	7	5	6·5
M.	4	5	5	3	4	3	5	4	4	5	5	4	4	4	4	4	4	4	4	4	3	4·1
J.	6	1	3	0	2	2	1	2	1	1	2	2	2	1	2	2	2	2	2	2	1	1·6
J.	7	0	1	2	0	0	0	1	1	1	0	1	1	1	2	1	1	1	1	1	1	·9
A.	9	9	9	10	10	13	10?	9	9	9	11	8	10	11	9	11	11	11	9	9	9	9·9
S.	7	5	4	6	4	5	8	3	6	6	5	4	4	4	4	3	4	5	6	3	4	4·6
O.	10	10	12	9	11	12	8	12	9	9	10	11	12	13	15	12	15	8	8	12	13	11·1
N.	9	7	5	9	6	5	4	6	7	7	5	7	5	7	7	5	6	4	4	5	8	6·0
D.	13	20	18	16	20	20	22	19	22	21	19	21	18	19	13	18	22	22	20	18	19	19·3

From this we learn (1) that the only months in which the fall differed much from the average were March and December in excess, and June and July in defect; (2) that except in January and September the distribution over the district was singularly uniform. This disposes of one probable explanation of the excess in the central districts—viz., an excessive fall during some one month. There is nothing to support such a view, and this table appears to drive us to the conclusion, that whatever was the cause of the excess, it acted almost equally throughout the year.

Therefore, unless we are prepared to condemn the mean values given last year, which for several reasons we think it would be unwise and almost impossible to do, we are driven to the conclusion, that *the causes which ordinarily produce the excessive rains of the Lake District operated to an unusual extent during the whole of 1868 at the heads of Ullswater and Haweswater.*

If it be assumed that the heavy rainfall of the Lake Districts is produced by the cooling of the air by contact with the colder mountains, it does not seem improbable that in so warm a year as 1868, the difference between the temperature of the air and that of the mountain masses would be greater than usual, and therefore the condensation would be proportionally greater, especially at stations situated like Patterdale and Mardale.

EASTERN LAKE DISTRICT.

Since the foregoing was in type, the returns of the Western Lake District have been received from Mr. Fletcher; they support as strongly as it is possible so to do, the conclusions arrived at in the preceding pages, but they do not throw the slightest glimmer of additional light on the cause.

No. on Map.	STATION.	Altitude.	Rainfall in 1868.	Excess in 1868 per cent. of mean.
		feet.	in.	
9	Taylor's Gill.....	1077	178·17	2·5
3	Brant Rigg	695	80·78	3·7
7	Sprinkling Tarn ...	1985	126·81	4·8
1	Wastdale Head ...	247	95·38	6·0
11	Seathwaite, 4 in. ...	422	138·33	9·1
11	„ 8 in.	422	142·50	9·6
5	Great End.....	2982	75·63	9·6
8	Stye Head.....	1472	130·71	9·8
11	Seathwaite, old 5 in.	422	157·11	12·2
4	Scawfell	3200	70·77	12·3
6	Esk Hause	2550	92·08	13·7
10	The Stye.....	1077	207·49	14·1
12	Stonethwaite	330	119·49	16·0

From this table we see, as in the Eastern so in the Western, district, the excess does not vary with the altitude nor with the amount, but, small as is the area occupied by these stations (five miles from west to east and three from north to south), they yet indicate the same fact as previously obtained from the larger area, the Western stations having a mean excess of 8 per cent., and the Eastern ones of 11 per cent., which agrees perfectly with the amount due to the district by the concentric circular arrangement round Brotherswater before mentioned. It gave—

Within a radius of	Mean Excess.	
	Eastern Stations. per cent.	Western Stations. per cent.
2½ miles	42	...
Over 2½ and under 5	29	...
„ 5 „ 7½	19	...
„ 7½ „ 10	17	...
„ 10 „ 12½	16	16
„ 12½ „ 15 .....	...	10
„ 15 „ 17½ .....	...	8

They thus most abundantly corroborate the facts previously deduced ; though the explanation may be doubtful the facts are not.

DERBYSHIRE.

To the best of our knowledge no steps have been taken towards obtaining the additional stations in the vicinity of the Peak, which we hold to be so necessary, that we have urged again and again the desirability of starting them. We do not bring forward any fresh arguments on behalf of the proposal, because we consider them unnecessary, but we shall not cease drawing attention to their importance until they have been actually started.

We have much pleasure in noting that Mr. Sykes has planted a gauge on Axe Edge, at an altitude of 1,600 feet, for comparison with that at 1,000 feet at the Devonshire Hospital, Buxton. We have also, as will be seen subsequently, returns from new stations at Cromford and Matlock.

 WALES.

In our last we expressed the conviction that "these returns are rapidly removing the rainfall of Wales from the uncertainties of conjecture to the rigorous domain of physical facts." Thanks to Major Mathew, Mr. Bateman, and the observers in the Principality, the progress commented upon in 1867, has been continued through 1868. Much remains to be done; but our information now, with nearly a hundred stations, will bear very favourable comparison with fourteen, the total number at *all* periods before 1860, and of which not half a dozen were available at any one time. The presumption of those who produced shaded rain maps, and assigned different tints to various parts of the country, becomes strikingly evident from this fact—but this by the way.

There are no long-established continuous registers in Wales, and hence it might appear, at first sight, very difficult to assign mean values to any Welsh stations without great liability to error; but, by a species of rainfall triangulation, and by four different modes of computation, which it would be absurd to reproduce in detail, it has been placed beyond doubt that the rainfall during the six years, 1860-65, was very nearly (within 3 per cent. + or —) equal to the mean of the fifty years, 1815 to 1864. It also appears, from the following table, that these six years, 1860-65, were very nearly identical with the nine years, 1858-1866, which have been elsewhere shown to be within one per cent. of the mean of the twenty years, 1847-66, thus affording additional confirmation of the correctness of the 1860-65 mean.

STATION.	COUNTY.	Average.		Depth in 1868.	Difference from average, 1860-5.	
		1858-66.	1860-65.		Amount.	Per cent.
		in.	in.	in.	in.	*
Cardiff, Ely	Glamorgan ...	...	41·86	41·59	·27	— 1
Rhydwen	Carmarthen' ...	...	49·04	52·10	3·06	+ 6
Lampeter	Cardigan	44·02	43·81	48·26	4·45	+ 10
Hay	Brecknock .....	...	29·77	33·37	3·60	+ 12
Rhayader	Radnor	45·13	44·88	42·53	2·35	— 5
Hawarden	Flint	25·41	24·45	27·61	3·16	+ 13
Holywell	„	24·22	23·58	20·73	2·85	— 12
Llandudno	Denbigh .....	...	30·09	29·75	·34	— 1
Burford	Shropshire	25·66	26·25	26·58	·33	+ 1
Mean .....		..	34·86	35·84	·98	+ 3

It further appears that the rainfall in 1868 did not, on the whole, differ much from the 1860-65 mean, being about three per cent. in excess. Bearing these facts in mind, we are in a position to estimate, with some approach to accuracy, the distribution of rain throughout the Principality. Not that we would for a moment countenance the idea that we have by any means exhausted the subject—not at all; for instance, the greatest rainfall reported from Glamorganshire in 1868 is 64·13 from Aberdare, and had the old station of Ystalyfera been at work it would have given about 67 inches. But, in 1852, four gauges were at work in the Swansea Valley, which collected:—

Allygrug	85·66 in.	Ynisedwyn	92·67 in.
Graigarw	81·62 in.	Ystalyfera	84·08 in.

Thus we see that instead of the (64·13, plus three per cent., *i.e.*) 66·05 at Aberdare representing the greatest fall in the county, if there had been a return from Ynisedwyn it would have shown a mean of about 76 inches.

Making allowance for the inevitable existence of deficiencies of this class, we yet possess a very considerable acquaintance with the general character of the rainfall of the Principality. The ordinary coast fall, at a small elevation, may be taken at 43 inches, rising to 70 or 80 in parts of Glamorganshire, and probably in a small district near the Brecknockshire Beacons. Falls of 80 inches per annum occur also on the hills N.E. of Plynlimmon and Aran Mowddy. It will be seen that 80·60 is reported also from the valley at Llanwddyn, but with the mark of uncertainty against the

* To economize space, the signs are not repeated, but placed between the amount and per-centage, to each of which they of course equally apply.

entry, for the following reason. The gauges in this district were started October 1st, 1866. The returns have been as follows:—

Period.	Llanwddyn. 720 ft.	Head of River Vyrnwy. 2000 ft.	Head of River Clwydog. 1300 ft.
Oct.-Dec., 1866	16·33	24·80	24·90
Year 1867.....	67·40	81·70	84·70
Year 1868.....	80·60	80·80	83·50

Turning these values into ratios, for the sake of comparison, we have

Oct.-Dec., 1866	·66	1·00	1·00
Year 1867.....	·80	·96	1·00
Year 1868	·97	·97	1·00

Whence it appears that whereas at first the fall at Llanwddyn was, as might have been expected, two-thirds that on the hills, in 1868 it is reported to have been the same within 0·20 inch, which is improbable if not impossible. It is not customary in these pages to enter into the detailed reasons for inserting the (?), but knowledge of the importance of these gaugings has induced this explanation.

Continuing our survey of the rain-producing capabilities of Wales, we come upon a still wetter spot at the upper portion of Merionethshire, namely, at the Rhiwbrifdir Slate Quarries, near the upper terminus of the celebrated Port Madoc railway, where the mean annual fall is very nearly 100 inches. Still further north we have, and have had, three stations within a mile or two of the summit of Snowdon, which appear to have a mean annual fall of 110 inches; they are—Beddgelert (No. 5 on the Map), and Hafod-y-lan Quarry (No. 38), on the south, and Snowdon Quarries (43), on the west of the mountain.

One special characteristic of Welsh rainfall is the very small area within which large falls are found to prevail. For instance, if circles of ten, fifteen, and twenty miles radius, respectively, are struck from Snowdon and Scawfell Pike as their respective centres, it will be found that the N.E. quadrants of the inner and outer Welsh zones have mean falls of 46 and 28 inches respectively, and that at the corresponding distances from Scawfell the mean is 79 and 61 inches respectively. Or to put it another form:—the mean fall is only 25 inches at 18 miles N.E. of Snowdon, but it does not reach that low point until 30 miles from Scawfell.

SCOTLAND.

The rainfall at most Scotch stations has been so largely in excess of the average, and the averages themselves having been (we think, too hastily) impugned, on the ground that many of them are from the

stations of the Board of Northern Lights, where accurate observations are rendered impossible by the amount of sea spray blown into the gauges, we do not propose to enter on any detailed examination of the distribution of rain in Scotland, beyond that which will naturally arise subsequently in considering the rainfall of the whole country.

We are sure that the lighthouse stations are of great value, and we are prepared to prove it if necessary. For the present we confine ourselves to two or three facts which lie on the surface of the question, such as—What can any one tell us of the rainfall in Scotland before 1850, if they do not use lighthouse returns? There are the Carbeth, Deanston, Dollar, Glasgow, and Haddington registers, and broken ones at various places, but for “continuity” nothing comes up to the returns of the Board of Northern Lights. But perhaps some one may think a continuous bad register worth nothing. In the first place, it must be proved that they are bad, and in the next that the error is a variable one, for, if it be a constant one, although the amount reported would be wrong, it would answer just as well for determining the fluctuation of the fall from year to year. We will return to the question of goodness or badness: let us first consider that of their utility as standards of reference in regard to the fluctuation in the amount of rain from year to year, and from decade to decade. From the usual comparison table, on a subsequent page, we find the three westerly stations round the Isle of Mull return as follows:—

Station.	Mean.		Fall in 1868.	Diff. from 1860-5.	
	1850-59.	1860-65.		Amount.	Per cent.
	in.	in.	in.	in.	
Tyree (Hynish)	73·90	84·77	83·42	4·35	— 2
Lismore	38·44	46·95	45·98	·97	— 2
Ardnamurchan	38·50	47·94	44·01	3·93	— 8

If now we take 1850-59 as the mean, we shall find that not only do they agree fairly in 1860-65 and 1868, but that throughout the seventeen years they rise and fall with regularity.

Tyree (Hynish)	1·00	.....	1·15	.....	1·13
Lismore	1·00	.....	1·22	.....	1·20
Ardnamurchan	1·00	.....	1·24	.....	1·14

This is by no means an extra favourable specimen, and singularly enough it illustrates the good which may be got out of bad returns, for Ardnamurchan and Lismore are remarkably below adjacent stations. It would be very desirable to know *why* they are so different, but it is imperative that, *if* any fault is detected, it must be perpetuated, or

the whole value of the register will be destroyed (see Rule II.) The gauges should be visited and tested, and the cause of the errors discovered, if possible; new gauges should be provided where necessary, but, *for a few years*, the old ones *must* be kept on, for the purpose of connecting the two series. The Board of Northern Lights have long held a high position, in the estimation of meteorologists, for the aid their returns often afford, and set an example it would be well indeed for the Elder Brethren of our Trinity House to follow.

IRELAND.

If either of the three kingdoms has need of an efficient staff of rain observers it is Ireland, with its thousands of acres of land still undrained, or in process of drainage. But, as a rule (of course, with exceptions), neither landlords nor tenants "see the use of measuring the rain," and when the drainage works are to be begun a gauge is stuck up and a random shot made from this spasmodic register. Works designed in accordance with such a record are scarcely likely to be the best adapted for the locality, and perhaps if the resultant fact was generally known that it would save £ s. d. to have some more rain gauges in the country, we should no longer have to point out that in England there is one gauge to each 58 square miles; in Wales, one to each 84; in Scotland, one to each 116; and, in Ireland, only one in each 479 square miles.

ON THE MONTHLY PER-CENTAGE OF MEAN ANNUAL RAINFALL.

BY FREDERIC GASTER, ESQ., F.M.S.

IN "*British Rainfall, 1867*," a paper was inserted on the "Monthly Per-centage of the Mean Annual Rainfall at Stations in the British Islands," and it was shown that the per-centage of the mean annual fall which is registered in the different months varies according to certain laws in proportion as the annual rainfall at the station is large or small. The rules which were then laid down as being general, related only to stations in England, and were obtained principally from observations made in the decennial period 1850-9, without in any way referring to the particular portion of the country where the observations were made. The whole of the values received for the complete period were taken in groups for each 5 in. of annual fall from 15 in. to 60 in. ; but supplementary tables were given for the periods 1830-9 and 1840-9, in which the stations had been collected into western, central, and eastern districts, and arranged in 5 in. groups as above. It was moreover stated that the returns for 1850-9 were being treated in a similar manner, in order that any possible effect of position with regard to longitude might be rendered apparent.

Not only has this now been done, but the returns for Scotland and Ireland have also been tabulated for the three decennial periods from 1830 to 1859—Scotland being divided into two districts, eastern and western, and the Irish stations (on account of the few returns received), being merely arranged in 5 in. groups, without being referred to districts at all.

The whole of the mean values derived from this system of grouping were presented in the Report of the Rainfall Committee to the British Association, at their Norwich meeting, and will appear *in extenso* in the Report, together with some remarks thereon. But the main features in the variations observed in the period 1850-9 were so well confirmed and supported by the records of the previous years, that it will be unnecessary in the present case to do more than quote those for this period in England, Scotland, and Ireland—as on account of the great excess of returns, the variations are more distinctly and conclusively exhibited.

The following are the tables referred to :—

Monthly Per-centage of Mean Annual Rainfall in the Decennial Period, 1850-9.
(Mean values.—Stations arranged in 5 in. groups, according to their annual fall.)

ENGLAND AND WALES.

Limiting Amounts.	Name of District.	No. of Stations.	MONTHLY PER-CENTAGE OF ANNUAL FALL.															
			Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.				
in. in.																		
15—20	W.	0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	C.	1	7.7	4.5	4.8	7.0	6.2	11.1	11.8	13.2	8.6	11.1	8.3	5.7				
	E.	4	7.7	4.7	5.3	6.9	7.4	8.7	12.3	11.8	9.3	10.7	8.9	6.3				
20—25	W.	8	7.9	5.5	5.7	7.2	7.0	10.2	10.6	10.5	9.1	11.1	8.5	6.7				
	C.	9	8.5	4.4	5.0	7.0	7.8	9.4	11.7	10.6	9.0	11.9	8.3	6.4				
	E.	12	7.9	4.8	5.1	7.1	8.7	8.2	12.1	10.4	9.0	12.3	8.6	6.0				
25—30	W.	11	9.1	5.4	5.5	6.9	7.2	9.0	9.9	9.8	8.4	11.7	8.5	8.6				
	C.	7	8.8	4.5	5.3	7.6	8.0	8.6	9.6	9.5	9.0	13.3	8.5	7.3				
	E.	12	8.7	4.8	5.3	7.0	7.5	7.3	11.0	9.6	9.5	12.7	9.5	7.1				
30—35	W.	9	9.3	6.1	5.7	7.2	6.3	8.4	8.7	9.4	8.7	11.7	9.3	9.2				
	C.	0	...	...	...	...	...	...	...	...	...	...	...	...
	E.	2	9.7	4.2	5.5	6.9	7.6	7.6	8.7	8.1	10.0	14.9	8.9	7.9				
35—40	W.	5	10.4	6.9	6.6	7.0	5.8	8.5	8.1	9.0	7.9	11.3	9.0	9.5				
	C.	0	...	...	...	...	...	...	...	...	...	...	...	...
	E.	1	9.7	4.5	6.8	6.7	7.0	7.8	9.4	7.8	10.1	14.3	8.2	7.7				
40—45	W.	4	11.4	7.4	6.5	6.9	5.8	7.7	7.7	8.6	7.6	10.9	9.2	10.3				
45—50	W.	2	9.3	7.7	5.3	5.6	4.8	9.4	9.4	10.9	8.7	10.9	8.8	9.2				
50—55	W.	2	10.7	7.1	6.4	7.3	5.8	7.7	7.7	9.2	8.0	10.6	9.3	10.2				
55—60	W.	1	13.9	7.8	5.7	4.9	4.8	7.0	7.7	8.1	8.4	10.7	8.5	12.5				
60—65	W.	1	13.9	9.1	5.8	5.5	4.3	6.4	7.4	9.1	7.0	10.2	8.7	12.6				
65—70	W.	0	...	...	...	...	...	...	...	...	...	...	...	...
70—75	W.	2	14.1	9.6	6.0	5.5	4.0	6.4	6.8	9.0	7.2	9.8	8.9	12.7				
125—130	W.	1	13.6	9.6	6.4	6.0	4.5	6.8	7.2	8.5	7.2	10.2	8.1	11.9				

SCOTLAND.

15—20	W.	0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	E.	3	8.4	5.4	5.4	7.1	5.5	8.2	9.2	10.9	8.6	11.8	9.9	9.6				
20—25	W.	1	10.9	8.2	6.2	7.4	4.8	9.0	9.4	7.3	5.1	10.8	9.4	11.5				
	E.	10	9.9	6.4	5.5	5.8	5.4	8.6	9.4	9.3	8.1	12.4	9.5	9.7				
25—30	W.	*1	11.4	7.8	5.7	5.3	6.3	9.4	10.1	9.4	8.1	10.1	6.4	8.0				
	E.	7	10.7	6.8	6.2	6.3	5.5	8.7	9.1	9.6	7.3	10.9	9.1	9.8				
30—35	W.	3	11.0	8.3	6.7	5.9	4.6	6.7	8.9	8.5	8.1	10.3	9.4	11.6				
	E.	5	10.9	6.6	7.1	6.8	6.2	8.3	8.2	8.6	8.3	10.2	9.9	8.9				
35—40	W.	4	11.1	7.6	6.6	5.5	4.9	8.0	9.2	8.4	7.5	10.9	8.9	11.4				
	E.	2	12.2	7.8	6.5	5.7	5.0	7.4	8.0	8.7	7.3	11.3	9.1	11.0				
40—45	W.	4	11.0	8.2	6.3	7.8	5.5	8.5	8.2	9.5	6.5	9.5	8.6	10.4				
	E.	*1	10.2	8.0	5.0	4.8	6.2	8.8	11.2	10.6	7.3	10.1	6.3	11.5				
45—50	W.	2	10.5	8.6	6.9	6.8	5.7	8.5	8.5	9.2	6.6	9.9	7.7	11.1				
50—55	W.	1	11.7	7.9	6.4	5.7	5.4	6.5	9.2	8.7	7.3	10.4	8.2	12.6				
65—70	W.	1	13.0	9.2	6.9	6.4	5.0	6.6	7.4	7.8	6.7	10.1	7.7	13.2				
70—75	W.	1	14.4	9.3	6.6	4.9	4.0	5.4	6.9	6.1	8.0	10.1	9.5	14.8				

* The returns from these stations seem very singular.

IRELAND.

(N.B. The number of stations in Ireland is so small, that their arrangement into districts has not been attempted.)

20—25	...	2	9.3	5.5	6.2	7.9	8.1	10.3	9.0	8.4	8.0	9.6	9.7	8.0
25—30	...	2	9.8	5.3	6.0	8.8	8.0	9.8	9.6	7.7	7.9	9.6	8.7	8.8
30—35	...	2	11.5	8.0	6.7	8.1	6.0	7.7	8.5	9.2	7.2	8.5	8.4	10.2
35—40	..	3	11.2	6.9	6.8	7.5	6.3	8.4	8.2	8.9	7.4	9.2	8.6	10.6

From these the following rules may be briefly drawn, as being observed *generally* in the three parts of the United Kingdom.

ENGLAND AND WALES.—The rules for this division are little else than a recapitulation of those given in “*British Rainfall, 1867.*”

1. With some few exceptions, the time of year when the maximum *monthly* rainfall occurs varies in accordance with the variations in the *mean annual* fall at the station. Comparatively dry stations have their maximum in the summer months, whilst at the wetter stations the period of maximum falls later in the year, till at the very rainy stations we find the maximum in the winter months. This seems to hold for all three divisions (W., C., and E.) into which we have imagined the country to be divided. There is, however, some reason for believing that at stations with actually the *same* average annual fall, the maximum monthly proportion occurs rather later in the eastern than in the western districts. This, however, will need further examination.

2. In places where the mean annual rainfall is small, the period of minimum monthly fall is found in *March*, but with increased rain this period advances, though more slowly than that of the maximum; and at stations where the rainfall is large, it is found in *May*. If we examine the tables merely as they stand, it may appear that in some cases the minimum is as early as *February*; but on allowing for the deficit of time in that month, the true minimum for dry stations will be *generally* found in *March*.

3. At stations where the mean annual rainfall is large, the maximum is a much more decided maximum, and the minimum a much more decided minimum than at stations where the fall is small; or, in other words, the larger the annual fall the greater is the *range* between the monthly values.

SCOTLAND.—1. The peculiarities in the Scottish rainfall are represented by a number of stations scarcely sufficient to give so regular a result as that for England, but the time of maximum evidently differs from that in the latter country, as follows:—At stations which have a small annual rainfall, the tendency is to an *autumnal* maximum, instead of the summer one of England; but at stations where a large amount of rain is registered, the maximum in the *winter* is exhibited in a very clear manner—as in England.

2. The time of minimum fall also seems to occur a little later at dry stations than in England, and perhaps to extend over a greater time (*March* to *May*); whilst in wet districts it falls in *May* only. Considerable caution must, however, be used in accepting this, on account of the very limited number of stations from which reports have been received for the whole period 1850-9.

3. At wet stations these extremes are more marked than at comparatively dry ones.

IRELAND.—The Irish returns are still less numerous than the Scotch, and the total annual falls differ but little from each other. At the drier stations a February minimum and early summer maximum *seem* to prevail; whilst in the wet districts a May minimum and winter maximum are shown. The extremes are, however, not so decided as in the sister countries, and altogether the want of observations spoils the regularity of the results.

With regard to the causes of the peculiarities here indicated, little can at present be said; but it may be desirable to point out one or two considerations, which are suggested by the work in its present state. It will, however, be necessary to wait until the completion of the present decennial period, 1860-9, in order to obtain records from a vastly larger number of better managed stations before attempting a more minute inter-comparison of the records.

One fact should be constantly borne in mind, viz., that the averages hitherto obtained are calculated from observations made with gauges at variable heights above the ground and sea level; and it is probable that the peculiarities noticed may be, to a considerable extent, the effect of one, or both, of these causes. That it is not entirely the height above *ground* seems certain, as phenomena of similar nature are observed in gauges at all heights, and the recent experiments at Calne and elsewhere (the results of which are to be found in previous volumes of *British Rainfall*) give us fair corrections for altitude above the earth's surface. It is also equally certain that *mere height above sea* is not *the* cause of the changes referred to, nor is *mere* geographical position. *All* probably help to produce the effect noticed, and if so, the value for *each* should be eliminated.

It may, however, be remarked, that could careful observations be made at sea, where no influence of undulating land exists, much might be done in clearing up the questions which are presented to us in this branch of land meteorology.

The Dutch Government some time since published a series of bi-monthly charts, showing the *prevalence* of rainy weather in the Atlantic and Indian Oceans, and from these a few facts will now be quoted.

The charts were compiled in the following manner:—The surface of the ocean being divided hypothetically into certain convenient districts, the meteorological registers kept by captains of vessels in these districts were examined. The total number of observations of *every* weather noted in each district was first tabulated, and then

the number of those observations in which rain (without regard to intensity or duration) was registered, was entered in a corresponding column. This collection of data for *each month* being carried on for several years, totals were obtained, and the per-centage of rainy weather calculated. Charts were then prepared, and the average prevalence for each two months during the year (beginning with December-January) was entered in the districts to which they referred.

An examination of these charts tends to show that in our latitudes in the Atlantic Ocean, and near our shores, the driest period is April and May, whilst the wettest appears to be October and November. This result is peculiar, but it must be remembered that neither the relative intensity of rain at these periods, nor its continuity, has been considered; and it is not intended to state here that stations where the rain falls during the greatest number of hours *are*, as a rule, the wettest stations.

These charts will be again examined when speaking of the monthly per-centage of rain more minutely on a future occasion. A careful registration of the *hours* of rain on *land* is evidently most necessary, as affording the only means of comparison with marine statistics at present available.

ON THE IMPORTANCE OF REGISTERING THE MAXIMUM
RAINFALL THAT MAY COME IN THE MINIMUM TIME.

By W. MENZIES, Esq.

THE attention you have formerly given in your annual register induces me to trouble you again on a subject which has not yet received its due importance. The averages of rainfall one year with another are very valuable, inasmuch as we can generally calculate upon what we may expect to receive as a whole. The average monthly supply is also valuable, because we are thus enabled to judge at what season, one year with another, we may enter upon works requiring dry weather for their execution. So also are the average number of rainy days in a year, and the average fall on those days is, to a certain extent, valuable ; but something more is wanted, if we can get it from some observers as enthusiastic as yourself, who have the opportunities of doing it. It would be of the greatest advantage if the longest period of drought could be stated clearly each year for several places, and also if the maximum amount of rain falling in the shortest period could also be given.

A good knowledge of the former is of the greatest service in calculating all reservoirs, tanks for houses, and capability of storage ground, and as it is not unlikely that the legislature will make a full enquiry before long into the sanitary condition of the labouring classes, it is probable that stipulations will be made as to the storage of water, and the first question that will arise in each locality will be, What is the longest known period of drought in each neighbourhood ?

Generally these matters have been done in a very hap-hazard way, without any accurate data for their foundation, but it is hoped we shall have something better in the future.

The second point to which I have alluded is even more important.

Much discussion has arisen during the last four or five years on drainage questions, especially in the Thames valley, (see report by Lieut.-Colonel Ewart, of the Royal Engineers, on the proper principle of drainage to be applied to the towns of Oxford, Eton, Abingdon,

and Windsor, October, 1868 ; Harrison & Sons, Pall Mall,) in which the treatment of the rainfall became of the first consideration. At page 28 of your last year's report you give some of the data upon which Mr. Bazalgette founded his calculations when designing the metropolitan sewers, and you there state from these data "there would appear to be 155 rainy days annually, whereof only 25 had a quarter of an inch in 24 hours."

Again, at page 80 of the same book, you state that 3.30 inches fell at Crossness on the 26th July. The inference is that this fell in 24 hours, whereas we know from a statement published immediately after that day, that that quantity fell in nine hours, and the inference is still greater that it fell at a much greater rate than even that during some period of these nine hours. Now although rainfall does not arrive at an outlet drain with the same instantaneousness, or in the same quantity, as it falls on the roofs, &c., of a town, it is obvious that any calculations made for averages such as that spoken of by you, a quarter of an inch in 24 hours will break down in cases where carrying power of drains and pumping power of engines are concerned. In reality, the uncertainty of these rushes of rain, and the violence with which they come, have led many people (of whom I am one) to insist upon the total exclusion of rainfall from sewage drains. The question will no doubt be still much contested, and many thousands of pounds and other important interests are depending upon the issue.

Accurate knowledge of the worst that can happen will facilitate the investigation.

Truer words were never penned than those in the foregoing which state that the determination of the longest period of drought has hitherto generally been of a very hap-hazard nature. But we do not hold meteorologists solely responsible for the omission. To the best of our knowledge, no engineer ever defined what was to be considered as a drought, and we do not think any two of them would, if asked, give identical definitions. We have therefore had nothing to guide us in the preparation of the article upon the subject given in a subsequent portion of this work ; it, like everything else, must stand or fall by its own merits ; and if it falls before some really good definition of a drought, we shall view its overthrow with satisfaction, perfectly content that our failure should be the foundation of one of more stable structure instead of the hap-hazard, shadowy myths which have so often misled and mystified those who have tried to use them.

We heartily concur also in Mr. Menzies' second suggestion, as to the desirability of ascertaining the maximum fall in the minimum

time. After this knowledge we have been striving for some years, and if Mr. Menzies had had time (which we well know he has not had) to go *seriatim* through our various publications, he would have found scattered up and down therein, numerous details of the kind he and so many others require. For general convenience, we have collected into a table a *few* of those contained in some of our earlier works, which are mostly out of print or very scarce.

Date.	Station.	Heavy Fall.		Rate per hour.
		Duration.	Amount.	
1862, September 2nd ...	Calne	0h. 6m.	·39	3·90
1863, August 29th	Westley, Suffolk	0h. 15m.	·76	3·04
„ June 6th	Camden Town	0h. 6m.	·20	2·00
„ August 24th	Leckpatrick	0h. 30m.	·60	1·20
1864, May 20th	West Retford	2h. 15m.	3·10	1·38
„ September 2nd ...	York	0h. 10m.	·50	3·00
„ October 21st	Sunderland	0h. 13m.	·70	3·23
1865, July 6th	Trowbridge	0h. 20m.	1·25	3·75
„ „ „	Hitchin	0h. 25m.	1·42	3·41
„ „ 17th	Bury St. Edmunds	2h. 0m.	2·36	1·18
„ „ „	„ (Beech Hill)	1h. 0m.	1·41	1·41
„ August 23rd	Wantage	0h. 6m.	·45	4·50
„ October 9th	Abergavenny	0h. 30m.	·94	1·88

The publications for 1866 and 1867 are readily obtainable; we do not, therefore, extract the similar results from them, or they would fill several pages. A few cases will also be found under the head of “Maximum Falls” in the present work, and we hope, by the general adoption of the instrument shown on page 28, that on this and all other points we shall be able abundantly to supply the particulars necessary for the use of practical men and for the benefit of the public at large.

OBITUARY.

THE following list needs few words of preface or of comment ; with so large a corps of observers—nearly 1,600—it is perhaps matter of congratulation that the list is not longer. We have placed in the forefront the distinguished Mayor of Lyons, Professor Fournet, President (nay, life and soul) of the Hydrometric Commission of Lyons, a man, whose death at the age of sixty-eight, in the very act of completing an analysis of the vast treasures of his mind, is not only a loss to France, but to the science of Europe and the world. Mr. Leyland Woods, of Chilgrove, is another serious loss, for, in addition to being a careful observer, it is hardly three months since he called to show us a fragment of a statement he was compiling, from farm registers, extending over nearly two centuries, the entries in which formed a most complete check upon the rain records of bygone years, and, so far as the work had progressed, the confirmation had been unexpectedly complete. Mr. Woods had also for many years paid great attention to the fluctuation of water in the deep chalk wells of his neighbourhood, and especially in reference to their relative promptitude in varying after heavy falls of rain. We must not, however, be tempted into a lengthened notice of one, since all have contributed more or less to the work we have in hand, but must conclude with the hope that those who now occupy their places, will at least equal those whose loss we all regret.

	Period of Observation.
Fournet, Professor J. J., &c., &c., Lyons.....	1847—67
Davy, John, Esq., M.D., F.R.S., Lesketh Howe, Ambleside	1844—67
Dobell, F., Esq., Maidstone	1856—67
Evans, Charles, Esq., Norwich	1865—67
Farrow, Mr. R., Leek	1856—66
Gillett, Rev. E., Runham, Yarmouth	1866—67
Guy, Mark, Esq., Roscarrock, Cornwall	1856—67
Howells, T., Esq., Highfield, Shrewsbury.....	1860—67
Milner, Rev. W. H., The Vicarage, Horncastle	1863—67
Milner, W. R., Esq., The Prison, Wakefield	1848—67
Nickisson, Rev. W., Church Aston, Salop	1866—67
Peacock, Captain, Greatford Hall, Stamford	1860—66
Pearce, H. S. R., Esq., Loperwood, Southampton	1866—67
Woods, W. Leyland, Esq., Chilgrove, Chichester	1834—67

RAINFALL AND METEOROLOGY

OF

1868.

ON THE METEOROLOGY OF 1868,

WITH DETAILS OF THE PRINCIPAL PHENOMENA.

JANUARY.

The year commenced with a cold period, snow falling generally—at Florence and in many parts of the Continent to an unusual depth. During the frost the observer at Laggan reports hearing a railway whistle at seven miles distant.

The frost gave way on the 11th, silver thaws occurred in several places, and a series of gales commenced; one on 18th was very violent; the barometer in London fell, between 1.30 and 1.45 p.m., at the rate of 0.18 inch per hour. On 19th and 21st thunder and lightning in many places. On the 24th a very violent gale, especially severe in Scotland. At Lanrick Castle 2500 trees were uprooted, and at Gordon Castle “it blew down more trees than any gale for the last 20 years.” Several buildings damaged in Edinburgh. At Sandwick the wind blew at the rate of 70 miles an hour from 10 a.m. to 3 p.m.

