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ANEROID BAROMETERS.

It is somewhat remarkable that the principal works on the Aneroid barometer have been written by those who were not meteorologists. The work which Mr. Whymper, the well-known traveller and engraver, has just issued\* is another and striking example of the same rule. It is a remarkable book, and one which, by its thorough demonstration of facts, not altogether unknown but not previously attended to, will form a distinct epoch in the use of the Aneroid at great altitudes by all who care for accuracy. Briefly, the scope of the work is as follows:—The author, in his travels amongst the great Andes of the Equator, took with him two mercurial barometers and several aneroids. He found that the readings of the aneroids ran away from those of the mercurials because they took time to fall to their lowest point, and this time allowance had not been made in their original graduation, is not recognised in the certificates issued at Kew, and has not hitherto been allowed for. As far as we can see, it is merely the effect of imperfect elasticity in the vacuum boxes, and possibly chemists and meteorological instrument makers between them will be able to find an alloy which may minimize the evil.

Although we have put in these very few words that which seems to us to be the essential feature of Mr. Whymper's work, and it is easy enough to do so when he has marshalled all the facts, we wish to impress upon all who intend to use aneroids at heights exceeding 1,000 ft. or so that they must read and master his book if they desire to get the best results from their instruments. Mr. Whymper has been working at this subject for many years; he gives the results of dozens of aneroids, some tested in his travels and many more compared in his workshop, where they have been kept at low pressures for weeks and even months, and he gives page after page of tables, proving his case with a thoroughness which, as far as we can see, leaves no loophole for doubt. And the results are very bad. He shows that it is possible to determine an altitude and make it too

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\* "How to use the Aneroid Barometer," by EDWARD WHYMPER. London: J. Murray. Med. 8vo., 61 pages.

much by 2,000 feet. Happily, he also shows how great errors may be avoided.

Mr. Whymper seems to expect a degree of accuracy which is far in excess of what appears to us reasonable. On page 17 he gives the errors of a series of six watch aneroids to thousandths of an inch. They must have been read under a microscope! These aneroids were kept at  $22\frac{1}{2}$  inches for some weeks. Mr. Whymper tells us elsewhere that aneroids become untrustworthy near their lowest graduation, so we shall probably do him no injustice if we assume that these instruments were graduated to show from 21 in. to 31 in.—*i.e.*, 10 inches. By actual measurement of three aneroids of the same size (2-inch), we find that the divided circles have diameters of 1.60, 1.60, and 1.65 inches; therefore their circumferences are 5.03, 5.03, and 5.18 inches respectively; there is usually a little space between the two ends of the scale, and consequently we are more than justified in saying that each inch of pressure is, on these aneroids, represented by less than half an inch of linear space. Hence it follows that the thousandths of an inch in Mr. Whymper's table represent a two thousandth of an inch of linear space—to get readings like that, without either a vernier or a microscope, is simply impossible. Why, the hands of the aneroid have a breadth of about .01 in., so that the readings are taken to 1-20th of the breadth of the hand. We never previously saw the readings of watch aneroids published to three places of decimals, and think that it would have been better to have stopped at two places—even that would imply reading accurately *without a vernier* to the 1-200th part of a linear inch—say to about half the breadth of a human hair.

The monograph would be improved also by a series of diagrams giving graphic representations of the values in the tables; but taken as it is, we welcome it as an extremely valuable contribution to meteorology and to physical geography.

The question now remains, how is the error to be dealt with and removed? It closely resembles the difficulty which for half a century attached to mercurial thermometers in what was known as the change of zero, and the parallelism is very close. Mr. Whymper does not publish a series of comparisons hour by hour for, say, two or three days, but from the values he gives, it seems to us that just as Denton's process has given us mercurial thermometers with constant zeros, so aneroids should not be pointed off in an afternoon, but placed under reduced pressure for some time before being graduated.

One optician has given us clinical thermometers advertised as taking up the true temperature in one minute. Will not he or some one else give us aneroids which will show the true pressure on a 10,000 feet mountain in something less than a month?

That the issue of certificates for aneroids must be reconsidered, and in all probability the charge for them considerably increased, seems obvious; but beyond everything in importance is the discovery of the best material of which to make the vacuum boxes—therein lies a handsome income for the lucky discoverer.

## ROYAL METEOROLOGICAL SOCIETY.

The usual monthly meeting of this Society was held on Wednesday evening, December 16th, at the Institution of Civil Engineers, Mr. Baldwin Latham, M. Inst. C.E., President, in the chair.

