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THREE DAYS ON THE TOP OF MONT BLANC.

(Abridged from *La Nature*, of September 10th, 1887).

IT is somewhat late to refer to an expedition carried out in July 1887, but both as regards Meteorology and Physiology, it was of considerable importance.

Our readers know something (not perhaps as much as they should do) of the remarkable series of self-recording meteorological instruments invented and constructed by MM. Richard Frères, of Paris. M. J. Vallot, a member of the Alpine Club, conceived the bold idea of establishing three series of these self-recording instruments in proper screens, one at Chamounix (3,445 ft.), one at the Grands Mulets (10,007 ft.) and one on the summit of Mont Blanc (15,781 ft.), and he not only did this, but much more—as will subsequently appear.

We pass over all preliminaries, though they can neither have been few nor unimportant, and come to July 27th, 1887, when the Chamounix instruments were all in position under the care of M. H. Vallot, who had also a series of instruments for direct observation each hour. The two observers for the summit M. J. Vallot and M. F. M. Richard, (of the firm of Richard Frères) were ready, the baggage, tent, and instruments weighing nearly a quarter of a ton—all which had to be carried up to the Grands Mulets, and very nearly all of which had to be taken up to the summit; no fewer than 24 guides were therefore necessary—indeed, it was asserted at Chamounix that to take all the baggage to the top and to spend three days up there was impossible.

However, the party started at noon on July 27th, reached the Grands Mulets at 10 p.m., went to sleep at 11 p.m., rose on 28th at 3 a.m., and reached the Grand Plateau at 7 a.m., where they rested awhile, but finally reached the summit at 3 p.m. All the guides but two started immediately to return, leaving M.M. Vallot and Richard and the two guides on the summit with all the boxes and baggage deposited on the snow. M. Richard and the two guides began to put up the tent, but soon found themselves exhausted, the former as well as M. Vallot suffering from head-ache and exhaustion. Then

they melted some snow, and with the snow-water and a spirit lamp made some soup, and with boxes for pillows went to sleep. M. Vallot, however, soon recovered, and began erecting the apparatus, but the cold soon drove him into the tent, and everybody, though shivering with cold, went to sleep. About 1 a.m. M. Richard awoke, and fearing that they might all be choked for want of ventilation, they decided on leaving a small opening, and lighting a lantern, supposing that the carbonic acid would cause it to go out before there was serious danger to life. The precaution was needless, as a strong wind arose, and at the same time ventilated the tent, and nearly froze the occupants, and well it might, for when daylight came they found that the minimum on the snow had been $2\frac{1}{2}$ degrees below zero Fahrenheit, *i.e.*, $34\frac{1}{2}$ degrees below freezing.

On the morning of 29th, all four residents were in better health, but M. Richard and Payot (one of the guides) had violent head aches, their pulses beat as if they were in high fever, and the least exertion so fatigued them that they had to go into the tent to sit or lie down. Hourly observations were made regularly all day, synchronously with those at Chamounix, and they had also the variety of a visitor, Baron Munch, who, having come up from Courmayeur, was naturally very much astonished to find an observatory and hot soup on the top of Mont Blanc. Night closed in and passed less painfully than the previous one.

The 30th was again wholly devoted to observations. The party had no appetite and took little except soup with cheese crumbled in it, and hot coffee. This day they had two visitors, one an English tourist, the other a jackdaw, which the guides said was a sign of fine weather. It did not prove so. About 2 p.m. clouds gathered in the valleys, then it began to thunder, and to blow so hard that at 4 p.m. they were driven into the tent. The first idea was to start downwards, but much must have been left behind, so they tightened the tent and heaped up snow to protect it. During the evening M. Vallot took diagrams of the pulses of all the party, and made other physiological observations, which were especially valuable considering the time that all had been on the summit. On going out about 9 p.m., he found himself in an electric cloud, with faint St. Elmo's fire. The storm ceased about 2 a.m., and all slept quietly.

The 31st had been fixed for the return, the hourly observations were continued until 9 a.m., then the greater part of the apparatus was stowed in the tent, a last look was given to the self-recording instruments, and the party was ready to descend, but Payot was so unwell with head ache and fever, that at first it seemed as if a sledge must be made for him, however he rallied, and finally at 7 p.m. all returned safe to Chamounix, having been absent 103 hours, of which 68 had been spent on the summit.

The recording instruments at Chamounix and Grands Mulets were the usual ones constructed to run a week without touching, but those on the summit were made to run 15 days, as ascents are

not always possible even in summer. Subsequently when M. Vallot went up to wind the instruments and put on fresh papers, Madame Vallot went with him.

We have not yet seen any account of the records obtained; when we do, we shall have pleasure in bringing them to the notice of our readers. It is not every day that one can find a man like M. Vallot, willing to defray the cost, and to bear the hardships, of three nights on Mont Blanc.

SOCIÉTÉ MÉTÉOROLOGIQUE DE FRANCE.

PRESIDENTIAL ADDRESS BY M. E. RENOU

GENTLEMEN,—The Meteorological Society of France has just elected me President for the year, I thank you heartily, you have rewarded my devotion to the science which we all love. It is the third time that I have had this honour; the first was in 1858, when our Society was still young, in fact it dates from 1853. In 1852, some eminent men joined in drawing up a circular proposing the formation of the Society and inviting members, of those who signed that invitation, one alone is still with us, M. d'Abbadie; of the 148 who responded to the invitation, 10 only remain.