30th-31st.—These two days were noticeable for the tremendous fall of rain in the Scotch mountain districts. At Ardlui, Loch Lomond, 13 inches fell, and at Upper Glencroe 10 inches; even up to the Grampians a similar result obtained, the fall at Grantown exceeding 2 inches. “The Spey rose to within 2 feet of the celebrated Moray flood of 1829.”

FEBRUARY.

The month commenced amid a violent gale which had risen in the evening of 31st January and which caused innumerable serious accidents in all parts of the country. It did not appear to be at all cyclonic in its character, simply a great sweep of W.S.W. wind rushing over the country at a speed of about 60 miles an hour. Rivers flooded in all parts of the country, the Scotch ones mostly, to a greater extent than they had been for 30 years. Another gale on 19th, lasting off and on until 22nd; thunder and lightning in several places. Heavy rains on 29th.

MARCH.

Gale on 1st; snow on 3rd, with thunder and lightning in Yorkshire; snow and hail on 8th; gale from S.W. on 11th, 50 miles per hour at Sandwick, Orkney. [On this day a terrific hurricane in the Mauritius.] Hail on 12th; thunderstorms on 13th.

APRIL.

The first few days mild; frost about 10th, with hail and snow; from 20th to 27th, a series of thunderstorms in various parts of the country. Numerous accidents from the lightning, and some from peculiar violent rushes of wind, not generally manifested by long tracks of damage, but by great exhibitions of force at intervals in one direction, that is to say, great injury would occur at A B C, and *none* at points between A and B or between B and C. It is very desirable that when cases of local violent action occur, the observer residing nearest to them should carefully collect and examine all the circumstances as closely as possible. From facts I have observed in several such cases I have been almost convinced that the wind acts as if it were a mass of air revolving on a horizontal axis, which, as it passes on, varies in its elevation above the ground. I do not for a moment say this really occurs, merely that some such peculiarity is indicated. If this explanation is supplanted by a simpler one so much the better.

MAY.

Sharp frost in the eastern counties in the first week, but the month on the whole warm and fine, notably the 19th, which was, perhaps, one of the hottest and driest days ever known in May. The temperature in the shade rose to 87° at most English stations, and at Wigston was reported as 91°, and the humidity at several stations was below 30 (saturation=100). Thunderstorms in various places on 11th, 14th, 18th and 19th. On 28th a destructive thunderstorm in Wales, Herefordshire, and Devon, passing on 29th across the midland, southern, and eastern counties, at an apparent rate of about 14 miles per hour. Several persons were killed, and property of very great value destroyed in various parts, especially in Surrey, Sussex, Kent, Middlesex, and Suffolk.

LENY.—Early in this month a westerly wind blew with great violence, and blighted all the foliage exposed to it—it was probably highly charged with saline particles—even the native foliage, such as hazel, bird cherry, &c., suffered from it.

The month of May was unusually hot in Iceland; in fact the spring was stated to have been milder than for 10 or 12 years.

JUNE.

A very hot, dry month ; pastures burnt and crops suffering severely from drought. The only relief was afforded by thunder showers, of which there were a few between 19th and 22nd. The earliest date is 19th, at 10 p.m., at Newton Abbot (Devon), and Selborne at the same hour ; the latest date (22nd) is from Culloden, Inverness ; but it must not be concluded that the storm travelled from one position to the other ; there are not sufficient returns to enable anyone to speak positively.

MELBURY HOUSE, DORCHESTER.—On the 19th we had a remarkable thunderstorm ; it began between 11 and 12 p.m., and continued till about 2 a.m. of 20th. Thunder astoundingly loud, lightning vivid and in quick succession, with torrents of rain and hail. Much glass was broken in the gardens, and the walks rutted out to the large stones where they were much on the slope.

REDHILLS.—On 21st one of the heaviest thunderstorms I ever noticed ; 1.68 in. fell in 3 hours and 30 minutes.

MILFORD, PEMBROKESHIRE.—The heavy rainfall on 21st was accompanied by distant thunder ; the wind from 6 a.m. to noon, S. ; from noon to 6 p.m., N.N.E. ; 6 to 11 p.m., S.W. ; from 11 p.m. to 6 next morning, quite calm ; movement, 244 miles from 6 a.m. to 6 p.m.

JULY.

Another month of almost uninterrupted sunshine, which so baked the crust of the earth as seriously to injure much agricultural produce, and almost wholly to prevent the moisture in the ground from reaching the surface ; this being the case, evaporation was limited, and the air became so dry that very little dew was deposited, thus depriving the grass of a most important succour ; this was notably the case at a distance from large tracts of water. The temperature on several days was above 90°, and in some cases, apparently well authenticated, 100° was registered. Sun-stroke was very frequent. Scarcely any rain fell, except at places where there were thunderstorms, and altogether the month can only be adequately described by one word—scorching. And not only did the sun shine with an intensity to which we are unaccustomed, but its heat in many parts so dried the grass, the crops, and the heather, that “another burning mountain” became a frequent heading in the daily journals, and, as we now learn from the half-yearly reports of the railway companies, crops along the sides of the lines, though carefully watched by the companies’ servants, were ignited by sparks from the locomotives, and property to the extent of many thou-

sand pounds was destroyed. Towards the end of the month several towns in Lancashire were placed on short water-supply.

It is worthy of note, that during this hot period in England and in Northern Europe generally, there were continuous heavy rains on the Atlantic, and beyond it, on the American continent, the heat was equally intense with that in this country.

NUTHALL.—Great heat and almost uninterrupted sunshine has parched up the land to a degree unprecedented in living memory. The 23rd of this month was very remarkable for the sudden fall of the ther. from 93° on the 22nd to 65° on that day, accompanied by N.E. wind and sunless sky.

AUGUST.

On the 5th rain fell in many places, and from the 11th to the 24th very heavy falls occurred, subsequently noticed in detail. Heavy gale, with thunder and lightning, on 22nd, doing considerable damage.

BROMSGROVE.—During the months of June and July, and up to the 7th August, only $\cdot 835$ in. of rain had fallen; the long drought, with the excessive heat, had turned the grass lands into barren wastes, and although we are situate in a position where a lack of water is seldom felt, we were on the eve of experiencing a deficiency, the springs in some cases having ceased to run, and in many others become extremely low. On Wednesday the weather providentially gave unmistakable signs of a break up. Thunder and lightning prevailed during the after part of the day, but no measurable rain fell until past midnight, and indeed very little until 10 a.m., when a heavy storm came on, accompanied by much thunder and lightning; the rain came down at intervals in complete torrents until 5 p.m., at which time it ceased, $1\cdot 830$ in. having fallen in seven hours; this is the greatest quantity I have ever registered in so short a time, and only on one occasion has it been exceeded in the space of the usual 24 hours, viz., on the 21st June, 1857, when $2\cdot 000$ in. was deposited. At the time I am writing, 8 a.m. (Saturday), there is every indication of more wet, the air being now charged with 80° of moisture. The temperature has decreased greatly; on the 2nd inst. the solar registration was $122^{\circ}\cdot 3$, and on the 6th 80° ; on the 3rd the air temperature was $87^{\circ}\cdot 2$, and on the 7th $70^{\circ}\cdot 2$.—*George Dipple.*

DUNMOW.—Thunder at 6 a.m., on 11th, very heavy, seven miles distant, accompanied by very violent wind and heavy hail for about five minutes, breaking the windows, &c.

KILLINGHOLME.—11th. Torrents of rain about Barton-on-Humber; man killed by lightning on Sunk Island. 14th. Rooks wheeling aloft

“or playing football.” 21st. Rooks swooping and very excited; high wind from 22nd to 28th. Harvest finished on 29th; would have been a week earlier but for the rain. Some turnips were sown after the harvest. Horse-flies and lady-birds very numerous, the former very troublesome.

HARTLEY, CRANBROOK.—A terrific gale commenced at 8 a.m., on 22nd, and continued till 11 p.m., doing much damage in the hop-grounds, in some cases as much as £25 per acre.

SEPTEMBER.

The earlier portion of this month was remarkable for exceedingly high temperature and deficient rainfall. During the latter part, rain fell pretty generally, and was often accompanied by thunderstorms and heavy falls of hail. A fearful storm passed over parts of Norfolk on 27th. A heavy gale blew in the Channel, and water-spouts were seen in several places. Tremendous inundations in North Italy.

WELLS-NEXT-THE-SEA.—Very heavy thunderstorm and fall of immense hailstones on 27th, at 10.30 a.m.; quite blocks of ice, some being $2\frac{1}{8}$ in. by $1\frac{3}{8}$ in., the average being $1\frac{1}{8}$ in. by 1 in. Bar. 29.90; wind from E. to S.W.

OCTOBER.

No special features of note. There was a rather violent gale on 24th, passing Huddersfield at 5.15 p.m.; velocity of wind, 52 miles per hour. This appears like one more instance of the periodicity of the Royal Charter gale.

NOVEMBER.

Gale on 3rd; sharp frost with snow about 7th; warmer after 22nd, but a cold month. Rapid fall of the barometer between 19th and 22nd, followed by several fatal coal mine explosions.

On 3rd, at 3.20 p.m., during bright sunshine, a meteor of considerable brilliancy was seen from London, Rugby, Birmingham, Chipping Norton, and Northampton. The following note from Colonel Ward is of high interest in connection therewith:—

“I was at Great Marlow that day. It was clear sunshine, with very heavy squalls of wind and rain at times. I was standing at a window of a friend’s house, when I, with my friend and many others, heard a noise something between the report of a gun and the falling of some heavy substance on the roof. I said to my friend, ‘Something has happened to the roof of your servants’ apartments.’ He went to see, and came back shortly, saying that all was right. My carriage was at the door at the time, and both the coachman and

footman looked up at the moment of the explosion, and they remember the noise, but thought as I did, that something had fallen on the roof. The wind was apparently E.N.E. from where I stood, and it was exactly at 3.20 p.m. by my chronometer. Two days afterwards, I was at a friend's near Gerrard's Cross, about ten miles N.E. of Marlow, and not very far from Chalfont St. Giles, and he asked me if I had 'heard the earthquake,' two days before. He said it was the general subject of conversation that day at the meet of the old Berkeley hounds, close by, as every one seemed to have heard it. I conclude this must have been the explosion of the meteor, visible in sunshine that day, and which was supposed to have burst over Banbury."

DECEMBER.

A very remarkable month ; one of the hottest, wettest, and most stormy on record. Thunderstorms almost daily. Barometer remarkably low on 24th.

EARTHQUAKES IN 1868.

A very general and correct impression having prevailed that the past year was noticeable, *inter alia*, for the great frequency of earthquake shocks, we have attempted to prepare a list in chronological order. It must not be accepted as "warranted correct," but is probably nearly so:—(1) January 4th, 5h. 10m., a.m., slight in Somerset. (2) February 20th, at night, slight at Malta. (3) March 26th, slight in South Wales. (4) March 28th to April 2nd, a series of violent ones in the Sandwich Isles, terminating in a volcanic eruption on the latter date. (5) April 4th, about 2 a.m., slight in Jersey and at Brest. (6) May 22nd, at 10 p.m., severe at Riva, Lago di Garda. (7) June 18-19th, at 15 seconds before midnight, rather sharp near Hunter River. (8) July 19th, at 3.30, a.m., sharp in the Pyrenees. (9) August 13th, at 5, p.m., very severe in South America. (10) August 18th, slight at Gibraltar. (11) September 24th, at 9.45, a.m., slight at Malta. (12) October 3rd, severe in Japan. (13) October 18th, at 0h. 12m., a.m., sharp in New Zealand. (14) October 21st (?), San Francisco. (15) October 26th, sharp in New Zealand and California. (16) October 30th, slight in Devonshire and other western counties. (17) November 12th, very severe at Peshawur and Lahore. (18) November 13th, violent at Bucharest in the morning. (19) November 17th, slight at Cologne. (20) November 19th, slight in Leicestershire, at 7.30 p.m. (21) November 20th, slight at Liverpool. (22) November 29th, slight at Bucharest. (23) December 20th, severe in Mexico.

OBSERVERS' NOTES ON THE YEAR 1868.

II.

COBHAM.—Average (40 years), 1826—1865, 23·845 in. ; 1868, 26·26 in.

WEYBRIDGE HEATH.—The total rainfall of 1868 at this station is exactly the same as that of 1867, the very same figures 25·9550 expressing the result in each case, a coincidence of rare occurrence.

TUNBRIDGE.—The total fall, 26·97 is 1·10 below the average of the last 8 years.

LINTON PARK, STAPLEHURST.—Fewer rainy days than in any year I have on record, excepting 1858, and fewer frosty days than in any. January and December wet months ; June and July very dry, and the latter very hot, but the temp. of that month not more remarkable than that of December, which showed a greater average above other years than did July, with all its extreme heat. The rainfall of the year about the average of the last 13 years.

BECKENHAM, PARKSIDE. — A year of extreme heat, every month except October and November being above the average. Ther. forty-four times above 80°, of which seven times were above 90°. As to the rain, the excessive drought of the summer was nearly compensated by the three wet months, January, August, and December, the aggregate of these months (11·26 in.) is exactly the same as that of the other nine months. Very few thunderstorms ; those which did occur were unusually heavy and very partial—for instance, on May 29th, very slight here but very heavy in other places ; those of July 11th and 12th, very heavy here, but little in neighbouring places ; on July 15th, only ·14 in. of rain here, but Penge was flooded. In only two months, July and September, was the prevailing wind from an easterly point. December remarkable for very frequent and at times excessively strong gales—on 7th, 30 lbs. on square foot ; on 28th, 27 lbs. ; on 9 days the pressure exceeded 10 lbs. From 9 a.m. on Nov. 3rd to 9 a.m. on 4th, horizontal motion of air equalled 843 miles.

HIGH WICKHAM.—Rainfall nearly 3 in. above the average here. The chief characteristic of the year has been violent storms of wind and rain. December has been a month of almost continued storms ; the

storm-signal has been up six times and was always followed by storms, some of which lasted three or four days. I have kept a journal of sixteen heavy storms (during the year) with signal up, and only once was the signal up when no storm followed.

GLYNDE PLACE, LEWES.—Only twice during the last twelve years have we had more than 7 in. of rain in one month :—November, 1861, 7·15 in., and October, 1862, 7·50, but this year we have had 8·17 in.

MARESFIELD (FOREST LODGE).—Notwithstanding the drought during the summer months, the fall of rain here in 1868 has been 4·57 in. above the average of the preceding 12 years ; this is mainly referable to the unprecedented amount (7·92 in.) which was registered here in December. The heaviest fall in 24 hours was on July 11th, when 1·19 in. was registered.

EAST GRINSTEAD.—On the whole, a prosperous year for the farmers on the wet clayey soil of this district. On five days only did rain fall between the 4th of June and the 26th of July.

CADLANDS, SOUTHAMPTON.—The average rainfall for the last seven years was 32·25 in. ; it will thus be seen that notwithstanding the dry summer, the total fall (38·05 in.) is considerably above the average. Prevailing winds from W., 82 days ; E., 51 ; S., 29 ; N., 48 ; N.E., 26 ; N.W., 38 ; S.E., 21 ; S.W., 70.

LEIGH PARK (HAVANT).—In 62 days, from May 26th to July 27th, only 1·03 in. fell, but the total of the year was above the average.

III.

BERKHEMPSTEAD.—The amount of rain was 3·36 in. more than in 1867, but the number of rainy days was fewer by 22.

ETON COLLEGE.—Long periods of drought :—March 25th to April 17th (22 days) 0·10 in. ; April 27th to May 21st (23 days), 0·09 in. ; May 24th to June 21st (27 days), 0·07 in. ; June 23rd to July 11th (17 days), and Aug. 26th to Sept. 18th (22 days), no rain at all ; therefore in 111 days the rainfall at Eton was only 0·26 in.

HENLEY-ON-THAMES.—No rain between May 25th and June 21st.

CONINGTON CASTLE.—Only nine days in the three months of May, June and July, on which a measurable amount of rain fell.

ABINGTON PIGOTTS—The driest day in the year was June 27th. At noon, barometer reduced and corrected, 30·283 in. ; dry bulb, 84° ; wet bulb, 61° ; dew point, 45·8 ; humidity, 26. On Tuesday, May 19th, at 3 p.m., humidity, 32, and July 15th, at 1 p.m., 30. The August rainfall was 2·5 in. in excess of any month at Royston, which is only five miles distant, falling chiefly on the 19th. 61 nights frost in air, 4ft. above ground ; 117 nights on grass.

IV.

HIGH RODING, DUNMOW.—The rainfall in December has been greater than in any month during the past three years, and the rainfall of May 29th was greater than that of any *one* day during the same period; these are remarkable as happening in a year marked by want of water in this district; the rainy days of 1868 were fewer in number than those of 1866 by 61.

SAFFRON WALDON, AUDLEY END.—Mean daily temp., $50^{\circ}7$; dew point, $44^{\circ}6$. Mean daily temp. of earth, 6 in. deep, at 9 a.m., $51^{\circ}52$; 1 ft. deep, at 9 p.m., $54^{\circ}95$. Max. of year, $92^{\circ}6$, on July 21st; min. of year, $21^{\circ}5$, on Jan. 3rd.

GRUNDISBURGH.—This has been a most extraordinary year for heat and dryness. I never saw my pastures in such a state where they slope towards the south; the grass will not recover for some time; from May 30th to Aug. 5th, inclusive, we had only 0.75 in. of rain, and on 37 days out of these 68, the max. temp. was 76° or above, on 19 days 80° or above, on 9 days 85° or above, on July 16th, $90^{\circ}5$, and on 21st, 92° . I am glad the winter is so mild and open, as our root crops are very short, and hay and clover the same. From Aug. 24th to Sept. 16th, a period of 24 days, we had only 0.04 in. of rain, which told very much, after we thought the worst was over; what would have been done if we had not had the thunderstorm of May 29th I do not know.

BURY ST. EDMUNDS.—In the five months, May, June, July, August, and September, it only rained on 31 days.

WALSHAM-LE-WILLOWS, BURY ST. EDMUNDS.—Remarkable drought during May, June, July, and until Aug. 6th; also during the first half of September.

SWAFFHAM, PICKENHAM HALL.—The heat was very great in the summer; no grass here, turnips all but a failure, barley light, wheat splendid; a great game year; very little dew during the hot weather, many nights not any.

WELLS-NEXT-THE-SEA.—Frequent and heavy gales of wind (quite unparalleled on this coast) in October, November, and December.

V.

BAVERSTOCK, WILTS.—The rainfall of 1868 exceeded the average by about 1 in., notwithstanding the unusual drought of the summer.

CHALBURY, DORSET.—On five days the fall exceeded an inch—viz., Jan. 18th, 1.14 in.; Feb. 29th, 1.08, April 19th, 1.02; Aug. 17th, 1.12; and Aug. 18th, 1.58. Rain fell on fewer days than usual.

SHAFTESBURY.—Summer remarkable for the absence of thunder, notwithstanding the great heat.

GILLINGHAM, DORSET.—Max. temp. was on July 21st, 85° in shade.

LAMORNA, TORQUAY.—Rainless periods of more than a week's duration :—March 27th to April 7th, inclusive, 11 days ; April 9th to 17th, 9 days ; April 29th to May 8th, 10 days ; May 25th to June 18th, 25 days ; June 23rd to July 6th, 14 days ; 13th to 25th, 13 days ; Aug. 27th to Sept. 15th, 20 days ; Nov. 6th to 18th, 13 days.

TAVISTOCK.—This year is nearly 13 in. above the average of the ten years 1858 to 1867 inclusive ; most of our rain is from the south and south-west.

GREAT TORRINGTON.—It appears as if the fall of rain was increasing while the number of days on which it falls is decreasing—thence it follows that heavier falls have taken place. The rainfall was in excess of the monthly average in January, March, April, August, October, and December—the last named being nearly double the average, and the largest I have ever had, except in August, 1866. Rainfall at the close of 1868 and opening of 1869 was unprecedented, commencing on the 20th of November and continuing, with the exception of two or three days, to the 8th of January, 1869. June and July were the driest months for six years, except September, 1865, when only .10 was measured. No snow during the year to lie on the ground. Notwithstanding the high temperature, there has been but little thunder. The temp. throughout the year has been high, and this may be specially said of December, when the min. night temp. was 37° on the 30th, and 50° on the 11th. Anemones and violets are in bloom, as are some primroses, though in a spot where they get no sun.

ALTARNUM.—This year's rainfall, notwithstanding the hot and dry summer, is 10 inches above the average.

BRAMPFORD SPEKE, EXETER.—The heat and drought of May, June and July, and the continuous S., S.W., and W. rain and gales since the 20th of November are the most striking features of 1868.

TAMAR HOUSE, DEVON.—This part is famous for strawberries, plums, cherries, and is the centre of a very limited area where cherry orchards thrive ; I think the rainfall has something to do therewith, as we are rather drier than places a mile or two E. or W.

VI.

CLIFTON, SOUTH PARADE.—The total rainfall of the year 1868 exceeds the average of the last 16 years by more than two inches.

BERKELEY.—We had only two thunderstorms in the year, one on the 29th of May and the other on the 18th of December.

CIRENCESTER.—The rainfall has exceeded the average of 20 years by 2·68 in., wholly due to the extraordinary fall in December, which was 4·30 in. more than the average. The heat and drought of June and July was not compensated by the autumn rains, and November being unusually cold, the growth of grass was small, and keep is short.

STONEHOUSE (SAUL LODGE) DEVON.—The rainfall of the year, notwithstanding the excessive drought of June and July, has exceeded the average of this locality by 2·50 in. The months of June and July were characterized by an unusually high temp.; the atmospheric repose of these two months, as shown by the barometer, over an area of 250,000 square miles, from Nairn to Brest, and from Valentia to Yarmouth, was most remarkable, the variation throughout the period over the entire area being very trifling. This repose has since been thoroughly broken up. From the fierce gale of November 22nd, to the end of the year, there has been a rapid succession of gales. On the average of the last 11 years February has been the driest month. How do you account for the name of February fill-dyke?*

WEST LODGE, LEOMINSTER.—This has been the wettest year I have recorded, 1866 being next to it. The sunshine of June and July was so much that the copious rain of August was not sufficient to raise the brooks or penetrate to much depth in the soil, still our pastures recovered their colour sooner than in some other places.

ELLASTONE.—Rainfall 4 inches above the average, chiefly caused by the heavy fall in December, the wells being low till the middle of that month.

VII.

FLECKNEY, NEAR LEICESTER.—The year 1868 has been remarkable for the excessive drought of May, June, and July, and for the heavy rainfall of August and December; more than twice as much fell in the last five months as fell in the first seven.

STRETTON FIELDS, HINCKLEY.—Rainfall of 1868, 4·11 less than 1867, which was 3·37 less than that of 1866.

MELTON MOWBRAY (WALTHAM).—No instance has occurred in the last nine years of such a rainfall as in December, 5·86 in. In August, 1860, there was a fall of 4·99; in August, 1866, of 4·40, but in no other month has the fall reached 4·00. The variations of the barometer have been frequent and sudden, with several severe gales.

HEYDOUR.—The rain fell chiefly at night, scarcely at all hindering agricultural labours.

* See *British Rainfall*, 1863, page 15.

RUDDINGTON GRANGE.—Wettest month, December, 5·88 in 26 days ; driest month, July, 0·16 in two days.

WELBECK, NOTTS.—The year 1868 will long be remembered for the extreme dryness and heat which characterized it, and likewise for its violent hurricanes, principally from the W. and S.W. The mean temperature of the year at this place was 49°·0, not quite so high as that of 1846, which was 49°·5. Although the winter, spring, and summer months were so dry, the annual average rainfall has nearly been made up by the unprecedentedly large fall of 6·13 in December. In the months of March, April, May, June, and July, only 4·13 in. fell, the number of days on which it fell being only 25, while the rainfall of August and December was nearly 10 inches, being almost one-half of the total fall in the year. The effect of the great fall in December has been to flood all the lowlands in the valley of the Trent, and likewise the valleys of Yorkshire and Lancashire. The want of rain in June and July made the turnip crop a failure on nearly all soils, and the pastures were burnt up, and yielded but little food for the cattle. The wheat crop was above the average, but all the other cereal crops were deficient ; good average crops of fruit were produced in the midland counties, and when the potatoes had grown again after the rain some heavy crops were secured.

STONEY MIDDLETON.—93 days with frost, 11 with thunder.

VIII.

RUFFORD —Average rainfall for last 22 years is 34·78 in., so that 1868 (32·19) is 2·59 below it.

SOUTHSHORE, BLACKPOOL.—From May 24th to July 16th, 7 weeks and 3 days, no rain fell here, and even to the 10th of August, making 11 weeks, the fall was under an inch, but the total rainfall of the year, 33·10 in., was 1·51 in. above the average of the last 13 years, partly caused by the great fall in December, which exceeded any one month during that period, being 1·19 in. above that of September, 1866, which was the next wettest.

DOWNHAM HALL, CLITHEROE.—This year, in spite of the drought in summer, is 3 in. above the average of the last 14 years.

CATON, LANCASHIRE.—The total rainfall of 1868 exceeded the average of 20 years by 2·50 in.

IX.

FRIESLAND.—A fall of only ·55 in. in June and July caused the best of the springs to fail ; they were for some time unaffected by subsequent rains.

LONGWOOD.—I think for the fall of rain the year ought to commence on Oct. 1st and end on Sept. 30th. The three last months, though generally wet, have no effect on the dry season of that year, but fill the underground reservoirs for the following year.

LEEDS, WOODHOUSE RESERVOIR.—This gauge is within the watershed of the River Aire, and is on the high ground of the immediate outskirts of the urban portion of Leeds; I should be inclined to consider it the representative gauge of Leeds.

NORTHALLERTON.—The greatest amount of rain at one time was on August 6th, 1·87 in., which fell in less than an hour and a half during a thunderstorm. The past summer was unusually hot and dry, and as a consequence vegetation generally suffered much, with the exception of wheat, the crop of which was uniformly good, indeed it never was known better.

X.

OTTERBURN.—Only 12 or 14 days all the spring with east wind.

NORTH SUNDERLAND.—Rainfall considerably below the average.

WHINFELL HALL, COCKERMOUTH.—In the beginning of August, the springs and brooks were lower than on any previous occasion except two in the last 50 years; on those two occasions—one in 1826 and once since—they were nearly, if not quite, as low, yet the rainfall for 1868, owing to the wet early and late months of the year, exceeds the average of the preceding 12 years by 5·22 in., and the number of rainy days by 16.

APPLEBY, WESTMORELAND.—Rainfall of year nearly 6 in. above the average.

GREAT STRICKLAND, PENRITH.—The driest May, June, and July by far that I have ever recorded, and yet, owing principally to the extraordinary fall in January and December, the total rainfall in the year is larger than any other that I have noticed.

BROUGHAM HALL.—Although the last summer was so hot and dry, the total rainfall has exceeded that of 1867, the difference being in the beginning and end of each year, the first and last months of 1867 being the driest, the first and last of 1868 being the wettest; the total has been above the average.

STOCKTON-ON-TEES.—The wind W. on 25 days in January, 24 in May, 22 in June, 16 in July, and 16 in August—total, 103 in the five months.

XI.

WALES.

CHEPSTOW.—The wettest year since 1860, except 1866, the fall in which year only exceeded this by 0·16 in.

DINGESTOW.—Finest winter, spring, and summer ever known, scarce any rain or snow in the winter; no February or July rain as usual; the springs lower than ever; wheat nearly all in in July; grass crops not bad; after the rain of August 17th to 26th, quite a sudden new spring. The summer was characterized by less wind and a steadier barometer than ever observed; these would naturally go together. It was also remarkable for so little thunder, considering the great heat. I have a strong impression that the universal distribution of telegraphic wires now so diffuse the electricity of the air that we have less frequent thunderstorms than we used to have. Another suggestion I would make is that the weather in England and Ireland is chiefly governed by the number of icebergs in the Atlantic; this I have in great measure ascertained and verified by information obtained from captains of vessels crossing the Atlantic and others in communication with them.

LLANDUDNO, GREAT ORME'S HEAD.—From May 25th to August 10th, only 0·47 in.; from May 25th to August 3rd, 0·33 in.; August 24th to September 14th, 0·05 in.

LLANERCH.—The local rainfall seems to have been deficient. From May 23rd to July 17th, only 0·10 was registered, falling on two days; no heavy fall till December 6th, from which time it fell almost every day to the end of the year.

CHANNEL ISLANDS.

ALDERNEY.—The rain has been slightly above the average (28·47) of the last 18 years.

SCOTLAND.

XII.

SOUTH CAIRN, STRANRAER.—During the bygone summer a severe and protracted drought prevailed, which in some cases almost destroyed the oats, created extensive blanks among the turnips, burned the pastures fairly brown, and seriously curtailed the amount of dairy produce. The latter end of the year was extremely favourable, renovating the pastures and causing the bulbs of the turnips to increase in size most amazingly.

DUMFRIES.—The rainfall of 1868 is nearly 10 inches above the average of the last five years.

WANLOCKHEAD. — Notwithstanding the dryness of some of the months, the rainfall of 1868 was 18·48 inches above the average of the last nine years.

GOLDIELANDS.—Notwithstanding the extreme dryness of the summer months, when vegetation was parched and withered for lack of moisture, the rainfall during the whole year has been considerably above the average.

XIV.

NEWTON, MEARNS.—The year 1868 shows the largest amount of rain for eight years. It has been a remarkable year for storms, rain, heat and drought. Towards the end of the summer many wells were dry. What would have been the consequences of the great drought if we had not had an abundance of rain in the early and later part of the year?

XV.

ARDLUI.—Nearly 12 inches of rain fell in the last three days of January. Thunder and lightning frequent during January, February and March.

CALLTON MÔR.—More rain in 1868 than in 1867, though the season has been finer.

INVERARY CASTLE.—The past season here contrasts favourably with many other places in Scotland and England, as when they were suffering from drought, we had more than enough to keep vegetation healthy, and no more dry weather than sufficient to get in the crops.

STONEFIELD, ARGYLESHIRE.—January, February and March, particularly the first two, were unusually wet and stormy. The wettest year for more than a quarter of a century.

XVI.

LENY.—The driest and warmest summer I ever remember in Scotland. I cut, made, and carried my hay within a week. The max. heat was in July, and early in August, 83° and 83°·5 in shade. Oaks were in leaf long before the ash this year.

STRONVAR.—Rain in 1868, 101·59 ; in 1867, only 66·57 ; difference, 35·02. Lowest in last nine years, 1866, 62·11 ; highest in eight years prior to 1868, 97·84 ; average of eight years prior to 1868, 80·81.

XVII.

BOGSIDE, LEOCHIEL CUSHNIE.—The months of May, June, and July were remarkably dry, only 2·77 in. of rain falling in the three months;

crops of all kinds suffered severely from want of rain, and were very light, the poorest since 1826. Pastures completely burnt up. The months of August and September very wet, the rainfall during those months being 11·67 in. The heaviest fall in the year was 2·26 on the morning of August 14th, which fell in six hours. The total fall in the year is nearly five inches and a half less than that of 1867.

TILLYDESK.—The great deficiency in the bulk of the crops did not arise so much from the absolute deficiency of rain (although it was deficient) as from the extreme drought in the months of May, June, and July. The dessicating power of the gales which prevailed on many days was altogether unprecedented in our climate.

GORDON CASTLE.—Season remarkable for a long continuance of S.W. gales ; three months severe drought, and a summer of great heat.

XVIII.

ARDROSS CASTLE.—We have had a very fine season, and dry spring for getting on with labour. Our warm weather commenced about June 19th, and continued till September. August was very wet ; the river Alness was larger on the 11th and 14th than it has been for the last 20 years. We have had fine autumn and winter weather to the end of the year.

FEARN.—The register of 1868, while indicating the greatest rainfall in the last four years, is also remarkable for presenting the extremes of greatest drought and greatest humidity ; these, as might be expected, are found close to each other. In July (if we except night dews) we had but two rainy days, and total quantity for the month 0·38. This continued to the 11th of August, when on that and two following days 3·62 in. fell. Though I have no accurate means of determining the fact, I believe I may conclude that such a fall has not taken place for a quarter of a century. It must have been general, as the Balnagowan river, a small stream five miles distant, rose in a few hours to 8 or 9 feet above its usual level. Several bridges were swept away ; the low grounds, turnip and cornfields, flooded, and the waters at last found their way to the sea, two miles distant from their usual channel ; a similar occurrence has not been witnessed for 20 years. I have observed in connection with some of our heavy rainfalls that they sometimes take place with a pretty high bar. On June 26th, 0·67 in. fell with the bar. at 30 inches, and on September 29th 1·74, with the bar. not much below that height. Perhaps you or some of your correspondents will tell me whether such facts are of frequent occurrence.

LAGGAN.—Very little snow on the low grounds, instead of which

there was an almost unprecedented fall of rain. Summer exceedingly hot; hill pastures much dried up, but in the extensive meadows of the valley of the Spey the vegetation luxurious.

IRELAND.

XX.

GLENAM, CLONMEL.—Although part of the summer was excessively hot (90° in the shade) and very dry, at other times the rain has been so heavy as to have made the fall this year 10 in. more than either 1866 or 1867.

XXI.

BALLYHYLAND.—From Nov. 20th to Dec. 31st, 13 in. of rain fell.

WOODFORD, INISTOGUE.—Total fall, 50·18 in., the greatest fall here since 1852, when 55·31 in. fell.

CARLOW, BROWNE'S HILL.—During the latter part of December, the rivers exceedingly high, and a great portion of the low-lying country under water.

FASSAROE.—The last 12 in. of rain fell between Nov. 21st and Dec. 31st, during which time there were only six days without rain.

ROCKVILLE, BLACKROCK.—The rainfall in this year, 32·67 in., is the greatest I ever registered since I commenced in 1840; the nearest approach being 1852, when 31·62 in. was measured.

DUBLIN.—May, June, July, and 12 days of August were dry almost beyond precedent. On July 15th, 0·214 of rain was registered; this fall was very partial, and fell from a thunder-cloud—in fact, was a thunder-shower without the thunder. October was dry, but the average was restored by the drenching rains of December, in which month a succession of gales occurred from the southward. The rainfall at Monkstown, exceeds that registered by me in December by nearly 2 in., while that of Phoenix Park is much less than mine; this is doubtless due to the mountains to the S. and S.W. of the city.