Mr. R. H. Hooker, B.A., Mr. A. B. MacDowall, M.A., Mr. E. G. Ravenstein, F.R.G.S., and Mr. R. Hedger-Wallace were elected Fellows of the Society,

Mr. W. Marriott gave the results of the investigation undertaken by the Society into the thunderstorms of 1888 and 1889, which he illustrated by a number of lantern slides. The investigation was originally confined to the south-east of England, but as this district was found to be too circumscribed it became necessary to include the whole of England and Wales. After describing the arrangements for collecting the observations and the methods adopted for their discussion, Mr. Marriott gave statistics showing the number of days on which thunderstorms occurred at each station; the number of days of thunderstorms in each month for the whole country; the number of days on which it was reported that damage or accidents from lightning occurred; and also the number of days on which hail accompanied the thunderstorms. In 1888 there were 113 days, and in 1889, 123 days on which thunderstorms occurred in some part of the country. The number of days with damage by lightning was in 1888 33, and in 1889 38; and there were 56 days in each year on which hail accompanied the thunderstorms. The tables of hourly frequency show that thunderstorms are most frequent between noon and 4 p.m., and least frequent between 1 a.m. and 7 a.m. Thunderstorms appear to travel at an average rate of about 18 miles an hour in ill-defined low barometric pressure systems, but at a higher rate in squally conditions. The author is of opinion that individual thunderstorms do not travel more than 20 miles; and that they take the path of least resistance, and are consequently most frequent on flat and low ground. Isobaric charts, with isobars for each two-hundredths ( $\frac{1}{100}$ th) of an inch were prepared for 9 a.m., and 9 p.m. each day for the month of June, 1888. An examination of these charts showed that instead of the pressure being so very ill-defined, as appeared on the daily weather charts, there were frequently a number of small but distinct areas of low pressure, or cyclones with regular wind circulation, and that these small cyclones passed over the districts from which thunderstorms were reported. Sometimes it is not possible to make out well-formed areas of low pressure from two-hundredths of an inch isobars, but there is a deflection of the wind which shows that there is some disturbing cause; and thunderstorms usually have occurred in that immediate neighbourhood. The author believes that the thunderstorms formation are small atmospheric whirls—in all respects like ordinary cyclones, and that the whirl may vary from one mile to ten miles or more in diameter. There are frequently several whirls near together, or following one another

along the same track. The numerous oscillations in the barometric curve are evidently due to the passage of a succession of atmospheric whirls; and it appears that lightning strokes are most frequent when these oscillations are numerous.

Mr. F. J. Brodie read a paper "*On the Prevalence of Fog in London during the Twenty Years 1871 to 1890*." The popular notion that November is the month of most frequent fog, is not confirmed by the figures given by the author. The number of fogs in that month is, if anything, slightly less than in October or January, and decidedly less than in December, the last-mentioned month being certainly the worst of the whole year. The latter part of the winter is not only less foggy than the earlier part, but is clearer than the autumn months. In February the average number of days with fog is only 6.6, as against 8.9 in January, 10.2 in December, 9.2 in October, and 8.8 in November.

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### THE MUNICH CONFERENCE.\*

The following summary from *Nature* of the principal subjects discussed, and decisions arrived at, will complete our notice of the above meeting.

*Temperatures.*—All temperatures published after 1901 are to be referred to the readings of the air thermometer.

*Sun Thermometers.*—Actinometrical observations are not held to be sufficiently certain to justify their general introduction.

*Hygrometers.*—The application of a ventilating arrangement to wet-bulb thermometers was recommended.

*Rain.*—It was decided to count as days of rain those on which 0.005 inch (0.1 mm.) of rain was measured, and to print monthly the number of days on which 0.05 inch (or 1 mm.) fell.

*Snow.*—A note is to be made in the monthly schedules of the number of days on which about half the country surrounding the station is under snow.

*Clouds.*—A new classification of clouds to replace Howard's, proposed by Prof. Hildebrandsson and the Hon. R. Abercromby, was adopted by a large majority, England and the United States being dissentients. A committee was then appointed to consider the question of typical cloud pictures in general, taking the above classification more or less as a basis of arrangement. A report also was received and adopted on the observation of the motions, &c., of cirrus and other high-level clouds.

*Wind.*—Robinson's anemometer was the only form of instrument discussed. It was decided that no instrumental results should be published unless the instrument had been previously compared with a standard, either directly or indirectly.

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\* See also pp. 148 and 168.

*Time.*—A proposal to recommend the adoption of universal or zone time was emphatically rejected on the ground that local time alone can be used for climatological inquiry. It was further decided to insist that in all publications the day should commence with midnight as 0 hours.

*Gravity correction.*—It was decided to introduce the practice of correcting barometrical readings for the force of gravity at lat. 45° after the beginning of the year 1901.

*Terrestrial Magnetism.*—The questions relating to this subject were referred by the Conference to a special sub-committee, whose decision will appear in the published report of the proceedings.

Mr. Wragge, for Queensland, and Captain Pinherio, for Brazil, gave interesting notices of what is being done for meteorology in their respective countries.

