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# INDEX.

	PAGE		PAGE
Aqueous Vapour and Temperature..	104	Dry Februaries, Recent .....	26
August 10th, The Yorkshire Whirl-		Dryness of the First Half of 1895...	85
wind of .....	117	Earthquakes, History of British ...	93
Australia, West, A New Observa-		Earth Temperatures and Water	
tory for .....	186	Pipes—The Frost .....	37, 53, 75
Barometric Pressure, January 9th,		European Rivers, Temperature of...	126
1896 .....	181	Februaries, Recent Dry .....	26
Barometric Undulations .....	29	February, 1895, The Frost of ...15,	21
Belgium, The Rainfall of .....	101,	“Fin de Siècle” Project, A .....	73, 87
125, 143,	156	Fish, A Shower of, on June 15th ...	110
British Association at Ipswich .....	133	Frost, Earth Temperatures and	
Meteorology .....	133	Water Pipes, The.....	37, 53, 75
Report on Underground Temp....	137	Frost of Jan. and Feb., 1895 ...15,	21
Report on Solar Radiation .....	137	Gale, The Great, in the Midlands	
Report on Earth Tremors .....	137	on March 24th .....	41
Report on the Application of		Hail, Salt .....	141
Photography to Meteorology ..	138	Health and Climate .....	165
Report on Meteorological Observa-		Heat in Southern Russia, The .....	110
tions on Ben Nevis .....	138	January and February, 1895, The	
Report on Earthquakes in Japan.	139	Frost of.....	15, 21
Report of the Committee on		January, The Weather of: A Record	14
Underground Waters .....	140	January 9th, Barometric Pressure of	181
Report on Cosmic Dust .....	140	January 23rd, The Thunderstorm of	1
E. S. Bruce.—On Probable Pro-		June 15th, A Shower of Fish on ...	110
jective Lightning Flashes .....	140	Kites, The Scientific Use of .....	10
Miller Christy, F.L.S.—About		Lightning? Do Overhead Wires	
Rockall .....	157	ward off .....	93
Dr. Thistleton Dyer.—Exhibition		Lunar Rainbow.....	123
of Photographs and Specimens		Manchuria, Meteorological Obs. in..	167
of a Cedar struck by Lightning	157	March 24th, The Great Gale on ...	41
Prof. Schuster, F.R.S.—Some Ob-		May 31st, Mock Moon Phenomenon	122
servations with Lord Kelvin's		Meteorological Notes on the Months	
Portable Electrometer.....	157	19, 35, 51, 67, 83, 99, 115, 131,	
Prof. Michie Smith.—Indian		147, 163, 179,	191
Thunderstorms .....	158	Meteorological Observations in	
G. J. Symons.—Notes on Autumn		Manchuria .....	167
Floods of 1894 .....	159	Meteorological Society, The Royal	
W. H. Wheeler.—The Effect of		12, 27, 62, 71, 90, 171,	183
Wind and Atmospheric Pressure		Meteors, Photographing .....	76
on Tides .....	159	Midlands, Great Gale in the ...	41
British Earthquakes—History of ...	93	Mock Moon Phenomenon of May	
British Empire, The Climate of the,		31st .....	122
during 1894 .....	169	Observatory, New, for West Aus-	
China, Rainfall Observations in,		tralia .....	186
1886-92 .....	69,	October, 1895.....	156
167		Palestine, Rainfall in, in the Second	
Climatological Tables for the British		Century .....	142
Empire .....	16, 32, 48, 64, 80, 96,	Photographing Meteors .....	76
112, 128, 144, 160, 175, 176, 187,	188	Queensland Rain Return, A.....	167
Climate of the British Empire, 1894	169	REVIEWS:—	
Climate and Health .....	165	Cloudland. A Study on the Struc-	
Cloudless Sky, Snow from a.....	27, 44	ture and Character of Clouds,	
Cloud, Classification and Definition	6	by Rev. W. Clement Ley, M.A.,	
Crystals, Unusual Snow.....	15, 27	F.R.Met.Soc. London: Stan-	
Cyclonic Storm at Rotherham .....	117	ford, 1894 .....	7
Degree Marks on Thermometers ...	89		

# INDEX.

	PAGE		PAGE
Annales de l'Observatoire Météorologique du Mont Blanc, publiées sous la direction de J. Vallot .....	9	Congrès de l'Atmosphère sous les auspices de la Soc. royale de Géographie d'Anvers, 1894.....	183
The Climatology and Physical Features of Maryland. Report of the Maryland State Weather Service for 1892 and 1893 .....	31	U.S. Weather Bureau. Reports of the Chief for 1891-92 and for 1893 .....	184
Meteorological Work in Australia. A Review by Sir C. Todd, K.C.M.G., F.R.S. ....	44	Rainbow Lunar.....	123
Bodenphysikalische und Meteorologische Beobachtungen mit besonderer berücksichtigung des Nacht frost phänomens, von Theodor Homen, Privatdocent an der Universität zu Helsingfors .....	45	Rainfall and Temperature, Monthly 18, 34, 50, 66, 82, 98, 114, 130, 146, 162, 178, .....	190
An Essay on Southerly Bursters, by H. A. Hunt, Meteorological Assistant, Sydney Observatory .....	47	Rainfall in Falestine in the Second Century .....	142
Neudrucke von Schriften und Karten ueber Meteorologie und Erdmagnetismus herausgegeben von Prof. Dr. Hellmann. No. 4. E. Halley, W. Whiston, J. C. Wilcke, A. von Humboldt, C. Hansteen. Die ältesten Karten der Isogonen, Isoklinen, Isodynamen, 1701-1826. 4to. ....	61	Rainfall Observations in China, 1886-92 .....	69
The Earliest Isoclinics and Observations of Magnetic Force, by L. A. Bauer .....	61	Rainfall of Belgium...101, 125, 143,	156
Beiträge zur Kenntniss des Wesens der Säcular Variation des Erdmagnetismus von L. A. Bauer, Berlin, 1895 .....	61	Rain Return, A Queensland ...	167
Les Aurores Polaires par Alfred Angot Météorologiste titulaire au Bureau Central Météorologique de France .....	77	Recording Rain Gauges: A Lost Opportunity .....	88
Dorset Annual Rainfall, 1848-92, by Henry Storks Eaton, M.A., Past Pres. Roy. Met. Soc. ....	78	Rivers, Temperature of European .....	126
Pubblicazioni della Specola Vaticana .....	108	Rotherham and Parkgate, Storm at .....	117
The Clyde Sea Area, by Hugh R. Mill, D.Sc., F.R.S.E. Part III. "Distribution of Temperature" .....	109	Russia, The Heat in Southern .....	110
The English Lakes, with Bathymetrical Maps and Illustrations, by H. R. Mill, D.Sc., F.R.S.E.....	173	Salt Hail .....	141
Clouds and Weather: A Study for Navigators, by Capt. D. Wilson Barker, F.R.S.E. ....	174	Sea Spray Carried by Gale, An Early Record of .....	60, 79
Meteorologische Volksbücher von Prof. Dr. Hellmann. Second ed. ....	174	September, 1895 .....	149
		Sept. 7th, The Thunderstorms of ...	124
		Shower of Fish on June 15th, A ...	110
		Snow Crystals, Unusual.....	15, 27
		Snow from a Cloudless Sky .....	27, 44
		Southern Russia, The Heat in ...	110
		Storm at Rotherham and Parkgate. ....	117
		Storm Centres in Switzerland .....	111
		Supplementary Tables of Rainfall... 17, 33, 49, 65, 81, 97, 113, 129, 145, 161, 177, .....	189
		Switzerland, Storm Centres in .....	111
		Telephones and Thunderstorms..93,	94
		Temperature, Aqueous Vapour and Temperatures, Earth, and Water Pipes.....	37, 53, 58, 75
		Temperatures of European Rivers..	126
		Thermometers, Degree Marks on ...	89
		Thunderstorm, The, of January 23rd .....	1
		Thunderstorms and Telephones..93,	94
		Thunderstorms and Watches.....	4
		Thunderstorms of Sept. 7th, The... ..	124
		Tidal Wave, A .....	111, 121
		Undulations, Barometric.....	29
		Water Pipes, The Frost, Earth Temperatures and .....	37, 53, 58, 75
		Wave, A Tidal .....	111, 121
		Weather of January, The: A Record ..	14
		Whirlwind in La Haute Marne, A... ..	107
		Whirlwind of August 10th, The Yorkshire .....	117
		Wires, Do Overhead, Ward off Lightning ? .....	93, 94
		Yorkshire Whirlwind of Aug. 10th..	117

# SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

CCCXLIX.]

FEBRUARY, 1895.

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## THE THUNDERSTORM ON JANUARY 23RD.

A SHORT, sharp thunderstorm, causing several accidents, occurred at various stations nearly along the meridian of Greenwich, in the forenoon of January 23rd. It was spoken of in *The Standard* as a "quick travelling secondary," and it was stated that "the nucleus of the thunderstorm was travelling S.S.E. wards at the rate of about 50 miles an hour." The rate *seems* to have been even higher than this, if there be no confusion as to the phenomena with which we are dealing, and we do not think that there can be, because, with the exception of the York record, the differences between the computed and observed times are rarely large.

STATIONS.	Distance measured along a line from Sunderland to Dungeness.	Beginning of Squall.	Computed Time at the Rate of 62 miles an hour.	
			Time. h. m.	Error. h. m.
Sunderland .....	0	5.55 a.m.	5.55 a.m.	0
Knaresborough .....	62	7.10 "	6.55 "	+ 15
York .....	67	5.45 "	7. 0 "	— 1.15
Ketton .....	160	8.15 "	8.30 "	— 15
Kettering .....	180	8.30 "	8.49 "	— 19
Easton Mauduit .....	186	8.40? "	8.55 "	— 15
Camden Square .....	239	9.46 "	9.46 "	0
Maida Vale .....	240	9.46 "	9.47 "	— 1
London .....	241	9.50 "	9.48 "	+ 2
Kennington ..	243	10. 2 "	9.50 "	+ 12
Kingston .....	246	10. 0? "	9.53 "	+ 7
Croydon .....	251	9.55 "	9.58 "	— 3
Wallington .....	252	9.57 "	9.59 "	— 2
Crowborough .....	275	10.20 "	10.21 "	— 1
Ditchling .....	281	11. 0 "	10.27 "	+ 33
Hythe .....	282	10.20 "	10.28 "	— 8

We insert this table, not altogether on account of any inherent importance in it, but because we think that observers will see from it that if they are not careful in keeping their clocks and watches

right, it is tolerably certain that that fact will come out. It will be seen that in the following notes the Rev. H. A. Boys, of Easton Mauluit, says, "*about 8.40*"; it is clear, from the table, that 8.55 would harmonize better with the other records.

The point, however, of which we should like to see proof is the *motion* of the nucleus; there is no doubt that the phenomena occurred later, in the south, but that does not prove that *the* storm which was over Kettering about 8.30 a.m. was over London at 9.46 a.m.

These phenomena might be imagined to have something like a decennial period, and a fondness for January—at any rate, the following are the dates of some analogous cases:—

- 1869. Jan. 16th. Quar. Weather Report, 1869, pl. vii., and Quar. Journal Met. Soc., vol. iv., 1876, p. 75.
- 1876. Jan. 30th. Quar. Jour. Met. Soc., vol. iv., 1876, p. 73.
- 1886. Jan. 13th. Quar. Jour. Roy. Met. Soc., vol. xii., 1886, p. 292.
- 1895. Jan. 23rd.

In the discussion upon Mr. Scott's paper on the squall of 1886, Mr. Gaster explained why "care is necessary in deciding whether phenomena occurring in chronological order at a line of stations are the result of one travelling disturbance, or of several independent ones."

The following notes are arranged from N. to S. :—

SUNDERLAND.—The rise on the barogram is at 5.55 a.m.; there had been aurora at 4.35 a.m., but I have no record of the weather at 5.55 a.m., nor were T or L reported.—*T. W. Backhouse.*

CONYNGHAM HALL, KNARESBOROUGH.—There is a slight rise in the barometer curve at 7.10 a.m., but no T or L was observed here, although some of my men were up before 6 a.m. T was said to have been heard at Leeds.—*Basil T. Woodd.*

YORK.—Our barograph was gaining badly (corrected  $3\frac{3}{4}$  hours on 25th), but I make the jump to have occurred at 5.45 a.m. Furious wind from N.W. or N.N.W., with sleety S. I did not notice the time. Cannot hear of any T or L.—*J. F. Clark.*

NEWARK.—Violent S and hailstorm in early morning with T and L.

SOUTH LINCOLNSHIRE.—A remarkable storm passed over here. A heavy leaden cloud enveloped the district about 8 a.m., and S fell thickly, accompanied by T and L. The wind blew a hurricane, and for about 15 minutes there was a perfect blizzard. The darkness was so intense that artificial light was necessary. After the cloud had passed, the sun shone out brilliantly, and continued during the remainder of the day; the weather, however, was bitterly cold.

KETTON, RUTLAND.—A very dark cloud passed over at 8.15 a.m.; the birds were frightened, and flew towards the house.—*F. Coventry.*

OUNCLE.—S, H, B, L and T in the morning.

KETTERING.—A violent storm burst over the town about 8.30 a.m. The lightning struck the dome of Rockingham-road Wesleyan Chapel, smashing a

portion of it, and slightly damaging the roof of the main building. At Messrs. Humphries and Barlow's shoe manufactory, the lightning severed a gas pipe and ignited the gas, which in turn set fire to the adjacent woodwork. The outbreak was discovered some time afterwards by the workpeople in an opposite factory, and was soon subdued. Throughout Northamptonshire it became so dark between 8.30 and 9 a.m., that lights were everywhere used.—*Standard*.

EASTON MAUDUIT, NORTHAMPTON.—Sun bright at 8.15 and 8.30 a.m.; about 8.40 I was startled by a long rattle of T, and saw a black cloud coming from N.N.W.; it burst on us, with snow and sleet, from about 8.50 to 9.30 (= .05 in.), wind strong, and increased till noon, when it blew furiously.—*H. A. Boys*.

### A WINTER THUNDERSTORM.

*To the Editor of the Times.*

SIR,—In other countries winter TSS are common; but in this country, when during a S shower there is vivid L and loud T, many persons look upon it as unprecedented. It is unusual, but that is all. If I am not mistaken, there has already been one English house wrecked by L this year; and this morning we had a short, sharp storm in London with H and S. The storm must have been extremely low in the atmosphere and very near this house, for the time-interval (that is, the interval between seeing the L and hearing the T) was extremely short. The times of the L, of the T, the time-interval, and the duration of each peal of T were as follows:—

Lightning.			Thunder.			Time-Interval.	Duration of Thunder.
H.	M.	S.	H.	M.	S.		
9	52	10	9	46	45	—	—
9	53	8	9	52	12	2 secs.	8 secs.
9	53	37	9	53	11	3 secs.	7 secs.
9	53	56	9	53	40	3 secs.	5 secs.
9	54	56	9	54	0	4 secs.	3 secs.
9	54	56	9	55	1	5 secs.	29 secs.
9	56	30	9	56	33	3 secs.	14 secs.

Adopting the usual approximate rule that sound travels a mile in five seconds, we see that all these flashes occurred within a mile of this house, and most of them within half a mile. There was, as usual, a sharp rise of the barometer, .049 in. in about ten minutes, a fall of 5 deg. in temperature, while the H and S when melted yielded just 0.10 in. water. It was very soon over, and by 10.10 a.m. the sun was shining brightly.—Your obedient servant,

62, Camden Square, N.W., Jan. 23rd.

G. J. SYMONS.

MAIDA VALE, LONDON.—First T at 9.46 a.m.; L and T at 9.51 to 9.58; squall commenced 9.53, moderated at 10.7 a.m.—*K. J. Marks*.

WILLESDEN.—The TS was accompanied by a heavy downfall of H and S. One flash of L had the appearance of a huge bomb bursting in the air.

LONDON.—Early yesterday morning a remarkable storm swept over London. It began to rain at about 9.50, with a boisterous wind from the south-west, which suddenly raced to the north, changed the R to sleet, then to H, and finally settled down to a good fall of S. Darkness as of night now prevailed as a sharp thunderstorm passed. Five minutes afterwards the sky presented a clear blue, with a comparatively balmy air and brilliant sunshine, the wind gently blowing from the north-west.—*Daily Graphic*.

LONDON.—Almost simultaneously with one of the severe claps of T, the steeple of St. Clement Danes Church in the Strand was so shaken that the bells were set ringing, and were heard distinctly in one of the rooms in the basement of the Law Courts opposite. The Churchwarden expresses doubt of this, but evidence on the other side is distinct. There is also the confirmatory evidence that another report states that “during the TS, people in the Strand heard a muffled and then a loud peal of bells from the belfry of the church of St. Clement Danes. It was subsequently found that the steeple had been struck by L, and that, with the heavy T, had started the bells. No damage was, however, done.”

WESTMINSTER.—The church of St. Stephen, Rochester Row, was struck by L. The conductor on the spire was first struck, but the conductor crossed a gaspipe, and there the L melted the lead and ignited the gas. This set fire to the organ loft, but the attention of a bellringer was attracted, and he succeeded in extinguishing the flames.

CHISWICK.—A horse attached to a carrier's cart was struck dead by L in the Chiswick High Road on Wednesday morning. The animal was standing outside a public-house, where its master was taking shelter from the storm, when the L, which was very vivid, and followed by a heavy clap of T, struck it behind the left ear.

KENNINGTON.—The storm was very severe. Just after ten o'clock, S and H fell heavily, accompanied by a perfect hurricane, and the L and T which followed were terrific. For a time it was almost impossible to carry on the tram or omnibus traffic, and passengers on the roofs of the omnibuses and trams sought shelter in the shops and other covered ways. There was great delay in the changing of horses at the Kennington terminus, and the road was so slippery that the animals in many instances could not keep their feet. The tram company will be heavy sufferers by the injuries done to their stock.

BRIXTON.—In this neighbourhood much damage was done to glass, and many trees were blown down by the gale.

BLACKHEATH, LONDON, S.E.—Many watches stop in London daily, but the following *may* be of interest.—ED.

## THUNDERSTORMS AND WATCHES.

*To the Editor of the Standard.*

SIR,—During the remarkable thunderstorm which passed over London yesterday morning my watch suddenly stopped. At the time I did not think much of the occurrence, although my watch has never done so before; but I afterwards met no fewer than four persons who told me that the same thing had happened to them. I think this must be something more than a mere coinci-



dence, and it would be interesting to know whether any other of your readers have met with a similar experience.—I am, Sir, your obedient servant,

4, The Grove, Blackheath, S.E., Jan. 25.

G. H. ELDER.

SHEERNESS.—An interval of darkness, followed by S, with T and L, and a N.W. gale.

SHEPPEY, LEYSDOWN.—Squall with H, T, L, and a N. gale, then sunshine.—*A. Farbrother.*

HERNE BAY.—The storm broke here with considerable fury about 10 a.m., and was accompanied by sleet and S, and the tide was unusually high.

KINGSTON-ON-THAMES.—About 10 a.m. the sky suddenly became overcast, and a torrent of large hailstones, accompanied by T and L, swept over Kingston-on-Thames. So violent was the wind that 6 large trees in Lower Ham Road were levelled with the ground in an instant. Several windows in the houses in Lower King's-road were blown in, a chimney and part of the roof of one house were blown away, and a large tree in the grounds of the residence of the Mayor, Alderman Sherrif, was blown against the house and did much damage. At the infants' school in Richmond-road slates were dislodged, and in London-street tiles were blown off several houses. At the railway station, several large boards were hurled down, and the bookstall was cleared of its papers, which were scattered about. The L rang the fire alarms in Kingston, and the Brigade quickly turned out, only to find that their services were not required.

LOWER ADDISCOMBE ROAD, CROYDON.—Two claps of T at 9.55 a.m., squall at 10 a.m., R, then dark, then sleet, changing to H, then lighter, with S till 10.20 a.m.—*H. Newby.*

WALLINGTON.—According to the trace of my barograph, the TS passed here at 9.57 a.m.—*F. C. Bayard.*

HYPHE, KENT.—At 9 a.m. R, at 10.20 a.m. dense darkness and S blizzard, which lasted for a few minutes.—*H. Mackeson.*

CROWBOROUGH OBSERVATORY, SUSSEX.—Sky became suddenly overcast about 10.15 a.m. by a dense mass of cloud from N.W.; S soon began, and in less than five minutes quite a hurricane came on, and a regular blizzard, which continued till about 10.35, when it ceased as suddenly as it had begun. At 10.25 a.m. there was a brilliant flash of L, and a very loud and *prolonged* peal of T; the spire of Rotherfield Church was struck, but the conductor proved equal to the occasion, and scarcely any damage was done.—*C. L. Prince.*

DITCHLING, SUSSEX.—Heavy S squall at 11 a.m.—*F. H. Phillips.*

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We are glad to be able to state that this subject will be treated of in a paper by Mr. W. Marriott at the meeting of the Royal Meteorological Society on February 20th.

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## CLASSIFICATION AND DEFINITION OF CLOUDS.

*To the Editor of the Meteorological Magazine.*

SIR,—In the January number of your Magazine, Mr. Scott's report to the Royal Meteorological Society on the "Classification and Definition of Clouds," adopted by the International Meteorological Committee last August, differs somewhat from my own report on this subject, published in the *American Meteorological Journal* for December, 1894, and reprinted in *Nature* of December 20th.

As a member of the Special Committee appointed at Munich in 1891 to report on a new Cloud Atlas to the Permanent Committee, of which Mr. Scott has so long been the indefatigable and efficient secretary. I should like to explain my interpretation of the official *procès-verbaux*, which Mr. Scott has evidently translated. The cloud classification recommended is substantially that of Abercromby and Hildebrandsson, for which the Atlas, with its text in four languages, published in 1890 by Drs. Hildebrandsson, Köppen, and Neumayer, has been generally accepted hitherto by Meteorological institutions as an authoritative exposition. This Atlas formed the basis of the Cloud Committee's discussion at Upsala, and I have, therefore, preferred to follow closely its English text, except so far as modifications introduced by us in its French text (which alone was considered) affected the former.

The differences between Mr. Scott's version and my own are, in general, immaterial, but I should like to substitute for his definition of Alto-Cumulus (dense fleecy cloud), "largish globular masses"—my definition of "larger . . . balls"—as being a better rendering of the French text, and also as showing this cloud's relation to Cirro-cumulus (fleecy cloud), which is defined as "small white balls," or, according to Scott, "small globular masses. . . ."

Regarding cloud heights, I would call attention to the note in my report pertaining to the altitude of the Nimbus and Cumulo-nimbus, as measured at Blue Hill. It was here found that the bases of the Nimbus frequently fell below 1,000 metres (3,280 feet) while the tops of the Cumulo-nimbus often attained 8,000 metres (26,240 feet). Prof. Hildebrandsson, the Chairman of the Publication Committee for the Cloud Atlas, has promised to modify the altitudes stated in this Atlas, so that low clouds shall include those below 2,000 metres, and the superior limit of the Cumulo-nimbus shall be raised to 8,000 metres. With these changes, the heights of the clouds measured in Sweden are in fair agreement with the same clouds measured by identical methods in America.

The importance of an exact statement of definitions in the first announcement of what will doubtless soon come into current use in meteorology is my excuse for occupying your space with such details. Our Committee has sought to secure accuracy by requiring

that translations of the French, English, or German text into other languages shall be made under the supervision of the Publication Committee, consisting of Prof. Hildebrandsson, M. Teisserenc de Bort, and Prof. Riggenbach.—Yours faithfully,

A. LAWRENCE ROTCH, F.R.Met.Soc.

*Blue Hill Observatory, Readville, Mass., Jan. 30th, 1895.*

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[The responsibility for the account of the Meeting of the *Roy. Met. Soc.* rests entirely with us, we believe the report of Mr. Scott's paper to be substantially correct.—ED. *Met. Mag.*]

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## REVIEWS.

*Cloudland. A Study on the Structure and Characters of Clouds*, by Rev. W. CLEMENT LEY, M.A., F.R.Met.Soc. London: Stanford, 1894. large 8vo. ix.—208 pages, 6 coloured plates, 8 photo prints, 4 charts, and 10 diagrams.

It is with a feeling of sadness that we begin our notice of this work, for the preface is signed, not by the author, W. Clement Ley, but C. H. Ley. Mr. Clement Ley has devoted years to the study of clouds; probably since man first trod this earth, no one, not even Luke Howard, watched the clouds more carefully, or for a longer period. For years he has been collecting facts for, and looking forward to the publication of, this work, but he was too enthusiastic, and as the result he has been unable to complete it. We are sure that he and his family will have the sympathy of all our readers.

We, however, have to report upon the book, not on the author; and we can begin by saying that the get-up of the book is faultless, and that the reproductions of Mr. Clayden's cloud photographs are the best we have ever seen. Years ago (in 1872) we had to review Mr. Clement Ley's *Laws of the Winds in Western Europe* (Part I.). Part II never appeared; but it seems to us that the latter portion of the present work, with its isobaric charts, &c., would be nearly equally appropriate as a sequel to *Laws of the Winds* as it is to *Cloudland*.

However, it is with *Cloudland* that we have to do; and we cannot say that we like it. The nomenclature is founded upon Howard's (whose name, strange to say, we have not seen anywhere in the volume), but split up into no fewer than 26 varieties, and some of them with nearly that number of letters in their name, *e.g.*, Cumulonimbus Grandineus. If clouds, like plants, had definite forms, it would be easy to adopt 26 or 260 names just as botanists do, but, unfortunately no two clouds are alike, and every cloud is constantly changing in appearance, both from its own change of structure, and

from the varying angle which its motion causes it to make with the eye of the observer. We, therefore, think that to attempt to provide a nomenclature to suit all times and climes is to attempt the impossible.

We think, however, that the publication of this book is singularly opportune, because, if we understand aright the proceedings of the International Meteorological Committee, that body is going to issue "an authoritative cloud atlas"—the appearance of which we await with interest—and it is evidently advantageous that the members of that Committee have had the opportunity of considering the outcome of Mr. Clement Ley's researches before issuing their report.

It is, perhaps, desirable that we should mention that Mr. Ley has two classes of clouds, one of less importance than the other; and that each class is divided into four varieties:—clouds of (1) radiation, (2) interrefret, (3) inversion, (4) inclination. For the precise meaning which he attaches to the above words we must refer the reader to the work itself.

Mr. Ley tells one bright little story which well illustrates the remarkable personal utility of his life-long study.

"47. Occasionally when the area of high barometric pressure at the [earth's] surface is gaining the victory, and the advancing cyclonic disturbances are dying out, this form of cloud disappears, or is superseded by Stratus Quietus, or by other cloud varieties of less interesting type. But rather more frequently the ulterior development into Cumulo-nimbus occurs here and there as the cyclonic disturbances approach. The possibility of hazarding a prognostic of this development, even when the direction of the movement of the cloud is totally unknown, may permissibly be illustrated by the following little anecdote, which at the same time indicates the small amount of attention devoted to the form of cloud. An artist, possessed of a keen sympathy with nature, and a most conscientious draughtsman, showed the writer a painting of a sky marked by this cloud in unusually large proportions, occurring over North Britain, and asked what kind of weather was experienced subsequent to the drawing of his sketch. He received the correct answer that a severe thunderstorm occurred within about an hour of the time when the sketch was taken, although in the painting there were no representations of those clouds which are commonly called "thunderclouds." On being asked what certain other painters had remarked about his painting, the artist answered, "they only say 'What a funny cloud.'"

In artistic matters our judgment is probably worth little, but we have not yet seen any coloured plates of clouds which, in our opinion, approach success. As reproductions of the originals, and as specimens of colour printing, we do not doubt the excellence of plates i. to vi. in *Cloudland*, but we infinitely prefer the photo-prints in the same book: they are very similar to those by Sig. Manucci, published by the Specola Vaticana; we could not give them higher praise, for they are as like nature as any reproduction that we can imagine. The problem before the compilers of the "authoritative cloud atlas" is, we think, neither the obtaining of good photographs, nor their reproduction, but giving names and definitions which shall be better than Howard's, and last in favour as long as his, viz., 91 years.

*Annales de l'Observatoire Météorologique du Mont Blanc* (altitude 4,365 metres = 14,321 feet), publiées sous la Direction de J. VALLOT, Fondateur et Directeur de l'Observatoire. Paris, Steinheil, 1893, 4to, xvi.-190 pages.

THE first article in the *Meteorological Magazine* for 1889 bore the strange but true title of "Three days on the top of Mont Blanc." That article explained how a French gentleman, entirely at his own cost, had requested Messrs. Richard Frères to construct a remarkable series of meteorological instruments, had a tent, food, fuel, and all the instruments and material required for their installation, carried to the top of Mont Blanc, and how he and M. F. M. Richard jointly erected them, and took the observations.

It was M. J. Vallot who did all that, it is to M. J. Vallot that we are indebted for the sumptuously printed volume which to our regret has had to wait long for the very hearty welcome we are glad to give it.

It is curious that High Level observatories are generally the result of private enterprise. Scotland would never have had Ben Nevis but for Mr. Wragge, France would not have had the Pic du Midi but for General de Nansouty, and there would have been no observatory on Mont Blanc but for M. J. Vallot.

If subsequent volumes resemble the first there will be a large collection of very useful and interesting information ; there is so much in the present volume that it is difficult to do justice to it.

The preface deals with the issue of the Annals, the arrangements of the observatory, which is now a large and comfortable building with eight rooms, besides an annexe with two rooms for tourists and guides. The arrangements for the accommodation of scientific men who desire to carry on experiments at a high altitude are extremely liberal—hospitable would, perhaps, be a better word. We ought, perhaps, to explain that the observatory is not on the absolute summit, but in what is in many respects a better position, viz., on the Roches des Bosses, at 14,321 ft., the highest summit being 15,781 ft.

M. J. Vallot, who is evidently a lover of the mountain, probably knows it even better than the guides, and must have spent several thousand pounds in what has already been done, seems to us to have three primary objects : (1) Meteorological research ; (2) Aiding all branches of scientific work on Mont Blanc ; (3) Producing a rigorously accurate map of it on the scale of 3 inches to the mile by an entirely new triangulation and survey.

The eleven articles in the present volume are extremely interesting, and are mostly by either M. H. or by M. J. Vallot. The first epitomizes the results (and reproduces the curves) of synchronous records of barometers at Chamonix (3,396 ft.), Grands Mulets (9,876 ft.) and Summit (15,781 ft.). Perhaps the most noticeable feature is the excessive thickening of the barometer trace during storms, it might be thought that this was due to the wind shaking the instrument, but in a later article M. J. Vallot shows conclusively

by the records of a statoscope that they are really due to differences of pressure, and by taking the statoscope into the open and sitting on a rock, while holding it and allowing it to make its record, he showed that the cause is a natural one, quite independent of any change produced in a confined space by the passage of a strong air current. He, therefore, holds that the oscillations are due to the passage of a multitude of small disturbances (may we not say to eddies in the general atmospheric stream, which are as imperceptible at low altitudes in the atmosphere as would water eddies be to an observer at the bottom of a river). The use by M. Vallot of the word 'tourbillons' suggested to us that of whirls, but we see no evidence of circular motion; we presume that when a current of air which we should call (say) a strong W. wind flows over the plains of France some parts of the current are going faster than others, when the current reaches Mont Blanc it must escape laterally or rise and flow over the top, and it is to the passage of streams at various velocities and various angles that we should attribute the irregularities in the atmospheric pressure recorded by the barometer and confirmed by the statoscope.

Another interesting article is on the accuracy of the temperature correction of Fortin, Aneroid and Bourdon barometers; and then there is the full story of how M. Eiffel drove a tunnel into Mont Blanc 46 ft. below the summit, which tunnel, originally 97 ft. long, and subsequently lengthened by 75 ft., went all the way through solid ice; but there is no end to the information, there are exciting stories of a death from Mal de Montagne, and of two by an avalanche, we hear how one man secured sleep only by opium and phénacétine, and another was brought round by some of the oxygen which M. Vallot had always in reserve; but we must stop. It is one of the most fascinating books which we have read, copiously illustrated, and one of which any government and *à fortiori* any private gentleman may well be proud.

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### THE SCIENTIFIC USE OF KITES.

WE believe that the first use of a kite in connection with meteorology was about 1750, when Franklin, in his well-known experiment, obtained electrical discharges from a thunder-cloud by means of a cord carried up to the cloud by a kite. Admiral Back, when in command of the "Terror" in 1836 and 1837, is reported to have used a kite to obtain the temperature of the upper air in the Arctic regions; and Sir Francis Ronalds, at Kew, in 1847, made experiments with kites.

In 1882 Mr. Douglas Archibald carried on a somewhat elaborate series of scientifically conducted experiments with anemometers and thermometers carried by kites up to heights of about 2,000 ft. With the object of obtaining additional power he used a series of

kites flown "*tandem*," i.e., one above the other, and was, we believe, the first to adopt this device. Thus from time to time this comparatively simple and inexpensive apparatus has been tried for meteorological work, but we believe it has never been used by any of the Government services, although the results obtained would, we think, amply justify a more extensive and prolonged series of trials.

After the lapse of another ten years, for we believe Mr. Archibald's observations were the last, we find a fresh series of experiments, this time in America, and the authors in an article in the December number of the *American Meteorological Journal*, speak hopefully of the value of the results to be obtained.

The experiments were made at the Blue Hill Observatory of the well-known meteorological enthusiast, Mr. A. Lawrence Rotch, by Mr. William A. Eddy, of Bayonne, N.J., who, by means of the *tandem* principle, has sent up kites to altitudes exceeding a mile.

A modified Richard thermograph was constructed chiefly of aluminium on a hard rubber base, the total weight being only one pound eight ounces.

On August 4th this thermograph was carried up by six kites, reaching an altitude above the hill-top of 1,000 ft., and again on August 15th, the results obtained being compared with the records of Richard thermographs at the Observatory, 640 ft. above sea-level, and at the Valley Station two miles N. of the observatory and 50 ft. above sea-level.

*Rate of Decrease of Temperature per 100 ft., August 4th, 1894.*

Time.	2.22 p.m.	2.41 p.m.	3.8 p.m.	3.10 p.m.	4.37 p.m.	5.3 p.m.	5.5 p.m.
Valley to Summit	0°·41	0°·37	0°·34	0°·39	0°·39	0°·49	0°·39
Summit to Kite ...	1°·43	1°·01	0°·90	0°·66	0°·33	0°·36	0°·50

*August 15th, 1894.*

Time.	1.30 p.m.	1.52 p.m.	3.28 p.m.	3.30 p.m.	4.3 p.m.	4.18 p.m.	4.20 p.m.
Valley to Summit	0°·80	0°·76	0°·46	0°·47	0°·47	0°·41	0°·41
Summit to Kite ...	0°·14	0°·28	0°·36	0°·40	0°·51	0°·18	0°·26

On August 4th the sky had been clouded during the morning with strato-cumulus surmounted by a sheet of alto-stratus, but these began to break away about 2 p.m., and after 3.10 p.m. the sun came out though the sky continued more than half covered. While the kites were in the air the wind was from W. and N.W., with a velocity gradually rising from ten miles at the beginning to twenty miles at the end of the experiment. The barometer was rising, a minimum having occurred during the preceding night.

On August 15th during the experiment the wind blew steadily from the south with a nearly constant velocity of about twenty miles an hour. The barometer was falling slowly. The sky was covered with alto-cumulus and alto-stratus increasing in density, and it became necessary to draw down the kites on account of the approach of a thunder-shower.

The following are among the results furnished by the kites :—

“On July 31st the kites were let up at noon in a sea breeze. When the kites had risen about 400 ft. above the hill the topmost kite veered round from the west, thus giving the depth of the sea breeze as 1,000 ft. above sea level. During the afternoon the sea breeze steadily increased in depth and veered toward the south.”

“On August 6th, during the prevalence of light winds from the west, an effort was being made to elevate the kites which refused to remain permanently in the air since the air movement was not sufficient to sustain the heavy kites employed. But at 2.20 p.m., while a five-foot kite was being maintained at a short distance above the hill by means of sundry jerks and pulls, a rather large cumulus cloud approached the zenith, and suddenly the kite began to ascend almost vertically. Cord was rapidly let out and in a short time the kite was flying directly overhead, and continued to rise until all the available cord had been let out. It followed the cumulus for a short distance beyond the zenith, then rapidly dropped to the earth. Mr. Eddy afterward measured the length of cord out and reported 1,172 ft, which must have been approximately the altitude of the kite since the cord hung almost vertically under it. This seems to furnish striking evidence of the existence of ascending currents under the cumulus clouds.”

“The kites also at times gave evidence of great ærial eddies around and above the hill, which swayed the kites from side to side.”

“It is hoped to continue these experiments at the Blue Hill Observatory, and if possible reach great altitudes. Mr. S. P. Fergusson believes he can construct a meteorograph which will record pressure, temperature, wind velocity, and humidity, and not be beyond the lifting-power of the kites.”

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#### ROYAL METEOROLOGICAL SOCIETY.

THE annual meeting of this Society was held on January 16th, at the Institution of Civil Engineers, Mr. R. Inwards, F.R.A.S., President, in the chair.

The report of the Council was read by Mr. F. C. Bayard, and showed a successful year, and general activity in the various branches of work undertaken by the Society and its Committees. Forty-five Fellows were elected during the year, and the number on the roll increased, although the Society lost by death two Honorary Members and 11 Fellows. The balance-sheet shows an excess of assets over liabilities of nearly £3,000, in addition to the library and instruments, and £1,300 of funds held for special purposes. The following are the officers and council for the ensuing year :—

*President*, Mr. R. Inwards ; *Vice-Presidents*, Dr. Robert Barnes, Mr. Peregrine Birch, Dr. C. Theodore Williams, Captain Wilson-Barker ; *Treasurer*, Mr. H. Perigal ; *Secretaries*, Mr. F. C. Bayard, Mr. G. J. Symons ; *Foreign Secretary*, Mr. R. H. Scott ; *Council*, Messrs. A.



Brewin, G. Chatterton, R. H. Curtis, W. H. Dines, W. Ellis, C. Harding, Baldwin Latham, Admiral J. P. Maclear, Mr. E. Mawley, Dr. H. R. Mill, Messrs. H. Southall and Sowerby Wallis.

The President delivered an address entitled "Weather Fallacies," being practically a brief history of prophetic weather lore from the times of Hesiod, Theophrastus and Aratus to the present day, grouped under Saints Day fallacies, sun and moon fallacies, and those concerning animals and plants, Almanac makers, weather prophets and impostors. Owing to the vastness of the subject the paper was necessarily condensed, and no abstract can be given.

The usual votes of thanks were accorded to the Officers, Council, Committees, &c., and to the Institution of Civil Engineers for the use of their theatre for the meetings of the Society.

The annual meeting was preceded by an ordinary meeting, at which several new fellows were elected, and a paper was read by Mr. Charles Harding on the gale of December 21st-22nd. He said that this storm was one of exceptional severity, especially over the northern portions of England and Ireland, and in the south of Scotland. It developed energy very quickly and travelled with great rapidity, the centre of the disturbance traversing the north of Scotland. The self-registering anemometers show that the greatest violence of the wind occurred at Fleetwood, where the velocity of the wind was 107 miles in the hour, recorded at nine o'clock on the morning of the 22nd, and for four consecutive hours the velocity of the wind exceeded 100 miles. This is the greatest force of wind ever registered in the British Isles, and the maximum velocity is eleven miles an hour in excess of the highest recorded in the "great storm" of November 16th-20th, 1893. At Holyhead the wind in squalls attained the hourly velocity of 150 miles between 10 a.m. and noon on the 22nd, and at Liverpool the wind travelled 89 miles between 10.30 and 11.30 a.m. The strongest force of the wind was generally from the north-westward. Exceptionally violent gusts of wind were experienced during the gale in nearly all parts of the United Kingdom, and at Greenwich a pressure of 28 lbs. on the square foot was registered at about 6 a.m. on the 22nd. A precisely similar squall was registered a few minutes earlier at Kew, while two hours earlier a squall passed over Falmouth, in which the changes of wind, barometer, and temperature justify the opinion that it was due to this same disturbance, travelling at the rate of about 120 miles an hour. The storm was of comparatively short duration, but at Fleetwood the velocity of the wind was 85 miles an hour, or above, for eleven hours, and the average wind velocity for twenty-three hours was 77 miles. Much destruction was wrought both on sea and land, and there was a very heavy loss of life. The Board of Trade returns received up to January 16th show that 167 lives were lost at sea on our coasts within the limit of the wreck chart, and there was also great loss of life in the North Sea. One hundred and ten casualties were posted on the Loss Book at

Lloyd's, mostly due to the gale. The Lifeboats of the Royal National Lifeboat Institution were launched forty-three times during the gale, and they were the means of saving 103 lives and two vessels. The storm appears to have traversed the Atlantic, and was situated to the south of Bermuda on December 19th.

In the discussion which followed, Mr. Symons quoted from a letter addressed to Mr. H. S. Eaton, giving observations of the deflection of the Blackpool Tower (500 feet in height) obtained by Messrs. Ashley and Bell, who remained in the room at the top during the gale. The maximum deflection was about  $2\frac{1}{4}$  inches. Mr. Symons also summarised observations of the deposit of salt on window panes and foliage during the gale, showing that it was recorded at Settle, 24 miles from the sea, Sowerby Bridge, 40 miles, Bolton Abbey (42 miles), Meltham (45 miles), Harrogate (50 miles), East Ardsley, Wakefield (57 miles), Bramhope (60 miles), Masham (65 miles), and Birmingham, 55 miles from the Bristol Channel, and nearly 100 miles from Cardigan Bay.