XXII.

CREGG PARK, GALWAY.—Summer very warm and dry; still the total rainfall of the year exceeds the average of the last four years by more than 3 inches. Swallows did not appear till August, and then not in great numbers. Mushrooms extremely abundant in the early part of August; harvest good; potatoe blight appeared unusually late, but not much felt, in consequence of the crop being very abundant.

XXIII.

ANTRIM.—The leading meteorological features of 1868 in this district have been—greatly diminished rainfall, a favourable seed-time, dry warm summer, and an early and well secured if not an abundant harvest. From May 24th to Aug. 4th, both inclusive, being two months and twelve days, rain fell only on 12 days, and the total registered was merely 1·16 in. The months of November and December have been exceedingly mild; this and the dry weather of October have permitted a large breadth of wheat to be sown, and the labour of spring to be forwarded.

MONEYDIG, GARVAGH.—Less thunder during the year than usual, more wind, and but little frost and snow.

TEMPLECRONE.—This gauge is about 300 yards from the open shore of the Atlantic, on the west coast of Ireland; much less rain falls here than a few miles inland.

ANALYSIS OF DAILY RAIN REGISTERS.

In our last volume we gave, for the first time, a series of abstracts of twenty or thirty *daily* registers of rain, at various stations, in the years 1865, 1866, and 1867, together with an analysis of the results of the three years, and this year we give a similar one for the year 1868, to which we have appended two lines, from a very valuable paper, in No. 39 of the *Proceedings of the Meteorological Society*, wherein Mr. Dines gives an epitome of the results of an analysis of the Cobham and Chiswick registers for the forty years 1826-65. Although not strictly related to the subject now in hand, the following paragraphs are of such interest as fully to justify their quotation.

“The three days on which the least rain fell during the forty years were as follows:—At Cobham, March 18, 0·67 in., February 16, 0·71 in., and December 21, 0·84 in.; at Chiswick, February 16, 0·59 in., March 24, 0·67 in., and March 18, 0·79 in. The three days of greatest rainfall were as follows:—At Cobham, October 22, 6·48 in., August 14, 6·13 in., and September 26, 5·99 in.; at Chiswick, August 2, 6·06 in., October 22, 6·03 in., and September 28, 5·93 in. Taking seven days in succession, the time of least rainfall at both places has been from March 18th to the 24th inclusive; at Cobham the rainfall on those days was 9·82 in.; at Chiswick, 9·44 in. The seven days on which most rain fell were from October 22nd to the 28th, during which time 32·67 in. were registered at Cobham;

31·90 in. at Chiswick. Excessive rain is generally supposed to be accompanied by a low barometer; but, as this indicates wind as well as rain, the greatest rainfall occurring on the days named is one of considerable interest, as it was on October 26, 1859, that the 'Royal Charter' was wrecked; and, since that time, the question has been much discussed whether what has been called the 'Royal Charter' gale is periodic or not. If each day's rainfall be taken and added to that of the two days preceding and following, and then divided by 5 for the day's average, the same result is arrived at: there is only one other seven days in the year at all comparable with the days named, and that is from September 23 to 29, when 29·71 in. were registered at Cobham, and 28·82 in. at Chiswick."

Returning, however, to the consideration of the tables, we find that the results of 1868 confirm those of the three previous years, and therefore require no further comment than reference to the previous deductions. As regards the disputed point of the number of days in London when a quarter of an inch of rain may be expected to fall,—and which for the main drainage purposes was assumed to be 25—the following sentence was inserted last year as a postscript:—

"The mean fall of rain in London being about 24 in., we find from the preceding tables that the number of days having 0·25 in. or upwards is nearer 35 than 25. I am inclined to think that the former, though only based on three years, is the more correct; but, at the first opportunity, will ascertain the true number. I believe Howard's observations give about 37."

The result of tabulating the daily returns for 80 years (at Cobham and Chiswick), by Mr. Dines, is that there are on an average 32 such days per annum; and 86 years analyzed by ourselves give 35 such days. Whence it is clear the number *is* nearer 35 than 25, and that they were under-estimated to the extent of 25 per cent.

DRY PERIODS IN 1868.

ONE great hindrance to the progress of the science of meteorology has been the absence of specific rules and definitions. We had difficulty enough in deciding what was to be considered a day of rain; that has been surmounted, except that there are, of course, a few who will hold to their own opinions, however large may be the majority, and however strong the facts, against them. Having cleared up this and reduced sundry other vague matters to definite practice, the question arises, "What is a drought?" Is it a series of days without *any* rain, if so, how could engineers speak of droughts of 140 or 150 days? If the line is not to be drawn so tightly as to exclude even one shower, where is it to be drawn—at falls of a tenth of an inch, or a quarter of an inch? All these rules are open to this difficulty—suppose a fall of 0·25 in. of rain in twenty-four hours is held to terminate a drought, are four separate daily falls of 0·20 in. to be included? If they are not, the limit must depend on a certain quantity in a certain longer period of time; yet the time must not be lengthened unduly, or we shall have such a case as 0·07 in. falling on, say six consecutive days; this would amount to 0·42 in., and on the last definition would terminate the drought; but we are sure that there are few reservoirs which would receive much benefit from, if they showed any trace of, these slight showers on the thirsty ground. It may occur to some that the flow of water into the reservoirs is the best guide to duration; but there are several objections thereto:—(1) Ordinary observers could not assist. (2) The duration assigned to the drought would depend considerably on the nature of the soil in the district, and the character of the rainfall. In drawing up the following tables, we have taken two or three consecutive days of rain, or one fall of half an inch, as terminating a period; and under the head of "exceptions" we have given all falls exceeding 0·10 in., and the aggregate of *all* amounts during the period.

Dry Periods in 1868.

Station. County. Total Fall in Year.	Duration.		Exceptions.	
	Date.	No. of Days.	Total Depth.	Falls above .10 in.
Camden Town, MIDDLESEX. 23.40 in.	April 28 to May 22	24	.06	
	May 29 to June 20	22	.25	.25, June 4.
	June 23 to July 27	34	.21	.21, July 11.
	April 28 to July 27	90	2.57	Rain on 10 days.
Englefield, BERKS. 29.31 in.	April 29 to May 22	23	.24	
	May 25 to July 11	47	.49	.33, June 22 ; .11, June 23.
	April 29 to July 11	73	1.27	Rain on 11 days.
Hartley Cranbrook, KENT. 33.07 in.	Nov. 4 to Nov. 20	16	...	No rain.
	April 28 to May 23	25	.21	
	May 25 to June 21	27	.26	.14, June 4.
Tunbridge Wells, KENT. 32.66 in.	April 28 to June 21	54	1.19	Rain on 17 days.
	April 24 to May 20	26	.08	
	May 25 to July 10	46	.65	.15, May 29 ; .26, June 21.
Alton, HANTS. 37.39 in.	April 24 to July 10	77	1.41	Rain on 11 days.
	April 28 to May 18	20	...	No rain.
	May 24 to July 11	48	.51	.35, June 21.
Eton College, BUCKS. 25.98 in.	April 28 to July 11	74	1.31	Rain on 8 days.
	April 27 to May 22	25	.14	
	May 24 to July 10	47	.45	.25, June 21.
	April 27 to July 10	74	.70	Rain on 11 days.
Shoeburyness, ESSEX. 16.31 in.	April 27 to Aug. 9	104	2.38	Rain on 16 days.
	Nov. 4 to Nov. 18	14	...	No rain.
	April 27 to May 29	32	.32	.11, May 10.
	May 30 to July 28	59	.31	.19, June 4.
Sheering, ESSEX. 21.80 in.	April 27 to July 28	92	1.39	.22, July 12.
	April 27 to Aug. 5	100	1.65	Rain on 10 days.
	April 28 to May 22	24	...	No rain.
	May 30 to Aug. 5	67	.73	.20, June 4 ; .26, June 20 ; .13, July 28
Thorpe Hamlet, NORFOLK. 22.82 in.	April 28 to Aug. 5	99	1.57	Rain on 13 days.
	Aug. 26 to Sept. 16	21	...	No rain.
	April 20 to May 21	31	.50	.22, May 8.
	May 25 to July 15	51	.89	.36, June 4 ; .17, June 21.
Burnham, SOMERSET. 27.81 in.	July 16 to Aug. 5	20	.05	
	April 20 to Aug. 5	107	2.43	Rain on 17 days.
	Aug. 28 to Sept. 17	20	...	No rain.
	April 28 to May 19	21	.26	.20, May 9.
Tytherton, WILTS. 26.93 in.	May 29 to July 11	43	.26	.22, June 20.
	July 14 to 26.....	12	...	No rain.
	Aug. 28 to Sept. 17	20	...	No rain.
	April 28 to Aug. 13	107	3.92	Rain on 18 days.
Bramford Speke, DEVON. 35.62 in.	April 28 to May 19	21	.18	
	May 25 to July 8	44	.34	.12, June 21.
	July 13 to Aug. 4	22	.10	
	April 28 to Aug. 4	98	2.24	Rain on 18 days.
Sellack, HEREFORD. 29.63 in.	Aug. 27 to Sept. 16	20	.03	
	April 29 to May 8	9	...	No rain.
	May 25 to June 17	23	...	No rain.
	June 24 to July 7	13	...	No rain.
Sellaek, HEREFORD. 29.63 in.	April 29 to July 25	87	2.50	Rain on 15 days.
	Aug. 27 to Sept. 16	20	...	No rain.
	April 28 to May 7	9	...	No rain.
Sellaek, HEREFORD. 29.63 in.	May 29 to August 6	69	.80	.21, June 21 ; .11, June 22 ; .47, July 12
	May 29 to June 20	22	...	No rain.

Station. County. Total Fall in Year.	Duration.		Exceptions.	
	Date.	No. of Days.	Total Depth.	Falls above .10 in.
Sellack—(con.)	June 24 to August 6	43	.47	.47, July 12.
	Aug. 27 to Sept. 17	21	.02	
	April 28 to Aug. 6	100	2.99	Rain on 16 days.
Wolverhampton, STAFFORD. 28.84 in.	April 27 to May 19	22	.26	
	May 29 to June 21	23	.01	
	June 24 to Aug. 5	42	.26	.15, July 17.
Henley-in-Arden, WARWICK. 26.03 in.	April 27 to Aug. 5	100	2.54	Rain on 18 days.
	Aug. 27 to Sept. 17	21	.02	
	April 28 to May 22	24	.41	
Rugby, WARWICK. 23.15 in.	May 29 to Aug. 4	67	.50	.25, June 21 ; .17, July 12.
	April 28 to Aug. 4	98	1.56	Rain on 15 days.
	Aug. 26 to Sept. 16	21	..	No rain.
Owston, LEICESTER. 28.90 in.	Mar. 25 to Apr. 14	20	.07	
	April 28 to May 21	23	.19	
	May 26 to August 5	71	.56	.26, June 22 ; .21, July 12.
Boston, LINCOLN. 23.80 in.	April 28 to Aug. 5	99	1.09	Rain on 10 days.
	Aug. 26 to Sept. 17	22	...	No rain.
	April 28 to May 22	24	.18	
Brampton, Chesterfield, DERBY. 31.58 in.	May 29 to August 6	69	.52	.30, June 21 ; .12, June 22.
	April 28 to Aug. 6	100	1.30	Rain on 14 days.
	Aug. 26 to Sept. 16	21	...	No rain.
Penketh, LANCASHIRE. 29.87 in.	March 27 to April 6	10	...	No rain.
	April 28 to May 21	23	.04	
	May 29 to August 6	69	.74	.38, June 21 ; .25, July 25.
Royton, LANCASHIRE. 41.33 in.	April 28 to Aug. 6	100	1.13	Rain on 13 days.
	Aug. 26 to Sept. 18	23	.01	
	April 28 to Aug. 5	99	1.02	Rain on 10 days.
Masborough, YORKS. 22.83 in.	Aug. 25 to Sept. 17	23	...	No rain.
	March 25 to Apr. 6	12	...	No rain.
	April 29 to May 8	9	..	No rain.
Fartown, Huddersfield, YORKS. 32.17 in.	May 29 to August 5	68	.57	.13, June 21 ; .18, June 22.
	April 29 to Aug. 5	98	1.95	Rain on 20 days.
	Aug. 27 to Sept. 16	20	...	No rain.
Ripon, YORKS. 29.55 in.	March 25 to April 5	11	...	No rain.
	April 30 to May 20	20	.34	.14, May 9 ; .16, May 12.
	May 29 to August 5	68	.61	.13, June 21 ; .27, July 15.
Ripon, YORKS. 29.55 in.	April 30 to Aug. 5	97	2.08	Rain on 25 days.
	Aug. 30 to Sept. 16	17	.03	
	April 28 to May 19	21	.41	.19, May 9.
Fartown, Huddersfield, YORKS. 32.17 in.	May 29 to August 5	68	1.03	.33, June 21 ; .28 July 15.
	April 28 to Aug. 5	99	2.30	Rain on 20 days.
	Aug. 28 to Sept. 16	19	...	No rain.
Fartown, Huddersfield, YORKS. 32.17 in.	March 23 to April 6	14	...	No rain.
	April 28 to May 28	30	.32	
	May 30 to August 5	67	.60	.11, June 21 ; .15, June 22 ; .20, July 5
Fartown, Huddersfield, YORKS. 32.17 in.	April 28 to Aug. 5	99	1.26	Rain on 17 days.
	Aug. 24 to Sept. 16	23	.39	.36, September 7.
	March 25 to Apr. 7	13	...	No rain.
Fartown, Huddersfield, YORKS. 32.17 in.	April 28 to May 19	21	.31	
	May 29 to August 5	68	.76	.31, June 21 ; .18, July 5 ; .14, July 15.
	April 28 to Aug. 5	99	1.78	Rain on 22 days.
Fartown, Huddersfield, YORKS. 32.17 in.	Aug. 27 to Sept. 16	20	.03	
	March 25 to April 6	12	...	No rain.
	April 29 to May 8	9	...	No rain.
Fartown, Huddersfield, YORKS. 32.17 in.	May 29 to July 15	47	.40	.16, June 22.
	July 19 to August 5	17	...	No rain.

Station. County. Total Fall in Year.	Duration.		Exceptions.	
	Date.	No of Days.	Total Depth.	Falls above .10 in.
Ripon—(con.)	April 29 to Aug. 5	98	2·01	Rain on 19 days.
	Aug. 26 to Sept. 17	22	·07	
Filey, YORKS. 22·97 in.	March 28 to April 7	10	...	No rain.
	April 22 to May 24	32	·10	
	May 30 to Aug. 11	73	1·16	·17, June 3; ·25 June 23; ·57, July 17
	April 22 to Aug. 11	111	2·03	Rain on 10 days.
	Aug. 24 to Sept. 11	18	·07	
Whitby, YORKS. 25·90 in.	March 25 to April 6	12	...	No rain.
	April 29 to May 7	8	...	No rain.
	May 29 to July 16	48	·53	·19, June 21.
	July 22 to Aug. 10	19	·06	
	April 29 to Aug. 10	103	2·27	Rain on 25 days.
	Aug. 22 to Sept. 10	19	·17	
Wallington, NORTHUMBERLAND. 31·47 in.	Mar. 25 to April 4	10	...	No rain.
	April 27 to May 19	22	·37	
	May 25 to Aug. 5	72	·96	·15, Jne 24; ·16, Jly 16; ·21, 22; ·11, 28.
	Aug. 22 to Sept. 10	19	·10	
	April 27 to Aug. 5	100	2·20	Rain on 28 days.
Tintern Abbey, MONMOUTH. 46·61 in.	Mar. 25 to April 6	12	...	No rain.
	April 29 to May 8	9	...	No rain.
	May 30 to Aug. 5	67	·99	·11, June 3; ·39, 21; ·11, July 15.
	April 29 to Aug. 5	98	3·96	Rain on 21 days.
	Aug. 26 to Sept. 16	21	...	No rain.
Presteign, RADNOR. 37·72 in.	Mar. 26 to April 5	10	...	No rain.
	April 30 to May 10	10	...	No rain.
	May 30 to Aug. 5	67	1·01	·14, June 22; ·23, July 12; ·22, 19.
	April 30 to Aug. 5	97	3·11	Rain on 23 days.
	Aug. 27 to Sept. 17	21	·04	
Cobbinshaw, EDINBURGH. 44·30 in.	Mar. 25 to April 16	22	·60	·60, April 7.
	April 30 to May 7	7	...	No rain.
	May 26 to June 10	15	...	No rain.
	June 21 to Aug. 9	49	·50	·30, July 18.
	April 30 to Aug. 9	101	3·70	Rain on 22 days.
	Sept. 1 to Sept. 16	15	·10	
Laggan, INVERNESS. 63·12 in.	Mar. 25 to April 5	11	...	No rain.
	June 26 to July 15	19	...	No rain.
	July 20 to Aug. 5	16	·03	
	April 30 to Aug. 5	97	5·73	Rain on 45 days !
	Sept. 1 to Sept. 23	22	·12	
Loch Broom, Ross. 65·49 in.	Mar. 25 to April 5	11	·07	
	June 27 to Aug. 5	39	·59	·23, July 21; ·11, July 30.
	April 30 to Aug. 5	97	6·72	Rain on 48 days !
	Sept. 1 to Sept. 17	16	·36	·18, September 5.
Balbriggan, DUBLIN. 29·92 in.	Mar. 25 to April 18	24	·15	·12, April 6.
	April 30 to May 13	13	·11	
	May 26 to June 20	25	·10	
	June 25 to Aug. 6	42	1·61	·43, July 7; ·71, July 28.
	April 30 to Aug. 6	98	4·01	Rain on 26 days.
	Aug. 28 to Sept. 17	20	·24	
Ballymoney, ANTRIM. 35·24 in.	Mar. 25 to April 5	11	...	No rain.
	April 30 to May 10	10	·11	
	May 27 to July 14	48	·75	·18, June 22; 12, 23.
	July 17 to Aug. 5	19	·20	·14, July 28.
	April 30 to Aug. 5	97	4·16	Rain on 35 days.
	Aug. 28 to Sept. 16	19	·24	·15, September 10.

We think the foregoing table is best left to speak for itself, as data for our engineering friends to work upon, and for meteorologists to discuss; we hope it is in a suitable form, but, as we have already said, it is high time a strict definition was provided. It will readily be seen that between April 27th and August 5th, 100 days, there were at most stations only about 14 days on which any rain fell, and the total fall during that time was not much over 2 inches—obviously a great deficiency, as at that rate we should only have had about 7 inches in the year. The number of days with rain during this dry period was least in the South and East of England, and greatest in the North and West.

The following extracts—one from Mr. Marshall's "Abstract of Meteorological Observations at Kendal," and the other from the *Times*, may form an appropriate conclusion to this notice:—

"The most casual, as well as the more careful and scientific observer of the weather, will admit that the extraordinary season of drought in the summer and the latter part of spring is the most conspicuous event of the past year. Beginning with the advent of May to the 11th of August, the duration was 102 days, there being but slight showers on 36 days, and never half an inch was measured on any of these days. This is the longest period of drought that I have registered in 47 years, the nearest approach to it being in 1852, when there was a greater amount of dry weather than even in the well-remembered season of 1826. The year 1852, singularly enough, was the wettest during that period, the amount of rain that year being 65·354 in. From the 19th February to 29th April, in that year, there were but three days on which rain fell, and the aggregate fall was only 0·21 in., being a period of 70 days with less than a quarter inch of rain. The droughts nearest approaching this in duration occurred as follows:— In 1861, from the 1st April to 8th June, a period of 69 days, there were but 9 on which rain fell, and 1·65 in.; in 1839, from 28th March to June 4th, 67 days, there were but 12 on which rain fell, and 1·97 in.; in 1826 (the notoriously dry year), from 28th April to 28th June, 60 days, rain fell only on 8, and 1·12 in.; in 1829, from the 14th December to the 8th February, 1830, 55 days, rain fell on 5 days only, and an aggregate fall of 0·65 in."

"THE DROUGHT AND HARVEST IN WESTMORELAND.—Windermere Lake is, at this date (August 3rd), 7 ft. 2 in. lower than the highest high-water mark, and that, notwithstanding the fact of its having had the advantage of a considerable body of water let out of Stickle Tarn to supply the powder works at Elterwater. The long drought still continues in Westmoreland, and may now be said to have endured for fully three months—a term unprecedented during the past 46 years. It may be dated from the 1st of May, for, though there was the usual amount of rain in that month, yet the quantities were, at any one time, so small, as to be in most instances but just appreciable. In the

month of June there were 0·807 in. against 3·880 in., the average; and 4 wet days against an average of 14. In July but 0·562 in. of rain against 4·568 in., the average; and 7 wet days against 15. In these three months of the extraordinary dry year of 1826 there were 3·871 in. of rain, and in the same months of this year there were but 3·429 compared with the average 10·716 in. The duration of the drought in 1826 lasted from the 28th of April to the 28th of June, or 61 days; while in the last three months of 1868 it may be said to have endured for 92 days, with no appearance of change at the end. The temperature of May this year exceeded the average by 2°·8; in June by 1°·3; in July by 4°·3; a deviation from the average temperature rarely experienced in this county; indeed, the average of the latter month has not been equalled in 46 years, except in 1852 and 1855, which were hotter months than the one just ended. The barometer throughout has been always high, and the prevailing wind has been contrary to precedent, from the dry and cold quarter of N.E., notwithstanding which the heat in the shade has been on several occasions as high as 87°, thus showing the immense power of the sun. With the exception of 0·110 in. of rain during the present month, the prevailing feature of the past quarter of the year still continues, all the minor streams being quite dried up, and the very largest of the rivers are reduced to the merest dribbles, of course rendering the prosecution of factory and mill work by means of water power quite impossible; and, what is remarkable, many fine trout have been taken out of the streams dead, the effect, it is supposed, of sun-stroke. There is very little water for domestic purposes, and in the town of Kendal the inhabitants have received notice, in fact, they are now under notice, to preserve their consumption 'as much as possible.' Even the permanent wells are giving indications of exhaustion, and, in short, the drought in Westmoreland is beginning to assume the appearance of a visitation, for whereas rain in considerable quantities has fallen in North Lancashire, Cumberland, and in Northumberland, it has passed over what has been described, and justly, as the wettest county in all England. However, the harvest progresses with undisturbed vigour. The yield of wheat is unprecedentedly abundant, especially in the lowlands, while the oaten and the barley crops are just the reverse, the ear being small and chaffy, and the straw short and thin; indeed, in some, and they are not a few, instances the latter is scarcely six inches in length. Turnips suffer greatly."

MAXIMUM FALLS IN 1868.

THIS subject has been treated in great detail in our last three volumes, and the novel and important results deduced from the returns of 1865 have been checked and confirmed by those of 1866, 1867, and 1868. But as the last 2,000 observations have simply confirmed the results of the first 500, and have most thoroughly done that, we have resolved on discontinuing their publication in their late form, though preserving the data in M.S., and only printing an epitome of the whole. This we shall do in a threefold manner by giving (1) a tabular synopsis of the results, with a few comments; (2) a sketch of the history of the most important rains of the year; and (3) a list of heavy falls in short periods of time.

Abstract of Maximum Falls in 1868.

LARGEST FALLS.				LARGEST PER-CENTAGES.			
Date.	Station.	Depth.	Per Cent.	Date.	Station.	Per Cent.	Depth.
		inches.					inches.
Jan. 24..	Camusinas..	5·60	5	Aug. 12..	House of Tongue.	11	4·00
Aug. 12..	House of Tongue.	4·00	11	„ 20..	Stevenage	10	2·90
Nov. 29..	Bann Reservoir...	3·90	9	„ 13..	Heading Hill ...	9	2·51
Aug. 12..	Glenam, Clonmel.	3·34	7	„ 18..	Stretton Fields...	9	2·05
„ 13..	Royal Inst., Cork	3·30	8	„ 19..	Hitchin	9	2·22
Nov. 21..	Hingston Down	3·27	4	May 30..	Broom Hill Ho..	9	2·09
June 21..	Fenagh Lodge ...	3·05	8	Nov. 29..	Bann Reservoir...	9	3·90
March 5..	Dunford Bridge ..	3·04	6	May 29..	High Roding.. ...	8	1·74
Dec. 29..	Snowdon SlateQr.	3·04	3	June 4..	Cambridge Obs...	8	1·46
Aug. 19..	Longthorns	3·00	6	„ 21..	Fenagh Lodge ...	8	3·05
Dec. 21..	Kirkpatrick	3·00	4	July 12..	Deepdene	8	2·45
Feb. 1..	The Howe	2·98	4	„ 11..	West St. Dorking	8	2·60
„ 20..	Barrow House ...	2·97	3	Aug. 11..	SkeneSt.Ab'rdeen	8	2·45
„ 1..	Arddaroch	2·90	3	„ 13..	Royal Inst., Cork	8	3·30
Aug. 20..	Stevenage	2·90	10	„ 18..	Burnham	8	2·17
Sept. 29..	Ardross Castle ...	2·82	6	„ 18..	Leamington	8	1·94
	Mean.....	3·32	6·1		Mean.....	8·6	2·55

Analysis of previous abstracts.

LARGEST FALLS.				LARGEST PER-CENTAGES.			
Years.	Depth.	Per Cent.	Mean Total Fall in the year at these Stations.	Years.	Per Cent.	Depth.	Mean Total Fall in the year at these Stations.
	in.		in.			in.	in.
1864 average ...	3·47	6·3	55·1	1864 average...	9·0	2·48	27·6
1865 ,, ...	3·67	6·4	57·3	1865 ,, ...	9·9	2·62	26·5
1866 ,, ...	3·40	4·4	77·3	1866 ,, ...	8·1	2·31	23·5
1867 ,, ...	3·17	9·0	35·2	1867 ,, ...	11·0	2·85	25·9
1868 ,, ...	3·32	6·1	54·3	1868 ,, ...	8·6	2·55	29·7

Year.	Number of Returns.	Mean Per-centage.	Mean Amount.	Mean Total Fall in year.	1867 being assumed =100.	Ratio of Rainfall to the Mean.
1865	481	5·1	1·70 in.	33 in.	106	102
1866	590	3·7	1·48 ,,	40 ,,	129	119
1867	584	4·6	1·44 ,,	31 ,,	100	100
1868	676	4·3	1·43 ,,	33 ,,	106	106

There is no respect in which the returns for 1863 differ from previous years, except that there were fewer *excessively* heavy rains; the fall seems to have been more equable—perhaps because there were so few thunderstorms in the summer—and consequently high per-centages are unusually rare. It cannot, however, be too strongly impressed on the minds of both observers and engineers, that there is no part of this country where a fall of *four inches* in 24 hours will not occur sooner or later, and both should therefore be ready for such a fall should it visit them, or their works; and when it does, it will probably all fall in the course of 5 or 6 hours.

NOTES ON THE PRINCIPAL RAINS OF 1868.

JANUARY 31st.

The greatest fall of rain in the year occurred on this day at stations between Halifax and Keswick, not extending to the coast on either side; the largest fall was 2·98 in., at the Howe, Troutbeck, and the largest per-centage 7 at Huddersfield.

MAY 29TH.

Heavy rain during the thunderstorm on this day; it was confined to the counties of Kent, Middlesex, Herts, and Suffolk; in the greater part of the latter county the fall exceeded an inch and a quarter, reaching 2·09 in., or 9 per cent. of the total yearly fall at Broom Hill House, Colchester. Advantage was taken of this storm to test, at Camden

Square, the action of Pastorelli's storm gauge (see page 28), with the results noted in the following extract from a letter in the *Times* :—

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

Time. p.m.			Total Fall of rain.	Rate of fall per hour.		Time. p.m.			Total Fall. of rain.	Rate of fall per hour.			
H.	m.	s.	in.	in.	in.	H.	m.	s.	in.	in.	in.		
1	50	50	...	0·12	...	—	2	2	0	...	0·55	...	2·3
1	52	0	...	0·17	...	2·6	2	3	20	...	0·60	...	2·3
1	53	30	...	0·20	...	1·2	2	7	10	...	0·65	...	0·8
1	54	30	...	0·25	...	3·0	2	11	20	...	0·70	...	0·7
1	55	40	...	0·30	...	2·6	2	14	10	...	0·75	...	1·1
1	57	50	...	0·35	...	1·4	2	15	0	...	0·80	...	3·6
1	58	20	...	0·40	...	6·0	2	16	40	...	0·85	...	1·8
1	59	40	...	0·45	...	2·3	2	20	0	...	0·90	...	0·9
2	0	40	...	0·50	...	3·0	2	20	10	...	rain ceased.		

From this we find that the great downpour which occurred here at 1h. 58m. p.m., was at the enormous rate of 6 in. per hour, or 144 in. per day. Hitherto there has been no facile means of noting the rainfall at very short intervals ; hence our knowledge of the rate at which rain falls in this and other countries is very limited. The only measurement by myself at all resembling the present was on the 13th of December, 1856, when 0·50 fell in 7½ minutes, being at the rate of 4 in. per hour for that period. I was not then able to measure at short intervals, or the *maximum* rate would doubtless have been greater than to-day, since there was no period of 7½ minutes to-day in which the fall exceeded 0·30, or 2½ in. per hour.

JULY 11TH AND 12TH.

The violent thunderstorms of this date produced the maximum daily fall in the year at nearly all stations between Oxford and Hastings ; the largest falls and largest per-centages were near the middle of the track, viz., in the vicinity of Dorking, where about 2½ in. of rain fell.

AUGUST 11TH TO 14TH.

Owing to some observers still entering the rain on the day of measurement, there is considerable difficulty in separating the falls on these days ; they concur, however, in showing that there was a general and very heavy fall, especially in the north and east of Scotland and in the Northern Isles ; four inches was measured at the House of Tongue, and between two and three inches at most other stations ; in fact, in the districts above-named, nearly one-twelfth of the year's fall, occurred during this time.

AUGUST 17TH AND 18TH.

At 120 stations the greatest fall in the year occurred on the 17th of August ; these stations being all situate south of 53° N. and W. of

the meridian of Greenwich; the fall was singularly uniform throughout, namely, between an inch and an inch and a half, and averaging 4 per cent. of the total yearly fall; in the neighbourhood of Taunton and of Coventry it somewhat exceeded this value.

SEPTEMBER 25TH AND 26TH.

On this day the maximum occurred at a considerable number of stations on and near the second meridian W. of Greenwich; the per-centage was, however, in no case excessive, and the largest amount one and a half inches.

NOVEMBER 21st.

The heaviest fall of the year, but by no means a heavy one, occurred at the stations in Cornwall and Devon, and along the banks of the Severn on this date; but there were very few places at which it amounted to 4 per cent. of the total yearly fall.

HEAVY FALLS IN SHORT PERIODS.

NORTHAM.—January 10th, 1·13 in. of rain in 16 hours.

BRECON.—January 18th, 1·65 in. fell in 6 hours. March 11th, 1·61 in. fell in 7 hours; 8 a.m. to 3 p.m.

DUNMOW.—May 29th, 1·74 in. in 8 hours; nearly all in 4 hours.

ST. MARY'S ROAD, ISLINGTON.—May 29th, ·59 in. of rain fell between 1 and 3 p.m., during a thunderstorm.

LEYSTERS.—May 29th, 1·38 in. of rain fell between 5 and 10 o'clock in the morning.

SAMBOURNE, ALCESTER.—May 29th, ·50 in. fell between 9 and 11 a.m.

BRECON.—May 29th, ·53 in. in 2 hours.

DEEPDENE, DORKING.—July 11th. On Saturday night a succession of thunderstorms commenced, which continued, at intervals, till Sunday night, yielding 2·45 in. of rain. On Monday, at noon, ·95 in. was registered, making a total of 3·40 in. in one day and two nights, a greater fall than I ever remember.

TEDDINGTON.—The heaviest fall of the year, 1·36 in., occurred on July 11th, between 2 and 4 a.m., and was accompanied by loud thunder and almost continuous lightning; the storm seems to have been local, and the rain was all absorbed immediately.

WEST HOATHLEY (PEARCELANDS).—A tremendous thunderstorm, of which this seemed the centre, on the night of July 11th, and morning and evening of the 12th, until after midnight; 3·43 in. of rain fell within 30 hours—marked as 1·17 in. on morning of 12th, and 2·26 in. on morning of 13th.

WEYCOMBE, HASLEMERE.—Heavy thunderstorms on 12th and 13th ; 3·38 in. of rain fell in 48 hours.

Several cases of sun-stroke between 16th and 23rd.

HUNSTANTON.—August 6th : began to rain at 3.15 p.m., with thunder and lightning ; wind W. 11th : thunder and lightning from S.S.W., 7.30 a.m. ; 1.10 in. in 1 hour and 45 minutes.

LAMBOURNE, STUDLEY, REDDITCH. — August 6th : 0·58 in. fell between 11 and 12 a.m.

COLCHESTER (FORD ST. MILL).—Aug. 10th : 0·35 in. in 20 minutes.

BROMSGROVE.—August 11th : ·97 in. of rain in 12 minutes ; thunder, lightning, with hail and large lumps of ice.

HAREFIELD, SELLING, FAVERSHAM.—August 17th, 1·in. fell in 1 hour and 20 minutes.

HUNSTANTON.—August 22nd, ·93 in. of rain in 20 minutes, 2.30 p.m.

LUDGERSHALL.—September 19th, 0·35 in. fell in about 15 minutes, from 10.20 to 10.35 a.m. ; the shower was very local ; at the time mentioned no rain fell at a place 2 miles S, and very little at a place 4 miles E.S.E.

CARGEN.—September 29th, severe storm of thunder and lightning at 11 a.m., when 0·45 in. of rain fell in 10 minutes.

MONTHLY RAINFALL IN 1868.

ENGLAND.

