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THE INDICATIONS OF THE SKY.

SURPRISE is often felt at the slight confidence which can be placed in the dicta of even the most careful observers as to impending changes of the weather, and uncomplimentary comments not unfrequently attend their failure. Although by no means considering predictive success a measure of meteorological skill, we do not see why observers of education should in this respect be behind both the sailor and the farmer. Would it not be advantageous for a few observers to concentrate their attention on the optical and chromatic changes of the atmosphere and the sequences thereof? There are many parts of the country where observers are thickly clustered; one of them might abandon part of the ordinary routine of observation, and give his time and thought to the changes of the sky, to which as a rule so little heed is paid. The best observers simply note the proportion of sky covered, the character of the weather, and perhaps the prevailing form of cloud such as "ci-cu." There are several modes of investigation, which we intend to submit for consideration, and, we hope, for trial.

CLOUDS.

We doubt if since Luke Howard's time any observer has given close attention to the constant changes of form, nay to the formation and dissipation of those fleecy masses which look, and are, softer than the softest down, and yet which are storehouses of water adequate to the wants of the largest towns, or capable of driving the most ponderous machinery. Probably some observers may be dismayed at the very frequency of change, and picturing to themselves long pages full of such entries as—

May 24th, 9 a.m., grey ci-cu in W., lighter in N., ci in zenith, clear elsewhere.

3 p.m., ci-cu in W. have almost gone, clear sky, except ci across zenith in line from S.W. to N.E.

may think the undertaking too great, and so *without method* it would prove; but surely the reasons in favour of throwing such observations into a tabular form are even stronger than those which have long ensured the adoption of that plan with reference to changes in pressure temperature and hygrometry. Moreover, graphic representation of

instrumental records has long been practised with advantage; this might also readily and appropriately be applied to prevalent forms of cloud. This investigation, and one or two others yet to be proposed, are especially suitable to those whose residence is not sufficiently permanent to secure good, continuous, meteorological records. A meteorological register kept properly for two months, then missing a fortnight, then resumed, and so on, would be of very little value, but we think an accumulation of interrupted cloud and weather records would be of considerable service, although certainly of less than if continuous. Probably the simplest and easiest mode of entering observations would be to procure a faint ruled foolscap sized book, with about 40 lines to the page; then to rule the left-hand page with 16 columns—(1) date, (2) hour, (3) temperature, (4) barometer, (5) wind direction, (6) wind force, (7) rain, (8) amount of cloud, (9) form of cloud; (*a*) cirrus, (*b*) cirro-cumulus, (*c*) cirro-stratus, (*d*) cumulus, (*e*) cumulo-stratus, (*f*) stratus, (*g*) nimbus, (*h*) scud. The entries will be of the usual kind as far as, and including, column (8), which will contain the proportion (0 being none and 10 wholly overcast) of cloud. The columns under the general heading of "Form of cloud" should, we think, contain figures representing, however approximately, the area of each form of cloud; for example, let the total amount of cloud be 7, and let it consist of a bank of cumulus in the horizon, and a wisp of cirrus in the zenith—the apparent magnitude might be 3 for the cirrus and 4 for the cumulus—all this would be represented by a 3 in the "ci" column and a 4 in the "cu" column. The right-hand page should be used for remarks. Such a register as is above indicated would be very little trouble, and would give more insight into the sequences of cloud configuration than all that has been done during the half century which has elapsed since the publication of Luke Howard's capital "Essay on the Modification of Clouds."

In proof that we are not alone in our estimate of the usefulness of such enquiries, we will conclude with an extract:—

"Since clouds are subject to certain distinct modifications from the same causes which produce the other atmospheric phenomena, the face of the sky may be regarded as indicating the operation of these causes, just as the face of man indicates his mental and physical states. The ancient meteorologist was content with discerning the face of the sky, in order to predict the coming weather. It is to this chiefly that the weather-wise sailor and the farmer still look in foretelling the weather; and their predictions are frequently more correct than are those made solely from the indications of the barometer and other meteorological instruments. The best system of weather prediction comprises both methods."*

In subsequent articles we shall draw attention to the experiments which we think should be made with Saussure's cyanometer—[Can any person oblige us with the loan of one? ED.]—with the spectroscope, and with the polariscope, as well as some other observations on the optical phenomena of the atmosphere.

* Buchan's *Handy Book of Meteorology*, 2nd edition, p. 177.

LUNAR AND SOLAR INFLUENCE ON THE WEATHER.

To the Editor of the Meteorological Magazine.

SIR,—Your correspondent Mr. Brumham has certainly brought together a formidable array of cases in support of his theory that “the perigee and apogee positions of the moon with regard to our meridian, as well as perigee of the sun, have an extremely important influence on the weather.”

Nevertheless, I cannot think that he will succeed in convincing *scientific* meteorologists that his rules are “infallible,” or indeed that the connection between the weather and the positions of the heavenly bodies, so far as he has established such a connection, is anything more than the merest coincidence. Even as regards the limited area from which Mr. Brumham draws his illustrations, the evidence by which he endeavours to prove his point will be found to be in many cases far too vague, and often quite insufficient—[for instance, in two cases, viz., the years 1855 and 1865, a deficiency in the rainfall to the extent of 0·03 in. [0·3 in., Ed.], or something less than the third of an inch on the six months from March to September, is regarded as sufficient evidence of a drought !]—and if we extend the range of our enquiry a little, the rule utterly and palpably breaks down. For surely, if Mr. Brumham's rule has anything in it, it ought to hold good of all places on the same meridian, which, after the most liberal allowance for local differences, is notoriously not the case. Take for example the weather of last year. The summer season of 1868 was in this country one of the driest and hottest on record. But we now know that in the south of Europe it was as exceptionally cold and wet as it was here dry and warm. I have before me an extract from the letter of a correspondent in the *Tablet* newspaper, who, writing of the weather of last year in Rome, says, “During a nine years' residence in Rome I never remember such a year as this. June and July were wet and cold as an English spring; August and September scarcely warm; November and December wet, cold, and foggy.” Now, as the difference between the meridian of Greenwich and that of Rome, as represented in time, amounts to no more than 50 minutes, and the time of lunar apogee or perigee was, according to the table, within 5 minutes of the moon's southing in England, and therefore within 55 minutes of its southing at Rome, the case comes fairly within the scope of Mr. Brumham's rule.

