

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

XXVII.]

APRIL, 1868.

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METEOROLOGY IN ABYSSINIA.

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

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

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

To the Editor of the Meteorological Magazine.

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

R. H. F.

Senafé, February 23rd, 1868.

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

No.	TEMPERATURE.						HYGROMETRY.						WIND.						CLOUDS.									
	Max	Min.	9 a.m.	noon	3 p.m.	6 p.m.	Wet. Hum.	Wet. Hum.	Wet. Hum.	Wet. Hum.	Wet. Hu.	Wet. Hu.	9 a.m.	noon.	3 p.m.	6 p.m.	RAIN.	7 a.m.	9 a.m.	noon.	3 p.m.	6 p.m.	9 a.m.	noon.	3 p.m.	6 p.m.		
	°	°	°	°	°	°	9 a.m.	9 a.m.	9 a.m.	noon.	noon.	°	°	°	°	°		°	°	°	°	°	°	°	°	°		
1	74	43	44	65	72	60	...	...	...	...	...	...	...	...	...	...	0	...	...	...	...	...	...	...	...	...	...
2	...	42	46	...	...	...	...	...	...	...	...	...	...	...	...	...	0	...	...	...	...	...	...	...	...	...	...	...
3	...	42.5	...	...	...	68	...	...	...	...	...	...	...	...	...	...	0	...	...	...	...	...	...	...	...	...	...	...
4	80	39	...	62	80	79	...	65	...	64	42	60	...	...	...	...	0	...	0	...	...	...	...	...	...	...	...	...
5	81	45	...	61	68	80	...	...	...	...	...	...	...	...	...	...	0	...	...	...	...	...	...	...	...	...	...	...
6	75	39.5	...	59	75	66	...	...	...	...	...	...	...	...	...	...	0	...	...	...	...	...	...	...	...	...	...	...
7	79	45	...	61	77	65	...	...	...	...	...	...	...	...	...	...	0	...	...	...	...	...	...	...	...	...	...	...
8	...	39	...	61	71	...	...	...	...	...	...	...	...	...	...	...	0	...	...	...	...	...	...	...	...	...	...	...
9	72	41.5	...	61	72	68	...	...	...	...	...	...	...	...	...	...	0	...	...	...	...	...	...	...	...	...	...	...
10	69	47	...	63	69	69	...	...	...	...	...	...	...	...	...	...	0	...	...	...	...	...	...	...	...	...	...	...
11	80	38.5	...	70	78	80	...	...	...	...	...	...	...	...	...	...	0	...	...	...	...	...	...	...	...	...	...	...
12	...	36	...	65	...	...	...	...	...	...	...	...	...	...	...	...	0	...	...	...	...	...	...	...	...	...	...	...

Goose Plain, five miles from Senafé. Height above sea (own observation) 7,256 feet.											
No.	Max	Min.	9 a.m.	noon	3 p.m.	6 p.m.	Wet. Hum.				
°	°	°	°	°	°	°	9 a.m.	9 a.m.	9 a.m.	noon.	noon.
14	78	33	...	67	78	65	...	...	...	...	...
15	...	32.5	...	60	...	...	...	...	...	...	...
16	85	32	...	60	85	81	...	...	...	...	...
17	...	35	...	70	...	...	...	...	...	...	...
18	77	40	...	70	...	77	...	...	...	...	...
19	...	44	...	...	...	...	...	...	...	...	...
20	...	40	...	...	...	...	...	...	...	...	...
21	...	36	...	68	80	...	...	...	...	...	...

REMARKS.

There is almost invariably heat-lightning every evening after sunset.
 2nd—Heavy mist and fog night of 2nd–3rd.
 3rd—Mist came up at 6 p.m. ; very heavy dew.
 4th—Clouds disappeared except in the W. at sunset ; no mist driving.
 5th—No mist at night ; heavy cloud.
 6th—Mackerel sky at even ; no mist at night.
 8th—Mist driving up at 6 p.m. ; heavy mist all night.
 9th—Heavy mist at night.
 10th—Strong E. wind at night.
 11th—Clear sky 9 p.m. ; very heavy dew, tent wringing wet.
 13th—On the march.
 14th—Very heavy dew night of 13-14th. Heavy thunder clouds at 3 p.m. ; thunder and a few large drops of rain ; a few drops twice during night.
 17th, 18th, and 19th—Heavy clouds with thunder and lightning after sunset, and a few drops of rain.
 20th—Fine sunset ; a few heavy clouds.
 N.B. The S. R. thermometers were placed in a stand on my tent-pole. The wet and dry bulb thermometers were slung, so that the dry bulb was freely suspended in the air. The tent was always open throughout the day at bottom and door. The min. was always exposed on a tent-peg at 1 ft. above the ground at night. The wind at Senafé must have been much affected by the hillsround and passages between, by which it swept round. The ground there was rocky, but there was grass at Goose Plain, hence the min. showed greater cold at night at the latter.