COUNTY ..	Kent.	Sussex.	Berks.	North- ampton. Welling- borough.	Norfolk.	Devon.	Cornwall.	Somerset.	Worcester.
STATION ..	Tunbridge.	Chichester.	Newbury.		Cossey.	Sidmouth.	St. Austell.	Burnham.	Lark Hill.
Ft. abv. Sea	71	20	235	...	...	26	300	30	157
	in.	in.	in.	in.	in.	in.	in.	in.	in.
January	3·70	3·05	4·07	2·63	2·12	3·43	6·49	4·28	2·54
Feb. ...	1·00	1·03	1·84	1·05	1·49	1·58	1·45	1·16	1·52
March..	1·91	1·41	1·89	1·67	2·06	1·54	2·95	1·21	1·59
April ...	2·04	2·25	2·51	1·14	1·90	2·64	3·73	1·31	2·28
May ...	·76	·91	·92	·44	·79	1·36	1·91	1·63	1·79
June ...	— ·43	— ·69	— ·48	·71	·70	·60	— 1·44	— ·23	— ·41
July ...	1·71	·81	1·90	·14	— ·55	— ·56	1·60	1·54	1·09
August.	3·50	3·57	4·33	2·64	2·82	3·76	2·96	+5·21	4·26
Sept. ...	1·91	2·80	4·45	2·30	2·27	5·27	4·06	1·73	2·67
October.	2·02	3·41	2·76	2·41	2·61	2·51	5·62	3·89	1·93
Nov. ...	1·89	1·38	1·57	1·34	2·24	2·59	5·48	1·09	1·94
Dec. ...	+6·10	+7·30	+5·89	+4·28	+4·48	+5·94	+8·34	4·53	+5·78
Totals..	26·97	28·61	32·51	20·75	24·03	31·78	46·03	27·81	27·80

ENGLAND—(continued.)

WALES.

COUNTY....	Lincoln.	Lanca- shire. Lancaster.	York.	York.	Cumber- land. Alston.	Cardigan.	Cardigan.	Brecknock.	Merioneth.
STATION ..	Branston.		Leeds.	Whitby.		Kilgerran.	Abery- stwith.	Hay.	Bala.
Ft. abv. Sea	...	118	95	184	1416	80	42	317	544
	in.	in.	in.	in.	in.	in.	in.	in.	in.
January	1·85	3·19	2·65	2·51	8·10	4·22	5·57	3·55	7·78
Feb. ...	1·54	2·89	1·29	·84	3·17	2·54	2·95	1·50	4·33
March..	1·03	4·42	1·96	1·24	5·61	3·86	4·29	2·44	7·42
April ...	1·69	2·46	1·77	2·56	3·72	2·09	2·84	1·59	2·29
May ...	·38	2·10	·97	1·07	2·36	1·82	1·56	2·12	1·72
June ...	·52	·64	— ·17	— ·47	1·64	— ·96	— ·52	— ·39	·69
July ...	— ·30	— ·40	·40	·70	— ·54	1·81	2·47	1·19	— ·45
August.	2·44	4·83	1·70	2·70	5·23	3·50	3·33	5·43	2·91
Sept....	2·30	1·53	3·05	4·14	2·88	3·01	2·26	3·99	3·16
October	2·04	6·00	2·52	2·58	4·72	3·47	4·71	2·61	5·15
Nov. ...	1·01	2·48	1·55	1·32	3·85	1·04	2·77	1·38	4·36
Dec. ...	+5·58	+8·75	+6·85	+5·77	+8·84	+14·89	+9·13	+7·18	+12·13
Totals..	20·68	39·69	24·88	25·90	50·66	43·21	42·40	33·37	52·39

MONTHLY RAINFALL IN 1868—(continued.)

SCOTLAND.

COUNTY....	Kirkcud- bright. Dalbeattie.	Edin- burgh. Cobbin- shaw.	Dumbar- ton. Ardda- roch.	Argyll. Ardfenaig	Fife. Cupar.	Aberdeen. CastleNewe	Ross. Apple- cross.	Ross. Ardross Castle.	Inverness. Farraline.
Ft. abv. Sea	25 ?	863	80	20	130	910	50	450	700
January	in. 5·32	in. +6·10	in. 12·68	in. 7·48	in. 4·90	in. 3·27	in. 7·57	in. 7·25	in. +11·90
Feb. ...	6·05	5·50	+13·92	+8·12	1·92	1·98	+10·85	4·79	6·80
March..	6·80	5·00	11·09	6·01	1·89	1·36	8·29	3·35	3·00
April ...	3·91	4·10	6·03	3·02	3·01	4·16	3·60	2·70	1·50
May ...	4·38	2·60	5·79	3·30	1·96	·77	3·92	1·79	1·60
June ...	·78	·60	3·53	1·95	·63	·51	5·41	2·09	1·20
July ...	— ·71	— ·50	— 1·38	1·54	— ·52	— ·44	1·94	— ·25	— ·10
August.	5·12	4·30	82·7	8·86	4·92	+6·02	6·85	+7·64	6·80
Sept. ...	2·96	2·90	4·55	— 1·14	5·55	4·94	— 1·46	5·40	1·50
October	6·88	3·80	9·87	5·26	1·15	2·12	7·48	3·68	4·70
Nov. ...	3·87	3·40	8·01	4·06	1·81	1·84	5·18	2·60	3·10
Dec. ...	+10·42	5·50	13·91	4·01	+5·69	3·06	8·53	3·45	4·80
Totals..	57·20	44·30	99·03	54·75	33·95	30·47	71·08	44·99	46·10

IRELAND.

COUNTY....	Kerry.	Tipperary.	Carlow.	Dublin.	Galway.	Roscom- mon. Holywell.	London- derry. Bellarena.	Cavan. Red Hills.	Antrim.
STATION ..	Killarney.	Clonmel.	Carlow.	Skerries.	Cregg Park Gort.	...	...	...	[Antrim.
Ft. abv. Sea	20	80	291	12	120	...	20	...	...
January	in. 8·49	in. 5·03	in. 4·08	in. 3·12	in. 3·27	in. 3·06	in. 3·37	in. 4·11	in. 2·57
Feb. ...	5·03	2·16	2·32	1·66	3·46	2·99	4·08	3·19	2·25
March..	5·39	3·09	2·33	2·35	4·08	3·28	4·53	3·58	3·50
April ...	2·94	3·86	3·00	1·90	2·45	1·90	1·75	2·38	1·62
May ...	2·60	2·07	2·09	1·56	2·25	2·28	2·11	2·52	1·73
June ...	— ·83	1·69	3·33	— 1·12	— ·80	2·32	·75	3·01	·59
July ...	2·61	— 1·36	— 1·10	1·15	1·27	— 1·07	— ·50	— ·96	— ·57
August.	4·88	+8·71	4·34	5·41	5·37	4·23	+4·59	4·26	+4·10
Sept. ...	4·66	6·21	3·65	2·20	2·82	3·32	1·81	1·88	1·12
October.	6·84	2·89	2·55	1·53	5·10	3·52	3·36	2·79	1·92
Nov. ...	8·19	3·80	2·53	2·14	3·16	2·50	3·75	2·94	2·66
Dec. ...	+18·17	8·42	+7·32	+5·78	+6·45	+5·30	3·34	+5·10	3·89
Totals..	70·63	49·29	38·64	29·92	40·48	35·77	33·94	36·72	26·52

MONTHLY PER-CENTAGE OF RAIN IN 1868.

Months.	ENGLAND.														WALES.			
	Tunbridge.	Chichester.	Newbury.	Wellingborough	Cossey.	Sidmouth.	St Austell.	Burnham.	Worcester.	Lincoln.	Lancaster.	Leeds.	Whitby.	Alston.	Kilgeran.	Aberystwith.	Hay.	Bala.
January ...	14	11	12	13	9	11	14	15	9	9	8	11	10	16	10	13	11	15
February...	4	4	6	5	6	5	3	4	5	7	7	5	3	6	6	7	5	8
March ...	7	5	6	8	9	5	6	4	6	5	11	8	5	11	9	10	7	14
April	8	8	8	5	8	8	8	5	8	8	6	7	10	7	5	7	5	5
May	3	3	3	2	3	4	4	6	6	2	5	4	4	5	4	4	6	3
June	2	2	2	3	3	2	3	1	2	2	2	1	2	3	2	1	1	1
July	6	3	5	1	2	2	4	6	4	1	1	2	3	1	4	6	4	1
August ...	13	12	13	13	12	12	7	19	15	12	12	7	10	10	8	8	16	6
September.	7	10	14	11	9	16	9	6	10	12	4	12	16	6	7	5	12	6
October ...	7	12	8	12	11	8	12	14	7	10	15	10	10	9	8	11	8	10
November .	7	5	5	6	9	8	12	4	7	5	7	6	5	8	2	7	4	8
December..	22	25	18	21	19	19	18	16	21	27	22	27	22	18	35	21	21	23

Months.	SCOTLAND.										IRELAND.							
	Dalbeattie.	Cobbinshaw.	Ardarroch.	Ardenaig.	Cupar.	Castle Newe.	Applecross.	Ardross.	Farraline.	Killarney.	Clonmel.	Carlow.	Skerries.	Cregg Park.	Holywell.	Bellarena.	Red Hills.	Antrim.
January ...	9	14	13	14	14	11	11	16	24	12	10	11	10	8	9	10	11	10
February...	11	12	14	15	6	6	15	10	15	7	4	6	6	9	8	12	9	9
March	12	11	11	11	6	5	12	7	6	7	6	6	8	10	9	13	10	13
April	7	9	6	5	9	14	5	6	3	4	8	8	6	6	5	5	6	6
May	8	6	6	6	6	2	6	4	4	4	4	5	5	6	6	6	7	7
June	1	1	4	4	2	2	8	5	3	1	3	9	4	2	7	2	8	2
July	1	1	1	3	2	1	3	1	3	4	3	3	4	3	3	2	2	2
August ...	9	10	8	16	14	20	10	17	15	7	18	11	18	13	12	14	12	15
September.	5	7	5	2	16	16	2	12	3	6	13	9	8	7	9	5	5	4
October ...	12	9	10	10	3	7	10	8	10	10	6	7	5	12	10	10	8	7
November .	7	8	8	7	5	6	7	6	7	12	8	6	7	8	7	11	8	10
December..	18	12	14	7	17	10	12	8	10	26	17	19	19	16	15	10	14	15

NOTES ON THE RAINFALL OF EACH MONTH.

JANUARY.—The rainfall throughout the country was near its average amount, but rather in excess at western stations and in the central districts of the north of Scotland.

FEBRUARY.—Rainfall again near the average, but in excess in Wales and Scotland, excepting the north-eastern portion of the latter country.

MARCH.—Rainfall below the average in the greater part of England, but very much above it in mountain districts and in Wales.

APRIL.—Rainfall generally rather above the average, especially on the N.E. coast.

MAY.—A dry month, especially in the eastern counties.

JUNE.—In scarcely any part of England did the rainfall amount to 3 per cent. of the yearly fall; the deficiency was greatest in Wales and South Lancashire. Rainfall above the average in the N. and N.W. of Scotland.

JULY.—Except in those small districts which were visited by thunderstorms there was scarcely any rain this month; the deficiency was greatest in the midland counties, where most of the stations had less than a tenth of an inch, and some had none at all.

AUGUST.—With one or two exceptions in Kent, Suffolk, and Wales, the fall was above the average, and considerably so in the west midland counties, but on first receiving the lighthouse returns from the north of Scotland for this month, we were very much surprised to see 9 in. or 10 in. reported as having fallen at (usually) dry stations, and were somewhat sceptical as to the accuracy of the observations. Careful collation of all the returns, both from the sea-coast and inland stations, induces the belief, if not the certainty, that the returns are all correct; certain it is that, large as is the excess at many of the lighthouse stations, it is actually not so great as in the inland districts of Aberdeen and Inverness, where one quarter of the total yearly fall fell in August.

SEPTEMBER.—The rainfall this month was generally near the average; in Scotland there was a remarkable excess on the E. coast.

OCTOBER.—This month was not quite so wet as usual, except in south western and northern counties.

NOVEMBER.—The rainfall was also below the average, except in the south of Yorkshire and S.E. of Ireland.

DECEMBER.—The rainfall of December, 1868, was remarkably in excess; at most English stations it amounted to a quarter of the whole year's fall, and at one or two, especially in South Yorkshire, to very nearly one-third of the total amount.

NOTES ON THE DISTRIBUTION OF RAIN FOR THE
YEAR 1868.

The following comparison tables require little explanation beyond that afforded by the headings. A fresh column, giving the per-centage of difference, has been added this year, and, in order to economize space and gain room for this column, the plus and minus signs are arranged to do double duty, applying to the amount before and the per-centage after them.

At three stations the mean fall 1850—9 is in parenthesis, thereby indicating that the values are partly computed. Their insertion was necessary to ensure the correctness of the means of the columns.

During 1868, as will be seen, the average of all English stations shews an excess of 2 per cent., and it would have been still larger but for the great local deficiency in Essex, where two stations had respectively 28 and 26 per cent. less than their average. There was little or no regularity in the grouping of the stations as regards their excesses and deficiencies, but this is perhaps not very surprising, when we reflect that of the twenty-two stations with less than their averages, half are only short by the yield of one thunderstorm.

The Scotch returns are far different; there we also find a few stations in the extreme east and west with a deficiency, but in the central and northern districts there are excesses of bewildering magnitude. Preliminary steps already taken, have shown the rainfall of Scotland to be liable to greater fluctuations than that of England, and several Scotch observers have called attention to the special irregularity which has characterized 1868; we must, therefore, leave these remarkable reports to abide subsequent inquiry. The question being undecided, we have left them in the table, but we may remark that if they were struck out, the excesses in Scotland and Ireland would become very nearly the same. We think it will be quite safe to take—

England and Wales...	...	...	2	per cent. in excess.
Scotland ... ..	..	..	10	” ”
Ireland ... ..	...	...	6	” ”
Mean of the whole ...	...	...	6	” ”

COMPARISON OF THE RAINFALL IN 1868 WITH PREVIOUS YEARS.
ENGLAND AND WALES.

Div.	STATION.	COUNTY.	Average			Depth in 1868.	Difference from Average, 1860-5	
			1840-9	1850-9.	1860-65.		Amount.	Per cent
			in.	in.	in.	in.	in.	
I.	Camden Town	Middlesex ...	...	(24·30)	25·01	23·40	1·61	— 6
II.	Sittingbourne (Tong) ...	Kent .....	...	24·03	25·40	23·42	1·98	— 8
"	Chichester Infirmary.....	Sussex	29·10	26·67	29·01	28·61	·40	— 1
"	" (Shopwyke) .....	" .....	...	26·25	28·41	31·33	2·92	+ 10
"	" (Chilgrove)	"	33·41	32·23	32·77	36·13	3·36	+ 10
"	" (W. Dean) .....	" .....	...	35·30	37·02	37·63	·61	+ 2
"	Uckfield Observatory .....	" .....	...	30·03	31·50	30·51	·99	— 3
"	Buxted Park .....	" .....	...	30·78	33·21	37·46	4·25	+ 13
"	Ventnor, Isle of Wight...	Hants .....	...	28·46	29·26	27·25	2·01	— 7
III.	Hemel Hempstead	Herts	25·86	26·43	25·47	27·33	1·86	+ 7
"	Berkhempstead .....	" .....	...	28·05	28·02	32·09	4·07	+ 14
"	Hitchin .....	" .....	...	24·72	23·25	24·41	1·16	+ 5
"	High Wycombe	Bucks .....	...	23·20	24·29	27·31	3·02	+ 12
"	Althorp	Northants .....	...	20·34	21·77	23·70	1·93	+ 9
"	Cardington (8 in. gauge)..	Bedford .....	...	21·60	21·87	21·94	·07	+ 0
IV.	Epping	Essex	26·99	23·18	26·05	18·67	7·38	— 28
"	Witham .....	" .....	...	20·55	20·73	15·37	5·36	— 26
"	Norwich (Honingham) ...	Norfolk .....	...	25·99	23·28	22·69	·59	— 2
"	Holkham .....	" .....	...	26·13	23·10	23·42	·32	+ 1
V.	Baverstock	Wilts	31·09	28·69	29·57	33·31	3·74	+ 12
"	Plymouth (Ham)	Devon .....	...	44·70	42·17	46·58	4·41	+ 10
"	Exeter Institution.....	"	29·35	26·91	30·17	34·29	4·12	+ 13
"	Honiton (Broadhembury)	"	35·14	32·75	34·28	35·88	1·60	+ 5
"	Helston	Cornwall .....	...	36·22	38·05	36·56	1·49	— 4
"	Truro	"	43·81	40·00	42·56	45·02	2·46	+ 6
"	Bodmin .....	" .....	...	43·48	46·12	53·85	7·73	+ 17
VI.	Cirencester	Gloucester .....	...	29·60	30·87	32·68	1·81	+ 6
"	Burford	Shropshire .....	...	25·52	26·25	26·58	·33	+ 1
"	Shiffnal (Haughton Hall)	" .....	...	24·02	23·74	22·95	·79	— 3
"	Orleton	Worcester	28·41	28·82	30·06	30·95	·89	+ 3
VII.	Wigston	Leicester .....	...	26·39	26·49	23·24	3·25	— 12
"	Southwell	Notts .....	...	19·65	19·54	20·76	1·22	+ 6
"	Welbeck	"	25·44	23·29	24·02	22·66	1·36	— 6
"	Derby	Derby .....	...	23·98	25·14	26·02	·88	+ 3
VIII.	Bolton (The Folds).....	Lancashire	46·46	44·01	48·33	46·34	1·99	— 4
"	" (Belmont) .....	" .....	...	51·19	55·70	53·20	2·50	— 5
"	Preston (Howick) .....	" .....	...	34·28	38·09	35·22	2·87	— 8
"	Ormskirk (Rufford) .....	" .....	...	33·24	34·81	32·19	2·62	— 7
"	Preston (Ho. of Correctn.)	" .....	...	33·60	36·79	37·78	·99	+ 3
"	Holker .....	" .....	...	39·17	44·98	45·58	·60	+ 1
IX.	Redmires	Yorkshire	40·75	37·86	37·89	39·03	1·14	+ 3
"	Standedge .....	" .....	...	49·58	52·17	50·50	1·67	— 3
"	Halifax (Well Head).....	"	31·88	30·71	31·09	34·57	3·48	+ 11
"	Leeds (Holbeck, M. & Co.)	" .....	...	20·91	21·98	22·63	·65	+ 3
"	York	"	25·42	22·02	23·38	25·70	2·32	+ 10
"	Settle	"	43·41	35·55	39·77	41·92	2·15	+ 5
X.	Bishopwearmouth	Durham	19·94	16·91	21·16	17·06	4·10	— 19
"	Seathwaite	Cumberland..	...	126·98	153·47	157·11	3·64	+ 2
"	Keswick (Post Office) ...	" .....	...	55·01	60·56	65·72	5·16	+ 8
"	Kendal (Kent Terrace)...	Westmore'nd	51·18	44·91	52·88	52·75	·13	— 0
"	Windermere (The Howe)	" .....	...	72·13	89·65	82·77	6·88	— 8
XI.	Lampeter	Cardigan.....	...	(43·00)	43·81	48·26	4·45	+ 10
"	well (Maes-y-dre) ..	Flint .....	...	24·25	23·58	20·73	2·85	— 12
"	Guernsey	Channel Isds.	...	34·46	37·09	34·76	2·33	— 6

**COMPARISON OF THE RAINFALL IN 1868 WITH PREVIOUS YEARS.
SCOTLAND.**

Div.	STATION.	COUNTY.	Average			Depth in 1868.	Difference from Average, 1860-5	
			1840-9.	1850-9.	1860-65.		Amount.	Per cent
			in.	in.	in.	in.	in.	
XII.	Mull of Galloway	Wigtown.....	20·67	22·52	28·31	25·21	3·10	— 11
„	Little Ross	Kirk'udbright	...	25·27	27·35	30·45	3·10	+ 11
XIII.	Haddington	Haddington..	23·77	24·35	26·93	23·50	3·43	— 12
„	Cobbinshaw	Edinburgh ...	...	35·65	35·65	44·30	8·65	+ 24
„	Glencorse .....	„ .....	...	36·96	36·77	46·45	9·68	+ 26
„	Inveresk	„	25·81	24·72	30·05	30·12	·07	+ 0
XIV.	Bothwell Castle	Lanark .....	...	27·76	28·33	33·02	4·69	+ 15
„	Largs (Mansfield)	Ayr .....	...	43·06	48·63	52·50	3·87	+ 8
XV.	Arddaroch	Dumbarton...	...	66·55	75·83	99·03	23·20	+ 31
„	Pladda	Bute	40·02	35·23	38·12	49·20	11·08	+ 29
„	Mull of Cantyre	Argyll	45·76	41·19	44·61	48·87	4·26	+ 9
„	Rhinns of Islay	„	33·79	30·58	32·66	36·66	4·00	+ 12
„	Castle Toward.....	„ .....	...	47·88	53·80	58·28	4·48	+ 8
„	Tyree (Hynish) .....	„ .....	...	73·90	84·77	83·42	1·35	— 2
„	Lismore .....	„ .....	...	38·44	46·95	45·98	·97	— 2
„	Ardnamurchan .....	„ .....	...	38·50	47·94	44·01	3·93	— 8
XVI.	Isle of May	Fife	20·94	15·21	21·08	22·79	1·71	+ 8
„	Deanston.....	Perth	35·74	39·21	42·35	51·40	9·05	+ 21
„	Stanley	„	32·00	29·05	30·60	35·03	4·43	+ 14
„	Dundee (Hill Head)	Forfar .....	...	31·06	35·59	37·97	2·38	+ 7
„	„ (Craigton) .....	„ .....	...	31·87	35·64	37·16	1·52	+ 4
„	Arbroath .....	„ .....	...	25·08	29·71	33·63	3·92	+ 13
XVII.	Girdleness [Aberdeen]	Kincardine ...	23·14	19·71	22·13	23·18	1·05	+ 5
„	Castle Newe	Aberdeen.....	...	32·99	34·60	30·47	4·13	— 12
„	Buchanness.....	„	26·84	23·40	22·51	30·01	7·50	+ 33
„	Kinnairdhead.....	„	22·01	22·05	23·32	25·48	2·16	+ 9
XVIII.	Cromarty.....	Cromarty ...	...	23·67	27·80	25·38	2·42	— 9
„	Barrahead	Inverness ...	31·60	32·67	32·62	31·96	·66	— 2
„	Island Glass	„	34·98	31·92	23·86	55·51	31·65	+ 133
„	Cape Wrath	„	38·86	36·94	39·59	48·70	9·11	+ 23
„	Noss Head .....	„ .....	...	25·57	23·57	26·29	2·72	+ 12
XIX.	Dunnethead	Caithness ...	27·39	22·09	25·93	19·47	6·46	— 25
„	Pentland Skerries .....	„ .....	...	24·12	28·92	28·43	·49	— 2
„	Sandwick	Orkney .....	...	36·14	36·79	43·43	6·64	+ 18
„	Start Point	„	25·05	23·77	24·32	61·80	37·48	+ 154
„	Sumburghhead	Shetland	25·43	25·22	25·52	34·49	8·97	+ 35
„	Bressay Manse .....	„ .....	...	36·22	40·40	45·40	5·00	+ 12

IRELAND.

XX.	Cork	Cork	41·30	34·23	34·41	41·46	7·05	+ 21
„	Portlaw	Waterford ...	...	39·49	45·90	51·80	5·90	+ 13
„	Killaloe	Clare .....	...	38·33	46·70	47·14	·44	+ 1
„	Tullamore	King's County	...	24·37	28·09	28·56	·47	+ 2
XXI.	Black Rock	Dublin	23·20	21·78	25·83	32·67	6·84	+ 26
XXIII.	Armagh	Armagh .....	...	(28·20)	32·40	29·59	2·81	— 9
„	Belfast (Linen Hall) ...	Antrim	29·44	30·01	37·12	33·22	3·90	— 10

ABSTRACT.

England .....	...	33·37	35·66	36·07	·41	+ 2
Scotland .....	...	32·44	35·50	40·51	5·01	+ 16
Ireland.....	...	30·92	35·78	37·78	2·00	+ 6
Mean of the whole .....	...	32·75	35·61	38·02	2·41	+ 8

EXTREMES OF RAINFALL IN 1868.

ENGLAND.

GREATEST.		LEAST.	
	in.		in.
The Styre, Cumberland.....	207·49	Witham, Essex	15·37
Taylor's Gill ,,	178·17	Sheerness, Kent	16·89
Seathwaite ,,	157·11	Barningham, Suffolk	17·05
Styre, Head ,,	130·71	Middlesborough, York	17·17
Sprinkling Tarn,,	126·81	Castle Hedingham, Essex	17·56
Mardale Green, Westmoreland	123·08	Potton, Beds	17·65

WALES.

GREATEST.		LEAST.	
	in.		in.
Snowdon Slate Quarries	115·10	Llanerch, Flint	25·80
Rhiwbrifdir, Merioneth	101·29	Brynbellia ,,	26·73
R.V.H. Llanberis, Carnarvon	84·25	Trevalyn Hall, Denbigh	27·28
Clwydog, Montgomery	83·50	Hawarden, Flint	27·61
Vrnwy ,,	80·80	Llwyn Onn Hall, Denbigh ...	29·44
Llanwddyn ,,	80·60	Llandudno ,,	29·75

SCOTLAND.

GREATEST		LEAST.	
	in.		in.
Glencorse, Edinburgh	166·60	East Linton, Haddington	18·12
Bridge of Orchy, Argyll	161·55	St. Abb's Head, Berwick	20·36
Ardlui, Dumbarton	154·75	Smeaton, Haddington	22·20
Arrochar ,,	135·30	Fenton Barns, ,,	22·51
Kyleakin, Inverness.....	125·33	Milfield ,,	23·50
Glen Fyne, Argyll.....	120·40	Kelso, Roxburgh	23·86

IRELAND.

GREATEST.		LEAST.	
	in.		in.
Killarney, Kerry	70·63	Glasnevin, Dublin	23·53
Valentia, ,,	58·17	O. S. Office, Dublin	23·72
Letterkenny, Donegal	56·56	Fitzwilliam Street, Dublin ...	24·94
Waterford, Waterford	51·59	Aghalee, Antrim.....	25·18
Inistogue, Kilkenny	50·18	Antrim ,,	26·52
Clonmel, Tipperary	49·29	Milltown, Down.....	28·11

GENERAL TABLES
OF
TOTAL RAINFALL IN 1868,
AT ABOUT
1500 STATIONS
IN THE
BRITISH ISLES.

RULES FOR RAINFALL OBSERVERS.

[We do not like the word "Rules;" it has a dictatorial appearance entirely at variance with our wishes and intention. Our sole object in framing them has been to ensure uniformity and accuracy. Any observer who objects to, or can suggest improvements in any one of them, will oblige by forwarding the substitute he would prefer, and a short statement of his reasons for so doing. These shall appear in the next issue of the *Meteorological Magazine*, and the rule shall be altered or not, as decided by the observers themselves.]

I.—SITE.—A rain gauge should not be set on a slope or terrace, but on a level piece of ground, at a distance from shrubs, trees, walls, and buildings—at the very least, as many feet from their base as they are in height. Tall-growing flowers, vegetables, and bushes must be kept away from the gauge. If a thoroughly clear site cannot be obtained, shelter is most endurable from N.W., N., and E., less so from S., S.E., and W., and not at all from S.W. or N.E.

II.—OLD GAUGES.—Old established gauges should not be moved, nor their registration discontinued until, at least, two years after a new one has been in operation, otherwise the continuity of the register will be irreparably destroyed. Both the old and the new ones must be registered at the same time.

III.—LEVEL.—The funnel of a rain gauge must be set quite level, and so firmly fixed, that it will remain so in spite of any gale of wind or ordinary circumstance.

IV.—HEIGHT.—The funnel of gauges newly placed should be 1 ft. above grass.

V.—RUST.—If the funnel of a japanned gauge becomes so oxidised as to retain the rain in its pores, or threatens to become rusty, it should have a coat of gas tar, or japan black. [Ebonite funnels will probably soon be obtainable.]

VI.—FLOAT GAUGES.—If the measuring rod is detached from the float, it should never be left in the gauge. If it is attached to the float, it should be pegged or tied down, and only allowed to rise to its proper position at the time of reading. To allow for the weight

of the float and rod, these gauges are generally so constructed as to show 0 only when a small amount of water is left in them. Care must always be taken to set the rod to the zero or 0.

VII.—CAN AND BOTTLE GAUGES.—The measuring glass should always be held upright; the reading is to be taken midway between the two apparent surfaces of the water.

VIII.—TIME OF READING.—Nine a.m. daily; if only taken monthly, then 9 a.m. on 1st.

IX.—DATE OF ENTRY.—The amount 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. (*This rule has been approved by the Meteorological Societies of England and Scotland, cannot be altered, and is particularly commended to the notice of observers.*)

X.—MODE OF ENTRY.—If less than one-tenth ($\cdot 10$) has fallen, the cypher must *always* be prefixed; thus, if the measure is full up to the seventh line, it must be entered as $\cdot 07$, that is, no inches, no tenths, and seven hundredths. For the sake of clearness, it has been found necessary to lay down an invariable rule that there shall always be two figures to the right of the decimal point. If there be only one figure, as in the case of one-tenth of an inch (usually written $\cdot 1$) a cypher must be added, making it $\cdot 10$. Neglect of this rule causes much inconvenience. All columns should be cast up *twice*. When there is no rain, a line should be drawn rather than cyphers inserted.

XI.—CAUTION.—The amount should always be written down before the water is thrown away.

XII.—SMALL QUANTITIES.—The unit of measurement being $\cdot 01$, observers whose gauges are sufficiently delicate to show less than that, are, if the amount is under $\cdot 005$, to throw it away, if it is $\cdot 005$ to $\cdot 010$ inclusive, they are to enter it as $\cdot 01$.

XIII.—Every observer should train some one as an assistant; but where this is not possible, instructions should be given that the gauge should be emptied at 9 a.m. on the 1st of the month, and the water bottled, labelled, and tightly corked, to await the observer's return.

XIV.—HEAVY RAINS.—When very heavy rains occur, it is desirable to measure immediately on their termination, and it will be found a safe plan after measuring to return the water to the gauge, so that the morning registration will not be interfered with. Of course if there is the slightest doubt as to the gauge holding all that falls, it must be emptied, the amount being *previously* written down.

XV.—SNOW.—In snow three methods may be adopted—it is well to try them all. (1) Melt what is caught in the funnel, and measure that as rain. (2) Select a place where the snow has not drifted, invert the funnel, and turning it round, lift and melt what is enclosed. (3) Measure with a rule the average depth of snow, and take one-twelfth as the equivalent of water. Some observers use in snowy weather a cylinder of the same diameter as the rain gauge, and of considerable depth. If the wind is at all rough, all the snow is blown out of a flat-funnelled rain gauge.

ARRANGEMENT OF GENERAL TABLES.

The divisions are the same as those adopted by the Registrars General of England and Scotland.

The boundaries of these divisions are shown on the map prefixed to *British Rainfall*, 1863.

The counties follow the same order as in the reports of the aforesaid officers.

An alphabetical list of the counties is given with the page or pages on which all returns from each will be found.

The stations in each county are arranged in the order of their latitude from South to North.

In order to facilitate finding the fall in any part of the country, the first name is almost always that of a place given in *Bradshaw* or the *British Postal Guide*; the second name is added occasionally to fix accurately the site of Observation. In a very few instances, this second name is in [] instead of (); it shows the nearest town, which is then in an adjoining county.

The contents of the columns are sufficiently explained by the headings, except that in the column headed “diameter” figures will occasionally be noticed of a different type from the rest of the tables; these figures indicate the length of the sides of rectangular mouthed gauges. These measurements are all in inches.

An asterisk * denotes that the gauge was tested before erection, and a † that it has been visited and examined since. A note of interrogation (?) implies doubt, not necessarily error. ... indicatethe absence of information.

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ENGLAND AND WALES.

DIVISION I.—MIDDLESEX.

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain. 1868	Days on which ·01 or more fell.
		Diameter.	Height Above Ground.	Height Above Sea Level		
			ft. in.	feet.	inches.	
MIDDLESEX.						
Hampton Wick (The Grove) ...	T. J. Nelson, Esq.	5	1 1	27	23·21	157
„ (Fairlight)	C. Mostyn, Esq.	5	...	52	23·24	143
Teddington (Gomer House)	R. D. Blackmore, Esq. ...	5	0 10	26	24·62	146
Twickenham Observatory	W. C. Plummer, Esq. ...	10	0 9	34	24·39	112
Chiswick	<i>Gardeners' Chronicle</i> ...	12	3 9	14	19·26	...
Westminster (Spring Grdns), S.W.	J. W. Bazalgette, Esq.	8	6 8	36	21·03	120
London (Guildhall), E.C.	W. Haywood, Esq. ...	8	2 6	49	22·41	142
„ „	„ „ „ „	8	50 0	118	21·42	142
„ (Chiswell Street), E.C.	A. Slate, Esq.	5	51 0	...	18·07	100
„ (Mile End), E.	F. Charrington, Esq. ...	12	14 0	...	19·05	114
„ (Dorset Square,) W.	H. E. Segrave, Esq. ...	5	10 0	100	22·41	157
† „ (Camden Road), N.W.	G. J. Symons, Esq. ...	8	0 4	100	23·40	142
„ Islington (St. Mary's Road, N.)	W. T. Reynolds, Esq. ...	5	1 0	90 ^p	22·09	146
„ (Compton Terrace)	Dr. Ballard	8	...	...	22·83	146
† „ (Holloway) N.	W. B. Kesteven, Esq.	5	1 3	95	22·60	157
* Upper Clapton (Hadham Ho.) ...	J. Parnell, Esq.	5	1 1	91	22·59	160
Hampstead, N.W. (Roslyn Ho.)	C. H. L. Woodd, Esq. ...	...	1 4	317	24·13	111
„ (Squire's Mount)	Rogers Field, Esq. C.E.	5	1 0	380	24·96	146
„ (The Grove)	H. Sharpe, Jun., Esq. ...	5	2 0	440	25·06	161
„ „	„ „ „ „	5	50 0	470	18·53	153
† Highgate Nurseries	J. Cutbush, Esq.	5	1 0	394	21·91	129
Harrow-on-the-Hill	T. Hewlett, Esq.	5	1 0	354	24·41	223
Harrow Station	B. Haughton, Esq., C.E.	5	1 0	184	26·15	127
Tottenham (Grove Ho.)	Charles Ashford, Esq. ...	5	3 0	55	24·23	134
Mill Hill (Bittacy House)	J. A. Hadden, Esq. ...	6	1 0	350	25·84	139
Enfield (Nag's Head Lane)	W. C. Mylne, Esq. ...	...	3 0	89	28·46	170
† Winchmore Hill	T. Paulin, Esq.	8	0 9	350 ^p	22·88	136
Potters' Bar	Mrs. Kaye	3	0 8	...	25·56	94

DIVISION II.—SOUTH-EASTERN COUNTIES.