I will not trace the history of the Society, that has been done by M. Berigny, but it will not be inappropriate to consider what was the state of meteorology then, what it is now, and what it ought to be.

Four years before our Society was organized, a small group of devoted men had collected observations and published four annual volumes which served as models for our own. At that date there were few stations, and owing to the absence of any instructions, and of any supervision the observations were not made under favourable conditions. The thermometers, seldom exact, were all exposed at windows, and therefore could give only erroneous results, the barometers scarcely ever accurate, contained air, and the attached thermometers had rarely been verified. The rain gauges were of all patterns, most of them on roofs, and only collecting part of the snow. The vanes, heavy and inaccurate. The state of the weather only vaguely stated, and no definition of fog, so that little could be gathered from the registers; no definition of what constituted a "rainy day," so that of two observers in the same town, one would report twice as many days as the other.

This is by no means an exaggerated sketch of the state of things 36 years since.

This state of things impressed me from the first, naturally disinclined to accept any thing which was not proved, simply because it always had been, and having a natural antipathy to "about," I devoted all my care to the improvement of observations, and I have demonstrated that meteorology is capable of the same precision as other sciences.

Soon after our Society was founded, weather forecasting attracted

much attention, and with that object efforts were made to cover France with a multitude of stations at a cost little exceeding that of the instruments, and as 1-1000ths of an inch of mercury, and 1-10ths of a degree of temperature are needless for weather forecasting, precision was not aimed at, but it was hoped that the observations would gradually improve, and that eventually accurate climatological data would be obtained.

This was a great mistake. I have always held that nothing would be learned this way, and the result has confirmed my opinion.

Weather forecasting itself has not achieved a very great success, but this is not from want of accuracy in the observations utilized, but rather from the limited area whence reports are received, and deficient rapidity in the despatches. The heads of the services in each country should be in direct and prompt communication, and then bad weather could always be announced. But we ought first to have records from Central Africa, Senegal, the Azores, and America. It will be long before we obtain these valuable helps.

As regards precise, complete, accurate meteorology from 20 to 25 meteorological observatories are needed in France. Then we can utilize volunteers, and establish a great number of secondary stations for the study of the rainfall, storms, snow-storms, inundations, &c., it is also necessary to have mountain stations among which the chief should be Mont Blanc. Nothing is easier than to have at the top of such a mountain an observatory of which the records should be automatically transmitted to the base, and there recorded. It is solely a question of money.

I have often been asked why frequent, and hourly observations are required. They enable us to solve all kinds of questions. They enable comparisons to be made with stations at which observations can be made only three or four times a day, that is especially needed in comparisons with countries far E., or far W., of France. Hourly readings coupled with the sheets from self-recording instruments give us all the details of meteorological phenomena. Is it not painful to see in the records of the Observatory, that many important phenomena are not even mentioned, because they did not occur at the regular hour for observations. In legal cases one of the first things asked a witness is often, "What was the weather?" If our records are vague and incomplete, how can we state what it was at a certain hour on a given day. I have often had to give evidence of this kind.

If in France, proper meteorological arrangements, especially as to thermometer stands have been adopted, it is not so in other countries where the best pattern of stand is still being discussed, whereas in France it is settled. We hope that the Congress to be held in Paris this summer will have the advantage of bringing foreign observers to see us; they will be able to see how the Observatory of Parc St. Maur is organized, and can ascertain for themselves how far we have advanced in the determination of all the phenomena which are dealt with by meteorologists.

REVIEWS.

Results of Meteorological Observations made in New South Wales during 1886, *under the direction of* H. C. RUSSELL, B.A., F.R.S., Government Astronomer. Charles Potter, Sydney, 1888. 8vo., 186+192 pages, and 15 diagrams.

Results of Rain, River, and Evaporation Observations made in New South Wales during 1887. By H. C. RUSSELL, B.A., F.R.S, 8vo., 100 pages and 3 large maps.

SERIAL publications on Meteorology are so numerous, that it is impossible for us to notice a tithe of them; the only thing to do is to take sometimes one, sometimes another, and so keep our readers acquainted with what is going on.

There are few colonies where better work is being done than in New South Wales. We are not sure that we may not take the steady growth of the meteorological system there, and the very large amount of accurate work published by Mr. Russell, as evidence of the goodness of the climate. It may be that the Colony is wise enough to give him a good staff of assistants; and then good training and a good system will produce a good output of work, provided the head knows what is to be done, and does not waste the mental power placed at his disposal. But there is more than quantity and quality in Mr. Russell's work, there is originality and solidarity, and it seems to us that we can trace in his work the difference between sunny Sydney and, shall we say, foggy London.

It is some years since we last noticed these reports, and the two now before us are substantial evidence of the development of the organization throughout the Colony, for Mr. Russell has now 866 stations, and (most wonderful of all, for it shows how populous the Colony is becoming,) there is only *one square degree* (*i.e.*, 29° to 30° S., and 142° to 143° E.,) *without a rain gauge station.* This is progress indeed, and if we do not secure some fresh observers in Sutherland, we shall have the New South Wales people beating us.

Mr. Russell has for many years given much attention to evaporation, and is now spreading observations of this important element, not broadcast over the Colony, but at typical stations.

It is rather curious that each of three directors of Sydney Observatory designed an evaporator.

Mr. Scott's was the first; a cylindrical glass standing on the ground, about 8 inches high and 8 inches in diameter, containing usually about 6 inches of water. Read by a vernier and ivory point.