Admiral Maclear remarked that the velocities given by Mr. Harding exceed by 50 per cent. hurricane force of Beaufort Scale, and yet the effects of the wind bear no comparison to what he had himself seen in hurricanes in the China Sea.

Mr. Curtis spoke on the bearing of the factor used in graduating anemometers on the results given by Mr. Harding, and explained that the bridled anemometer at Holyhead was graduated by direct experiments made by Mr. Dines on his whirling machine at Hershham.

Mr. Harding, in his reply, said that as there was no case in which an anemometer had survived a tropical hurricane, there was no information as to what the velocity in them really was.

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## THE WEATHER OF JANUARY : A RECORD ?

*To the Editor of the Meteorological Magazine.*

SIR,—There have, of course, been colder Januarys than the last, but not one, so far as my observations go, in which there has been such a uniform dead-level of low temperature from beginning to end. There was not a single day in the whole month which could be called "mild" even for the time of the year. The absolute maximum in the shade,  $41^{\circ}8$ , is not only the lowest that I have registered in any January, but in any month of any year covered by my observations. The nearest approach to such a low maximum, in the 23 years during which I have carried on regular observations in the Midland district, was in January 1879, when the maximum was  $44^{\circ}5$ , and the next nearest was in January 1881, when it was  $46^{\circ}4$ . There was only one other instance during the 23 years when the maximum was below  $50^{\circ}$ , viz., in 1891, when it was  $49^{\circ}2$ . The mean of the

absolute maxima for the whole period being  $52^{\circ}3$ ; more than 10 degrees above the highest point reached by the thermometer in January 1895. I shall be interested to hear whether so low a maximum has been registered by any observer in the Midland district either in last January or in any month of any previous year.

GEORGE T. RYVES, F.R.Met.Soc.

*Team Vicarage, Stoke-on-Trent,  
February 4th, 1895.*

### THE FROST OF FEBRUARY, 1895.

As the frost still (13th) continues, it would be impossible to deal with it satisfactorily in this number; we therefore hold over until next month all communications received. Exceptionally low temperatures have been recorded in many parts of the kingdom, especially about Leicester, where, owing to its central position, the climate approximates more nearly to Continental conditions.

At Camden Square, the frost—considering both intensity and duration—is clearly unprecedented since observations commenced in 1858; from a cursory examination of the Greenwich values, it appears to be similar to that of 1855.

### UNUSUAL SNOW CRYSTALS.

*To the Editor of the Meteorological Magazine.*

SIR,—During the recent cold and snowy weather, I have been constantly on the look-out for remarkable snow crystals, but without success until this morning, when at 8.30 a.m., with the temp. about  $10^{\circ}$ , snow was falling in single crystals, varying considerably in size, and many of them exceptionally large. With the same pocket scale referred to in my letter of January 6th, 1894, I measured about a dozen, and succeeded in finding two even larger than the largest recorded in that letter. One measured exactly  $\frac{1}{12}$  inch, and the other a shade under  $\frac{2}{24}$  inch. I have not seen any spherical crystals, but found several with an additional limb starting from the centre at the usual angle of crystallisation.

Yours very truly,

H. SOWERBY WALLIS.

25, Northwood Road, Highgate, February 7th, 1895.

## CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JULY, 1894.

STATIONS.  (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
°		°		°	°	°	0-100	°	°	inches			
England, London .....	88·2	6	48·9	14	73·0	54·8	53·7	74	128·2	42·6	3·25	17	6·9
Malta.....	96·3	12	64·7	3	87·6	69·0	67·1	69	150·0	58·3	·00	0	1·9
<i>Cape of Good Hope</i> ...	...	...	...	...	...	...	...	...	...	...	...	...	...
<i>Mauritius</i> .....	77·6	11	59·7	21	74·9	64·8	61·6	77	124·7	48·6	2·29	19	5·0
Calcutta .....	90·8	14	75·7	11	86·9	78·0	78·2	88	159·7	74·6	11·34	18	8·3
Bombay.....	87·5	2	74·1	17	84·2	77·0	76·3	86	134·5	72·0	26·16	31	8·6
Ceylon, Colombo .....	86·7	1	73·3	...	84·4	77·0	71·6	78	145·5	70·0	1·72	13	5·6
<i>Melbourne</i> .....	...	...	...	...	...	...	...	...	...	...	...	...	...
<i>Adelaide</i> .....	68·1	27	37·2	8	58·0	45·5	44·0	78	123·8	30·7	3·50	17	7·1
<i>Sydney</i> .....	68·9	28	40·4	11	58·7	45·4	40·0	74	111·9	27·9	1·35	7	3·1
<i>Wellington</i> .....	59·0	26	34·5	28	53·4	44·4	41·4	76	98·0	24·0	6·49	21	5·5
<i>Auckland</i> .....	62·0	3	39·5	28	58·6	46·6	45·0	75	116·0	37·0	4·35	19	5·6
Jamaica, Kingston.....	92·9	17	66·3	25	89·2	72·1	71·0	73	...	...	1·21	6	3·6
Grenada.....	87·0	29	72·0	1, 6	83·8	74·5	68·9	72	157·0	...	3·53	22	4·3
Trinidad .....	92·0	6	66·0	25	88·5	69·4	70·2	77	172·0	62·0	4·53	15	...
Toronto.....	89·9	12	46·6	9	79·5	58·7	57·8	69	...	41·5	1·61	13	4·5
New Brunswick, } Fredericton .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Manitoba, Winnipeg... }	95·8	16	40·0	4	81·3	54·9	...	...	...	...	·63	12	4·6
British Columbia, } Esquimalt.....	84·0	12	45·2	31	69·1	49·6	51·7	81	...	...	·21	6	2·8

## REMARKS.

**MALTA.**—Adopted mean temp. 77°·6. Mean hourly velocity of wind 6·2 miles. Sea temp. rose to 81°·3. The dew point temp. ranged between 49°·7 on 12th and 73° 8 on 30th. J. F. DOBSON.

**Mauritius.**—Mean temp. of air 0°·7 above, of dew point 2°·2 above, and rainfall ·09 in. below, their respective averages. Mean hourly velocity of wind 11·1 miles below average; extremes, 26·1 on 2nd, and 1·7 on 21st and 22nd; prevailing direction, E.S.E. C. MELDRUM, F.R.S.

**Adelaide.**—Mean temp. 0°·2 above, and rainfall ·88 in. above, the average of 37 years. A very cloudy month, the mean amount being 1·5 above the average of 25 years. Good rains fell over the agricultural districts, mostly in excess of the average, especially in the South-Eastern district; but in the Northern, North-East and North-West is was for the most part light and deficient. C. TODD, F.R.S.

**Sydney.**—Temp. 0°·4 below, humidity 3°·1 below, and rainfall 3·11 in. below, their respective averages. H. C. RUSSELL, F.R.S.

**Wellington.**—Showery, unpleasant weather during this month, with occasional intervals of fine days; prevailing S.E. and N.W. winds, generally moderate in force. On the 20th, severe TS, with heavy rain and hail; also hail on 26th. Mean temp. 1°·3 above, and rainfall ·16 in. above the average. Aurora on 20th and 21st. R. B. GORE.

**Auckland.**—Showery and unsettled, but not more so than is usual in July. Mean temp. slightly above, rainfall just under, the average. T. F. CHEESEMAN.

**JAMAICA.**—Mean hourly velocity of wind 4·3 miles. In Kingston the rainfall was about one-half the average, but the mean for every division was a little over the average. R. JOHNSTONE.

**TRINIDAD.**—Rainfall 4·92 in. below the average of 30 years. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL,  
JANUARY, 1895.

[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.			
II.	Dorking, Abinger Hall.	2·45	XI.	Lake Vyrnwy .....	4·85
„	Birchington, Thor .....	3·17	„	Corwen, Rhug .....	3·35
„	Hailsham .....	2·85	„	Carnarvon, Cocksidia ...	2·81
„	Ryde, Thornbrough .....	4·00	„	I. of Man, Douglas .....	2·61
„	Emsworth, Redlands ...	2·69	XII.	Stoneykirk, Ardwell Ho.	2·66
„	Alton, Ashdell .....	2·79	„	New Galloway, Glenlee	2·18
III.	Oxford, Magdalen Col...	2·48	„	Melrose, Abbey Gate ...	3·47
„	Banbury, Bloxham .....	2·90	XIII.	N. Esk Res. [Penicuick]	3·75
„	Northampton, Sedgebrook	2·74	„	Edinburgh, Blacket Pl..	1·77
„	Alconbury .....	2·49	XIV.	Glasgow, Queen's Park.	58‡
„	Wisbech, Bank House..	2·67	XV.	Inverary, Newtown .....	2·18
IV.	Southend .....	1·66	„	Islay, Gruinart School..	1·30
„	Harlow, Sheering ...	2·09	XVI.	Dollar.....	2·07
„	Colchester, Lexden.....	1·98	„	Balquhidder, Stronvar..	3·31
„	Rendlesham Hall .....	4·24	„	Ballinluig .....	3·75
„	Diss .....	3·07	„	Dalnaspidal H.R.S. ...	3·94
„	Swaffham .....	3·21	XVII.	Keith H.R.S. ....	1·95
V.	Salisbury, Alderbury ...	3·51	„	Forres H.R.S. ....	3·14
„	Bishop's Cannings .....	3·53	XVIII.	Fearn, Lower Pitkerrie.	2·74
„	Blandford, Whatcombe ..	3·77	„	Loch Shiel, Glenaladale	4·51
„	Ashburton, Holne Vic....	5·31	„	N. Uist, Loch Maddy ...	2·92
„	Okehampton, Oaklands.	4·69	„	Invergarry .....	1·75
„	Hartland Abbey .....	3·77	„	Aviemore H.R.S. ....	3·83
„	Lynmouth, Glenthorne.	3·80	„	Loch Ness, Drumnadrochit	2·46
„	Probus, Lamellyn .....	6·13	XIX.	Invershin .....	2·19
„	Wellington, Sunnyside..	3·94	„	Scourie .....	2·86
„	Wincanton, Stowell Rec.	4·11	„	Watten H.R.S. ....	2·75
VI.	Clifton, Pembroke Road	3·93	XX.	Dunmanway, Coolkelure	5·61
„	Ross, The Graig .....	4·40	„	Fermoy, Gas Works ...	2·91
„	Wem, Clive Vicarage ...	3·53	„	Killarney, Woodlawn ...	5·11
„	Cheadle, The Heath Ho.	4·82	„	Caher, Duneske .....	4·23
„	Worcester, Diglis Lock	3·32	„	Ballingarry, Hazelfort...	2·30
„	Coventry, Coundon .....	4·12	„	Limerick, Kilcornan ...	...•
VII.	Ketton Hall [Stamford]	2·70	„	Ennis .....	2·29
„	Grantham, Stainby .....	3·62	„	Miltown Malbay.....	2·55
„	Horncastle, Bucknall ...	3·18	XXI.	Gorey, Courtown House	5·04
„	Worksop, Hodsck Priory	3·54	„	Athlone, Twyford .....	1·92
VIII.	Neston, Hinderton .....	3·45	„	Mullingar, Belvedere...	1·87
„	Preston, Haighton .....	1·94	„	Longford, Currygrane...	2·07
„	Broughton-in-Furness..	3·45	XXII.	Woodlawn.....	3·31
IX.	Ripon, Mickley .....	4·69	„	Crossmolina, Enniscoe..	3·87
„	Melmerly, Baldersby ...	4·10	„	Collooney, Markree Obs.	4·06
„	Scarborough, South Cliff	4·98	„	Ballinamore, Lawderdale	2·77
„	Middleton, Mickleton...	2·39	XXIII.	Lough Sheelin, Arley ..	2·29
X.	Haltwhistle, Unthank..	2·43	„	Warrenpoint .....	2·50
„	Bamburgh.....	3·28	„	Seaforde .....	3·57
„	Keswick, The Beeches...	4·65	„	Belfast, Springfield .....	3·10
XI.	Llanfrechfa Grange .....	5·25	„	Bushmills, Dundarave...	2·68
„	Llandovery .....	4·58	„	Stewartstown .....	3·27
„	Castle Malgwyn .....	...	„	Buncrana .....	3·50
„	Builth, Abergwessin Vic.	7·01	„	Lough Swilly, Carrablagh	3·43
„	Rhayader, Nantgwilt..	6·79			

‡ Snow probably blown out of the gauge.

## JANUARY, 1895.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.						Days on which 40 or more fell.	TEMPERATURE.						No. of Nights below 32°.
		Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours		In shade.	Max.		Min.		On grass.				
				Dpth	Date		Deg.		Date	Deg.		Date.			
inches.	inches.	in.													
I.	London (Camden Square) ...	1.96	+	.34	.75	19	16	51.9	20	20.2	30	21	26		
II.	Maidstone (Hunton Court)...	2.16	+	.61	.30	19	23	...	...	...	...	...	...		
III.	Strathfield Turgiss .....	2.55	+	.74	.68	19	18	52.2	20	19.1	29	18	29		
IV.	Hitchin .....	2.69	+	1.15	.85	19	21	48.0	20	14.0	28	23	...		
V.	Winslow (Addington) .....	2.51	+	.70	.73	19	21	44.0	18	11.0	29	24	27		
VI.	Bury St. Edmunds (Westley) ...	2.87	+	1.40	.84	19	23	48.0	20	7.0	26	...	...		
VII.	Norwich (Brundall) .....	3.44	...	...	.54	19	27	45.0	16	9.5	27	20	27		
VIII.	Weymouth (Langton Herring) ...	4.07	+	1.73	1.44	12	16	50.0	16	20.0	27	21	...		
IX.	Torquay (Cary Green) .....	4.10	...	...	1.27	12	20	51.6	20	23.2	28	16	24		
X.	Polapit Tamar [Launceston]..	4.09	+	1.07	.59	19	19	52.5	18	18.0	29	14	25		
XI.	Stroud (Upfield) .....	3.22	+	1.02	.65	19	18	45.0	17	19.0	10	26	...		
XII.	Church Stretton (Woolstaston) ...	4.51	+	2.35	.67	20	22	40.5	18	12.0	12	26	30		
XIII.	Tenbury (Orleton) .....	4.37	+	2.23	1.05	20	18	45.0	24	12.0	30	24	28		
XIV.	Leicester (Barkby) .....	3.08	+	1.32	.99	20	24	45.0	19	4.0	28	27	31		
XV.	Boston .....	3.07	+	1.68	.61	20	24	47.0	18	13.0	12	23	...		
XVI.	Hesley Hall [Tickhill] .....	3.00	+	1.23	.67	20	20	38.0	20	0.9	12	26	...		
XVII.	Manchester (Plymouth Grove) ...	2.64	+	.18	.48	16	16	44.0	23 <sup>c</sup>	18.0	29	23	...		
XVIII.	Wetherby (Ribston Hall) .....	2.94	+	1.05	.56	20	15	...	...	...	...	...	...		
XIX.	Skipton (Arneliffe) .....	4.51	—	1.13	.65	16	23	...	...	...	...	...	...		
XX.	Hull (Pearson Park) .....	4.62	+	2.85	.83	6	26	41.0	<sup>b</sup>	12.0	11 <sup>d</sup>	27	28		
XXI.	Newcastle (Town Moor) .....	5.28	+	3.47	.77	7	22	...	...	...	...	...	...		
XXII.	Borrowdale (Seathwaite) .....	5.89	—	6.29	.83	23	17	...	...	...	...	...	...		
XXIII.	Cardiff (Ely) .....	4.74	+	1.45	.68	19 <sup>a</sup>	19	...	...	...	...	...	...		
XXIV.	Haverfordwest .....	5.46	+	1.04	.91	20	24	46.2	19	14.3	29	13	23		
XXV.	Aberystwith (Gogerddan) .....	3.40	—	.13	.53	2	14	47.0	16	10.0	27	28	...		
XXVI.	Llandudno .....	2.51	+	.23	.43	20	22	45.0	16	24.8	27	...	...		
XXVII.	Cargen [Dumfries] .....	2.27	—	1.50	.38	16	14	42.2	23	12.0	28	26	...		
XXVIII.	Jedburgh (Sunnyside) .....	2.79	+	1.07	.99	14	...	41.0	22	0.0	11	30	...		
XXIX.	Colmonell .....	2.00	...	...	.31	23	15	48.0	23	10.0	27	23	...		
XXX.	Lochgilthead (Kilmory) .....	1.85	—	4.29	.42	22	11	...	...	14.0	27	28	...		
XXXI.	Mull (Quinish) .....	1.70	—	3.97	.41	6	8	...	...	...	...	...	...		
XXXII.	Loch Leven Sluices .....	2.70	—	.20	1.20	15	9	...	...	...	...	...	...		
XXXIII.	Dundee (Eastern Necropolis) ...	2.90	+	.93	.85	13	19	42.4	23	13.1	11	26	...		
XXXIV.	Braemar .....	3.34	+	.65	.60	13	22	38.0	23	—5.0	9	29	31		
XXXV.	Aberdeen (Cranford) .....	5.13	...	...	1.45	17	25	42.0	14 <sup>g</sup>	5.0	10	24	...		
XXXVI.	Strathconan [Beauly] .....	4.58	—	.30	1.60	1	...	...	...	...	...	...	...		
XXXVII.	Glencarron Lodge .....	5.70	...	...	.85	1	17	42.1	23	9.1	28	30	...		
XXXVIII.	Cawdor [Nairn] .....	2.85	+	.68	.59	18	22	...	...	...	...	...	...		
XXXIX.	Dunrobin .....	3.28	+	.82	.95	16	19	44.2	19	18.5	<sup>e</sup>	21	...		
XL.	S. Ronaldsay (Roeberry) .....	3.04	+	.09	.34	6	28	47.0	18	23.0	27	20	...		
XLI.	Darrynane Abbey .....	5.45	...	...	.76	12	23	...	...	...	...	...	...		
XLII.	Waterford (Brook Lodge) .....	5.76	+	2.20	1.16	15	18	48.0	14	21.0	9 <sup>f</sup>	19	...		
XLIII.	O'Briensbridge (Ross) .....	3.11	...	...	.58	5	16	...	...	...	...	...	...		
XLIV.	Carlow (Browne's Hill) .....	4.34	+	1.44	.89	12	19	...	...	...	...	...	...		
XLV.	Dublin (Fitz William Square) ...	5.71	+	3.85	1.80	12	24	44.8	22	16.9	9	18	29		
XLVI.	Ballinasloe .....	2.38	—	.70	.56	5	23	43.0	12 <sup>c</sup>	14.0	10	29	...		
XLVII.	Clifden (Kylemore) .....	6.23	...	...	1.32	11	24	...	...	...	...	...	...		
XLVIII.	Waringstown .....	2.87	+	.22	.90	12	23	45.0	22	12.0	27	26	30		
XLIX.	Londonderry (Creggan Res.) ..	3.99	+	.57	.61	2	23	...	...	...	...	...	...		
L.	Omagh (Edenfel) .....	2.86	—	.16	.60	12	19	44.0	22	19.0	26	23	30		

<sup>a</sup> And 20. <sup>b</sup> Various. <sup>c</sup> And 24. <sup>d</sup> And 12. <sup>e</sup> And 9, 11. <sup>f</sup> And 26. <sup>g</sup> And 16, 19.

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

# METEOROLOGICAL NOTES ON JANUARY, 1895.

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.—At the beginning of the month the temp. was considerably below the mean with slight falls of R or S, and this continued during the second week, but with rather more sunshine. The end of the month was very cold and snowy. Gales on 12th and 23rd.

ADDINGTON.—January opened with a sharp frost, and frost was registered in the shade on twenty-four days, very sharp on the 10th, 11th and 12th, and again from the 26th to the end. From the 12th until the 18th the bar. was very low, particularly on the 13th, 14th and 16th. Dense fog on the 10th; a large flood on the 20th.

BURY ST. EDMUNDS.—A month of real winter, only six days without frost. S on 17 days, mostly in small quantities. A blizzard on 31st, with distant thunder.

NORWICH, BRUNDALL.—A very wintery month; not one mild day, and S recorded on 18 days. Some very rough, coarse weather at times. Mean temp.  $32^{\circ}\cdot8$ , the lowest since 1881, except 1891, which was  $0^{\circ}\cdot4$  lower. The ground was completely covered with S from December 30th to January 15th, and from January 22nd to 31st. T at 4 p.m. on 17th.

LANGTON HERRING.—A bitterly cold month. Mean 9 a.m. temp.  $32^{\circ}\cdot7$ ; only two months in the last 23 years have had a lower 9 a.m. mean, January 1881  $29^{\circ}\cdot9$ , December 1890  $31^{\circ}\cdot0$ . On 19 nights temp. fell to or below  $30^{\circ}$ , and on the last six nights to or below  $23^{\circ}$ . The heavy R on 12th was followed by 5 days of very low bar. On the 14th there were two very loud sharp claps of T with vivid L. At the end the ground was covered with about 3 inches of S; there was very little drift.

TORQUAY, CARY GREEN.—Rainfall  $\cdot70$  in. above, mean temp.  $37^{\circ}\cdot0$  or  $4^{\circ}\cdot0$  below, and duration of sunshine 19 hours above, the average; six sunless days.

POLAPIT TAMAR.—Wetter than usual and very cold, the mean min. in shade being  $32^{\circ}\cdot2$ , and on grass  $25^{\circ}\cdot1$ . From the 13th to the 17th inclusive the bar. remained below 29 in., an unusual length of time to remain so low and remarkable for being free from gales. T on 27th.

STROUD, UPFIELD.—S drifted much on the 12th and some roads were impassible.

WOOLSTASTON.—A very severe month. S fell heavily on 13 days, blocking the roads, and the cold was intense. There was a furious gale on the 12th, causing huge drifts, in one of which a woman was lost on 24th and frozen to death. No such fall of S has occurred since 1865. Mean temp.  $30^{\circ}\cdot3$ .

TENBURY, ORLETON.—The coldest January since 1881. Great gale and S storm on the night of 12th, the depth being about 1 foot, and in drifts from 6 ft. to 10 ft. Very wet with floods between 12th and 20th,  $3\cdot91$  in. of R and S falling in the 9 days. Intense frost set in on 26th and continued to the end of the month.

LEICESTER, BARKBY.—A very cold, wintery, wet and boisterous month. It seems to have been colder here than anywhere else in England. Mean max. temp.  $36^{\circ}\cdot7$ , mean min. temp.  $22^{\circ}\cdot4$ . From 7th to 11th inclusive the min. temp. was never above  $15^{\circ}$ . The Leicester water famine is at an end. (I expect the cold weather to continue for some time, at least 10 days.—E. N. POCHIN, Feb. 1st, 1895.)

## WALES.

HAVERFORDWEST.—January commenced with wet weather, and some S and sleet on the 3rd; the weather became more wintry on the 5th, with N.E. wind. S fell at night, and heavily next day, followed by keen frost and changeable cold weather. On the 11th very stormy, cold weather set in, wind E., rising

to a gale at night, with heavy S, the gale and S continuing till 13th. A rapid thaw occurred on 15th, and cold E, freezing as it fell, on 16th, the weather remaining variable till 20th. The remainder was most winterly, with several deep falls of S, and gales on 24th and 25th, and 27th and 28th. The Precelly range was covered with S nearly the whole month.

ABERYSTWITH, GOGERDDAN.—Severe frost set in on 26th, with about a foot of S on that and the two following days.

#### SCOTLAND.

CARGEN.—The mean temp. of the month,  $30^{\circ}\cdot 8$ , is  $7^{\circ}\cdot 3$  below the average, and the lowest recorded in January since observations commenced 35 years since. With the exception of December, 1878, when the mean temp. was  $29^{\circ}\cdot 2$  this is the coldest month recorded. The first and latter parts of the month were extremely cold; from the 13th to the 23rd was somewhat milder, the mean temp. being  $34^{\circ}\cdot 6$ . The rainfall of this period was about an inch, the rest of the fall for the month being nearly all S, which was 6 inches deep on 28th. N. to E. winds prevailed for 29 days. The duration of sunshine was much above the average, and there was little fog.

JEDBURGH, SUNNYSIDE.—The temp. was extremely low throughout, and all outdoor work was suspended. S fell more or less almost every day, but there was little drifting, and the trains arrived at the normal times.

COLMONELL.—Rainfall  $2\cdot 94$  in. below the average, 1876-94. Mean temp.  $32^{\circ}\cdot 6$ ,  $3^{\circ}\cdot 9$  below the average. Falls of S were frequent at the beginning and end of the month, about 2 inches falling on 13th, and  $2\frac{3}{4}$  inches on 26th.

BRAEMAR.—A month to be remembered for intensity of frost and almost incessant S and drifts. All traffic by sleigh only.

GLENCARRON.—A very severe month, with wind, S, and hard frost.

ROEBERRY.—A very coarse, cold month. Mean temp.  $35^{\circ}\cdot 2$ .

#### IRELAND.

O'BRIENSBRIDGE, ROSS.—Sharp frost, with light S showers in the first week; a gale from S.E. on 11th, followed by dull and cold weather up to the 19th, the cold increasing in intensity from that date to the end.

DUBLIN.—A very severe month, with much S and frost, alternating with frequent thaws. The coldest January since 1881, and as regards rainfall a record month. The precipitation was chiefly S, sleet, or H, the total being more than double the average, and  $1\cdot 39$  in. in excess of the fall in January, 1877, the next wettest. The mean temp.,  $35^{\circ}\cdot 4$ , is  $6^{\circ}\cdot 0$  below the average.

WARINGSTOWN.—An unusually severe month; roads blocked in many places on 12th and 13th.

EDENFEL.—January, 1895, has been marked by every unpleasant characteristic. Polar and easterly winds blew on 29 days, sometimes with the force of a gale, accompanied by light drifting S, with which the ground was more or less covered on every day of the month. Although it froze more or less keenly on every night but one, and the mean temp. was very low, but few days passed without a temporary thaw setting in for an hour or two. The E for the month,  $2\cdot 86$  in., is almost all melted S, of which the heaviest fall since January, 1881, took place on the 12th.



# SYMONS'S

## MONTHLY

# METEOROLOGICAL MAGAZINE.

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### THE FROST OF JANUARY AND FEBRUARY, 1895.

WE cannot speak for others, but to us one lesson which experience is teaching is that in meteorological phenomena duration is of equal importance with intensity.

Our recent work in connection with the floods of last winter has shown us that it is not merely the extreme height reached which has to be considered, but the hours during which the river was in flood.

So with the recent frost, severe as it was, the most remarkable feature seems to have been, not the low temperature reached, but the duration of the intense cold. Taking, as one is apt to do, their own records as an illustration, the absolute minimum on the Glaisher stand at Camden Square, and by far the lowest recorded there in February during the 36 years 1859-95, was  $7^{\circ}3$  on February 8th, and (with the exceptions of December 25th, 1860, and January 5th, 1867, when the temperature fell to  $6^{\circ}7$ ) the lowest recorded in any month.

Concerning the distribution of the intensity of the cold over the country generally, Mr. F. Campbell Bayard, LL.M., has undertaken to read a paper before the Royal Meteorological Society, and therefore we have handed over to him the information which we have received. We may, however, mention that we have heard of readings in Stevenson's screens of  $-17^{\circ}$  at Braemar, Aberdeen; of  $-13^{\circ}$  at Esthwaite, Lancashire; of  $-8^{\circ}$  at Bromley, Kent, and at Ketton, Rutland; and of  $-5^{\circ}$  at Loughborough. Other low readings will be found in the table on page 34. We think that the Loughborough record for the following ten days will not be easily beaten.

	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	Mean
Min.	10	8	2	-5	-4	-1	1	4	2	4	2.1
8 a.m.	16	11	12	-4	1	1	24	7	4	9	8.1
Max.	30	28	30	26	26	29	33	39	38	30	30.9
6 p.m.	24	18	18	20	18	25	25	26	26	23	22.3

This gives for the mean temperature of the ten days  $16^{\circ}5$ .

The following are minima at Greenwich below  $10^{\circ}$ , and it will be noted that 1895 is the only year with two such entries, and that they are on consecutive days.

1820, Jan. 15th, $0\cdot0$	1845, Feb. 11th, $7\cdot7$	1870, Dec. 25th, $9\cdot8$
1838, Jan. 20th, $-4\cdot0$	1860, Dec. 25th, $8\cdot0$	1895, Feb. 7th, $9\cdot6$
1841, Jan. 8th, $4\cdot0$	1867, Jan. 5th, $6\cdot6$	" " 8th, $6\cdot9$

Therefore, as regards absolute minimum temperature, 1895 was surpassed at Camden Square by 1860 and 1867, and at Greenwich by 1820, 1838, 1841 and 1867.

The following are mean daily temperatures at Greenwich below  $20^{\circ}$  :—

1814, Jan. 10th, $19\cdot6$	1830, Jan. 18th, $18\cdot1$	1841, Jan. 7th, $17\cdot4$
1815, Jan. 14th, $16\cdot2$	" Feb. 2nd, $17\cdot0$	" " 8th, $12\cdot8$
1816, Feb. 8th, $19\cdot7$	" " 3rd, $19\cdot2$	" Feb. 3rd, $19\cdot2$
" " 9th, $12\cdot6$	" " 5th, $19\cdot0$	1845, " 12th, $19\cdot2$
1820, Jan. 1st, $19\cdot9$	" " 6th, $18\cdot7$	1867, Jan. 4th, $13\cdot2$
" " 13th, $18\cdot7$	" Dec. 24th, $18\cdot4$	" " 14th, $19\cdot3$
" " 15th, $14\cdot6$	" " 25th, $18\cdot6$	1881, " 15th, $19\cdot8$
1823, " 19th, $13\cdot4$	1838, Jan. 12th, $16\cdot8$	1890, Dec. 22nd, $19\cdot5$
1826, " 14th, $19\cdot5$	" " 15th, $6\cdot2$	1891, Jan. 10th, $18\cdot4$
" " 15th, $18\cdot4$	" " 19th, $17\cdot0$	1895, Feb. 6th, $19\cdot4$
" " 16th, $18\cdot9$	" " 20th, $10\cdot7$	" " 7th, $18\cdot3$
		" " 8th, $18\cdot9$
		" " 9th, $18\cdot0$

In this list there are in the 81 years twelve days colder (lower mean daily temperature) than any one day in 1895, there are three cases of two consecutive days colder than any two consecutive days in 1895, and there is one case of three consecutive days each with a mean temperature below  $20^{\circ}$ ; but there is no case of four such days until we come to 1895.

We may test this question of duration in another form, *viz.*, as to the number of consecutive days on each of which the mean temperature was below  $32^{\circ}$ . No period is quoted unless it exceeded 10 days.

1814, Jan. 1st to 26th, 26	1870-1, Dec. 21st to Jan. 4th, 15
1823, Jan. 9th to 26th, 18	1881, Jan. 12th to 27th, 16
1838, Jan. 8th to 21st, 14	1890, Dec. 10th to 25th, 16
1855, Feb. 7th to 23rd, 17	1892-3, Dec. 24th to Jan. 7th, 15
1860, Dec. 18th to 29th, 12	1895, Jan. 25th to Feb. 18th, 25
1867, Jan. 12th to 22nd, 11	

As regards mean temperature, there is no case equal to 1895 with four consecutive days on each on which the mean temperature was below  $20^{\circ}$ ; the nearest approaches are—

1816	1826	1830	1838	1841	1895
Feb. 8, $19\cdot7$	Jan. 14, $19\cdot5$	Feb. 2, $17\cdot0$	Jan. 12, $16\cdot8$	Jan. 7, $17\cdot4$	Feb. 6, $19\cdot4$
" 9, $12\cdot6$	" 15, $18\cdot4$	" 3, $19\cdot2$	" 15, $16\cdot2$	" 8, $12\cdot8$	" 7, $18\cdot3$
	" 16, $18\cdot9$	" 5, $19\cdot0$	" 19, $17\cdot0$		" 8, $18\cdot9$
		" 6, $18\cdot7$	" 20, $10\cdot7$		" 9, $18\cdot0$

It may be thought strange that we have not dwelt upon the winter of 1855, January and February of which year much resembled the corresponding months of 1895. There was a great

similarity, but 1855 was not nearly so severe as 1895. The absolute minima in the two Januarys were very similar, but the minimum in February, 1855, was  $11^{\circ}1$  on the 19th, whereas in 1895 it was  $6^{\circ}9$  on the 8th; and the mean temperature of the coldest four consecutive days in 1855 (16th to 19th) was  $22^{\circ}7$ ; in 1895 the four days (6th to 9th) had a mean of only  $18^{\circ}7$ .

Another striking proof of the severity of the 1895 frost is afforded by the temperature of the earth. The thermometer with its bulb 1 foot below the surface was first read at Camden Square on January 1st, 1871. Prior to 1895 it was never below  $32^{\circ}$ , and it reached that point in only 1880, when the 9 a.m. readings were—

January.				February.				
29th	30th	31st.	1st	2nd	3rd	4th	5th.	
32.0	32.1	32.0	32.0	32.0	32.0	32.0	32.0	

But in February, 1895, we have—

10th	11th	12th	13th	14th	15th	16th	17th	18th	19th
32.0	32.1	31.9	31.8	31.2	31.1	31.1	31.0	30.9	31.1

20th	21st	22nd	23rd	24th
31.6	31.8	31.9	31.9	32.0

There are therefore twelve consecutive days every one of which was cold beyond precedent since the observations began in 1871. This excess is, however, due to two causes—(1) the duration of the low air temperature, (2) the fact that there was very little snow—for a layer of snow 6 inches thick keeps the earth several degrees warmer than it would be without it.

Respecting earth temperatures and water pipes, we hope to be able to say something next month.

---

*To the Editor of the Meteorological Magazine.*

SIR,—In this district the great feature of the frost has been the very low depth of water in the wells. Some, never dry before, have been dry this year, and others, where there is generally an abundance of water, exhausted after a short pumping. The pits and streams are now full, but the wells are filling very slowly.—Yours truly,  
S. W. JONES.

*Salt Vicarage, Stafford, February 18th, 1895.*

[This strikes us as extremely interesting. Apparently the surface of the ground was sealed by frost, and thereby the subsoil water was maintained at a constant level, being unable to run out of the soil, as the frozen surface prevented the entrance of air to take its place.—ED.]

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*To the Editor of the Meteorological Magazine.*

SIR,—The great frost seems now to have broken up, but it will long be remembered. From December 30th to February 27th (60 days) the thermometer fell below  $32^{\circ}$  every night except four, which I think is a record. The mean temperature for the month was  $28^{\circ}5$ , the lowest mean for February during the 23 years in which I have kept an account of the weather. The maximum on February 6th was only  $22^{\circ}$ , the lowest maximum I ever recorded.

The frost of 1881 was more severe, viz.,  $-4^{\circ}0$  (or  $-3^{\circ}0$ ), according to different thermometers. My figures are from instruments in a Stevenson's screen at 4 feet from the ground, which I believe to be correct. I have tested them recently at freezing point. The rainfall for February was only  $\cdot 26$  in., including snow.—Yours truly,

S. KING.

*Elswick Lodge, Garstang, March 1st, 1895.*

P.S.—The 4 nights when the temp. was not below  $32^{\circ}$  were :—

January 14th .....	$32^{\circ}$	January 19th .....	$34^{\circ}$
„ 15th .....	$32^{\circ}$	February 23rd .....	$34^{\circ}$
Max. temp. in February .....	$44^{\circ}$	Lowest max. in February .....	$22^{\circ}$
Min. „ „ .....	$7^{\circ}$	Highest min. „ .....	$36^{\circ}*$
Mean „ „ .....	$28^{\circ}5$	Nights of frost „ .....	26

\* Feb. 28th, not included in the 60 days.

*To the Editor of the Meteorological Magazine.*

SIR,—I send you a few particulars of the frost, which to-day seems to be at an end. — Yours truly,

CHARLES L. BROOK.

*Harewood Lodge, March 6th, 1895.*

#### FROST OF JANUARY—FEBRUARY, 1895.

- (1.) This frost commenced December 27th, 1894, and ended March 6th, 1895, a period of 70 days.
- (2.) During this time the minimum temperature on the ground was below  $32^{\circ}$ , except on March 1st,  $33^{\circ}7$ , and January 15th, when it was exactly  $32^{\circ}$ .
- (3.) The minimum temperature in a Stevenson's stand was *below*  $32^{\circ}$  on 59 nights out of 70, with a continuous period of 32 days from January 22nd to February 22nd inclusive.
- (4.) From December 29th, 1894, to February 19th, 1895 (53 days) the maximum temperature in Stevenson's screen did not reach  $40^{\circ}$  (see Mr. Ryves' letter in your February number), the highest being  $39^{\circ}2$  on January 18th.
- (5.) The thermometer at one foot below the surface was below the freezing point from February 11th–23rd (13 days).
- (6.) The ground was frozen to the depth of 17 inches.
- (7.) The ice on a large reservoir attained a maximum thickness of  $13\frac{3}{4}$  inches.

The average temperatures for the months January and February were :—

	Max.	Min.	Mean.	Grass Ther.
January .....	$34^{\circ}3$	$25^{\circ}1$	$29^{\circ}7$	$20^{\circ}0$
February .....	$33^{\circ}9$	$21^{\circ}7$	$27^{\circ}8$	$14^{\circ}9$

The four coldest months I have registered in 16 years are :—

1. February, 1895 .....  $27^{\circ}8$
2. January, 1881 .....  $29^{\circ}2$
3. { January, 1895 .....  $29^{\circ}7$  }
4. { December, 1890 .....  $29^{\circ}7$  }

*To the Editor of the Meteorological Magazine.*

SIR,—The following may be of interest :—

TEMPERATURE OF FEBRUARY.

Mean of 13 years (1882-94) ..... 39°·4  
Mean of 1895 ..... 26°·9

Deficiency ..... 12°·5

Lowest temp. registered February 8th—

In screen .....—3°·0 a record.

On grass..... 5°·0

Mean temp. of 8th .....—9°·0 a record.

Mean temp. Feb. 6th-10th, inclusive ... 14°·9

Rain fell on 3 days—max., 1st, ·13 in.; total ·17 in. Absolute drought, 2nd to 23rd inclusive; partial drought, whole month. February is the month in which I generally record minima of rainfall :—

	Rain fell on	Total.
1887 .....	10 days .....	·51 in.
1888 .....	13 „ .....	·44 „
1890 .....	9 „ .....	·58 „
1891 .....	1 „ .....	·02 „
1895 .....	3 „ .....	·17 „

Yours faithfully,

R. J. ROBERTS.

*Pool Quay Vicarage, Welshpool, March 1st, 1895.*

*To the Editor of the Meteorological Magazine.*

SIR,—Referring to the absence, as far as I have seen in the profuse literature upon the late weather, of any reference to the curious variation of minimum temperature indicated by thermometers placed at different local elevations, though comparatively close, I append a record of such readings here for the week ending 12th February, No. 1 Thermometer being placed in the screen, No. 2 on the surface of the snow close by, and No. 3 about 200 yards off and in a hollow of the ground, at a lower elevation of about 50 feet (about 250 ft. above sea level) :—

	No. 1.	No. 2.	No. 3.		No. 1.	No. 2.	No. 3.
Feb. 6th.....	5	2	—12	Feb. 10th.....	17	12	—1
„ 7th.....	13	8	—6	„ 11th.....	7	4	—8
„ 8th... ..	12	5	—8	„ 12th.....	14	10	5
„ 9th... ..	16	14	9				

These instruments have Kew certificates, and have lately been thoroughly tested.—Yours very truly,

L. M. BUCHANAN  
(Colonel).

*Edenfel, Omagh, Tyrone, March 3rd, 1895.*

## RECENT DRY FEBRUARIES.

*To the Editor of the Meteorological Magazine.*

SIR,—The extremely small rainfall of the February just past, coming only four years after an absolutely rainless February in 1891; led me to take out the average of February for the 10 years 1886–1895 the result is remarkable, being 1·23 in. only, or about two-thirds of the *true* average, by which I mean an average of 20 years or more. In these 10 years, which is the extent of the record of rainfall here, there have been five years in which the total of February has been less than one inch, viz. :—

1886.....	0·68 in. ....	1890.....	1·05 in. }	both below the true
1887.....	0·62 „ ....	1892.....	1·62 „ }	average.
1888.....	0·93 „ ....	1894.....	1·82 „ }	about the true average
1891.....	0·00 „ ....	1889.....	2·34 „ }	or slightly under.
1895.....	0·12 „ ....	1893.....	3·12 „ }	both above the true
				average.