It was resolved that an International Meteorological Committee should be constituted to prepare for a possible Congress in Paris in the year 1896. The Committee is to consist of 17 members, of whom 14 were elected, and it was decided to fill the 3 vacancies by the co-option of extra-European meteorologists. The officers of the Committee—Messrs. Wild and Scott—were re-appointed.

#### INSIDE A WATERSPOUT.

IN our November number (p. 151) we quoted from the *Leisure Hour* a very interesting account of the sensations of a young officer of the "Crest of the Wave," when inside a water-spout, in the year 1855. Through the kindness of Mr. R. H. Scott, F.R.S., we have received a copy of the account of the same event, as written by the captain, in the ship's log, which is still preserved at the Meteorological Office, and which we print verbatim.—ED.

*Extract from the Meteorological Register kept on board the "Crest of the Wave,"* CAPTAIN JOHN STEELE.

1855, *August 20th.*—At 7 a.m., when in Lat. 35° 50' N., Long. 19° 42' E., or 138 miles W.¼S. from Cape Matapan, passed under a waterspout. At 6 a.m. heavy squall-like cloud forming at S.E. and N.W., a waterspout forming at east end of S.E. squall, and another at west end of N.W. squall, both squalls closing upon the ship. Up till this time the weather had been clear, with an almost cloudless sky, and light but steady wind from W.S.W. All studding sails had been set during the night. At 6.30 took in studding sails and all light sails, hauled up courses, and stood by topsail haulyards and jib down-haul. Waterspout now near at hand, direct ahead, and coming fast upon us; let fly topsail haulyards, and had got the jib about half down, when it struck us on the port bow, fulling staysail and jib to starboard, but pressing fore-yard fast aback, in another instant fulling head-yards and pressing main yard aback, and again throwing main and mizen-yards full and aback, at the same instant

whirling along port side with a violent gust and round the stern with a loud noise, throwing water into the stern windows as it passed. A moment after there was a calm, then heavy gusts, succeeded by a heavy squall and much rain from E.S.E. The waterspout waved and bent to the whirling wind, and in its action was like a huge transparent chimney, in which the water, "smoke-like," was curling its way to heaven. I had time to view it, and was much struck with the curling vapour rolling up its glass-like tube. I have heard it stated that any body passing through a waterspout would burst it; this one had half its base acting upon my ship, but still remained perfect in form and action.

### { RAINFALL AT LEON, GUANAJUATO, MEXICO.

WE notice in the May number of the *Memorias de la Sociedad Científica "Antonio Alzate"* two tables of the rainfall of Léon, which may be of interest to some of our readers. Léon is in Lat.  $21^{\circ} 7' 24''$  N., Long.  $101^{\circ} 10' 44''$  W., and 5,901 feet above sea-level. It is therefore on the high land of Mexico, and about 200 miles N.W. of the capital.

The tables show that the mean rainfall is about 30 inches, falling on 123 days, and that the driest year had 81 per cent. of the mean, and the wettest 120 per cent. of it. Unless, therefore, there was something exceptional in the rainfall of the 13 years 1878-90, it is evident that the annual rainfall in Guanajuato is much less variable than in this country.

Professor Leal, under whose directions the observations have been made, gives no details respecting the rain gauge or its position, nor does he give the fall for each month or the mean monthly fall. It would be satisfactory if he would supply this information in a subsequent paper. In its absence we have thought it well to add the monthly fall for 1890, which is given in another part of the same number of the *Memorias*.

YEARLY RAINFALL.				RAINFALL IN 1890.	
Year.	Depth. in.	Days.		Months.	Depth. in.
1878	24.43	92		January	.04
1879	27.92	100		February	.01
1880	32.50	119		March	.24
1881	24.80	127		April	.04
1882	27.53	117		May	.27
1883	35.47	134		June	8.88
1884	24.14	111		July	6.46
1885	30.95	130		August	5.35
1886	28.23	97		September	7.28
1887	30.79	136		October	4.41
1888	34.24	152		November	.78
1889	30.22	134		December	.38
1890	34.14	145			
Mean	29.64	123		Total	34.14

## ORDNANCE BENCH MARKS.

*To the Editor of the Meteorological Magazine.*

SIR,—May I draw the attention of Borough Surveyors, and Surveyors under the County Councils in particular, to the fact that many of the Ordnance Survey marks are being removed, through walls being pulled down and alterations made in buildings. Should any reader notice anything being done to a place where a mark is known to exist, would he adopt my plan and send at once to the architect engaged, because it is not a difficult matter then to measure its position exactly and replace it. If it be impossible to replace the brick or stone with the mark on, in its original position, a simple arrow  $\blacktriangle$  without the cross line might be cut with its point as nearly as possible to the former position of the Ordnance Survey mark, then it would be seen at a glance that it was not the original, and had been interfered with.—Yours faithfully,

JOHN J. GILBERT, A.I.C.E., F.R.Met.Soc., &c.

72, Cambridge Street, The Crescent, Birmingham. Dec. 22nd, 1891.