It is when they are brought to the test of considerations like these that all the weather rules which I have ever met with, in which the state of the weather at a given time is made to depend on certain positions of the heavenly bodies, break down.

No doubt it would be very delightful to be able to predict periods of dry or wet weather with the same precision as we now predict an eclipse, but so long as one and the same position of the heavenly bodies may coincide with a period of extreme drought, say, in the south of England, and an equally exceptional period of wet weather in the north of Scotland, *both districts being on the same meridian, a*

case which has happened within my own recollection, I cannot help thinking that astro-meteorological speculations of this kind would be better suited to the readers of *Zadkiel* than to those of a sober scientific periodical.

I will only add, while on this subject of weather predictions, that we have so far no appearance here of the warm and dry weather which has been so confidently predicted as about to set in towards the end of May. A steady rain has been falling nearly the whole day, with a cutting wind from N.E., and temperature at 1 p.m. 46.—Yours, &c.,
G. T. RYVES.

Cheltenham, May 28th, 1869.

[We had some doubts as to the insertion of the above, because it seemed trenching closely on the personal, but on re-perusal we have arrived at the conclusion that *we* are the principal offenders, in that we have inserted in “a sober scientific periodical” “astro-meteorological speculations,” “better suited to the readers of *Zadkiel*.” We consider they are not “speculations” but facts, and we doubt not that most of our readers will agree with us that their true import ought to be ascertained. Mr. Ryves would, we presume, have refused insertion to Mr. Brumham’s letter; we think suppression a dangerous process, and that the progress of truth has always been most advanced by free discussion. Mr. Brumham will doubtless say a few words on the defensive; our duty at present is simply to see fair play, and defend ourselves—and even that we leave to our readers.—Ed.]

POLAR AND EQUATORIAL CURRENTS.

To the Editor of the Meteorological Magazine.

SIR,—As an instance of extreme rainfall consequent on the admixture of polar and equatorial currents of air, I enclose a table containing the returns from four different sources in the vicinity of Dublin, for the week ending May the 8th, 1869.

It will doubtless be in the recollection of your readers that during the above-mentioned week a remarkable wind system held over the western shores of Europe; that at the same time corresponding barometric curves were noticeable, and that great variations of temperature were experienced.

While over France the wind throughout the week was south-westerly and westerly, in Scotland, Ireland, and part of England it was at the same time north-easterly and easterly. So, while in France a barometric gradient of considerable steepness sloped from the south to the north of that country, a like gradient over the British Isles sloped from north to south, a “trough” of low pressure being thus caused in the neighbourhood of the British Channel.

Along the line of this trough, intermingling of the *warm moist* S.W. and of the *cold* N.E. current took place, and the result was a large rainfall, better marked on the N. side of the line of union of the currents than on the S. border of the same.

The effects of this system are, as regards Dublin, given in the appended table, for which, with this note, I will be glad if you can find a corner in the *Meteorological Magazine*.—Yours very truly,

J. W. MOORE, M.B., Trin. Col. Dub.

40, Fitzwilliam Square West, Dublin.

Rainfall at Dublin, week ending Saturday, May 8th, 1869.

MAY.	40 Fitzwilliam Square West, Dublin. 57ft. abv. sea.	Bloomsbury, Dundrum, Co. Dublin. 279ft. abv. sea.	Easton Lodge Monkstown, Co. Dublin.	Ordnance Survey, Phoenix Park Dublin.	Wind.
Sunday, 2nd	·054	·084	·040	·115	E., S.E., E.
Monday, 3rd.....	1·320	1·305	1·290	1·155	S.E., E.N.E.
Tuesday, 4th ...	·098	·135	·151	·110	E.N.E., E.S.E.
Wednesday, 5th.	·185	·258	·225	·177	S.E.
Thursday, 6th ...	1·082	1·332	1·250	·875	E., N.N.E.
Friday, 7th	·320	·410	·350	·285	N.N.E., E.N.E.
Saturday, 8th ...	...	...	...	...	N.E.
Total	3·059	3·524	3·306	2·717	...

Until Saturday, S.W. and N.E. currents of air were in continual conflict; the upper clouds (cirrus) were at times seen to be moving from S.W., while the lower clouds and wind were generally moving from N.E. to S.E. On Saturday the polar currents proved triumphant, and at 3 p.m. on that day the sky cleared with a brisk gale (force 6) from N.E.

THE THUNDERSTORM OF APRIL 14TH.

To the Editor of the Meteorological Magazine.

SIR,—A very unusually heavy thunderstorm has passed over this neighbourhood to-day. The morning was unusually warm and bright, indeed it was one of the most glorious spring mornings I ever remember. There was but little wind, and at times a perfect calm. At 2.45 p.m. a strong electrical breeze sprung up, and made me look out towards the quarter from which the wind was blowing. The sight that met my view was one the like of which I never remember. A dense brown-coloured cloud seemed to be advancing in one solid mass. In four or five minutes it reached us, and proved to be what it seemed to be in the distance, a regular dust storm. The wind was from the south.

I have seen many a thunderstorm, and under nearly all circumstances, but I never remember to have remarked more vivid and curiously zig-zagged flashes of lightning. During the course of the storm the wind veered from S. to W., then N. to E., back again to S., and is now (7 p.m.) E.N.E. The rain is still falling heavily. I have not heard of any damage done as yet. The sea, which was high last night, is as calm as it is possible for it to be. The barometer fell about two-tenths of an inch between 7 a.m. and 3 p.m.