Thus we have seven, if not eight years, with a deficient rainfall in February, and only two years with an excess. Though the gauge has been kept here only 10 years, at Muswell Hill, two miles S.E. of this place, we have a record for 23 years, 1872–1894; the average of February for that period is 1·91 in., while the 10 years average there (1886–95) is 1·22 in., differing only ·01 in. from the average for the same period here; thus the 10 years' average is 0·69 in., or 36 per cent. less than the 23 years' average. On examining the preceding 10 years, 1876–1885, we find the average is 2·61 in., or 0·70 in. above the 23 years' average, showing that we may expect that any great departure from the true average in one decade will be rectified by a corresponding difference the other way in the following one; it also seems to show that 10 years is not a sufficiently long period to take as an average for the month, though it may be so for the year. The following are the totals of February at Muswell Hill for the 20 years, 1876–1895 :—

## 10 years, 1876–1885.

	in.
1876 .....	2·14
1877 .....	1·80
1878 .....	1·64
1879 .....	3·97
1880 .....	2·36
1881 .....	4·03
1882 .....	1·44
1883 .....	3·95
1884 .....	1·52
1885 .....	3·27

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 26·12

Average ... 2·61

## 10 years, 1886–95.

	in.
1886 .....	0·65
1887 .....	0·69
1888 .....	0·97
1889 .....	2·25
1890 .....	1·15
1891 .....	0·00
1892 .....	1·47
1893 .....	3·05
1894 .....	1·81
1895 .....	0·14

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 12·18

Average ... 1·22

Yours truly,

J. W. SCOTT.

*Elleray, Etchingham Park, Finchley, Middlesex, March 7th, 1895.*

## SNOW FROM A CLOUDLESS SKY.

*To the Editor of the Meteorological Magazine.*

SIR,—On the 6th February, at 9 a.m., light snow began to fall, sparkling in sunshine from a cloudless sky. Thinking that the snow might be blown off a roof, I went out on the common, clear of houses, and made no doubt that the fall was from the sky. Gradually it clouded over, and at 10 a.m. was quite overcast, the snow continuing as a natural shower for a short time longer.

J. P. MACLEAR.

*Cranleigh, Surrey, 21st February, 1895.*

## UNUSUAL SNOW CRYSTALS.

*To the Editor of the Meteorological Magazine.*

SIR,—On February 14th, between 8 a.m. and 8.30 a.m., snow fell in single crystals of large size, the shade temp. at the time being 21° or 22°. I devoted half an hour to measuring the largest, and succeeded in beating my previous record, the two largest measuring  $\frac{1}{16}$  in. and three others  $\frac{1}{24}$  in.—Truly yours,

H. SOWERBY WALLIS.

*25, Northwood Road, Highgate, February 21st, 1895.*

## ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this Society, was held on Wednesday evening, February 20th, at the Institution of Civil Engineers, 25, Great George-street, S.W., Mr. R. Inwards, F.R.A.S., President, in the chair.

After the transaction of formal business, Captain Wilson Barker exhibited some lantern photographs taken from the ship *Worcester* at Greenhithe, showing the ice on the Thames, some blocks being 10 ft. thick. It was necessary to rig up rocket apparatus to maintain communication with the shore, as it was impossible during the greater part of each day for boats to navigate the water. Mr. W. Marriott also had taken photographs from Westminster bridge, which showed the water completely covered with ice.

Mr. E. Mawley presented his report on the phenological observations for 1894. Between the third week in March and the third week in May, plants generally came into blossom in advance of their usual time, and towards the end of April the dates of first flowering differed but little from those recorded at the same period in the very forward spring of 1893. The cuckoo was heard even earlier than in the previous year. The year 1894 was a very productive one, and both the hay and corn crops proved unusually heavy, but much of the latter was harvested under very trying conditions as regards weather. The frosts of May 21st and 22nd entirely destroyed the

previous prospect of a glorious fruit season. Indeed, the only really good crop was that of pears, which were singularly abundant throughout nearly the whole of England.

The paper was illustrated by a diagram showing the mean dates of flowering of certain plants in 1894, in different parts of the British Isles, compared with the average.

Dr. Buchan spoke of the great value of the records, and mentioned that in 1894 Shetland was the earliest district of the British Isles in which grain ripened, the harvest having been the earliest ever known. The damage done by the May frost was extremely irregular; he believed that a very few days difference in the state of the blossom greatly affected the result.

Mr. Symons appreciated the manner in which Mr. Mawley marshalled his statistics, and thought that the table of averages proved the excellence of the observations. The President and Mr. Bayard also took part in the discussion. Admiral Maclear said that many gardeners attributed the damage in the May frost to the sun shining on the vegetation before it thawed, and considered that watering would have mitigated the injury, instancing the parallel case of rapidly thawing a frost-bitten member in man.

Mr. Mawley in replying considered that variations of soil were of great importance in frost in winter, but not in spring frosts; that there was no doubt as to the efficacy of slowly thawing, and that it was a recognised practice with rosarians in case of frost to syringe their roses before sunrise. Blossom once fertilized was much less susceptible to injury.

Mr. W. Marriott gave an account of the thunderstorm and squall which burst over London suddenly on the morning of January 23rd. He considers that this storm passed across England in a south-south-easterly direction at the rate of about 47 miles an hour, being over Northumberland at 4 a.m., and reaching the English Channel by 11 a.m. Thunder was first heard in the vicinity of Leeds, and accompanied the storm in its progress across the country. One of the most remarkable features of the storm was the sudden increase in the force of the wind; for in London it rose almost at one bound from nearly a calm to a velocity of 36 miles an hour. This sudden increase of wind caused considerable damage, and at Bramley, near Guildford, twenty-eight trees were blown down along a track 1860 yards in length.

Dr. Preller spoke of the growing importance of records of atmospheric discharges in connection with the increased commercial use of electricity, and said that he knew of no country in which records were kept in such a form as to be of use to the electrician. He believed that thunderstorms showed a maximum frequency in the areas of maximum magnetic force mapped out by Prof. Rücker.

Mr. Bayard asked if in winter, thunderstorms similar to that described the path of the storm bore a constant relation to the position of the areas of low pressure.



Dr. Buchan spoke of the nearness of the lightning, and referred to the great darkness in spite of the absence of fog ; he attributed the darkness to two currents of air differing greatly in temperature and humidity. With reference to the relation to cyclones the secondary was always on the right of the primary, and the thunderstorm was connected with the secondary.

Mr. Symons said that he believed that injury by lightning was very frequent in Northamptonshire, and that Devon and Cornwall were comparatively exempt from injury. He was inclined to think that the character of the soil played some part in inducing areas of thunderstorm injury. The short time-interval between the lightning and thunder appeared to be a feature of the storm under discussion.

Mr. H. S. Eaton saw the storm approaching, and noticed the cumulo-stratus which is so good an indication of an approaching thunderstorm.

Mr. Sowerby Wallis said that nearly everyone who described this storm spoke of the nearness of the lightning, and it appeared that lightning was not seen or thunder heard at distances much exceeding a mile ; he thought that the two strata of air of very different temperature and humidity mentioned by Dr. Buchan as the cause of the darkness would account for this also.

Mr. W. Marriott said that winter thunderstorms travel with the wind, and are therefore controlled by the position of the cyclone, that under discussion being clearly of the tornado type. Summer thunderstorms generally travel along the lowest ground.

Mr. A. B. MacDowall's paper on "Some gradual weather changes in certain months at Greenwich and Geneva," was read by the Secretary.

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## BAROMETRIC UNDULATIONS.

*To the Editor of the Meteorological Magazine.*

SIR,—Barometric undulations such as those represented by Mr. Backhouse on p. 179, are of very frequent occurrence at the Blue Hill Meteorological Observatory, and occur both during quiet and windy weather. Marked examples are reproduced, and described in the "Results of the Meteorological Observations made at the Blue Hill Meteorological Observatory, Mass., U.S.A., in the year 1886," and in the "Observations made at the Blue Hill Meteorological Observatory, Mass., U.S.A., in the year 1887 ;—Annals of the Astronomical Observatory of Harvard College, Vol. XX, Part I." A detailed discussion of these undulations is made in the volume of Blue Hill Observations for 1893,—*"Annals of the Astronomical Observatory of Harvard College Vol. XL. Part III"* pp 195 to 202. The conclusion arrived at there is that the observations fully sustain Helmholtz's conclusion that the barometric undulations are the result

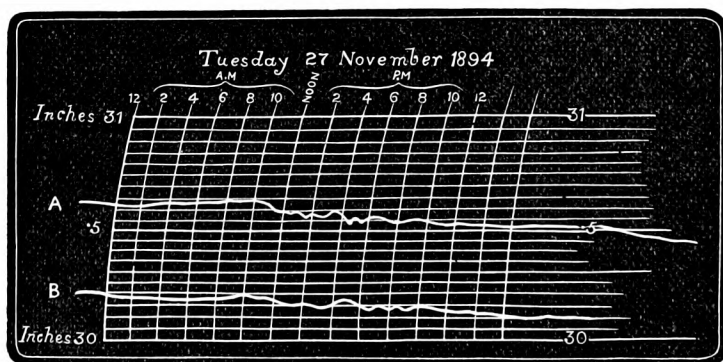
of real gigantic waves in the atmosphere like the waves in the ocean which are brought about by friction between atmospheric strata of different densities moving in different directions and with different velocities. These atmospheric waves are of all sizes, from the minutest ripple to the gigantic billows which affect the barometer, and have a very much greater influence in determining the conditions of the sky and weather than has heretofore been supposed. The parallel rows of clouds, the cloud furrows and striations, the rhythmic clearing and clouding at short intervals sometimes observed are all indications of the frequent existence of these waves. Their influence is felt in the precipitation, in the wind, and in the temperature oscillations of short periods, all of which at times show undoubted wave-like fluctuations.

In New England the barometric waves were all found to move from west to east, which is probably the general direction of motion of these waves north of the tropics, because the upper currents, which drive across and kick up waves in the lower currents, usually move from the west.

H. HELM CLAYTON.

*Blue Hill Meteorological Observatory, February 7th, 1895.*

[Mr. Clayton has conferred a benefit upon our readers by referring them to his paper upon the subject in the publication quoted. It seems to us that he has dealt chiefly with storm phenomena, for out of 78 occurrences on only one was the velocity of the wind below ten miles an hour. We had not previously read the explanation by Von Helmholtz, and it is not for us to question the *dicta* of so great a man, however difficult we may find it to understand them. We have been favoured with the tracing of the barograph at Skelwith Fold, Ambleside, for the same calm day, so reproduce the block with the extra curve, drawn however (for the sake of clearness) half-an-inch too low.]



REVIEW.

*The Climatology and Physical Features of Maryland.* First Biennial Report of the Maryland State Weather Service, for the years 1892 and 1893. Baltimore: 1894. Royal 8vo, 140 pages, six plates.

THIS well-printed modern American book is peculiar in several respects. It is an unusual size—a full page measuring 7·20 in. by 4·66 in.—but it has no signatures. Have our American friends discovered that they are superfluities? Then it has no publisher, unless we are to infer from its second title that it is issued from the Weather Service Office, in the Johns Hopkins University in Baltimore. We infer from the reports of the Director and of the Treasurer that the volume is not intended for sale but for free distribution as one means of “setting forth the advantages of the State from a climatic standpoint.” We see further that no portion of the appropriation of two thousand dollars (say £400) granted by the State is to be paid for editorial work, and that there is a heading in small type, “U.S. Department of Agriculture, Weather Bureau.” So we take it that the volume is really a local record of Maryland Weather prepared at the joint cost of the Weather Bureau and of the State of Maryland.

We have had to investigate this, because while we in no way whatever impugn the absolute impartiality of the writers of this report, we have had painful experience of the weakness of human nature when persons interested have written accounts of the localities in which they reside. A pamphlet which we recently received but have not noticed has shown us that this evil has followed civilization across the Atlantic, and we trust that Prof. Harrington will be on guard against its finding any home in the publications of his Bureau. Confidence once destroyed can never be repaired.

The first three chapters, devoted respectively to Topography, Geology, and Agriculture, seem to us good and practical. But we cannot say much for the one devoted to Climate. There are extremely pretty maps, and there are sundry tables, like those on pages 57 and 58, which look as if they represented the result of long and well organised work, but when closely examined it seems (though we hope that it is not really so) as if all these maps and tables, and the generalizations made with much positiveness, rest on the observations made during *the year* 1892 and part of 1893. There are, on pages 65 and 66, two lines of figures exempt from this criticism, but as far as we can see there are no others.

Isotherms and hyetographic shading based upon less than two years observations may look pretty, but they are not worthy of being printed, not worthy of being criticized, not worthy of the country which has given to Meteorology Loomis and Ferrel.

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## CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, AUGUST, 1894.

STATIONS.  (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
	°		°		°	°	°	0-100	°	°	inches		
England, London .....	79·3	14	63·1	21	69·2	53·3	52·7	78	124·9	41·9	2·85	18	7·1
Malta.....	95·2	30	65·2	23	86·4	70·1	66·3	69	147·5	60·2	·00	0	0·6
<i>Cape of Good Hope</i> ...	...	...	...	...	...	...	...	...	...	...	...	...	...
<i>Mauritius</i> .....	78·4	27	58·2	1	74·8	64·8	60·3	74	127·6	49·3	2·09	22	5·8
Calcutta.....	90·6	29	75·2	20	86·2	77·9	78·4	88	157·2	74·7	4·82	16	8·0
Bombay.....	87·2	27	74·0	30	84·7	77·3	75·5	84	140·3	72·2	8·40	28	8·9
Ceylon, Colombo .....	85·6	18	70·0	29	84·3	77·0	70·6	75	146·0	66·0	·86	12	6·6
<i>Melbourne</i> .....	69·7	21	34·1	4	58·1	44·2	44·3	78	120·2	27·0	1·96	17	7·3
<i>Adelaide</i> .....	68·4	19	39·2	14	60·9	47·5	45·7	75	132·3	33·0	2·92	17	6·3
<i>Sydney</i> .....	71·3	26	41·6	9	62·1	47·8	43·6	73	118·7	28·3	1·14	10	3·7
<i>Wellington</i> .....	65·0	25	33·3	6	54·9	43·8	42·8	79	109·0	21·0	5·61	15	5·3
<i>Auckland</i> .....	63·0	27	40·0	6	58·5	46·1	45·3	77	125·0	35·0	5·95	23	6·0
Jamaica, Kingston.....	92·5	20	70·2	12	89·8	72·9	70·6	72	...	...	1·31	5	5·1
Grenada.....	87·2	13	71·8	1	83·6	75·4	72·5	80	156·5	...	6·78	25	4·0
Trinidad .....	91·0	*	67·0	6	87·5	71·1	71·3	83	171·0	67·0	12·06	22	...
Toronto .....	85·1	8	46·3	21	75·5	55·7	52·8	66	...	45·9	·38	5	5·7
New Brunswick, Fredericton .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Manitoba, Winnipeg ...	92·1	22	37·5	14	80·3	50·8	...	...	...	...	·77	12	4·1
British Columbia, Esquimalt.....	80·2	28	47·7	9	69·3	50·8	53·7	83	...	...	·25	4	3·3

\*Various.

## REMARKS.

MALTA.—Adopted mean temp. 77°·4, 1°·0 below the average. Mean hourly velocity of wind 7·9 miles. Sea temp. ranged between 78°·5 and 79°·5. Lightning seen on 26th and 27th. J. F. DOBSON.

*Mauritius*.—Mean temp. of air 0°·4 above, of dew point 1°·1 above, and rainfall ·07 in. below, their respective averages. Mean hourly velocity of wind 13·4 miles or 1·1 above average; prevailing direction, E.S.E. C. MELDRUM, F.R.S.

*Adelaide*.—Mean temp. 0°·2 above average. Over the Southern parts of the Colony good rains fell, exceeding the average at most stations, and the Northern areas, where it has been so dry since the beginning of the year, during the latter part of the month received moderate and welcome rains. C. TODD, F.R.S.

*Sydney*.—Temp. 0°·1 below, and rainfall 1·78 in. below, their respective averages.

H. C. RUSSELL, F.R.S.

*Wellington*.—The first half of the month was generally showery, with moderate winds from S.E. and N.W.; then fine up to the 27th, but strong N.W. winds on 24th, 25th, 27th and 28th; showery for the remainder of the month. Thunder on 29th; fog on 1st and 2nd; hail on 4th; brilliant aurora on 20th. Mean temp. 1°·3 above, and rainfall ·41 in. above, the average. R. B. GORE.

*Auckland*.—Stormy, showery and unpleasant through the greater part of the month. Mean temp. slightly below the average; rainfall largely in excess, being 1·68 in. above the average. T. F. CHERSEMAN.

JAMAICA.—Mean hourly velocity of wind 3·8 miles. Kingston rainfall about one-fourth, Island rainfall about one-half, of the average. Lunar rainbow seen at Kingston on 18th. R. JOHNSTONE.

TRINIDAD.—Rainfall 1·74 in. above the average of 30 years.

J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL,  
 FEBRUARY, 1895.

[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.			
II.	Dorking, Abinger Hall.	·20	XI.	Lake Vyrnwy .....	1·01
„	Birchington, Thor .....	·68	„	Corwen, Rhug .....	·20
„	Hailsham .....	·22	„	Carnarvon, Cocksidia ...	·24
„	Ryde, Thornbrough .....	·11	„	I. of Man, Douglas .....	1·74
„	Emsworth, Redlands ...	·06	XII.	Stoneykirk, Ardwell Ho.	1·75
„	Alton, Ashdell .....	·11	„	New Galloway, Glenlee	2·39
III.	Oxford, Magdalen Col...	·08	„	Melrose, Abbey Gate ..	·71
„	Banbury, Bloxham .....	·11	XIII.	N. Esk Res. [Penicuik]	·80
„	Northampton, Sedgebrook	·11	„	Edinburgh, Blacket Pl..	·56
„	Alconbury .....	·11	XIV.	Glasgow, Queen's Park.	·14
„	Wisbech, Bank House..	·32	XV.	Inverary, Newtown .....	·97
IV.	Southend .....	·58	„	Islay, Gruinart School..	1·56
„	Harlow, Sheering .....	·18	XVI.	Dollar .....	1·45
„	Colchester, Lexden .....	·33	„	Balquhiddel, Stronvar..	·99
„	Rendlesham Hall .....	·58	„	Ballinluig .....	·94
„	Diss .....	1·07	„	Dalnaspidal H.R.S. ...	1·31
„	Swaffham .....	·30	XVII.	Keith H.R.S. ....	·75
V.	Salisbury, Alderbury ...	·10	„	Forres H.R.S. ....	·83
„	Bishop's Cannings .....	·26	XVIII.	Fearn, Lower Pitkerrie.	·83
„	Blandford, Whatcombe ..	·11	„	Loch Shiel, Glenaladale	1·84
„	Ashburton, Holne Vic. ...	·05	„	N. Uist. Loch Maddy ...	·74
„	Okehampton, Oaklands.	·14	„	Invergarry .....	·45
„	Hartland Abbey .....	·59	„	Aviemore H.R.S. ....	·93
„	Lymouth, Glenthorne.	·12	„	Loch Ness, Drumnadrochit	·83
„	Probus, Lamellyn .....	·15	XIX.	Invershin .....	·24
„	Wellington, Sunnyside..	·14	„	Scourie .....	2·63
„	Wincanton, Stowell Rec.	·18	„	Watten H.R.S. ....	1·06
VI.	Clifton, Pembroke Road	·11	XX.	Dunmanway, Coolkelure	3·20
„	Ross, The Graig .....	·04	„	Fermoy, Gas Works ...	...
„	Wem, Clive Vicarage ...	·36	„	Killarney, Woodlawn ...	2·37
„	Cheadle, The Heath Ho.	·19	„	Caher, Duneske .....	·46
„	Worcester, Diglis Lock	·18	„	Ballingarry, Hazelfort...	·73
„	Coventry, Coundon .....	·14	„	Limerick, Kilcornan ...	·50
VII.	Ketton Hall [Stamford]	·25	„	Ennis .....	...
„	Grantham, Stainby .....	·30	„	Miltown Malbay .....	1·24
„	Horncastle, Bucknall ...	·30	XXI.	Gorey, Courtown House	·26
„	Worksop, Hodsck Priory	·13	„	Athlone, Twyford .....	·52
VIII.	Neston, Hinderton .....	·24	„	Mullingar, Belvedere...	·92
„	Preston, Haighton .....	...	„	Longford, Currygrane...	2·07
„	Broughton-in-Furness...	1·24	XXII.	Woodlawn .....	·73
IX.	Ripon, Mickley .....	·43	„	Crossmolina, Enniscoe..	·63
„	Melmerly, Baldersby ...	·56	„	Collooney, Markree Obs.	·49
„	Scarborough, South Cliff	...	„	Ballinamore, Lawderdale	·44
„	Middleton, Mickleton...	1·78	XXIII.	Lough Sheelin, Arley ..	·35
X.	Haltwhistle, Unthank..	·71	„	Warrenpoint .....	·54
„	Bamburgh .....	1·74	„	Seaforde .....	·69
„	Keswick, The Beeches...	2·17	„	Belfast, Springfield ....	1·40
XI.	Llanfrehfa Grange .....	·05	„	Bushmills, Dundarave...	1·37
„	Llandovery .....	·28	„	Stewartstown .....	·43
„	Castle Malgwyn .....	·15	„	Buncrana .....	·80
„	Builth, Abergwessin Vic.	·72	„	Lough Swilly, Carrablagh	1·26
„	Rhayader, Nantgwillt..	·47			

## FEBRUARY, 1895.

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 Nights below 32°.
		Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours		In shade. On grass.								
				Dpth	Date			Max.		Min.				
								Deg.	Date	Deg.	Date			
		inches.	inches.	in.										
I.	London (Camden Square) ...	·12	— 1·76	·06	1	4	46·2	23	7·3	8	25	28		
II.	Maidstone (Hunton Court)...	·76	— 1·04	·35	5	6	...	...	...	...	...	...		
III.	Strathfield Turgiss .....	·18	— 1·82	·10	24	2	47·5	23	1·8	7	25	28		
IV.	Hitchin .....	·21	— 1·54	·11	1	3	43·0	23	2·0	7	26	...		
V.	Winslow (Addington) .....	·16	— 2·00	·09	24	3	45·0	28	1·0	9	26	28		
VI.	Bury St. Edmunds (Westley)	·23	— 1·33	·09	24	3	43·0	23	—2·0	7	...	...		
VII.	Norwich (Brundall) .....	·88	...	·17	24	18	45·8	23	4·0	7	26	27		
VIII.	Weymouth (Langton Herring)	·02	— 2·58	·02	24	1	43·0	23	13·0	6	27	...		
IX.	Torquay (Cary Green) .....	·01	...	·01	24	1	48·3	28	21·6	13	22	27		
X.	Polapit Tamar [Launceston]..	·12	— 3·15	·08	24	4	48·0	28	11·5	13	26	28		
XI.	Stroud (Upfield) .....	·12	— 2·44	·10	24	2	44·0	28	11·0	7, 8	27	...		
XII.	Church Stretton (Woolstaston)	·27	— 2·18	·15	1	4	45·5	24	8·0	8	27	28		
XIII.	Tenbury (Orleton) .....	·17	— 2·31	·11	24	2	46·3	28	—0·3	6	26	28		
XIV.	Leicester (Barkby) .....	·15	— 1·66	·08	24	7	45·0	23 <sup>b</sup>	—10·0	7	27	28		
XV.	Boston .....	·53	— 1·15	·23	24	8	46·0	19	0·0	8, 10	27	...		
XVI.	Hesley Hall [Tickhill] .....	·14	— 1·36	·04	24	7	48·0	24	—1·0	8	26	...		
XVII.	Manchester (Plymouth Grove)	·36	— 1·69	·17	28	4	42·0	25 <sup>c</sup>	12·0	9	25	27		
XVIII.	Wetherby (Ribston Hall) ...	·24	— 1·34	·15	1	3	...	...	...	...	...	...		
XIX.	Skipton (Arncliffe) .....	1·11	— 3·58	·36	28	6	...	...	...	...	...	...		
XX.	Hull (Pearson Park) .....	·61	— 1·19	·25	24	15	45·0	22 <sup>d</sup>	5·0	8	27	28		
XXI.	Newcastle (Town Moor) .....	1·12	— ·28	·34	1	12	...	...	...	...	...	...		
XXII.	Borrowdale (Seathwaite) .....	2·18	—10·46	1·10	6	7	...	...	...	...	...	...		
XXIII.	Cardiff (Ely) .....	·19	— 3·00	·09	28	4	...	...	...	...	...	...		
XXIV.	Haverfordwest .....	·12	— 4·00	·07	24	5	45·0	28	12·9	13	27	28		
XXV.	Aberystwith (Gogerddan) ...	·23	— 3·03	·12	24	3	44·0	21	6·0	11	28	...		
XXVI.	Llandudno .....	·46	— 1·46	·21	28	6	44·0	28	17·5	9	...	...		
XXVII.	Cargen [Dumfries] .....	1·08	— 2·57	1·08	7	1	46·4	21	—2·0	11	26	...		
XXVIII.	Jedburgh (Sunnyside) .....	·97	— ·54	·38	2	3	46·0	20 <sup>e</sup>	—2·0	8, 10	25	...		
XXIX.	Colmonell .....	1·93	...	1·00	6	4	51·0	21	—1·0	11	24	...		
XXX.	Lochgilpead (Kilmory) .....	1·12	— 4·07	·75	23	2	...	...	12·0	10 <sup>g</sup>	28	...		
XXXI.	Mull (Quinish) .....	·43	— 5·04	·40	24	2	...	...	...	...	...	...		
XXXII.	Loch Leven Sluices .....	1·00	— 1·75	·20	1 <sup>a</sup>	5	...	...	...	...	...	...		
XXXIII.	Dundee (Eastern Necropolis)	·75	— 1·35	·25	6	11	48·2	28	4·0	10	25	...		
XXXIV.	Braemar .....	·93	— 2·43	·22	28	13	41·0	28	—17·0	11	26	28		
XXXV.	Aberdeen (Cranford) .....	1·78	...	·60	5	15	48·0	28	0·0	7	23	...		
XXXVI.	Strathconan [Beaul] .....	3·37	— 1·34	·94	28	9	...	...	...	...	...	...		
XXXVII.	Glencarron Lodge .....	2·32	...	·94	28	13	43·7	21	8·6	11	22	...		
XXXVIII.	Cawdor [Nairn] .....	1·17	— 1·06	·33	28	10	...	...	...	...	...	...		
XXXIX.	Dunrobin .....	1·09	— 1·00	·35	28	7	46·0	28	16·5	18	16	...		
XL.	S. Ronaldsay (Roeberry) .....	·97	— 1·67	·25	23	18	44·0	20 <sup>f</sup>	19·0	6	18	...		
XLI.	Darrynane Abbey .....	3·88	...	1·00	6	9	...	...	...	...	...	...		
XLII.	Waterford (Brook Lodge) ...	1·15	— 2·93	·70	6	6	48·5	28	16·0	12	26	...		
XLIII.	O'Briensbridge (Ross) .....	·69	...	·48	6	6	...	...	...	...	...	...		
XLIV.	Carlow (Browne's Hill) .....	·52	— 2·56	·20	1	6	...	...	9·0	12	...	...		
XLV.	Dublin (Fitz William Square)	·62	— 1·73	·31	6	9	48·6	28	19·0	7	18	28		
XLVI.	Ballinasloe .....	·87	— 1·91	·50	6	6	48·0	28	—5·0	6	28	...		
XLVII.	Clifden (Kylemore) .....	1·51	...	·39	14	9	...	...	...	...	...	...		
XLVIII.	Waringstown .....	·63	— 1·82	·28	5	6	47·0	28	—1·0	6	26	27		
XLIX.	Londonderry (Creggan Res.) ..	·80	— 2·23	·20	28	10	...	...	...	...	...	...		
L.	Omagh (Edenfel) .....	·51	— 2·18	·20	7	7	45·0	23	5·0	6	25	28		

<sup>a</sup> And 2, 3, 6, 28. <sup>b</sup> And 28. <sup>c</sup> And 26, 28. <sup>d</sup> And 23, 28. <sup>e</sup> And 21, 23. <sup>f</sup> And 22, 28. <sup>g</sup> And 11.

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

# METEOROLOGICAL NOTES ON FEBRUARY, 1895.

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.

STRATHFIELD TURGIS.—The driest and coldest February ever recorded at this station. All growth at an utter standstill, and no insects or birds moving.

HITCHIN.—Mean temp.  $26^{\circ}\cdot5$ . The lowest ever recorded here during 45 years;  $27^{\circ}\cdot0$  has been twice recorded.

BURY ST. EDMUNDS.—This month and February 1886, which are both alike, have the smallest rainfall in February since observations first commenced in 1857. This is also the coldest month: the min. of the exposed ther. (1 foot above ground) not having been once above  $30^{\circ}$ . If it had not been for the heavy snow of January, and very little wind, much more damage would have been done to vegetation, which is not so much hurt as in 1860.

NORWICH, BRUNDALL.—A severely cold month; mean of max. and min. temp.  $30^{\circ}\cdot3$ ; which is only  $0^{\circ}\cdot1$  warmer than December 1890. S on the ground on 25 days; in fact, with 8 days exception, the earth was continuously covered with a white mantle from December 30th to February 28th, a period of 61 days. The mean of the shade max. and. min. for the week ending 12th was  $22^{\circ}\cdot4$ .  $22^{\circ}\cdot4$ .

LANGTON HERRING.—On one day only did any R fall this month, which has broken many records. It has been by far the coldest month since observations began in 1872; the mean temp. at 9 a.m. ( $26^{\circ}\cdot9$ ) being as much as  $12^{\circ}\cdot3$  below the average for February. Compared with the next coldest month in 23 years, viz., January 1881, and with the average for February for the 23 years we have:—

	Mean at 9 a.m.		Min.	Max.
February, 1895 ...	$27^{\circ}\cdot0$	...	$23^{\circ}\cdot7$	$33^{\circ}\cdot8$
January, 1881 ...	$29^{\circ}\cdot9$	...	$27^{\circ}\cdot8$	$36^{\circ}\cdot0$
February average ...	$39^{\circ}\cdot3$	...	$36^{\circ}\cdot0$	$44^{\circ}\cdot8$

Frost occurred on every night but one, 21st–22nd, when temp. was  $34^{\circ}$ . It was freezing on 22 days at 9 a.m. The highest temp. at 9 a.m. was  $37^{\circ}$ ; in 23 years it had not been lower in February than  $45^{\circ}$ ; highest max.  $43^{\circ}$ ; previous lowest max. in February,  $48^{\circ}$  in 1873.

TORQUAY, CARY GREEN.—Rainfall 2.73 in., and wet days 14, below the average; mean temp.  $33^{\circ}\cdot4$ , or  $9^{\circ}\cdot0$  below the average. Amount of sunshine, 83 h. 55 min., being 1 h. 25 min. above the average; 5 sunless days.

POLAPIT TAMAR.—Exceptionally small rainfall. Except June 1887, this has been the driest month since January 1881, before which date there is no record here. The wind for 25 days was more or less from the E., but there was more than the average amount of sunshine. A very cold month; the mean min. on the grass being  $20^{\circ}\cdot6$ , and mean min. in the shade,  $24^{\circ}\cdot1$ .

WOOLSTASTON.—The frost continued with great severity till the 23rd, when there was a partial thaw for two days; the frost then returned, though with less severity than before. Several undoubted readings of the ther. below zero were recorded in the neighbourhood on the 8th. Mean temp. of the month,  $28^{\circ}\cdot3$ . The mortality amongst the wild birds has been very great.

TENBURY, ORLETON.—The coldest month ever recorded here; the mean temp.,  $24^{\circ}\cdot1$ , being nearly  $2^{\circ}\cdot5$  below that of January 1881, and nearly  $15^{\circ}\cdot3$  below the average temp. of February. The min. on the 6th,  $-0^{\circ}\cdot3$  in the screen, and  $-5^{\circ}\cdot0$  on the grass—is the lowest on record, and the ther. on the grass fell below zero on 4 nights, while on 11 days the temp. did not reach  $32^{\circ}$ . S and R fell on only two days, and the total fall is, with two exceptions (Sep. 1865 and Feb. 1891), the smallest recorded in any month for 64 years. The rivers were frozen over about the 8th and continued so until the 25th, when the ice broke up. Until the 6th of this month, the lowest temp. recorded here was  $0^{\circ}\cdot0$  in screen and  $-2^{\circ}\cdot0$  on grass, in January 1865.

LEICESTER, BARKBY.—Very cold, as the following min. readings show:—

4th, $4^{\circ}$	7th, $-10^{\circ}$	10th, $23^{\circ}$	13th, $0^{\circ}$	16th, $7^{\circ}$
5th, $0^{\circ}$	8th, $-4^{\circ}$	11th, $0^{\circ}$	14th, $10^{\circ}$	17th, $6^{\circ}$
6th, $-4^{\circ}$	9th, $-2^{\circ}$	12th, $1^{\circ}$	15th, $23^{\circ}$	—

**MANCHESTER, PLYMOUTH GROVE.**—Not only the coldest February, but the coldest month experienced since observations commenced 29 years ago. Also the driest month. Mean temp.  $29^{\circ}5$ . Fog on six days.

#### WALES.

**HAVERFORDWEST.**—The driest February during the last 50 years, and perhaps the coldest. The ice on many ponds varied from 12 to 18 inches in thickness, and on still reaches of the river Cleddau from 10 to 12 inches, while navigation was impeded. On 8 nights the shade temp. fell to between  $12^{\circ}$  and  $20^{\circ}$ , and on 14 nights to between  $20^{\circ}$  and  $25^{\circ}$ . The only February to compare with it was 1855, when, on the 10th, the shade temp. fell to  $8^{\circ}$ , and there were 11 nights with the min. ranging from  $8^{\circ}$  to  $20^{\circ}$ .

#### SCOTLAND.

**JEDBURGH, SUNNYSIDE.**—The temp. of the month was very low, more so than it has been since 1860. There was much sunshine during the day, but the nights were very cold. All outdoor work was suspended; gas and water pipes generally were frozen, and birds suffered much.

**COLMONELL.**—On 6th and 7th a violent storm of S occurred, lasting for 32 hours, the average depth is estimated at about 2 feet; but the ground was bare in places, and the drifts varied up to 15 feet. Rainfall half the average. Mean temp.  $28^{\circ}9$ ,  $9^{\circ}3$  below the average. The lowest minimum previously recorded was  $6^{\circ}$  in 1888.

**BRAEMAR.**—By far the most severe month on record; the min. being below zero on the following nights:—

7th, —  $1^{\circ}5$  9th, —  $11^{\circ}0$  11th, —  $17^{\circ}0$  17th, —  $9^{\circ}0$  19th, —  $8^{\circ}0$   
8th, —  $12^{\circ}0$  10th, —  $14^{\circ}0$  13th, —  $7^{\circ}5$  18th, —  $7^{\circ}5$  20th, —  $5^{\circ}0$

**GLENCARRON.**—S and frost up to the 20th, when a thaw set in.

**ROEBERRY.**—A very cold month; the coldest recorded; mean temp.  $33^{\circ}5$ .

#### IRELAND.

**DARRYNANE ABBEY.**—The first few days were very cold with S.E. wind, which backed to S.W. on the 6th, when, about 6 p.m., S began and continued all night, covering the ground to a depth of about 13 inches. On the high grounds and in exposed places the drifts were very heavy, and all postal communication was stopped till the 10th. Wet S and sleet fell on 8th, and R on 10th, 13th and 14th. The rest of the month was very fine but rather cold.

**WATERFORD, BROOK LODGE.**—A very cold month; prevailing wind easterly. The wind was S. on the 6th when heavy S fell, and the drifts after the blizzard on the 10th had not melted at the close. Thrushes were singing at the close.

**O'BRIENSBRIDGE, ROSS.**—The actual R falling was only .09 in., the balance of the total being melted snow. Since the memorable year, 1855, there has been nothing to compare with the frost and polar wind of this month, in duration and intensity. S began to fall in the afternoon of 6th and, lasting only two hours, effectually blocked the country for a week after.

**DUBLIN.**—The coldest February that is since 1855. The mean temp. ( $34^{\circ}2$ ) was  $8^{\circ}6$  below the average,  $10^{\circ}7$  below that of February 1894, and  $1^{\circ}4$  below that of January 1895. There was an overwhelming prevalence of strong E. and S.E. winds. The rainfall was scanty and consisted principally of S and H. Absolute drought held from the 7th to the 20th inclusive. Fogs on six days.

**CLIFDEN, KYLEMORE.**—On the 9th a snow blizzard raged all day, such as has not been known in the West for many years.

**WARRINGTOWN.**—Continuous frost, S covering the ground all the month. On the morning of the 7th the min. temp. was  $-1^{\circ}$ , a reading only equalled once since observations began in 1860; though zero was touched on Jan 7th, 1894.

**EDENFEL.**—The month was remarkable here, as elsewhere, for its intense and protracted severity. Both in January 1867, and in January 1881, even lower temperatures were reached in the screen, but in those years there was no such persistence of low temperature even in January, nor can I find any February record at all approaching that of this year.



# SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

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## THE FROST — EARTH TEMPERATURES AND WATER PIPES.

WHEN we concluded the article on page 23 of our last number with the words, "Respecting earth temperatures and water pipes we hope to be able to say something next month," we little thought what was before us.

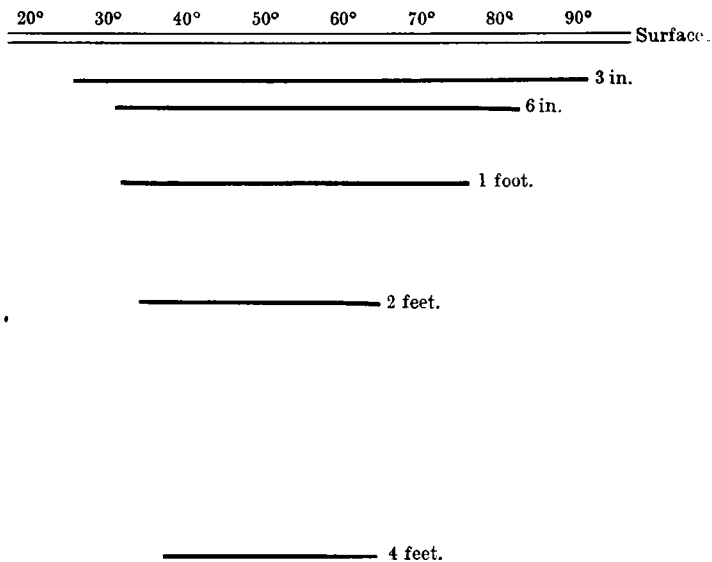
For years past, certainly for more than half a century, there has been a gradually increasing number of stations giving daily records of the temperature of the soil at different depths.

Now that over a large portion of England (not in London only as Londoners seem to imagine), there have been thousands of water pipes burst by the expansion of the contained water in freezing, we hoped that the records of these thermometers would supply ample details. The *Royal Meteorological Society* kindly allowed us to copy the records sent to it, and we have incorporated in some others, but the result is that the records of the thermometers and the facts as to the water pipes seem to be at variance, and to show that the thermometers are wrong—a very disheartening fact (if it is a fact) for those who, like ourselves, have been recording them for a quarter of a century.

Of course, an inference like this must be supported, and should not be mentioned without some reasons being given. And first of all, it may be convenient to inform those who have not previously considered the subject, that the yearly mean temperature of the soil down to say 10 ft. does not vary much, and also that at 10 ft. the difference between the summer and winter is trifling, but the nearer we come to the surface the greater is the influence of season.

From a paper read before the Royal Botanic Society in 1877, and based upon tri-daily observations for six years (1871-76), we take the following facts.

These values are reproduced in the following diagram, which, we trust, is self-explanatory :—



	Absolute Lowest.	Diff.	Mean.	Diff.	Absolute Highest.
At a depth of 3 inches ...	26·2	23·5	49·7	43·3	93·0
„ „ „ 6 „ ...	31·0	19·2	50·2	33·8	84·0
„ „ „ 1 foot ...	32·0	17·9	49·9	27·3	77·2
„ „ „ 2 feet ...	33·0	16·5	49·5	17·8	67·3
„ „ „ 4 „ ...	37·0	13·0	50·0	16·0	66·0

Therefore, these observations, showed no case of a frost penetrating two feet, and only one case of its just reaching one foot.

We may now turn to the figures for 1895, and in the first place we will deal only with records obtained at a depth of one foot, because those observations are the most numerous. We did intend to give the observations *in extenso*, but the following abstract shows so steady a relation between the mean and the absolute minimum, that we see no necessity for printing two pages of figures when the facts can be brought out more prominently by an abstract.

In the table on page 39 we give for February, 1895, the mean temperature at the depth of one foot, and the lowest temperature at that depth at nearly twenty stations.

We have already seen that the deeper the thermometer is buried the less will it feel the frost. The following table shows that at 1 foot frost occurred at only 10 stations out of 18, and our previous table and diagram show that the minima are higher for each foot of depth—and, as far as we can see, the logical sequence of this is that the observations show that at no station could frost have occurred at a depth of 2 ft. 6 in.

And this conclusion (we do not say that we believe it), can be sup-

ported by some other records. We are not aware of any observations at the depth of 2ft 6 in., but there are a few at 2 ft. and at 4 ft.