Mr. Smalley followed with a tin vessel painted white, standing on the ground, 1 foot high, 8 inches in diameter, and usually containing about 8 inches of water. Amount of evaporation determined by weighing, vessel and contents each day.

Lastly came Mr. Russell's of galvanized iron, 2 ft. 6 in. deep, 4 ft. in diameter, sunk 2 ft. 4 in. in the ground. Read by float and finely divided scale.

It is easy to see that the water in both Scott's and Smalley's would heat far too much if, as we suppose, they were exposed to sun and air. In fact, this seems proved in two ways, first by the very much larger amount which they indicated as compared with Russell's, and secondly, by the fact that their excess over Russell's was roughly proportional to temperature. The nine years 1871-79 give the following values :—

	Evaporation.	
	Inches.	Ratio.
Scott	49·22	156
Smalley	54·83	173
Russell	31·69	100

And this helps us out of a puzzle of which we could not at first guess the solution. At several of the second order stations the amount of evaporation is given, and is followed by the following note, "Evaporation from a bucket, if it is reduced 35 per cent., it equals that from a tank." Now "a bucket" is a bucket all the world over, but a tank—well the name is applied to bodies of water of from 100 to 100,000 gallons or more. Moreover, "a bucket" implies a handle and sloping sides, and is altogether somewhat unscientific. Yet after all the note put into scientific phraseology should, we believe, be, "Evaporation by Smalley's evaporator, if it is reduced 35 per cent., it equals that from Russell's." If we take our nine year means as above, Smalley 54·83 in., Russell 31·69 in., and apply this rule to the value given by Smalley's instrument.

$$\left(\frac{54{\cdot}83}{100} \times 35\right) = \begin{array}{rl} \text{then} & 54{\cdot}83 \\ - & 19{\cdot}19 \\ \hline & 34{\cdot}64 \end{array}$$

the 35 per cent. would therefore be rather too small, 43 per cent would be the value for our nine years, but doubtless Mr. Russell has good grounds for adopting 35.

It is well known to be wrong to speak disrespectfully of the Equator; we certainly have no reverence for Smalley's evaporator, but it does seem rather hard to call it "a bucket," however much it may resemble one.

Another subject to which Mr. Russell gives special attention is that of underground temperature. The mean values for 1866 were—

Shade temp.	1 in. deep.	2 ft. 6 in. deep.	5 feet deep.	10 feet deep.	19 ft. deep.
63·5	62·7	64·3	64·1	64·0	65·8

As regards this last value, we regret that (we believe) the system of earth thermometers adopted at Sydney does not admit of the thermometers being withdrawn for verification, because we believe that in December, 1886, this thermometer was quite 1½ degrees too high. We have not the volume for 1881, but we think that the value for that year should be 62°·6; if so, it appears that for some

unknown reason that thermometer, which remained steady from 1870 to 1881, has since then risen 0°·4 per annum. We do not want to load this notice with figures, and therefore do not insert the data which have led to this conclusion, being quite sure that it is sufficient to call Mr. Russell's attention to it. The change may be real, may be due to some drainage scheme, or railway cutting for aught we can tell, but there is certainly some change going on at 19 ft. which is not felt at 5 ft. or at 10 ft.

One more grumble. Mr. Russell's work is so good that there is no fear of our conveying any false impression as to our estimate of it, and we can therefore indulge in grumbles without any risk of being misunderstood. But why, oh why, does he print such a remark as this, "A shock of earthquake lasting 2″." Mr. Russell is one of the first astronomers of the day, and yet he prints 2″ (for two seconds of time) as if it were either 2 inches, or 2 seconds of arc. He might evidently, with truth, reply that the word "lasting" proves that " must be indicative of time, and not of either arc or length; but in all probability he will agree with us that while it is bad to use the same symbol for seconds of arc and for inches, it is needless to use it also for time where "s" is the recognized symbol.

And now having found all the fault that we can, let us conclude by congratulating Mr. Russell on the excellency of his organization, the Colony on having so able a director, and the world on the mass of valuable information gradually being stored in that distant Colony.

Ueber eine nahezu 26-tägige Periodicität der Gewittererscheinungen. VON W. VON BEZOLD. [Excerpt Sitzungsb. der K. Preussischen Akad. d. Wis.]. 1888. 8vo. 10 pages.

Prof. von Bezold points out that the magnetism of the earth has a periodicity of about 26 days, corresponding therefore closely with that of the rotation of the sun on its axis.

Considering the intimate relation which exists between magnetism and electricity, Prof. von Bezold has tabulated the returns of thunderstorms in Bavaria and in Wurtemburg for eight and seven consecutive years respectively, in order to see if these values showed any analogous periodicity. There is no doubt that they do, and it is therefore obviously desirable that a similar investigation should be made in other parts of the world.

THE FOG, AND GAS CONSUMPTION.

THE *Gas World* gives some figures regarding the quantity of gas sent out by the Gas Light and Coke Company during the recent foggy weather. On Monday December 31st, when the fog was very bad, the output reached the highest point ever recorded, viz., 105,046,000 c. ft. On the correspondiug day of last year the output was only 79,978,000 c. ft. The increase is thus at the rate of 23·86 per cent. In the course of the week ended the 7th inst., the output was 627,317,000 c. ft., as against 512,943,000 c. ft. for the corresponding week of 1888, or an increase of 18·23 per cent. The Gas Light and Coke Company has always been prepared to meet a demand for gas, ranging from 50,000,000 to 105,000,000 c. ft. per day. The general public accept the friendly aid of the gas lamps on a foggy day, but they never give a thought to the enormous labour and expense involved in the production of the gas required. They take it as a matter of course, and would no doubt make a great outcry were it withdrawn even for a minute.