Since writing the above I find that the storm extended over all Northumberland and Durham. The description I have had from various persons who witnessed it elsewhere singularly corresponds

with what I have before said. The thermometer rose to 68° during the day. It is placed with a north aspect, well shaded, and about 5 ft. from the ground.—Faithfully yours.

R. F. WHEELER.

The Vicarage, Whitley, North Shields, April 14th, 1869.

To the Editor of the Meteorological Magazine.

SIR,—I regret that I should have omitted to send you a memorandum of the thunderstorm of April 14th, as it would have cleared up one point, at least as regards our district, as to which you express yourself in doubt (see first page of Magazine for May), viz., the direction of the storm, which was here clearly from W. to E.

I was able to trace the storm during its whole course, as far as it was visible and audible from here, viz., from a point about ten miles west of us to a point some twenty miles to the eastward, say from the neighbourhood of Derby to somewhere in the neighbourhood of Sleaford in Lincolnshire.

I first heard thunder in west about 5 p.m., and on making an observation saw the storm-cloud, then at a low elevation above the horizon, advancing with a remarkably even and well-defined edge. There was frequent thunder, gradually increasing in loudness, from this time till 6.30 p.m., when the storm broke overhead, and raged furiously for about a quarter of an hour, the lightning seeming to flash from every quarter of sky, and the thunder rolling almost continuously. The storm then broke away to the east of us, and I watched it retreating to a distance of probably 20 miles. The thunder ceased to be audible when at a distance, estimated by time-interval at about 12 miles, but the lightning continued visible for some time after, and the point of discharge could not have been less than 20 miles distant, when the storm gradually died out between 8.30 and 9 p.m.

I have been interrupted in writing the above by another thunderstorm, which has passed 3 or 4 miles to the S. and S.E. of us; thunder first heard at 10.30, and ceased at 11.10 a.m. This makes six storms of greater or less violence which have visited this district since February 18th inclusive, a striking contrast to last year, when, notwithstanding the extraordinary heat, we had but one thunderstorm during the summer, viz., that on August 11th, with which the fine weather broke up.

I shall be happy to send you memoranda of any future storms that may occur in this district, if by so doing I can contribute, however humbly, towards the attainment of "more accurate knowledge of the path and progress of thunderstorms."—Yours very truly,

G. T. RYVES.

Nuthall, Nottingham, May 19th, 1869.

3.30 p.m. I add a line to say that we had a renewal of the storm this morning between 0h. and 1h. p.m., with a heavy downpour of rain, this time in an E. current.

To the Editor of the Meteorological Magazine.

SIR,—We had thunder from 2 o'clock p.m. on April 14th; sheet lightning at intervals; at 7 o'clock fork lightning and peals of thunder, continuing with torrents of rain. Two horses were struck in a stable at Wheldrake, one killed and the other most seriously injured. The storm cleared off soon after 9 o'clock, and the following fortnight was cold and wet; before, the heat was most oppressive—Yours sincerely,
M. C. DUNNINGTON JEFFERSON.

Thicket Priory, York, May 19th, 1869.

[The first of the foregoing letters was accidentally omitted in our last. The three jointly appear to agree with an actual travelling storm, but reports must be more numerous and (if our correspondents will forgive us for saying so,) more precise as to time and azimuth, if the results are to be of the nature we desire.—ED.]

NORWAY RAINFALL.

To the Editor of the Meteorological Magazine.

SIR,—I have much pleasure in forwarding Ex-Consul Jens Beer's return of rainfall for 1868. You will see that the fall in 1868 was more than 50 per cent. above that in 1867.—Yours truly,
C. O. F. CATOR.

Parkside, Beckenham.

RAINFALL IN 1868 AT ÖJE, FLEKKEFJORD, NORWAY.

Rain Gauge—Funnel, 12½ in. square; height of top above ground, 8 ft.; above sea level, 18 ft.

Month.	Total Depth.	Greatest Fall in 24 hours.		Days on which ·01 or more fell.	Days of Snow.
		Inches.	Depth.			Date.
January	8·68	1·93	26	14	8
February	9·04	1·30	1	27	5
March	8·83	2·06	17	20	6
April	4·45	·97	22	14	...
May	2·11	·94	24	12	...
June	2·31	·47	25	8	...
July	1·01	·45	19	9	...
August	7·62	1·43	27	16	...
September ...	3·44	·75	2	13	...
October	6·57	·86	10	21	...
November ...	5·59	2·66	23	11	1
December ...	7·79	1·82	11	19	7
Total	67·44	...	...	184	27

Unusually little snow at the latter part of the year; with exception of a little frost, 19–21st November, and 8–10th December, down to -6° Reaum. ($18^{\circ}5$ Fah.); mild weather to end of year, with temperature from 0° to $+6^{\circ}$ Reaum. (32° to $45^{\circ}5$ Fah.) The ground quite soft, and the grass green up to the 12th January, 1869.

C. O. F. CATOR, FOR EX-CONSUL JENS BEER.

[The position of this station has already been described, (*Met. Mag.*, Vol. III., p. 32,) and the returns from it agree remarkably well with those Scotch stations whose positions most resemble it. We have

previously dwelt (*British Rainfall* 1868, p. 97,) on the irregularity of the Scottish fall in 1868, so far as concerns total quantity, several stations having even greater excesses than Flekkefjord. The wet and dry months also agree remarkably well.—ED.]

TEMPERATURE OF THE EARTH AT GREAT DEPTHS.

THE experiments described in previous numbers of this magazine have been steadily continued, and some remarkably consistent results obtained. We have not space on the present occasion to describe them fully, but may incidentally mention that the rate of increase is very steady, averaging 1° Fahrenheit for every 52 feet of depth, so that the temperature at 1050 feet is $69^{\circ}\cdot 0$, while at the surface it is $49^{\circ}\cdot 0$. This would indicate almost exactly a rise of 100 degrees for each mile of vertical depth.