[The evil is a serious and growing one. Scores of Ordnance Bench Marks must be removed every year, and eventually all those quoted in the useful volumes "*Abstracts of Spirit Levelling*," will have vanished. A bench mark moved may, however, be worse than none at all; we heard of one rebuilt two feet too high and which, on the fact being reported to the Ordnance Survey Office, the Director promptly sent and had defaced so that it should do no more mischief. For rough work Mr. Gilbert's suggestion, if carefully carried out, would be useful, but perhaps it would be better either to put the mark wrong side up or to enclose it in a ring. We fancy that there is a section in the Survey Act prohibiting any one but the officers of the Survey cutting such a mark—if there is not there ought to be. But we have always pleaded for the adoption in this country of the French plan of affixing a metal plate stating in raised figures its own altitude.—ED.]

## THE UNITED STATES WEATHER BUREAU.

*To the Editor of the Meteorological Magazine.*

SIR,—Referring to the kind and appreciative notice of my special report on p. 171 of your magazine, I must hasten to set you right respecting your understanding of that portion relating to rain-gauges. I assure you there is no lack of expert supervision, both as to the accuracy of the gauges themselves as instruments, and as to their use and exposure of stations, for all of which duties the official in charge of instruments is responsible.

The bulky and less delicate character of rain-gauges, as compared with thermometers, barographs, &c., and the large number issued by the Bureau, makes it more convenient to place the actual shipment of these instruments in the hands of our Property Clerk.

Very respectfully yours,

MARK W. HARRINGTON,

*Chief of Weather Bureau.*

*Weather Bureau, Washington D C.. Dec. 30th, 1891.*

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JUNE, 1891.

STATIONS.  <i>(Those in italics are South of the Equator.)</i>	Absolute.				Average.				Absolute.		Total Rain.		Aver. Cloud.
	Maximum.		Minimum		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
England, London .....	79·0	22	44·9	10	71·5	52·2	50·6	71	125·9	38·9	8·02	10	5·4
Malta.....	99·6	7	58·3	2	83·0	64·5	59·6	66	155·7	50·0	·02	1	2·7
<i>Cape of Good Hope</i> ...	78·2	1	37·7	30	62·0	49·4	...	...	...	...	3·16	12	6·1
<i>Mauritius</i> .....	76·6	24	58·3	1	74·8	65·1	62·6	79	128·5	51·3	2·55	24	4·8
Calcutta .....	98·1	14	74·4	8a	93·3	80·6	79·9	81	156·5	72·8	5·94	9	5·5
Bombay.....	93·2	7	76·0	29	90·5	81·6	77·0	76	141·6	72·0	13·99	14	5·4
Ceylon, Colombo .....	87·0	11	73·3	19	84·2	78·9	71·4	76	147·8	70·0	9·79	19	7·7
<i>Melbourne</i> .....	60·5	23	35·2	9	56·6	45·7	47·0	86	108·6	30·4	2·54	15	7·7
<i>Adelaide</i> .....	63·5	1	36·2	23	59·8	44·5	43·3	72	127·0	27·2	1·44	13	5·5
<i>Tasmania, Hobart</i> .....	58·8	29	33·2	9	53·2	42·5	44·5	92	108·0	27·8	1·40	20	6·9
<i>Wellington</i> .....	59·5	8	32·0	26	52·7	38·3	41·6	87	98·0	22·0	2·89	15	4·0
<i>Auckland</i> .....	63·0	5	39·0	15	56·9	44·8	41·8	72	113·0	30·0	1·47	10	5·5
Jamaica, Kingston.....	90·9	5	72·2	8	87·7	74·9	71·6	71	...	...	6·47	...	...
Trinidad .....	97·0	7	68·0	22	85·9	72·0	72·1	76	154·0	58·5	5·54	21	...
Toronto .....	91·9	16	42·5	4	74·6	54·3	54·1	68	...	33·0	3·05	11	5·0
New Brunswick, Fredericton .....	86·0	16	37·0	5	69·5	48·6	50·7	69	...	...	3·20	14	7·3
Manitoba, Winnipeg ...	84·0	22	34·8	4	71·3	49·9	51·5	72	...	...	4·56	15	5·8
British Columbia, Esquimalt .....	72·1	25	39·4	8	63·1	48·8	51·7	88	...	...	1·26	13	6·1

a And 28.

REMARKS.

MALTA.—Mean temp. 72°·3; mean hourly velocity of wind 7·2 miles. Sea temp. rose from 66°·5 to 75°·5. L on 18th. Screen temp. 90° on 5 days. Sun max. 150° on 5 days. J. SCOLES.

*Mauritius*.—Mean temp. of air 0°·2 below; dew point 1°·9 above; and R·63 in above, their respective averages. Mean hourly velocity of wind 9·1 miles, or 2·2 below average; extremes, 21·9 on 29th and 1·6 on 12th; prevailing direction S.E. to E. by S. T and L during night of 13th and morning of 14th. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—L was seen on 6 days. J. C. H. CLARKE, Lt. Col. R.E.