R. H. F.

HAIL SHOWER AT SIDMOUTH.

To the Editor of the Meteorological Magazine.

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

J. INGLEBY MACKENZIE,
 M.B. Cantab., F.M.S.

Sidmouth, Devon, Feb. 29, 1868.

"WHAT IS A FROST?"

To the Editor of the Meteorological Magazine.

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

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

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

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

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

I am, Sir, yours very truly,

F. BONNYCASTLE GRITTON.

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

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

Jan. 6th, 1868.—9 a.m., minimum thermometer in air (4 ft.), 33°·5 ; on grass, 31°·0 ; snow on the ground.

Jan. 11th, 1868.—9 a.m., minimum thermometer in air, 32°·5 ; on grass, 31°·0 ; thawing, but snow on the ground.

Jan. 16th, 1868.—9 a.m., minimum thermometer in air, 36°·3 ; on grass, 32°·0 ; no visible signs of a frost during the night.

Feb. 18th, 1868.—9 a.m., minimum thermometer in air, 34°·0 ; on grass, 30°·0 ; a white frost on lawn and adjacent fields.

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

IS THE ROYAL CHARTER GALE PERIODIC?

To the Editor of the Meteorological Magazine.

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

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

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

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

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

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

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

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

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

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

P. H. NEWNHAM.

Bournemouth, March 20th, 1868.

To the Editor of the Meteorological Magazine.

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

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

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

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

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

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

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

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

C. T. K.

VERIFICATION OF THERMOMETERS.

To the Editor of the Meteorological Magazine.

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

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

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

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

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

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

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

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

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

No. 4064	44°·25	...	54°·3	68°·05	69°·6
3679	44 ·15	47·50	54 ·5	68 ·00	69 ·6
3534	44 ·07	47·35	54 ·3	68 ·10	69 ·7
2192	44 ·10	47·50	54 ·4	68 ·10	69 ·85

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

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

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

G. L. TUPMAN.

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

ANEMOMETERS.

To the Editor of the Meteorological Magazine.

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

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

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

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

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

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

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

AN OLD OBSERVER.

REVIEWS.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(To be continued.)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

MACKENZIE'S "CLIMATE OF SIDMOUTH."

To the Editor of the Meteorological Magazine.