Several persons having expressed a desire to visit the bore, Mr Symons will be happy to forward cards of admission (with map showing the locality), for Saturdays June 19th and 26th, to those who may intimate their wish to receive them.

RAINFALL AT THE OBSERVATORY, NELSON, NEW ZEALAND.

Lat. $41^{\circ} 16' 17''$ S. ; Lon. $173^{\circ} 18' 46''$ E. ; height above sea, 18 ft.

	1863.	1864.	1865.	1866.	1867.
January	00 ...	75 ...	348 ...	333 ...	1655
February	690 ...	60 ...	843 ...	1618 ...	62
March	184 ...	18 ...	380 ...	475 ...	47
April	129 ...	254 ...	588 ...	159 ...	305
May	380 ...	417 ...	1435 ...	31 ...	211
June	87 ...	581 ...	380 ...	101 ...	295
July	807 ...	813 ...	344 ...	494 ...	437
August	1354 ...	203 ...	226 ...	864 ...	146
September	1249 ...	1476 ...	684 ...	465 ...	75
October	1272 ...	508 ...	218 ...	334 ...	194
November	260 ...	1023 ...	360 ...	1046 ...	329
December	208 ...	648 ...	310 ...	1285 ...	954
	6620	6071	6116	7205	4710

(6076)

HENRY CLOUSTON, *Meteorological Registrar.*

REVIEWS.

A Report on the Sanitary Condition of the City and Borough of Bath during the years 1867 and 1868, with a Synopsis of that of several previous years, together with a Geological, Meteorological, and general Topographical Sketch of the City and its vicinity in relation to matters connected with the Public Health. By C. S. BARTER, M.B. Lond., F.R.C.S., &c.—Davies, Bath. 8vo, 101 pages.

WE do not remember to have seen a better report by any Medical Officer of Health than this of Dr. Barter's, nor one compiled with

greater care and judgment. In almost every respect it is characterized by sound knowledge and discretion, but singularly enough he either intentionally or unintentionally adopts a plan of obtaining mean pressure, and mean temperature, different from all other observers, taking simply the arithmetical mean of the extreme readings, *e.g.*, in 1868 he gives the following elements:—

Mean Max of Barometer, 30·425 in.
 „ Min. „ 29·204 „
 „ Height „ 29·814 „

Evidently here we have the arithmetical mean of the highest and lowest readings in each *month*. On a previous page (3), however, he takes the mean of the highest and lowest in each *year* as the mean for that year, and the same with respect to temperature. On page 3 the mean temperature of each of eighteen years is taken from the arithmetical mean of the max. and min. temp. in the *year*; on page 74 from the mean daily max. and mean daily min. in the usual way, no corrections being applied.

We cannot accept this delightful short cut without proof of its accuracy, but if it can be shown that any simple correction will always bring out the true value, none will be more ready than ourselves to bring it under the consideration of observers. It is clear that in 1868 the correction would have been large, for the max. was 89°·8, the min. 23°·5, and the mean of these is 56°·6, while the daily readings give 53°·4, thus giving no less than 3°·2 difference.

Another thing which puzzles us very much is the mode of obtaining “mean daily range of temperature.” We always thought it was the difference between the mean daily max. and the mean daily min., but Dr. Barter's values sometimes agree exactly with this rule, sometimes differ widely from it, *e.g.*—

1867.	Jan.	Feb.	Mar.	April	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean Max.	42·1	52·9	46·2	60·8	64·1	71·0	71·8	73·6	68·7	58·1	47·6	44·5
„ Min.	34·1	44·3	35·3	46·8	48·0	50·6	54·8	54·6	53·1	46·5	37·6	37·2
„ Range	8·0	8·6	10·9	14·0	16·1	20·4	17·0	19·0	15·6	11·6	10·0	7·3
„ (as printed) ...	8·0	8·5	10·6	13·3	16·7	17·0	16·6	19·0	15·6	11·6	10·3	7·3
Difference	0·0	—1	—3	—7	+6	—3·4	—4	0·0	0·0	0·0	+3	0·0

It is most unpleasant, yet it is certainly our duty, to point out every departure from established usage, hence while on the whole praising Dr. Barter's work most warmly, we have been obliged to notice certain practices which require some explanation.

The Rainfall in Devonshire during 1866 and 1867. By W. PENGELLY, Esq., F.R.S., &c. [Reprinted from the Transactions of the Devonshire Association for the Advancement of Science, Literature, and Art, 1868.] 8vo. 18 pages.

THIS is a somewhat striking illustration of exhaustive treatment, and shows the same well-directed energy and indomitable perseverance as

have won for Mr. Pengelly so distinguished a place among geologists. But the paper is a most difficult one to review, there being scarcely anything redundant or which can be omitted without damaging the whole. Mr. Pengelly explains in an introductory note that having a few years since commenced careful observations of the rainfall at Torquay, he has been led on to make certain calculations and comparisons as to the fall in various parts of England and of Devonshire in particular. These calculations have been based on *British Rainfall*, 1866 and 1867. The first table consists of nearly forty columns, containing elements from 36 stations—that is to say, some 1500 entries. The following are some of the details given:—Name of Station, Distance and Direction of nearest Arm of the Sea, Distance and Direction of Centre of Dartmoor, Diameter, Height above Ground and above Sea of each Gauge; then, for 1866, Total fall of rain, Ratio to mean of all stations including Prince Town, and also excluding that very wet station, Days on which .01 in. fell, Ratio to mean at all stations, Mean daily fall. Similar details are given for 1867, and finally for the mean of the two years.