*Earth Temperatures at 1 foot in February, 1895.*

STATION.	COUNTY.	Mean Temp.	Minimum.	Min. below Mean.
Lowestoft .....	Suffolk .....	29°0	28°2	0°8
Regent's Park, London .....	Middlesex.....	30°8	28°2	2°6
Wallington .....	Surrey .....	31°9	30°4	1°5
Shaftesbury .....	Dorset .....	31°9	30°8	1°1
Bolton.....	Lancashire .....	32°2	31°0	1°2
Stowell .....	Somerset .....	32°2	31°0	1°2
Camden Square.....	Middlesex.....	32°3	30°9	1°4
Harestock, Winchester .....	Hampshire .....	32°3	31°7	0°6
Southwell .....	Notts.....	32°6	32°0	0°6
Rousdon Observatory .....	Devon .....	32°7	31°7	1°0
Bennington .....	Herts .....	32°7	32°0	0°7
Norwood .....	Surrey .....	32°9	32°1	0°8
Tunbridge Wells .....	Kent .....	32°9	31°9	1°0
Rounton.....	York, N.R. ....	33°0	32°0	1°0
Hodsock.....	Notts.....	33°0	32°2	0°8
Margate .....	Kent .....	33°4	32°6	0°8
Somerleyton .....	Suffolk .....	33°8	33°0	0°8
Tavistock .....	Devon .....	34°0	33°4	0°6

In the above table the stations are grouped in the order of their mean temperature, and some results are remarkable. The coldest station, Lowestoft 29°·0, is within a short walk of the hottest but one, Somerleyton 33°·8. We believe that the thermometers at both stations have been verified, but think that reverification is desirable. There is, however, one important factor respecting underground thermometers, concerning which sufficient precision has not been enforced. We have seen no printed rule as to whether the ground in which they are sunk is or is not to be always open to the sun when it shines. Unfortunately, we did not begin observations on this point ourselves until the frost was nearly over, but we have had two thermometers each 1 foot deep, and within 100 feet horizontally, the one reading 1°·2 above the other. We do not suggest that all or any of the above minima require lowering by 1°·2, we merely say that in winter the sun has enough power, when it shines, to make one patch of ground, at 1 foot below the surface, 1°·2 warmer than another.

There are many other features in the table which need explanation, such as why the absolute minimum at Wallington was nearly 2° below Norwood, and why that at Regent's Park was nearly 3° below Camden Square.

In the following table we give all the minima at 1 ft., 2 ft., and 4 ft., at all stations arranged in our usual sequence, and in the last three columns some figures, to which no further weight must be

attached than this; that according to the information at present available, they represent what appears to have been the temperature at the respective depths, if the several thermometers may be regarded as accurate.

		Observed Minima.			Observed and Estimated Minima at			
		1 ft.	2 ft.	4 ft.	1 ft.	1ft. 6in.	2 ft.	2ft. 6in.
Middlesex.	Camden Sq. ....	30·9	°	37·1	30·9	32·7	34·1	35·1
"	Roy. Bot. Soc. ....	28·2	34·0	34·8	28·2	31·0	34·0	33·4
Surrey.....	Wallington .....	30·4	...	...	30·4	32·2	33·6	34·6
"	W. Norwood .....	32·1	...	...	32·1	33·9	35·3	36·3
Kent .....	Tunbridge Wells	31·9	...	...	31·9	33·7	35·1	36·1
"	Margate .....	32·6	35·8	40·0	32·6	34·4	35·8	37·3
Hampshire	Harestock .....	31·7	34·2	38·4	31·7	33·4	34·2	35·8
Herts .....	Bennington .....	32·0	...	...	32·0	33·8	35·2	36·2
Suffolk ...	Lowestoft .....	28·2	31·9	36·8	28·2	30·9	31·9	33·3
"	Somerleyton ...	33·0	...	37·4	33·0	34·8	36·2	37·2
Dorset.....	Shaftesbury .....	30·8	...	...	30·8	32·6	34·0	35·0
Devon.....	Tavistock .....	33·4	...	...	33·4	35·2	36·6	37·6
"	Rousdon .....	31·7	35·5	38·1?	31·7	33·8	35·5	36·2
Somerset..	Stowell .....	31·0	...	...	31·0	32·8	34·2	35·2
Notts .....	Southwell .....	32·0	...	...	32·0	33·8	35·2	36·2
"	Hodsock .....	32·2	...	...	32·2	34·0	35·4	36·4
Lancashire	Bolton .....	31·0	33·2	35·6	31·0	31·9	33·2	34·3
"	Blackpool .....	...	...	36·8	30·5	32·3	33·7	34·7
York N.R.	Rounton .....	32·0	...	...	32·0	33·8	35·2	36·2

From this we see that, according to the thermometers,—

Frost penetrated to 1 ft. at 11 stations.

" " 1ft. 6in. 3 "

" " 2ft. 1 station.

" " 2ft. 6in. no station.

The fact that ice formed in many pipes buried 2ft. 6ins. is, we believe, indisputable, indeed, we have statements of its being found at depths exceeding 3 ft., but space will not allow us to enter into details this month, nor to point out what may be the explanation of the apparent discordance.

*Erratum.*—Mr. von V. Searle has pointed out that the table at the top of p. 22 is not complete; we were aware of it when we wrote "The following are minima," instead of writing "The following are *all the* minima," but had forgotten it when we wrote the concluding words of the sentence. We do not think that lower readings are omitted, but that in some years there were other days with min. below 10°—this is certainly the case with Jan. 7th, 1841, on which it fell to 9°·8; and on Jan. 4th, 1867, when it fell to 7°·7; therefore, in each of those years, as in 1895, there were two consecutive days with minima below 10°.

# THE GREAT GALE IN THE MIDLANDS ON MARCH 24TH.

THERE can be no question as to this having been locally, one of the heaviest gales for many years. We have not space to report fully, but reproduce two typical descriptions, and a few others will be found in the "Notes on the Month" on p. 51.

*To the Editor of the Meteorological Magazine.*

SIR,—On Sunday, March 24th, at 9 a.m., the wind was S.S.W., force 5; then it increased, and must have been blowing 6, 7, or perhaps 8 towards noon, with small showers, and a smart one about 0.30 p.m. At 1 p.m. the wind was about force 8 from S.W., but it was not till 1.30 p.m. that I became alarmed. Direction was then W.S.W., and sky quite as much blue as cloudy. The wind was so furious, with distinct blasts of greater force, that I went to a window which commands a view of the main gable of the house, where slates had gone in the gale of February 11th, 1894. It was clear that they would go again. They trembled and shivered; one edge-slate slipped down, was caught by the wind, hurled over the house, and smashed on a door-step on the other side. One by one others went away, and at 2 so many were flapping and quivering that I had great fears for the roof itself. At 2.10 damage to the slates ceased, *not* by a change in the direction of the wind, but by abatement of its force. Meantime the cross above the weathercock on the church spire (copper, and 2 feet long) had been torn away by the wind, and the rod of the weathercock was shaking terribly. Some said they saw the stone-work of the spire move. This I could *not* see, nor can I see any sign of cracking since.

When it was safe to go out, I found that the village street was full of thatch. Every house with thatch was showing a hole somewhere. Chimney-pots, ridge-tiles, and slates had gone more or less from every house; but the destruction to the trees was the worst. Just outside my garden five large elms were lying side by side, torn up by the roots. This I fancy was done by one blast between 1.50 and 2, for exactly in the direction towards which these pointed, which was a few yards to the south of my vicarage, three solid chimney-pots had been carried away from a very substantial farmhouse, and, still in the same straight line, close to another farmhouse, seven large trees lay together (poplars, a Scotch fir, a larch, and a kind of ash), and further on, still in the same line, lay two large elms, torn up by the roots also. I have counted 19 large trees down within a very short half-mile of my house, not counting broken limbs of trees, and I am by no means sure that I have seen all.

The damage to thatch, tiles, &c., may supply a good measure of the force of the wind as compared with that of other gales; but the tearing up of the trees I judge to be due in great part to the late frost. The seven great elms torn up by the roots, already mentioned, were in low-lying hollows, where frost had gone deepest, and where

the ground has since been unusually loose for about two feet from the surface. On higher ground the roots had held for the most part (not always), and the tree stems had snapped near the ground, or some way up.

But whether to trees or to buildings, no gale since I have been here has done damage in any way comparable to this, and no one pretends to remember anything approaching to it. I wish I had had any means of calculating the angle to which a fir tree opposite my study window bent without breaking!

By 3 p.m. the wind had much abated; by 4 it had ceased to be at all remarkable, and by sunset was not more than a fresh breeze. There was much lightning about 8 p.m. in N.W.

The hurricane may be said to have lasted from 1.30 to 2.15, and the very worst of it from 1.50 to 2. The extreme force might certainly be put as high as 11, perhaps even at 12. Had the extreme fury continued for an hour, there is no knowing how the house roofs would have stayed on.—Yours very truly,

H. A. BOYS.

*Easton Mauduit Vicarage, Northampton.*

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*To the Editor of the Meteorological Magazine.*

SIR,—The comparatively scanty accounts in the London papers of Sunday's storm lead me to suppose that the intensity in the metropolis was very much inferior to that experienced in this county, where it is stated that, as far as the disastrous results are concerned, nothing like it has been experienced since 1703.

I well remember the great gale of the 14th of October, 1881, and the numbers of trees which were then blown down, but it was *not to be compared* with that of the 24th of March, 1895. Older men than myself speak of the great "May" gale of 1860, with which they compare the recent one, but all admit that even that did not equal the awful and destructive hurricane we have just passed through.

My own experiences of Sunday were as follows. After a stormy night, with rain, at 9 a.m. the wind was blowing a moderate gale from W.S.W., the sky was clouded, the barometer (corrected and reduced), was 29.28 ins. Temp. dry, 51°.6; wet, 51°0. The min. had been as high as 47°8. During the forenoon the wind slightly increased and the sky partially cleared. At 2 p.m. the barometer had fallen to 29.09 ins., and the wind was blowing a fresh gale nearly due W. At 3 p.m. the hurricane began in earnest, and a few minutes later my garden wall was blown over. At 3.30 p.m. the gale was at its height, the barometer being 28.99 ins. The gusts were something terrific. The water was being blown out of the river like dense clouds of smoke over the adjoining marshes, and the spray could be felt in my garden, 60 feet above it. Rockland and Surlingham Broads were compared to "bonfires," so great and dense were

the clouds of spray being blown out of them. Three signal posts on the line were blown down, and roofs were swept of tiles by the 100, chimney-pots blown down, and in many instances stacks of chimneys blown through the roofs. At Blofield Church the service was suspended, the lead on the roof was rolled up like parchment, many of the trees in the churchyard were uprooted, and the congregation was unable to leave by the usual door owing to the falling masonry. At Strumpshaw (the adjoining parish) a whole plantation of larch trees was laid flat, not a tree left standing, and the grounds of Brundall House, noted for the great variety of beautiful trees and shrubs were left a perfect wreck, large trees being piled one on the top of another. On a farm near here 300 trees were blown down and in a park near East Dereham it is said that 1100 trees were uprooted. In some parts of Norwich the houses look as if they had been bombarded, the roofs being stripped of tiles, chimney stacks fallen through the roofs, and windows blown in. Nothing the least approaching it has happened in my recollection, nor of anyone, even of old people with whom I have come in contact.

After 3.30 p.m. the barometer rose briskly, and from 4 p.m. the gale gradually abated. At 9 p.m. the barometer had risen to 29.34 ins., the wind was W.N.W., about force 6, and there was much distant lightning.

I see that in the *Quarterly Journal Roy. Met. Soc.*, 1874 (p. 111), it is stated that a "hurricane that tears up trees and throws down buildings" has a velocity of 110.48 miles per hour. I should think, therefore, that the most violent gusts on Sunday afternoon must have been but little short of force 12.

Yours very truly,

ARTHUR W. PRESTON.

*Bradestone House, Brundall, Norwich, 26th March, 1895.*

P.S.—I have since ascertained that the damage caused in Norfolk by the gale of the 24th ult. is far more extensive than I was then aware of. On three estates I hear of 2,000 trees being blown down, and on another of 1,700.

I have recently been in Suffolk, where they also experienced a severe gale, but the results appear trifling when compared with the devastation wrought in this county.

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*To the Editor of the Meteorological Magazine.*

SIR,—A severe S.W. gale, apparently at its height from noon till 1 p.m., as during that time 10 great forest trees were blown down to my knowledge (principally elm) within a mile of here, and various other damage was done. Rainfall only .03 in. ; lightning at night.

ROSE E. STANTON.

*Upfield, near Stroud, Gloucestershire, March 24th, 1895.*

## SNOW FROM A CLOUDLESS SKY.

*To the Editor of the Meteorological Magazine.*

SIR,—The 6th of February was a brilliant day here, but at intervals some snow crystals and minute spiculæ of ice fell without any visible cloud, and unaccompanied by any other form of snow.

These corresponded, for the most part, with Figs. 89, 98, 104 and 132 in the series of snow crystals published in the Fifth Annual Report of the Roy. Met. Soc.

Snow crystals also fell on February 1st, 2nd, 7th, 8th, 14th and 15th, in endless variety of forms.

Yours truly,

C. LEESON PRINCE.

*The Observatory, Crowborough, Sussex, March 29th, 1895.*

## REVIEWS.

*Meteorological Work in Australia: A Review*, by Sir C. TODD, K.C.M.G., F.R.S. [? "Excerpt Report Australian Association for the Advancement of Science."] 8vo, 25 pages, 1 plate.

AT the first meeting of the Association at Sydney, in 1888, Mr. Russell epitomized the work in Astronomy and Meteorology done in Australia up to 1860; in the present paper Sir Charles Todd deals with the period from 1860 to 1892. Incidentally, he gives some figures so startling and so important that we at once proceed to extract them. We must, however, first explain where "Alice Springs" is, because some of our readers may not know.

Sir Charles Todd was appointed Government Astronomer of South Australia in 1856, and with that appointment was joined that of Director of the Telegraph service. Towards the end of the sixties, the wonderful undertaking of erecting a line of telegraph right across Australia from South to North (about 2,000 miles) was commenced, and finished in 1872 by Sir Charles; and Alice Springs is the name of a telegraph station not many miles from the centre of the vast continent of Australia.

We will now let Sir Charles tell his own tale :—

"At Alice Springs there is a large evaporation tank similar to that at the Adelaide observatory, which it may be convenient here to describe. It consists, first, of a brick tank lined with cement; internal measurement, 4 ft. 6 in. square and 3 ft. 2 in. deep. Inside this tank is another, made of slate, 3 ft. square and 3 ft. deep, leaving an intervening space between it and the larger tank of 7 in. Both tanks are filled to the same level, or to within 3 in. or 4 in. of the top, fresh water being added as required. The evaporation is measured by a graduated vertical rod, which is carried by a float placed in a vertical cylinder of copper 4 in. in diameter (perforated at the bottom) standing in the inner tank. The rod is graduated to  $\frac{1}{10}$ th of an inch, and is read off by means of a fixed vernier to  $\frac{1}{100}$ th



of an inch. A rain gauge is placed by the side of the tank, and both the evaporation and the rainfall are read at 9 a.m. and 9 p.m.

"As the question of evaporation is an important one in connection with water conservation, I give below the mean evaporation at Adelaide, deduced from twenty-three years' observations, and at Alice Springs, in the centre of the continent, during the years 1890, 1891 and 1892.

Evaporation at Adelaide.		Evaporation at Alice Springs.		
Mean of Twenty-Three Years.		1890.	1891.	1892.
	Inches.	Inches.	Inches.	Inches.
January .....	8·93	—	12·84	14·02
February .....	7·23	11·20*	13·84	10·55
March .....	6·03	11·99	11·85	8·72
April .....	3·60	6·00	5·04	7·18
May .....	2·13	4·76	4·48	4·66
June .....	1·38	3·15	2·66	3·95
July .....	1·46	4·44	3·82	4·21
August .....	2·03	5·43	5·81	5·69
September .....	3·02	—	7·78	8·17
October .....	4·86	11·22	8·23	9·84
November .....	6·50	11·73	9·26	11·87
December .....	8·36	13·79	12·94	11·49
Year .....	55·53	—	98·55	100·35

\* Twenty-seven days.

Greatest [evaporation] in one year at Adelaide ... 60·95 in. in 1876.

Least [evaporation] in one year at Adelaide ..... 47·39 in. in 1892.

Average rainfall at Adelaide for 54 years ..... 21·08 in.

Average rainfall at Alice Springs for 19 years..... 11·25 in.

We have heard that when fixing the telegraph there was one station (and we rather think that it was Alice Springs) to which drinking water had to be sent several hundred miles. With the supply which its present name indicates, and with a mean rainfall of  $11\frac{1}{4}$  inches, it is now, doubtless, independent, but it will need something to keep up an evaporation of 100 inches a year.

*Bodenphysikalische und Meteorologische Beobachtungen mit besonderer berücksichtigung des Nachtfrostphänomens*, von THEODOR HOMEN, Privatdocent an der Universität zu Helsingfors. Mayer and Müller, Berlin, 1894, 225 pages and two plates.

WE have never seen a satisfactory explanation of the reason why persons who write in German do their work with such thoroughness. We have here a book written by a member of the University of Helsingfors (just where the Baltic narrows to become the Gulf of Finland), which is in many respects a model. Twelve years ago he wrote a short paper on nocturnal frosts; and in the pre-

sent book he carries on the investigation with fresh instruments, and in relation, not merely to night frosts, but to dew and to evaporation. The work seems to us to have only one failing, and that is one rather usual with German books—an absence of woodcuts. A sketch of one or two of his thermometers in position, a process-photo of one of his experimental groups, and an outline plan showing the sites of the observations, would have made it more easy to appreciate fully the conditions of the experiments.

The author explains the pattern of the thermometer used, and the precautions taken to ensure accuracy. He had about thirty-six thermometers, thirty of which were in groups of six each. Each group had its bulb at the respective depths below the surface of—

0       $\frac{3}{4}$  in.      2 in.      4 in.      8 in.      1 ft. 4 in.

and the five groups were respectively placed in—

- (1) Open sandy heath, with scanty grass.
- (2) Sandy heath, but very shady, with small pine trees.
- (3) Loamy soil, bearing wheat.
- (4) On an open moor or bog.
- (5) On a field of rye reclaimed from the moor or bog.
- (6) In a fir plantation on the same moor or bog.

Three observers took part in the work, and the whole thirty thermometers were read hourly from 11 a.m. on August 12th, 1892, till 4 p.m. on the 14th, *i.e.*, for 53 consecutive hours, and from 4 a.m. September 6th, 1892, to midnight, September 8th-9th, *i.e.*, for 68 hours. These observations are printed *in extenso*.

We notice one erroneous entry; whether a mistake in the observation or a misprint, we cannot tell, but certainly the reading of the 5 cm. thermometer at 3 p.m. on August 14th was 16°·0 not 15°·0; otherwise the tables are remarkably accurate.

We cannot, of course, quote the figures *in extenso*, but roughly the results for August 12th to 14th are:—

Daily Range of Temperature.			
	Open Heath.		Fir Plantation on a Moor or Bog.
Surface.....	27·5 F.	.....	12·5 F.
$\frac{3}{4}$ in. below .....	18·0	.....	6·5
2 in. „ .....	13·0	.....	3·0
4 in. „ .....	8·5	.....	1·0
8 in. „ .....	5·0	.....	0·5
16 in. „ .....	1·1	.....	0·0

In subsequent sections, the author deals with the capacity of the various strata of the soil for heat, the temperature exchanges between the soil and the atmosphere, and the amount of water found in the various layers of earth.

He then deals with the amount of dew and its mode of production, giving notes from Aristotle, Gersten, Six, Wilson, Wells, Fusinieri, Stockbridge, Chistoni, Aitken, Wollny, Russell, Masure, Marié-Davy, Flauguergues, Raddi, Nacca, Gasparin and Dines, and

finishing up with original experiments by himself with various flannels and other woven materials.

The next section is the weakest in the book. It is devoted to evaporation, and is almost wholly based upon records with Dr. Wild's apparatus, the important work done by French engineers, and copied in this country, in America, and Australia, being apparently unknown to Professor Homén.

The last sections are devoted to explaining the production of night frosts and their prediction.

No one ought to write on the above subjects until he has made himself familiar with what the author has done.

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*An Essay on Southerly Bursters* by H. A. HUNT, Second Meteorological Assistant, Sydney Observatory. [Excerpt Journal Royal Soc. of N. S. Wales.] 8vo, 48 pages, four photo plates.

[Awarded the Prize of £25 offered by the Hon Ralph Abercromby, for the best *Essay on Southerly Bursters*, May 2nd, 1894.]

MR. ABERCROMBY is to be congratulated on this the first outcome of his donation to the Royal Society of New South Wales. The writer is evidently more at home in weather forecasting, and in the study of synchronous observations, than in literary work, but as he says (although had he been a more practised scribe he would have left it to others to say), he has devoted "a vast amount of patient research," and the result is, we think, very satisfactory.

We do not like the name "Southerly Burster" so well as its precursor, "Brickfielder," and Mr. Hunt's reason for the change seems to us rather insufficient; however, he ought to know if anyone does, and this is his statement:—

"In the early days of Australian settlement, when the shores of Port Jackson were occupied by a sparse population, and the region beyond was unknown wilderness and desolation, a great part of the Haymarket was occupied by the brickfields, from which Brickfield Hill takes its name. When a 'Southerly Burster' struck the infant city, its approach was always heralded by a cloud of reddish dust from this locality, and, in consequence, the phenomenon gained the local name of a 'brickfielder.' The brickfields have long vanished, and with them the name to which they gave rise, but the wind continues to raise clouds of dust as of old, under its modern name of 'Southerly Burster.'"

The essay contains a mass of information generally well arranged, and will, we think, remain for some time the best paper upon the subject.

The investigation of the Helm Wind by the Royal Meteorological Society left upon our mind the impression that its importance had been considerably exaggerated, but Mr. Hunt's paper, and especially plates v., vi. and viii., have reminded us of it, for the plates represent rolls of cloud similar to those which we understood prevailed during a Helm Wind, and formed the Helm and the Helm Bar.

## CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, SEPTEMBER, 1894.

STATIONS.  (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
England, London .....	71·2	1	36·7	28	63·0	48·0	48·1	79	113·6	31·6	1·05	11	6·6
Malta.....	95·8	5a	65·0	23	87·3	71·6	68·4	76	145·7	60·4	·23	1	2·1
Cape of Good Hope ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius.....	79·0	25	61·4	5	76·5	64·7	61·1	75	129·4	52·3	1·88	16	5·7
Calcutta.....	90·6	22	75·8	21	87·6	77·8	78·6	89	158·7	74·3	6·52	15	7·2
Bombay.....	86·2	4	73·3	22	83·1	75·7	74·9	86	139·3	71·5	12·04	25	8·4
Ceylon, Colombo ...	87·6	21	69·6	6	85·6	76·7	72·5	80	148·5	68·0	·78	15	7·5
Melbourne.....	71·2	20	36·1	29	60·5	43·6	43·7	74	124·9	30·0	2·69	19	5·5
Adelaide .....	77·0	20	37·2	6	64·3	45·5	44·9	72	140·6	31·8	1·02	16	4·5
Sydney .....	79·8	22	45·3	18	64·1	49·9	49·0	76	135·8	32·5	4·62	22	5·4
Wellington .....	64·0	8	36·0	3, 16	56·6	45·2	42·1	73	125·0	23·0	5·03	19	4·8
Auckland .....	69·0	11	35·0	3	59·9	48·1	47·3	77	130·0	31·0	5·08	21	6·4
Jamaica, Kingston.....	92·9	21	70·6	19	90·1	73·8	71·8	77	...	...	1·55	6	4·4
Grenada.....	87·2	12	69·8	29	84·1	74·9	72·8	77	155·0	...	12·16	26	4·9
Trinidad .....	91·0	c	69·0	26	89·1	71·4	71·5	81	172·0	67·0	5·48	12	...
Toronto .....	84·1	2	38·9	26	71·5	53·7	54·7	78	...	30·0	5·48	14	5·2
New Brunswick, Fredericton .....	77·7	22	29·5	27	67·2	46·4	48·3	72	...	...	2·60	8	6·1
Manitoba, Winnipeg ...	85·0	5	26·8	17	65·8	42·3	...	...	...	...	2·18	11	5·7
British Columbia, Esquimalt .....	68·0	10	40·2	23	60·2	47·6	50·4	89	...	...	3·73	17	6·2

a—and 14. b—and 19. c—Various.

## REMARKS.

**MALTA.**—Adopted mean temp. 77°·6, 3°·0 above the average. Mean hourly velocity of wind 8·2 miles. Thunder storm on 30th. Lightning on 18th and 19th. No rain, except a few drops on 18th, before the night of 30th. September, 1893, was the first rainless September recorded in 12 years. J. F. DIBSON.

**Mauritius.**—Mean temp. of air equal to, dew point 1°·3 above, and rainfall ·42 in. above, their respective averages. Mean hourly velocity of wind 11·1 miles or 0·9 below average; extremes 25·3 on 1st, and 1·6 on 6th; prevailing direction, E.S.E. to E. by N. C. MELDRUM, F.R.S.

**Adelaide.**—Mean temp. 2°·2 below the average of 37 years. Rain ·80 in. below the average. C. TODD, F.R.S.

**Sydney.**—Mean temp. 1°·7 below, humidity 6°·1 above, and rainfall 1·41 in. above, their respective averages. H. C. RUSSELL, F.R.S.

**Wellington.** On the whole a showery month, with occasional intervals of fine weather; prevailing southerly weather and strong wind from that quarter from the 1st to 3rd and 19th and 20th. Thunder hail and snow on 2nd; fog on 8th. Mean temp. same as average; rainfall ·77 in. above average. R. B. GORE.

**Auckland.**—A wet, stormy and disagreeable month. Slight snow storm on the 3rd, the first snow recorded in Auckland for fifteen years. Rainfall about 1·50 in. in excess. Barometric pressure and mean temperature both considerably below the average. T. F. CHEESEMAN.

**JAMAICA, KINGSTON.**—Cyclone to the North on 23rd. Mean hourly velocity of wind 3·8 miles; prevailing direction S.S.E. Island rainfall a little less than, and Kingston rainfall one-third of, their respective averages. R. JOHNSTONE.

**TRINIDAD.**—Rainfall 2·05 in. below the average of 30 years. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL,  
MARCH, 1895.

[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.			
II.	Dorking, Abinger Hall.	2.20	XI.	Lake Vyrnwy .....	4.67
„	Birchington, Thor .....	1.11	„	Corwen, Rhug .....	1.52
„	Hailsham .....	2.45	„	Carnarvon, Cocksidia ...	4.71
„	Ryde, Thornbrough .....	2.07	„	I. of Man, Douglas .....	4.43
„	Emsworth, Redlands ...	2.13	XII.	Stoneykirk, Ardwell Ho.	3.88
„	Alton, Ashdell .....	1.96	„	New Galloway, Glenlee	4.35
III.	Oxford, Magdalen Col...	1.34	„	Melrose, Abbey Gate	3.71
„	Baibury, Bloxham .....	2.53	XIII.	N. Esk Res. [Penicuick]	5.40
„	Northampton, Sedgebrook	2.28	„	Edinburgh, Blacket Pl.	2.80
„	Alconbury .....	1.54	XIV.	Glasgow, Queen's Park.	1.17
„	Wisbech, Bank House..	2.01	XV.	Inverary, Newtown	6.25
IV.	Southend .....	1.24	„	Islay, Gruinart School..	1.15
„	Harlow, Sheering .....	1.18	XVI.	Dollar .....	4.57
„	Colchester, Lexden .....	1.21	„	Balquhidder, Stronvar.	5.01
„	Rendlesham Hall .....	1.78	„	Ballinluig .....	1.47
„	Diss .....	1.79	„	Dalnaspidal H.R.S. ...	4.87
„	Swaffham .....	2.32	XVII.	Keith H.R.S. ....	3.95
V.	Salisbury, Alderbury ...	1.74	„	Forres H.R.S. ....	2.74
„	Bishop's Cannings .....	2.67	XVIII.	Fearn, Lower Pitkerrie.	1.42
„	Blandford, Whatcombe.	2.81	„	Loch Shiel, Glenaladale	7.75
„	Ashburton, Holne Vic...	4.04	„	N. Uist, Loch Maddy ...	2.38
„	Okehampton, Oaklands.	3.28	„	Invergarry .....	5.23
„	Hartland Abbey .....	3.03	„	Aviemore H.R.S. ....	3.05
„	Lynmouth, Glenthorne.	4.07	„	Loch Ness, Drumnadrochit	7.20
„	Probus, Lamellyn .....	3.30	XIX.	Invershin .....	2.18
„	Wellington, Sunnyside..	3.05	„	Scourie .....	3.98
„	Wincanton, Stowell Rec.	2.68	„	Watten H.R.S. ....	1.97
VI.	Clifton, Pembroke Road	2.27	XX.	Dunmanway, Coolkelure	7.48
„	Ross The Graig .....	2.13	„	Fermoy, Gas Works ...	2.42
„	Wem, Clive Vicarage ...	2.17	„	Killarney, Woodlawn ...	5.10
„	Cheadle, The Heath Ho.	2.49	„	Caher, Duneske .....	3.82
„	Worcester, Diglis Lock	1.62	„	Ballingarry, Hazelfort...	2.61
„	Coventry, Coundon .....	2.19	„	Limerick, Kilcornan ...	2.93
VII.	Ketton Hall [Stamford]	1.81	„	Ennis .....	2.76
„	Grantham, Stainby .....	2.37	„	Miltown Malbay .....	4.16
„	Horncastle, Bucknall ...	2.10	XXI.	Gorey, Courtown House	2.86
„	Worksop, Hodsck Priory	1.52	„	Athlone, Twyford .....	3.55
VIII.	Neston, Hinderton .....	2.56	„	Mullingar, Belvedere ...	3.41
„	Preston, Haighton ...	3.29	„	Longford, Currygrane...	3.67
„	Broughton-in-Furness..	6.21	XXII.	Woolawn .....	4.22
IX.	Ripon, Mickley .....	2.64	„	Crossmolina, Enniscoe..	5.04
„	Melmerly, Buildersby ...	2.17	„	Collooney, Markree Obs.	4.04
„	Scarborough, South Cliff	1.57	„	Balhamore, Lawderdale	4.11
„	Middleton, Mickleton...	3.53	XXIII.	Lough Sheelin, Arley ...	3.36
X.	Haltwhistle, Unthank..	3.41	„	Warrenpoint .....	3.84
„	Bamburgh .....	2.42	„	Seaforde .....	3.01
„	Keswick, The Beeches...	5.28	„	Belfast, Springfield ...	4.24
XI.	Llanfrehfa Grange .....	4.20	„	Bushmills, Dundarave...	3.59
„	Llandovery .....	5.40	„	Stewartstown .....	3.49
„	Castle Malgwyn .....	4.56	„	Buncrana .....	4.00
„	Builth, Abergwessin Vic.	8.52	„	Lough Swilly, Carrablagh	3.91
„	Rhayader, Nantgwillt..	5.67			

## MARCH, 1895.

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 Nights 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.			Deg.	Date	Deg.	Date.						
I.	London (Camden Square) ...	1.42	—	.19	.38	26	14	63.7	22	23.7	3	7 17		
II.	Maidstone (Hunton Court)...	1.52	+	.02	.26	9	19	...	...	...	...	...		
III.	Strathfield Turgiss .....	1.44	—	.15	.43	25	19	66.0	22	22.8	14	13 23		
IV.	Hitchin .....	1.94	+	.60	.59	27	14	60.0	21	24.0	2	11 ...		
V.	Winslow (Addington) .....	1.56	—	.16	.29	26	16	61.0	22	19.0	3	11 19		
VI.	Bury St. Edmunds (Westley)	1.93	+	.38	.32	27	15	57.0	21 <sup>b</sup>	25.0	4	...		
VII.	Norwich (Brundall) .....	1.86	...	...	.28	3	19	61.2	23	23.0	3	8 19		
VIII.	Weymouth (Langton Herring)	2.33	+	.43	.43	26	19	55.0	20 <sup>b</sup>	23.0	4	8 ...		
IX.	Torquay (Cary Green) .....	3.11	...	...	.60	26	15	61.9	20	29.4	4	1 12		
X.	Polapit Tamar [Launceston]..	3.03	+	.50	.50	26	16	62.5	22	27.0	13	8 14		
XI.	Stroud (Upfield) .....	2.37	+	.18	.39	27	21	61.0	21	26.0	3	11 ...		
XII.	Church Stretton (Woolstaston)	1.99	—	.14	.25	28	18	61.0	22	22.0	3	8 19		
XIII.	Tenbury (Orleton) .....	1.74	—	.34	.26	26	16	63.5	21 <sup>b</sup>	20.8	3	11 15		
XIV.	Leicester (Barkby) .....	1.67	—	.04	.39	30	18	61.0	23	20.0	2, 3	15 24		
XV.	Boston .....	1.96	+	.42	.32	9	15	65.0	17	25.0	4	11 ...		
XVI.	Hesley Hall [Tickhill] .....	1.50	—	.40	.37	9	13	62.0	18	25.0	3	11 ...		
XVII.	Manchester (Plymouth Grove)	2.93	+	.71	.46	23 <sup>d</sup>	20	57.0	18	25.0	3	10 13		
XVIII.	Wetherby (Ribston Hall) ..	1.00	—	1.06	.35	10	9	...	...	...	...	...		
XIX.	Skipton (Arncliffe) .....	4.93	—	.17	1.09	23	23	...	...	...	...	...		
XX.	Hull (Pearson Park) .....	1.68	—	.37	.30	24	19	60.0	17 <sup>b</sup>	24.0	3	11 14		
XXI.	Newcastle (Town Moor) .....	2.22	—	.41	.46	9	17	...	...	...	...	...		
XXII.	Borrowdale (Seathwaite) .....	13.39	+	2.89	4.41	23	26	...	...	...	...	...		
XXIII.	Cardiff (Ely) .....	4.65	+	1.67	1.01	27	17	...	...	...	...	...		
XXIV.	Haverfordwest .....	4.33	+	1.09	.93	23	25	57.8	17	27.8	18	4 15		
XXV.	Aberystwith (Gogerddan) ...	5.16	+	2.18	.81	23	18	55.0	25	21.0	3	15 ...		
XXVI.	Llandudno .....	3.47	+	1.39	.47	24	21	...	...	...	...	...		
XXVII.	Cargen [Dumfries] .....	3.22	—	.08	.68	23	13	57.8	21	25.8	3	7 ...		
XXVIII.	Jedburgh (Sunnyside) .....	...	...	...	...	...	...	...	...	...	...	...		
XXIX.	Colmonell .....	4.16	...	...	.73	8	20	59.0	22	25.0	2	5 ...		
XXX.	Lochgilthead (Kilmory) .....	4.42	—	.04	.74	23	20	...	...	21.0	2, 3	13 ...		
XXXI.	Mull (Quinish) .....	4.25	+	.41	.86	24	16	...	...	...	...	...		
XXXII.	Loch Leven Sluices .....	3.60	+	.63	.80	28	12	...	...	...	...	...		
XXXIII.	Dundee (Eastern Necropolis)	2.30	—	.10	.85	27	17	58.9	21	25.0	3	11 ...		
XXXIV.	Braemar .....	2.29	—	.35	.77	28	16	49.2	21	13.8	12	18 24		
XXXV.	Aberdeen (Cranford) .....	4.04	...	...	1.07	28	21	58.0	16 <sup>c</sup>	24.0	2	11 ...		
XXXVI.	Strathconan [Beaully] .....	4.22	—	.10	1.00	29	9	...	...	...	...	...		
XXXVII.	Glencarron Lodge .....	8.91	...	...	1.04	23	26	52.8	22	18.0	2	9 ...		
XXXVIII.	Cawdor [Nairn] .....	4.18	+	2.14	1.21	28	21	...	...	...	...	...		
XXXIX.	Dunrobin .....	2.92	+	.67	.45	28	22	55.5	16	30.0	1	4 ...		
XL.	S. Ronaldsay (Roeberry) .....	1.85	—	.69	.24	20	26	50.0	16	22.0	2	8 ...		
XLI.	Darrynane Abb-y .....	4.47	...	...	.93	23	22	...	...	...	...	...		
XLII.	Waterford (Brook Lodge) ...	3.33	+	.43	.84	23	14	60.0	21	27.0	5, 7	3 ...		
XLIII.	O'Briensbridge (Ross) .....	4.33	...	...	.84	23	18	...	...	...	...	...		
XLIV.	Carlow (Browne's Hill) .....	3.48	+	1.11	.57	24	18	...	...	...	...	...		
XLV.	Dublin (Fitz William Square)	2.75	+	.74	.57	27	19	58.7	16	29.5	13	5 10		
XLVI.	Ballinasloe .....	3.27	+	.64	.64	27	19	57.0	16	24.0	4 <sup>d</sup>	12 ...		
XLVII.	Clifden (Kylemore) .....	9.65	...	...	1.70	7	21	...	...	...	...	...		
XLVIII.	Waringstown .....	3.34	+	.99	1.10	27	21	60.0	17 <sup>b</sup>	25.0	4 <sup>e</sup>	10 19		
XLIX.	Londonderry (Creggan Res.) ..	3.61	+	.88	.65	20	27	...	...	...	...	...		
L.	Omagh (Edenfel) .....	3.50	+	.99	.49	27	26	54.0	23	25.0	4	8 13		

a And 24. b And 22. c And 21. d And 12, 13. e And 13.

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

# METEOROLOGICAL NOTES ON MARCH, 1895.

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.

STRATHFIELD TURGISS.—March opened with changeable weather, with showers of sleet and S, and with a low mean temp. Towards the middle of the month the weather became more genial, but the end of the month was very unsettled, with heavy gales of wind. Snowdrop in flower on 1st, palm blossom on 7th, daisy in flower on 16th, humble bee first seen on 22nd.

ADDINGTON.—The first fortnight cold, afterwards milder and a few fine days. From the 24th until the end the bar. was very low, and a heavy gale occurred on the 24th, its greatest violence being between 1 p.m. and 2 p.m. A great deal of damage was done—many trees uprooted, and others wrenched in two at heights ranging from three to 15 feet from the ground, much injury also to buildings and stacks.

BURY ST. EDMUNDS.—A favourable month generally, with little east wind. Remarkable for the very severe gale of Sunday, the 24th. The wind had been rough all the morning, but began to blow violently about 2 p.m., and continued tremendous till 3.30 p.m., when it gradually subsided. The greatest force of the gale was about 2.55 p.m. The corn stacks had the tops blown off, and sheaves of corn were carried a great distance; straw stacks suffered much, and slates and tiles went in all directions; many fine trees had their tops blown off. A remarkable cloud of a yellow red colour, which appeared to be at least 10 miles in length, was formed in the North by the sand blowing off the light lands. I consider this the heaviest gale in Suffolk since 1857, when I first reported to you. S on 2nd, 3rd, and 4th.

NORWICH, BRUNDALL.—The fine weather of the middle fortnight brought up the month's mean temp. to slightly above the average. The devastating hurricane on the afternoon of the 24th—the most severe on record in these parts—will make the month a memorable one. S daily from 1st to 5th.

LANGTON HERRING.—The mean temp. at 9 a.m.  $40^{\circ}8$  is  $0^{\circ}7$  below the average of 24 years. The dense fogs on the 22nd, 23rd and 24th were the most notable feature of the month; fogs occurred also on the 9th, 15th, and 27th. L on the night of the 23rd. A very high wind on the 24th, which, however, did no damage in this neighbourhood. Solar halo on the 11th.

TORQUAY, CARY GREEN.—Rainfall  $\cdot 12$  in. above the average; wet days exactly the average. Mean temp.  $43^{\circ}8$  or  $1^{\circ}2$  above the average. Amount of sunshine 151 hours 20 minutes, being 2 hours above the average; three sunless days.

POLAPIT TAMAR.—Rather wetter than March usually is, and an absence of the characteristic bleak east wind that usually prevails. S on 3rd.

STROUD, UPFIELD.—About half an inch of S on the ground on 2nd, and S showers on 3rd and 4th. Aurora seen at 8.30 p.m. on 13th. S.W. gale on 24th, greatest force apparently from noon to 1 p.m.; many forest trees blown down; S.W. gale also on 28th.

WOOLSTASTON.—The early part of the month was cold, with frost nearly every night, and S fell on the 2nd. The last fortnight was more genial. A heavy gale raged on the 24th, which became a terrific hurricane about 1 p.m., uprooting trees, levelling stacks, and blowing down chimneys in all directions, in the course of about 10 minutes. Severe storms of H occurred the same evening. Mean temp.  $41^{\circ}7$ .

TENBURY, ORLETON.—A fairly favourable month; cold and dry till the 19th, then much warmer with frequent R to the end. Great gale on 24th, doing an immense amount of damage, and L at night. S on 2nd and 3rd. The temp. reached  $50^{\circ}$  on 11th, for the first time since December 26th.

LEICESTER, BARKBY.—A cold and wet month, except for a few days in the middle. Fearful hurricane, doing much injury, with R, L and T, for nearly three hours on 24th. Mean temp.  $41^{\circ}2$ .

HESLEY HALL.—Heavy gale, with T, L and H on 24th. Frost on 11 out of the first 17 days; none after.

MANCHESTER, PLYMOUTH GROVE.—S on 3rd, and S and sleet on 5th. Dense fog on 18th; thick fog and wet mist on the 7th. Very stormy weather on 24th and 25th, with T and L.

#### WALES.

HAVERFORDWEST.—A fall of S on the 3rd, covering the ground, was followed by a couple of days' hard frost; continuous R then set in until the 15th, but although R fell on 25 days or nights, yet there were a great many hours of bright sunshine and fine weather; these factors, taken together with the sharp night frosts, combined to bring the land into a favourable condition for ploughing and sowing. The weather became unsettled, cold and stormy from the 18th, and in the night of the 23rd a strong gale arose, and a terrific squall at 11 a.m. on 24th in a few minutes unroofed houses, and blew down trees, and nearly took several persons off their feet. Squally wintry weather continued to the end of the month.

GGERDDAN.—Very stormy and cold throughout the month, with very little sunshine.

#### SCOTLAND.

CARGEN.—A dull, sunless month. Duration of sunshine only 82 hours, the average for 36 years being 128 hours. The mean bar. reading also is exceptionally low, 1861 and 1876 being the only years with a lower mean for March. The changes of both temp. and pressure were great and sudden. Owing to the long continued frost which lasted almost uninterruptedly for ten weeks from December 29th, 1894, to March 9th, 1895, vegetation is unusually backward.