*Melbourne*.—Mean temp. of air 1°·4, of dew point 3°·4, humidity 6, R·57 in., and cloud 1·1 above their respective averages. Prevailing wind S.E. and S.; strong on 7 days. Heavy dews on 9 days. Hoarfrost on 21st. Fog on 6 days. R. L. J. ELLERY, F.R.S.

*Adelaide*.—Mean temp. 1°·4, and R 1·40 in. below the average of 34 years. C. TODD, F.R.S.

*Wellington*.—Showery in the early part of the month, fine in the latter, with cold, frosty nights and clear skies. Prevailing southerly wind, but light or calm, except fresh on 1st from S.W. Earthquake on 2nd at 4.25 a.m., and on 30th, at 4.55 p.m., slight. Mean temp. 3°·5 and R 2·33 in. below the average. R. B. GORE.

*Auckland*.—The first week of the month was stormy and squally, but from thence to the close settled fine weather prevailed, with bright, sunny days, and cold frosty nights. Mean temp. the lowest recorded for the month. Rainfall not much more than a quarter of the average, and the smallest since 1859. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL,  
DECEMBER, 1891.

[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 Hall.	4·62	XI.	Builth, Llanwrtyd Wells	11·00
„	Margate, Birchington...	...	„	Rhayader, Nantgwilt...	12·91
„	Brighton, Prestonville Rd	2·70	„	Corwen, Rhug .....	6·88
„	Hailsham .....	4·15	„	Carnarvon, Cocksida ...	8·29
„	Ryde, Thornbrough .....	4·93	„	I. of Man, Douglas .....	8·69
„	Alton, Ashdell .....	5·64	XII.	Stoneykirk, Ardwell Ho.	3·79
III.	Oxford, Magdalen Col...	2·99	„	New Galloway, Glenlee	10·93
„	Banbury, Bloxham .....	4·14	„	Melrose, Abbey Gate ...	6·07
„	Northampton .....	2·92	XIII.	N. Esk Res. [Penicuick]	9·15
„	Cambridge, Fulbourne..	3·12	XIV.	Ballantrae, Glendrishaig	6·06
„	Wisbech, Bank House..	2·72	„	Glasgow, Queen's Park.	6·68
IV.	Southend .....	1·92	XV.	Islay, Gruinart School..	7·21
„	Harlow, Sheering .....	3·39	XVI.	Dollar .....	6·59
„	Rendlesham Hall .....	2·83	„	Balquhider, Stronvar..	13·04
„	Diss .....	3·02	„	Coupar Angus Station..	2·95
„	Swaffham .....	3·49	„	Dunkeld, Inver Braan..	5·61
V.	Salisbury, Alderbury ...	4·18	„	Dalnaspidal H.R.S. ...	10·18
„	Warminster .....	...	XVII.	Keith H.R.S. ....	·91
„	Bishop's Cannings .....	4·90	„	Forres H.R.S. ....	1·62
„	Ashburton, Holne Vic....	11·37	XVIII.	Fearn, Lower Pitkerrie.	2·45
„	Okehampton, Oaklands.	7·58	„	Loch Shiel, Glenaladale	...
„	Lynmouth, Glenthorne.	9·42	„	N. Uist. Loch Maddy ...	...
„	Probus, Lamellyn .....	4·56	„	Invergarry .....	11·77
„	Launceston, S. Petherwin	...	„	Aviemore H.R.S. ....	3·91
„	Wincanton, Stowell Rec.	4·61	„	Loch Ness, Drumnadrochit	5·26
„	Wells, Westbury .....	...	XIX.	Lairg H.R.S. ....	2·30
VI.	Bristol, Clifton .....	4·63	„	Scourie .....	5·77
„	Ross, The Graig .....	3·56	„	Watten H.R.S. ....	2·91
„	Wem, Clive Vicarage ...	3·32	XX.	Dunmanway, Coolkelure	12·69
„	Cheadle, The Heath Ho.	5·05	„	Fermoy, Gas Works ...	5·69
„	Worcester, Diglis Lock	3·13	„	Darrynane Abbey .....	7·32
„	Coventry, Coundon .....	3·31	„	Tipperary, Henry Street	...
VII.	Ketton Hall [Stamford]	2·85	„	Limerick, Kilcornan ...	4·80
„	Grantham, Stainby .....	3·11	„	Ennis .....	6·96
„	Horncastle, Bucknall ...	3·01	„	Miltown Malbay .....	7·64
„	Worksop, Hodsek Priory	3·37	XXI.	Gorey, Courtown House	6·30
VIII.	Neston, Hinderton .....	4·21	„	Mullingar, Belvedere ...	5·89
„	Knutsford, Heathside ...	4·44	„	Athlone, Twyford .....	5·71
„	Lancaster .....	6·48	„	Longford, Currygrane ...	5·32
„	Broughton-in-Furness ...	11·00	XXII.	Galway, Queen's Coll...	7·76
IX.	Ripon, Mickley .....	4·68	„	Crossmolina, Enniscoe..	7·21
„	Scarborough, West Bank	2·78	„	Collooney, Markree Obs.	4·95
„	East Layton [Darlington]	3·16	„	Ballinamore, Lawderdale	6·03
„	Middleton, Mickleton..	5·54	XXIII.	Lough Sheelin, Arley ..	5·80
X.	Haltwhistle, Unthank..	6·08	„	Warrenpoint .....	3·22
„	Bamburgh .....	3·17	„	Seaforde .....	5·41
„	Shap, Copy Hill .....	...	„	Belfast, New Barnsley..	5·45
XI.	Llanfrechfa Grange .....	7·13	„	Bushmills, Dundarave...	3·49
„	Llandovery .....	9·03	„	Stewartstown .....	5·39
„	Castle Malgwyn .....	8·10	„	Buncrana .....	4·64