Yes, quite true from the manufacturer's point of view. But there are two sides to most things. The Company up to the above date charged 2s. 9d. per 1,000 cubic feet, therefore on December 31st, they charged £14,443 16s. 0d. (about 360,000 francs) for the gas they supplied, and this was £3,446 17s. 0d., more than on the corresponding day of the previous year. Allowing the odd £446 17s. 0d., for natural growth, we have an extra payment to one gas company for one days fog of £3,000. Add to that payments to other companies; extra electric lighting, lamps, &c., the cost of damaged goods, damaged vehicles, damaged health, and surely for London alone we may put the cost of that one day's fog, at from £6,000 to 10,000. And though that was the worst, we have had quite twenty bad ones—take each of these as only half as bad, and we get a total damage of from £60,000 to £100,000, irrespective of the enormous amount of money taken out of the country by those who rush to the Riviera to escape them, and the thousands kept out of the country by those who do not care to visit us during our foggy season, and we are sure that £120,000 is the minimum damage. And yet not a sixpence is forthcoming to try the experiment mentioned in our last. We are not electricians, and do not for a moment assert that anything can be done—but it does seem strange that with such vast amounts at stake, we drift on without even trying if anything can be done. Suppose £100 or £1,000 was "thrown away" in experiments what would it represent. Six hours fog!—ED. *M.M.*]

ROYAL METEOROLOGICAL SOCIETY.

THE anniversary meeting was held on January 16th, at the Institution of Civil Engineers, 25, Great George Street, Westminster, Dr. W. Marcet, F.R.S., President, in the chair. Mr. Maxwell Hall, Mr. G. T. Livesey, M.Inst.C.E., Mr. E. W. Priestlay, B.Sc., Mr. J. Radcliffe, and Rev. J. R. Stratton, were elected Fellows of the Society.

The Report of the Council showed that a large amount of work had been done during the past year, and considerable progress made in the investigation of one of the most interesting and hitherto somewhat neglected branches of meteorology—viz., thunderstorms. Forty-nine new Fellows were elected last year, the total number on the books now being 535.

After the Report had been adopted, the President delivered an address on "Fogs," which he illustrated by a number of interesting lantern slides. He considered fogs and clouds as one and the same, and that a cloud is a fog when entered into, and a fog seen from a distance, suspended in the air, becomes a cloud. After describing the various kinds of fog—*e.g.*, river, sea, Newfoundland, radiation, town, &c., fogs—Dr. Marcet referred to London fogs. Dr. Tyndall has accounted for them by assuming each particle of condensed vapour to be covered by coal smoke. These fogs usually accompany a high barometer, and are frequently dry in their character. It is a well-known fact that cold air on the tops of hills being heavier than the air below, slides down the slopes, so that the lower parts of hill sides are actually colder than the plains at some distance from the hills. Now London, in the Thames valley, may be regarded as surrounded by hills—to the north, Highgate, Hampstead, and Harrow; in a westerly direction, Putney and Wimbledon; and in a more southerly direction, Clapham and Sydenham. The air is colder on these hills than in London with its millions of inhabitants, its coal fires and factories, hence it is heavier and will have a great tendency to slide down towards the town and the river. Should the air in town be on the point of saturation, and the cold air from above saturated with vapour, it is obvious that the increased cold from above will produce a precipitation of moisture, and it will come to pass that a fog is produced. If the hill tops be not only colder than the air below, but enveloped in a fog, it stands to reason that the fog below will be all the denser, and especially in the neighbourhood of water, such as the River Thames and the ornamental waters in the parks.

The Officers and Council for the ensuing year were then elected, and the meeting adjourned.

THUNDERSTORM ON FEBRUARY 2ND.

To the Editor of the Meteorological Magazine.

SIR,—On the 2nd inst., at 7.30 p.m., there occurred at this place a thunderstorm of short duration. There were three very bright flashes of lightning, with intervals of about one minute between consecutive flashes, which were followed in each case one second later by a loud clap of thunder. It may be noted that after a long interval of solar inactivity, sun spots, although very minute, have been visible since the beginning of this month.

Yours obediently,
J. PARNELL.

Hadham House, Upper Clapton, E.
February 5th, 1889.

GLOBULAR LIGHTNING.

To the Editor of the Electrician.

SIR,—This evening at 7.35 p.m. a fireball about two metres in diameter fell in the direction of Stamford-hill, N. At the same time a fearful explosion took place, lasting some two seconds, and the globe of fire seemed to split into four quarters. showing a bluish fiery light. The explosion was unlike thunder, and was more like a detonation of explosives. A snowstorm of two minutes' duration ensued, leaving $1\frac{1}{2}$ in. of snow on the ground; after which the atmosphere became splendidly clear. It would be interesting to know if this phenomenon has been observed by others in this neighbourhood, and under what conditions. The wind was W.N.W., sky cloudy, and the thermometer stood at 38° F.—Yours, &c.,
ERNST FAHRIG.

Listria Park, Stamford-hill, Feb. 2.

RAINFALL AT HELIGOLAND.

Dr. Hellman recently worked up the observations on the rainfall of Heligoland, and obtained the mean annual rainfall of 72·50 inches, far exceeding the quantity observed at any of the stations on the west coast of Sleswick or the mouth of the Elbe. He explains this excessive rainfall by the circumstance that the steep coast, rising almost perpendicularly to the height of 164 feet above the level of the sea, forced the moist sea winds suddenly upwards, and so caused them to condense very rapidly.—*Athenæum.*

THE OLD BAROMETER IN SALISBURY CATHEDRAL.