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain.	Days on which ·01 or more fell.
		Diameter	Height Above Ground.		1868	
			ft.	in.	feet.	inches.
SURREY.						
Godalming (Dunsfold)	J. W. Woods, Esq.	5	0	6	166	29·62 ...
Weycombe [Haslemere]	G. B. Buckton, Esq. FRS	5	1	1	579	42·66 ...
Guildford (Cranley)	Rev. P. Roberts	5	0	8	...	29·36 ...
" (Ewhurst)	Capt. James, R.E.	5	1	6	345	30·28 ...
Farnham (Culverlands)	Miss Gibson	5	1	1	300	31·23 160
Godalming (Elstead)	Capt. James, R.E.	5	1	0	165	30·50 ...
Guildford (Shalford Common)	" " "	10	0	6	120	30·04 ...
† " (Commercial Road)	" " "	5	1	1	120	33·79 ...
† " (County School)	" " "	5	1	4	187	27·71 ...
Dorking (Deepdene)	Mr. Whiting	12	2	9	...	29·50 106
" (West Street)	Mrs. W. A. Marsh ...	10	35	0	150 P	34·06 158
" (Box Hill)	E. Boorman, Esq.	8	4	0	500	27·20 ...
Leatherhead (Eastwick Park) ...	H. E. Segrave, Esq. ...	5	1	0	...	29·37 119
Cobham (Pyports)	G. Dines, Esq.	8	1	1	66	26·26 168
Chobham	Dr. Ward	5	3	0	93	26·67 124
† Weybridge Heath	W. F. Harrison, Esq. ...	8	0	6	150	25·96 ...
† " (Village) ... (monthly)	" " "	8	0	6	53	25·81 ...
Croydon	Dr. Westall	5	1	0	152	24·58 130
"	J. Weston, Esq.	5	0	9	...	25·76 ...
" (Park Lane)	W. Robinson, Esq.	5	0	10	220	28·59 ...
" (Waldenhurst)	C. W. Johnson, Esq. ...	8	28	0	217	21·70 116
Kingston-on-Thames	T. Chalk, Esq.	5	0	6	...	25·72 ...
Wimbledon	T. Devas, Esq.	12	3	0	160	21·64 145
Upper Tooting	D. A. Freeman, Esq. ...	5	0	6	86	23·19 147
* Brixton Hill	Miss Sweeting	5	1	0	127	22·85 152
Wandsworth (South Fields)	R. Coleman, Esq.	10	1	0	...	24·43 ...
† " (West Hill)	J. E. Richard, Esq. ...	3	0	10	86	24·00 98
† Kew Observatory	Dr. Stewart, F.R.S. ...	10	1	3	19	22·83 138
Kennington Road	A. H. Thorns, Esq. ...	8	5	0	...	21·21 139
KENT.						
† Tenterden (Maytham Hall)	R. Appach, Esq.	8	1	2	120	31·18 147
† Hythe	H. B. Mackeson, Esq. ...	8	0	8	12	32·50 178
† Dover (Castle Street)	H. J. Poulter, Esq. ...	5	2	2	52	30·98 ...
† " (Castle Keep)	" " "	5	99	0	512	11·59 ...
† Hythe (Horton Park)	J. Kirkpatrick, Esq. ...	8	1	6	350	31·18 129
† Cranbrook (Hartley)	G. Pile, Jun. Esq.	5	4	0	352	33·07 211
† " (Tillsden)	T. Pile, Esq. ....	...	0	3	...	39·60 143
Goudhurst Vicarage	Rev. J. S. Clarke	5	1	1	490	29·59 145
* Tunbridge Wells	Rev. F. W. Stow	5	0	6	403	32·66 150
† Tunbridge	Dr. Fielding	5	1	0	71	26·97 165
Edenbridge (New Falconhurst) ...	J. G. Talbot, Esq., M.P.	5	1	0	400	29·71 141
† Staplehurst (Linton Park)	Mr. J. Robson	8	0	6	296	25·19 137
† " (East Sutton Park) ..	Mr. T. Skinner	8	0	6	387	23·94 ...
† " (Hunton Court)	Mr. P. Goddard	8	0	6	80	24·49 140
† East Peckham (Orchard Cotrage)	S. T. Harris, Esq.	5	2	0	76	22·91 129
† Faversham (Brogdale)	W. C. Stunt, Esq.	5	0	7	140	24·10 130
† Canterbury (Chartham)	C. T. Drew, Esq.	8	2	6	40	25·56 127
" (Bridge Street)	J. Reid, Esq.	5	1	0	52	27·25 161

DIVISION II.—SOUTH-EASTERN COUNTIES—(continued.)

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain. 1868	Days on which ".01 or more fell.	
		Diameter	Height Above Ground.				Height Above Sea Level
			ft.	in.	feet.	inches.	
KENT (<i>con.</i>)							
† Sandwich (Walton House, Eastry)	Colonel Rae	5	1	2	53	21.56	...
† Maidstone (Larkfield)	Rev. N. Dimock	5	3	6	...	22.67	...
Seven Oaks (River Hill)	J. T. Rogers, Esq.	5	1	3	525	28.52	...
" (Riverhead)	Rev. J. B. Murdoch ...	5	1	0	...	34.82	157
† Westerham (Chartwell).....	J. C. Colquhoun, Esq. 5	0	6	500	29.46	...	
Selling (Harefield)	E. Neame, Esq.	5	2	6	217	23.82	154
† Sittingbourne (Tong).....	G. Eley, Esq.	5	2	6	2	23.42	140
* " (Hartlip).....	W. Bland, Esq.	5	2	0	159	20.41	152
† Ramsgate (Cannon Brewery) ...	R. Cramp, Esq.	12	7	6	78	18.52	142
† " (Nelson Crescent).....	Dr. Smiles	5	7	2	90	17.04	...
† Margate (Acol)	E. S. Lendon, Esq. ...	5	1	0	60	21.51	111
West Wickham	Rev. J. T. Austen	12	1	2	380	22.61	...
Bickley (Gordon Lodge)	G. F. Chambers, Esq. 5	1	0	220	21.80	...	
Bromley Common, S.E.	Rev. A. Rawson	8	1	3	250	26.42	148
Foot's Cray (Sidcup)	Miss Berens	5	0	8	...	22.19	...
Strood (High Street).....	Mr. Sandy	5	0	9	15	22.65	152
† Sheerness Water Works	J. Lund, Esq., C.E. ...	5	1	0	9	16.89	118
† " " "	" " "	5	70	0	79	7.84	94
Lee (Blessington Road).....	J. Grant, Esq.	10	4	9	49	23.27	...
† Beckenham (Parkside)	C. O. F. Cator, Esq. ...	8	0	3	142	22.53	150
" (Foxgrove).....	Percy Bicknell, Esq. ...	5	0	5	138	23.31	...
Dartford (The Downs)	R. F. Jarvis, Esq.	5	2	0	250	19.41	124
Greenwich (Royal Observatory)..	J. Glaisher, Esq., F.R.S. 8	0	5	155	25.15	...	
Deptford (Pumping Station).....	W. Jeffree, Esq.	10	3	8	18	24.03	144
WEST SUSSEX.							
† Bognor (Aldwick)	H. Upton, Esq.	5	1	0	10	23.28	...
† Worthing (Bedford Row).....	W. J. Harris, Esq. ...	5	0	9	17	24.75	147
" (Water Works).....	" " "	5	0	11	25	27.12	...
† Arundel (Yapton)	R. Redford, Esq.	5	1	0	24	31.26	150
Emsworth (West Thorney)	F. Padwick, Esq.	5	0	10	10	30.88	135
† Chichester (Infirmary = Museum)	W. Hills, Esq.	5	0	6	20	28.61	...
† " (Westgate)	Dr. Tyacke	4	0	6	15?	27.75	...
† " (Shopwyke)	Rev. G. H. Woods ...	8	1	3	61	31.33	...
† Arundel (Dale Park)	J. C. Fletcher, Esq. ...	11	3	0	316	34.77	118
† Chichester (West Dean)	H. Paxton, Esq.	8	1	4	250	37.63	152
† " (Chilgrove)	John W. Woods, Esq. ...	5	0	6	284	36.13	...
† " (Bampton Hill)	" " "	5	0	6	554	42.97	...
† Petworth Rectory	Rev. C. Holland	5	1	10	190	37.37	127
† Fernhurst [Haslemere]	Miss E. A. Salvin	8	0	10	301	34.90	118
Milland House [Liphook]	Rev. J. M. Heath	18	25	0	340	36.96	...
† Horsham (Leonards-Lee)	Mr. S. Ford	5	1	6	200	30.43	...
EAST SUSSEX.							
† Beachy Head	Miss W. L. Hall	5	1	0	610	21.51	...
† Eastbourne	" " " "	5	4	3	12	30.36	149
† Pevensey	M. Vidler, Esq., C.E. ...	8	4	0	10	22.51	127
Brighton (Cambridge Rd., Hove)	H. W. Peake, Esq. ...	5	1	0	...	28.08	...

DIVISION II.—SOUTH-EASTERN COUNTIES—(continued.)

STATIONS.	AUTHORITIES.	Rain Gauge:			Depth of Rain.	Days on which 0.1 or more fell.	
		Diameter.	Height Above Ground.				1868
			ft.	in.	feet.	inches.	
HANTS—(con.)							
Selborne (The Wakes)	T. Bell, Esq.	6	4	0	400	39.53	145
Alton (Culverton Ho.)	P. Crowley, Esq.	8	3	6	334	37.39	155
Aldershot	Mr. J. Arnold	8	0	6	325	31.92	149
" " "	" " "	5	3	0	328	31.03	149
" " "	" " "	5	6	0	331	29.91	149
" " "	" " "	5	12	0	337	27.77	149
" " "	" " "	8	25	0	350	22.62	149
" " " (Bourley—2 miles W.)	" " "	8	1	0	370	31.44	145
† Basingstoke (Sherborne St. John)	Rev. D. W. Chute ...	5	1	2	276	32.07	134
† " (The Vyne)	W. Wiggett Chute, Esq.	8	1	2	236	30.86	124
† " " "	" " "	3	0	11	236	30.68	124
Heckfield (Highfield Park)	H. Marson, Esq.	5	2	0	...	31.73	133
† Strathfield Turgiss.....	Rev. C. H. Griffith ...	5	3	0	209	28.52	129
† " Saye	Mr. J. Bell.....	8	1	0	160?	30.89	142
BERKS.							
Sunningdale (Lynwood).....	Admiral Sir F. W. Grey	8	0	9	264	28.60	144
Windsor (Cumberland Lodge) ...	Viscount Bridport.....	5	1	0	200	29.91	...
" (Parkside)	W. Menzies, Esq. ....	...	6	0	...	28.73	...
" (Woodside)	W. Devas, Esq.	5	0	10	...	27.92	163
Reading (Englefield)	E. Robinson, Esq.	5	1	0	...	29.31	...
" (Forbury Gardens).....	Mr. Davis	5	1	3	130	25.72	100
"	Dr. Workman	5	2	8	...	25.95	152
Newbury (Greenham).....	J. Ward, Esq.	5	1	0	235	32.51	168
" (Speen)	Rev. H. W. Majendie...	5	1	0	...	28.18	...
" (Welford Park).....	Mr. C. Ross	5	0	11	...	33.00	159
Maidenhead (White Waltham)...	Mr. J. Silver .....	...	1	6	...	22.58	...
" (Ray Lodge)	W. Lassell, Esq.	6	1	0	90?	26.47	128
Streatley Vicarage	Rev. J. Slatter	10	0	4	144	29.03	141
Maidenhead (Cookham Vic.).....	Rev. R. W. Rogers ...	5	1	3	60?	27.75	165
" (The Halls)	F. W. Jowers, Esq. ...	5	1	6	70	27.36	148
* Wantage	E. C. Davey, Esq.	5	12	8	185	26.58	142
Wallingford (The Castle)	J. Kirby Hedges, Esq.	5	0	9	175	26.00	92
Long Wittenham	Rev. J. C. Clutterbuck	12	1	6	170	27.79	137

DIVISION III.—SOUTH MIDLAND COUNTIES.

HERTS.

Watford (Eastbury)	D. Carnegie, Esq.	3	0	4	376	26.61	...
King's Langley	J. E. Groome, Esq. ...	5	1	2	...	28.65	...
Hoddesdon (Field's Weir).....	N. Beardmore, Esq. C.E.	24	2	0	82	25.11	126
Hatfield (St. Mary's).....	Rev. R. P. Davies ...	8	2	8	376	26.31	142
Bayfordbury	W. C. Baker, Esq.	8	0	4	250	23.79	147
St. Albans (Gorhambury)	Mr. G. Bogue	6	2	9	...	28.48	127
Hemel Hempstead (Nash Mills) ...	J. Evans, Esq., F.R.S.	12	3	0	250	27.33	158
Berkhampstead	W. Squire, Esq.	8	1	6	370	32.09	151
Tring (Cowroast)	H. Thomas, Esq.	4	...	...	...	32.56	143
Kensworth [Dunstable].....	T. Jones, Esq.	5	1	0	902	29.21	118

DIVISION III.—SOUTH MIDLAND COUNTIES—(continued.)

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain. 1868	Days on which -01 or more fell.
		Diameter	Height Above Ground.	Height Above Sea Level		
		ft.	in.	feet.	inches.	
HERTS—(con.)						
Ware (Much Hadham)	Rev. H. S. Mott	5	1 1	222	23·02	162
Stevenage	Rev. J. O. Seager.....	8	4 2	321	27·28	157
Hitchin.....	W. Lucas, Esq.....	9	1 6	238	24·41	154
Royston	H. Wortham, Esq. ...	8	0 6	266	22·62	...
BUCKINGHAMSHIRE.						
Eton	Rev. Herbert Snow ...	5	1 0	100	25·98	132
High Wycombe	H. S. Wheeler, Esq....	8	0 9	225	27·31	...
Missenden Abbey	J. Begbie, Esq.	6	1 0	...	? 35·30	...
Newport Pagnell	R. Littleboy, Esq.....	4	2 0	...	24·64	...
OXFORD.						
Henley-on-Thames	T. F. A. Byles, Esq....	5	4 0	90	30·08	...
" (Nuffield)	Rev. A. Hamersley ...	5	4 0	698	27·57	121
Oxford (Radcliffe Observatory)	Rev. R. Main, F.R.S... 10	0 8	210	26·07	134	
" " (Upper Heyford)	Rev. C. B. Mount.....	9	1 2	300 ?	28·96	145
*Bicester (Stratton Audley Park)	G. Glen, Esq.....	5	1 1	295 ?	23·75	...
Chipping Norton (Kingham).....	Rev. J. W. Lockwood.	5	3 6	442	27·55	...
Banbury (Broughton Lodge) ...	E. C. Morrell, Esq. ...	5	2 0	360 ?	27·13	145
" (High Street)	T. Beesley, Esq.....	6	7 0	350	26·65	163
" (Neithrop)	F. Francillon, Esq. ...	5	1 0	340	26·31	...
NORTHAMPTON.						
Potterspurty [Stony Stratford] ...	Rev. R. E. Crawley ...	5	0 4	...	25·49	165
Yardley-Hastings	Rev. R. W. Prichard	5	1 2	260	24·07	...
Weedon Beck	Rev. J. S. Winter.....	8	1 6	280	23·51	...
Northampton	H. Terry, Esq.	5	5 0	...	24·12	161
* " (Wellington Pl.)..	Mr. G. Ellick.....	8	7 6	...	24·60	...
" (Thorpelands).....	H. J. Little, Esq.	8	0 8	250 ?	23·81	122
" (Althorp House)...	Mr. W. F. Jakeman ...	8	3 4	310	23·70	128
Wellingborough	E. Sharman, Esq.	5	0 3	...	20·75	144
Easton [Stamford].....	Mr. Day.....	5	1 0	220	24·78	103
HUNTS.						
St. Neots, (Tetworth Hall).....	Miss Kaye	5	0 6	200	21·73	115
" (Waresley)	Rev. W. M. H. Elwyn	8	1 0	170	21·37	125
"	G. Bower, Esq.	5	1 6	60	21·00	...
Kimbolton (Hamerton)	Rev. A. F. Stopford ... 10	5 4	170	19·99	...	
*Huntingdon (Wistow)	Rev. T. Woodruff.....	5	1 0	...	22·08	...
Conington Castle	J. M. Heathcote, Esq..	5	1 0	...	21·06	...
Standground Sluice, [Peterboro']	R. Lunn, Esq. ....	...	...	...	20·95	129
BEDFORD.						
Woburn (Lindon)	W. Lynn Smart, Esq..	5	2 0	...	24·38	...
Stotfold [Baldoek].....	W. Denne, Esq.	5	0 9	224	22·56	134
Amphill	W. S. Slinn, Esq.....	5	1 1	320	23·22	108
Biggleswade	C. T. Newbery, Esq... 5	5 6	...	21·57	...	
Potton (Sutton Park).....	Sir J. M. Burgoyne, Bt.	5	1 1	...	17·65	128
Cardington	Mr. J. B. McLaren ...	8	0 0	109	21·94	...
" (Staff gauge)	" " "	12	3 6	113	21·30	129
"	" " "	8	36 0	145	16·94	...
CAMBRIDGE.						
Abington Pigotts [Royston].....	G. Pigott, Esq.	8	0 6	130	19·62	150

DIVISION III.—SOUTH MIDLAND COUNTIES—(continued.)

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain. 1868	Days on which ·01 or more fell.
		Diameter.	Height Above Ground.	Height Above Sea Level		
			ft. in.	feet.	inches.	
CAMBRIDGE—(con.)						
Granchester Mill.....	J. Nutter, Esq.	5	4 0	45	18·64	139
Cambridge (Beech House).....	" " "	8	4 0	40	18·49	151
* " (Observatory)	Professor Adams, F.R.S.	5	0 9	88	19·20	161
Ely (Stretham)	Mr. Edwin Stanley ...	9	4 9	...	17·90	...
Wisbech (Harecroft Ho.)	A. Peckover, Esq.	8	0 8	11	23·78	133
" (Observatory)	S. H. Miller, Esq.	8	0 6	10	22·84	123
" " (monthly)	" " "	5	0 6	10	22·47	...
" "	" " "	8	8 0	18	21·68	123
" "	" " "	20x10	35 0	45	19·07	...

DIVISION IV.—EASTERN COUNTIES.

ESSEX.

Shoeburyness	Colonel Curtis, R.A....	5	4 0	12	16·31	116
Rochford (Clement's Hall).....	A. Holt White, Esq....	8	4 0	25 ?	17·25	114
Rayleigh (Hockly).....	A. Cockey, Esq.....	10	1 0	97	18·88	107
* Billericay	Dr. Carter	5	1 0	...	22·41	142
Waltham Abbey	Captain Smith, R.A. ...	8	4 0	80	22·89	...
Epping	H. Doubleday, Esq. ...	8	6 0	360	18·67	99
Harlow (Sheering)	Rev. Edward Hill ...	5	1 0	214	21·39	157
" (Moor Hall)	Mr. Huntley	8	1 6	189	20·44	130
Witham (Dorward's Hall).....	H. Dixon, Esq.	6	1 6	20 ?	15·37	...
Dunmow (High Roding)	Rev. E. Maxwell	5	0 8	252	21·59	143
"	H. E. Cockayne, Esq....	12	0 0	234	20·79	126
* Colchester (Birch Hall).....	Mr. W. Ingle	5	1 0	80	19·01	126
" (Broom Hill House) ...	Captain Walker	5	1 3	87	22·21	110
" (Ford Street Mill).....	Mr. S. Nutter	5	1 0	...	18·98	132
Braintree (Bocking)	S. Tabor, Esq.	12	3 6	200	19·67	94
Halstead (Hedingham Castle) ...	L. A. Majendie, Esq. ...	8	0 6	...	17·56	140
Saffron Waldon (Wimbish)	D. K. Emson, Esq. ...	8	1 6	...	23·57	103
" " (Ashdon)	Rev. J. T. Walker	5	1 0	300	19·40	...
" " (Audley End) ..	Mr. J. Bryan	5	1 1	140	19·74	160
SUFFOLK.						
Nayland (Tendring Hall)	Mr. G. L. Rushmore...	8	0 8	...	18·32	122
Sudbury	J. Alexander, Esq. ...	5	3 10	116	19·45	147
Ipswich (St. Peter's)	M. Oliver, Esq.	5	1 2	17	19·04	124
Hadleigh (Aldham).....	J. F. Lloyd, Esq.	5	2 6	...	21·29	150
Grundisburgh	P. Harris, Esq.	5	3 8	...	18·15	152
Saxmundham (Carlton Hall) ...	Mr. Clark	8	5 0	...	21·81	160
Bury St. Edmunds (Lawshall) ...	Rev. Tyrwhitt Drake..	8	1 1	...	19·49	...
" " (Drinkstone Pk.)	Mr. Nicholl	5	1 2	...	19·40	...
† " " (Abbeygate St.)..	T. C. Hinnell, Esq. ...	6	35 0	...	19·56	129
† " " (Beech Hill)	H. Turner, Esq.....	6	0 9	...	24·45	134
† " " (Westley)	R. Burrell, Esq.	5	1 6	...	20·20	...
† " " (Barton Hall) ...	Mr. W. Allan.....	5	1 0	...	19·71	138
† " " (Culford)	Mr. P. Grieve	5	1 2	...	21·72	131
Ixworth	Rev. W. Steggall	5	1 7	...	19·71	150

DIVISION IV.—EASTERN COUNTIES—(continued.)

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain.	Days on which 1/10 or more fell
		Diameter	Height Above Ground.	Height Above Sea Level	1868	
			ft. in.	feet.	inches.	
SUFFOLK—(con.)						
Ixworth (Walsham-le-Willows)..	Miss Martineau.....	5	0 11	...	19.80	151
„ (Barningham)	J. Fison, Esq.....	8	1 2	...	17.05	...
Eye (Yaxley)	Rev. W. H. Sewell ...	8	1 0	199	18.74	164
† Lowestoft (Gisleham).....	Rev. H. Jodrell.....	5	1 2	36	20.23	...
† „ (Carlton Colville).....	G. Edwards, Esq.	8	0 9	6	22.18	...
† „ (Somerleyton Hall) ...	L. J. Crossley, Esq. ...	8	3 0	60	19.58	131
† „ („ Rectory)	Rev. C. J. Steward ...	5	0 9	56	21.22	142
† „ (Hopton Hall)	C. Cory, Esq.....	8	0 2	47	20.58	101
NORFOLK.						
† Beccles (Geldeston)	E. T. Dowson, Esq. ...	5	1 0	30	19.20	149
Brandon (West Tofts)	Mr. R. Martin	5	1 0	...	19.73	138
Hingham	Rev. J. M. Du Port ...	...	...	...	22.46	...
„ (Carelton Forhoe) .....	„ „ „ .....	...	...	...	23.35	...
„ (Hardingham) .....	„ „ „ .....	...	...	...	26.44	...
*DownhamMarket(OutwellSluice)	R. Lunn, Esq. ....	...	4 0	16	16.64	...
„ (Fincham)	Rev. W. Blyth	3	4 0	60	22.43	...
Swaffham (Pickenham Hall).....	E. A. Applewhaite, Esq	5	1 0	160?	21.90	149
† Norwich (St. Catherine's Close)	Mrs. Evans	5	2 3	120	23.15	142
„ (Literary Institution)...	The Secretary.....	...	30 0	...	22.52	124
† „ (Thorpe Hamlet)	Mrs. Cooke.....	5	1 0	33	22.82	...
† „ (Thorpe)	W. Birkbeck, Esq.....	5	1 0	137	23.71	159
Acle (Lingwood).....	Rev. J. M. Du Port ...	...	...	...	20.26	...
† Acle	Rev. R. W. Kennion...	8	0 9	40	19.81	113
† Filby.....	Mr. Crisp	5	2 4	11	20.44	...
Norwich (Eaton).....	J. Pymar, Esq.	6	0 4	...	24.60	...
„ (Cossey)	H. Culley, Esq.	5	1 0	...	24.03	167
† „ (Honingham Hall)	Lady Bayning	5	0 6	88	22.69	156
„ (Honingham)	Rev. J. M. Du Port ...	...	...	90	23.41	...
† Dereham (Mattishall)	„ „ „	8	1 2	165	24.22	160
*Swaffham.....	C. J. Drury, Esq.	5	1 10	239	22.83	161
† East Dereham.....	G. H. Cooper, Esq. ...	8	3 0	161	25.44	...
Swaffham (Dunham)	Rev. J. M. Du Port ...	...	...	...	24.48	...
*Reepham	T. Alderton, Esq.	5	1 0	...	23.89	152
Litcham (Weasenham)	Rev. J. M. Du Port ...	...	...	...	23.93	...
Lynn (Hillington)	Rev. H. Ffolkes	5	4 6	93	23.61	150
Fakenham (Egmere)	R. Overman, Esq.....	4	4 8	150	27.63	136
Burnham (Westgate)	W. H. Spencer, Esq...	3	5 10	13	26.10	147
Holkham	J. Davidson, Esq. ...	8	0 0	39	23.42	144
„ „ „	„ „ „	12	4 0	43	23.83	...
Wells	H. R. Rump, Esq.....	5	1 0	16	24.19	191
Hunstanton	Mr. J. Rippingale.....	11	3 8	60	24.54	...

DIVISION V.—SOUTH-WESTERN COUNTIES.

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain.	Days on which "01 or more fell.	
		Diameter.	Height Above Ground.		Height Above Sea Level		1868
			ft.	in.	feet.	inches.	
WILTS.							
Landford	J. R. Wigram, Esq. ...	5	1	6	160 ^p	35·07	150
Salisbury (Alderbury)	Rev. R. S. Hutchings..	5	0	6	250 ^p	35·31	136
„ (Woodford).....	H. Hinxman, Esq.....	5	1	2	150	33·35	...
„ (Baverstock)	Ven. Archdeacon Hony	12	3	0	229	33·31	...
Heytesbury (Chiltern Ho.)	R. Hayward, jun., Esq.	11	4	0	380	32·59	161
Salisbury Plain (Orcheston).....	Rev. J. Wardale	6	0	8	300 ^p	34·08	129
Ludgershall [Andover]	E. G. Fawcett, Esq.....	8	0	0	400 ^p	29·93	147
Trowbridge (Sunny Side)	W. J. Mann, Esq.	5	1	1	...	31·57	159
Marlborough (Kingsbury Street)	W. C. Merriman, Esq.	15	4	0	500	33·58	...
„ College	Rev. T. A. Preston ..	5	0	0	456	34·92	154
„ (Mildenhall).....	Rev. C. Soames	5	0	8	502 ^p	33·88	168
Chippenham (Tytherton)	Major Gritton	5	1	2	150 ^p	26·93	181
Swindon (Draycot Folliatt)	T. Arkell, Jun., Esq....	5	0	10	...	33·56	...
„ (Penhill)	T. Arkell, Esq.	5	0	10	...	30·68	153
Chippenham (Badminton).....	Mr. A. McNaughten...	5	0	8	...	29·42	132
DORSET.							
Corfe Castle (West Backnowle)..	W. Voss, Esq.....	5	10	6	160	33·21	...
Weymouth (Osmington)	Captain Hall	5	1	0	150 ^p	38·92	165
Upwey	J. Miller, Esq.	5	1	0	70	32·34	148
*Dorchester	J. Jowett, Esq.	5	0	6	250	42·31	168
Lyme Regis.....	Mr. H. Tucker	5	1	6	19	36·40	174
Bridport	A. Stephens, Esq.....	8	0	8	65	32·59	152
Cerne Abbas (Melbury).....	Mr. T. C. Elliott	12	2	9	...	46·27	130
*Wimborne Minster (Chalbury)...	Rev. G. H. Billington.	5	2	0	338	38·27	156
Blandford.....	W. Shipp, Esq.	5	1	0	...	39·64	...
„ (Longthorns).....	Capt. Mansell.....	5	0	4	340	47·71	84
Shaftesbury	T. Ackland, Esq.	5	1	3	460	37·32	152
Gillingham	T. Thompson, Esq. ..	5	1	5	110	34·53	150
DEVON.							
Kingsbridge (Burton)	W. Balkwill, Esq.....	5	2	0	200	35·72	...
„ (Fore Street Hill)...	G. Fox, Esq.	5	0	6	68	38·93	181
Plymouth (Old Town Street) ...	A. P. Balkwill, Esq....	5	30	0	150	40·37	...
† „ (Saltram Gardens) ...	Mr. J. Snow	5	0	3	96	48·50	...
† „ (Ham)	Rev. C. T. C. Trelawny	5	3	0	94	46·58	127
Brixham (Lupton)	Mr. G. Erskine.....	12	3	2	200	47·71	128
† Plympton St. Mary (Ridgeway)	Miss B. T. Phillipps ...	5	0	6	116	50·77	178
Beer Ferrers (Tamar House).....	H. R. Trelawny, Esq.	5	4	0	150 ^p	45·25	...
*Torquay (Lamorna)	W. Pengelly, Esq., F.R.S	5	0	9	205	39·19	171
† Dartmoor (Lee Moor).....	W. L. Martin, Esq. ...	5	0	3	900	67·54	...
Newton Abbot (Devon-square)...	Mrs. Harris	5	6	0	...	41·92	153
† Newton Bushel (Highwick)	Dr. Barham	5	1	6	250 ^p	40·71	160
† Dartmoor (Prison Reservoir) ...	Mr. H. Watts	5	0	2	1400	77·65	236
† „ (North Hessary Tor)...	„ „ „	5	0	3	1596	84·30	236
† Teignmouth (Landscape)	Mrs. Clark	5	0	6	200	31·45	...
„ (Bishopsteignton)...	Rev. S. M. Scroggs ...	5	6	6	100	36·43	175
† Tavistock (Public Library)	Mr. W. Merrifield.....	8	20	0	273	53·76	153
* „ (Mount Tavy)	H. Clark, Esq.	5	0	6	...	60·15	...

DIVISION V.—SOUTH-WESTERN COUNTIES—(continued.)

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain. 1868	Days on which ·01 or more fell.
		Diameter.	Height Above Ground.	Height Above Sea Level		
			ft. in.	feet.	inches.	
SOMERSET.						
Ilminster (South Petherton).....	W. Blake, Esq.	8	0 6	200 ?	29·86	177
Ilebrewers (Walrond Park)	J. Ostler, Jun., Esq....	5	1 0	116	30·23	99
Ilchester	J. W. Bourne, Esq. ...	8	1 6	30 ?	31·06	138
*Wellington (Sunnyside).....	W. Elworthy, Esq. ...	5	1 0	...	34·65	166
*Taunton (Fullands School)	W. Reed, Esq.	5	1 4	...	30·48	126
„ (College School)	Rev. W. Tuckwell ...	5	1 0	48	29·72	162
„ (The Castle)	G. Gillett, Esq. ....	...	1 6	...	28·47	152
Langport (Long Sutton)	R. Palmer, Esq.....	5	0 10	50	28·23	159
*Wiveliscombe	B. Boucher, Esq.	5	1 2	...	37·02	165
Glastonbury (Street)	W. S. Clark, Esq.	8	1 0	60	30·26	...
Wells (Dinder)	Rev. T. J. Bumpsted	8	4 0	140 ?	41·24	175
Burnham (The Colony)	Captain Estlin	5	1 0	30	27·81	151
Frome (Mells Rectory)	Rev. J. H. Horner. ...	5	1 0	342	43·40	195
E. Harptree (Sherborne Reservoir)	Bristol Water Works	5	1 0	338	51·13	...
Chew Magna [Bristol]	„ „ „ ...	5	1 0	160	36·31	...
Bath (Paragon)	Dr. Barter	5	1 3	113	31·83	156
„ (Literary Institute)	C. P. Russell, Esq.....	5	8 0	75	30·53	146
„ (Weston)	„ „ „	5	10 0	190	30·41	171
„ (Batheaston, Bannerdown Ho.)	Colonel Ward.....	5	1 0	290 ?	31·00	158
„ „ Reservoir).....	A. Mitchell, Esq.	12	2 0	226	30·17	154
Chelvey [Bristol]	Rev. J. Matthew	5	0 5	37	31·90	180
Barrow Gurney Reservoir.....	Bristol Water Works	5	1 0	320	40·68	...
Brislington [Bristol]	G. Thomas, Esq. ....	...	5 0	100	31·88	...

DIVISION VI.—WEST MIDLAND COUNTIES.

GLOUCESTER.

Bristol (Small St.)	Bristol Water Works	5	25 0	40	30·69	...
„ (Phil. Inst.)	B. Wright, Esq.....	...	...	...	31·63	...
„ (Montpelier)	F. P. Bisson, Esq....	5	2 0	100	33·78	180
Clifton (South Parade)	Dr. G. F. Burder	8	0 6	192	34·11	...
„ „	„ „ „	8	50 0	242	27·54	...
„ (Royal York Crescent)	A. North, Esq.	12	0 8	197	34·15	158
„ „ „ „	„ „ „	5	0 8	197	33·60	158
Fairford (Kempsford)	R. A. Iles, Esq.....	5	0 8	...	27·43	108
Nailsworth (Spring Hill)	H. D. Humphries, Esq.	8	2 0	...	34·10	...
Berkeley (Chantry Cottage).....	E. Osborne, Esq.	5	1 6	60	32·54	194
Lydney	W. H. Bathurst, Esq...	8	1 0	32	36·35	...
Cirencester (Further Barton) ...	T. C. Brown, Esq.....	10	1 2	446	32·68	...
Fairford (Hatherop)	W. Arkell, Esq.....	5	...	...	30·45	...
Stroud (Upfield)	Miss Stanton	5	0 11	100	28·58	...
„ (Castle Villas).....	J. Bateman, Esq. ....	...	1 0	240	33·61	172
Frampton-on-Severn (Saul Lodge)	W. B. Clegram, Esq. C.E.	5	3 6	42	26·84	143
Gloucester (Witcomb Court).....	A. Bubb, Esq.....	8	2 0	225	27·05	...
„ („ Water Works)	T. Small, Esq.	8	3 0	297	28·97	...
„ (Quedgeley Ho.).....	J. C. Hayward, Esq....	5	0 10	50	27·13	...
„ (Barnwood Ho.).....	Dr. A. J. Wood	8	3 6	50	25·51	...