DECEMBER, 1891.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which "01 or more fell.	TEMPERATURE.				No. of Night below 32°	
		Total Fall.	Differ- ence from average 1880-9.	Greatest Fall in 24 hours.		Max		Min.		In shade.	On grass.		
				Dpth	Date			Deg.	Date			Deg.	Date
		inches.	inches.	in.									
I.	London (Camden Square) ...	3·24	+ 1·17	·70	1	18	57·2	5	16·8	22	10	17	
II.	Maidstone (Hunton Court)...	2·76	+ ·52	·48	1	18	...	...	...	...	...	...	
III.	Strathfield Turgiss .....	3·81	+ 1·80	·84	1	20	55·9	5	18·2	20	13	18	
III.	Hitchin .....	3·56	+ 1·53	·83	13	20	55·0	3, 5	13·0	24	10	...	
IV.	Windsor (Addington) .....	3·66	+ 1·21	·77	1	21	57·0	5	12·0	22	12	17	
IV.	Bury St. Edmunds (Westley)	3·02	+ ·78	·57	1	19	...	...	...	...	...	...	
V.	Norwich (Cossey) .....	2·90	+ ·67	·53	1	16	...	...	13·0	22	9	14	
V.	Weymouth (Langton Herring)	3·97	+ ·87	·88	1	22	55·0	3	26·0	21 <sup>b</sup>	7	...	
ENGLAND.	Barnstaple .....	3·16	- 1·53	·61	14	16	58·0	4, 6	23·0	24	...	...	
ENGLAND.	Bodmin (Fore Street) .....	7·58	+ 2·24	·98	29	23	...	...	...	...	...	...	
VI.	Stroud (Upfield) .....	3·04	+ ·59	·40	1	22	55·0	3	19·0	22	13	...	
ENGLAND.	Churchstretton (Woolstaston)	4·61	+ 1·56	·70	9	21	54·0	3	14·0	25	12	20	
ENGLAND.	Tenbury (Orleton) .....	3·62	+ 1·25	·67	12	19	58·7	3	14·0	23	12	17	
VII.	Leicester (Barkby) .....	3·33	+ 1·19	·52	30	21	56·0	3	11·0	21	15	24	
ENGLAND.	Boston .....	2·34	+ ·49	·68	1	13	55·0	3	15·0	22	13	...	
ENGLAND.	Hesley Hall (Tickhill) .....	3·13	+ 1·15	·66	13	19	56·0	3	12·0	23 <sup>a</sup>	15	...	
VIII.	Manchester (Plymouth Grove)	5·71	+ 2·27	·80	30	21	55·0	3	16·0	24	10	17	
IX.	Wetherby (Ribston Hall) ...	3·23	+ ·79	·96	10	12	...	...	...	...	...	...	
ENGLAND.	Skipton (Arncliffe) .....	10·79	+ 3·98	1·86	9	22	58·0	5	16·0	25	9	...	
ENGLAND.	Hull (Pearson Park) .....	3·35	+ 1·08	·65	13	19	56·0	3	18·0	25	12	18	
X.	Newcastle (Town Moor) .....	3·48	+ 1·18	1·50	7	14	...	...	...	...	...	...	
ENGLAND.	Borrowdale (Seathwaite) .....	25·25	+ 7·44	3·15	8	23	...	...	...	...	...	...	
XI.	Cardiff (Ely) .....	7·23	+ 2·68	·99	30	22	...	...	...	...	...	...	
ENGLAND.	Haverfordwest .....	7·87	+ 2·88	1·25	13	23	54·8	4	21·0	25	8	9	
ENGLAND.	Carno (Tybrith) .....	11·51	+ 5·62	1·60	9	22	48·0	3	7·0	23	15	...	
ENGLAND.	Llandudno .....	4·92	+ 1·96	·70	9	17	58·5	3	23·0	25	7	...	
XII.	Cardgen [Dumfries] .....	6·91	+ 2·89	·88	12	18	53·6	4	22·4	22	10	...	
ENGLAND.	Jedburgh (Sunnyside) .....	4·92	+ 2·72	·94	7	18	50·0	1, 4	15·0	25	16	...	
XIV.	Old Cumnock .....	7·31	+ 2·24	·88	15	22	...	...	...	...	...	...	
XV.	Lochgilphead (Kilmory) .....	9·44	+ 2·07	1·19	9	24	...	...	27·0	7	12	...	
ENGLAND.	Oban (Craigvarren) .....	9·45	...	·95	10	24	54·0	2	32·8	8	0	...	
ENGLAND.	Mull (Quinish) .....	9·74	+ 2·17	1·20	15	23	...	...	...	...	...	...	
XVI.	Loch Leven Sluices .....	5·50	+ 2·19	·90	10	16	...	...	...	...	...	...	
ENGLAND.	Dundee (Eastern Necropolis)	3·55	+ 1·47	·70	10	15	50·1	3	23·7	17	13	...	
XVII.	Braemar .....	4·20	+ 1·73	·75	9	19	50·2	3	16·0	15 <sup>a</sup>	19	25	
ENGLAND.	Aberdeen (Cranford) .....	2·13	...	·57	15	16	53·0	3	22·0	24	14	...	
XVIII.	Strome Ferry .....	9·71	+ 1·92	·91	3	23	...	...	...	...	...	...	
ENGLAND.	Inverness (Culloden) .....	2·48	+ ·55	...	...	...	59·0	26	26·0	17	8	28	
XIX.	Dunrobin .....	3·32	- ·05	·66	15	15	49·0	1	25·5	8	17	...	
ENGLAND.	S. Ronaldsay (Roeberry) .....	3·54	- ·12	·49	15	21	51·0	3	32·0	30	...	...	
XX.	Dromore Castle .....	6·63	...	·80	11	19	50·0	20	28·0	26	...	...	
ENGLAND.	Waterford (Brook Lodge) ...	6·38	+ 2·74	1·36	12	22	54·0	3, 30	29·5	12	4	...	
ENGLAND.	O'Briensbridge (Ross) .....	7·40	...	1·23	9	21	47·0	4	27·0	24	12	...	
XXI.	Carlow (Browne's Hill) .....	5·44	+ 2·32	·93	12	19	...	...	...	...	...	...	
ENGLAND.	Dublin (Fitz William Square)	3·30	+ 1·14	·75	6	21	58·0	3	25·2	22	6	15	
XXII.	Ballinasloe .....	6·95	+ 3·53	1·26	9	24	49·0	2, 3	24·0	25	16	...	
ENGLAND.	Clifden (Kylemore) .....	10·49	...	1·25	25	26	...	...	...	...	...	...	
XXIII.	Waringstown .....	4·34	+ 1·30	·73	12	24	54·0	4	23·0	21	16	19	
ENGLAND.	Londonderry (Creggan Res.) ..	4·52	+ ·31	1·00	10	22	...	...	...	...	...	...	
ENGLAND.	Omagh (Edenfel) .....	5·62	+ 1·94	·76	9	23	52·0	2, 3	27·0	24	7	18	