Some years since a discussion arose as to when and why the word "Change" on barometers was put against 29½ inches instead of against 30, which is much nearer the real mean pressure. We do not remember that any satisfactory reply was given.

Last autumn we saw in the vestry of Salisbury Cathedral an extremely old barometer—we do not know either the maker or the date—but we will revert to these after giving the barometric scale, which seems designed on the one side for mild, on the other for severe, weather.

Fair if Mercury Rises.		Foul if Mercury Falls.
Very Dry.....	31	Hard Frost
Set Fair	30·5	Set Frost
Fair	30	Frost
Change	29·5	able
Rain	29	Snow
Much Rain	28·5	Much Snow
Stormy	28	weather

It is provided with an attached thermometer, and this gives us a rough guide as to date. The scale is a curious one; it reads *downwards* from a point called "Extreme hot." But we give the lettering:—

Extreme hot	0
Sultry	15
Hot	25
Warm air.....	35
Temperate air.....	45
Cold air	55
Frost.....	65
Hard frost	75
Extreme cold	90

An Immisch thermometer placed beside it read 52° when the above thermometer was at 36°.

Now this scale is the one first used in this country, being "made (and commonly very carelessly made) after the standard one kept in the Royal Society,"* and as Fahrenheit's scale was, we believe, in general use by 1730, it seems probable that this Salisbury barometer is at least 160 years, and (considering the history of barometers) not more than 190 years old.

This would carry the placing of the word "Change" opposite 29½ inches back to between 1700 and 1730. Can anyone complete the inquiry?

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* Martine, G., M.D. "Essays on the Construction and Graduation of Thermometers." 2nd Edition. Edinburgh, 1772, page 45.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JULY, 1888.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		0–10
England, London	72·7	19	42·8	11	67·1	52·3	52·4	82	120·2	41·6	4·91	26	7·7
Malta	102·8	10	63·6	4	89·0	70·8	65·5	65	154·7	56·0	·00	...	0·7
Cape of Good Hope.	67·0	25	35·5	19	59·6	45·7	...	...	...	...	3·77	12	5·4
Mauritius	77·0	7	56·7	18	74·7	63·5	59·4	74	123·0	47·3	1·50	19	4·7
Calcutta	92·5	16*a*	75·2	31	87·9	78·3	77·8	83	158·5	74·3	12·25	24	9·1
Bombay	87·5	12	73·3	14	84·6	77·8	76·8	86	142·0	70·9	22·47	28	9·5
Ceylon, Colombo	87·4	17	75·6	25	85·9	77·7	72·0	76	143·0	72·2	·98	6	5·8
Melbourne	64·2	1	28·3	27	55·4	41·8	41·2	76	113·4	20·9	1·51	15	6·2
Adelaide	62·3	6	39·7	21	58·2	46·8	46·1	79	119·4	33·5	4·04	26	6·6
Wellington	...	...	...	...	...	...	...	...	...	...	...	...	...
Auckland	61·5	25	40·0	19, 30	57·4	46·3	45·4	79	115·0	29·0	3·85	20	6·6
Jamaica, Kingston	94·6	28	70·8	24	90·9	74·2	74·3	73	...	...	1·88	...	...
Barbados	86·0	14*b*	70·0	2, 18*c*	83·0	73·0	74·0	85	...	...	...	...	6·0
Toronto	87·7	4	47·3	13	76·6	55·7	53·9	65	...	40·2	·86	9	5·0
New Brunswick, Fredericton	85·7	5	42·0	2	75·7	52·4	54·7	68	...	...	2·12	16	6·2
Manitoba, Winnipeg	91·0	28	43·3	7	78·2	53·4	56·2	73	...	...	3·78	13	4 1
British Columbia, Victoria	85·0	17	37·0	7	70·7	46·7	...	...	...	...	·34	5	..

a And 18. *b* And 15. *c* And 19, 20.

REMARKS, JULY, 1888.

MALTA.—Mean temp. 78·7; mean hourly velocity of wind 7·9 miles. Sea temp rose from 76°·0 to 82°·8. Temp. in shade above 100° on 3 days. J. SCOLES.

Mauritius.—Mean temp. of air 0°·1 below, mean dew point 0°·1 above, and R ·88 in. below, their respective averages. Mean hourly velocity of wind 11·0 miles, or 0·6 below average; extremes 29·0 miles on 26th and 2·4 on 25th. Prevailing direction E.S.E. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 0°·8 above average; dew point 0°·2, humidity 4, mean amount of cloud 0·1, pressure ·092 in., and R ·22 in. below average. Prevailing winds N. and N.W.; strong on 12 days. Heavy dew on 7 days. Ice on 2 days. Dense fog on morning of 6th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean pressure ·054 below the average of 31 years. Mean temp. 0°·8 and rainfall 1·50 in. above average. C. TODD.

Auckland.—Finer and more moderate than usual for July, with very little wind. Rainfall 1·00 in. below the average of 21 years. Mean temp. and pressure close to the average. T. F. CHEESEMAN.