Of the remarks on this table we can only quote one, but we note with great pleasure that Mr. Pengelly brought prominently under the notice of the Association the dearth of observers in certain parts of the county; we trust he will secure recruits in those unrepresented districts:—

“*Mean Daily Rainfall.*—If the total rainfall of the year at any station be divided by the total number of wet days, the quotient will, of course, be the *mean daily fall* at that station for the year. The question of this quantity or element in the meteorology of any district is one of more than mere curiosity; for on it depends the further question of whether a large or small portion of the year's rain has or has not penetrated the soil, which, in its turn, is closely connected, not only with the agriculture of the district, but with the geological changes it is undergoing, and with its general thermal condition. Heavy falls are calculated to furrow the surface; sluggish ones, to promote its *general* degradation.

On the other hand, the latter, by penetrating the soil, are calculated to do more internal work than the former, to disintegrate and decompose rocks beneath the surface, and to excavate subterranean water-courses. The latter also render the district more uniformly an evaporating surface, and in every way promote the augmentation of the quantity of vapour yielded by it. Vapour is formed by the abstraction of heat which does not raise temperature. Hence, all other things being the same, a district devoted to sluggish rain, that is to a low average daily rate of fall, is thereby kept cooler than one having a more energetic rain. Further, the motion of the falling drops is necessarily destroyed, as motion, when they reach the ground; and, according to the doctrine of the correlation of forces, is converted into heat, the amount of which varies directly as the square of the velocity of the moving body; hence the heat into which the motion of rain is transmuted is greatest when the rain falls most energetically, and *vice versa*. In other words, the quotient of the total rainfall of the year divided by the annual number of wet days, is a quantity on which to some extent, probably a small one, the mean temperature of the district depends.”

In Table II. Mr. Pengelly gives interesting comparisons of Devonshire with the other South-Western Counties, and in Table III. he gives some results from the whole of the English and Welsh returns

for 1866 and 1867, published in *British Rainfall*. The table contains name of county, mean fall at all stations in the two years, relative mean annual fall, mean annual wet days, relative ditto, mean daily fall, relative ditto. It is obviously impossible to make this table perfect, nor is it expedient to attempt it. Supposing such a marvel as a grant of £10,000 per annum for rainfall purposes, it would not enable anyone to determine *accurately* the mean rainfall in any one county, unless it was Rutland. We are getting yearly nearer and nearer to the truth, but so long as hills and valleys, woods and downs, and rivers and lakes, remain, so long will it be impossible *accurately* to give the mean rainfall of any county. Take Carnarvon, for instance, a county of no great size, yet having at some places 115 inches, at others not one-third thereof; or take a flat county, of which the mean would be most easily ascertained. Cambridge is perhaps the most level, only one station being more than 100 ft. above the sea; still we find the fall varies from 24 inches to 19 inches—that is as 100 : 30 in the former case, and as 100 : 79 in the latter. In the latter case it is not improbable that the arithmetical mean of the returns from any dozen stations selected hap-hazard would give the mean fall of the county within two or three per cent. of the truth, but in a hilly country no such approximation is possible; as a rule (with many exceptions) the gauges are near residences, and therefore as a rule *not* in very wet places, but for experimental purposes they are sometimes so placed; for example, the Stye gauge, with its 165 inches per annum, is one of 48 stations in Cumberland, and represents, therefore, 31 square miles, or one forty-eighth of the whole county; but no one would contend that that enormous fall really applies to a district $5\frac{1}{2}$ miles square. Admitting to the fullest extent these difficulties, and knowing them to be insuperable, we are brought face to face with the question, Is it therefore useless to take the arithmetical mean of the returns as they stand? We think not, and Mr. Pengelly's table seems to support the opinion, for the counties at the top and bottom of his list are just those we should have expected to see there. Wettest of all is Cumberland, then Westmoreland, Merioneth, Montgomery, and at the bottom of the list (reading upwards), is Bedford, then Cambridge, Huntingdon, Lincoln, Surrey, Norfolk. The average fall at all stations during the two years was 35·77; the average in Cumberland was 66·73, and in Bedfordshire 23·20. Devonshire is thirteenth in descending order, and its total fall 23 per cent. above the average of the whole country.

It is somewhat singular that the rainfall of this county has been the subject of the two most suggestive monographs of county rainfall yet published—that by Mr. Eaton, in Vol. I. of the *Proceedings of the Meteorological Society*, and the present; yet they have hardly two points in common, and by no means exhaust the subject. Mr. Pengelly intimates that his may be looked upon as the first of a series, and we have much pleasure in registering his intention.

An Account of certain Experiments on Aneroid Barometers made at Kew Observatory at the expense of the Meteorological Committee, by DR. BALFOUR STEWART, F.R.S. — [Proceedings Royal Society.] 10 pages, 8vo.

It is generally known that there exist at the Kew Observatory of the British Association facilities for testing barometers at any required pressure. The able director, Dr. Stewart, availed himself thereof for the purposes of the experiments described in the above paper, our duty to which will be most faithfully discharged by quoting the results as summed up by the author, simply premising that from the tables it appears that by the terms "good results" and "tolerably correct," errors of less than 0·10 in. are to be understood.

"From all these experiments we may perhaps conclude as follows :—

"(1) A good aneroid of large size may be corrected for temperature by an optician, so that the residual correction shall be very small.

"(2 a) If an aneroid correct, to commence with, be used for a balloon or mountain ascent, it will be tolerably correct for a decrease of about 6 inches of pressure.

"(2b) A large aneroid is more likely to be correct than a small one.

"(2 c) The range of correctness of an instrument used for mountain ascents may be increased by a previous verification, a table of corrections being thus obtained.

"(3 a) If an aneroid have remained some time at the top of a mountain, and be supposed correct to start with, then it will give good results for about 8 inches of increase of pressure.

"(3 b) A large aneroid is more likely to be correct than a small one.

"(3 c) If the aneroid has been previously verified, it is likely to give a better result.