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

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

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

I am, Sir, faithfully yours,

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

MARCH, 1868.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of nights below 32°.
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Days on which .01 or more fell.	Max.		Min.		
				Dpth	Date.		Deg.	Date.	Deg.	Date.	
		inches	inches.	in.							
I.	Camden Town	1.29	— .79	.44	25	16	60.5	15	29.2	25	4
II.	Staplehurst (Linton Park) ...	1.29	— 1.20	.41	26	12	59.0	14*	28.0	25	12
III.	Selborne (The Wakes).....	2.21	— .59	.68	11	14	62.0	31	24.0	30	8
III.	Hitchen.....	1.52	— .55	.46	7	17	55.0	13¶	25.0	24	6
IV.	Banbury	1.90	— .30	.35	11	18	56.5	14	25.5	25	9
IV.	Bury St. Edmunds (Culford).	2.05	— .15	.70	8	16	58.0	13	26.0	24	8
V.	Bridport	1.39	— 1.48	.23	9	17	61.5	21	27.0	30	8
V.	Barnstaple.....	3.23	+ .08	.57	8	22	...	...	...	...	...
V.	Bodmin	3.38	— .37	.58	9	20	58.0	16	34.0	30	0
VI.	Cirencester	2.56	— .04	.86	8	12	...	...	...	...	...
VI.	Shifnal	1.36	— .58	.31	7	15	57.0	13	24.0	25	7
VII.	Tenbury (Orleton)	1.76	— .66	.44	7	19	59.0	21	25.0	25	8
VII.	Leicester (Wigston)	2.56	+ .45	.45	8	14	64.0	30	24.0	24	7
VII.	Boston	1.61	— .17	.43	25	17	60.2	13	28.5	25	4
VII.	Gainsborough	1.21	— .30	.32	25	15	63.0	13	27.0	24	3
VII.	Derby.....	2.32	+ .08	.32	7	20	58.0	21+	27.0	25	4
VIII.	Manchester	4.00	+ 1.31	.61	4	18	59.6	27	26.0	25	7
IX.	York	1.47	— .52	.29	25	15	60.0	13	28.0	25||	4
IX.	Skipton (Arncliffe)	8.19	+ 3.28	2.85	4	22	57.0	31	28.0	25	2
X.	North Shields	1.14	— 1.21	.32	22	13	58.5	13	27.0	25	4
X.	Borrowdale (Seathwaite).....	27.24	+ 13.84	4.13	13	25	...	...	...	...	...
XI.	Cardiff (Town Hall).....	...	...	...	...	...	...	...	...	...	...
XI.	Haverfordwest	3.03	— .42	.72	11	16	56.5	26	30.0	29	2
XI.	Rhayader (Cefnfaes).....	4.21	+ .37	.90	10	21	58.0	...	26.0	...	...
XI.	Llandudno	3.26	+ 1.00	.50	22	18	58.0	30	32.0	25	0
XII.	Dumfries	4.72	+ 1.74	.58	22	21	61.0	27	27.5	25	3
XII.	Hawick (Silverbut Hall).....	3.67	...	.73	4	19	...	...	...	...	...
XIV.	Ayr (Auchendrane House) ...	6.49	+ 2.76	1.04	16	24	60.0	29	26.0	24	4
XV.	Castle Toward	6.57	+ 1.98	1.01	11	24	61.0	29	25.0	24	4
XVI.	Leven (Nookton)	1.90	— .17	.41	25	14	57.0	31	26.0	25	5
XVI.	Stirling (Deanston)	4.88	+ 1.35	.76	4	21	61.0	28	24.7	25	12
XVI.	Logierait	3.67	...	.93	11	16	...	...	...	...	...
XVII.	Ballater	2.95	...	1.66	11	18	61.5	30	21.0	25	8
XVII.	Aberdeen	1.78	...	.56	11	21	62.2	31	27.4	25	8
XVIII.	Inverness (Culloden)	2.05	...	.75	26	...	58.1	13	30.3	24	2
XVIII.	Fort William	10.97	...	1.07	4	26	...	...	...	...	...
XVIII.	Portree	12.62	— 3.58	1.82	13	27	55.5	28	28.7	24	5
XVIII.	Loch Broom	5.55	...	.56	7	26	...	...	...	...	...
XIX.	Helmsdale	3.60	...	.51	2	20	...	...	...	...	...
XIX.	Sandwick	4.27	+ .94	.72	11	23	56.5	13	27.2	24	3
XX.	Cork	3.28	...	.85	10	16	...	...	...	...	...
XX.	Waterford	3.63	+ .74	.87	10	19	61.0	31	34.0	8	0
XX.	Killaloe	5.12	+ .80	.93	4	23	61.0	30‡	31.0	9	1
XXI.	Portarlington	2.71	— .60	.35	23	24	52.5	23	31.0	8	1
XXI.	Monkstown	2.10	— .48	.44	4	...	63.0	...	29.0	24	2
XXII.	Galway	5.38	...	1.28	4	25	58.0	30	37.0	7	0
XXII.	Bunninadden (Doo Castle) ...	4.24	...	.46	4	25	58.0	27||	31.0	8	2
XXIII.	Bawnboy (Owendoon)	4.81	...	.72	4	24	61.0	29	50.0	23	3
XXIII.	Waringstown	3.06	...	.45	22	22	60.0	29	27.0	23	7
XXIII.	Strabane (Leckpatrick)	4.68	...	.53	4	24	60.0	29	26.0	29	7

* And 21st & 31st. †And 27th. ‡And 31st. || And 29th. ¶And 21st
 + Shows that the fall was above the average ; — that it was below it.

METEOROLOGICAL NOTES ON THE MONTH.

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

ENGLAND.

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

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

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

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

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

BODMIN.—Very mild, and vegetation remarkably forward.

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

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

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

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

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

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

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

WALES.

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

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

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

SCOTLAND.

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

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

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

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

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

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

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

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

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

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

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

I R E L A N D.

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

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

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

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

PERIODIC HAIL BALLS.

To the Editor of the Meteorological Magazine.

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

C. O. F. CATOR.

Beckenham, March 12th.

To the Editor of the Meteorological Magazine.

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

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

THOS. PAULIN.

Winchmore Hill, April 1st.

To the Editor of the Meteorological Magazine.

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

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

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

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

G. WARREN.

Cambridge.

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