BARBADOS.—Mean temp. (77°·2), 0°·5 above the average. Mean hourly velocity of wind 2 miles below the 15 years' average. Rainfall a trifle above the average. Evaporation 15 per cent. below the average. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, JANUARY, 1889.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	1·52	XI.	Castle Malgwyn	2·14
,,	Margate, Birchington...	·74	,,	Rhayader, Nantgwillt..	2·65
,,	Littlehampton	·95	,,	Carno, Tybrith	2·18
,,	Hailsham	1·14	,,	Corwen, Rhug	1·53
,,	Ryde, Thornbrough	1·13	,,	Port Madoc	2·64
,,	Alton, Ashdell.....	1·27	,,	I. of Man, Douglas	2·46
III.	Oxford, Magdalen Col...	·66	XII.	Stoneykirk, Ardwell Ho.	2·68
,,	Banbury, Bloxham	·64	,,	New Galloway, Glenlee	4·55
,,	Northampton	·78	,,	Melrose, Abbey Gate...	·66
,,	Cambridge, Beech Ho...	·71	XIII.	N. Esk Res. [Penicuick]	1·30
,,	Wisbech, Bank House..	·91	XIV.	Ballantrae, Glendrishaig	3·96
IV.	Southend	1·04	,,	Glasgow, Queen's Park.	2·04
,,	Harlow, Sheering	·61	XV.	Islay, Gruinart School..	6·21
,,	Rendlesham Hall	·77	XVI.	Dollar.....	2·54
,,	Diss	·91	,,	St. Andrews, Pilmour Cot	1·03
,,	Swaffham	·74	,,	Balquhidder, Stronvar..	7·30
V.	Salisbury, Alderbury...	·71	,,	Dunkeld, Inver Braan..	2·46
,,	Warminster	·72	,,	Dalnaspidal H.R.S. ...	4·84
,,	Bishop's Cannings	·84	XVII.	Keith H.R.S.	1·14
,,	Ashburton, Holne Vic....	2·49	,,	Forres H.R.S.	·51
,,	Hatherleigh, Winsford.	2·81	XVIII.	Strome Ferry H.R.S....	5·85
,,	Lynmouth, Glenthorne.	1·97	,,	Fearn, Lower Pitkerrie.	·81
,,	Probus, Lamellyn	2·63	,,	Loch Shiel, Glenaladale	12·83
,,	Launceston, S. Petherwin	1·94	,,	N. Uist. Loch Maddy ...	4·73
,,	Wincanton, Stowell Rec.	·90	,,	Invergarry	6·49
,,	Taunton, Lydeard Ho...	·86	,,	Loch Ness, Drumnadrochit	1·94
,,	Wells, Westbury.....	·54	XIX.	Lairg H.R.S.	...
VI.	Bristol, Clifton	·84	,,	Forsinard H.R.S.	..
,,	Ross	·84	,,	Watten H.R.S.	1·45
,,	Wem, Clive Vicarage ...	·39	XX.	Dunmanway, Coolkelure	7·12
,,	Cheadle, The Heath Ho.	·97	,,	Fermoy, Gas Works ...	2·94
,,	Worcester, Diglis Lock	·56	,,	Tipperary, Henry Street	3·03
,,	Coventry, Coundon	1·06	,,	Limerick, Kilcornan ...	2·46
VII.	Ketton Hall [Stamford]	1·39	,,	Miltown Malbay.....	4·27
,,	Grantham, Stainby	1·56	XXI.	Gorey, Courtown House	2·34
,,	Horncastle, Bucknall ...	1·21	,,	Navan, Balrath	3·21
,,	Mansfield, St. John's St.	1·32	,,	Mullingar, Belvedere ...	1·82
VIII.	Neston, Hinderton	·55	,,	Athlone, Twyford	2·48
,,	Knutsford, Heathside ...	1·19	,,	Longford, Currygrane...	3·06
,,	Lancaster, South Road.	2·49	XXII.	Galway, Queen's Coll...	3·52
,,	Broughton-in-Furness ..	3·39	,,	Clifden, Kylemore	8·10
IX.	Wakefield Prison	1·22	,,	Crossmolina, Enniscoe..	4·36
,,	Ripon, Mickley	·98	,,	Collooney, Markree Obs.	3·40
,,	Scarborough, West Bank	1·15	,,	Ballinamore, Lawderdale	...
,,	East Layton [Darlington]	·67	XXIII.	Warrenpoint	4·53
,,	Middleton, Mickleton ..	1·32	,,	Seaforde	2·57
X.	Haltwhistle, Unthank..	1·29	,,	Belfast, New Barnsley .	3·39
,,	Shap, Copy Hill	3·13	,,	Bushmills, Dundarave...	2·78
XI.	Llanfrechfa Grange	1·68	,,	Stewartstown	2·64
,,	Llandovery	3·05	,,	Buncrana	2·79