"(4) After being subjected to sudden changes of pressure the zero of an aneroid gradually changes, so that under such circumstances it ought only to be used as a differential and not as an absolute instrument, that is to say, used to determine the distance ascended, making it correct to begin with, or to ascertain the distance descended, making it correct to begin with, it being understood that the instrument ought to be quiescent for some time before the change of pressure is made."

Report of the Sanitary Committee of the Borough of Nottingham for the Year ending September, 30th, 1868. Stevenson, Nottingham. 8vo, 19 pages and folding tables.

THE meteorological observations are taken by Mr. Tarbotton, C.E., with his usual care—perhaps the most important one is the maximum temp. on July 23rd, viz., 94°·3. Sanitary matters seem well cared for, but the water supplied to the town appears from the analyses to be of considerable hardness; the application for power to construct new works has been rejected by Parliament within the last few days, and we therefore trust the borough will bring forward such a scheme for next session as shall by its own merits command success, and be a benefit to the town for years to come.

We regret very much that the report is made up to the end of September, instead of to the end of the ordinary year; and hope the advantages of adopting a chronology similar to other towns, and to established usage, will sooner or later become obvious to the authorities, and induce them to to adandon this bad practice.

MAY, 1869.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of nights below 32° on grass
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Days on which more than 1 in.	Max.		Min.		
				Dpth	Date		Deg.	Date.	Deg.	Date.	
I.	Camden Town	3.27	+ .87	.61	3	17	71.2	26	33.0	30	0
II.	Staplehurst (Linton Park) ...	3.78	+ 1.54	.93	4	17	78.0	7	31.0	2	3
III.	Selborne (The Wakes).....	4.68	+ 2.20	.83	3	14	65.0	25	29.1	30	2
III.	Hitchen	3.31	+ 1.38	.82	3	19	64.0	7*	35.0	29	1
IV.	Banbury	4.47	+ 2.25	.72	3	22	65.0	25	30.5	2	0
IV.	Bury St. Edmunds (Culford).	3.23	+ 1.07	.76	3	16	65.0	7, 25	23.0	29†	6
V.	Bridport	4.74	+ 2.71	.86	3	14	63.0	13	32.5	2	0
V.	Barnstaple.....	4.89	+ 2.45	1.50	3	18	68.0	1	37.5	21§	...
VI.	Bodmin	6.28	+ 3.82	1.00	3	22	70.0	24†	39.0	3, 5	0
VI.	Cirencester	4.09	+ 1.81	.65	3, 8	15	...	...	...	...	...
VI.	Shifnall (Haughton Hall) ...	4.73	+ 2.47	1.05	25	16	66.0	24	32.0	13	0
VII.	Tenbury (Orleton)	5.51	+ 2.63	1.15	25	19	64.7	2	31.8	12	1
VII.	Leicester (Wigston)	4.72	+ 2.60	.86	3	15	69.0	24	33.0	4||	...
VII.	Boston	3.71	+ 1.77	.55	3	18	70.0	10	35.8	5	0
VII.	Grimsby (Killingholme)	5.47	..	1.83	26	19	65.0	10	39.5	2	...
VIII.	Derby.....	3.97	+ 1.81	.81	3	20	64.0	10	35.0	5, 13	...
VIII.	Manchester	2.73	+ .07	.71	7	17	65.0	1	33.0	13	...
IX.	York	4.49	+ 2.54	1.18	26	13	61.0	10	32.5	5	0
X.	Skipton (Arneliffe)	4.11	+ .76	.96	19	13	71.0	2	35.0	12	...
X.	North Shields	2.58	— .06	.62	6	16	59.0	30	35.7	13	0
XI.	Borrowdale (Seathwaite).....	3.16	— 6.38	1.00	6	12	...	...	...	...	...
XI.	Cardiff (Town Hall).....	4.92	..	.86	3	18	...	...	...	...	...
XI.	Haverfordwest	5.65	+ 2.93	1.34	5	13	66.3	25	33.0	1	...
XI.	Rhayader (Cefnfaes).....	4.59	+ 1.74	1.10	3	19	63.0	...	51.0	...	...
XI.	Llandudno... ..	3.90	+ 1.52	.58	7	13	65.5	24	38.4	13	...
XII.	Dumfries	1.87	— .52	.58	6	13	69.0	1	29.5	12	3
XIV.	Hawick (Silverbut Hall) ...	2.51	..	.80	6	15	...	...	...	...	...
XV.	Ayr (Auchendrane House) ...	1.02	— 2.09	.40	6	13	63.0	1	26.0	9	4
XV.	Castle Toward .....	.49	— 2.90	.29	6	6	66.0	1	28.0	10¶	13
XVI.	Leven (Nookton)	1.56	— .44	.80	6	12	60.0	1	31.0	29	2
XVI.	Stirling (Deanston)	1.04	— 1.61	.41	7	10	71.0	1	26.0	9, 29	10
XVII.	Logierait .....	.73	..	.23	18	10	...	...	...	...	...
XVII.	Ballater .....	.96	..	.53	6	18	68.5	1	24.0	9	9
XVII.	Aberdeen	1.56	..	.55	6	14	62.6	1	28.7	5	11
XVIII.	Inverness (Culloden)	2.01	..	.73	7	12	64.1	1	32.9	8	0
XVIII.	Fort William .....	..	..	..	..	..	...	...	...	...	...
XVIII.	Portree	1.33	— 4.32	.34	12	10	...	...	...	...	...
XVIII.	Loch Broom	1.74	..	.37	6	13	...	...	...	...	...
XIX.	Helmsdale	1.27	..	.15	5, 19	19	...	...	...	...	...
XIX.	Sandwick	1.03	— 1.23	.24	19	15	52.1	10	34.5	9	...
XX.	Cork	5.48	..	1.13	16	18	...	...	...	...	...
XX.	Waterford	4.87	+ 2.62	1.16	6	21	63.0	31	40.0	12	...
XX.	Killaloe	4.20	+ 1.02	.76	6	20	67.0	1	30.0	12	2
XXI.	Portarlington	3.14	— .06	1.01	7	22	65.0	1	34.0	12	...
XXI.	Monkstown	5.73	+ 3.82	1.15	6	19	60.0	23	34.0	12	...
XXII.	Galway	4.80	..	.79	6	21	69.0	1	35.0	28	...
XXII.	Bunninadden (Doo Castle) ...	2.72	..	.62	3	15	61.0	29	27.0	9, 13	3
XXIII.	Bawnboy (Owendoon)	2.93	..	.76	3	23	71.0	1	32.0	12	1
XXIII.	Waringstown	2.25	..	.45	3	17	68.0	1	30.0	12	3
XXIII.	Strabane (Leckpatrick)	2.84	..	.43	18	19	68.0	1	27.0	9	14