COLMONELL.—Rainfall '96 in. above the average.

ROEBERRY.—Mean temp. 39°·6.

#### IRELAND.

DARRYNANE ABBEY.—On the whole a wet but mild month, with some very fine, warm days in the middle.

WATERFORD, BROOK LODGE.—Mean temp. 44°·3. T on 25th and 30th. H on 24th and 30th. The Comeragh, Carlow and Wexford mountains were covered with new S on the 3rd.

O'BRIENSBRIDGE, ROSS.—More than average R for March, with very cold and wintry weather, especially at the close of the month. Great storm on 24th and 25th, with much L and T. Vegetation late.

DUBLIN.—A changeable, dull and rather rainy month. The cold weather which had prevailed through January and February lasted until the 13th, when the ther. touched 50° in the shade, for the first time since December 25th, 1894. A mild spell followed, continuing to the 24th, after which temp. fell again, and remained below the average to the end of the month. Mean temp. 44°·1, one degree above the average. Fog on 6 days. High winds on 13 days, reaching the force of a gale on the 23rd, 24th and 28th. S or sleet fell on 4 days, and H on 6 days. The temp. exceeded 50° in the screen on 13 days. Brilliant aurora borealis on the 13th. L on the 24th.

EDENFEL.—The month was generally stormy, rainy and unsettled, with little frost or S, but more R than was suitable for the prosecution of farm work, already extremely backward from the prolonged and severe winter.



# SYMONS'S

## MONTHLY

# METEOROLOGICAL MAGAZINE.

CCCLII.]

MAY, 1895.

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### THE FROST—EARTH TEMPERATURES & WATER PIPES.

*Continued from page 40.*

It would be beyond the scope of a note in this Magazine to prepare an analysis of all earth temperature records, but Mr. Rogers Field has directed our attention to some given in an American work,† which is hardly likely to be generally known to meteorologists, and from which we have therefore formed the following table:—

#### *Winter Earth Temperature Observations in the United States.*

Place.	Year	Month.	Air.			Minimum in Soil.							
			Max.	Min.	Mean	3 in.	6 in.	1 ft.	2 ft.	3 ft.	4 ft.	5 ft.	6 ft.
S. Anthony Park, Minnesota	1890	Nov.	66	17	41·2	33·5	35·0	37·5	40·5	...	...	...	...
		Dec.	47	1	25·6	32·0	33·0	34·5	36·5	...	...	...	...
		Jan.	49	1	28·9	32·0	27·0	33·0	34·5	...	...	...	...
		Feb.	58	4	33·1	23·5	27·5	33·0	34·0	...	...	...	...
		Mar.	54	0	31·6	24·0	30·0	33·0	34·0	...	...	...	...
	1891	April	82	20	49·5	31·5	33·0	35·0	36·5	...	...	...	...
		Jan.	38	10	25	15	...	18	24	31	34	36	37
		Feb.	46	—3	17	6	...	18	18	25	30	33	34
		Mar.	62	14	44	21	...	26	25	26	30	32	34
		April	68	42	56	46	...	35	32	32	32	33	39
Lincoln, Nebraska	1890	Nov.	66·0	20	38·9	32·0	...	40·0	45·0	48·0	...	...	...
		Dec.	59·5	5	30·9	23·0	...	34·0	39·0	41·7	...	...	...
	1891	Jan.	...	...	27·9	22·7	...	31·4	35·7	38·5	...	...	...
		Feb.	...	...	20·1	14·6	...	24·2	31·4	34·8	...	...	...
		Mar.	...	...	23·4	16·4	...	22·8	30·0	33·2	...	...	...
		April	...	...	53·4	33·7	...	35·7	36·2	36·5	...	...	...
		Nov.	78·0	3·0	34·5	26·3	...	37·3	42·8	46·0	...	...	...
		Dec.	64·5	—1·0	32·6	29·2	...	35·0	39·0	42·0	...	...	...
Fort Collins, Colorado	1890	Jan.	39·8	9·6	24·7	28·0	29·4	31·1	33·8	36·2	...	...	42·0
		Feb.	45·0	15·0	30·0	32·5	33·3	33·6	34·6	36·0	...	...	46·0
		Mar.	52·9	23·2	38·0	39·2	39·5	38·6	38·2	38·3	...	...	40·8
		April	60·0	33·1	46·6	47·1	47·7	47·3	46·1	45·2	...	...	44·6
		Nov.	54·9	21·3	38·1	36·7	38·2	40·8	44·2	46·7	...	...	52·1
		Dec.	49·6	18·3	34·0	32·1	33·3	35·5	38·0	40·5	...	...	46·7

† Sewage Disposal in the United States, by G. W. Rafter, M. Am. Soc. C. E. ; and M. N. Baker, Ph. B. : New York, 1894.

## REMARKS.

*Philadelphia.*—Nearly 3 ft. of snow in December, 1890.

*S. Anthony.*—The max. and min. mean are merely those of daily readings at 2 p.m. The soil was bare of snow during February, hence the great penetration of the frost. The authors say :—“These Minnesota observations are of special interest, as illustrating the time required for the ground to free itself from frost when once frozen. The mean air temperature for March [at 2 p.m. Ed.] was 44°, with a mean soil temperature at the depth of three inches of 41°. At the depth of two feet, 32° was not reached until March 28th, and it remained at that point till April 5th. These results show the considerable length of time required for the soil, and entrained moisture, to recover its lost latent heat. In winters of extreme cold the soil of Minnesota is said to freeze to the depth of six feet.”

Before concluding our remarks upon the above subject, we have to insert a few further particulars respecting soil temperature.

*To the Editor of the Meteorological Magazine.*

SIR,—Referring to your article in the *Monthly Meteorological Magazine* of April on Earth Temperatures, perhaps the following may be found interesting from the temperatures having been taken in a different way from usual. I use a Negretti and Zambra's slow action thermometer, having the bulb encased in paraffin, as used by the British Association Committee on Rock (Underground) temperatures. This is buried in ground exposed to, and on a slope facing, S.E. at a depth of 1 ft., and is dug up twice a month. On February 15th the ground was frozen to the depth of 10 or 11 inches. The following are the temperatures this year and last :—

				1895.			1894.
January	1	...	...	39°·8	...	...	42°·0
„	16	...	..	36°·2	...	...	41°·8
February	1	...	...	36°·2	...	...	43°·2
„	15	...	...	33°·0	...	...	44°·0
March	1	...	...	34°·2	...	...	43°·2
„	16	...	...	43°·4	...	...	44°·0
April	1	...	...	44°·1	...	...	50°·1
„	15	...	...	47°·8	...	...	50°·1

The soil is a decomposed clay slate, with many fragments of the rock, and the slope is a sharp one.—Yours truly,

ALFRED O. WALKER.

*Nant-y-Glyn, Colwyn Bay.*—April 22nd, 1895.

*To the Editor of the Meteorological Magazine.*

SIR,—If you could spare time to glance at the daily readings of our Southport 1-ft., 4-ft., and 10-ft. earth thers. which are printed in the weekly returns I send you, you would, I think, see that they agree *well* with Blackpool, and *fairly* with Bolton. But much must depend on the freedom (artificial or natural) of the ground around the thers. *from snow*. Some observers clear it away. Others (the majority, I hope) do not. But I doubt the desirability of allowing the iron tubes and caps to project six inches or so out of the ground. The snow soon melted away for some distance around mine.

Yours faithfully,

JOSEPH BAXENDELL.

*The Observatory, Birkdale, Southport, April 18th, 1895.*

Mr. Baxendell's values are within a tenth of a degree of those for Bolton. The entry for the table on p. 39 would be—

Southport Observatory, Lancashire 32°·3 31°·1 1°·2  
and for the table on p. 40 —

Lancashire, Southport Observatory

31°·1 ——— 36°·4 31°·1 32°·9 34°·3 35°·3

We therefore see no probability whatever that the natural soil at Southport was frozen 2 ft. below the surface.

Looking back over all the thermometric records we adhere to our original opinion that at no spot in England did the natural soil in its normal condition become frozen at the depth of 2 ft.

#### BURST WATER PIPES.

We now turn to the evidence on the other side, proving that water-pipes and mains were frozen at 2 ft. and at much greater depths.

We give, first, a few notes as to the mischief wrought in different towns. This list is not to be assumed to be complete or authoritative. No effort has been made towards ensuring either, as the sole object is to give typical information.

**WEST HAM.**—March 28th.—More than half our houses are waterless, and some have been in this state for nearly eight weeks.

**BRIGHTON.**—Serious splits occurred along the London Road, and the engineer reported on April 2nd that he had already relaid 440 yards of 4-inch and 100 yards of 3-inch mains at the depth of 2 ft. ; the old ones had been at from 1 ft. 2 in. to 2 ft.

**READING.**—Since the end of February 250 fractures in 4 in. mains, and 665 fractures in 3 in. mains, have been discovered and repaired, and during the same period over 500 service pipes have been made good. There are still (May 2nd) many leakages.

In the village of Burghfield all the mains near the Hatch Gate were burst, and have been replaced by new ones.

**MAIDENHEAD.**—The mains are mostly laid at 2 ft. 6 in. and many of them are burst.

**FENNY STRATFORD (BUCKS).**—March 29th.—The overtime worked in pumping was reasonable considering the amount of water required, owing to some extent to the bursts in the mains.

**HONITON.**—Water supply very much interfered with, the mains in the principal streets having been burst.

**SHREWSBURY.**—The pipes supplying Severn water burst in more than 50 places and the conduits in about 10. The bursts have been chiefly in the suburbs. On March 21, mains 2 ft. 6 in. below the surface were still blocked.

**WOLVERHAMPTON.**—The breakages were 135 two-inch pipes,

209 three „ „

37 four „ „

1 six „ „

1 eight „ „

and about 350 street services.

**BIRMINGHAM.**—The estimated number of bursts in private houses is put at 2,000, and the cost to the Corporation for repairs and for supply (£100 a day up to February 27th) about £3,000.

**LEAMINGTON.**—Cost of injury to mains about £900.

**COVENTRY.**—The severe frost caused considerable damage to the water mains. The water became frozen, even at more than 2 ft. below the surface.

**CHESTERFIELD.**—March 21st.—Frost not yet entirely out of the system. One pipe at Newbold was frozen at the depth of 28 inches. Total bursts about 600, but not many mains.

**DERBY.**—The total bursts in private houses were 3,490, and of street mains, 40.

**LIVERPOOL.**—There are in Liverpool 1,030 courts, containing 6,180 houses, supplied by standpipes, these often freeze, and about 20 men were engaged continually in trying to keep them in action. 128 men were engaged in connection with temporary standpipes, they rang bells when the pipes were delivering. At the time of greatest severity probably (besides the courts already mentioned) 27,000 houses were without supply—they were, however, all supplied by standpipes, except four blocks in the suburbs where the main was frozen and a cart service was substituted. The smallness of the number of mains frozen is attributed to (a) their depth, (b) the maintenance of constant supply and therefore continuous motion. Besides the above-mentioned 148 men, about 200 were employed in packing, and keeping free, the fire hydrants. Of street pipes 407 were burst, all but 15 being of less than 5 inches diameter, and most of them old ones laid at shallow depths; the total of lead pipes burst is put at 19,536, and more than 600 hydrants were damaged. The total cost to the Corporation was about £6,000.

**OLDHAM.**—March 30th.—It was reported that nearly all breakages had been made good.

**BACUP.**—The pipes conveying the water from the source to the main were split in many places.

**KEIGHLEY.**—There had been hundreds of bursts.

**SHEFFIELD.**—In the second week of March, and notwithstanding the thaw, nearly 170,000 persons were without proper water supply, and according to the report of the Engineer, published March 11th, the district service pipes had been frozen in 21 places at depths of and exceeding 1 ft. 6 in.

April 27th.—Nearly 500 men have been at work during the week repairing mains, but fresh fractures reveal themselves.

**HUDDERSFIELD.**—Repairs of burst pipes cost the Corporation £250, and extra labour in delivering water cost £550.

**RIPON.**—Water mains burst in several parts of the city, but they were mostly only 2-inch.

**WORKINGTON.**—Even on April 20th the supply is intermittent as, though the mains are all repaired, many services remain leaky.

**BUILTH.**—Much inconvenience has arisen from the water mains being frozen.

**ST. ASAPH.**—The service main burst in more than 20 places.

**COLWYN BAY.**—The bursts along the promenade at Rhos were so numerous that the main was practically useless.

**SELKIRK.**—March 28th.—So many bursts have occurred that no attempt will be made to repair, but new mains will be laid throughout.

MUSSELBURGH.—On February 27th a service pipe was found frozen at the depth of 37 inches in soil under whinstone blocks, and nearly at sea level.

ALLOA.—Roads reported in very bad state owing to numerous burst pipes.

INVERNESS.—Mr. Macdonald, water manager, on May 1st, reported :—" Every effort is being made to carry out your instructions as regards the restoration of the water supply to its normal state ; but this is found to be a most difficult undertaking, as leaks and bursts, both in main and service pipes, are found to be universal. However, with the exception of Kessock Road, where men are employed uncovering the pipes, the supply of water is restored, but the pressure is not yet sufficient in many cases to rise to the cisterns. Almost in every case where the pipes were frozen they were also burst, and their renewal thus became imperative. If the leaks showed any indication on the surface of the ground it would be an easy matter to overcome them, but in most cases there was no appearance of leakage. For instance, on April 30th, in King Street, a 3-inch pipe was discovered with about two feet by two inches of the metal entirely severed from the pipe, yet not a drop came to the surface, and its discovery was due to an all-night inspection of the sewers. Again, in Glen Urquhart Road, the pipes were nearly all found split, and the water not rising above the pipes. The same remarks apply to many other roads in and around the town. I suspect that there are leakages at present going on in Kenneth Street, Telford Street, Attadale Road, Harrowden Road, Culduthel Road, and probably many other places, in addition to a host of service pipes. Strenuous efforts will continue to be made to overcome this serious state of matters."

The above extracts will suffice to prove—

- (1) The wide area of the trouble—from Devon to Inverness.
- (2) That pipes were found containing ice 28, 30, and 37 inches below the surface. In the report (on p. 62) of the meeting of the Royal Meteorological Society, 42 inches is mentioned, and in the subjoined note\* 54 inches.
- (3.) The great cost which has fallen upon most of the large towns.

Several correspondents have suggested that which we believe to be the real explanation of the apparent contradiction, but before proceeding to sum up the evidence, we reprint two letters, which tell a story very different from the above.

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\* A correspondent, signing himself "Amateur," stated that in the South of London the ground was frozen to a depth of 4 ft. 6 in. As our lowest temperature at 4 ft. was 37°·1, corresponding to nearly 38° at 4 ft. 6 in., we doubted the statement and wrote for particulars. They are most precise and positive ; our correspondent says that it was in digging down to repair a large driving main at Upper Tulse Hill, that the man was positive as to the correctness of the depth, and added that in Lower Tulse Hill the penetration was 3 ft. 5 in. to 3 ft. 7 in.

## DEPTH OF WATER MAINS.

*To the Editor of the "Standard."*

SIR,—About the depth to which water mains should be laid, I venture to ask space in *The Standard* for the following experiences relating thereto.

The mains of Lord Salisbury's Hatfield and district water supply, which now have been in use for about four years, have a minimum depth from the surface to the tops of the sockets of two feet six inches. But, notwithstanding this exceptional depth, we have a three-inch main, in which for a short distance, and in an exposed situation, the water became frozen on the 23rd of last month. On opening the ground, this partially frozen main was found to be three feet three inches below the surface of the London road, showing how necessary it is to lay water mains so that the tops of their sockets shall, at least, be two feet six inches in depth.

This partially frozen main would have remained unfrozen but that it has a closed or "plugged" end, and thus the circulation of water through it was, for the greater part of the night, inappreciable.

Owing to the depth to which they were laid, Hatfield and district water mains, extending in town and country to about three miles, remained in a practical sense unaffected by this year's abnormally severe frost, so much so, indeed, that we have not had a burst pipe in any of the mains.

I am, Sir, your obedient servant,

JOHN MILLER.

*Hatfield, March 28.*

On seeing the above letter we asked the writer to favour us with replies to a few questions, which he kindly did, and they may be thus epitomized.

The water is pumped from a well 300 ft. deep, in which there is generally 150 ft. of water, the usual temperature is 51°, it is pumped into an uncovered reservoir, of which the surface became frozen, and the ice had to be broken to ensure proper pressure in the mains. The pipes are extra thick, and even the frozen one did not burst.

## WATER PIPES AND THE FROST.

*To the Editor of the "Surrey Advertiser."*

SIR,—I have read so many letters in various newspapers on the subject of frozen water mains and consequent stoppage of supply, in some cases for several weeks, that I thought perhaps our experience here would not only interest, but might possibly be of use to some of your readers. This company has nearly eight miles of mains, none of which have been frozen this season, nor has the supply been interrupted for a single day. The mains were laid to a depth of 2ft. to the top of the sockets of the pipes, and in the few parts of the system where it was impracticable to do this, the main was wrapped with

felt or flannel, passed through a larger pipe, and the ends of this made secure. Moreover, during the late severe weather, the valves and hydrants were daily inspected and kept thawed where necessary. To these simple precautions I attribute our immunity from the troubles that appear to have overtaken so many water companies and their customers during the past winter.—I am, &c.,

STEPHEN ROWLAND.

*Cranleigh Water Company, Limited, April 22, 1895.*

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We wrote also to Mr. Rowland, and his reply states :—

The water is derived from very deep seated springs from the Lower Greensand, it leaves the springs at about 50°, and then goes into a covered reservoir, whence it is distributed.

Hence, in both these cases the water was from deep sources ; and though at Hatfield it was allowed to cool so as to freeze on the surface, it is probable that the supply on entering the main was considerably above 32°.

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Now we come to the end of the subject. We believe that the key to the contradiction is, not that the frost went down through the soil to the pipes, but that water was forced into the pipes at a temperature within a few degrees of freezing point, that the continued passage of this cold liquid chilled the pipes, and the ground around them, and so the soil between the pipes and the surface was chilled both from above and from below. This, however, of itself, would not turn water into ice—but there are two other facts which we believe completed the disaster. Every shallow service pipe is a metallic (and therefore excellent) conductor of heat and of cold, and every frozen service pipe was not merely useless to its owner, but was carrying cold down to the main. So also with the fire hydrants which swarm in our streets, but are designed rather for the climate of Madras than for that of St. Petersburg. They are in perfect metallic connection with the mains, they come to the pavement at a temperature of, in many cases, 30° below freezing, and conduct some of that cold down to the mains.

When, as at Sheffield, and other towns, you draw water from a frozen reservoir, or, as at London, you draw it from a river on which we ourselves were walking within sight of the intake of some of the companies, you draw a liquid which may be said to need little more than repose to fly into the solid form. The deep laying of mains will be costly, and will, therefore, have many advocates, but when the pipes have to be filled with ice-cold water, we believe that the conduction of cold by service pipes and by hydrants will not be neutralized by an extra foot of depth.

Happily, on the authority of Messrs. Bayard and Marriott, we hear that there has not been such a frost for 80 years, may it be another 80 before Britons have a like experience.

## AN EARLY RECORD OF SEA-SPRAY CARRIED BY A GALE.

*To the Editor of the Meteorological Magazine.*

SIR,—With reference to the correspondence in the *Met. Mag.* of January, 1895, I venture to send you the following extract from Hone's "Every Day Book," vol. ii. :—

"REMARKABLE STORM."

"The following remarkable letter in the *Gentleman's Magazine* relates to the present day seventy years ago.

*'Wigton, Oct. 23, 1756.*

'MR. URBAN,

'On the 6th inst., at night, happened a most violent hurricane ; such a one, perhaps, as has not happened in these parts in the memory of man. It lasted full 4 hours, from about 11 till 3. The damage it has done over the whole country is very deplorable. The corn has suffered prodigiously. Houses were not only unroofed, but in several places overturned by its fury. Stacks of hay and corn were entirely swept away. Trees without number torn up by the roots. Others snap off in the middle, and scattered in fragments over the neighbouring fields. Some were twisted almost round ; bent, or split to the roots, and left in so shattered a condition as cannot be described.

'The change in the herbage was also very surprising ; its leaves *withered, shrivelled up, and turned black*. The leaves upon the trees, especially on the weather side, fared in the same manner. The *evergreens* alone seem to have escaped, and the grass recovered in a day or two.

'I agreed, at first, with the general opinion, that this mischief was the effect of *lightning* ; but, when I recollected that, in some places, very little had been taken notice of ; in others none at all ; and that the effect was *general*, I began to think of accounting for it from some other cause. I immediately examined the dew or rain which had been left on the grass, windows, etc., in hopes of being able, by *its taste*, to form some better judgment of the particles with which the air had been impregnated, and I found it as salt as any sea-water I had ever tasted. The several vegetables were also all saltish more or less, and continued so for 5 or 6 days, the saline particles not being then washed off ; and when the moisture was exhaled from the windows, the saline crystal *sparkled* on the outside, when the sun shined, and appeared very *brilliant*.

'The *salt water*, I conceive, has done the principal damage, for I find upon experiment, that common salt dissolved in fresh water affected some fresh vegetables, when sprinkled upon them, in the very *same manner*, except that it did not turn them quite so black, but particles of sulphurous, or other quality,\* may have been mixed with it.



'I should be glad to see the opinions of some of your ingenious correspondents on this wonderful phenomenon—whether they think this water was brought from the sea,† and in what manner.

'Yours,

A. B.'

\* 'In an adjoining bleach-yard, some clothes which had lain out all night was turned almost yellow. Other pieces also which were spread out the next morning contracted the same colour, which was not without great difficulty washed out.'

† 'The wind was easterly [?—Ed.], and consequently in its passage swept the Irish Sea.'

Yours truly,

FRED. COVENTRY.

Ketton, Stamford, April, 13th, 1893.

*Neudrucke von Schriften und Karten ueber Meteorologie und Erdmagnetismus*, herausgegeben von PROF. DR. HELLMANN. NO. 4. E. HALLEY, W. WHISTON, J. C. WILCKE, A. VON. HUMBOLDT, C. HANSTEEN. Die ältesten Karten der Isogonen, Isoklinen, Isodynamen, 1701—1826. 4to, Assher & Co., Berlin and London, 1895, 25pp., 7 Maps.

*The Earliest Isoclinics and Observations of Magnetic Force*, by L. A. BAUER [Bull. Phil. Soc., Washington.] 8vo., Washington, 1894. 14 pp.

*Beitrage zur Kenntniss des Wesens der Säcular-Variation des Erdmagnetismus* von L. A. BAUER. Berlin, 1895, royal 8vo, 56 pp. 2 folding plates.

WE have said so much as to the excellence both in knowledge and in typography of Dr. Hellmann's *Neudrucke* that we need do little more than mention the appearance of No. 4. But we have coupled with it the title of Dr. Bauer's paper read before the Philosophical Society of Washington, because he and Dr. Hellmann each deal with Whiston's pamphlet\* and both seem to consider that its "discovery" is something new. We do not agree with this; the standard authority upon Electrical and Magnetical works (until our American friends fulfil their promise and publish the Bibliography of Meteorology), is the Ronald Catalogue; Whiston's book is duly quoted, and is itself in the Ronald library. Merely from catalogues on our own shelves we see that there are copies at the Royal Society, Royal Astronomical Society, University College, and the Institution of Civil Engineers; this, with the one in our own collection, makes six, irrespective of the British Museum and several other libraries in which we expect that it would be found, so that probably

\* WHISTON, W., M. A. "The Longitude and Latitude found by the Inclinator or Dipping Needle; wherein the Laws of Magnetism are also discovered." 8vo., London, 1721.

there are quite a dozen copies in London alone. If Dr. Hellmann is correct (and it will be wonderful if he is not) in saying, "sie in Keinem den Erdmagnetismus behandelnden Werke erwähnt werden," we think that a modification of George Stephenson's celebrated answer respecting the cow and the railway train, would be appropriate: "So much the worse for the — works on Terrestrial Magnetism." Probably the real explanation is, that hitherto no one has attempted to work up the history of the progress of Magnetic observation; Dr. Hellmann's few pages are excellent as far as they go, and Dr. Bauer's second work shows both ability and interest in the same direction, so perhaps, ere very long, something may be done towards issuing a complete monograph.

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### ROYAL METEOROLOGICAL SOCIETY.

AT the meeting of this Society, on Wednesday evening, April 17th, which was held at the Surveyors' Institution, Westminster Messrs. F. C. Bayard and W. Marriott communicated a paper on "The Frost of January and February, 1895, over the British Isles," The cold period which commenced on December 30th, and terminated on March 5th, was broken by a week's mild weather from January 14th to 21st, otherwise there would have been continuous frost for 66 days. Temperatures below  $10^{\circ}$  Fahrenheit, and in some cases below zero, were recorded in parts of England and Scotland between January 8th and 13th, while from the 26th to the 31st, and from February 5th to 20th, temperatures below  $10^{\circ}$  occurred on every day in some part of the British Isles. The coldest days were February 8th to the 10th. The lowest temperature recorded were— $17^{\circ}$  at Braemar and— $11^{\circ}$  at Buxton and Drumlanrig. The mean temperature of the British Isles for January was about  $7^{\circ}$ , and for February from  $11^{\circ}$  to  $14^{\circ}$  below the average, while the mean temperature for the period from January 26th to February 19th was from  $14^{\circ}$  to  $20^{\circ}$  below the average. The distribution of atmospheric pressure was almost entirely the reverse of the normal, the barometer being highest in the north and lowest in the south, the result being a continuance of strong, northerly, and easterly winds.

The effect of the cold on the public health was very great, especially on young children and old people. The number of deaths in London due to diseases of the respiratory organs rapidly increased from February 2nd to March 2nd, when the weekly number was 1,448, or 945 above the average. Rivers and lakes were frozen, the ice being more than 10 inches thick.

The frost will long be remembered for its effect on the water-pipes all over the country, in many cases the householders being without water for more than nine weeks. As the result of enquiries the authors find that mains have frozen which have been laid as low as

3 ft. 6 ins. from the surface of the ground to the top of the pipe. It appears, however, that the nature of the soil had far more to do with the depth to which the frost penetrated than the intensity of the frost itself.

From a comparison of previous records, the authors are of opinion that the recent frost was more severe than any since 1814.

Mr. Southall spoke of the similarity of the frost to that of 1814, known in the West of England as the twelve weeks' frost, and said that in that year the snow was over the hedges, and everything was protected by it.

Mr. Leeson Prince said that the mean temp. of February, 1895, was the lowest recorded in any month from 1842 to the present time, but that owing to the height of Crowborough above sea level (774 ft.) the extreme minimum in shade was only  $12^{\circ}8$ . At East Grinstead the ice on a pond was  $13\frac{1}{2}$  inches thick.

Mr. Percy Bicknell said that at the Skating Club in Regent's Park the members skated for 50 consecutive days. At Swavesey Fen, Cambridgeshire, his son found the ice to be two feet thick.

Mr. Symons referred to the protection afforded by snow, and to the effect of the pressure and motion of the water in mains, on the formation of ice therein.

Mr. C. Harding raised the question of the definition of a great frost—whether it should be reckoned by the period during which the min. was below  $32^{\circ}$ , or during which the max. did not rise above  $32^{\circ}$ , &c.; he also quoted various particulars relating to previous frosts. The President, Mr. Jackson, Mr. Dines, and Mr. Tripp also took part in the discussion.

Mr. Birt Acres also read a paper on "Some Hints on Photographing Clouds," illustrated by exceptionally beautiful photographs of clouds.

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## CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, OCTOBER, 1894.

STATIONS.  (Those in italics are South of the Equator.)	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 .....	62·1	2a	31·2	17	56·9	45·2	45·8	85	101·9	29·2	4·45	17	7·6
Malta.....	90·1	19	59·4	15	81·1	67·8	65·3	79	136·9	55·2	1·62	4	4·7
Cape of Good Hope ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius.....	82·3	26	60·3	16	79·0	66·1	61·2	72	133·6	49·9	1·11	14	5·3
Calcutta.....	88·4	7	65·9	31	85·8	75·4	76·0	87	155·3	60·5	4·41	12	4·5
Bombay.....	89·4	21	72·3	31	85·6	76·1	75·0	83	142·5	64·8	3·08	13	5·5
Ceylon, Colombo .....	87·9	12	72·8	...	85·3	75·7	72·6	82	147·2	68·0	20·81	23	7·0
Melbourne.....	87·1	23	39·3	12	70·1	50·3	51·0	76	143·7	33·9	3·84	17	5·8
Adelaide .....	91·5	22	43·1	19	72·0	53·0	48·8	64	153·5	36·5	2·97	14	5·9
Sydney .....	77·9	26	49·7	9	69·9	57·1	56·7	75	146·4	41·7	2·54	23	5·0
Wellington .....	71·0	28	36·3	6	61·9	49·0	46·3	72	132·0	23·0	·42	7	4·4
Auckland .....	71·0	22	42·5	4·5	65·6	51·0	51·5	78	138·0	40·0	1·16	10	4·0
Jamaica, Kingston.....	90·3	31	67·0	25	86·7	71·5	71·6	84	...	...	12·78	14	4·7
Grenada.....	85·8	11	17·8	5·6	32·8	74·6	72·0	76	157·2	...	10·55	18	4·0
Trinidad .....	90·0	b	68·0	6	87·8	72·1	70·9	79	170·6	66·0	3·92	22	...
Toronto .....	67·3	3	33·3	15	57·3	43·3	42·0	79	...	27·0	2·35	17	6·6
New Brunswick, Fredericton .....	61·0	8	25·4	13	54·6	36·3	39·6	79	...	...	4·32	15	6·3
Manitoba, Winnipeg...	67·7	15	18·5	30	51·6	30·9	...	...	...	...	1·79	13	6·3
British Columbia, Esquimalt.....	62·1	15	32·7	18	54·0	41·4	45·6	92	...	...	4·60	19	7·6

a—and 11, 13. b—Various.

## REMARKS.

**MALTA.**—Adopted mean temp. (73°·1), 4°·2 above the average. Mean hourly velocity of wind 7·5 miles. Sea temp. averaged 75°·0. Thunderstorms on 1st, 2nd, 12th, and 13th, and lightning on 6 other days. The max. in sun in July was 147°·4 on 12th, not as printed. J. F. DOBSON.

**Mauritius.**—Mean temp. of air 0°·1, of dew point 0°·5, and rainfall ·62 in. below, their respective averages. Mean hourly velocity of wind 10·5 miles, or 0·9 mile below average; extremes 32·0 on 29th and 2·2 on 28th; prevailing direction, E.S.E. to E. by N. C. MELDRUM, F.R.S.

**Adelaide.**—Mean temp. 0°·6 above, and rainfall 1·11 in. above, the average of 37 years. Good general rains this month. C. TODD, F.R.S.

**Sydney.**—Temp. 0°·2 above, humidity 5°·9 above, and rainfall ·40 in. below, their respective averages. H. C. RUSSELL, F.R.S.

**Wellington.**—Generally fine throughout the month; unusually small rainfall. Prevailing N.W. winds, and strong from that quarter during the middle of the month; also strong from S.W. in the beginning of the month. Mean temp. 1°·8 above the average; rainfall 3·95 in. below, or less than one-tenth of, the average. R. B. GORE.

**Auckland.**—An unusually fine and dry month, the only rain of consequence falling on the 28th and 31st. Barometric pressure and mean temp. both largely above the average; rainfall very small, and not one-third of the average. T. F. CHEESEMAN.

**JAMAICA, KINGSTON.**—Mean hourly velocity of wind 3·4 miles. Rains known as "Seasons" general all over the island, the fall being one-third in excess of the average and many stations having twice their average or more. R. JOHNSTONE.

**TRINIDAD.**—Rainfall 2·75 in. below the 30 years' average. J. H. HART.

# SUPPLEMENTARY TABLE OF RAINFALL, APRIL, 1895.

[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.			
II.	Dorking, Abinger Hall.	2·38	XI.	Lake Vyrnwy .....	2·71
"	Birchington, Thor .....	·99	"	Corwen, Rhug .....	1·82
"	Hailsham .....	2·24	"	Carnarvon, Cocksidia ...	3·28
"	Ryde, Thornbrough .....	2·56	"	I. of Man, Douglas .....	2·98
"	Emsworth, Redlands ...	2·34	XII.	Stoneykirk, Ardwell Ho.	2·12
"	Alton, Ashdell .....	2·22	"	New Galloway, Glenlee	3·67
III.	Oxford, Magdalen Col...	1·62	"	Melrose, Abbey Gate ...	1·01
"	Banbury, Bloxham .....	1·75	XIII.	N. Esk Res. [Penicuick]	1·50
"	Northampton, Sedgebrook	1·37	"	Edinburgh, Blacket Pl.	1·17
"	Alconbury .....	1·04	XIV.	Glasgow, Queen's Park.	1·05
"	Wisbech, Bank House..	1·59	XV.	Inverary, Newtown .....	5·03
IV.	Southend .....	·95	"	Islay, Gruinart School..	·89
"	Harlow, Sheering .....	·84	XVI.	Dollar .....	1·88
"	Colchester, Lexden .....	·94	"	Balquhitter, Stronvar..	7·20
"	Rendlesham Hall .....	·77	"	Ballinluig .....	1·78
"	Diss .....	·88	"	Dalnaspidal H.R.S. ...	4·46
"	Swaffham .....	1·54	XVII.	Keith H.R.S. ....	·97
V.	Salisbury, Alderbury ...	2·84	"	Forres H.R.S. ....	1·38
"	Bishop's Cannings .....	2·60	XVIII.	Fearn, Lower Pitkerrie.	...
"	Blandford, Whatcombe.	2·95	"	Loch Shiel, Glenaladale	6·22
"	Ashburton, Holne Vic....	2·99	"	N. Uist, Loch Maddy ...	3·96
"	Okehampton, Oaklands.	2·53	"	Invergarry .....	3·64
"	Hartland Abbey .....	2·10	"	Aviemore H.R.S. ....	1·69
"	Lynmouth, Glenthorne.	1·87	"	Loch Ness, Drumnadrochit	2·37
"	Probus, Lamellyn .....	2·04	XIX.	Invershin .....	1·68
"	Wellington, Sunnyside..	2·19	"	Scourie .....	2·90
"	Wincanton, Stowell Rec.	2·63	"	Watten H.R.S. ....	1·96
VI.	Clifton, Pembroke Road	2·63	XX.	Dunmanway, Coolkelure	5·66
"	Ross, The Graig .....	2·60	"	Fermoy, Gas Works ...	2·78
"	Wem, Clive Vicarage ...	1·81	"	Killarney, Woodlawn ...	3·24
"	Cheadle, The Heath Ho.	2·23	"	Caher, Duneske .....	2·03
"	Worcester, Diglis Lock	1·82	"	Ballingarry, Hazelfort...	1·75
"	Coventry, Coundon .....	2·16	"	Limerick, Kilcornan ...	1·54
VII.	Ketton Hall [Stamford]	1·26	"	Ennis .....	3·23
"	Grantham, Stainby .....	1·87	"	Miltown Malbay .....	2·58
"	Horncastle, Bucknall ...	1·38	XXI.	Gorey, Courtown House	2·12
"	Worksop, Hodsck Priory	2·18	"	Athlone, Twyford .....	1·82
VIII.	Neston, Hinderton .....	1·78	"	Mullingar, Belvedere ...	1·45
"	Preston, Haighton .....	...	"	Longford, Currygrane...	1·69
"	Broughton-in-Furness...	3·47	XXII.	Woodlawn .....	1·35
IX.	Ripon, Mickley .....	2·22	"	Crossmolina, Enniscoe..	2·09
"	Melmerby, Baldersby ...	1·63	"	Collooney, Markree Obs.	2·54
"	Scarborough, South Cliff	...	"	Ballinamore, Lawderdale	...
"	Middleton, Mickleton...	1·16	XXIII.	Lough Sheelin, Arley ..	1·71
X.	Haltwhistle, Unthank..	1·55	"	Warrenpoint .....	3·91
"	Bamburgh .....	·93	"	Seaforde .....	2·61
"	Keswick, The Beeches...	2·81	"	Belfast, Springfield .....	2·18
XI.	Llanfrehfa Grange .....	3·00	"	Bushmills, Dundarave...	1·28
"	Llandovery .....	2·11	"	Stewartstown .....	1·64
"	Castle Malgwyn .....	4·16	"	Buncrana .....	1·70
"	Builth, Abergwessin Vic.	3·68	"	Lough Swilly, Carrablagh	1·71
"	Rhayader, Nantgwillt..	3·21			

APRIL, 1895.

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.					
				Dpth	Date	Deg.		Date	Deg.	Date.			
		inches.	inches.	in.								In shade.	On grass.
I.	London (Camden Square) ...	1.34	— .40	.61	25	13	67.1	29	29.1	1	1	8	
II.	Maidstone (Hunton Court)...	1.21	— .44	.45	25	13	...	...	...	...	...	...	
III.	Strathfield Turgiss .....	1.71	+ .11	.61	24	9	65.5	19	26.4	1	3	8	
IV.	Hitchin .....	1.08	— .71	.48	25	13	63.0	11 <i>b</i>	28.0	13 <i>i</i>	4	...	
V.	Winslow (Addington) .....	1.45	— .47	.56	25	12	63.0	6.1 <i>ys</i>	28.0	1	6	9	
VI.	Bury St. Edmunds (Westley)	1.33	— .33	.64	25	9	64.0	17	30.0	15	2	...	
VII.	Norwich (Brundall) .....	1.20	...	.18	1 <i>a</i>	11	65.8	20	29.0	5	2	10	
VIII.	Weymouth (Langton Herring)	2.36	+ .48	.88	24	13	61.0	17 <i>c</i>	33.0	1, 14	0	...	
IX.	Torquay (Cary Green) .....	2.43	...	.70	22	13	60.3	10	33.6	1	0	4	
X.	Polapit Tamar [Launceston]..	2.42	+ .20	.45	22	16	62.5	17	29.0	13	2	6	
XI.	Stroud (Upfield) .....	2.99	+ .84	.68	24	14	64.0	17 <i>d</i>	34.0	12	0	...	
XII.	Church Stretton (Woolstaston)	2.24	— .10	.93	25	17	69.0	30	28.0	5	6	10	
XIII.	Tenbury (Orleton) .....	2.14	+ .06	.51	25	14	62.7	21	28.0	5	6	9	
XIV.	Leicester (Barkby) .....	1.72	— .38	.47	25	13	67.0	29	25.0	12 <i>i</i>	11	19	
XV.	Boston .....	1.49	— .22	.56	25	10	70.0	28	29.0	13	2	...	
XVI.	Hesley Hall (Tickhill) .....	1.66	— .05	.57	25	10	66.0	21	29.0	5 <i>k</i>	5	...	
XVII.	Manchester (Plymouth Grove)	1.36	— .35	.50	25	10	65.0	30	29.0	4, 7	4	7	
XVIII.	Wetherby (Ribston Hall) ..	1.20	— .65	.56	26	5	...	...	...	...	...	...	
XIX.	Skipton (Arnccliffe) .....	3.41	— .02	.99	22	12	...	...	...	...	...	...	
XX.	Hull (Pearson Park) .....	1.19	— .73	.30	22	12	65.0	20 <i>f</i>	28.0	8	8	10	
XXI.	Newcastle (Town Moor) .....	1.31	— .52	.71	25	11	...	...	...	...	...	...	
XXII.	Borrowdale (Seathwaite) .....	8.30	+ 1.16	2.61	5	15	...	...	...	...	...	...	
XXIII.	Cardiff (Ely) .....	2.32	— .09	.42	22	14	...	...	...	...	...	...	
XXIV.	Haverfordwest .....	3.69	+ 1.06	1.07	22	16	64.0	17	26.0	5	2	11	
XXV.	Aberystwith (Gogerddan) ..	2.45	— .11	.77	26	8	68.0	17	20.0	4	11	...	
XXVI.	Llandudno .....	2.39	+ .58	1.08	25	15	63.8	20	32.4	5	0	...	
XXVII.	Cargen [Dumfries] .....	2.47	+ .24	.76	22	10	62.4	17	27.0	5	6	...	
XXVIII.	Jedburgh (Sunnyside) .....	1.52	— .18	.47	25	11	63.0	30	26.0	14	6	...	
XXIX.	Colmoneil .....	2.89	...	.84	25	10	65.0	15	27.0	4, 13	8	...	
XXX.	Lochgilthead (Kilmory) .....	3.24	+ .43	.65	5	17	...	...	23.0	6	10	...	
XXXI.	Mull (Quinish) .....	2.96	— .02	.87	6	15	...	...	...	...	...	...	
XXXII.	Loch Leven Sluices .....	1.80	— .42	.40	23	9	...	...	...	...	...	...	
XXXIII.	Dundee (Eastern Necropolis)	1.15	— .90	.25	25	12	63.1	22	27.4	4	7	...	
XXXIV.	Braemar .....	1.34	— 1.08	.36	25	15	59.0	18	25.0	4	14	19	
XXXV.	Aberdeen (Cranford) .....	1.37	...	.29	25	15	57.0	21 <i>g</i>	29.0	15	5	...	
XXXVI.	Strathconan [Beaully] .....	3.01	+ .20	.70	26	7	...	...	...	...	...	...	
XXXVII.	Glencarron Lodge .....	5.89	...	1.40	5	23	66.0	18	26.5	7	7	...	
XXXVIII.	Cawdor [Nairn] .....	1.74	+ .22	.88	26	12	...	...	...	...	...	...	
XXXIX.	Dunrobin .....	1.62	— .11	.29	26	13	61.0	23	32.0	3	1	...	
XL.	S. Ronaldsay (Roeberry) .....	2.80	+ 1.19	.71	5	17	...	...	29.0	3	2	...	
XLI.	Darrynane Abbey .....	2.78	...	.38	22	18	...	...	...	...	...	...	
XLII.	Waterford (Brook Lodge) ..	2.46	— .01	.81	22	12	59.0	18	29.0	3	4	...	
XLIII.	O'Briensbridge (Ross) .....	1.62	...	.38	5	16	...	...	...	...	...	...	
XLIV.	Carlow (Browne's Hill) .....	1.87	— .41	.41	22	15	...	...	...	...	...	...	
XLV.	Dublin (Fitz William Square)	1.15	— .97	.25	26	13	64.0	21	32.9	4	0	5	
XLVI.	Ballinasloe .....	1.19	— 1.15	.19	20	15	61.0	21	29.0	2	7	...	
XLVII.	Clifden (Kylemore) .....	6.53	...	1.62	20	21	...	...	...	...	...	...	
XLVIII.	Waringstown .....	1.70	— .72	.30	29	19	67.0	22	28.0	1, 5	7	12	
XLIX.	Londonderry (Creggan Res.)	2.04	— .20	.52	23	19	...	...	...	...	...	...	
L.	Omagh (Edenfel) .....	2.04	— .19	.27	18	17	60.0	15 <i>h</i>	33.0	1, 27	0	10	

a And 19, 26. b And 20. c And 19. d And 23. e And 29. f And 21. g And 25.

h And 16. i And 14. k And 12, 13, 15.