DIVISION VI.—WEST MIDLAND COUNTIES—(continued).

STATIONS.	[AUTHORITIES.	Rain Gauge.			Depth of Rain.	Days on which ".01 or more fell.
		Diameter.	Height Above Ground.	Height above Sea Level.	1868	
			ft. in.	feet.	inches.	
GLOUCESTER—(con.)						
Cheltenham (Keynsham Bank)...	H. D. Humphries, Esq.	8	6 6	232	27.09	135
„ (Hatherley Sew. Wks.)	„ „ „	8	16 6	172	17.68	149
„ (Arle=Chelt „ „)	„ „ „	8	16 6	169	16.38	143
Newent (Boyce Court)	General Drummond	8	1 3	133	27.21	145
Moreton-in-Marsh (Frogmore)...	W. Arkell, Jun., Esq...	5	0 10	...	26.89	...
HEREFORD.						
Ross (Rocklands)	J. M. Herbert, Esq. ...	8	1 10	100 ?	37.13	158
Ross	H. Southall, Esq.	5	1 0	200 ?	29.05	165
„ (Sellack Vicarage).....	Rev. W. C. Ley.....	...	...	...	29.63	151
Hereford (Broomy Hill)	T. Curley, Esq., C.E	5	0 11	195	28.65	187
„ (Blue Coat School).....	W. Cooke, Esq.	8	6 0	190	25.37	...
„ (Richmond Place).....	E. J. Isbell, Esq.	8	5 8	184	28.53	185
„ (Davison's Nursery ...	„ „ „	8	1 0	194	30.48	...
„ (Hagley Park)	A. Hutchinson, Esq....	5	0 6	300	23.94	...
„ (Tupsley)	P. Ballard, Esq.	5	1 1	...	27.38	...
„ (Stretton)	Rev. H. C. Key	5	1 0	170	28.98	142
Leominster (West Lodge)	E. P. Southall, Esq. ...	5	4 6	233	31.85	175
Kingston (Burcher Cottage).....	Miss Boddington	5	3 2	...	33.87	...
Leominster (Leysters)	Rev. T. S. Hewitt.....	5	0 4	600 ?	25.71	...
SHROPSHIRE.						
Burford [Tenbury].....	Lord Northwick	5	1 0	100 ?	26.58	...
Ludlow (Knowbury)	Rev. J. B. James	5	1 0	1000 ?	31.16	...
„ (Mill Street).....	W. Marston, Esq.	5	1 1	350	33.37	174
Bridgenorth (Quatt School)	Mr. L. Roach.....	5	4 2	...	26.75	139
Church Stretton (Woolstaston)...	Rev. D. Carr	5	1 0	790	33.40	190
Shiffnal (Erelith)	Miss Elwell	5	4 6	430	28.14	...
„ (Haughton Hall)	Rev. J. Brooke	5	3 6	353	22.95	154
Shrewsbury	Marshall & Co.	10	4 4	192	18.55	...
„ (Monkmoor)	Miss Lovett	5	1 0	200	23.05	185
„ (Fitz Manor)	R. Middleton, Esq.....	5	2 6	287	18.42	...
Newport	J. Bodenham, Esq.....	5	1 0	250	25.99	176
Oswestry (Hengoed)	Rev. A. R. Lloyd	5	6 0	471	37.11	...
Market Drayton (Nort'n-in-Hales)	Rev. F. Silver	8	0 6	335	20.36	113
Whitchurch	A. B. George, Esq.....	5	3 0	...	28.60	124
STAFFORD.						
Wolverhampton (Oaklands)	H. Ward, Esq.	5	0 10	520	28.84	145
„ (Waterloo Road)	C. G. DeLessert, Esq. .	5	1 1	500	26.07	163
„ (Wadham's Hill)	Rev. E. W. Winter ...	8	4 6	450	23.61	...
„ (Merridale Road)	J. Thurstans, Esq.....	8	6 0	430	23.42	161
„ (Pattingham)...	Rev. B. S. Malden ...	5	1 0	400	27.88	122
„ (Patshull).....	„ „ „	8	2 0	350	27.03	...
„ (Wrottesley) ...	J. Hough, Esq.	3	0 4	490	25.17	...
„ („)	„ „ „	8	0 8	490	23.57	...
„ („)	„ „ „	3	0 10	...	23.94	172
Weston-under-Lyzziard [Shiffnal]	Hon. Rev. J. Bridgeman	5	0 7	...	25.18	...
Stafford (Infirmary)	P. H. Greaves, Esq. ...	5	3 0	152	24.11	145
Burton-on-Trent	J. Matthews, Esq.....	5	0 6	530	29.43	157
Stoke (Barlaston)	W. Scott, Esq.	5	3 0	400	37.48	174
Oakmoor (Ellaston)	Rev. Sir C. R. Lighton, Bt.	5	3 0	400	37.48	174

DIVISION VI.—WEST MIDLAND COUNTIES.—(continued.)

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of	Days on which 01 or more fell	
		Diameter.	Height Above Ground.		Rain.		
			ft.	in.	feet.	1868	inches.
STAFFORD—(con.)							
Stoke (Stanley Reservoir).....	J. Forbes, Esq., C.E....	5	3	1	550	27·87	133
„ (Etruria)	„	5	4	2	440	31·13	161
Leek (Rudyard)	„	5	12	7	500	31·71	144
Knypersley [Congleton]	„	5	14	0	500	26·43	157
Wincle [Macclesfield]	„	5	5	0	500	34·26	142
WORCESTER.							
Northwick Park.....	Lord Northwick	8	1	0	...	23·96	...
Evesham (Lansdowne)	R. Burlingham, Esq... ..	8	4	6	124	22·87	155
Great Malvern	Messrs. W. & J. Burrow..	5	0	10	522	30·82	183
West Malvern	A. H. Hartland, Esq. ..	8	1	6	900	30·05	...
Worcester (Lark Hill)	W. Burgess, Esq.	5	1	0	157	27·80	168
„ (Gas Works)	F. N. Gosling, Esq. ...	10	4	1	...	24·26	...
Tenbury (Orleton)	T. H. Davis, Esq.	5	0	9	250	30·95	194
Bromsgrove (The Ford House)...	G. Dipple, Esq.	11	4	4	273	28·45	153
Moseley [Birmingham].....	T. L. Plant, Esq.	4	4	0	487	31·83	170
Stourbridge (Hagley Rectory) ...	Hon. Mrs. Lyttleton... ..	...	...	...	...	29·45	165
„ (Dunsley)	J. Bourn, Esq.	5	0	10	500 ?	27·08	150
WARWICK.							
Alcester (Sambourne).....	A. Winkfield, Esq.	5	1	3	...	26·76	...
Henley-in-Arden (Arden House)	G. R. Dartnell, Esq....	5	2	0	400	26·03	148
Leamington (Upper Parade).....	S. U. Jones, Esq.	5	0	8	195	24·64	148
Rugby	F. Fuller, Esq.	12	2	4	384	23·15	156
Coventry (Radford).....	A. H. Atkins, Esq. ...	8	1	0	305	23·36	145
Pailton House [Lutterworth] ...	Capt. Constable Curtis	5	1	0	...	24·89	144
† Birmingham (Edgbaston).....	Miss R. B. Southall ...	8	1	3	510	29·83	173
† „ (Bloomsbury Street)	D. Smith, Esq.	8	0	10	340	29·62	165

DIVISION VII.—NORTH MIDLAND COUNTIES.

LEICESTER.							
Knaptoft Hall [Rugby].....	T. Willson, Esq.	5	1	6	...	25·36	145
† Market Harborough (Fleckney)	J. B. Putt, Esq.	5	0	8	411	23·21	...
Hinckley (Stretton Fields).....	T. J. Scott, Esq.	5	0	6	...	23·17	152
† Wigston	T. Burgess, Esq.	8	0	6	220	23·24	118
† Leicester	H. Billson, Esq.	8	0	6	237	26·21	134
† Thornton Reservoir	J. Bevins, Esq.	10	2	8	420 ?	23·50	129
Appleby	Rev. F. B. Falkner ...	5	1	0	333	28·90	...
† Owston [Oakham]	Miss Gilford	5	1	0	580	28·90	161
Melton Mowbray (Dalby Hall)...	Mr. G. Jones	8	2	6	480 ?	24·14	149
„ (Asfordby)	Rev. C. A. Holmes ...	5	0	9	32	21·20	99
Loughborough (Cedar Cottage)...	J. Giles, Esq.	5	0	9	400	27·99	...
„ (Belton).....	Rev. R. Dalby	5	4	0	250 ?	25·71	159
Waltham Rectory	Rev. G. E. Gillett.....	8	0	8	560	23·41	147
† Belvoir Castle	W. Ingram, Esq.	8	1	0	237	24·17	142
RUTLAND.							
Tickencote Warren	Rev. C. L. Wingfield..	8	2	0	...	24·49	122

DIVISION VII.—NORTH MIDLAND COUNTIES—(continued.)

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain. 1868	Days on which "01 or more fell.
		Diameter.	Height Above Ground.	Height Above Sea Level.		
			ft. in.	feet.	inches.	
LINCOLN.						
Stamford	Dr. Newman	5	1 0	...	22·83	...
* Bourne (Wytham-on-the-Hill)	A. C. Johnson, Esq. ...	5	1 3	167 ^p	21·49	120
† Grantham	J. W. Jeans, Esq.	8	0 6	179	21·88	147
Sleaford (Heydour)	Rev. G. F. Deedes	5	2 6	...	22·45	88
" (Aswarby)	Rev. C. Whichcote .....	...	...	...	20·78	...
Boston	Dr. Mercer Adam	5	1 0	20	23·80	164
"	" " "	8	6 0	20	21·85	139
"	W. H. Wheeler Esq. C. E.	5	5 0	25	25·61	154
Stubton [Newark]	G. Nevile, Esq.	5	4 6	...	20·75	117
Spilsby (Welton-le-Marsh)	Rev. A. Wright	5	3 6	180 ^p	21·92	...
Lincoln (Branston)	A. S. Leslie Melville, Esq.	5	0 9	...	20·68	118
"	M. S. & L. R. Co †	9	3 6	26	19·64	154
Gate Burton	" " "	9	3 6	96	23·85	139
Louth	T. W. Wallis, Esq.	3	5 0	80	29·80	167
Market Rasen	M. S. & L. R. Co.	9	3 6	100	21·35	96
Gainsborough	" " "	9	3 6	76	21·11	116
Stockwith	" " "	9	3 6	21	21·48	108
Brigg	" " "	9	3 6	16	22·07	135
Grimsby	" " "	9	15 0	42	23·53	141
Barnetby	" " "	9	3 6	51	22·38	127
Crowle (Keadby) .....	" " " .....	...	...	10	20·98	...
Ulceby (Killingholme)	Rev. J. Byron	5	1 4	60	26·25	178
Brigg (Appleby)	Rev. J. E. Cross	5	0 9	60	25·25	...
" (Ferriby Sluice)	" " "	5	0 9	10	24·76	...
New Holland	M. S. & L. R. Co.	9	3 6	18	24·62	159
NOTTS.						
Nottingham (Ruddington Grange)	C. Paget, Esq.	8	1 1	...	23·06	151
Beeston Lock	Mr. H. Barker	8	1 1	100	21·88	77
Nottingham Park	Mr. W. Chapman	5	1 3	80	25·79	...
" (Arboretum)	M. O. Tarbotton Esq. C. E.	8	0 5	238	25·33	151
" " "	" " "	8	25 6	238	24·55	154
" (Gedling)	Hon. & Rev. O. Forrester .....	...	6 3	...	23·39	...
Southwell (Oxton)	H. Sherbrooke, Esq. ...	2	2 0	...	26·73	...
"	W. W. P. Clay, Esq. ...	6	1 6	200	20·76	...
Welbeck Abbey	Mr. W. Tillery	6	4 0	80	22·66	113
Workshop	M. S. & L. R. Co.	9	3 6	127	19·47	128
Retford	" " "	9	3 6	52	21·67	90
DERBY.						
Sawley	Mr. J. Windle	5	0 9	100	24·92	...
Sudbury	A. Dick, Esq.	5	1 9	174	29·05	127
Doveridge [Uttoxeter]	Mr. Povey	6	4 0	270	25·78	131
Derby (Mickleover)	Mr. R. Ryley	5	17 6	310	24·99	121
"	J. Davis, Esq.	5	6 0	180	26·02	179
" (Morley)	Rev. S. Fox	5	3 0	406	27·62	...
" (West Hallam)	Rev. C. J. Newdigate	5	2 0	356	27·88	170
" (Duffield)	W. Bland, Esq.	5	0 6	200 ^p	26·50	172

† Kept for the Canals Department of the Manchester, Sheffield, and Lincolnshire Railway Company.
Returns supplied by R. D. Heathcote, Esq.

DIVISION VIII.—NORTH WESTERN COUNTIES—(continued.)

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain.	Days on which "10 or more fell.
		Diameter.	Height Above Ground.	Height Above Sea Level.	1868	
			ft. in.	feet.	inches.	
LANCASHIRE—(con.)						
Manchester (Plymouth Grove)...	J. F. Roberts, Esq.....	8	3 8	150	31·81	185
" (Eccles)	T. Mackereth, Esq.....	10	3 0	145	32·92	208
" "	" " "	5	3 0	145	32·45	208
" "	" " "	5	34 0	179	26·53	208
Salford (Town Hall)	" " "	5	7 0	123	31·05	211
Manchester (Ardwick)	J. Casartelli, Esq.....	9	3 0	145	29·23	189
† " (Piccadilly)	M. S. & L. R. Co.....	9	40 0	194	31·41	189
Fairfield	" " "	9	6 0	312	37·57	189
" Gorton Reservoir	J.F.Bateman, Esq.FRS	...	...	263	31·19	...
Manchester Water Works. " Denton .....	" " " .....	...	...	324	30·22	...
" Godley .....	" " " .....	...	...	500	31·02	...
" Arnfield .....	" " " .....	...	...	575	35·47	...
" Rhodes Wood .....	" " " .....	...	...	520	46·93	...
" Woodhead .....	" " " .....	...	...	680	53·62	...
" Torrside .....	" " " .....	...	...	600	45·41	...
Stoneclough (Outwood).....	W. Horrocks, Esq. ...	12	1 0	295	37·90	182
Wigan (Water Works)	J. L. Hunter, Esq., C.E.	8	1 6	223	37·58	190
Oldham (Waterhouses)	M. S. & L. R. Co.....	9	3 6	345	34·31	166
" (Gas Works).....	J. Taylor, Esq.	9	6 0	600	34·37	204
" (Strines Dale)	" " "	10	6 0	800	32·19	207
" (Brushes Clough)	" " "	10	6 0	950	42·73	218
" (Picthorne)	" " "	10	6 0	800	37·54	208
*Oldham (Royton)	J. Heap, Esq.....	5	1 0	544	41·33	182
Bolton-le-Moors (The Folds).....	H. H. Watkins, Esq... 10	3 6	286	46·34	...	
" (Vale Bank).....	J. Watkins, Esq. 5	3 0	300	45·37	174	
" (Heaton)	H. Baylis, Esq. 10	0 0	500	43·90	147	
" "	J. S. Holdsworth, Esq 10	3 6	497	42·79	194	
" (Belmont)	H. Baylis, Esq. 10	0 0	800	53·20	153	
Entwistle.....	" " " .....	...	0 0	700	49·90	136
Rochdale (Nagden Dane).....	C. E. Cawley, Esq. M.P. 5	1 6	900	36·51	...	
Ormskirk (Rufford)	J. Porter, Esq. 5	0 8	38	32·19	191	
Blackburn (W. Works Office)...	J.F.Bateman, Esq.FRS	...	...	400	42·21	...
" (Pickup Reservoir) ...	" " " .....	...	...	720	47·10	...
" (Guide Reservoir) ...	" " " .....	...	...	650	43·30	...
" (Audley Place)	J. Shackleton, Esq. ... 5	0 6	450	47·48	204	
Burnley W. Works (Swindon)...	J. Emmett, Esq. ....	...	18 0	750	41·89	...
Preston (Howick House) <i>old gauge</i>	T. Norris, Esq.	12	0 6	73	35·22	...
" " <i>(new gauge)</i>	" " "	12	0 6	73	35·70	...
" (House of Correction) ...	Mr. J. Hesketh	7	1 1	140	37·78	...
" " "	" " "	7	53 6	187	29·65	...
" (Atherton Terrace)	J. Armytage, Esq., C. E. 8	1 2	143	38·75	...	
Blackpool (South Shore)	G. Sharples, Esq. 10	1 8	29	33·10	...	
Stonyhurst College	Rev. S. J. Perry	11	1 3	381	47·20	197
" Alston	J. Armytage, Esq., C.E.	8	1 2	320	42·87	...
" Knowl Green	" " "	8	1 2	400	38·54	...
" Jeffrey Hill	" " "	8	1 2	900	37·84	...
" Loud-scales	" " "	8	1 2	400	43·32	...
" Spade Mill	" " "	8	1 2	400	41·59	...

DIVISION VIII.—NORTH WESTERN COUNTIES—(continued.)

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain. 1868	Days on which -01 or more fell.
		Diameter.	Height Above Ground.	Height Above Sea Level.		
			ft in.	feet.	inches.	
LANCASHIRE—(con.)						
Clitheroe (Downham Hall)	R. Assheton, Esq. M.P.	10	1 6	464	44·70	...
Garstang (Vale House)	J. Jackson, Junr., Esq.	6	4 3	455	42·38	200
" (Grizedale)	B. Riley, Esq.	8	1 0	438	39·69	...
Lancaster (South Road).....	W. Roper, Esq.	12	3 6	118	44·80	199
† " (Caton)	Rev. A. Christopherson	5	1 9	120	42·30	190
Hest Bank	T. Ransome, Esq.	12	2 2	58	37·15	...
Melling (Hornby Castle)	C. H. Lethbridge, Esq.	12	3 2	103	45·61	158
" (Storr's Hall)	F. F. Pearson, Esq. ...	5	1 0	220	40·81	...
Yealand Conyers [Milnthorpe]...	Rev. T. Birkett	5	3 0	220	40·52	183
Silverdale [Milnthorpe]	S. Marshall, Esq. ....	...	...	...	41·46	...
Leck Hall [Kirkby Lonsdale] ...	H. T. Welch, Esq.	5	1 3	498	41·74	...
† Cartmel (Allithwaite)	Mr. W. R. Nash	5	1 0	88	39·34	197
† " (Holker)	Mr. Wilson	8	4 8	155	45·58	199
" (Grange)	A. Beardsley, Esq. ...	8	3 0	25	46·70	172
*Ulverston	J. H. Matthews, Esq.	5	5 6	98	53·88	197
Newby Bridge (Backbarrow) ...	T. Ainsworth, Esq. ...	12	3 3	70	51·86	114

DIVISION IX.—YORKSHIRE.

WEST RIDING.

Sheffield (Station)	M. S. & L. R. Co.	9	3 6	188	29·90	171
" (Edge)	" " " " " "	9	3 6	336	33·96	181
" (Broomhall Park)	D. Doncaster, Jun. Esq.	10	2 0	337	31·04	186
" (High Hazles)	Mrs. Hounsfield	9	3 0	...	23·82	...
Redmires	J. Gunson, Esq. ....	...	4 0	1100	39·03	...
Tickhill	Dr. Dixon	8	2 0	61	22·64	157
Rotherham	M. S. & L. R. Co.	9	...	85	25·58	116
† " (Moorgate Grove)	R. Chrimes, Esq.	5	1 0	262	25·11	154
" (Masboro' Vicarage) ..	Rev. H. Masters White	5	1 0	125	22·83	161
" (Wath-upon-Dearne) ..	W. M. Burman, Esq. ...	8	6 6	186	20·13	147
" (West Melton).....	Rev. J. Boyd	6	0 10	172	22·62	...
Doncaster	M. S. & L. R. Co.	9	...	35	20·33	117
" (Magdalens)	Mr. J. Howorth	5	5 9	46	24·02	103
Dunford Bridge	M. S. & L. R. Co.	9	3 6	954	67·29	204
" (Reservoir)	Mr. G. Whitfield	12	2 0	1100	54·19	...
Penistone	M. S. & L. R. Co.	9	3 6	717	31·35	194
Carlotes	" " " " " "	9	3 6	1075	70·36	190
Barnsley (Elsecar)	" " " " " "	9	...	175	23·60	151
" (Worsborough) ..	" " " " " "	9	...	225	24·13	163
" 	" " " " " "	9	...	175	23·28	131
" (Church Street).....	Dr. Sadler	5	1 3	350	26·87	200
Holmfirth (HolmeStyes Reservoir)	J. F. Bateman, Esq. FRS	...	...	850	39·80	...
" (Boshaw Whams Reservoir)	" " " " " "	...	...	950	37·50	...
" (Bilberry Reservoir) .....	" " " " " "	...	...	800	41·20	...
Saddleworth (Friesland)	G. Venables, Esq.	5	3 6	630	44·98	164
" (Station)	E. Greenwood, Esq.	10	5 0	640	41·21	...

DIVISION IX.—YORKSHIRE—(continued).

STATIONS.	AUTHORITIES,	Rain Gauge.			Depth of Rain.	Days on which ·01 or more fell.
		Diameter	Height Above Ground.	Height Above Sea Level	1868	
			ft. in.	feet.	inches.	
WEST RIDING—(con.)						
Standedge	E. Greenwood, Esq. ...	8	2 0	1150	50·50	...
Ackworth School	G. Satterthwaite, Esq.	5	0 3	135	23·70	161
Huddersfield (Nortonthorpe).....	A. M. Box, Esq.	3	0 3	475	30·59	198
„ (Longwood)	C. K. Hare, Esq.....	10	4 6	600	34·90	195
„ (Fartown).....	Captain Chichester ...	5	1 6	300	32·17	183
„ (Dalton).....	J. W. Robson, Esq. ...	5	0 6	350	32·24	173
„ „	„ „ „	8	0 6	350	32·45	173
Goole	T. Kendall, Esq.....	11	3 4	...	27·35	166
Mirfield (Cote Wall)	E. B. W. Balme, Esq...	8	0 9	200	27·35	116
„ (Calder F. Reformatory).....	Mr. J. Johnson	8	0 5	320	27·02	160
Todmorden (Stansfield Hall).....	J. Fielden, Esq., M.P.	8	12 4	500 ?	39·46	189
*Huddersfield (Rastrick).....	A. Clay, Esq.....	5	1 3	410	33·39	176
Halifax (King's Cross)	J. Gledhill, Esq.....	8	30 0	690	34·04	174
† „ (Well Head) <i>monthly</i>	J. Waterhouse, Esq. FRS	12	0 11	487	34·57	...
„ („) <i>(daily)</i>	„ „ „	7	1 0	527	39·62	186
„ (Dean Clough Mills).....	L. J. Crossley, Esq. ...	11	15 0	475	39·34	131
Bradford (Mechanics' Institute)...	C. Lund, Esq.	8	48 0	373	32·67	197
„ (Manywells)	C. Gott, Esq.	5	0 9	700	37·43	184
„ (Chellow Dean)	„ „	10	5 0	650	37·06	116
„ (Doe Park)	„ „	8	0 9	810	47·89	190
„ (Queensbury)	W. Foster, Esq.	5	5 4	1050	42·86	127
Leeds (Leventhorpe Hall).....	J. T. Leather, Esq. ...	10	2 0	90	21·88	...
† „ (Holbeck)	Messrs. Marshall & Co.	10	32 0	127	22·63	132
„ („)	„ „ „	5	1 0	95	24·88	170
„ („ W. Works Depot).....	E. Filliter, Esq., C. E. ...	8	1 3	95	26·01	167
„ (Philos. Hall)	H. Denny, Esq.	10	48 0	137	23·15	168
„ (Woodhouse Moor).....	E. Filliter, Esq., C.E.	8	0 9	305	25·86	172
„ (Westwood Hall).....	H. C. Marshall, Esq. ...	5	0 7	400	27·96	186
„ („ Reservoir)	E. Filliter, Esq., C.E.	8	0 9	325	26·02	165
„ (Allerton Hill)	T. Fenwick, Esq., C.E.	5	0 7	418	25·79	...
„ (Eccup).....	E. Filliter, Esq., C.E..	8	0 9	340	28·80	189
Shipley (Baildon Green)	Rev. H. M. Stallybrass	5	4 6	262	34·82	140
Keighley (Braithwaite).....	Mr. W. Shackleton ...	5	6 6	770	43·81	192
Otley	H. Thorns Esq.....	8	0 7	206	30·90	159
Harewood (Arthington).....	E. Filliter, Esq., C.E.	8	0 9	140	29·52	169
Ilkley	Dr. Scott	5	1 0	500	38·89	147
„ (Myddleton)	„ „	5	0 1	500	45·93	169
† York (Bootham)	F. Thorp, Esq.	5	0 6	50	25·70	166
† „ (Coney Street)	Mr. Sigsworth	5	8 0	40	26·59	151
„ (Cherry Hill)	H. Richardson, Esq. ...	5	1 4	60	23·58	...
Thornton-in-Craven	T. Wilson, Esq.....	5	5 4	456	40·49	209
Whiteholme [Clitheroe]	Mrs. Birchall.....	5	1 3	...	53·84	...
Skipton (Woodlands).....	J. Heelis, Esq.	5	0 8	430	41·45	188
† Harrogate	Dr. Bainbridge	8	0 6	420	32·83	160
Settle	J. Tatham, Esq.....	12	40 0	498	41·92	...
Arncliffe	Rev. W. Boyd	8	2 9	730	66·70	194
Ripon (Littlethorpe)	Mrs. Swire.....	...	...	...	26·86	...
„ (The Knoll).....	Rev. F. W. Stow	5	0 6	112	30·54	...

DIVISION IX.—YORKSHIRE—(continued).

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain 1868	Days on which '01 or more fell.
		Diameter.	Height Above Ground.	Height Above Sea Level		
			ft. in.	feet.	inches	
WEST RIDING—(con.)						
Ripon (The Knoll)	Rev. F. W. Stow	12	5 0	116	29·55	160
Wharfedale (Oughtershaw)	C. H. L. Woodd, Esq.	5	1 3	1175	74·53	160
Sedbergh (Thorne)	Miss Elam	5	1 1	400?	57·07	209
„ (Dentdale, Stone House)	„ „ „	5	1 4	800	73·06	...
„	Rev. E. Raven	5	0 6	440	58·54	209
EAST RIDING.						
Patrington	W. B. Pugh, Esq.	5	0 3	28	23·53	179
† Hull (Manor House Street)	W. Lawton, Esq.	5	0 10	14	25·60	164
† „ (Beverley Rd., York Parade)	J. Smith, Esq.	8	3 10	11	26·54	163
„ („ „ N. Parade)	A. Norman, Esq.	5	1 10	...	24·71	...
„ (Baker Street)	A. O. Atkinson, Esq. ...	5	1 6	10	25·34	...
„ (People's Park)	Mr. E. Peak	5	0 6	0	27·06	181
„ (Cottingham)	J. H. Hill, Esq.	8	1 3	25	24·90	97
† Holme-on-Spalding-Moor	G. Dunn, Esq.	5	6 4	33	21·34	163
Thorganby (Thicket Priory)	Miss M. C. D. Jefferson ..	6	1 4	26	18·45	84
Beverley (Middleton)	Rev. H. D. Blanchard..	5	1 0	150	24·67	109
Pocklington (Warter)	J. Coxon, Esq.	5	1 10	...	24·95	173
Ganton [Scarborough]	Mr. Boulton	10	1 0	150?	26·62	155
NORTH RIDING.						
Flaxton	H. Richardson, Esq.	5	0 9	130	23·61	...
† Malton	H. Hurtle, Esq.	10	1 0	75	25·95	...
*Filey Reservoir	Mr. D. Philliskirk ..	5	9 0	183	22·97	144
Thirsk	A. O. Atkinson, Esq. ...	5	2 6	114	25·90	...
Beadlam Grange	J. H. Phillips, Esq. ...	5	0 6	192	25·71	...
Scarborough	Dr. Cornelius Fox	5	1 0	102	23·90	163
*Northallerton	Dr. Hodgson	5	1 3	...	25·45	...
Catterick (Tunstall)	H. C. Marshall, Esq. ...	5	1 0	350	28·07	...
*Whitby	M. Simpson, Esq.	5	2 0	184	25·90	179
„ (Ruswarp)	A. O. Atkinson, Esq. ...	5	1 6	7	28·57	...
*Port Mulgrave	A. S. Palmer, Esq. ...	5	2 0	300	25·67	...
Greta Bridge Thorpe Grange) ...	T. Dodgson, Esq. ....	...	...	...	28·69	...
Middlesborough (Marton Hall) ...	H. W. Bolckow, Esq. MP ..	...	1 3	120	19·64	...
„	W. Fallows, Esq.	8	1 0	21	17·17	120
Redcar (Upleatham)	M. Gray, Esq.	4	0 4	330	24·15	...

DIVISION X.—NORTHERN COUNTIES.

DURHAM.

*Darlington (Dinsdale)	Rev. J. W. Smith	5	1 6	50	24·96	187
Eaglescliffe [Yarm]	Rev. J. Hull	5	1 0	80	20·38	167
Darlington (Southend)	Mr. J. Richardson ..	5	4 0	140	37·25	129
Stockton-on-Tees	W. B. Baker, Esq. ...	...	0 10	30	17·85	...
Sedgefield	Dr. Smith	5	0 7	360	26·84	...
Wolsingham (St. John's)	W. Backhouse, Esq. ...	5	1 1	928	37·33	194
„ „ „	„ „ „	5	1 0	927	38·33	194
Stanhope Castle	Mr. T. Surtees	8	4 0	760	39·68	...
Durham Observatory	J. J. Plummer, Esq. ...	12	4 6	335	30·77	191
„ (S. Cuthbert's Col. Ushaw) ..	Rev. Dr. Gillow	5	0 10	600	25·75	175

DIVISION X.—NORTHERN COUNTIES—(continued.)