JANUARY, 1889.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average. 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE Max. Deg.	Date	Min. Deg	Date.	No. of Nights below 32°. In shade.	On grass
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	·81	— 1·54	·19	12	10	53·1	31	22·0	7	11	22
II.		Maidstone (Hunton Court)...	·93	— 1·64	·38	9	8	...	...	...	...	...	...
,,		Strathfield Turgiss	·80	— 1·75	·40	9	11	50·1	18	19·0	6	20	24
III.		Hitchin	·92	— 1·30	·28	9	14	52·0	31	19·0	5	12	...
,,		Winslow (Addington)	·99	— 1·56	·30	9	12	52·0	31	16·0	6	19	24
IV.		Bury St. Edmunds (Culford)	·60	— 1·24	·35	13	...	46·0	25	12·0	6	...	25
,,		Norwich (Cossey)	·78	— ·92	·20	11	10	...	...	...	...	10	18
V.		Weymouth(LangtonHerring)	·68	...	·26	9	11	51·0	31	30·0	2, 6	10	...
,,		Barnstaple	1·19	— 3·07	·30	9	8	53·0	19*a*	24·0	4	...	...
,,		Bodmin	2·89	— 3·62	·80	11	15	50·0	29	30·0	3,4,6	7	15
VI.		Stroud (Upfield)	·80	— 2·19	·25	9	15	52·0	29*b*	22·0	3	17	...
,,		ChurchStretton(Woolstaston)	·66	— 2·77	·18	9	16	52·5	18*c*	20·0	6	15	24
,,		Tenbury (Orleton)	·59	— 2·40	·24	8	11	54·0	18*c*	19·3	4	16	19
VII.		Leicester (Barkby)	1·42	— ·58	·51	9	15	54·0	31	19·0	3	21	26
,,		Boston	·97	— ·75	·24	10	10	50·0	28	15·0	6	18	..
,,		Hesley Hall [Tickhill].....	1·58	...	·70	9	13	54·0	31	16·0	6	16	...
VIII.		Manchester (Ardwick).....	1·22	— 2·02	·32	31	11	56·0	18*c*	30·0	1	5	...
IX.		Wetherby (Ribston Hall) ...	·99	— 1·23	·34	10	10	...	...	...	...	...	...
,,		Skipton (Arncliffe)	3·25	— 3·68	1·18	29	16	...	...	...	...	...	...
,,		Hull (People's Park)	1·38	— ·53	·69	9	13	...	...	...	...	...	...
X.		North Shields	1·20	— ·64	·35	9	13	56·5	31	26·0	27	13	16
,,		Borrowdale (Seathwaite).....	12·36	— 6·39	3·10	29	16	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	1·89	— 2·82	·73	9	10	...	...	...	...	...	...
,,		Haverfordwest	2·65	— 3·62	·49	28	21	51·4	29	23·6	2	12	20
,,		Plinlimmon (Cwmsymlog) ...	3·35	...	1·03	9	11	...	...	...	...	...	...
,,		Llandudno.....	1·21	— 1·75	·39	9	15	53·9	29	31·2	7, 27	2	...
XII.	SCOTLAND.	Cargen [Dumfries]	2·62	— 3·49	·64	28	14	53·6	31	22·8	27	8	...
,,		Jedburgh (Sunnyside).....	·54	— 1·51	·13	9	11	52·0	18*c*	23·0	27	13	...
XIV.		Old Cumnock	3·14	— 1·50	·59	28	14	53·0	18	20·0	26	10	...
XV.		Lochgilphead (Kilmory).....	8·47	+ ·60	1·24	8	21	...	...	...	...	..	...
,,		Oban (Craigvarren)	5·87	...	1·08	17	23	53·6	17	29·6	27	3	...
,,		Mull (Quinish).....	7·68	...	1·17	15	21	...	...	...	...	...	...
XVI.		Loch Leven Sluices	1·80	— 2·02	·50	18	8	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	1·20	— 1·25	·40	8	11	57·6	31	23·7	2	11	...
XVII.		Braemar	1·68	— 1·10	·50	8	18	53·3	18	19·3	2	12	28
,,		Aberdeen (Cranford)	...	...	...	...	...	...	...	...	...	...	..
XVIII		Lochbroom	3·45	...	·69	18	18	...	...	...	...	...	...
,,		Culloden	2·80	— 1·49	...	...	...	55·0	18	30·0	2*e*	9	21
XIX.		Dunrobin	1·53	...	·40	9	9	58·0	18	28·0	2	10	...
,,		S. Ronaldsay (Roeberry).....	2·37	— ·47	·34	15	22	...	...	...	...	...	..
XX.	IRELAND.	Cork (Blackrock)	3·40	— 2·62	1·17	15	12	61·0	31	26·0	2	8	...
,,		Dromore Castle	7·28	...	1·36	15	14	54·0	30	28·0	15	...	...
,,		Waterford (Brook Lodge) ...	2·51	...	·86	11	13	58·0	31	23·0	3	6	...
,,		O'Briensbridge (Ross)	3·17	...	·67	11	17	54·0	31	25·0	3	...	11
XXI.		Carlow (Browne's Hill)	2·36	— 1·26	·58	11	22	...	...	...	..	...	...
,,		Dublin (FitzWilliam Square)	2·21	— ·05	1·22	11	16	56·2	18	27·1	3	3	16
XXII.		Ballinasloe	2·94	— 1·42	·74	11	23	51·0	31	21·0	2	13	...
XXIII		Waringstown	1·97	— 1·44	·47	8	20	54·0	17*d*	24·0	2,26	13	18
,,		Londonderry (Creggan Res.).	3·27	...	·48	16	25	...	...	...	...	...	...
,,		Omagh (Edenfel)	3·37	— ·40	·75	11	22	53·0	17	25·0	1	8	12

a And 29, 30. *b* And 30. *c* And 31. *d* And 18, 31. *e* And 7, 11, 27.
+ Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON JANUARY, 1889.

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

ENGLAND.

STRATHFIELD TURGISS.—The greater part of the month was mild and free from storms of any serious kind. Agricultural matters were in a very satisfactory condition, and owners of breeding flocks have good reason, so far, to congratulate themselves upon such a favourable season.