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

# METEOROLOGICAL NOTES ON APRIL, 1895.

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.

STRATHFIELD TURGISS.—The first part of the month was cold and rough; from the 7th to the 21st the weather was beautifully fine and dry, but with cold winds; the month closed with showery unsettled weather. The nesting of the birds singularly late. Horse chestnut in leaf on 17th. Blackthorn in flower on 20th.

ADDINGTON.—A rather sharp frost on the 1st, followed by a few days of low max. temp. and slight frosts from the 13th to the 15th. Altogether a favourable month. Distant thunder on 17th and 27th. Plum trees in full blossom at the end, quite a fortnight later than last year. Summer visitors rather early. Swallows seen on the 10th, cuckoo on the 17th, and nightingale on the 25th.

BURY ST. EDMUNDS, WESTLEY.—A fine month, with frost only on the 5th and 15th. Foreign birds arrived at the usual time. Vegetation as forward as the average. Swallow seen on 11th, Cuckoo on 12th, and Nightingale on the 14th. Thunder on 17th and 25th.

NORWICH, BRUNDALL.—A fine growing month; mean temp.  $47^{\circ} \cdot 3$ . Cold and bleak from 1st to 7th; dry and warm from 8th to 12th; warm, with R at times, from 19th to 27th.

LANGTON HERRING.—The weather was fine from the beginning of the month to the 16th, but unsettled from the 17th to the end. L on the 17th. Mean temp. at 9 a.m.  $47^{\circ} \cdot 5$ ,  $0^{\circ} \cdot 2$  above the average. Fogs were frequent, those on the 8th, 9th, and 30th being thick. Cuckoo heard on the 10th. Blackthorn in blossom on the 16th. Foliage of trees four weeks later than the average.

TORQUAY, CARY GREEN.—Rainfall  $\cdot 26$  in. below the average. Mean temp.  $47^{\circ} \cdot 8$ , or  $1^{\circ} \cdot 3$  above the average. Duration of sunshine 167 hours, being 23 hours below the average; two sunless days.

POLAPIT TAMAR.—The month was rather wetter on the whole than usual. The first three weeks were dry and very favourable for agricultural work; the last ten days very wet.

STROUD, UPFIELD.—Slight TS from S.E. from 6 p.m. to 7 p.m. on 17th; T all the afternoon, and sheet L at night.

WOOLSTASTON.—The first half of the month was cold and backward, with sharp frosts on the ground on most nights. The latter part was warmer and more genial. The first swallow was seen on the 16th; the Cuckoo heard on the 18th. Mean temp. of the month  $47^{\circ} \cdot 3$ . H on the 1st.

TENBURY, ORLETON.—The first half of the month was very dry, but from the 16th to the end there was R nearly every day. The temp. of the month was about the average of 34 years. T on the 17th, 18th and 24th; L on 17th; cuckoo heard on the 12th, a week earlier than usual. Damson, cherry and plum trees in full blossom on the 30th. Sharp frosts on 5 days.

LEICESTER, BARKBY.—Some fine days, but often chilly, and even chillier nights in proportion. First swallow seen on the 9th, first cuckoo on the 19th. T on 1st. Mean temp.  $46^{\circ} \cdot 9$ .

MANCHESTER, PLYMOUTH GROVE.—A very fine month upon the whole. Summer weather from 9th to 17th, and generally fine to the end. Mean temp.  $47^{\circ} \cdot 8$ .

## WALES.

HAVERFORDWEST.—Excepting the 17th, there really was not one day of warm shade-temp. in April. The temp. was about the average and the weather showery in the first week. Fine bright weather with north-easterly wind and keen ground frosts set in on the 11th, lasting to the 16th, when the conditions

gradually altered, the air became much milder, the wind southerly, and the weather fine but damp. The wind reached the force of a gale on the 21st, and R fell in large quantities up to the 27th; temp. again decreased, and the month ended cold but fine. Horse chestnuts in leaf on the 17th, currants and gooseberries also in about the same stage of advancement; blackthorn in blossom only on 27th, and not generally even then. Oak swelling, but ash making no sign. Grass lands looking remarkably well, and general appearance of the country promising. Cuckoo heard on 11th, and swallow seen on the 14th.

GOGERDDAN.—Dry and cold with N.E. winds during the first half of the month; the last fortnight showery, with wind S.W.

### SCOTLAND.

CARGEN.—The chief characteristic of the month is the low sunshine record—only 121 hours; 46 hours less than the average for April during 36 years. The continuance of southerly winds for 8 days (18th to 25th) is quite exceptional, while east winds were much less prevalent than usual. The favourable winds, combined with a slight increase in the rainfall, and a more equable day and night temp. than usual, had a very marked effect on vegetation during the latter portion of the month, and pasture and corn crops more than made up their leeway occasioned by the unfavourable character of February and March. On the 9th the ground was still frozen 9 inches below the surface. T and L on 24th, and T on 25th.

JEDBURGH.—During the first two weeks the weather was cold, but towards the end, particularly the last ten days, it became much milder, and vegetation advanced rapidly. Most of the cereals were sown in good condition. Swallow seen on 23rd, cuckoo heard on 25th.

COLMONELL.—Rainfall .59 in. above the average of 19 years.

ROEBERRY.—A wet, cold month. Mean temp.  $44^{\circ} \cdot 4$ .

### IRELAND.

DARRYNANE ABBEY.—The first week was rather cold; the middle of the month fine and warm. The second half was unsettled, but mild, and vegetation made much progress.

WATERFORD, BROOK LODGE.—Swallows about the house on the 19th; Cuckoo heard on 25th, and Corncrake on 26th.

O'BRIENSBRIDGE, ROSS.—Moderate rain and rather low temp. up to the 20th. All vegetation three weeks later than the average, and fully a month later than in April, 1894.

DUBLIN.—Speaking generally, April, 1895, was a favourable and an average month. The wind was singularly variable, blowing from all points of the compass in nearly equal proportion. The mean temp. ( $48^{\circ} \cdot 1$ ) was  $0^{\circ} \cdot 4$  above the average. High winds were noted on nine days. Sleet and H fell on 1st, and H on 11th. The temp. exceeded  $50^{\circ}$  in the screen on every day except six. *Aurora borealis* on the 11th.

WARINGSTOWN.—Everything fully a month late.

EDENFEL.—On the whole a favourable and seasonable month, sufficiently fine in the early part for the prosecution of farm labour, and rainy in the latter half for purposes of vegetation. No appreciable frost.



# SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

CCCLIII.]

JUNE, 1895.

[PRICE FOURPENCE,  
or 5s. per ann. post free.]

## RAINFALL OBSERVATIONS IN CHINA, 1886-92,

By M. LE PROF. RAULIN.

WITH the year 1886 rainfall observations were commenced at many of the Chinese customhouses, and also by Missionaries at some towns on the Yang-Tse-Kiang river, in the centre of China, not far from the latitude of Shang-Hai, some of them nearly 700 miles inland. There were also five stations in Formosa and one in Hainan.

These observations have been published by Dr. Doberck, for the years 1886 to 1889, in the *Quarterly Journal of the Royal Meteorological Society*, and for the years 1890-92 in the *Observations and Results at the Hong Kong Observatory*.

We have thus information as to the rainfall of that part of Asia for from 5 to 7 years from 33 stations, which may be thus grouped :—

1. Southern coast of the Gulf of Pe-chi-li.
2. River Yang-Tse-Kiang.
3. Delta of the Yang-Tse-Kiang.
4. Coast from Wenchow to Swatow.
5. Canton and Hainan.
6. Formosa.

*Mean annual rainfall.*—This is small in the north, and increases greatly towards the south. From about 20 inches in the Gulf of Pe-chi-li, it becomes double that in the Delta of the Yang-Tse-Kiang, and going about 500 miles up the river we find 58 inches at Hankow. Continuing along the coast it is about 45 inches, but reaches 68 inches at Ningpo. At Canton it is 66 inches, in the north of the Island of Hainan 54 inches, in Formosa it ranges from 60 to 90 inches, but at Keelung, the N.E. point, it reaches 148 inches.

*Seasonal distribution.*—Notwithstanding the proximity of most of the stations to the sea, the régime is that of type I. which prevails over the greater part of Asia. The exceptions are Foochow, Middle Dog and Chapel Island, where the spring rains slightly exceed those of summer. The southern part of Formosa has also type I., but at Keelung, its northern extremity, we have the opposite, type IV., and at Tamsui, not far off, the intermediate type III.

*Abstract of Rainfall in China, 1886-92.*

STATIONS.	Long. E.	Lat. N.	Year.	Winter.	Spring.	Summer.	Autumn.	Year.
1. <i>South Coast of the Gulf of Pe-chi-li :—</i>				in.	in.	in.	in.	in.
Houki .....	120 39	38 4	6	0·09	1·71	10·91	3·21	15·92
Chefoo .....	121 32	37 34	6	1·93	2·20	17·02	4·45	25·60
Shantung Promontory.	122 42	37 24	6	1·67	3·05	13·83	3·97	22·52
2. <i>Yang-Tse-Kiang R. :—</i>								
Ichang .....	111 19	30 12	7	3·26	12·47	21·43	7·92	45·08
Hankow .....	114 20	30 33	7	8·98	18 55	22·14	8·02	57·69
Kiukiang .....	116 7	29 43	7	7·97	19·26	20·05	8 13	55·41
Wuhu .....	118 22	31 22	7	5·64	11·87	15·21	7·48	40·20
Chinkiang .....	119 30	32 12	6	3·63	8·27	14·27	6·30	32·47
3. <i>Delta of the Yang-Tse-Kiang :—</i>								
Wusung .....	121 27	31 25	5	6·16	9·36	14·24	9·73	39·49
Shaweshan .....	122 15	31 25	6	7·35	8·16	14·73	10·53	40·77
North Saddle .....	122 40	30 52	5	7·19	7·31	10 21	7·26	31·97
Gutzlaff ...	122 11	30 49	4	5·95	7·80	12·53	5·78	32·06
Steep Island .....	122 36	30 12	6	5·90	9·81	11·46	11·05	38·22
Ningpo .....	121 44	29 58	6	11·55	15·10	24·43	17·18	68·26
4. <i>Coast from Wenchow to Swatow :—</i>								
Wenchow .....	120 35	28 0	6	7·67	18·56	30·24	10·97	67·44
Foochow .....	119 38	26 8	7	6·85	17·42	16·47	8·04	48·78
Middle Dog .....	120 2	25 58	7	6·83	16·71	15·31	7·69	46·54
Turnabout ..	119 59	25 26	5	6·23	15·39	17 85	7·48	46·95
Ockseu .....	119 28	24 59	6	4·41	11·23	14·88	3·88	34·40
Amoy .....	118 4	24 27	7	6·68	15·28	18·57	6·08	46·61
Chapel Island .....	118 13	24 10	6	5·86	13·91	12·05	5·61	37·43
Fisher Island .....	119 28	23 33	7	6·75	12·18	22·43	4·09	45·45
Lamocks .....	117 18	23 15	7	4·14	14 14	19·99	5·51	43 78
Swatow .....	116 43	23 20	7	5·88	18·41	27·18	7·49	58·96
Breaker Point .....	116 28	22 56	7	4·85	18·03	28·93	9·22	61·03
5. <i>Canton and Hainan :—</i>								
Canton .....	113 17	23 7	6	4·52	24 93	27·26	8·91	65·62
Pakhoi .....	109 6	21 29	7	6·10	13·41	33·67	9·73	62·91
Kiungchow (Hainan) ...	110 20	20 3	7	4·63	14·20	20 32	15·28	54·43
6. <i>Formosa :—</i>								
Keelung .....	121 45	25 8	7	46·48	33·98	24·65	43·25	148·36
Tamsui .....	121 25	25 10	7	16·93	21·86	19·10	22·07	79·96
Anping .....	120 13	22 59	6	2·33	14·95	41·67	5·53	64·48
Takow ...	120 16	22 36	6	0·86	12·50	39·52	8·73	61·61
South Cape .....	120 51	21 55	7	6·15	11·94	45·45	24·23	87·77

[It may be convenient to append the following values for the same district as given in Loomis's "*Contributions*":—

STATIONS.	Long. E.	Lat. N.	Years.	Average Rain. in.
Pekin.....	116 29 ...	39 57 ...	33 ...	24.56
„ Tsien Tsin.....	117 10 ...	38 17 ...	4 ...	21.77
Shanghai .....	121 16 ...	31 19 ...	— ...	43.35
Zikawei .....	121 26 ...	31 13 ...	8 ...	42.44
Kelung .....	121 46 ...	25 20 ...	2 ...	120.08
Canton .....	113 16 ...	23 15 ...	— ...	77.64
Hong Kong .....	114 13 ...	22 20 ...	12 ...	84.45
Macao .....	113 32 ...	22 10 ...	14 ...	69.10
Hanoi Tonkin .....	105 48 ...	21 2 ...	1 ...	70.91
Bangkok .....	100 30 ...	11 45 ...	10 ...	58.55
Saigon .....	106 45 ...	10 47 ...	7 ...	82.96

[Ed.

### ROYAL METEOROLOGICAL SOCIETY.

THE Monthly Meeting of this Society was held on Wednesday evening, May 15th, at the Surveyors' Institution, Westminster, Mr. R. Inwards, F.R.A.S., President, in the chair.

Mr. G. J. Symons, F.R.S., and Mr. G. Chatterton, M.Inst C.E., read a paper on "The November Floods of 1894 in the Thames Valley," which they had prepared at the request of the Council of the Society. This consisted of a systematic description of the causes which led to the great floods of November last, and an analysis of the records obtained from the Thames Conservancy Board, from the engineers of several of the towns along the river, and also from rainfall observers throughout the Thames watershed. The information was given chiefly in the form of tables, one of the first being a chronological history of floods in the Thames Valley from the year A.D. 9 down to the present time. This was followed by a short description of the damage wrought in November, 1894, which was illustrated by a number of interesting lantern slides. Details were then given of the levels reached at various places in all the principal floods from 1750 to the present time. The authors exhibited a map showing the relative elevation of all the parts of the Thames Basin, and then gave details of the rainfall for each day from October 23rd to November 18th, 1894. The results obtained by the Thames Conservancy Board, showing the flood-levels at each lock, were exhibited on a longitudinal section from Lechlade to Teddington, and the hydraulic inclinations from lock to lock were shown in a tabular form. The volume of flood-water, as gauged by the Thames Conservancy at Teddington, rose rapidly from 4,000 million gallons per diem on November 12th, to 10,250 million gallons on the 16th, to 12,800 million gallons on the 17th, and to over 20,000 million gallons on the 18th, when the discharge reached its maximum. The last-named discharge is equivalent to 0.37 inch over the whole watershed of the Thames above Teddington Lock.

Mr. F. J. Brodie read a short paper "On the Barometrical

Changes preceding and accompanying the heavy Rainfall of November, 1894," from which it appeared that the latter half of October was characterised by unusually bad weather, especially in the more western and southern parts of the British Isles. The rains of November 11th to 14th, which actually caused the floods, were due to two secondary depressions which developed a certain amount of intensity as they passed over the southern part of England.

As the two papers dealt with two branches of one subject, the discussion on both was taken together.

Mr. Baldwin Latham thought that the paper proved that floods on the Thames were not larger than in old times, which showed that the statement so often heard that floods were increased by agricultural drainage was fallacious.

Mr. Peregrine Birch added his protest against the opinion that land drainage increased the floods, and suggested that the idea arose from the increase of buildings, the waters which now invaded dwellings being unnoticed in the times when they simply spread over meadows.

Mr. Chatterton said that he had been unable to ascertain the levels of the bed of the river, and spoke on the variations between the mean hydraulic gradient, and the actual level, of the floods. The water appears to be held up for a time in ditches, drains, &c., by slight obstructions till it reaches sufficient volume to carry away the obstructions and comes down with a run, causing a very rapid rise in the river.

Mr. R. F. Grantham did not agree with Mr. Latham and Mr. Birch that the floods were not increased by drainage, but the Thames had been greatly improved, and the water was passed down the river much more rapidly.

The Rev. J. Slatter thought that the Thames Conservancy might mitigate the floods by running the river down after heavy rain. At Whitechurch he had noticed that the rise of the river occurred 36 hours after the rain fell; the floods in recent years had not lasted one quarter of the time that they used to, owing to the improvements effected on the river.

The President, Mr. Scott, Mr. Burstall, Major Lamorock Flower, Captain Wilson Barker and Dr. Buchan also took part in the discussion.

Mr. Symons, in reply, said that the influence of drainage on floods is not ascertainable without precise information as to each individual flood, variations in the cause producing varying effects. He had pleaded for flood marks for 30 years, and could not understand the indifference of public bodies to their erection.

A paper by the Rev. F. W. Stow entitled "A Natural Thermometer" was also read, in which the author inferred the existence of a marked local difference of temperature from observations of the effects of the frosts of May 1894 on chestnut and ash trees near Bishopsdale, Yorkshire.

# A FIN DE SIÈCLE PROJECT.

[We do not regard the proposal dealt with in the following article—and which we believe has been rejected—quite so contemptuously as do our Belgian friends, but their criticism is so interesting and instructive that we translate it *in extenso* from *Ciel et Terre*—ED.]

The whole daily press has recently teemed with details respecting the magnificent project submitted by M. Paschal Grousset to the Director General of the Paris Exhibition of 1900, and destined, in the opinion of the author, to be the feature of the Exhibition.

M. Grousset requests authority to proceed with an experiment tending to clear up one of the most interesting subjects connected with terrestrial physics—that of the existence of a central fire. It is desired to ascertain whether beneath the crust of the earth there is a nucleus in a state of fusion, or any other source of heat accessible to man and forming a store of force, of light, and of motion. Or does a vast liquid ocean exist beneath our feet?

One may well be astonished, says M. Grousset, that man has never attempted to study a problem of such importance, and on the whole so easy, but in ordinary circumstances the costs of the attempt would be too great in proportion to the benefit immediately obtainable.

And this is how M. Grousset proposes to realise the magnificent project of which he is so fond, and to solve the important problem which has, for so many years, divided the physicists and geologists.

To dig horizontal galleries at successive depths of each 200 metres (say 650 feet), uniting them by a series of vertical shafts, and going downwards until an unbearably high temperature is reached, if the law of increase of temperature be confirmed.

We will not describe in detail the attractions which M. Grousset proposes to offer to visitors to his subterranean galleries—they are to pass in succession from representations of the Arctic regions with ice and snow, then to temperate, and finally to representations of the tropics. Electric lighting, perfect ventilation and safety, everything [!] has been arranged for.

M. Paschal Grousset is perhaps a profound politician and a great statesman (he was a member of the Paris Commune), but he is unquestionably an indifferent *savant*, and his knowledge of the physical condition of the earth's crust is that of the last century.

Some years ago a Spanish or Mexican engineer (we forget which) tried to awake popular interest in an even wilder scheme, namely, to dig a hole right through the centre of the globe!

One of our most distinguished bibliophiles, very learned in many things, who was equally haunted by the question of a central fire, imagined another mode of solving the problem, by selecting a very lofty and isolated volcano and at its base excavating a horizontal gallery abutting on the central region of the mountain.

M. Grousset would be satisfied with going down 1,500 metres

(nearly a mile), but to do that there is no need to sink at Paris horizontal galleries connected by vertical shafts—of which the cost is put at 15 million francs (say £600,000).

The Belgian mine of Viviers-Réunis (Gilly) has a depth of about 1,100 metres ( $\frac{3}{4}$  mile) and many others are between 800 and 1,000 metres.

At the well of Sperenberg, 40 kilomètres (24 miles) South of Berlin, the greatest depth is 1,390 metres (0·8 mile) and at Schledobach, also in Germany, the depth of 1,910 metres (1·2 miles) has been reached. Lastly, at Wheeling, in Western Virginia, a bore hole goes down to 1,500 metres.

When the Mont Cenis tunnel was being pierced, part of it was 1,654 metres (1 mile) below the summit, the summit of the St. Gothard is 1,706 metres (1·1 miles) above the rails, and those in the Simplon will be 2,135 metres (1·3 miles) below the summit.

M. Grousset does not appear to have any idea of the temperatures already ascertained at the great depths which we have above quoted.

In the Belgian coal mine of Poirier, although only 940 metres (0·6 mile) deep, the temperature in badly ventilated portions is 28° or 29° C. (82° to 84° F.), and in *culs-de-sac* it reaches 32° or 33° C. (90° to 91° F.).

At Sperenberg 49° C. (120° F.) and at Schledobach 57·5° C. (135·5° F.) has been observed.

At Wheeling, where the observations were made as a scientific investigation lasting over a whole year, the bottom temperature was 43°·5 C. (110°·3 F.), although at the surface it was only 10°·5 C. (51° F.). The increase of temperature became more rapid the deeper the boring was carried; for the whole depth it averaged 1° C. in 40 metres (1° F. for 72 feet), but near the bottom it was 1° C. for 30 metres (1° F. for 54 feet).

During the construction of the St. Gothard tunnel 30°·8 C. (87°·4 F.) was recorded. In the Simplon tunnel it has been computed that a temperature of 47°·5 C. (117°·5 F.) will be reached, and that for 10 kilomètres (6 miles) it will be at least 40° C. (104° F.). The constructors will reduce this excessive temperature by powerful ventilation and by the production of water spray under high pressure and infinitesimally fine.

The foregoing statements show that the temperature at the depth of 1,500 metres (4,875 feet) is already known. The realisation of M. Grousset's project would therefore teach us nothing.

Finally (and this is an important detail), has M. Grousset estimated the cost of cartage and dumping of the millions of cube metres of earth which will have to be raised from the various shafts and galleries? No such item appears in the estimates.

So far *Ciel et Terre*. We do not say that its criticism is not well founded, but this proposal like most, may be regarded from two points of view.

When the Eiffel Tower was proposed, much ridicule was heaped upon the suggestion, and yet to this hour instruments on its topmost platform are automatically recording facts in the *Bureau Météorologique* which, like those already obtained, will doubtless be worked up by French *savants* and published by M. Mascart—sufficient proof of their utility.

So with M. Grousset's project. It is perfectly true that deeper borings and mines have been sunk, but almost always with a commercial object, and nothing approaching to a physical or magnetical observatory has ever been established at a great depth. Why should less be learned at 1,500 metres below the ground than at 300 metres (1,000 feet) above it? Earth Tremors, the transit of earthquake shocks, the flexure of the Earth's crust, variations in the force of gravity, in fact a multitude of problems occur to us which a deep-seated observatory free from the vibration of machinery, of blasting and of mining work could pursue.

Lastly, we are certain that to the general public the law of increase of temperature with depth is unknown, and we can see no harm, but rather the contrary, in the general diffusion of knowledge upon the subject.

## EARTH TEMPERATURE AND WATER PIPES.

[We wish to ascertain the truth, and care relatively nothing as to whether suggestions made by ourselves are accepted or rejected. We see no advantage in printing letters which accept the suggestions which we offered; but, on the other hand, we wish to put our readers in possession of all that we have received, or seen, in criticism of our position, and these are the only two. The Rev. J. Slatter's letter really confirms our theory. The well water would not be "ice-cold water"—not like the Thames water which we see had, after storage, a temperature of  $32^{\circ}9$ .—ED.]

### WATER PIPES.

*To the Editor of the Meteorological Magazine.*

SIR,—There is one cause of injury to the water-pipes by frost which has escaped you—but which by my own cursory observations I am convinced has had as much to do with it as any you have enumerated—I mean careless laying of the pipes; so that continuity of the soil which was filled in was not preserved. My own pump draws from the well by about 35 feet of pipe laid horizontally, not more than 15 inches below the surface, and with a northern exposure; yet I suffered no inconvenience from frost. I attribute my immunity to the pipe being laid in ashes, which substance is not a good conductor, and being homogeneous and fitting close shut out the cold air completely.

Yours faithfully,

JOHN SLATTER.

*Whitchurch, Oxon, 23rd May, 1895.*

## HATFIELD WATER WORKS.

SIR,—Regarding your remarks in the *Meteorological Magazine* (pp. 58 and 59) as to the temperature of the water of this well, viz.  $51^{\circ}$ , ameliorating the condition of mains from being frozen, this may be so, under certain conditions, to a greater or less degree. But the depth of the mains is a most essential factor in preserving them from frost, even when the water is pumped at the temperature as above. That this is so is proven by the circumstances of the water mains of St. Albans and Watford, both in this district, which were frozen to such a degree during the late frost as to almost deprive for several weeks these towns of water, and that the Engineers of these respective water works inform me that the water from their wells, as pumped, is of a temperature of from  $50^{\circ}$  to  $51^{\circ}$ . In both towns the water is pumped into covered reservoirs. Hatfield mains would have been frozen this last winter just as so many other mains were, but that they were laid to the depth described in my letter on p. 58.

Another circumstance that deprives the temperature index of almost any significance in the case of these works is, that the supply of water is so great in relation to its consumption, that pumping for 15 hours suffices for the week's constant service of 168 hours. The former number of hours is but 9 per cent. of the latter. Consequently the water in the open reservoir, which has a week's supply capacity, was nearly all the winter as cold as ice, as long as the frost continued.

Yours sincerely,

H. M. MILLER.

*Hatfield, Herts, May 31st, 1895.*

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PHOTOGRAPHING METEORS.

IN *Ciel et Terre*, for April 16th, details are given of attempts made in the United States in 1893 to photograph members of several shooting star groups, and they were sufficiently successful to induce us to bring the suggestion before our readers, so that those interested in photography may try a new object. At Yale Observatory the camera was put upon an equatorial mounting and directed towards the radiant point, the total exposure was four hours, and three traces were found on the plate—one very good. On the same evening an ordinary camera, fixed at a window at Ansonia, caught the same meteor, and from the two traces the details of the meteor's path have been computed. The notice concludes with the following remarks:—

“Experience shows that with perseverance records of the path of meteors can be obtained. The exactitude of the results obtained is incomparably greater than can be obtained by any other method.”



REVIEWS.

*Les Aurores Polaires*, par ALFRED ANGOT, Météorologiste titulaire au Bureau central météorologique de France. F. Alcan, Paris, 1895. 8vo., vii.-318 pages, 18 engravings or plates.

M. ANGOT calls attention to the long interval (more than a century) between the appearance of de Mairan's *Traité physique et historique de l'aurore boréale* (1733), and the next important work, Bravais' contributions, published in the Voyages of the "Commission Scientifique du Nord," and to the fact that during the subsequent half century no special work upon the subject has appeared in French. We do not quite understand this, and had perhaps better quote verbatim, first from M. Angot's preface, "Depuis cette époque [1840? the publication of Bravais's work] aucun travail d'ensemble n'a paru sur cette question dans notre pays."

Either M. Angot's memory failed him, or else this is a severe hit at Prof. Lemström's *L'Aurore boréale*, published in Paris in 1886, and the Avant-propos of which finishes with these words, "Nous sommes heureux de pouvoir reproduire à la fin de cet ouvrage neuf dessins d'aurores boréales, qui ont été gravés d'après les documents fournis par M. Angot, météorologiste titulaire au Bureau central météorologique de France."

As regards the plates, those in Prof. Lemström's book are certainly better than those in M. Angot's.

However, we forsake comparisons and confine our attention to the work before us, which certainly has several merits. The subject is treated systematically, thoroughly, judiciously, and clearly; these are strong words, but we believe that each is absolutely true. It is not often that we can forgive an author who issues a book without an index, but M. Angot's arrangement of chapters and sections is so extremely good that the table of contents answers almost every purpose which an index would. For example, Chapter III., "The Physical Characteristics of Auroræ," has the following sections:—Colour, Intensity of the Light, Nature of the Light, Noise, Odour; or again, Chapter V., "Periodicity of Auroræ": Daily Period, Annual Period, Secular Period, Relation to Sun-spot Periodicity. Classification like this renders it easy to ascertain with great rapidity not merely M. Angot's opinion on any point, but what the most recent and competent investigators have said; because, as we have already mentioned, M. Angot seems to us to have written not merely a well-arranged book, but one which is very fair and judicial in the way it discusses statements, and which is very easy and pleasant to read.

As regards the sound of Auroræ, M. Angot evidently feels that the evidence is very weak, but he leaves the suggestion open for further investigation, but the evidence for Auroræ producing a smell either like ozone or of any other kind, he considers too unsatisfactory to be accepted.

One feature has struck us on looking through this book, and we

mention it without for a moment asserting that there is anything in it. In recent photographs of lightning strokes, they have not infrequently appeared as gauzy ribbons. Some of the "curtain" patterns of aurora are by no means dissimilar in appearance.

We ought to give a short extract typical of the general style of the book, but it is all interesting, and therefore selection is difficult. The Section, "On the relations between the Clouds and Auroræ," is very good, but we have room for the conclusion only, viz. :—

"To sum up, there exist indisputable relations between clouds of the cirrus type and auroræ; the two phenomena present the same laws of periodicity, they are successive and sometimes co-existent, and their analogy is often such that many observers do not hesitate to affirm that the production of aurora is dependent upon the presence of cirri. We shall see later on that these views have very important bearings upon the theory of the aurora."

We can conclude by strongly recommending the book to the attention of our readers.

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*Dorset Annual Rainfall, 1848-92*, by HENRY STORKS EATON, M.A.  
Past President of the Roy. Meteor. Soc. 8vo, Dorchester,  
1895 (Excerpt Proc. Dorset Nat. Hist. and Antiq. Field Club),  
30 pp., 2 coloured plates.

Mr. Storks Eaton has long been known as one of the best amateur meteorologists in the country. More than 30 years ago (in 1861) he contributed to the British (now the Royal) Meteorological Society a paper "On the fall of rain in Devonshire" which was far in advance of anything of the class, which had up to that time been done either for any part of England or of the world. In intervening years he has dealt with temperature, pressure, and other subjects, and now in the short paper under notice he gives an epitome of the rainfall of his native county which is almost as perfect as we can imagine, and as the observations permit. He has collected records from 75 stations in the county, and from 37 in the adjoining counties of Hants, Devon, Somerset and Wilts, the aggregate number of years dealt with being 670 in Dorset and 376 in the adjoining counties. The totals are printed *in extenso* so that they are available for anyone, but Mr. Eaton has worked out the true mean for each station with great care, computing them by differentiation from four stations and then adopting the mean of the four values. Mr. Eaton has, we believe, visited the majority of the existing stations so as to become conversant with the position and details of each, and gives in his paper a large map showing by shading the altitude above sea level of the whole county, while facing it is another on the same scale (4 miles to 1 inch, about  $\frac{1}{270000}$ ) showing the rainfall by small figures over the sites of the observations, and also by blue shading, which naturally takes much the same configuration as the shading repre-

senting altitude. It is with this map alone that we should have preferred an alteration, or to speak correctly an addition. We do not understand why the author did not put on isohyetal lines for 30, 35 and 40 inches of rainfall. We have drawn them on our own copy and think that they tend greatly to emphasise the facts observed. The mean rainfall varies from rather below 30 inches near Weymouth, and Swanage, and in the extreme N.W., to nearly 50 inches on the hills in the centre; where, for the information of water engineers, we may mention that there is a ridge nearly 20 miles by 4 miles—say of 80 square miles with a mean rainfall of more than 40 inches. If we took it at 44 inches this would give a daily supply of 40,000,000 gallons a day, sufficient for say two million persons.

The paper brings out many facts of interest and importance; we will quote two only. There has lately been a discussion as to whether in a long register the driest three consecutive years will have a rainfall less than the mean by  $\frac{1}{2}$ th or by  $\frac{1}{3}$ th—we prefer to express it thus: whether the mean ratio for the driest three consecutive years should be taken as 83·3 or 80·0—Mr. Eaton's table gives 78·7. The other discussion has been as to there being any justification for the statement that years ending with 4 are generally dry. The only such years in Mr. Eaton's table, and the ratios for these, are

Year.	Ratio.	
1854 .....	62	} Average, 79.
1864 .....	71	
1874 .....	95	
1884 .....	89	

Therefore they were all dry, and on the average there was a deficiency of 21 per cent.

Mr. Eaton and the Dorset Nat. Hist. Club have to be thanked for, and congratulated upon, an excellent piece of work.

# CORRIGENDUM.

*To the Editor of the Meteorological Magazine.*

*Met. Mag.*, vol. xxx., p. 61, Foot note, \*, line 11,

For "The wind was easterly,"

Read "The wind was westerly."

With every apology for the slip of the pen,

F. C.

[We thought so, and therefore put the ?.—ED.]

## CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, NOVEMBER, 1894.

STATIONS.  (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
England, London .....	63·9		31·3	22	52·0	41·5	42·7	87	98·1	26·1	2·85	14	6·3
Malta.....	78·6	1	52·5	25	70·6	58·5	51·3	80	130·5	46·8	4·60	16	6·6
<i>Cape of Good Hope</i> .....	...	...	...	...	...	...	...	...	...	...	...	...	...
<i>Mauritius</i> .....	83·9	9	63·5	24	81·9	68·7	63·8	71	135·8	53·3	1·31	10	5·3
Calcutta.....	85·6	1	59·2	25	79·7	64·4	65·0	80	146·8	52·0	3·04	4	2·1
Bombay.....	89·0	22	68·1	30	86·2	71·4	66·9	67	138·3	59·7	·00	0	1·2
Ceylon, Colombo .....	91·0	29	71·3	24	85·7	74·1	72·1	81	153·0	65·0	14·63	20	6·5
<i>Melbourne</i> .....	105·7	27	41·5	14	73·5	52·1	49·5	67	152·1	35·0	·79	7	5·1
<i>Adelaide</i> .....	107·0	26	45·3	1	81·5	55·2	47·5	47	161·0	37·3	·23	3	3·2
<i>Sydney</i> .....	97·5	26	55·3	19	79·2	62·8	57·3	62	155·0	43·9	·68	7	3·6
<i>Wellington</i> .....	70·0	1	42·0	26	63·8	51·3	48·5	76	142·0	29·0	4·14	14	4·5
<i>Auckland</i> .....	73·0	3	48·0	14	67·2	54·0	53·7	80	140·0	46·0	5·66	17	5·3
Jamaica, Kingston.....	90·3	19	68·7	5	88·2	71·1	70·4	81	...	...	2·07	6	4·6
Grenada.....	84·8	10	70·0	27	82·8	73·3	71·1	74	157·0	...	9·23	26	4·0
Trinidad .....	92·0	6	63·0	20	86·4	70·7	71·1	81	167·0	63·0	7·28	20	...
Toronto .....	54·8	3	10·0	19	40·7	27·6	28·1	73	...	5·7	·61	23	7·3
New Brunswick, Fredericton .....	56·9	3	1·5	30	37·4	21·2	24·2	74	...	...	1·66	14	5·5
Manitoba, Winnipeg .....	43·8	1	-25·0	28	27·0	9·3	...	...	...	...	1·87	17	7·1
British Columbia, Esquimalt .....	56·6	8	29·7	16	48·5	40·7	43·3	94	...	...	6·88	25	8·2

a—and 29. b—and 27.

Erratum.—In August table on p. 32, London—Absolute min. should be 41°·3, not 63°·1.

## REMARKS.

**MALTA.**—Adopted mean temp. (62°·8), 1°·3 above the average. Mean hourly velocity of wind 7·3 miles. Thunderstorms on 5 days, and lightning on 8 other days. Hail on 15th. Dew point temp. ranged between 64°·4 on the 1st and 46°·7 on the 3rd. At noon on the 30th, during a dead calm, several waterspouts were seen over the sea three or four miles N.E. and N.W. of this station. J. F. DOBSON.

**Mauritius.**—Mean temp. of air equal to, dew point 0°·3 below, and rainfall ·59 in. below, their respective averages. Mean hourly velocity of wind 11·2 miles, or 0·3 mile above average; extremes, 23·5 on 2nd and 12th and 1·7 on 5th; prevailing direction, E. by S. to E. by N. Thunder and lightning on 28th. C. MELDRUM, F.R.S.

**CEYLON, COLOMBO.**—Thunderstorms occurred on 11 days and lightning was seen on two other days. D. G. MANTELL.

**Melbourne.**—The max. temp. in shade (105°·7 on 27th) is the highest recorded in November during 40 years. R. L. J. ELLERY, F.R.S.

**Adelaide.**—Mean temp. 1°·5 above the average of 37 years. On four consecutive days (23rd to 26th) the max. shade temp exceeded 100°, a very unusual occurrence in November. Rainfall ·79 in. below average. C. TODD, F.R.S.

**Sydney.**—Mean temp. 4°·4 above, humidity 8 below, and rainfall 2·49 in. below, their respective averages. H. C. RUSSELL, F.R.S.

**Wellington.**—On the whole a wet month, with short intervals of fine weather. Prevailing N.W. winds, generally strong. Lightning on 13th. Mean temp. 1°·0 above, and rainfall 0·3 in. below, their respective averages. R. B. GORE.

**Auckland.**—Showery and variable during the month. Particularly heavy fall of rain on 17th, 3·15 in. falling in less than 12 hours. Barometric pressure and mean temp. close to the average of 27 years, rainfall 2·5 in. over the average. T. F. CHEESEMAN.

**JAMAICA, KINGSTON.**—Mean hourly velocity of wind 3·1 miles. In Kingston the weather was fine, with rainfall a little below the average. R. JOHNSTONE.

**TRINIDAD.**—Rainfall ·42 in. above the average of 30 years. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL,  
MAY, 1895.

[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.			
II.	Dorking, Abinger Hall.	·56	XI.	Lake Vyrnwy .....	...
„	Birchington, Thor .....	·70	„	Corwen, Rhug .....	2·52
„	Hailsham .....	·12	„	Carnarvon, Cocksida ...	·32
„	Ryde, Thornbrough .....	·27	„	I. of Man, Douglas .....	·26
„	Emsworth, Redlands ...	·25	XII.	Stoneykirk, Ardwell Ho.	·41
„	Alton, Ashdell .....	2·27	„	New Galloway, Glenlee	·58
III.	Oxford, Magdalen Col...	·18	„	Melrose, Abbey Gate ..	1·05
„	Banbury, Bloxham .....	·49	XIII.	N. Esk Res. [Penicuik]	·90
„	Northampton, Sedgebrook	·51	„	Edinburgh, Blacket Pl.	1·42
„	Alconbury .....	·47	XIV.	Glasgow, Queen's Park.	·20
„	Wisbech, Bank House..	·89	XV.	Liverary, Newtown .....	1·17
IV.	Southend .....	·16	„	Islay, Gruinart School..	·07
„	Harlow, Sheering .....	1·09	XVI.	Dollar .....	·54
„	Colchester, Lexden.....	·31	„	Balquhider, Stronvar..	1·00
„	Rendlesham Hall .....	·35	„	Ballinluig .....	·44
„	Diss .....	·59	„	Dalnaspidal H.R.S. ...	1·36
„	Swaffham .....	1·11	XVII.	Keith H.R.S. ....	·79
V.	Salisbury, Alderbury...	·22	„	Forres H.R.S. ....	1·10
„	Bishop's Cannings .....	1·03	XVIII.	Fearn, Lower Pitkerrie.	·52
„	Blandford, Whatcombe.	·24	„	Loch Shiel, Glenaladale	2·60
„	Ashburton, Holne Vic...	1·59	„	N. Uist, Loch Maddy ...	1·77
„	Okehampton, Oaklands.	·60	„	Invergarry .....	1·03
„	Hartland Abbey .....	·61	„	Aviemore H.R.S. ....	1·49
„	Lynmouth, Glenthorne.	·53	„	Loch Ness, Drumnadrochit	1·67
„	Probus, Lamellyn .....	·92	XIX.	Invershin .....	·56
„	Wellington, Sunnyside..	·65	„	Scourie .....	1·24
„	Wincanton, Stowell Rec.	·41	„	Watten H.R.S. ....	·43
VI.	Clifton, Pembroke Road	1·01	XX.	Dunmanway, Coolkelure	1·60
„	Ross, The Graig .....	·43	„	Fermoy, Gas Works ...	·70
„	Wem, Clive Vicarage ...	1·01	„	Killarney, Woodlawn ...	·94
„	Cheadle, The Heath Ho.	·58	„	Caher, Duneske .....	1·02
„	Worcester, Diglis Lock	...	„	Ballingarry, Hazelfort...	·99
„	Coventry, Coundon .....	·77	„	Limerick, Kilcornan ...	·86
VII.	Ketton Hall [Stamford]	·64	„	Ennis .....	1·03
„	Grantham, Stainby .....	·60	„	Miltown Malbay .....	1·17
„	Horncastle, Bucknall ...	·89	XXI.	Gorey, Courtown House	·15
„	Workop, Hotsck Priory	1·89	„	Athlone, Twyford .....	·41
VIII.	Neston, Hinderton .....	·39	„	Mullingar, Belvedere...	·15
„	Preston, Haighton ...	...	„	Longford, Currygrane...	·51
„	Broughton-in-Furness...	·71	XXII.	Woolawn .....	·96
IX.	Ripon, Mickley .....	·53	„	Crossmolina, Enniscoe..	2·17
„	Melmerby, Boldersby ...	·70	„	Collooney, Markree Obs.	1·30
„	Scarborough, South Cliff	...	„	Ballinamore, Lawderdale	·90
„	Middleton, Mickleton...	·89	XXIII.	Lough Sheelin, Arley ..	·41
X.	Haltwhistle, Unthank..	·47	„	Warrenpoint .....	·19
„	Bamburgh .....	·55	„	Seaforde .....	·21
„	Keswick, The Beeches...	...	„	Belfast, Springfield ....	·31
XI.	Llanfrechfa Grange .....	·34	„	Bushmills, Dundarave...	·93
„	Llandovery .....	·63	„	Stewartstown .....	·69
„	Castle Malgwyn .....	·26	„	Buncrana .....	1·23
„	Builth, Abergwessin Vic.	·91	„	Lough Swilly, Carrablagh	1·10
„	Rhayader, Nantgwillt..	·97			

MAY, 1895.