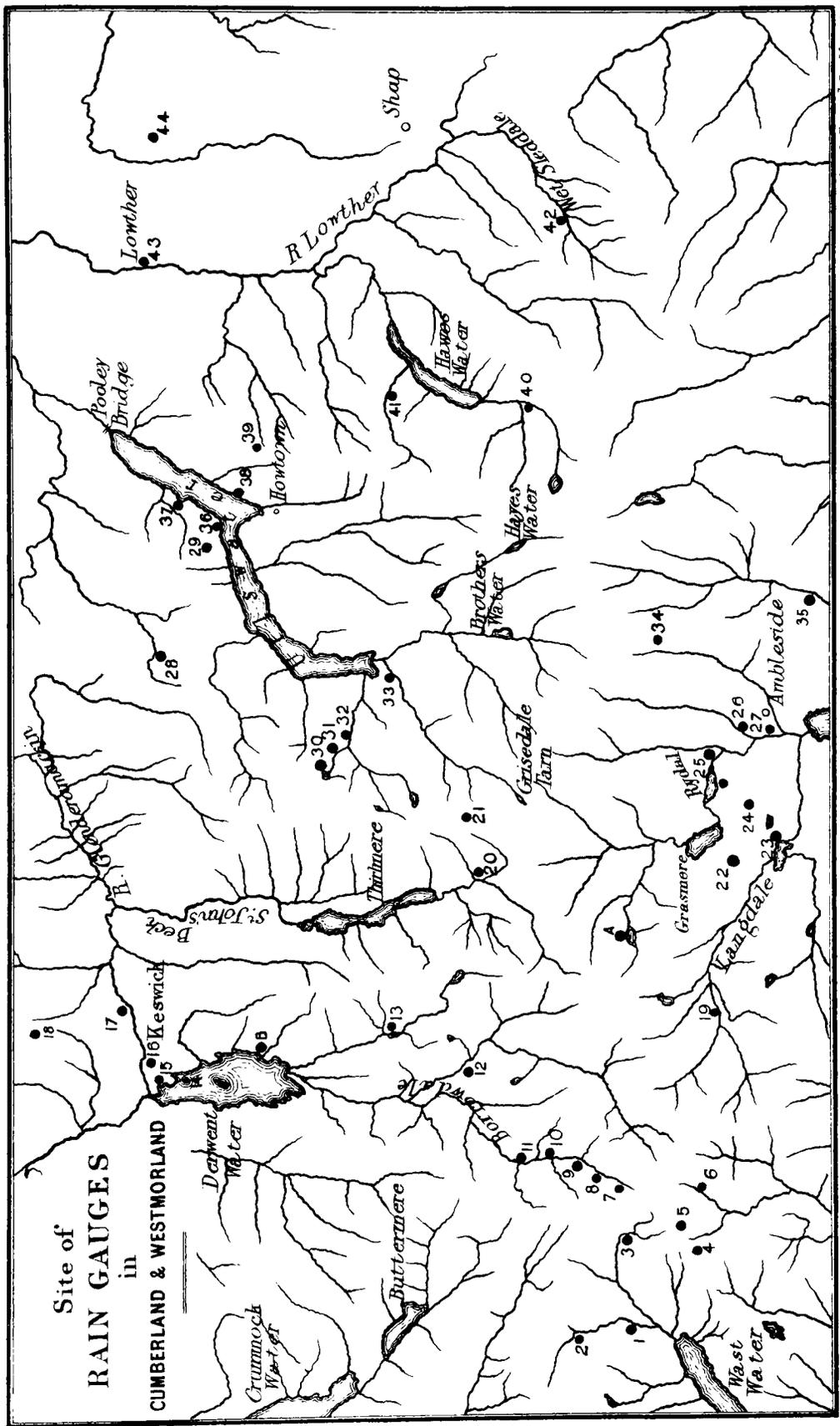
STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain. 1868	Days on which -01 or more fell
		Diameter	Height Above Ground	Height Above Sea Level		
			ft. in.	feet.	inches	
DURHAM—(con.)						
Seaham (Hall).....	R. Draper, Esq.....	5	1 0	100	22·56	145
„ (Vicarage).....	Rev. A. Bethune.....	5	0 4	80	24·09	128
† Sunderland (Hendon Hill)	J. W. Mounsey, Esq.	5	0 6	120	20·84	...
„ (West Hendon).....	T. W. Backhouse, Esq.	5	1 0	132	21·29	158
† „ (The Hall).....	Rev. G. Iliff	10	1 5	85	23·50	154
Bishopwearmouth	Dr. Ogden	8	30 0	130	17·06	136
„ (Esplanade).....	Dr. Pyle.....	...	8 2	128	19·87	...
NORTHUMBERLAND.						
Allenheads	M. Varty, Esq.	8	0 9	1360	56·42	225
Shotley Hall	Mr. J. Coulson	5	0 3	312	28·01	149
Bywell	Mr. J. Dawson	8	0 6	87	27·71	198
Wylam Hall	G. C. Atkinson, Esq.	10	5 0	96	26·43	132
„ (Horsley)	Rev. R. F. Wheeler ...	5	0 6	...	23·77	...
Newcastle (Philos. Soc.)	W. Lyall, Esq.	8	1 2	105	26·25	169
„ (Town Moor)	Rev. R. F. Wheeler ...	5	0 6	...	24·51	144
North Shields (Wallsend).....	J. W. Dees, Esq.	10	0 6	100	24·49	113
† „ (Rosella Place)	R. Spence, Esq.....	8	1 0	124	23·35	173
„ (Low Lights).....	J. R. Procter, Esq. ...	8	3 1	12	22·46	177
„ (Tynemouth).....	P. J. Messent, Esq. ...	5	1 2	62	21·05	170
„ (Clementhorpe).....	H. R. Procter, Esq. ...	5	1 0	150	20·92	174
* „ (Whitley).....	Rev. R. F. Wheeler ...	5	0 11	83	25·37	...
Stamfordham	Rev. J. F. Bigge	8	1 0	400	25·40	...
„ (Church Tower)	„ „ „	10	42 0	452	20·16	...
Hexham (Parkend).....	M. A. Ridley, Esq. ...	10	0 4	276	34·33	203
Bellingham (Hesleyside)	W. H. Charlton, Esq.	10	3 7	420	49·81	149
Hartburn (Wallington)	H. Laws, Esq.....	5	1 0	398	31·47	209
Cresswell.....	Rev. R. F. Wheeler ...	...	...	...	19·82	...
Bellingham (Otterburn)	Rev. T. Wearing	10	1 0	500	32·64	...
Morpeth (Brenckburn Priory) ...	C. H. Cadogan, Esq.	5	1 0	200	29·69	98
Rochester (Byrness)	Rev. R. F. Wheeler ...	10	2 0	...	37·26	189
Alnwick (Glanton Pyke)	F. W. Collingwood, Esq.	8	4 4	534	30·14	...
Howick	Earl Grey, K.G.	8	0 10	130	25·22	124
Lilburn Tower	E. J. Collingwood, Esq.	10	6 0	290	27·44	...
Belford (Middleton Hall)	J. T. Leather, Esq. ...	10	2 0	240	29·20	...
Bamburgh (North Sunderland)...	Rev. F. R. Simpson ...	8	1 2	60	23·23	161
* Wooler (Milfield)	G. A. Grey, Esq.	5	0 4	200	27·51	...
CUMBERLAND.						
Bootle (Whitbeck)	Rev. T. Ormandy	2	1 0	...	44·68	177
„ (Rectory)	Rev. A. Wilkin.....	12	1 5	87	45·76	198
Whitehaven (Braystones)	J. D. Watson, Esq. ...	10	3 8	36	35·65	...
Scawfell Pike	monthly (4) I. Fletcher, Esq., M.P.	4	0 6	3200	70·77	...
Esk Hause	„ „ „	4	0 6	2550	92·08	...
Great End	„ „ „	4	0 6	2982	75·63	...
† Wastdale Head	„ „ „	4	0 6	247	95·38	...
Brant Rigg.....	„ „ „	4	0 6	695	80·78	...
Sprinkling Tarn.....	„ „ „	4	0 6	1985	126·81	...

NOTE.—The numbers in parentheses on this and two following pages refer to the Map of the Lake District facing page 126.

DIVISION X.—NORTHERN COUNTIES—(continued.)

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain. 1868	Days on which '01 or more fell.
		Diameter	Height Above Ground.	Height Above Sea Level		
			ft. in.	feet.	inches.	
CUMBERLAND—(con.)						
Stye Head Tarn.....	monthly (8) I. Fletcher, Esq., M.P.	4	0 6	1472	130·71	...
The Stye	" " " (10)	4	0 6	1077	207·49	...
Taylor's Gill	" " " (9)	4	0 6	1077	178·17	...
† Seathwaite	" " " (11)	4	0 6	422	138·33	...
† "	" " " (11)	8	1 0	422	142·50	...
† "	daily (11) I. Fletcher, Esq., M.P.	5	1 0	422	157·11	236
Stonethwaite	monthly (12)	4	0 6	330	119·49	...
† Wythburn Parsonage	" (20) Rev. Basil Lawson ...	8	1 0	574	115·75	...
† Helvellyn (Birkside)	" (21) G. J. Symons, Esq... ..	8	1 0	1800	112·50	...
† Watendlath	" (13)	8	1 0	867	99·24	...
Keswick (Barrow House).....	(B) S. Z. Langton, Esq	8	0 6	240	84·60	213
† Penrith (Hallsteads)	" (36) Mr. Sinclair	10	4 0	490	69·20	...
† Gowbarrow Fell	" (29) G. J. Symons, Esq... ..	8	1 0	1100	68·75	...
† " (Watermillock)	" (37) Mr. W. Rumney	10	3 6	720	67·70	180
† Matterdale Common	" (28) G. J. Symons, Esq. ...	8	1 0	1400	96·50	...
† Keswick (Crow Park)	" (15) H. C. Marshall, Esq... ..	10	4 0	295	55·00	...
" " "	" " "	7	1 9	280	65·74	...
† " (Derwent Island)	" (14) " " "	5	1 0	280	62·29	220
† " (Post Office)	" (16) Mr. Crosthwaite	8	6 4	270	65·72	149
† " (Greta Bank)	" (17) J. J. Spedding, Esq. ...	5	1 0	400	67·33	205
† Skiddaw	" (18) G. J. Symons, Esq... ..	8	1 0	1677	61·00	...
† Bassenthwaite (Mirehouse)	" Mrs. Spedding	5	0 7	310	58·38	195
Cockermouth (Whinfell Hall) ...	" W. Robinson, Esq.	5	2 0	266	59·63	224
Workington (Stainburn)	" C. Litt, Esq.	8	0 3	99	39·63	196
" (Park End)	" W. Thompson, Esq... ..	5	1 2	124	38 80	...
Cockermouth	" Dr. Dodgson	8	0 6	158	50·12	181
" (on a post)	" " "	8	6 6	164	48·02	181
" (on Church Tower)... ..	" " "	8	100 0	267	27·10	...
" (Tarnbank)	" I. Fletcher, Esq., M.P. ..	8	0 6	225	47·05	186
" (Higham)	" G. R. Hoskins, Esq.	8	0 6	478	51·22	191
" (Bridekirk)	" Rev. J. Carter	8	0 6	350	37·94	...
Penrith.....	" T. Lester, Esq.	5	0 9	...	34·34	181
† " (Edenhall).....	" Mr. T. Bowstead	5	1 0	320 ?	35·18	...
Alstone (Love Lady Shield)	" J. Dickinson, Jun., Esq. ..	5	0 4	1145	48·35	211
" (Nenthead).....	" W. Dalton, Esq.....	5	1 0	1416	50·66	...
Wigtown (Brayton Hall)	" Mr. R. Elliot.....	8	0 5	120 ?	41·02	...
Silloth	" Rev. F. Redford	8	3 0	28	37·68	173
Carlisle (Cemetery).....	" Mr. J. Cameron, Jun.	8	0 0	114	28·93	169
" (Scaleby Hall)	" R. A. Allison, Esq.	8	1 0	120 ?	29·77	...
WESTMORELAND.						
Kirkby Lonsdale (Casterton).....	" S. Morris, Esq.	8	1 0	267	45·64	202
" " (") monthly	" " "	8	1 0	267	46·05	...
" " (Biggins House)	" Miss Tomlinson.....	12	3 6	400	44·94	...
" " (Whelprigg)	" Mrs. Gibson	5	4 6	475	44·88	...
" " (Rigmaden)	" E. Wilson, Esq.	6	3 0	350	49·13	...
" "	" Mr. W. Harrison	5	1 2	209	45·06	202
" " (Vicarage)	" Rev. H. Ware	5	1 0	210	45·52	...
† Kendal (Kent Terrace)	" S. Marshall, Esq.	8	4 6	149	52·75	186

Site of
RAIN GAUGES
 in
CUMBERLAND & WESTMORLAND



Stanford's Geog. Inst. London

DIVISION X.—NORTHERN COUNTIES—(continued.)

AUTHORITIES.	STATIONS.	Rain Gauge.			Depth of Rain.	Days on which ·01 or more fell.	
		Diameter.	Height Above Ground.		Height Above Sea Level		1868
			ft.	in.	feet.	inches.	
WESTMORELAND—(con.)							
Kendal (Underfell)	J. J. Wilson, Esq.....	8	4	6	300	49·48	180
Stavely (Middle Fairbank)	T. K. Atkinson, Esq...10		3	0	...	68·91	199
Windermere (High House)	E. Hayton, Esq.....	8	4	0	636	61·42	...
" (The Wood)	G. B. Crewdson, Esq..	8	3	2	310	81·21	198
† " (The Howe) (35)	Admiral Wilson	8	1	2	470	82·77	177
† Elterwater	E. B. W. Balme, Esq.	8	1	0	200	91·00	...
† Ambleside (Low Nook)	(27) J. C. Wilson, Esq.....	5	1	2	170	88·88	225
† Grasmere (High Close)	(22) E. B. W. Balme, Esq.	8	0	9	553	87·02	220
Loughrigg Fell	(24) " " " " "	8	1	0	1050	78·00	...
Langdale	(19) " " " " "	8	1	0	380	118·25	...
* Kirkby Stephen	T. Mason, Esq.	5	1	1	574	40·29	177
† Grasmere (Easedale Tarn) ...	(A) G. J. Symons, Esq...8		1	0	1175	111·00	...
† Shap (Wet Sleddale)	(42) " " " " "	8	1	0	1500	108·75?	...
† Haweswater (Mardale Green)	(40) " " " " "	8	1	0	800	123·08	...
† " (Measandbecks) (41)	" " " " "	8	1	0	1200	99·75	...
† Patterdale Hall	(33) Mr. Sinclair	7	2	0	490	106·14	...
Appleby	Dr. Armstrong	8	1	0	442	39·04	192
† Ullswater (Swarth Fell)	(39) G. J. Symons, Esq. ...8		1	0	1000	99·00	...
" (Sharrow Bay) ...	(38) A. Parkin, Esq.....	8	1	6	500	47·47	...
† Great Strickland [Penrith] (44)	H. Plumer, Esq.....	5	1	6	650	48·37	200
† Brougham Hall [Penrith]	Mr. G. Campbell	5	1	0	470	38·55	153

DIVISION XI.—MONMOUTH, WALES, AND THE ISLANDS.

MONMOUTH.

*Newport (Isca Foundry)	J. Laybourne, Esq. ...	5	1	0	0	41·68	...
* " (Llanfrechfa Grange) ...	F. J. Mitchell, Esq. ...	5	1	0	360	47·53	137
Chepstow	J. G. Wood, Esq.	8	4	0	200	44·24	162
" (The Mount)	H. Clay, Jun., Esq. ...	5	1	6	...	40·43	132
Tintern Abbey	Mr. W. Bowen	5	1	0	16	46·61	172
Tredegar (Ebbw Vale)	P. James, Esq.	5	1	0	918	65·97	184
" (Sirhowy)	R. Jordan, Esq.....	5	0	9	1055	64·69	187
Abergavenny	Dr. McCullough	5	1	3	220	39·01	165
Monmouth (Dingestow)	S. R. Bosanquet, Esq.	5	1	0	400	29·77	...
" 	Dr. Willis	5	1	0	...	37·13	...

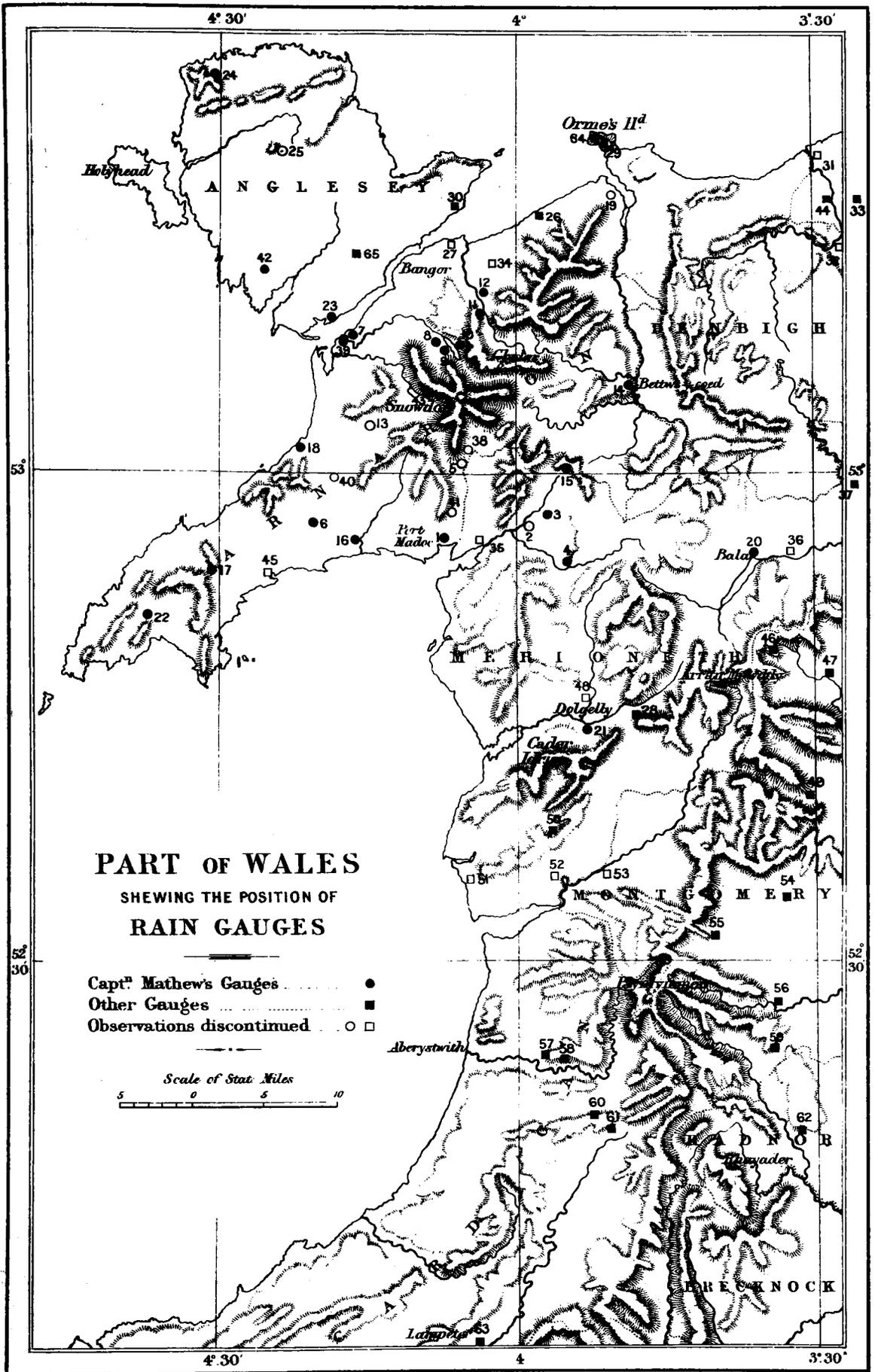
GLAMORGAN.

*Cowbridge (The Ham)	G. W. Nicholl, Esq. ...	8	1	3	50	35·02	152
Cardiff (Town Hall)	T. Waring, Esq.....	5	1	1	20	39·77	157
" (Ely)	T. G. South, Esq.	5	3	0	45	41·59	143
" (Pentyrch)	F. G. Evans, Esq.....	5	1	1	100	48·68	198
" (Lisvane)	T. G. South, Esq.....	5	2	0	142	38·06	157
Swansea	J. W. James, Esq.....	12	14	9	40	29·52	158
Aberdare (Dare Villa)	Evan Jones, Esq.	5	1	6	600	64·13	...
MerthyrTydfil (Thomas Town) ...	T. J. Dyke, Esq.....	5	5	0	550	61·59	159

DIVISION XI.—MONMOUTH, WALES, AND THE ISLANDS—(continued).

AUTHORITIES.	STATIONS.	Rain Gauge.			Depth of Rain.	Days on which "01 or more fell.
		Diameter	Height Above Ground.	Height Above Sea Level	1868	
			ft. in.	feet.	inches.	
CARMARTHEN.						
Llanely (West End Terrace) ...	D. M. Llewellyn, Esq.	5	0 10	20	42·13	200
"	E. Bagot, Esq., C.E....	5	7 0	20	35·77	208
Llanstephan	W. Ainslie, Esq.....	5	0 5	35	38·71	200
*Carmarthen—(Plas Cwrt Hyr)...	W. E. Gwynn, Esq....	5	4 6	80	58·10	173
" (Gaol)	G. Stephens, Esq.....	8	3 0	72	40·09	187
Llandissilio (Rhydwen).....	H. S. Morgan, Esq. ...	5	1 0	150	52·10	139
PEMBROKE.						
Milford.....	H. Edwards, Esq.....	8	3 0	130	41·64	176
*Haverfordwest (Moravian Chyd.)	E. P. Phillips, Esq. ...	5	1 0	150	59·15	138
" (Castle Hill)	" " "	5	1 0	85	45·83	149
" (High Street).....	" " "	5	1 2	94	56·01	144
CARDIGAN.						
Kilgerran (Castle Malgwyn).....	Rev. D. Evans	5	1 2	80	43·21	...
Lampeter	Rev. J. Matthews	8	5 0	420	48·26	176
Aberystwith (Logylas)	W. Ball, Esq.....	5	4 0	600	51·60	...
" (Frongoch Mine) (60)	" " "	4	3 6	730	38·65	...
Llanidloes (Ystrad-olwyn-fawr) 59	J. F. Bateman Esq F.R.S	...	...	950	48·20	...
Aberystwith (Capel Bangor) (57)	T. Paul, Esq.	5	1 0	42	42·40	186
BRECKNOCK.						
Crickhowell (Glanusk Park).....	Mr. Ireland	8	0 6	300	47·37	...
Brecknock	J. Kirk, Esq... ..	5	2 0	437	48·89	122
Hay (Pen-y-maes)	Captain Brown	5	1 1	317	33·37	166.
RADNOR.						
*Presteign	Captain Hannam	5	1 0	550 ?	37·72	201
Rhayader (Cefnfaes)	Mrs. Jones	5	2 0	880	42·53	181
MONTGOMERY.						
Llanidloes (Broomcliff)	T. F. Roberts, Esq. ...	5	3 10	610	48·80	185
Head of R. Clwydog	J. F. Bateman Esq F.R.S	...	...	1300	83·50	...
Carno (Capel) .....	" " "	...	...	550	58·20	...
Garthbibio (Lluest fawr).....	" " "	...	...	1100	62·20	...
Llanwddyn .....	" " "	...	...	720	? 80·60	...
Head of River Vyrnwy .....	" " "	...	...	2000	80·80	...
FLINT.						
Mold (Bryn Alyn)	Rev. R. B. Cooke	5	1 6	480	30·96	...
† Hawarden [Chester]	Dr. Moffat	8	1 0	270	27·61	140
Holywell (Maes y dre)	J. Williams, Esq.	10	5 0	400	20·73	...
St. Asaph (Brynabella).....	P. P. Pennant, Esq. ...	5	1 0	280	26·73	...
" (Llanerch)	Whitehall Dod, Esq....	5	1 1	100	25·80	...
DENBIGH.						
Wrexham (Brymbo)	C. E. Darby, Esq.....	6	6 3	620?	32·39	...
" (Llwyn Onn Hall) ...	F. G. Tippinge, Esq... ..	5	1 0	242	29·44	180
" (Grove Lodge)	C. Napier, Esq.	5	1 1	274	32·17	...
" (Gwersyllt Hill)	W. Lassell, Jun., Esq..	4	2 0	400 ?	32·10	107
Rosset (Trevalyn Hall)	Capt. Griffith.....	5	1 0	66	27·28	172
† Llandudno (Warwick House) (29)	Dr. Nicol.....	8	0 6	99	29·75	...
" (Great Orme's Head)	" "	12	6 0	175	25·62	...

NOTE.—The numbers in parentheses on this and the following page refer to the accompanying Map



PART OF WALES
 SHEWING THE POSITION OF
 RAIN GAUGES

- Capt. Mathew's Gauges ●
- Other Gauges ■
- Observations discontinued ○ □

Scale of Stat. Miles
 5 0 5 10

DIVISION XI.—MONMOUTH, WALES, AND THE ISLANDS—(continued)

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain. 1868	Days on which '01 or more fell.	
		Diameter.	Height Above Ground.				Height Above Sea Level
			ft.	in.	feet.	inches	
MERIONETH.							
*Dolgelly.....(21)	Major Mathew	5	1	0	43	64·37	186
* " (Brithdin).....(28)	J. Hill, Esq.	5	2	0	500	72·26	...
Bala.....(20)	Major Mathew	5	1	0	544	52·39	180
*Festiniog (Blaenyddol).....(3)	" "	5	1	0	600	74·51	214
*Rhiw brifdir.....(15)	" "	5	10	0	1100	101·29	232
Corwen (Rhug).....(37)	J. Wagstaff, Esq.	8	3	6	500	36·74	...
CARNARVON.							
Aberdaron (Sarn).....(22)	Mr. W. Jones.....	12	5	0	340	45·10	174
*Pwllheli (Bodfaen).....(17)	Major Mathew	5	4	9	80	43·87	200
*Llanystumdwy (Talarvor) ... (16)	" "	5	3	0	50	36·10	158
*Llangybi.....(6)	" "	5	1	1	200	46·63	168
*Port Madoc.....(1)	" "	5	3	0	10	47·89	205
Clynnog.....(18)	" "	5	1	0	70	53·00	188
*Snowdon Slate Quarries.....(43)	" "	5	1	0	1400	115·10	212
*Bettws y Coed.....(14)	" "	5	1	2	70	62·06	113
†*Llanberis (R. Vict. Hotel) ... (9)	" "	5	1	0	370	84·25	149
* " (Dinorwic Quarry) (10)	" "	5	1	10	850	69·00	175
* " (Glyn Padarn).....(8)	" "	5	1	0	377	77·00	206
Carnarvon (Cocksida).....(39)	" "	5	1	1	120	39·95	194
* " (Plas Brereton) ... (7)	T. Turner, Esq.	5	1	0	25	37·66	189
†Llanfairfechan.....(26)	R. Luck, Esq.....	5	0	8	150	35·07	160
ANGLESEA							
Menaifron.....(23)	Rev. W. W. Williams	5	5	0	17	36·54	196
Bidorgan (Llangadwaladr)...(42)	Major Mathew	5	3	6	50	35·53	...
Gaerwen (Brynteg).....(65)	Mr. R. King	5	1	0	...	32·70	173
Beumaris (Henllys).....(30)	Miss Hampton .....	...	1	6	150	34·67	...
Llanfairynghornwy.....(24)	Major Mathew .....	...	5	0	120	34·97	170
ISLE OF MAN.							
Douglas Head.....	Bd. of Northern Lights	...	0	6	...	34·50	...
Point of Ayre.....	" " "	...	3	4	27?	31·05	...
GUERNSEY.							
Guernsey.....	Dr. Hoskins, F.R.S. ...	12	12	0	204	34·76	176
" (Grange Road).....	Dr. Mansell	5	1	3	150	36·21	186
JERSEY.							
Millbrook.....	P. Langlois, Esq.	5	1	0	50	28·87	181
ALDERNEY.							
Alderney.....	J. May, Esq.	12	10	0	48	29·64	169
SARK.							
Sark Parsonage.....	Rev. T. L. V. Cachemaille	5	1	0	340	28·38	172

SCOTLAND.

DIVISION XII.—SOUTHERN COUNTIES.

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain.	Days on which ·01 or more fell.
		Diameter	Height Above Ground.	Height Above Sea Level	1868	
		ft.	in.	feet.	inches.	
WIGTOWN.						
Mull of Galloway	Bd. of Northern Lights ...			...	25·21	...
*Wigton (N. Balfern)	T. MacLelland, Esq....	5	1 0	75	50·39	199
Stranraer (South Cairn).....	Mr. J. Kennedy.....	3	0 4	209	50·30	167
Corsewall.....	Bd. of Northern Lights ...		3 4	22 ?	38·08	...
KIRKCUDBRIGHT.						
Little Ross	Bd. of Northern Lights ...		3 3	130 ?	30·45	...
*Dalbeattie	J. Grieve, Esq.	5	0 8	25 ?	57·20	190
Castle Douglas (Slogarie).....	T. R. Bruce, Esq.	4	0 6	800	72·18	...
" " "	" " "	8	6 0	300	73·09	134
Cargen [Dumfries].....	P. Dudgeon, Esq.	3	0 3	80	54·35	162
New Galloway.....	R. McKay, Esq.....	8	20 0	200	63·87	210
*" (Waterside)	P. Dalziel, Esq.....	5	1 5	215	69·37	192
" (Glenlee)	Mr. W. Melville	3	1 6	217	67·50	145
*Carsphairn	J. Hannah, Esq.	5	3 11	600	76·50	188
DUMFRIES.						
Annan (Warmanbie)	Rev. F. Redford.....	8	3 0	100	43·51	202
" (Clarencefield)	S. Cowan, Esq.	5	1 2	100	46·68	...
Dumfries (Crichton Asylum).....	Dr. Gilchrist	8	0 6	162	48·12	216
" (March Hill Cott.).....	Mr. T. Hogg	5	0 5	70	41·26	204
Canonbie School	J. Little, Esq.		0 9	140	54·40	...
Cleughfoot	" " "		0 9	400	43·40	...
Dunscore (Allanton)	<i>Dumfries Courier</i>.....		...	...	67·50	...
Thornhill (Wallace Hall)	C. T. Ramage, Esq. ...	3	0 10	207	48·70	...
Drumlanrig Castle.....	A. Buchan, Esq. ....		...	191	50·00	...
Kirkpatrick Juxta	Mr. Burgess	3	0 5	346	78·65	182
Wanlockhead	Mr. G. Dawson	3	0 4	1330	85·69	194
Langholme	J. Little, Esq.	3	1 0	270	71·95	...
Westerkirk School.....	" " "	4	0 6	420	69·70	...
Eskdale. Ewes School	" " "	3	1 0	407	62·40	...
Carlesgill.....	" " "	10	2 0	370	70·95	202
" (Hill Top)	" " "		0 9	1164	71·55	...
Eskdalemuir School	" " "	3	0 6	612	74·80	...
Eskdale Pen Top	" " "	4	1 0	2268	71·90	...
ROXBURGH.						
Liddlesdale (Whithaugh)	J. Little, Esq.		0 6	400	60·50	...
New Castleton (Kirndeane).....	Miss Elliot	3	0 9	370	56·70	...
" (The Flatt).....	J. Elliot, Esq.....	3	0 9	350	59·80	...
Hawick (Borthwickbrae)	A. E. Lockhart, Esq... 8		0 2	800	53·90	...
" (Goldielands)	Dr. Elliot		0 8	505	46·60	...

DIVISION XIV.—SOUTH-WESTERN COUNTIES.

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain. 1868	Days on which ·01 or more fell.	
		Diameter.	Height Above Ground.				Height Above Sea Level
			ft.	in.	feet.	inches.	
LANARK.							
Douglas (Newmains)	Mr. J. Russell	3	0	2	783	54·98	170
Uddingston (Meadowbank)	J. Anderson, Esq.	5	13	0	135	25·20	...
Lanark (Clydeville)	Captain Thornton	5	1	0	505	39·13	240
Carnwath.....	A. Buchan, Esq. ....	...	...	...	...	37·84	...
Hamilton (Murdostoun Castle)...	Mr. Armour	10	4	0	550	29·86	191
„ (Auchinraith)	R. Ker, Esq.	10	4	9	150	35·14	...
„ (Bothwell Castle)	Mr. A. Turnbull	10	18	0	147	33·02	179
Glasgow (St. George's Road).....	M. J. Bell, Esq.	8	1	0	140	43·62	212
„ (Cessnock Park).....	R. Hart, Esq.	10	4	4	30	43·82	207
„ (Observatory)	Professor Grant, F.R.S.	5	0	1	180	48·00	231
Baillieston	Mr. P. Jarvie.....	6	0	3	230	55·11	230
Coatbridge (Woodside House) ..	J. Baker, Esq.	5	1	4	275	39·20	188
Shotts (Hillend House)	Mr. D. Thompson	10	7	0	620	38·45	207
AYR.							
Girvan	Mr. P. Paterson .....	...	0	6	15	57·50	173
New Cumnock (Whitehills)	W. Lennox, Esq.	5	1	0	860	61·43	212
Ayr (Auchendrane House)	E. Cathcart, Esq.	8	2	3	96	48·92	216
„ „	„ „ „	5	0	0	94	50·38	216
Kilmarnock (North Craig).....	J. M. Gale, Esq., C.E.	12	0	6	330 ?	46·79	...
Largs (Mansfield)	Dr. Campbell	10	0	6	30	52·50	...
RENFREW.							
Eaglesham (Revoch)	Mr. J. Scott	4	0	3	700	59·25	...
Ryat Lynn	† Glasgow Water Works	8	0	5	310	55·25	...
Waulk Glen	„ „ „	12	0	5	280	57·40	...
Middleton	„ „ „	12	0	5	550	64·70	...
Black Loch	„ „ „	8	0	5	700	57·20	...
Mearns (Newton)	P. R. Murdoch, Esq. ....	...	0	5	360	61·10	...
„ (Nither Place)	W. Mather, Esq.	4	0	5	350	63·00	...
„ (Kilbarchan)	D. Robie, Esq.	5	0	8	350	71·73	...
Shaws W. Works (Loch Thorn)...	J. Wilson, Esq.	5	0	9	650	68·20	...
„ „ (Compen. Res.)	„ „ „	5	0	9	560	74·90	...
„ „ (Shiel Hill)	„ „ „	5	0	9	800	70·30	...
„ „ (Spango Burn)	„ „ „	5	0	9	540	60·70	...
Greenock (Hamilton Street)	J. Gardner, Esq.	6	0	6	50	77·31	245
„ (Gourock)	W. Melvin, Esq.	6	0	6	250	76·76	213

DIVISION XV.—WEST MIDLAND COUNTIES.

DUMBARTON.

Dumbarton (Cardross)	J. W. Burns, Esq.	3	0	2	96	68·35	...
„ (Balloch Castle).....	A. J. D. Brown, Esq.	7	0	4	91	58·78	245
Loch Lomond (Ardlui)	A. McDougall, Esq. ...	3	1	0	50 ?	154·75	...
„ „ (Firkin).....	„ „ „	3	0	6	90 ?	114·25	...
Loch Long (Arddaroch).....	J. White, Esq.	3	0	9	80	99·03	218
„ „ (Arrochar).....	A. McDougall, Esq. ...	3	1	6	70 ?	135·30	...

† Information supplied by J. M. Gale, Esq. C.E.

DIVISION XV.—WEST MIDLAND COUNTIES—(continued.)

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain.	Days on which ·01 or more fell	
		Diameter.	Height Above Ground.		Height Above Sea Level		1868
			ft.	in.	feet.	inches.	
STIRLING.							
Strathblane (Mugdock Reservoir)	Glasgow Water Works	8	0	6	320	56·90	...
Falkirk (Kerse)	Earl Zetland, K.T.	8	1	0	...	36·90	...
Stirling (Polmaise Gardens)	Mr. Gorrie	6	0	2	12	48·30	...
Ben Lomond	Glasgow Water Works	...	0	6	1800	103·20	...
BUTE.							
Pladda	Bd. of Northern Lights	...	3	3	55 ?	49·20	...
Cumbræ	J. Miller, Esq.	6	4	9	50	47·90	...
ARGYLL—(MAINLAND.)							
Castle Toward	Mr. McIntosh	5	4	0	65	58·27	219
Lochgilthead (Kilmory)	Sir J. P. Orde, Bart.	6	0	4	100	75·20	247
" (Callton Môr)	Mr. J. Russell	3	4	6	65	63·76	252
Lochgoilthead (Upper Glencroe)	A. McDougall, Esq.	3	0	6	400	166·60	...
Loch Fyne (Cairndow No. I.)	" "	3	0	5	30	114·71	...
" " (" No. II.)	" "	8	0	5	30	112·86	...
" " (Glen Fynè)	" "	6	0	6	50	120·40	...
Inverary Castle	Mr. J. Caie	4	0	1	30	81·00	...
Dalmally (Bridge of Orchy)	A. McDougall, Esq.	3	1	0	600 ?	161·55	...
Appin (Aird's)	R. A. Macfie, Esq.	...	...	...	...	67·30	...
Loch Eil (Corran)	Bd. of Northern Lights	...	0	4	14 ?	104·26	...
Ardnamurchan	" "	...	3	6	82 ?	144·01	...
" (Camusinas)	J. J. Dalgleish, Esq.	5	0	2	40	117·70	225
ARGYLL—(INSULAR.)							
Cantire, Mull of	Bd. of Northern Lights	...	...	...	279 ?	48·87	...
" Campbeltown (Devaar)	" " "	...	3	4	75 ?	50·31	...
" Tarbert (Stonefield)	Colin G. Campbell, Esq.	3	1	3	90	94·68	215
Islay (Eallabus)	R. Ballingal, Esq.	5	0	1	56	55·12	227
" (Rhinn)	Bd. of Northern Lights	...	3	0	74 ?	36·66	...
" (Mc Arthurshead)	" " "	...	0	4	106 ?	77·00	...
" (Rhu Vaal)	" " "	...	...	...	...	100·70	...
Jura (Lowlandmansbay)	" " "	...	...	...	...	59·26	...
Lismore (Mousedale)	" " "	...	3	4	37 ?	45·98	...
*Mull (Ardfenaig)	W. Murray, Esq.	5	1	2	20	54·75	178
" (Duart)	A. Fletcher, Esq.	5	1	0	...	104·19	...
" (Glengorm)	A. T. Forsyth, Esq.	6	0	9	...	59·30	...
" Sound of Mull	Bd. of Northern Lights	...	0	6	12 ?	92·80	...
Tyree (Hynish)	" " "	...	...	...	...	83·42	...
" (Scarnish)	L. Macquarie, Esq.	5	0	9	...	36·96	286

DIVISION XVI.—EAST MIDLAND COUNTIES.