a And 25. b And 24.

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

## METEOROLOGICAL NOTES ON DECEMBER, 1891.

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.—With the exception of a week's winter weather to remind us of Christmas time December was mild and genial. The land was very wet and agricultural matters are greatly in arrear.

ADDINGTON.—From the 1st to the 15th a great quantity of R fell, causing large floods; the temp. being high, and the wind often strong. On the 17th frost set in with considerable severity, and was very intense from the 21st to the 25th, the ice on the lake being  $4\frac{1}{2}$  inches thick. On the 26th a thaw set in lasting until the end. On the 31st at 9 a.m. the ther. stood at  $48^{\circ}$ , and the min. for the night was  $44^{\circ}$ .

BURY ST. EDMUNDS, WESTLEY.—The month was mild except from the 19th to the 25th, when a sharp frost prevailed, which was severe enough to spoil many of the white turnips.

LANGTON HERRING.—The first half of the month was wet, stormy and mild; this was followed by a spell of fine dry cold weather from the 17th to the 25th; the last week was mild and wet. The mean temp. of the month is  $2^{\circ}\cdot7$  above the average of 19 years, and on 17 days the temp. rose to or above  $50^{\circ}$ . Gales occurred on the 7th, 9th, 10th and 13th; L on the 10th; fog on 24th.

BODMIN.—R fell daily from the 1st to the 15th; it was dry from the 15th to the 23rd; frost prevailed from the 19th to the 24th, and then R to the end of the month. A very wet month and very stormy at times, especially on 9th, 10th, 12th and 13th; H on the 12th.