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		In shade.	Max.		Min.		On grass.				
				Dpth	Date		Deg.		Date	Deg.		Date.			
		inches.	inches.	in.				Deg.	Date	Deg.	Date.				
I.	London (Camden Square) ...	34	— 1·56	12	17	5	86·2	30	35·7	2	0	1			
II.	Maidstone (Hunton Court) ...	17	— 1·21	10	17	3	...	...	...	...	...	...			
III.	Strathfield Turgiss ...	60	— 1·27	28	23	8	85·1	30	31·5	3	2	4			
IV.	Hitchin ...	70	— 1·25	25	17 <sup>d</sup>	6	82·0	30	35·0	4	0	...			
V.	Winslow (Addington) ...	50	— 1·60	18	17	6	84·0	30	33·0	2, 17	0	3			
VI.	Bury St. Edmunds (Westley) ...	88	— 87	39	17	9	76·0	30	34·0	17	0	...			
VII.	Norwich (Brundall) ...	1·09	...	35	17	9	80·0	30	36·2	17	0	5			
VIII.	Weymouth (Langton Herring) ...	31	— 1·30	20	31	3	71·0	30	38·0	5	0	...			
IX.	Torquay (Cary Green) ...	66	...	38	31	3	73·7	14	39·0	7	0	0			
X.	Polapit Tamar [Launceston]..	33	— 1·50	19	31	5	77·0	30	31·0	2	1	4			
XI.	Stroud (Upfield) ...	48	— 1·56	21	24	6	81·0	30	37·0	1	0	...			
XII.	Church Stretton (Woolstaston) ...	78	— 2·09	49	1	8	78·0	30	34·0	17	0	2			
XIII.	Tenbury (Orleton) ...	61	— 1·94	32	1	9	82·1	30	32·5	2	0	5			
XIV.	Leicester (Barkby) ...	63	— 1·34	25	1	4	86·5	30	29·0	1	2	11			
XV.	Boston ...	1·87	+ 15	76	31	8	88·0	29 <sup>c</sup>	31·0	2	1	...			
XVI.	Hesley Hall [Tickhill] ...	1·15	— 89	60	24	8	84·0	30	35·0	2	0	...			
XVII.	Manchester (Plymouth Grove) ...	59	— 1·76	32	1	8	85·0	30	34·0	1	0	...			
XVIII.	Wetherby (Ribston Hall) ..	04	— 1·91	04	11	1	...	...	...	...	...	...			
XIX.	Skipton (Arnccliffe) ...	86	— 2·86	38	25	8	...	...	...	...	...	...			
XX.	Hull (Pearson Park) ...	64	— 1·24	27	1	8	...	...	...	...	...	...			
XXI.	Newcastle (Town Moor) ...	68	— 1·07	18	19	11	...	...	...	...	...	...			
XXII.	Borrowdale (Seathwaite).....	58	— 8·03	25	24	9	...	...	...	...	...	...			
XXIII.	Cardiff (Ely).....	48	— 2·37	39	31	2	...	...	...	...	...	...			
XXIV.	Haverfordwest ...	09	— 2·27	05	31	5	77·6	30	34·4	3	0	6			
XXV.	Aberystwith (Gogerddan) ...	43	...	15	24	3	85·0	30	...	...	...	...			
XXVI.	Llandudno ...	42	— 1·51	17	24	6	81·5	30	41·4	3	0	...			
XXVII.	Cargen [Dumfries] ...	06	— 2·46	06	25	1	76·4	30	34·0	20	0	...			
XXVIII.	Jedburgh (Sunnyside).....	1·22	— 68	52	24	11	75·0	29 <sup>c</sup>	35·0	2	0	...			
XXIX.	Colmonell ...	42	...	22	24	2	80·0	30	33·0	19	0	...			
XXX.	Lochgilthead (Kilmory).....	27	— 3·08	16	25	5	...	...	31·0	19	2	...			
XXXI.	Mull (Quinish).....	84	— 2·11	41	14	10	...	...	...	...	...	...			
XXXII.	Loch Leven Sluices ...	70	— 1·86	20	31	6	...	...	...	...	...	...			
XXXIII.	Dundee (Eastern Necropolis) ...	55	— 1·11	15	31	9	77·3	28	35·4	2	0	...			
XXXIV.	Braemar ...	55	— 1·86	15	24	12	69·9	30	30·2	3	2	19			
XXXV.	Aberdeen (Cranford) ...	69	...	25	19	11	71·0	28 <sup>b</sup>	33·0	16	0	...			
XXXVI.	Strathconan [Beaul] ...	2·28	— 81	65	25	6	...	...	...	...	...	...			
XXXVII.	Glencarron Lodge ...	3·45	...	72	23	15	75·5	31	33·0	18	0	...			
XXXVIII.	Cawdor [Nairn] ...	1·74	— 01	37	22	14	...	...	...	...	...	...			
XXXIX.	Dunrobin ...	1·10	— 1·00	30	19	10	68·0	29	37·0	2	0	...			
XL.	S. Ronaldsay (Roeberry).....	70	— 1·02	33	12	6	66·0	27	36·0	16	...	...			
XLI.	Darrynane Abbey ...	1·93	...	56	31	13	...	...	...	...	...	...			
XLII.	Waterford (Brook Lodge) ...	61	— 1·62	27	31	4	71·0	30	32·0	2, 3	2	...			
XLIII.	O'Briensbridge (Ross) ...	85	...	36	22	7	...	...	...	...	...	...			
XLIV.	Carlow (Browne's Hill) ...	54	— 1·80	17	12 <sup>a</sup>	5	...	...	...	...	...	...			
XLV.	Dublin (Fitz William Square) ...	18	— 1·75	07	31	3	71·9	30	36·1	21	0	1			
XLVI.	Ballinasloe ...	1·30	— 1·39	85	31	8	79·0	30	30·0	3, 6	5	...			
XLVII.	Clifden (Kylemore) ...	83	...	17	11 <sup>b</sup>	11	...	...	...	...	...	...			
XLVIII.	Waringstown ...	21	— 2·23	16	12	3	81·0	30	33·0	1	0	4			
XLIX.	Londonderry (Creggan Res.)..	99	— 1·53	29	24	10	...	...	...	...	...	...			
L.	Omagh (Edenfel) ...	74	— 1·73	28	24	9	77·0	30	34·0	1	0	1			

a And 31. b And 29. c And 30. d And 23.

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

# METEOROLOGICAL NOTES ON MAY, 1895.

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.

STRATHFIELD TURGISS.—A very dry May, fine and bright, with plenty of sunshine, and warm until the 15th when a sudden fall of temp. occurred. Great heat on the 30th, followed by a TS at night. First swarm of bees on the 3rd; Swift first seen on 6th; horse chestnut in flower on 7th, Ox eye daisy on 17th, Laburnum on 19th. TSS on 23d and 30th.

ADDINGTON.—A very fine month. R the least in May during the last quarter of a century, with the exception of 1871 when 47 in. fell on 5 days. Max temp. the highest registered in May since 1871. A sharp TS on the night of the 30th with very vivid L but not much R.

BURY ST. EDMUNDS, WESTLEY.—A dry sunny month; temp. above the average until the 14th, then five days of cold north winds which injured the trees and hedges on the north side like exposure to fire; very hot from the 26th to the end of the month. R much wanted. T on the 12th, and distant T on the 23rd. H on 16th and 17th.

NORWICH, BRUNDALL.—Fine and warm to 14th; on the 16th a great fall in temp., the max being 72°·0 on the 14th, 58°·4 on 15th, and 44°·2 on 16th, on which day storms of H and sleet were frequent. The latter part of the month was again warm. In many parts of the county the results of the storm of the 16th were apparent to the end of the month, the north sides of the trees being covered with brown shrivelled leaves as in November, while on the south side the bright green May foliage was intact. L and T at night on 30th.

LANGTON HERRING.—There was an absolute drought of 29 days from 2nd to 29th inclusive. A fine warm month; mean temp. at 9 a.m. 56°·0, or 2·1 above the average of 23 years. Fogs on the 13th, 14th, 24th, and 27th. TS on 30th. Hawthorn in blossom on 18th.

TORQUAY, CARY GREEN.—Rainfall 1·63 in. below the average. Mean temp. 54°·5, or 2°·7 above the average. Mean humidity 73. Duration of sunshine 298 hours 35 minutes, being 79 hours above the average; no sunless days.

POLAPIT TAMAR.—The driest May for 14 years. In addition to the drought the month was remarkable for the exceptional amount of sunny bright hot weather, and for the number of days on which there was very little wind. The average shade max. is 63°·9. There have been only three other months since January 1881 with less R.

STROUD, UFFIELD.—S and sleet fell on the hills on the 17th. T was heard on 22nd with H showers, and TSS occurred on 24th and 30th.

WOOLSTASTON.—An extremely dry month; the first and last parts were very hot, the middle part as cold, S falling lightly on the 17th. T with most vivid L for many hours on the 30th. Mean temp. 55°·1.

TENBURY, ORLETON.—The driest May for 47 years, and with the exception of May 1893 the warmest for 35 years, despite a week's cold weather from the 16th to the 22nd inclusive. The ther. reached 70° on 15 days and the maximum of 82°·1 on the 30th is the highest recorded in May since 1864. T on 23rd, 24th, 25th, and 30th. L on 25th and 30th.

LEICESTER, BARKBY.—A month of drought and changeable temp. First swift on 1st., first nightingale on 12th. L and T on the 9th without R, also on 30th with some R. Slight S on 20th.

MANCHESTER, PLYMOUTH GROVE.—The driest May experienced since observations commenced 29 years ago. The 30th was the hottest day in May for 29 years according to my record with the one exception of May 20th 1863, when the max temp in shade was 87°. A slight fall of S occurred in the early morning of the 17th, T and L on 24th, and T on the 30th. Mean temp. 55°·8.

WETHERBY, RIBSTON.—Hot sunshine daily; R much wanted.

## WALES.

**HAVERFORDWEST.**—Excepting 1859—the year of great drought, when May was rainless—this is the least  $\bar{R}$  in any May recorded. Great heat prevailed from the 7th to the 11th, succeeded by a sudden fall of temp. At night on the 15th it blew a gale stripping the fruit trees of their splendid bloom, and cold days and colder nights prevailed up to the 26th, when a warm period again set in. A great amount of bright sunshine and grass lands suffering much for the want of  $\bar{R}$ . Wind generally N or N.E.

**GOGGERDAN.**—Very dry throughout the month, with bright sunshine. T and  $\bar{R}$  in the neighbourhood.

## SCOTLAND.

**CARGEN.**—Another record in 1895 has to be noted, after the coldest month ever experienced (February), we have had in May the driest month since observations commenced 36 years ago,  $\bar{R}$  falling on only one day during a short TS. On no previous occasion has the  $\bar{R}$  in any month been below .10 in. Unless we have far more than the average for the next two months the water supply as far as it is dependent on springs and wells, is likely to become a serious consideration. The mean temp. for the month  $53^{\circ}\cdot3$  is  $2^{\circ}\cdot6$  above the average for May. In only three years since 1859 has a higher mean temp. been recorded, viz.,  $53^{\circ}\cdot7$  in 1875,  $54^{\circ}\cdot3$  in 1889,  $54^{\circ}\cdot5$  in 1893. An unusually warm period prevailed during the last 11 days of the month, the mean temp. from 21st to 31st being  $56^{\circ}\cdot5$ . The nights were generally very clear and cloudless, and radiation reduced the mean temp. below what might have been expected from the number of very warm days. Another feature was the high mean bar. 30.05 in., this pressure having been only twice exceeded in May since 1859. Vegetation unusually backward, and pastures and corn crops suffering for want of  $\bar{R}$ .

**JEDBURGH.**—The early part of the month was, as usual, cold and ungenial, with low temp. and N.E. and E. winds. The last fortnight was mild, and vegetation progressed rapidly. All crops look well. T and L on 24th and 29th.

**COLMONELL.**—Rainfall 2.23 in. below the average of 19 years.

**ROEBERRY.**—Very dry, with a very cold week during the middle of the month. Mean temp.  $49^{\circ}\cdot5$ .

## IRELAND.

**DARRYNANE ABBEY.**—A fine and dry month and on the whole warm, but with a few cold days in the middle and at the end.

**WATERFORD, BROOK LODGE.** T and H showers on the 1st. Mean temp.  $51^{\circ}\cdot9$ . Prevailing winds easterly.

**O'BRIENSBRIDGE, ROSS.**—A fine month with abundant sunshine, and the smallest  $\bar{R}$  in May since 1861, when only .51 in. fell. Cool in the evening from 15th to 21st. Great heat on 29th and 30th. Whitethorn bloom very scarce.

**DUBLIN.**—A beautiful month—bright and dry, without any severe night frosts. The amount of cloud was very low, only 3.7. Mean temp.  $54^{\circ}\cdot3$ ,  $2^{\circ}\cdot3$  above the average. Solar halos on the 3rd and 4th. Lunar halos on the 2nd, 3rd, and 9th, and an aurora on the 2nd. High winds on 3 days, attaining the force of a gale on 31st. T on 1st and 24th. H and sleet on the 1st. Slightly foggy on the 3rd and 4th.

**WARINGSTOWN.**—The driest May recorded.

**EDENFEL.**—Another month of deficient rainfall, making the total since 1st January, 9.65 in., the lowest for the like period in the 31 years during which the record here extends. Temp. above the average except during the third week, but as it did not then reach freezing point, the prospects of fruit are excellent, and the foliage is most luxuriant, but the drought is seriously affecting ordinary crops.



# SYMONS'S

## MONTHLY

# METEOROLOGICAL MAGAZINE.

CCCLIV.]

JULY, 1895.

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or 5s. per ann. post free.

### THE DRYNESS OF THE FIRST HALF OF 1895.

SEVERAL correspondents have sent notes calling attention to the fact that the first six months of this year have given a total rainfall smaller than even that of 1893.

Before writing anything upon the subject, we have tried to ascertain what departure from the average might be expected during the six months.

We have already shown that three consecutive dry years may have slightly less than four-fifths of the average; that two consecutive dry years may have only three-quarters of the average, and that one driest year may have rather less than two-thirds of the average; or, writing them as percentages—

Three consecutive years.	Two consecutive years.	One driest year.
78	74	63

We know also that a month may have no rain, when, of course, the percentage is 0. Plotting these values on a curve, it seems as if for six months the least total might be expected to be about half the average, or 50 per cent.

We have tested this by the Camden Square record, which now covers 37 consecutive years.

We may premise that on the mean of 37 years the fall for the first six months averages 11·40 inches, and for the second six months 14·48 inches, or 44 and 56 per cent. respectively of the *yearly* total.

The following are the six driest first six and driest last six months, and their percentages of the mean fall for the respective six months during the whole 37 years:—

#### *Dry Six Months.*

Year.		Total Depth.	Per cent of Mean.	Year.		Total Depth.	Per cent. of Mean
		in.				in.	
JAN. to JUNE.	1870	6·90	60	JULY to DEC.	1863	10·62	73
	1874	6·93	61		1864	8·48	59
	1887	7·16	63		1874	11·89	82
	1892	8·12	71		1884	10·60	73
	1893	6·39	56		1887	12·05	83
	1895	5·48	48		1890	9·48	68

This seems to show not merely that on the average the first six months are drier than the second (as everyone knew before), but also that they are liable to greater deficiencies than the second six months. The average percentage for the six most remarkable dry periods of January to June is 60, but for the corresponding group for July to December it is 73.

Lastly—and this is the point which has led to the enquiry—January to June of 1895 comes out with a little less than half the average, and as absolutely the driest corresponding period for 37 years.

We will now give some data worked upon a shorter basis, so as to include a representative number of stations, and thus to ascertain the area over which the drought has been exceptional. We have taken stations of which we have the values for 1895 and for 1893, and the average for 1880-89; and finally, to keep the table within a reasonable size, we print only those values which show that the fall has in 1895 been less than 70 per cent. of the 1880-89 mean:—

*Relation of the total rainfall in the first six months of 1893 and 1895 to the average for the same period during 1880-1889.*

STATION.	COUNTY.	Mean 1880-9.	1893.		1895.	
			Amount.	Percent	Amount.	Percent
		in.	in.		in.	
Camden Square.....	Middlesex ..	10·76	6·40	60	5·48*	51
Abinger Hall.....	Surrey .....	12·73	8·66	68	8·16	64
Chiselhurst .....	Kent .....	9·25	6·39	69	4·98	54
Tenterden .....	„ .....	10·95	9·69	89	6·83†	62
Crowborough.....	Sussex .....	13·82	9·43	68	7·99	58
Strathfield Turgiss ..	Hants .....	10·64	8·11	76	7·14	67
Fielde's Weir .....	Herts.....	10·79	5·74	53	5·01	47
Addington .....	Bucks .....	11·57	8·21	71	6·50	56
Magdalen College.....	Oxford .....	11·50	5·92	51	6·43	56
Sheering.....	Essex.....	9·88	6·37	64	5·54	56
Barkby .....	Leicester ..	11·70	7·05	60	7·96	68

\* Driest in 37 years.

† Driest in 32 years.

From this table it appears —

- (1.) That our estimate that the fall of rain for a period of six months may fall to half the average is very near the truth.
- (2.) That the district in which the deficiency in 1895 has been greatest is slightly to the N.E. of London.

This second conclusion is corroborated by the very remarkable figures contained in the following letter, for which we are indebted to Mr. Bryan. The Fielde's Weir figures are incorporated in the

above table ; the others cannot be, because we have not the averages. The Buckhurst Hill total of 4·06 inches looks more like the summer value for the Riviera than the total for six months in "so called" rainy England.

*To the Editor of the Meteorological Magazine.*

SIR,—Herewith I beg to send you the rainfall for the six months ending 30th June at stations in the Valley of the Lea. You will observe that the rainfall is very low indeed.

Lea Bridge ... ..	4·26 in.
Ferry Lane, Walthamstow ... ..	4·49 „
Chingford Mill ... ..	4·83 „
Hagger Lane, Walthamstow ... ..	4·90 „
Buckhurst Hill ... ..	4·06 „
High Beech ... ..	4·66 „
Waltham Abbey ... ..	5·84 „
Feilde's Weir (junction of river Stort and river Lea)...	5·01 „

Yours truly,

WILLIAM B. BRYAN, M.I.C.E.

*East London Waterworks Company, Lea Bridge, July 6th, 1895.*

## A FIN DE SIÈCLE PROJECT.

*To the Editor of the Meteorological Magazine.*

SIR,—Referring to the article on Grousset's proposal, in the *Meteorological Magazine* for this month, I think that you will find that the feasibility of the scheme is evident, from what has been done at Wieliczka salt-mines, a few miles from Cracow. I copy from "*The Angelus*" for May, 1895, published in Honduras. You may be able to verify the statement ; if it is correct, the greatest depth is over two miles :—

"The system of mines extends over an area of 6 miles from east to west, and 2 miles from north to south, with underground streets, squares, &c., and over 30 miles of tramway ; the greatest depth reached about 12,000 feet. At the depth of 300 feet is St. Anthony's chapel, hewn out of the salt rock. One of the caverns, called the *great hall*, contains lustres hanging from the roof, and all the curiosities, crystals, petrifications, &c., which have been found in the mines. It is of amazing beauty, as the salt, according to its various qualities, is of different colours, greenish, dark-grey, yellow, &c. The annual output of salt exceeds 50,000 tons."—Yours faithfully,

R. STRACHAN.

11, *Offord Road, N.*, June 19th, 1895.

[We were rather startled at the depth of "12,000 feet," as that ought to give a temperature of 281° F. The only work which we can find on our own shelves which gives a description of these wonderful mines is Klöden's *Handbuch der Erdkunde*, and it agrees with *The Angelus* in all respects except—as to the depth. Our Honduras contemporary has added a 0—1,200 feet is given by Klöden and is no doubt correct.—ED.]

## A LOST OPPORTUNITY—RECORDING RAIN GAUGES.

WE are sorry to use the above heading, but it seems the only appropriate one. We have heard much of the new Brussels Observatory at Uccle, and have often had to refer to the good work done by M. Lancaster. We suppose that either the Director, M. Folie, or perhaps a committee, is responsible for the instruments provided; but with whomsoever the responsibility rests, it is apparently the case that this observatory, upon which thousands of pounds have been spent, does not possess either a recording or a storm rain gauge. We can arrive at no other conclusion, from the fact that a great thunder and rain storm broke over the observatory about noon on June 10th, of which M. Lancaster gives a description in *Ciel et Terre*, but while his remarks give a vivid word picture of the storm, the actual numerical values are but two (and they are not absolutely consistent), and there is no information whatever as to the intensity of the fall during different parts of the 35 minutes.

The storm is stated to have begun at 5 minutes after noon, and to have lasted 35 minutes; that is to say, from 0.5 p.m. to 0.40 p.m., and the fall in 35 minutes is stated to have been 60 mm. (2.36 in.), but we are told also that the fall between 1 p.m. and 3.30 p.m. was 6 mm. (0.24 in.), and that the total for the day was 66 mm. (2.60 in.). This implies that there was no rain between 0.40 p.m. and 1 p.m., but nothing in the text gives that idea.

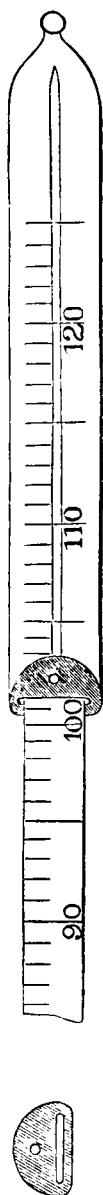
The Brussels records extend back for half-a-century, no such fall has occurred before, but every meteorologist knows that such falls will occur sooner or later. It has come, and apparently found skilled observers with no better apparatus than that put up by Quetelet more than half-a-century ago.

Brussels observatory is not alone in this unpreparedness. Greenwich Observatory has no recording rain gauge, except the antiquated one put up among the chimney pots about 1840. So with the other public observatories; Cambridge has not one, nor Bidston, nor Edinburgh (but one may be ordered for the new observatory, we do not know), nor Dublin.

On the other hand, we believe that the following Meteorological stations are already provided with one or more:—

Div. I. Camden Sq. (Private)	Div. VI. W. Bromwich Corporation
„ I. Hornsey Local Board	„ VII. Leicester „
„ II. Croydon (Private)	„ VIII. Liverpool „
„ II. Kew Observatory.	„ VIII. Stonyhurst Observatory
„ II. Eastbourne (Private)	„ VIII. Lancaster Corporation
„ II. „ Corporation	„ XIII. Edinburgh (Private)
„ III. Berkhamsted (Private)	„ XIV. Glasgow Observatory
„ III. Oxford Observatory	„ XVII. Aberdeen
„ IV. Abbey Mills (London C.C.)	„ XVIII. Fort William
„ V. Rousdon Observatory (Pvt.)	„ XX. Valentia.
„ V. Falmouth Observatory	„ XXIII. Armagh Observatory

# INDELIBLE DEGREE MARKS ON THERMOMETERS.



EVER since thermometers have been made accurately, and with the divisions engraved on the stems, there has been trouble from the black coming out of the said divisions, and when one realizes how extremely fine and shallow is the cut, in which the black has to be retained, the astonishment is, not at the fact that the black sometimes comes out, but that it ever stops in. As the result of much thought, this evil has, by the use of better materials, been largely mitigated. Some thermometers also, especially for use as "grass minima," are made on a plan which we suggested twenty years ago, and were told was impossible. We may as well mention what it was. About 50 years back, Mr. G. Leach, a very careful meteorological observer, had glass tubes made of about  $\frac{1}{4}$ -inch internal diameter, and long enough to contain the stem of a thermometer on which the divisions had been engraved and blackened; the bulb was left outside, and the tube was packed round with cork and other materials. These "Leach's shields" did partly protect the degree marks, but the joint was not air-tight, moisture condensed inside, and the divisions washed out. We suggested that the joint should be welded, and were told that unequal expansion would cause fracture—but it has been done.

Mr. Hicks, of Hatton Garden, has, however, hit upon a plan which seems to us perfect and everlasting. It seems so difficult to construct that an increased price would be necessary, but that is not the case, and if Mr. Hicks likes to supply the thermometers at

the usual price, it is not for the public to complain.

We cannot expect a description alone to be sufficient, so give a view of a broken bit of the tube and a section of the same.

The process of construction apparently is—

- (1) Prepare the thermometer stem with an enamel back and two bores, one of the usual size for the mercury or spirit,

- and the other a large flattened bore behind to contain a strip of mica.
- (2) Blow the bulb on the ordinary bore, fill with mercury or spirit, and seal that bore.
  - (3) Point off  $32^{\circ}$ ,  $52^{\circ}$ ,  $72^{\circ}$ , &c., on the front of the stem.
  - (4) Transfer these points to a prepared strip of mica, and divide and figure it as if it were the thermometer stem.
  - (5) Drop this scale into the large flattened bore, so that it agrees perfectly with the  $32^{\circ}$ ,  $52^{\circ}$ , &c., marks.
  - (6) Weld the bore, and thus hermetically seal the scale in position.

The illustration shows a broken thermometer stem with part of the mica scale projecting. The section shows the thermometric bore for the mercury or spirit, and the flattened bore for containing the mica scale.

We have carefully examined both a sound and a broken thermometer made under this patent, and as far as we can see, there is no reason why it should not be as legible a thousand years hence as in the present year of 1895.

#### ROYAL METEOROLOGICAL SOCIETY.

THE last meeting of this Society for the present session, was held on Wednesday evening, June 19th, at the Surveyors' Institution, Westminster. Mr. R. Inwards, F.R.A.S., President, in the chair.

Mr. R. H. Curtis, F.R.Met.Soc., read a paper on the "Hourly Variation of Sunshine at Seven Stations in the British Isles." The paper is based on records of the Campbell-Stokes instruments for 10 years, 1881-1890. at Aberdeen, Glasgow, Armagh, Stonyhurst, Valencia, Kew, and Falmouth.

The results are dealt with in two ways : (1) A comparison of the actual duration, irrespective of the varying length of time that the sun is above the horizon at the different stations, and (2) The relation of the duration recorded, expressed as a percentage of the possible duration.

From the fact that there is a fairly close agreement between the means for the two 5 year periods, into which the 10 years have been divided, it may be inferred that the 10-year means approximate closely to the means which a longer period would yield.

Taking first the average daily duration, Falmouth is decidedly the most sunny station of the seven, having a daily average amount of sunshine of  $4\frac{1}{2}$  hours. This amount is half-an-hour more than that recorded at Valencia, and three-quarters-of-an-hour more than at Kew. Of the other four stations, Aberdeen, the most northern but at the same time a coast station, with 3.64 hours has more than either Stonyhurst or Armagh, both inland stations ; whilst Glasgow with only 3 hours, or about a quarter of its possible amount, has the smallest record of the seven, a result to some extent due to the

nearness of the observatory to the large manufacturing works with which the City of Glasgow abounds. At Valencia, Kew, Stonyhurst and Armagh the maximum duration is reached in May, the daily mean amount varying in the order named from  $6\frac{3}{4}$  to 6 hours. At Falmouth and the Scotch stations the increase goes on to June, when the mean duration at Falmouth reaches  $7\frac{1}{2}$  hours, at Aberdeen  $6\frac{1}{4}$  hours, and at Glasgow 5·6 hours.

As might have been expected, January and December are the most sunless months of the year. At no station is there much difference between them, but the smallest mean daily duration of sunshine occurs in December at every station except Falmouth, where January is the least sunny month of the two.

Considering the distribution of sunshine throughout the day, the most prominent feature at all stations is the rapid increase in the mean hourly amount during the first few hours following sunrise and the even more rapid falling off again, just before sunset. This rapid increase in every month of the year covers two or three hours and the decrease rather less, the changes in the hourly amounts during the remainder of the day being of much smaller amplitude. This seems to be due rather to the greater extent of the lower atmosphere through which the sun's rays have to pass at those times than to greater cloudiness.

It is impossible in a short notice to describe the hourly variation but a few salient points may be mentioned. At Aberdeen, the different months show great similarity, and the most sunny hour is always at or close to noon; the hours following have a slight advantage over those preceding it.

At Glasgow, the greater amount of sunshine in the afternoon is well shown and, except in the winter, the max. occurs about 2 p.m.

At Armagh the sunniest part of the day occurs just before noon, but the variation is peculiar in several months, the max. in July occurring as early as 9 a.m.

The Stonyhurst maximum occurs at noon and 1 p.m., but varies in the different months from 11 a.m. in March and April, to 2 p.m. in July and August.

Valencia shows a fairly uniform course from sunrise to sunset, the max. occurring at noon.

At Kew, the increase and decrease in the hourly duration is very uniform, rising to 40 per cent. of the possible amount at noon and 1 p.m.

At Falmouth, the maximum is reached at 11 a.m. and is maintained till 2 p.m., the afternoon hours having rather more sun than the corresponding hours of the morning.

Mr. C. Harding thought that the smoke of the Glasgow factories mentioned in the paper is the cause of the defect of sunshine shown in the morning hours.

Mr. Bayard remarked on the flatness shown at the top of the curves of hourly variations, the lines being comparatively straight

from 10 a.m. to 3 p.m., also on the adjustment of the different patterns of instrument.

Mr. Dines suggested that the flatness of the curves is due to the fact that the instrument is a heat recorder and that, although slight obscuration would stop the record early or late, it would not do so when the altitude of the sun is considerable. He would like to see the records compared with those from photographic recorders.

Mr. Sowerby Wallis thought that, considering the effect of smoke at Glasgow and the slight interruption in the record at Armagh caused by the shadow of the anemometer, we should not at once assume that other anomalous results shown in the paper represented physical facts.

Mr. Tripp said that the Campbell instrument recorded the heat rays, the photographic the chemical rays, and asked whether there was any means of recording the light rays.

Mr. Symons believed that no other country in the world could produce such a series of records, and was proud to welcome the paper. The effect of smoke at Glasgow could not be denied, but Falmouth showed a similarity in the curve, though to a less extent. He thought the records were a function of the altitude of the sun, and would like to see the effect of this eliminated from the results.

The Hon. F. A. R. Russell would like to see the results compared with observations of direction of wind, amount of cloud and mist and haze.

Mr. Gaster said that the paper had proved the greater amount of sunshine at coast than at inland stations, but experiments were necessary as to the difference at hill and at valley stations. The direction of wind was important in relation to the effect of smoke, and a comparison of sunshine records at Kew and Greenwich showed this well.

Mr. Backhouse spoke on the daily variation of cloud as compared with sunshine.

Mr. Marriott referred to papers on the sunshine observations at Greenwich by Mr. Ellis, and at Kew by Mr. Whipple, described a method of testing the adjustment of the instrument, and spoke of the importance of height above ground.

The President spoke of the effect of wind, mist, rain, &c., on the trace burnt on the cards.

Mr. Curtis, in reply, said that the results should undoubtedly be studied not only with the physical characteristics of the station, but also with the other meteorological elements. He did not think that wind had any effect on the record, but while mist moderated the amount of burning, cloud stopped it altogether.

Mr. H. Harries, F.R.Met. Soc., read a paper on "The Frequency, Size and Distribution of Hail at Sea." The author had examined a large number of ships' logs, and gave extracts from them showing that hail has been observed in all latitudes, as far as ships go north



and south of the equator, and that seamen meet with it over wide belts on the polar side of the 35th parallel.

The Hon. F. A. R. Russell analysed the records showing that few of them described what would on land be called great hail storms, and that the majority were near shore or at least not in mid-ocean. The hour being late, the discussion was not continued.

## HISTORY OF BRITISH EARTHQUAKES.

*To the Editor of the Meteorological Magazine.*

SIR,—Many notices of British earthquakes are to be found in the *Meteorological Magazine*, perhaps more frequently in the early than in recent numbers. The subject has indeed but little direct connection with meteorology, but the training provided by the accurate reading of delicate instruments and the careful observation of the weather is precisely that which is most essential to the seismologist.

With a view to aiding in the careful observation of earthquakes and to pointing out the details most worthy of attention, I have drawn up a short paper of suggestions, a copy of which by your kind permission is inserted in this number of the *Met. Mag.*

I would also take this opportunity of mentioning that I am preparing a history of the British earthquakes of the nineteenth century, and should be very grateful for any notices of past or future shocks which your readers may be so kind as to contribute, whether derived from newspapers, private diaries, or other trustworthy sources. That such a history should even approach completeness is of course out of the question; my aim must be to reduce, as far as possible, the imperfection of our seismic record.

Yours obediently,

CHARLES DAVISON.

373, Gillott Road, Birmingham, June 17th, 1895.

## DO OVERHEAD WIRES WARD OFF LIGHTNING?

Have our cities been altogether wise in burying their electric wires? To answer this question, observations were first made in all the cities having telephone installations, and in a large number of places without such installations; and their result has been to demonstrate the fact that the network of telephone wires has diminished the violence of thunderstorms and lessened the danger from lightning. As the first statistics obtained were not free from objections, the observations were continued according to definitely limited rules. Thus there were examined 900 places, of which 340 had city telephone systems, and 560 had none. The results were favourable to the first; the ratio of injury to buildings in them to that in places without telephone systems was as 1 to 4.6. It may be objected that places without telephone systems are

usually smaller than those which possess them, and that experience has shown that danger from lightning is greater in the country than in the city. But this danger is at the greatest only about twice as large, while the above given ratio between towns with and without telephone systems shows the danger in the latter to be about five times greater. It seems to speak especially well for the protective powers of the telephone system that of a total of ninety-four buildings which were damaged by lightning in cities provided with such systems, there was only one which had a water-pipe connected with the lightning conductor. The wider problem also was investigated, whether the network of wires of the telephone system hinders or weakens the lightning discharge by gradually equalising the difference of electric potential which exists between the clouds and the earth's surface; and here the equally favourable result appeared that in the places with telephone systems an average of three lightning discharges struck the earth during each hour of storm, while in the places without telephone systems five bolts struck during the same time. The observations are not yet completed, but it should already be regarded as proved that the network of wires of a telephone system actually exerts a protecting influence against injury from atmospheric electricity.—[*Gaea (Leipsic)*.]—*Public Opinion*, April 19th, 1895.

#### TELEPHONES AND THUNDERSTORMS

Do overhead telephone wires exercise a controlling influence on the electricity of the atmosphere? That the converse occurs is evidenced only too plainly by the disturbances in telephonic communication which result from the presence or proximity of a thunderstorm. More than one instance may be recalled of a telephone wire being struck by lightning, to the detriment of the instrument and to the discomfiture of the listener. Such a case was commented upon in the *Lancet* of May 5th, 1894. But do overhead wires ward off lightning? We are indebted to the *Decorators' Gazette and Plumbers' and Gasfitters' Review* for the "fact" that the risk to buildings of being struck by lightning in places unprotected by overhead telephone wires is nearly five times greater than in places provided with a telephone system.\* An immunity of this kind cannot be considered improbable. It is to be remembered that an overhead telephone wire becomes in point of fact a lightning conductor, and in this capacity may act in two ways: (1) by equalising differences of potential, it may prevent the occurrence of the disruptive discharge; or (2) receiving a lightning charge it may carry the current to earth. With reference to the first point there can be little doubt that overhead conductors, if connected to earth, do play an important part in the distribution of atmospheric electricity. Lord Kelvin in a recent paper (read before the Philosophical Society of Glasgow) states that the difference of potential he obtained between the earth, and an insulated burning match placed nine feet above the ground, was 200 to 4,000 volts. What, then, is the result of permanently connecting by a good conductor the

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\* We think that the *Lancet* is mistaken in giving the credit to the *Decorator's Gazette* (a copy of which we have been unable to obtain) as the resemblance to the preceding quotation from the *Gaea* seems to show that the *Decorator's Gazette* has simply reproduced its facts.

earth and the atmosphere directly above it, a condition which exists in the case of single-wire telephone circuits? Such an arrangement must tend to equalise potential and prevent the accumulation of those charged masses which no doubt form the nucleus of the storm cloud. This equalisation will continue to take place in all conditions of weather. But when a storm does occur, it is obvious that the wire if struck by lightning carries the current to the point of greatest danger—viz., to the instrument and to anyone in its vicinity. Therefore, unless the strictest structural precautions be taken, such a wire becomes a source of danger rather than of safety.

To obviate this danger, every post or support for overhead wires ought to be fitted with a lightning guard, and every instrument, whether using the earth as a return or not, should be fitted with an efficient form of lightning arrester. Where the overhead wires are not connected to earth, as is the case with overhead "lighting mains" and "twin" telephone circuits, any equalising effect upon potential difference is practically lost, and any circuit connected with overhead wires of this kind must be dangerous, inasmuch as such wires become lightning conductors in all but the saving device of an earth connection. For "lighting mains" it can scarcely be doubted that the underground system is in most respects the better: (1) for obvious reasons connected with the size of the cables; (2) for the electrical reason that if carried overhead no earth connection is allowable by the Rules of the Board of Trade. For telephones the adoption of the "twin wire" system seems to bring with it the advisability of placing the wires below the surface of the ground, inasmuch as this system does away with the earth return as part of the circuit. It therefore appears that from an electrical point of view there may be in overhead wires an element both of safety and of danger. The latter will certainly predominate unless supports be protected with lightning guards and every instrument provided with an efficient "protector"—that is, with an unfailing means of carrying a strong current to earth without passing through the instrument. Is this secured in practice? Can it be secured with any certainty by even the best lightning arrester or earthing device of any description? As long as the coarse expedient of a connecting wire is necessary for the guidance of electrical energy, so long must this question of "wiring," with its safeties and its dangers, be one of great and growing interest. But it may be pointed out that if every house were fitted with an efficient form of lightning guard, a greater immunity from lightning discharges would be secured than that which at present exists with the closest network of overhead telephone wires.—*Lancet*, May, 1895.

## CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, DECEMBER, 1894.

STATIONS.  (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp	Date.									
	°		°		°	°	°	0.100	°	°	inches		
England, London .....	52.1	17 <sup>a</sup>	26.3	31	46.7	36.4	37.6	86	69.6	24.6	2.28	16	6.1
Malta.....	68.9	1 <sup>b</sup>	43.2	19	61.7	51.4	47.7	75	113.2	37.5	7.29	22	6.8
<i>Cape of Good Hope</i> ...	...	...	...	...	...	...	...	...	...	...	...	...	...
<i>Mauritius</i> .....	85.3	25	69.0	22	83.1	73.8	70.2	79	137.7	62.0	5.90	16	6.8
Calcutta.....	81.7	5	51.2	28	76.2	58.3	58.3	76	136.5	43.0	.04	1	2.2
Bombay.....	88.1	19	64.0	15	83.2	69.3	66.4	72	134.9	54.5	.01	1	1.0
Ceylon, Colombo ...	89.7	...	68.6	27	87.1	72.8	69.4	74	149.0	64.0	3.25	15	5.4
Melbourne.....	92.0	10	45.6	18	75.0	56.8	54.6	72	144.1	37.2	2.71	11	8.6
Adelaide .....	102.8	13	49.9	2	84.2	60.6	53.0	51	165.0	41.6	1.37	11	5.0
Sydney .....	90.7	15	56.2	3	76.6	64.9	59.4	65	156.2	46.7	3.03	19	5.7
Wellington .....	80.0	30	48.0	19 <sup>c</sup>	70.1	55.9	53.8	72	144.0	34.0	.82	8	3.9
Auckland .....	79.0	27	56.0	12 <sup>d</sup>	73.9	59.9	60.4	80	144.0	54.0	.20	4	4.3
Jamaica, Kingston.....	90.3	12	63.2	25	85.1	67.7	66.2	80	...	...	2.43	5	3.9
Grenada.....	86.4	24	70.2	12	82.3	72.9	70.8	73	159.0	...	7.84	24	2.8
Trinidad .....	90.0	20	68.0	<sup>e</sup>	86.9	69.8	70.5	81	169.0	66.0	3.16	14	...
Toronto .....	49.3	16	-5.0	28	37.2	23.6	25.3	79	...	-11.2	2.12	17	6.9
New Brunswick, Fredericton .....	46.9	17	-10.2	10	31.2	10.3	17.7	65	...	...	2.73	15	5.1
Manitoba, Winnipeg ...	37.4	19	-24.5	27	23.7	5.4	...	...	...	...	.55	10	4.9
British Columbia, Esquimalt .....	47.7	11	28.2	28	42.0	34.1	36.9	93	...	...	1.66	17	6.0

a—and 18. b—and 5. c—and 20, 28. d—and 14. e—Various.