* And 10th, 24th & 26th. † And 26th. ‡ And 31st. § And 30th. ¶ And 11th & 12th. ¶ And 13th & 30th.
 † Shows that the fall was above the average : — that it was below it.

METEOROLOGICAL NOTES ON THE MONTH.

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

[We cannot help prefacing the following notes by calling attention to the remarkable contrast in the character of the month north and south of latitude 54°. In the south, and especially in the south-west, the fall was greatly above the average; for instance, at Bodmin, 155 per cent. above, while in Scotland it was remarkably dry, for example, Castle Toward, 86 per cent. below the average. See also the remarks from Linton Park and Portree, also Dr. Moore's letter p. 68.—ED.]

ENGLAND.

CAMDEN TOWN.—TS on 19th; H at 11.30 a.m. on 31st.

LINTON PARK.—The wettest May I have on record, excepting in 1856; it has also been the coldest, the average day temp. having been 8° below that of last May. Frost occurred on the 2nd, 20th, and 30th, beside several times nearly approaching the freezing point; the bar. very unsteady, and the wind frequently changing, and bringing R with it from all directions.

SELBORNE.—Very fine aurora on the 13th; remarkable earth currents reported at all the railways in the S.W.; H, R, T, and violent storms (wind S.W.) from 10 a.m. 19th; white frost on 29th; dahlias, &c., nipped, in the valley the potatoes blackened, scarlet runners destroyed, and even the young shoots of oak and ash nipped.

BANBURY.—T on 19th and 20th; T and L on 10th, 22nd and 26th; H on 18th 19th and 20th; aurora on 28th; mean temp. 49°.

CULFORD.—Altogether an exceedingly cold and sunless month, the mean temp. being below that of the preceding month; the max. temp. also has been under that of April, being 65° instead of 73°. On the nights of the 29th and 31st the frost severely injured the dahlias and bedding plants, as well as the beans and potatoes; T on 7th, 10th, and 19th, and H on the 20th.

BRIDPORT.—Cold month, and much E. wind; TS on 27th.

CIRENCESTER.—A month of varied wind; ungenial on the whole, but no absolute frosts, and more than an average rainfall; TS on 10th and 25th; H with T on 10th.

SHIFFNAL.—A most unusually cold and wet May; more R has fallen than in any May for 35 years, the nearest approach to it having been in 1862, when 4.14 in. fell; the prevailing winds were from N.E., from the 18th to 24th only being from W. and N.W. Fearful TS on the 25th at 4 p.m., with violent rain, nearly an inch falling in three hours. Abundance of blossom on all trees, whether fruit or forest; the hollies unusually full. The oaks and ash in full leaf early in the month. Swifts first seen on 6th; corncrake heard on 18th, and turtle-dove on the 20th.

ORLETON.—The fall of R the greatest for May in the last 40 years. A succession of heavy TSS passed over from S. to N. on the 10th, between 11 a.m. and 6 p.m., and again on the 25th, between 1.30 and 2.45 p.m., with great R on the 25th and 26th. On the 26th the rivers all full or overflowing, which has not occurred in May for more than 40 years; the sky generally cloudy. Temp. very low, 3°.5 below the average. Distant T on 18th and 19th.

WIGSTON.—The greatest rainfall I have recorded in May for 30 years; the mean temp. 8° below that of May, 1868. Great abundance of grass.

BOSTON.—The weather has been cold, wet and stormy throughout the month; the only occasions on which 3.00 of rain have fallen in May since 1850 are 1860 (3.48), and 1867 (3.72). In 10 days, from 2nd to 11th, 2.18 in. fell, and from 16th to 26th, 1.50; the river Witham was swollen by the R, but no serious flooding of the fens occurred. E. and N.E. winds prevailed. Large numbers of swallows were found dead, partly from the severity of the cold, and partly from want of the usual insects on which these birds feed. TSS occurred on the 9th, 10th, 17th, and 18th. Lunar halo on the 21st. Potatoes much injured by the

soaked condition of the soil ; pasture lands very rich in grass ; wheat promising to yield a good harvest.

KILLINGHOLME.—Cold and wet month, the polar current prevailing, with scarcely an exception. The corn crops on inferior soils have suffered considerably, and the meadows are backward. The old saw has proved true—

“ Who doffs his coat on a winter's day,
Will gladly put it on in May.”

Hawthorn began to flower on 7th ; first swarm of bees on the 30th ; on the 26th the heaviest rainfall for several years, 2 inches in about 12 hours ; S in the N. of Yorkshire on 27th. T on 10th.

DERBY.—Rainfall much above the mean ; E. and N.E. winds prevailing most of the month ; wheat and barley looking very yellow. T on the 19th ; a magnificent aurora seen on the night of the 13th ; sun's disc on the same day had an unusual number of spots.

NORTH SHIELDS.—Strawberries in blossom on the 11th ; globe ranunculas, lily of the valley, double red campion, and white and purple lilac in flower about the same time.