STROUD, UPPFIELD.—Gales on the 8th, 9th, 10th, 12th and 13th; heavy on the latter day, when several great elm trees were blown down.

WOOLSTASTON.—A succession of gales raged during the early part of the month, that of the 10th being the most furious and destructive known for many years. A sharp frost set in afterwards, and continued till nearly the end of the month. Vivid L on the 10th. Mean temp.  $38^{\circ}\cdot9$ .

TENBURY, ORLETON.—A warm month with the exception of nine days from 17th to 25th inclusive (mean temp. for the 9 days  $23^{\circ}\cdot4$ .) The average temp. for the whole month was nearly  $2^{\circ}$  below the average of 30 years. At 9.30 p.m. on the 3rd the ther. stood at  $58^{\circ}\cdot7$ , the highest December max. recorded here in 30 years. The temp. on 11 days rose above  $50^{\circ}$ , and on 20 days above  $45^{\circ}$ , while in December, 1890, it never once rose above  $45^{\circ}$ . Fog on 2nd, 17th, 21st, 22nd, 23rd and 24th; S on 12th; gales on 7th, 10th and 11th.

LEICESTER, BARKBY.—R daily for the first half of the month and during the last week, and the country very wet. A model Christmas Day; plenty of good ice; lovely rime and glorious sunshine, with hard frost. Some strong winds from 9th to 15th.

MANCHESTER, PLYMOUTH GROVE.—Dense mist on 2nd; as mild as May on 4th, 5th and 6th; very stormy on 9th, and 10th; H showers on 11th; some S and sleet on the 12th; fine wintery weather from 17th to 20th; dense fog on 21st, 22nd and 23rd; hard frost from 21st to 24th. The rest of the month very unsettled. Mean temp.  $40^{\circ}\cdot5$ .

## WALES.

HAVERFORDWEST.—This month, like the preceding one, was characterised by excess of R, violent continuous storms, and mildness. The week preceding Christmas a sudden wave of excessive cold occurred, which lasted till Christmas Day, when the old character of weather returned. On Sunday evening, the 27th, a violent squall of R, H and wind took place at 7.30 p.m., and at 8 p.m. another squall with terrific L and T.

## SCOTLAND.

**CARGEN.**—The month was characterised by great and sudden changes of weather. The first fortnight was extremely stormy and wet, 5·05 in. of R falling. A very unusual fog (for this district) was experienced for 4 days, 22nd to 25th inclusive. A rather curious circumstance connected with the fog being that on the day it was most dense the crows belonging to the large rookery at Kirkconnell, about three miles distant, quite lost their bearings, could not find their way home, and roosted for the night in thousands on the trees round the park here. A sharp TS with heavy R was experienced on the evening of the 28th, and L was seen on the evening of the 29th and 30th.

**JEDBURGH.**—There was much R during the month and a great variability of temperature and range of the bar., but little or no fog. A good deal of frost, but country work went on when there were people to attend to it.

**OLD CUMNOCK.**—T and L on the 10th at 5.30 a.m. ; S on the 13th ; frost from 18th to 24th ; H and S at times from 25th to 31st.

**OBAN.**—A most tempestuous month, with continuous heavy R throughout ; saving one week in the second half, temp. high, but towards the close a gradual and seasonable fall occurred.

**S. RONALDSAY, ROEBERRY.**—Upon the whole a good month. Cold and more unsettled towards the end.

## IRELAND.

**WATERFORD, BROOK LODGE.**—A very mild month ; mean temp 44°·9. Some primroses in bloom in the early part. L during a gale in the night of the 11th ; H showers on the 27th.

**O'BRIENSBRIDGE, ROSS.**—The first fortnight, and last week of the month were very wet, wild and wintry, with an interval of nine days without R, from the 16th to 24th ; frost was frequent in that interval, but not severe at any time ; gales from S. W. frequent and violent, with much L.

**DUBLIN.**—The leading features of the month were a preponderance of S. W. winds, frequent gales, heavy rains, and unsteady, but often high temp. From the 16th to the 25th, however, severe cold and dense fogs with calms prevailed. Mean temp. 43°·0, 1°·7 above the average ; 6 days of frost in screen occurred, and 15 days of frost on the grass. A lunar rainbow was seen on the 15th ; solar halos on 8th, 9th, 13th and 14th ; high winds occurred on 14 days, attaining the force of a gale on 8 ; fogs on 9 days ; S or sleet fell on the 11th ; H on the 10th.

**BALLINASLOE.**—The first part of the month was very wild and wet ; roads were forced up by the E in much the same way as by the action of heavy and continuous frost, and floods occurred over portions of road which have not been inundated for many years.

**EDENFEL.**—Mostly wet and open, except during the week ending on Christmas Day, which was remarkably fine and generally clear. Gales on 10th and 11th, followed by S on 12th, but not to last.