CLACKMANNAN.

Dollar Mr. Westwood 7 | 0 | 6 | 170 | 45·72 | 107

KINROSS.

Loch Leven Sluice Mr. P. Farnie | 0 | 10 | | 37·90 | ...

FIFE.

Burntisland A. Buchan, Esq. | | | | 26·46 | 141

Balfour Mr. J. Dewar 3 | 0 | 6 | 129 | 33·96 | 148

Leven (Nookton) W. McG. Miller, Esq. 5 | 0 | 6 | 80 | 28·29 | 165

DIVISION XVI.—EAST MIDLAND COUNTIES—(con.)

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain.	Pays on which ·01 or more fell.
		Diameter.	Height Above Ground.	Height Above Sea Level	1868	
			ft. in.	feet.	inches.	
FIFE—(con.)						
Isle of May	Bd. of Northern Lights ...	...	2 2	182 ?	22·79	...
Cupar (Birkhill)	Mrs. Wedderburn	5	0 5	130	33·95	...
PERTH.						
Culross (West Grange)	J. J. Dalgleish, Esq....	...	0 2	116	30·18	130
Menteith (Cardross House)	Mr. Wyber.....	8	1 0	120	55·70	...
Aberfoyle.....	Glasgow Water Works	8	0 6	60	72·90	...
Ledard	" " "	8	0 6	1500	97·70	...
Dunblane (Kippenross).....	J. Stirling, Esq.	6	0 4	100	39·30	...
Deanston House	J. Finlay, Esq.	6	0 4	130	51·40	223
Loch Dhu.....	Glasgow Water Works	8	0 6	325	102·20	...
Loch Drunkie	" " "	8	0 6	420	78·00	...
" Vennachar	" " "	8	0 6	275	65·50	...
Lanrick Castle	A. Glover, Esq.	3	0 0	...	56·90	158
Bridge of Turk	Glasgow Water Works	8	0 6	270	61·70	...
Loch Katrine (Tunnel Hill Top)	" " "	8	0 6	830	94·90	...
Callander (Leny)	J. B. Hamilton, Esq....	3	0 6	345	78·50	...
Between Glen Finlas & Ben Ledi	Glasgow Water Works	8	0 6	1800	62·60	...
Auchterarder House	Colonel Hunter	8	2 3	162	43·96	...
Crieff (Muthill)	Rev. A. J. T. Morris... 3	1 0	247	62·05	212	
Auchterarder (Colquhalzie) ...	J. S. Hepburn, Esq.... 8	0 6	120	46·58	...	
" (Trinity Gask).....	Mr. R. Wylie.....	3	0 1	133	38·40	161
Loch Earnhead (Stronvar)	D. Carnegie, Esq. 3	0 4	460	101·59	...	
Perth Academy	Dr. Miller, F.R.S.E.... 15	64 5	79	26·29	...	
" (Balthaycock)	Mr. Wedderspoon	7	2 0	356	34·80	...
" (Inchbank)	Dr. Miller, F.R.S.E.... 10	1 6	20	34·59	...	
" (Early Bank).....	Mr. McGlashan.....	12	0 3	66	48 68	95
Scone Palace	Mr. J. Halliday.....	6	2 6	80 ?	31·96	90
Glen Almond (Logie Lodge).....	Mr. J. Stewart	2	4 6	1500	84·25	...
Stanley.....	Rev. W. Mather	10	2 0	200	35·03	...
Blairgowrie (Rosemount)	R. Geekie, Esq.	8	6 1	300	33·86	155
Aberfeldy (Bolfracks)	J. F. Wyllie, Esq....	12	0 6	360	49·30	...
*Logierait (Strath-tay)	Rev. G. D. R. Munro.. 5	1 0	250	41·11	173	
FORFAR.						
† Dundee (Hermon Hill)	R. Adamson, Esq. ...	11	0 0	116	33·03	...
† " (Westfield Cottage) ...	C. Clark, Esq.	5	5 6	50	31·23	183
† " (Eastern Necropolis)...	Mr. W. R. McKelvie 3	0 5	164	29·50	121	
" (Clelington)	† Dundee Water Works	...	...	338	27·01	...
† Barry Village	Mr. J. Proctor	12	0 3	35	31·15	209
† Craigton	Dundee Water Works	11	0 3	481	37·16	...
† Crombie Reservoir	" " "	11	0 3	522	35·32	...
Kettins.....	Mr. J. Gibb	4	1 0	218	42·03	135
† Hill Head	Dundee Water Works	11	0 3	570	37·97	...
Arbroath	A. Brown, Esq.	8	2 0	65	33·63	152
Montrose (Bridge Street)	D. Scott, Esq.	11	0 3	25	29·25	...
" (Museum)	Mr. J. Campbell	7	29 0	37	30·05	...
" (High Street)	Mr. W. Leighton .....	...	6 4	22	29·74	139
" (Sunnyside Asylum) ...	A. Buchan, Esq. ....	...	...	200	37·79	129

† Information supplied by J. Duncan, Esq.

DIVISION XVII.—NORTH EASTERN COUNTIES.

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain. 1868	Days on which '01 or more fell.	
		Diameter.	Height Above Ground.				Height Above Sea Level
			ft.	in.	feet.	inches.	
KINCARDINE.							
Brechin (The Burn)	Col. McInroy	6	0	6	237	35·50	...
Fettercairn	Mr. A. C. Cameron ...	3	0	2	221	37·80	163
„ (Arnhall)	J. Vallentine, Esq.	6	0	2	200	32·80	...
Girdleness [Aberdeen]	Bd. of Northern Lights	...	4	7	86	23·18	...
ABERDEEN.							
Braemar	Mr. J. Aitken	8	0	9	1114	37·23	162
Ballater	J. W. Paterson, Esq. ...	5	0	9	656	38·33	181
Drumoak (Drum Castle)	Mr. G. Gammie	5	1	8	275	38·77	...
Cromar (Coldstone)	Rev. J. G. Michie	5	4	0	680	33·62	114
Aberdeen (Pitnuxton)	Mr. J. Taylor	10	1	0	14	31·61	188
† „ (Rose Street)	A. Cruickshank, Esq. ...	8	0	4	95	28·52	...
„ (Skene St.)	Rev. A. Beverly	5	4	8	107	31·73	191
„ „ „ 'monthly	„ „ „	5	4	8	107	32·92	...
„ („ „) „	„ „ „	5	1	6	96	34·24	...
„ (Grammar School) „	„ „ „	5	8	6	103	28·58	...
„ („ „) „	„ „ „	5	63	10	161	28·79	...
„ (Heading Hill)	Sergt. Turner	8	0	6	61	28·16	168
„ („ „)	„ „ „	8	27	4	88	23·80	...
„ (Wallfield 'monthly	Rev. A. Beverly	5	3	4	162	32·29	...
Midmar (Blackstock)	Mr. J. Barrow	5	0	10	500	30·54	168
Alford (Bogside, Leochel)	W. Bruce, Esq.	5	3	0	882	32·05	187
Strathdon (Castle Newe)	Mr. A. Walker	5	1	0	915	30·47	188
Inverury (Kenmay)	Rev. G. Peter	8	0	0	307	32·53	...
„ „ „	„ „ „	8	0	7	307	31·63	...
„ (Manse)	Rev. J. Davidson	9	0	2	210	29·95	...
Ellon (Tillydesk)	Mr. W. Hay	11	0	4	349	31·23	...
Peterhead (Buchanness)	Bd. of Northern Lights	...	3	4	35?	30·01	...
Old Deer (Manse)	Rev. J. Peter	8	0	8	154	29·48	...
Turriff (New Byth)	A. Henderson, Esq. ...	5	0	3	391	36·82	...
New Pitsligo	Mr. D. Sturrock	3	0	3	501	35·03	211
Kinnairdhead	Bd. of Northern Lights	...	3	4	64?	25·48	...
BANFF.							
Gordon Castle	Mr. Webster	8	1	6	70	29·23	...
ELGIN OR MORAY.							
Covesea Skerries	Bd. of Northern Lights	...	...	...	...	18·49	...

DIVISION XVIII.—NORTH-WESTERN COUNTIES.

WEST ROSS. ‡

*Loch Alsh (Inverinate House) ...	Mrs. Matheson	5	3	0	150	91·74	167
*Applecross	Dr. Haynes	5	1	0	50	71·08	241
*Lochbroom	Mr. M. Macleay	5	0	8	47	65·49	241
Isle of Lewis (Stornoway)	Bd. of Northern Lights	...	3	4	31?	35·49	...
„ (Lewis Castle)	Mr. McDougall	5	0	8	60	? 25·91	204
„ (Bernera)	Mr. J. Macdonald	6	0	10	18	54·90	...
„ (Butt of Lewis)	Bd. of Northern Lights	...	3	6	...	48·93	...

‡ Including Cromarty.

DIVISION XVIII.—NORTH-WESTERN COUNTIES—(continued).

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain.	Days on which "01 or more fell.	
		Diameter.	Height Above Ground.		Height Above Sea Level		1868
			ft.	in.	feet.	inches.	
EAST ROSS. ‡							
Brahan Castle.....	K. S. McKenzie, Esq.	5	0	9	300 ?	33·24	...
*Dingwall Academy.....	J. Boyd, Esq.	5	0	11	20	34·46	...
Cromarty.....	Bd. of Northern Lights	...	3	4	28 ?	25·38	...
*Invergordon Castle.....	B. B. Æ. McLeod, Esq.	5	3	0	20	30·20	172
Alness (Ardross Castle).....	Mrs. Matheson	5	1	0	450	44·99	207
*Tain (Fearn).....	Mr. M. McLean	5	1	3	48	28·59	159
„ (Springfield).....	Mr. McLardy	5	1	2	80	38·41	173
Tarbetness.....	Bd. of Northern Lights	...	3	4	61 ?	19·32	...
WEST INVERNESS.							
*Fort William (Ross Parsonage)..	Rev. W. Simpson	5	0	8	20	109·08	244
Loch Nevis (Inverie).....	Mr. N. Macdonald	5	2	6	18	112·40	...
Isle of Skye (Oronsay).....	Bd. of Northern Lights	...	0	6	15 ?	97·80	...
„ (Kyle Akin).....	„ „ „	...	0	2	3 ?	125·33	...
„ (Raasay).....	Mr. T. Bunning	12	3	0	80	103·25	...
„ (Portree).....	<i>Fleming's</i> Mr. J. Grant	3	0	4	60	120·17	232
„ („).....	<i>Jagga's</i> „ „ „	5	0	4	60	116·90	232
* „ („).....	<i>Brit. Asso.</i> „ „ „	5	1	8	85	108·92	...
„ (Rona).....	Bd. of Northern Lights	...	0	6	196 ?	42·56	...
Barrahead.....	„ „ „	...	3	0	640 ?	31·96	...
S. Uist (Ushenish).....	„ „ „	...	0	4	157 ?	46·97	...
N. Uist (Monach).....	„ „ „	...	...	...	...	59·20	...
Harris (Island Glass).....	„ „ „	...	3	4	50 ?	55·51	...
EAST INVERNESS.							
*Laggan.....	Mr. A. McIntosh	5	0	9	1000 ?	63·12	230
Strath Errick (Farraline).....	Capt. Fraser	3	0	9	700	46·10	...
Glen Urquhart (Corrimony).....	T. Ogilvy, Esq.	3	0	6	450 ?	45·00	163
Strathspey (Grantown).....	Mr. W. Duncan	5	1	2	710	28·62	160
*Beauley (Beaufort Castle).....	Mr. W. Anderson	5	0	8	65	43·59	175
Inverness (High School).....	J. Robertson, Esq.	5	1	3	15	34·28	150
„ (Culloden House).....	A. Forbes, Esq.	...	3	0	104	31·62	...
Glen Strathfarrer.....	Mr. D. Fraser	5	1	0	500	83·24	248

DIVISION XIX.—NORTHERN COUNTIES.

SUTHERLAND.							
*Invershin.....	Mr. G. Young	5	4	0	20	33·92	...
Golspie (Dunrobin Castle).....	Mr. J. Mitchell	3	0	6	6	31·11	173
*Helmsdale.....	Mr. J. Campbell	5	1	0	34	40·14	186
Scourie.....	A. Buchan, Esq.	...	...	...	26	51·20	182
House of Tongue.....	J. Crawford, Esq.	4	0	1	33	38·70	259
Cape Wrath.....	Bd. of Northern Lights	...	3	6	355 ?	48·70	...
CAITHNESS.							
Wick (Pulteney House).....	Capt Rutherford, R.N.	5	3	8	70	27·37	179
„ (Nosshead).....	Bd. of Northern Lights	...	3	4	127 ?	26·29	...
Thurso (Holburnhead).....	„ „ „	...	0	4	60 ?	30·47	...
Dunnethead.....	„ „ „	...	3	6	300 ?	19·47	...
Pentland Skerries.....	„ „ „	...	3	3	72 ?	28·43	...

‡ Including Cromarty.

DIVISION XIX.—NORTHERN COUNTIES—(continued).

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain.	Days on which 10 or more fell.
		Diameter	Height Above Ground	Height Above Sea Level		
			ft. in.	feet.	inches.	
ORKNEY.						
South Ronaldsay (Roeberry) ...	J. Gray, Esq.	5	1 2	150	32·09	222
Hoy (Melsetter)	J.G. Heddle, Esq.	4	0 4	55	36·42	...
„ (Cantickhead)	Bd. of Northern Lights ...	...	...	...	40·50	...
„ Graemsay Sound (East).....	„ „ „	...	3 4	27 ?	40·75	...
„ „ (West).....	„ „ „	...	...	37 ?	35·05	...
*Pomona (Holm Manse)	Rev. O. Scott.....	5	1 4	30 ?	28·02	...
† „ (Kirkwall)	Mr. J. G. Iverach	3	0 4	8	48·93	224
Shapinsay (Balfour Castle)	D. Balfour, Esq.....	3	0 3	50	38·90	...
† Pomona (Sandwick)	Rev. C. Clouston, LL.D.	11	2 0	78	43·43	230
Stronsay (Auskerry)	Bd. of Northern Lights ...	...	...	...	35·60	...
Sanda (Start Point)	„ „ „	11	0 6	29 ?	61·80	...
*Papa Westray	Rev. C. Clouston, LL.D.	5	...	80 ?	40·32	...
North Ronaldsay	Bd. of Northern Lights ...	...	3 4	21 ?	32·38	...
SHETLAND.						
Sumburghhead	Bd. of Northern Lights ...	...	3 4	265 ?	34·49	...
Bressay Lighthouse	„ „ „	5	0 4	60	44·52	...
„ Manse	Rev. Dr. Hamilton ...	8	0 8	10	45·40	...
*East Yell	Mr. A. D. Mathewson	5	1 0	176	51·35	293

I R E L A N D.

DIVISION XX.—MUNSTER.

STATIONS.	AUTHORITIES.	Rain Gauge.			Depth of Rain 1868	Days on which ·01 or more fell.
		Diameter.	Height Above Ground.	Height Above Sea Level		
			ft. in.	feet.	inches.	
CORK.						
Cork (Queen's College)	Professor England ...	10	6 0	65	50·32	175
„ (Royal Institution)	Dr. Caulfield	10	50 0	70	41·46	141
Fermoy	A. Campbell, Esq.....	10	4 0	114	38·68	188
Mallow (Woodfoot)	G. S. Ware, Esq.	5	5 6	205	44·16	211
KERRY.						
Knightstown (Valentia).....	The Knight of Kerry	8	2 0	32	58·17	208
Killarney (Muckross Abbey) ...	Mr. Breese.....	12	4 0	24	70·63	196
WATERFORD.						
Waterford (Newtown)	Mr. R. J. Greer	5	4 0	60	51·59	213
„ (Glenville).....	M. D. Hassard, Esq ...	5	1 6	76	45·04	217
„ (Portlaw).....	C. Barker, Esq.....	24	20 0	50	51·80	...
TIPPERARY.						
Clonmel (Glenam)	Miss Grubb	5	1 10	80	49·29	217
„ (Bruce Villa)	J. H. Grubb, Esq.....	5	1 6	110	43·80	196
Tipperary (Ballykisteen)	Jasper Bolton, Esq. ...	5	1 0	350	39·61	200
„ „ „	„ „ „	5	7 0	350	35·82	...
*Borrisoleigh (Ballinlonty).....	Mr. Kearns	5	1 2	...	39·75	116
CLARE.						
Killaloe	Rev. C. Mayne	10	5 0	123	47·14	221

DIVISION XXI.—LEINSTER.

WEXFORD.						
Wexford (Reclaimed Lands).....	C. W. Palliser, Esq. ...	10	0 2	1	34·31	145
New Ross (Rosbercon Cas.)	A. E. Graves, Esq. ...	6	2 6	45	44·67	105
Enniscorthy (Ballyhyland)	J. Moffat, Esq.	5	1 0	420	46·99	...
KILKENNY.						
Inistogue (Woodstock)	Rt. Hon. W. F. Tighe	5	4 6	400	50·18	146
*Stoneyford (Inisnag)	Rev. J. Graves	5	1 0	196 ^p	32·57	...
Gowran Castle	Mr. Whitelaw	5	1 0	205	35·53	...
CARLOW.						
Bagnalstown (Fenagh)	R. C. Browne, Jun. Esq.	5	1 0	340	37·13	166
Carlow (Browne's Hill).....	„ „ „ „	5	1 0	291	38·64	232

DIVISION XXI.—LEINSTER—(continued.)

STATION.	AUTHORITIES.	Rain Gauge.			Depth of Rain. 1868.	Days on which -01 or more fell.
		Diameter.	Height Above Ground.	Height Above Sea level.		
			ft. in.	feet.	inches.	
QUEEN'S COUNTY.						
Portarlinton	Dr. Hanlon	5	1 1	736	30·40	233
KING'S COUNTY.						
Roscrea (Cangort Park).....	H. B. Trench, Esq. ...	5	8 0	340	29·34	193
Parsonstown (Birr Castle)	Hon. R. Parsons	4	0 3	200	33·63	180
Tullamore	H. J. B. Kane, Esq. ...	10	3 0	235	28 56	192
WICKLOW.						
Bray (Fassaroe)	E. Barrington, Esq. ...	10	5 0	250	41·71	162
DUBLIN.						
Black Rock (Rockville).....	T. Bewley, Esq.	12	29 0	95	32·67	114
Monkstown	Arthur Pim, Esq.	10	0 6	100	30·59	168
Dublin (Phoenix Park)	Capt. Wilkinson, R.E.	31	10 0	169	24·48	183
" " "	" " " "	13	3 0	162	23·72	183
" (FitzWilliam Square) ...	Dr. Moore	5	3 0	50	24·94	160
" (Glasnevin) .....	" " " " .....	...	6 6	65	23·53	148
* Skerries	Rev. T. Greene	5	1 0	12	29·92	200
Balbriggan	Rev. S. P. Warren .....	...	1 6	40	29·92	169
EAST MEATH.						
Moynalty	J. A. Farrell, Esq.	12	5 0	250	37·33	...

DIVISION XXII.—CONNAUGHT.

GALWAY.						
Gort (Cregg Park)	R. J. Lattey, Esq.	5	3 0	120	40·48	184
Galway (Queen's College)	Prof. Curtis, LL.D. ...	10	6 0	25	47·81	235
ROSCOMMON.						
* Hollywell	H. Smyth, Esq.	5	5 6	...	35·77	150
SLIGO.						
* Buninnadden (Doo Castle)	Mr. D. O'Dowd	5	2 0	...	44·47	206
Collooney (Markree Observatory)	Col. Cooper	24	16 3	145	40 67	171
Sligo (Haslewood)	Miss Wynne	2	2 4	47	40·15	165
" (Mount Shannon).....	F. M. Olpherts, Esq. ...	9	4 5	70	49·03	203

DIVISION XXIII.—ULSTER.

CAVAN.						
* Bawnboy (Owendoon)	G. H. L'Estrange, Esq.	5	1 3	218	47·59	252
" " " <i>monthly</i>	" " " "	5	1 2	118	45·69	...
* Beltarbet (Red Hills).....	Rev. E. Whyte Venables	5	0 9	...	36·72	227
FERMANAGH.						
Enniskillen (Florence Court) ...	Earl of Enniskillen F.R.S	12	11 0	300	49·02	221
ARMAGH.						
Armagh Observatory	Rev. Dr. Robinson F.R.S	10	1 5	208	29·59	221
DOWN.						
Ardglass Castle	De Vere Beauclerck, Esq	...	0 9	50	29·41	...
Seaforde	Colonel Forde, M.P.	8	0 5	180	40·19	207
Milltown (Bann Res).....	J. Smyth, Esq. C.E. ...	8	1 0	440	43·30	109
Banbridge (Milltown)	" " " "	8	0 8	200	28·11	191
" " " "	" " " "	12	40 0	220	23·66	...

DIVISION XXIII.—ULSTER—(continued).

STATION.	AUTHORITIES.	Rain Gauge.			Depth of Rain. 1868.	Days on which ·01 or more fell.
		Diameter.	Height Above Ground.	Height Above Sea level.		
			ft. in.	feet.	inches.	
DOWN— <i>con.</i>						
Waringstown	Capt. Waring	8	0 4	190	29·84	200
"	" "	2	0 4	190	29·28	...
ANTRIM.						
Lisburn (Aghalee)	Lancelot Turtle, Esq.	12	3 10	105	25·18	141
† Belfast (Queen's College)	Mr. W. Taylor	11	7 4	68	31·58	179
† " (Linen Hall)	J. Stephens Esq.	11	4 0	12	33·22	202
" (Old Park)	W. Girdwood, Esq.	6	4 0	224	39·90	202
" (Antrim Road)	Mr. G. Thompson	2	7 3	144	29·67	145
* Antrim (The Manse)	Rev. J. H. Orr	5	1 0	150	26·52	160
Ballymoney	E. H. Knox, Esq.	5	7 0	170	35·24	222
Cushendall (Agolah)	Rev. S. A. Brenan	10	2 6	100	35·44	...
LONDONDERRY.						
* Garvagh (Moneydig)	H. R. Morrison, Esq.	5	1 1	121	38·80	182
Londonderry	D. Watt, Esq.	8	0 6	150	36·31	...
" " "	Rev. F. Smith	12	8 0	90	38·33	233
Bellarena	Sir F. Heygate, Bt., M.P. ...	5	1 0	12	33·94	227
TYRONE.						
Omagh (Edenfell)	Captain Buchanan	8	1 0	275	32·58	235
Strabane (Leckpatrick)	Rev. C. Maxwell	8	0 5	260	39·15	225
DONEGAL.						
* Letterkenny	Rev. Dr. Kingsmill ...	5	0 6	108	56·56	...
Dunglow (Templecrone)	Rev. A. Delap	8	0 6	10	42·83	251

G. J. S.

FINANCIAL.

FEW persons are aware that the inevitable expenditure on the maintenance of the system of observation, whereof the results are epitomized in previous pages, amounts to several hundred pounds per annum, and that nearly the whole of that sum is provided by the observers themselves, or by myself if there is a deficiency. I find that there is among many persons a prevalent misconception that "Government," or some "Scientific Society," finds the funds. This is not the case, and I hope all who read these lines will do their best to contradict it. Like most other misconceptions, it has a *partial* foundation, in the fact that the British Association have appointed a committee to assist me, and provide £50 per annum for certain branches of the work; and the Royal Society some years since granted £100 for the salary of a temporary assistant, but with the intimation that by their rules they were precluded from affording any regular subsidy. These grants, though of no great effect as regards the question of finance, may well be taken as substantial proofs of the approbation of these learned bodies.

The continuance of the organization, therefore, mainly depends on the observers themselves, and it is they who should have the thanks of those to whom these tables are so valuable. Rainfall work, like most useful things, is rapidly progressive; but progress means harder work, more complete organization, more constant supervision, and more expense. That this last is the sole difficulty, anyone will see who will compare this volume with any of its precursors. Last year, for the first time, there was a balance in hand, to be credited against previous losses. This year, owing to deaths, removals, and other circumstances, the subscriptions are less, and the expenses greater. Let those, therefore, who approve what we are doing, assist us, so far as is in their power, to make 1869 at least *equal* 1868.

List of all Sums of £1 and upwards, received in payment for Books, Diagrams, &c., or as contributions to the general expenses of Rainfall investigations in 1869.

	£	s.	d.		£	s.	d.
Ainsworth, R. H., Esq.	1	18	0	Ffolkes, The Rev. H.	1	0	0
Aire & Calder Navigation Co...	1	11	0	Filliter, E., Esq., C.E.....	1	11	0
Alexander, J., Esq.	1	0	0	Finlay, J., Esq.....	1	0	0
Appach, R., Esq.	1	0	0	Forde, Colonel, M.P.....	2	5	0
Assheton, R., Esq., M.P.	1	0	0	Freeman, D. A., Esq.	1	0	0
Backhouse, W., Esq.....	1	0	0	Fuller, F., Esq.....	1	2	0
Baker, W. C., Esq.	1	0	0	Gale, J. M., Esq., C.E.	1	0	0
Balme, E. B. W., Esq.....	1	14	6	Gamlen, W. H., Esq.	1	3	0
Barrington, E. Esq.....	1	0	0	Gillet, The Rev. G. E.....	1	0	0
Bathurst, W. H., Esq.....	1	0	0	Gillow, Rev. Dr.	1	0	0
Baylis, H., Esq.....	1	1	0	Gosset, The Rev. I. H.....	1	16	0
Bayning, The Lady	1	1	0	Gott, C., Esq.....	1	1	0
Beardsley, A., Esq. (3 years)...	1	5	0	Grey, The Right Hon. Earl ...	1	0	0
Berens, Miss (2 years).....	2	0	0	Hankey, J. A., Esq. (4 years)..	2	0	0
Beverly, The Rev. A.	1	0	0	Harcourt, Colonel.....	1	0	0
Bicknell, P., Esq.	1	11	0	Hare, C., Esq.....	1	0	0
Birkbeck, W., Esq.	1	1	0	Harris, W. J., Esq.	1	12	6
Blake, W., Esq.	1	2	0	Harrison, W. F., Esq.....	1	11	6
Bland, W., Esq.....	1	2	0	Hassard, M. D., Esq.....	1	0	0
Bolckow, H. W. F., Esq., M.P.	1	0	0	Heberden, Rev. W.	1	0	0
Bolton, J., Esq.....	1	10	0	Herbert, J. M., Esq.....	1	0	0
Box, A. M., Esq.	1	5	0	Hill, The Rev. E.....	1	1	0
Bridgeman, Hon. & Rev. J.R.O.	1	1	0	Hill, J. H., Esq.....	1	0	0
Bridport, Viscount	1	0	0	Holdsworth, J. S., Esq.	1	0	0
Brooke, The Rev. J.....	1	0	0	Hony, The Ven. Archdeacon...	1	0	0
Brown, A. L. D., Esq.....	1	0	0	Hopkins, The Rev. T. A.	1	16	6
Brown, Captain.....	1	0	0	Horner, Rev. J.....	1	0	0
Brown, T. C., Esq.	1	0	0	Horrocks, W., Esq.	1	5	9
Bumpstead, The Rev. T. J.....	1	0	0	Hounsfield, Mrs.....	1	0	0
Burgoyne, Colonel Sir J. M., Bt.	1	0	0	Howard, W. D., Esq.	5	10	0
Burlingham, R., Esq.	1	12	6	Howman, The Rev. E. J.....	1	10	0
Campbell, Colin G., Esq.....	1	0	0	Hull, The Rev. J.....	1	0	0
Casella, L. P., Esq.	1	1	0	Hutchings, The Rev. R. S. ...	1	1	0
Cator, C. O. F., Esq.	1	10	0	Ingram, The Rev. H.	2	3	6
Charrington, F., Esq.	1	0	0	Jefferson, Miss M. C. D.	1	0	0
Chrimes, R., Esq.....	10	0	0	Jones, Mrs.....	1	0	0
Clarke, E., Esq.....	1	0	0	Jowers, F., Esq.....	1	5	0
Clegram, W. B., Esq., C.E. ...	1	1	0	Karlsruhe, The Rev. W. H.....	1	0	0
Collins, C. R., Esq.	1	1	0	Ker, R., Esq.....	1	0	0
Coode, W., Esq.....	1	1	6	Knowles, J., Esq.....	1	0	0
Cooke, The Rev. R. B.....	1	0	0	Lassell, W., Esq. Jun.....	1	0	0
Courtauld, S., Esq.	1	1	0	Leather, J. T., Esq.....	1	1	0
Courtown, Right Hon. Earl of	1	5	0	Legard, The Hon. Lady	2	10	0
Crowley, P., Esq.	1	14	0	L'Estrange, H. S., Esq.	1	0	0
Darby, C., Esq.	1	5	0	Lighton, Rev. Sir C. R., Bart..	1	1	0
Dartnell, G. R., Esq.....	1	0	0	Lockhart, A. E., Esq.....	1	0	0
Davis, T. H., Esq.....	1	0	0	Lucas, W., Esq.....	1	1	0
Denne, W., Esq.	1	1	0	Lund, C., Esq.	1	1	0
Dines, G., Esq.	1	0	0	Mackeson, H. B., Esq.....	1	15	0
Dipple, G., Esq.	1	1	0	Macfie, R., Esq.....	1	0	0
Divett, J., Esq.....	1	0	0	Majendie, The Rev. H. W.....	1	1	0
Dod, W., Esq.....	1	8	0	Majendie, L. A., Esq.	1	5	0
Doubleday, H., Esq.....	1	0	0	Malden, The Rev. C.....	1	5	0
Drummond, General.....	1	11	0	Mansel, Captain.....	1	0	0
Dudgeon, P., Esq.....	1	0	0	Marshall, H. C., Esq.	3	0	0
Du Port, Rev. J. M.....	1	0	0	Marshall, A., Esq.....	2	10	0
Dymond, E. E., Esq.....	1	1	0	Martin, Dr.	1	5	0
Elliot, Dr. A.....	1	0	0	Matheson, Mrs.	1	10	0
Estlin, Captain	1	5	0	Mathew, Major	1	16	0
Fawcett, H., Esq.....	1	7	6	Melville, A. S. L., Esq.....	1	1	0

	£	s.	d.		£	s.	d.
Mitchell, F. J. Esq.	1	0	0	Squire, W., Esq.	1	2	0
Morgan, T. H., Esq.	1	1	0	Stephens, A., Esq.	1	1	0
Murdoch, The Rev. J. B.	1	0	0	Stevenson, G. W., Esq., C.E. ...	1	1	0
Norris, T., Esq.	2	0	0	Stone, W. H., Esq., M.P.	1	0	0
North, A., Esq.	1	5	0	Strangman, T. H., Esq.	1	10	0
Nutter, J., Esq.	1	0	0	Tabor, S., Esq.	1	5	0
Ogilvy, T., Esq.	1	1	0	Taylor, R., Esq.	1	1	0
Parkin, A., Esq.	1	5	0	Thrustans, J., Esq.	1	0	0
Pasley, Admiral Sir T. S., Bt. ...	2	2	0	Tighe, the Right Hon. W. F. ...	1	0	0
Paulin, T., Esq.	2	3	0	Trench, H. B., Esq.	1	4	9
Paxton, H., Esq.	1	0	0	Trimleston, the Rt. Hon. Lord	1	0	0
Peckover, A., Esq.	1	1	0	Tuckett, F. F., Esq.	1	0	0
Pennant, P. P., Esq.	1	1	0	Turner, T., Esq.	1	0	0
Phillips, E. P., Esq.	1	10	0	Wagstaff, J. Esq.	1	1	0
Philliskirk, Mr.	1	0	0	Ward, Dr.	1	0	0
Pigott, G. Esq.	1	0	0	Ward, H., Esq.	1	1	0
Pim, A., Esq.	1	0	0	Ware, G. S. Esq.	1	0	0
Preston, The Rev. T. A.	2	2	0	Waring, Captain	1	10	0
Prince, C. L., Esq.	1	1	0	Warren, G., Esq.	1	10	0
Rainey, G., Esq.	1	0	0	Waterhouse, J., Esq., F.R.S. ...	1	1	0
Raulin, Professor (<i>Bordeaux</i>) ...	1	0	0	Watkins, J., Esq.	1	10	0
Reid, J., Esq.	1	5	6	Watson, H. H., Esq.	1	0	0
Reynolds, L. W., Esq.	1	1	0	Weston. Rev. G. F.	1	0	0
Robson, J., Esq.	1	0	0	Whitbread, S. C. Esq.	1	0	0
Robson, J. W., Esq.	1	0	0	White, A. Holt, Esq.	1	0	0
Scott, W., Esq.	1	0	0	White, J., Esq.	1	0	0
Sharpe, H., Jun., Esq.	1	1	0	White, The Rev. H. Masters. ...	1	1	0
Shiffner, Miss.	1	0	0	Wigram, J. R., Esq.	1	0	0
Smyth, J., Jun., Esq.	1	0	0	Wilson, T., Esq.	1	1	0
Smith, J., Esq.	2	2	0	Wingfield, the Rev. C. L.	1	0	0
Snow, The Rev. H.	2	0	0	Winter, the Rev. E. W.	1	1	0
Southall, E. P., Esq.	1	6	0	Woodd, C. H. L., Esq.	1	1	0
Spedding, T. S. Esq.	1	5	0	Yonge, J. B., Esq.	1	5	0

[Subsequent receipts will be acknowledged monthly in the
Meteorological Magazine.]

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