SEATHWAITE.—Only one day on which the fall exceeded half an inch.

W A L E S.

HAVERFORDWEST.—The wettest and one of the coldest Mays during the past 20 years. Sudden and severe storm of wind and R on the morning of the 19th ; H and sleet, mixed with R ; the storm, quite cyclonic in character, commenced at 9 a.m., and raged till 1 p.m., doing great damage to gardens and stripping trees of their foliage, branches strewn in every direction, vegetables literally blown out of the ground. Temp. of the month below the average, but did not once reach the freezing point. Vegetation on the whole forward ; general direction of the wind E.

CEFNFAES—A continuance of cold, damp weather ; nights frosty ; S on the hills on the 24th ; foliage luxuriant, and the blossoms on the shrubs, particularly hollies, most abundant and fine.

LLANDUDNO.—Laburnam and lilac, hawthorn and early peas, in flower at the beginning of the month ; honeysuckle at the middle. Splendid aurora on the 13th, from 10 to 11.30 p.m. ; colours most brilliant and varied, particularly in the S.E. and N.W., where they were green, orange, red and purple alternately ; the coruscations shot from all points of the compass towards the zenith. S on the distant hills on the 20th.

S C O T L A N D.

DUMFRIES.—Month cold ; winds mostly E. or N.E. Potatoes much injured on 12th and 29th. S on hills on 4th, 8th, and 27th. Hawthorn in blossom on 10th ; pastures suffering from want of R, from frost, and cold winds.

HAWICK.—Keen frosts on nine nights, which completely destroyed the potatoe stems, and severely injured fruit tree blossom. The ice in the drinking troughs was from one-eighth to half-an-inch in thickness. Singularly beautiful aurora on the night of the 13th. Landrail first heard on the 13th. Summits of the Cheviots white with S on the 26th ; pasture fields are deficient, and young grasses are indicative of a bad harvest.

AUCHENDRANE.—With a bar. below the mean, and bar. range somewhat above it, this May has been a month of small rainfall, of very low mean temp., and stunted evaporation ; and although these may have somewhat retarded vegetation, never were the “ green crop lands” more thoroughly cleaned and dressed.

CASTLE TOWARD.—Remarkably dry but cold. Crops healthy, but not making much progress ; white hawthorn in flower on the 3rd, and the scarlet on the 14th. The want of R and frequent frosts have been much against the hay crops and bedding out plants, but have been favourable for preparing the turnip fields for the crop.

NOOKTON.—Dry, cold, and ungenial ; prevailing winds E. and N.E..

DEANSTON.—Month very dry ; much E. wind ; frost frequent during the nights ; potatoes cut down by that of the 28th.

LOGIERAIT.—A very cold and ungenial month ; keen frosts on the nights of the 8th and 27th. Magnificent aurora about 11 p.m. on 13th, radiating from a circle in the zenith to all points of the horizon. Landrail heard on 20th.

BALLATER.—A cold, dry month, with almost constant N. or N.E. winds, very unusual for this quarter ; rainfall below the average ; temp. 4° below the mean of May for last 5 years. Vegetation seriously injured by the frost ; T on 11th ; heavy H shower (pellets conical, quarter of an inch in diameter at the base) on 12th at 2 p.m. Cuckoo heard on 1st.

ABERDEEN.—H on 3rd, 4th, 7th, 11th, 12th and 31st. A cold ungenial month ; crops have made very little progress ; potatoes blackened by frost all along Dee side on morning of 29th.

PORTREE.—Coldest and driest month on record ; many sheep on the hills died for want of water. Severe frost on 31st, which nipped all the potatoes.

LOCHBROOM.—The month has been remarkably dry and cold ; H and S more common on elevated ground than E.

SANDWICK.—A lamentable continuance of N. winds, with cold weather, there being only 6 days on which the wind did not touch the N., and on two of these it was E, which was as cold ; it was also very dry, so that vegetation is very backward. S on Hoy Head (1500 ft.) on 6th ; auroræ on 7th, 8th, 9th, and 13th, on the last date, about 11 p.m., red, and reaching almost to the S. horizon.

I R E L A N D.

DOO CASTLE.—One of the wettest and most ungenial months of May on record. In a gentleman's garden adjoining, myriads of caterpillars attacked some gooseberry bushes, and though picked off most carefully on five different occasions at intervals of four days, have been replaced by others equally numerous. I am curious to know, were they produced by ova deposited this year, and how it is that they were confined to about half a dozen bushes ? Few butterflies have been seen about this month.

OWENDOON. Great prevalence of E. and N.E. winds ; crops fully three weeks late.

WARINGSTOWN.—Very cold and ungenial, especially the last ten days. Almost constant N. and E. winds. Rainfall much below the average, and crops much in want of showers towards the end of the month.

LECKPATRICK.—Cold month, but very favourable for farm operations, and turnip crop sowed in good time. Frost on grass on 14 nights, ther. registering 21° on 9th and 13th.

STEVENSON'S RAIN GAUGE.

To the Editor of the Meteorological Magazine.

SIR,—I observe in the report on rain gauges that reference is made to the form which I suggested.

It occurs to me to mention that I never used any glass tube. The only peculiarity of the instrument, which may have a float with a graduated stem, or any other convenient method of observing, is the form of the rim and funnel, which assume a symoidal section.

I mention this merely to explain that I have no preference for the glass tube, which, as I stated, I have never adopted myself. Trusting you will kindly excuse this trouble,

I remain yours faithfully,

THOMAS STEVENSON.

Chambers, 84, George Street, Edinburgh, March 26th, 1869.

[We are very glad that Mr. Stevenson disclaims the very clumsy glass tube which was fitted to the instrument by the Scotch optician who supplied what *he called* Stevenson's Rain Gauge ; that part of the arrangement will be ignored in future.—Ed.]