WINSLOW, ADDINGTON.—From the first until the 8th very sharp frost prevailed, the max. temp on 5th and 6th being 24° and 25° respectively. Fog was very dense on several days and the trees were beautifully covered with rime. During the remainder of the month there were frequent slight frosts, but none severe. The last day of the month was very mild, max. temp. 52°.

WEYMOUTH, LANGTON HERRING.—On the whole a very fine month; there were a few foggy days and on several a little rain fell, but the total was 2·46 in. below the average. Mean temp. 38°·4, 0°·9 below the average of 17 years. The 5th, 11th, 13th, 14th, and 15th were more or less foggy, but on no day was the fog dense. The month was very calm, no storm occurring.

BODMIN.—A mild month, with high pressure. Mean temp. 39°·5.

UPFIELD, STROUD.—Fog on four days, with an unusual amount of rime. S.W. gale on 29th.

WOOLSTASTON.—An open, spring-like month, with constant slight frosts at night; gale on the 28th. Mean temp. 37°·5.

ORLETON.—A thick fog prevailed for the first seven days, during which time the sun was only visible for a few hours on the mornings of 2nd and 4th. A great rime commenced on the 3rd and lasted until the 8th. The remainder of the month was generally cloudy with occasional frosty nights. The temp. was very variable, but for the whole month the mean was only a trifle less than the average of 28 years. The bar. on the 3rd stood at 30·50, but on the 9th it fell to 29·12, accompanied by violent wind; afterwards it was generally very high and steady, although the sky was very changeable. The R was about two inches below the average and was smaller during the last 58 years only in 1855, 1858, and 1880. No snow fell during the month.

BARKBY.—A lovely rime upwards of an inch deep was on all the trees from 3rd to 7th, looking all the more decorative because of the contrast of the green grass; it was on the S.W. side of the branches, facing the wind. Five days' skating. Mean temp. 35°·1.

MANCHESTER.—A very mild month, with comparatively high temp. There was very little frost and no snow. Fog on the first six days.

HULL.—Fog and hoar frost prevailed during the early part of the month, but afterwards the weather was generally mild and fine, but cloudy.

WALES.

HAVERFORDWEST.—The month commenced densely foggy, with severe frost; the weather changed on the 7th, when R fell, and cold, rainy, foggy weather prevailed, with low night temp., to the end of the month. Mean temp. about the average of 25 years. Very high bar. during the first week.

SCOTLAND.

CARGEN.—The weather during the month was very changeable, and the fluctuations of pressure and temp. were on two or three occasions great and sudden. Frost never continued more than two days at a time. Mean temp. 1°·5 above the average.

JEDBURGH.—The temp. generally was high, but very variable; vegetation progressed much, especially spring flowers; a blackbird's nest with four eggs was found towards the close; agricultural work went on without intermission. The month is said by old people to be the mildest in their recollection.

OBAN, CRAIGVARREN.—An open warm month, with equable temp., growth continuing throughout; at the close only it became stormy; neither H nor S.

BRAEMAR.—A month of excellent and spring-like weather. Blackbirds heard singing on 25th.

LOCHBROOM.—Considering that January is generally the stormiest month of the year, this has been a wonderful one for openness and mildness; only on the 25th did it snow a little on the low ground, and soon melted. It was rather boisterous after the 23rd, but generally so warm that the bees were playing about their hives, and snowdrops and daisies were in full flower.

INVERNESS, CULLODEN.—The month was remarkable for the absence of R, and for high temp. Vegetation advancing rapidly.

ROEBERRY.—From the 1st up till the 18th the weather was settled and mild, but the latter part of the month was very rough and unsettled. Heavy gale from W. to N.W. on 18th.

IRELAND.

CORK.—Dull and foggy, with some frost, during the first two weeks, the remainder mostly fine and mild for the season.

DROMORE.—Weather very mild and open.

WATERFORD.—R greatly below the average. The month generally was very mild, mean temp. 40°·4.

ROSS.—No severe weather, very mild from 17th to the close, the mean temp. for that fortnight being 44°.

DUBLIN.—Open, but changeable. The mean temp., 42°·4, was 1°·1 above the average. The atmosphere was foggy on each of the first six days, and also on 22nd. High winds on eight days, reaching the force of a gale on two days, 11th and 18th. H fell on 9th and 11th, and S and sleet on 11th. Temp. exceeded 50° on eight days, compared with ten days in December, 1888, while it fell to or below 32° on only three nights, compared with five in December. The last five days of the month were chiefly mild, changeable and cloudy, and R fell frequently, although not in large quantities.

EDENFEL, OMAGH.—The month commenced with clear, pleasant, frosty weather, which on the 5th gave place to a continuance of the mild, and generally wet weather that has been so far characteristic of the winter. The ground was not once white with S.

LUNAR RAINBOW.

To the Editor of the Meteorological Magazine.

SIR,—Last night, November 19th, we were favoured with a remarkably fine lunar rainbow here in the W.N.W. When I first saw the bow the arc was perfect without any break; the brightest portion was towards the north, *i.e.*, for about 70° from the northern extremity, this part having the faintest blue tinge, the remainder being a misty white. A friend, with whom I had been conversing about a lunar rainbow some days previously, called at my house to tell me of it at 8 o'clock. I went out immediately, and watched it until its disappearance at 8h. 11m. The moon, full the previous day, rose at at 5h. 1m., and was therefore well above the horizon, and shining very brightly through the gaps in the heavy clouds. My friend assured me that he had seen the bow at intervals for fully an hour.

Yours truly,

WALTER E. STEWART.

Croft-on-Tees, Darlington, November 20th, 1888.