## REMARKS.

MALTA.—Adopted mean temp. (55°·8), 0°·5 below the average. Mean hourly velocity of wind 11·6 miles. Thunderstorms on 8 days, and lightning on 5 other days. Hail on 3 days. Dew point temp. ranged between 56°·6 on the 6th and 36°·0 on the 18th.

J. F. DOBSON.

Mauritius.—Mean temp. of air 0°·6 above, dew point 2°·2 above, and rainfall .79 in. above, their respective averages. Mean hourly velocity of wind 12·0 miles, or 1·1 mile above the average; extremes, 30·3 on 17th and 0·0 on 3rd; prevailing direction, E.S.E. to E. by N. Thunder and lightning on 1st, 4th, 5th and 27th, and thunder on 7th and 13th.

C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms occurred on the 1st, 2nd, 3rd, 5th and 6th, and lightning was seen on the 4th and 18th.

D. G. MANTELL.

Adelaide.—Mean temp. 1°·4 above, and rainfall .54 in. above, the average of 37 years. Weather generally hot, and general and heavy rains setting in after Christmas Day, especially heavy in pasture districts E. and N.E. of Lake Eyre. C. TODD, F.R.S.

Sydney.—Mean temp. 1°·1 above, humidity 4·7 below, and rainfall .44 in. above, their respective averages.

H. C. RUSSELL, F.R.S.

Wellington.—Prevailing wind N.W. and strong in the early part of the month. Generally fine pleasant weather. Mean temp. 2°·2 above, and rainfall 3·12 in. below, their respective averages.

R. B. GORE.

Auckland.—Remarkable for its extreme dryness, the total rain for the month being only .20 in., the average of 27 years being 2·78 in. Mean temperature much above the average.

T. F. CHEESEMAN.

JAMAICA, KINGSTON.—Generally fine. Northers from 16th to 20th and on 29th. Rainfall above the average. Mean hourly velocity of wind 3·7 miles. R. JOHNSTONE.

TRINIDAD.—Rainfall 1·65 in. below the average of 30 years.

J. H. HART.

# SUPPLEMENTARY TABLE OF RAINFALL, JUNE, 1895.

[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.			
II.	Dorking, Abinger Hall.	·37	XI.	Lake Vyrnwy .....	1·31
"	Birchington, Thor .....	·75	"	Corwen, Rhug .....	·56
"	Hailsham .....	·66	"	Carnarvon, Cocksidia ...	·69
"	Ryde, Thornbrough .....	·96	"	I. of Man, Douglas .....	·91
"	Emsworth, Redlands ...	·74	XII.	Stoneykirk, Ardwell Ho.	1·40
"	Alton, Ashdell .....	·54	"	New Galloway, Glenlee	·76
III.	Oxford, Magdalen Col...	·73	"	Melrose, Abbey Gate	1·95
"	Babury, Bloxham .....	·88	XIII.	N. Esk Res. [Penicuik]	1·40
"	Northampton, Sedgebrook	·61	"	Edinburgh, Blacket Pl.	2·88
"	Alconbury .....	·53	XIV.	Glasgow, Queen's Park.	1·68
"	Wisbech, Bank House..	1·25	XV.	Inverary, Newtown .....	2·86
IV.	Southend .....	·19	"	Islay, Gruinart School..	...
"	Harlow, Sheering ...	·16	XVI.	Dollar .....	2·45
"	Colchester, Lexden .....	·24	"	Balquhiddy, Stronvar.	2·42
"	Rendlesham Hall .....	·36	"	Balhulig .....	1·72
"	Diss .....	·55	"	Dalnaspidal H.R.S. ...	2·57
"	Swaffham .....	1·78	XVII.	Keith H.R.S. ....	5·25
V.	Salisbury, Alderbury ...	1·37	"	Forres H.R.S. ....	3·66
"	Bishop's Cannings .....	·95	XVIII.	Fearn, Lower Pitkerrie.	3·51
"	Blanford, Whatcombe.	1·40	"	Loch Shiel, Glenaladale	...
"	Ashburton, Holne Vic...	1·65	"	N. Uist, Loch Maddy ...	2·56
"	Okehampton, Oaklands.	1·10	"	Invergarry .....	2·05
"	Hartland Abbey .....	1·75	"	Aviemore H.R.S. ....	2·73
"	Lynmouth, Glenthorne.	1·19	"	Loch Ness, Drumadrochit	4·94
"	Probus, Lamellyn .....	1·54	XIX.	Invershin .....	2·29
"	Wellington, Sunnyside..	1·40	"	Scourie .....	1·92
"	Wincanton, Stowell Rec	1·00	"	Watten H.R.S. ....	2·46
VI.	Clifton, Pembroke Road	·82	XX.	Dunmawway, Coolkelure	2·75
"	Ross The Graig .....	·93	"	Fermoy, Gas Works ...	3·59
"	Wem, Clive Vicarage ...	·89	"	Killarney, Woodlawn ...	2·97
"	Cheadle, The Heath Ho.	1·20	"	Caher, Duneske .....	2·18
"	Worcester, Diglis Lock	3·60	"	Ballingarry, Hazelfort..	1·12
"	Coventry, Coundon .....	1·23	"	Limerick, Kilcornan ...	1·25
VII.	Ketton Hall [Stainford]	1·24	"	Ennis .....	...
"	Grantham, Stainby .....	·72	"	Miltown Malbay .....	1·59
"	Horncastle, Bucknall ...	1·68	XXI.	Gorey, Courtown House	3·35
"	Worksop, Hodgek Priory	1·98	"	Athlone, Twyford .....	·90
VIII.	Neston, Hinderton .....	1·63	"	Mullingar, Belvedere ...	2·34
"	Preston, Haighton ...	...	"	Loughford, Currygrane..	1·18
"	Broughton-in-Furness..	1·59	XXII.	Woodlawn .....	1·17
IX.	Ripon, Mickley .....	3·22	"	Crossmolina, Enniscoe..	1·39
"	Melmerby, Boldershy ...	3·49	"	Collooney, Markree Obs.	1·62
"	Scarborough, South Cliff	2·68	"	Ballinamore, Lawderdale	1·32
"	Middleton, Mickleton..	1·44	XXIII.	Lough Sheelin, Arley ..	1·69
X.	Haltwhistle, Unthank..	1·56	"	Warrenpoint .....	2·33
"	Bamburgh .....	1·51	"	Seaford .....	1·50
"	Keswick, The Beches...	1·01	"	Belfast, Springfield ...	2·81
XI.	Llanfrechfa Grange .....	1·49	"	Bushmills, Dundarave...	2·29
"	Llandoverly .....	·78	"	Stewartstown .....	2·33
"	Castle Malgwyn .....	·69	"	Buncrana .....	2·23
"	Builth, Abergwessin Vic.	1·23	"	Lough Swilly, Carrablagh	2·73
"	Rhayader, Nantgwillt..	1·00			

JUNE, 1895.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.						Days on which 1/10 or more fell.	TEMPERATURE.						No. of Night below 32°.	
		Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours		Deg.	Date		Deg.	Date	Deg.	Date				
				Dpth	Date											
													inches.	inches.	in.	
I.	London (Camden Square) ...	·30	- 1·71	·20	18	4	83·9	23	42·2	15	0	0				
II.	Maidstone (Hunton Court)...	·19	- 1·43	·15	30	5	...	...	...	...	...	...				
III.	Strathfield Turgiss .....	·66	- 1·14	·28	28	10	83·3	9	34·8	15	0	4				
IV.	Hitchin .....	...	...	...	...	...	...	...	...	...	...	...				
V.	Winslow (Addington) .....	·32	- 1·54	·18	28	5	80·0	26	35·0	15	0	1				
VI.	Bury St. Edmunds (Westley) ..	·52	- 1·27	·10	1 <sup>a</sup>	8	75·0	23	39·0	15	0	...				
VII.	Norwich (Brundall) .....	·85	...	·40	27	10	79·0	23	37·7	15	0	2				
VIII.	Weymouth (Langton Herring) ..	2·00	- 23	1·03	28	9	77·0	8	44·0	15	0	...				
IX.	Torquay (Cary Green) ...	1·10	- ...	·50	28	8	77·0	8	43·0	16	0	0				
X.	Polapit Tamar [Launceston]..	1·55	- 66	·49	30	8	80·0	24	31·0	16	0	2				
XI.	Stroud (Upfield) .....	·67	- 1·72	·25	29	8	83·0	25	46·0	15	0	...				
XII.	Church Stretton (Woolstaston) ..	·73	- 1·82	·27	26	5	82·0	25	39·0	15	0	1				
XIII.	Tenbury (Orleton) .....	·85	- 1·76	·56	1	7	83·0	25	33·2	15	0	5				
XIV.	Leicester (Barkby) .....	·71	- 1·64	·23	30	9	86·5	26	29·5	14	2	6				
XV.	Boston .....	1·17	- 72	·34	26	7	90·0	26	35·0	15	0	...				
XVI.	Hesley Hall [Tickhill] .....	1·95	+ 03	·65	26	10	86·0	26	34·0	15	0	...				
XVII.	Manchester (Plymouth Grove) ..	3·05	+ 40	·94	28	10	86·0	26	31·0	14	0	1				
XVIII.	Wetherby (Ribston Hall) ..	2·17	+ 28	·78	2 <sup>b</sup>	6	...	...	...	...	...	...				
XIX.	Skipton (Arncliffe) .....	2·38	- 98	·67	1	11	...	...	...	...	...	...				
XX.	Hull (Pearson Park) .....	2·49	+ 74	·87	26	9	79·0	26	34·0	15	0	...				
XXI.	Newcastle (Town Moor) .....	3·04	+ 1·40	·82	26	13	...	...	...	...	...	...				
XXII.	Borrowdale (Seathwaite) .....	3·18	- 3·40	·77	1	10	...	...	...	...	...	...				
XXIII.	Cardiff (Ely) .....	1·63	- 80	·39	1	9	...	...	...	...	...	...				
XXIV.	Haverfordwest .....	1·23	- 1·33	·49	30	9	80·3	25	34·2	16	0	6				
XXV.	Aberystwith (Gogerddan) ..	·89	...	·30	29	6	80·0	7	...	...	...	...				
XXVI.	Llandudno .....	·89	- 88	·35	1	9	77·4	26	42·5	15	0	...				
XXVII.	Cargen [Dumfries] .....	...	...	...	...	...	...	...	...	...	...	...				
XXVIII.	Jedburgh (Sunnyside) .....	1·04	- 70	·36	17 <sup>c</sup>	10	82·0	25 <sup>d</sup>	32·0	13 <sup>e</sup>	2	...				
XXIX.	Colmonell .....	1·23	...	·28	28	7	83·0	25	32·0	12 <sup>e</sup>	2	...				
XXX.	Lochgilthead (Kilmory) .....	2·00	- 1·10	·62	26	14	...	...	32·0	12	1	...				
XXXI.	Mull (Quinish) .....	·77	- 2·52	·28	17	13	...	...	...	...	...	...				
XXXII.	Loch Leven Sluices .....	1·20	- 55	·40	18	7	...	...	...	...	...	...				
XXXIII.	Dundee (Eastern Necropolis) ..	1·62	+ 15	·60	17	11	78·9	8	36·3	13	0	...				
XXXIV.	Braemar .....	2·67	+ 68	·87	18	15	77·4	7	34·4	13	0	4				
XXXV.	Aberdeen (Cranford) .....	2·34	...	·70	17	14	74·0	22	35·0	12	0	...				
XXXVI.	Strathconan [Beaulj] .....	5·71	+ 3·22	1·73	18	7	...	...	...	...	...	...				
XXXVII.	Glencarron Lodge .....	4·52	...	1·00	17	20	76·0	25	35·9	14	0	...				
XXXVIII.	Cawdor [Nairn] .....	4·34	+ 2·94	1·11	17	18	...	...	...	...	...	...				
XXXIX.	Dunrobin .....	2·75	- 73	·72	17	16	68·8	8	36·5	12	0	...				
XL.	S. Ronaldsay (Roeberry) .....	2·02	+ 26	·31	3	18	67·0	6	40·0	11 <sup>e</sup>	0	...				
XLI.	Darrynane Abbey .....	1·81	...	·52	30	7	...	...	...	...	...	...				
XLII.	Waterford (Brook Lodge) ..	...	...	...	...	...	...	...	...	...	...	...				
XLIII.	O'Briensbridge (Ross) .....	1·07	...	·36	27	6	...	...	...	...	...	...				
XLIV.	Carlow (Browne's Hill) .....	2·85	+ 1·01	·78	30	9	...	...	...	...	...	...				
XLV.	Dublin (Fitz William Square) ..	1·87	+ 21	·64	30	12	77·6	26	42·3	15	0	0				
XLVI.	Ballinasloe .....	·97	- 1·33	·33	30	7	79·0	24	30·0	13	2	...				
XLVII.	Clifden (Kylemore) .....	2·23	...	·60	30	13	...	...	...	...	...	...				
XLVIII.	Waringstown .....	1·76	- 31	·40	3	12	85·0	25 <sup>d</sup>	35·0	15	0	3				
XLIX.	Londonderry (Creggan Res.) ..	2·08	- 34	·31	20	18	...	...	...	...	...	...				
L.	Omagh (Edenfel) .....	1·21	- 1·26	·30	18	12	82·0	24	30·0	12	2	3				

a And 11, 18. b And 27. c And 28. d And 26. e And 13, 15.

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

# METEOROLOGICAL NOTES ON JUNE, 1895.

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.

STRATHFIELD TURGISS.—The month opened with unsettled weather and cloudy, but soon became fine and very dry. TSS occurred around this station, but did not develop here. The end of the month was showery and unsettled. On the 13th, 15th, 16th and 17th there was frost upon the grass.

ADDINGTON.—The least R on record for the month of June. The fall of the first six months of the year, 6·50 in. on 63 days, is also, with the exception of 1892, when only 6·40 in. fell on 73 days, the least recorded. On the 26th a very sharp TS occurred one mile to the N. of us, but no R fell here. Again on the evening of the 29th heavy R fell in the same locality, but none here. On the morning of the 15th slight frost on grass occurred, enough to blacken potatoes in low situations.

BURY ST. EDMUNDS, WESTLEY.—A month of great drought; the R fell in such small quantities that it dried up in a very short time. We have suffered more than in 1893, and the agricultural look-out is very bad. On the 26th, a short distance from here, a good R fell, and the TS on that night was most grand.

NORWICH, BRUNDALL.—A very dry month and many warm days. Mean temp. about the average. R one inch below the average. T on 1st, 12th, 13th, and 20th; T and L on 14th and 27th; L on 26th.

LANGTON HERRING.—On the whole a fine, bright, sunny month, very favourable for securing the hay. Mean temp. at 9 a.m., 61°·4, which is 1°·1 above the average of 23 years. Fog on the 22nd, but no T or L. The average reading of the bar. was the highest in June in 14 years.

TORQUAY, CARY GREEN.—Rainfall 1·28 in. below the average; Mean temp. 59°·6 or 1°·8 above the average; duration of sunshine, 273 hours 5 min., being 40 hours 30 min. above the average; no sunless day.

POLAPIT TAMAR.—A very hot, dry and calm month. The average max. shade temp. for the month is as high as 68°·8. The total R for the first six months of 1895 is only 11·54 in., being 2·96 in. under the average.

STROUD, UPFIELD.—T from 11 a.m. to 6 p.m., and a few flashes of L, on the 26th; the storm came from the S. and went to the E. On the 29th a flash of L and heavy peal of T about 5 p.m.

WOOLSTASTON.—A very hot and dry month, R falling on five days only. A severe storm of T and L occurred on 26th. Mean temp. 58°·6.

TENBURY, ORLETON.—A very fine, hot, dry month, the hottest June since 1870, and with the exception of June, 1889, the driest in the same time. Mean temp. was 2°·8 above the average. Sharp frosts on five mornings, the one on the 15th doing considerable damage to potatoes, &c. Great TS all round on the 26th, but no R here; T and L also on 29th. Fog on 1st and 3rd.

LEICESTER, BARKBY.—A very dry month, hay crops deficient. Mean temp. 58°·6. T on 12th, 26th, 27th and 30th.

HESLEY HALL [TICKHILL].—Severe TSS on 26th and 27th, and heavy T on 30th.

MANCHESTER, PLYMOUTH GROVE.—Summer weather from 7th to 10th; from 11th to 17th cold and unsettled, the temp. on grass falling to 29° on 15th. Fine summer weather from 19th to 25th. On the 26th a violent TS, the L being very vivid and frequent; T and L also on 27th, with showers, and a violent TS, with torrents of R, on 28th; T and L again on 29th, and T and showers on 30th. Mean temp. 58°·5.

## WALES.

HAVERFORDWEST.—There were six minima on grass below 32°, and 26° was recorded on the 16th, which committed sad havoc among the potatoes and

French beans; ash leaves were blighted as if by fire, and the young ferns were more or less destroyed. There has been no such frost in June in living memory in this locality. From the 25th to the end small quantities of R fell, but during the rest of the month almost absolute drought prevailed, with bright sunshine and high day temp. Straw will be very short, and in many localities green crops never came up. Prevailing wind E.N.E. and N.W.

GOGERDDAN.—Bright sunshine throughout, with N.W. and N.E. winds. Frosty mornings in the third week of the month.

#### SCOTLAND.

JEDBURGH.—The first half of the month was very dry and pastures and vegetation were much affected and hay is a light crop. Cereals looked well after the R in the last week but the straw will be short. T and L on 17th.

COLMONELL.—Rainfall 1·53 in. below the average of 19 years. T and L on the 26th, distant T on 29th.

MULL, QUINISH.—T on 29th. A dry hot month and crops suffered much from want of rain.

BRAEMAR.—T and L from 2 p.m. to 4 p.m. on 19th and from 3 p.m. to 8 p.m. on 26th.

ABERDEEN, CRANFORD.—The early part of the month was very dry. Vegetation stagnant in light soils.

CAWDOR [NAIRN].—Sharp TS and heavy H on 26th. Heavy showers and T on 29th and 30th.

ROEBERRY.—The first and latter parts of the month were fine, a cold snap occurring from the 9th to the 19th. On the evening of the 26th the heaviest TS experienced for many years occurred. Mean max. in shade  $57^{\circ}9$ ; mean min.  $46^{\circ}7$ .

#### IRELAND.

DARRYNANE ABBEY.—A very fine and very hot month, the middle being particularly hot and bright.

O'BRIENSBRIDGE, ROSS.—A splendid month with much brilliant sunshine. Some welcome R at the close. Distant T on 28th and 29th.

DUBLIN.—This was an exceptionally favourable month. Fair and quiet weather held until the 26th, hot sunshine by day being often succeeded by calm cold nights especially about the 13th. From the 26th to the close violent electrical disturbances took place and R fell in abundance. Mean temp.  $59^{\circ}2$  or  $1^{\circ}4$  above the average. High winds were noted on only 4 days and the force of a gale was never attained. Temp. reached or exceeded  $70^{\circ}$  in the screen on 7 days. H fell on the 12th and 29th. Solar halos were observed on the 3rd, 8th, 11th, 13th and 23rd. TSS occurred on the 26th, 29th and 30th.

WARINGSTOWN.—The rainfall of the last week did much good, but previous to that the state of the country was very critical.

EDENFEL.—With a continuance of deficient rainfall the month was most variable as to temp. the calm, hot and clear weather of the first week having given place on the 9th to a cold spell culminating on the 13th in a temp. of  $30^{\circ}$  in the screen and  $25^{\circ}$  on the grass and on the 15th of  $31^{\circ}$  and  $27^{\circ}$  respectively, the severest June frost ever recorded here. Potatoes and all tender plants in low situations were killed to the earth and the foliage of horse chestnut, rhododendron and laurel completely destroyed. With somewhat unsettled conditions a hot spell recurred during the fourth week followed by T, L, H and R.



# SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

CCCLV.]

AUGUST, 1895.

[PRICE FOURPENCE,  
or 5s. per ann. post free.]

## THE RAINFALL OF BELGIUM.\*

OUR continental friends excel in drawing up programmes. The young and vigorous Geological Society of Belgium has not merely decided that Hydrology comes within its purview, but has drawn up a programme for the hydrological section of the Society, which seems to us well worthy of translation and publication as a type of what ought to be done.

- (1) To determine how and in what quantities the rain falls over the country.
- (2) What proportion runs off the surface, and how much penetrates?
- (3) What becomes of the water that penetrates, how does it circulate, how does it accumulate in water-bearing strata, of large or small area, free or under pressure?
- (4) What improvements, changes, or deteriorations can the water undergo in its course through the soil?
- (5) How, in what quantities, and with what qualities more or less variable according to climatic or other influences, will it come out of the soil and return to the surface. What are the volumes and characters of the springs, brooks and rivers thus produced?
- (6) What supplies either above or below ground feed the principal rivers?
- (7) What has been the history of the modifications and changes in river waters in the past, how are they now used, and how could they be improved?
- (8) What are the origin, volume, properties, and variations of the mineral waters, and for what are they useful, either in medicine or for trade purposes?

This is a grand programme, and we may all wish the society the power and the patience necessary for its complete fulfilment.

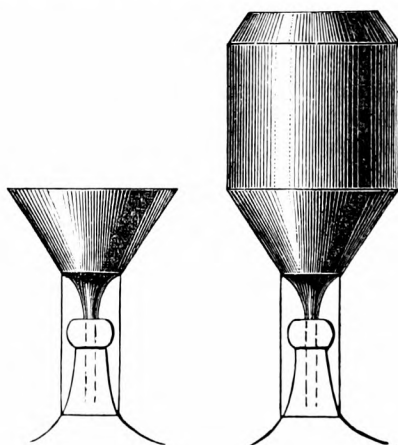
\* *La Pluie en Belgique*, par A. Lancaster, Météorologiste-inspecteur à l'Observatoire royal, Membre-correspondant de l'Académie des Sciences. Premier Fascicule [Publication de la Société Belge de Géologie, de Paléontologie, et d'Hydrologie], Hayez, Bruxelles, 1894. 8vo, 224 pages, one plate and one large map.

It has certainly begun well. Acting on the well known principle, that if you want a heavy task well done you should give it to the busiest man that you know, the society asked M. Lancaster to deal with the first item. All that has yet been issued is now before us, and though this deals with only one part of the first item, it is quite sufficient to show that M. Lancaster is going to make it as good as is reasonably possible, and a very interesting work.

This first portion of the work consists of four sections :—

- (1) The monthly fall at each station (arranged alphabetically) up to 1890 with the means for each month, and a few particulars as to the position of the gauges. We wish that these could have given more details—we miss any reference to the pattern or size of rain gauge, and (with few exceptions) to the height of the receiving surface above the ground. Another feature which we do not understand is the reason for sometimes placing the records together, as at Alost on page 3, and Anvers on page 7, and sometimes separating them, as at Bruxelles on page 21 and page 22.

With reference to the Brussels observations, we are much surprised to read, “Deux pluviomètres conjugués, ayant même ouverture rectangulaire (20 centimètres sur 10) ont constamment servi aux observations.” We think that M. Lancaster will find that the Brussels’ record, like many others, requires breaking up. If he will refer to Quetelet’s *Météorologie de la Belgique*, 1867, p. 140, he will find that the gauges then in use were of the pattern shown in the following engraving, and he will, we think, find in the



foot note an indication of the origin of the rectangular gauges. It is to us a cause both of surprise and of regret that so distinguished a meteorologist as Quetelet should have made this change in the mode of observation without

(as far as appears) having established a series of observations so as to ensure the continuity of the record.

We are afraid that the effect of this change has been serious, and that the Brussels record cannot be trusted as any guide to secular change, because we find that there is a considerable increase in the mean fall after about 1867. We have taken out the mean fall for fifty years, and the means are as under :—

1840-9. 28·35	1850-9. 27·88	1860-9. 27·99	1870-9. 30·28	1880-9. 30·04
28·07			30·16	

If we assume that the change was made in 1867 (the date of publication of the work above quoted) and take the means in two groups, we have—

Before (1833-66). 27·68 in.	After (1867-90). 30·39
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It is impossible to say how much of this difference is due to change of pattern of gauge and how much to secular variation, but a change of 50 mm. in the means for such long periods as 30 and 20 years is at least ground for very close investigation.

- (2) This gives the details for the years 1891 and 1892 which had been received before the printing of the earlier years had been completed, and therefore are given so as to strengthen the data on which the calculations and the map are based.
- (3) This section may be described as the commencement of the text—it is entitled “Geographical distribution of rain in Belgium,” and consists of an explanation of the mode of calculation employed, tabular statements as to the monthly seasonal and annual rainfall at 283 stations, and a general summary of the results graphically shown on the coloured map.
- (4) The map is printed upon an index sheet to the Government maps, and is a handsome one about 3 feet by 2 feet, being on the scale of  $\frac{1}{400,000}$ , or about  $6\frac{1}{2}$  miles to an inch, with twelve degrees of intensity of blue colouring, one for each increase of 100 mm. (4 inches) of rain, so that all the features of the distribution are shown with great clearness. The map has several very good features—for instance, no place names are put upon the map except where observations have been made, and the place names are made to indicate the duration of the observations, thus—

Less than 5 years	...	Leuze.
Five to 10 „	...	Uccle.
Ten to 15 „	...	HEYST.
More than 15 years	...	ALOST.

As regards the distribution, those interested should procure a copy

of this valuable work, we can here indicate only the principal characteristics, viz. : a rainfall of between 20 and 30 inches over the W. and N. of the country, and from 30 to 40 inches over the whole of the S.E., exceeding 40 inches in the Ardennes and in two districts, one (the wettest of all) a few miles S.E. of Verviers, where we find Hockai, at an altitude of 1,762 feet, with a mean rainfall of 52·36 inches, and the other at Paliseul in the Ardennes with a fall of 48·03 inches, at 1,348 feet.

M. Lancaster rightly calls attention to the anomaly that, whereas in the British Isles it is the western shores on which the rainfall is large, it is exactly the reverse in Belgium. The matter must be further investigated, and it may prove to add one more to the many climatic features of Western Europe which are dependent on the course of the Gulf stream.

We congratulate the Geological Society of Belgium and M. Lancaster on the successful completion of the first instalment of their work.

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## AQUEOUS VAPOUR AND TEMPERATURE.

*To the Editor of the Meteorological Magazine.*

SIR,—The tables below give the result of an investigation I have been making, with the object of determining the effect of the aqueous vapour in the air on the range of temperature, in this part of the world. The method first adopted was to determine the dew-point at 8 p.m., by means of the wet and dry bulb thermometers and Glaisher's tables; against this, placing the fall in air temperature from 8 p.m. to the succeeding minimum. This was done for every absolutely clear night in the year ending June 30th, 1895, neglecting even those nights showing a trace of cloud on the horizon. The various dew-points were then arranged in a horizontal row, every corresponding fall of temperature placed in vertical columns below, and the average taken. The result is shown in Table 1. Col. 1 shows the dew points arranged in order from 26° and under to 58° and over; col. 2 shows the number of clear nights on which the respective dew-points occurred; col. 3 shows the range of fall, *i.e.*, the least and greatest falls observed corresponding to any given dew-point; col. 4 the average. To all appearance the result establishes nothing in particular. At the least it gives no support to the results arrived at by Tyndall in experimenting on the absorption of heat by aqueous vapour. [*Heat, a Mode of Motion.* Lect. xiii.]

The relative humidities were next tried in the same way, and apparently with better success. Table II. is the result. Col. 1 shows the various humidity-ratios arranged in order from 25 per cent. and under to 80 per cent. and over; cols. 2, 3, 4, as before; col. 5 shows the averages arranged in sets, 30 per cent. and under, 30 per cent. to 40 per cent., 40 per cent. to 50 per cent., and so on.

TABLE 1.

Dew-point at 8 p.m.	No. of times Observed.	Range of Fall.	Average fall of Temp. to Min.
Degrees.		Degrees.	Deg.
26 & under .....	7	8 to 19	13.4
26 to 27.9 .....	10	8 „ 18	13.7
28 „ 29.9 .....	9	9 „ 20	13.4
30 „ 31.9 .....	12	6 „ 17½	11.5
32 „ 33.9 .....	10	11 „ 19	14.7
34 „ 35.9 .....	15	9½ „ 25	16.2
36 „ 37.9 .....	16	8 „ 22	15.3
38 „ 39.9 .....	19	7 „ 26	17.3
40 „ 41.9 .....	14	9 „ 28	17.5
42 „ 43.9 .....	11	9 „ 25¼	15.4
44 „ 45.9 .....	8	6¾ „ 18	13.6
46 „ 47.9 .....	13	11½ „ 24	14.5
48 „ 49.9 .....	11	10½ „ 19	14.5
50 „ 51.9 .....	5	10 „ 13	11.0
52 „ 53.9 .....	7	4¾ „ 21	13.4
54 „ 55.9 .....	6	4½ „ 16	10.7
56 „ 57.9 .....	1	...	9.5
58 & over .....	1	...	12.0

TABLE II.

Humidity at 8 p.m.	No. of times Observed.	Range of Fall.	Average fall of Temp. to Min.	Grouped Averages.
Per cent.		Degrees.	Deg.	Deg.
25 & under.....	5	14 to 21	18.2	18.4
26 to 27.....	4	13 „ 21	19.0	
28 „ 29.....	3	13 „ 24	18.0	
30 „ 31.....	4	18 „ 25	21.2	
32 „ 33.....	5	16 „ 26	20.0	18.6
34 „ 35.....	5	15 „ 20	17.6	
36 „ 37.....	5	10 „ 28	18.4	
38 „ 39.....	11	10 „ 23	17.7	
40 „ 41.....	3	14 „ 18	16.0	15.9
42 „ 43.....	12	11 „ 25	14.8	
44 „ 45.....	12	6 „ 22	16.4	
46 „ 47.....	4	14 „ 19	16.2	
48 „ 49.....	6	11 „ 25	16.5	13.6
50 „ 51.....	7	12 „ 24	15.2	
52 „ 53.....	8	10 „ 20	13.5	
54 „ 55.....	13	9 „ 21	14.0	
56 „ 57.....	5	10 „ 18	14.2	12.9
58 „ 59.....	12	7 „ 18	12.0	
60 „ 61.....	6	8 „ 16	12.3	
62 „ 63.....	11	8 „ 19	13.9	
64 „ 65.....	7	5 „ 18	12.1	11.6
66 „ 67.....	6	11 „ 16	13.5	
68 „ 69.....	3	7 „ 13	10.3	
70 „ 71.....	4	8 „ 15	12.5	
72 „ 73.....	1	...	11.0	9.0
74 „ 75.....	1	...	12.0	
76 „ 77.....	2	9 „ 11	10.0	
78 „ 79.....	5	10 „ 13	11.6	
80 & over .....	5	4½ „ 12	9.0	

TABLE III.

Month.		Range.	Diff. between Max. and Min.	Number of Clear Nights.	Percentage of Sunshine.
		Deg.	Deg.		Per cent.
July,	1894 .....	56	35½	20	85
August	„ .....	52	34	23	82
September	„ .....	56	34	11	80
October	„ .....	59½	35½	15	71
November	„ .....	57½	35	14	80
December	„ .....	51	32	12	73
January,	1895 .....	47½	32	10	76
February	„ .....	45	29	10	70
March	„ .....	47	26	9	60
April	„ .....	50	27	14	68
May	„ .....	58	30	18	83
June	„ .....	50	33	19	88

Here a very marked progression is evident, and granting the method of procedure to be trustworthy, it follows that the relative amount, rather than the absolute amount of water vapour, is the important factor in determining the energy of radiation here.

The matter may be summed up thus :—Given an air-temperature  $x$ , a corresponding dew-point  $y$ , with a humidity-ratio  $z$ . Also another air-temperature  $x^1$ , a corresponding dew-point  $y^1$ , with a humidity-ratio  $z^1$ . Let  $y^1$  be greater than  $y$ ; but  $z$  greater than  $z^1$ . Then according to Tyndall the fall of temperature following upon  $y$  will be greater than that following upon  $y^1$ , and moreover will be independent of  $x$  and  $z$ ; whereas the figures here given seem to show that the fall of temperature in this case will be the other way about—since  $z$  is greater than  $z^1$ ; in other words that the energy of radiation is independent of  $x$  and  $y$ , and varies as  $z$ .

There is one weak spot, at any rate, in my results : *e.g.*, the nights are not, of course, of the same length in summer and in winter. But on the other hand, the average humidity is higher in the winter, and assuming that, other things being equal, the total fall of temperature will be greater the longer the time given for it to take place in, it is clear that if the summer nights could be lengthened we should have a greater fall of temperature (corresponding to a low humidity-ratio) than is actually shown.

I hope later on to go into this matter somewhat more accurately and closely with a series of hourly observations, meanwhile this may be taken for what it is worth.

To make the investigation complete, it seems necessary to determine whether, under given conditions as to quantity of moisture, pressure, and wind, the fall of temperature will vary with its magnitude: for example, given a vapour tension of .5 inch, a barometric pressure of 26.200 inches, and a N. wind, at 8 p.m.—

will the temperature fall more rapidly from, say,  $70^{\circ}$  to  $60^{\circ}$ , than from  $50^{\circ}$  to  $40^{\circ}$ . This I am undertaking. But it ought to take some years to finish satisfactorily.

Table III. is designed to explain any small points which may arise out of Tables I. and II. Col. 1 is the month; col. 2 gives the total range of temperature in any month; col. 3 gives the difference between mean maximum and mean minimum; col. 4 the number of clear nights; col. 5 the approximate percentage of sunshine to the greatest amount possible.

The two hygrometers made use of are in a large louver-boarded screen, with their bulbs three feet above the ground. Long.,  $24^{\circ} 27' E.$ ; lat.,  $28^{\circ} 42' S.$ , approximately 3,900 feet above sea-level.

J. R. SUTTON, B.A. Cantab.

*The Kenilworth Observatory, Kimberley, South Africa, July 12th, 1895.*

[It is extremely satisfactory to find that accurate records are being kept at a locality of the climate of which so few data exist.—ED.]

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## A WHIRLWIND IN LA HAUTE-MARNE.

WE translate the following from a recent French newspaper because we wish to know whether any further details can be obtained respecting the fall of the barometer. We believe that when a whirlwind passes over a barometer, the latter (if of a kind capable of recording a sudden depression—which many are not) will give a record which will, to many persons, be a great surprise. A Richard barograph (of which there are many thousands now at work) ought to give such a record; but the difficulty is to secure one that shall be exactly in the centre of the track, and yet not be damaged by the storm. We call particular attention to the line printed in *italics*.

CHAUMONT,

*July 30th, 1895, 4 p.m.*

The news from the region devastated by the cyclone is most distressing, the disaster is greater than had been supposed. The cyclone ravaged the Canton of Poissons and afterwards entered the department of la Meuse near Gondrecourt.

Throughout its course all the crops were destroyed by the hail, though it lasted only 10 minutes. Trees were broken or torn up, and houses unroofed. At Champcourt, the church tower was overthrown, and the church thereby damaged.

*The barometer fell suddenly from 760 mm. to 750 mm. (29.92 in. to 29.53 in.)*

Happily no personal injury is reported. The sous-préfet of Wassy (on the 29th) visited the localities in the valley of the Blaise which seem to have suffered most severely.

## REVIEWS.

*Pubblicazioni della Specola Vaticana.* Volume IV. Turin, 1894.  
4to. xxvii.-620 pages, 42 photographic and other plates.

THIS sumptuous volume maintains in appearance the high level of merit which the series has taken from the very first, and of which we have already spoken.\*

We think that we may claim credit for having suggested the first article. In connection with Mr. Wood's translation of Theophrastus we heard of a "Table of the winds" in the Museo Pio Clementino; we wrote to Padre Denza; with characteristic promptitude and kindness he found it, had it photographed and sent us both photographs and casts of it—but a photograph and several pages of comments are given in Theophrastus,† so we need not repeat the story here. Suffice it to say that we are glad to see the photograph again in this volume, accompanying a short memoir upon it by Padre Giuseppe Lais. The memoir does not profess to be an exhaustive discussion of the nomenclature of the winds, and excellent as was Mr. Wood's note upon the subject, we think that the last word has not yet been said. Padre Lais refers to papers by D'Averache, Gosselin and Bertelli; and there is altogether, in our opinion, ample material for careful study. This article seems to us to have been written or printed in a hurry; in the copy of the inscription wherever the Greek capital  $\Lambda$  (*i.e.*  $\Lambda$ ) occurs it is printed  $\mathbf{A}$  making the words look ridiculous; and two pages later we have N.W.E. for N.N.E.—a mere accident undoubtedly, but as a rule the printing of the *Pubblicazioni* is extremely good, and therefore we adhere to our inference that this article was printed in a hurry. However, it contains several useful references, and must not be ignored when, if ever, a complete monograph upon the nomenclature of the winds is prepared.

This article is followed by a note by Padre Denza on three old celestial globes; and then comes the ordinary commencement of the volume, with the report of the Annual Meeting of the Council of Direction, the speeches and reports as to progress, the state of the library, the visitors to the Observatory, &c. 115 pages are then devoted to astronomical work and 36 to terrestrial magnetism.

We cannot stop to notice all the meteorological articles but we have a suspicion that the very strange differences shown in the article by Prof. G. Busti entitled "Confronto dell'acqua caduta a diverse altezze" are capable of easy explanation. We believe that the two rain gauges are read at different hours, and thus the daily amounts are not comparable. But these tables on pages 286 to 289 evidently need examination for the figures do not agree with those

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\* *Met. Mag.*, Vol. xxviii. p. 154.

† "Theophrastus of Eresus on Winds and on Weather Signs," by J. G. Wood, M.A. 8vo. Stanford, London, 1894.



in the monthly tables on pages 307 to 353, and on page 289 there is the obvious error of printing the values of December 1891 instead of those of Dec , 1892, as will be seen by referring to pages 287 or 353. But there are many errors all through this article, *e.g.* on May 13th, 1892, the record at the Specola should be 17·7 not 17·4, and it is quite certain that the amount in the garden on that day was forgotten to be entered. Moreover in the tables of differences the + and - signs are hopelessly mixed. We do not recollect ever seeing such bad work. To judge by the portion that we have tested there must be about 20 errors on each page. It is a comfort to think that Padre Denza has been spared having to examine it.

Nothing could surpass the beauty of the illustrations, and of the whole get up of the volume; but we are so disappointed at the result of examining this article, and it so discredits the parts of the book which we cannot test, that we have not the heart to go on with our notice.

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*The Clyde Sea Area*, by HUGH R. MILL, D.Sc., F.R.S.E., Part III. "Distribution of Temperature." [Excerpt Trans., Roy. Soc., Edinb.] Edinburgh, Grant & Son, 1894. 4to, 162 pages; 32 plates (mostly coloured).

THIS is the concluding part of the great work which Dr. Mill has been doing in the lovely Lochs of the South-West of Scotland.. The observations were mostly made in 1886, '87 and '88; the results as regards salinity and specific gravity were published in 1892, and noticed in these pages in March 1894. The still heavier part of the work, that relating to the temperature of the water, was published in November 1894, and is now before us.

At the outset we wish to say a word as to the brilliancy and accuracy of register in the colour-printing of the plates accompanying this memoir. Keith Johnston used to send us beautiful specimens of his work, and these plates show that Edinburgh has equal reason to be proud of Bartholomew's.

As regards the paper, we cannot pretend in the limits at our disposal to give an exhaustive criticism. We adhere to the opinion which we expressed in our previous notice as to the seriousness of the omission of complete records of the winds, and we do not remember seeing, either in this or the previous part, any records of surface movements by bottles, as in Prof. Harrington's experiments upon the American lakes. We recognise to the full the labour which Dr. Mill devoted both to making the observations and to preparing this elaborate paper, also the impossibility of his printing *in extenso* the tens or hundreds of thousands of observations which he must have made, and yet without them it is not easy to decide upon the acceptance of all the propositions enunciated; some of them extremely difficult, *e.g.*, the estimation of the proportion of the increase in the

temperature of the water in summer, which is due to direct solar radiation, and that due to the entry of warm water from the Atlantic. As regards the diagrams, we think that the disproportion between the ordinates and abscissæ is too great. In plate viii. it seems to be about 2,700 to 1, and we also think that it would have been better to have adhered to one ratio throughout; whereas a depth of 100 fathoms corresponds to 50 miles on plate viii., to 15 miles on plates xii. and xix., and to 7 miles on plates xvi. and xvii. Most authors would resent the fixing of definite ratios for use in diagrams, but it would render them much more useful; say, for instance, that in barometric charts 1 inch of height should always correspond to 1 hour, or 1 day, or 1 month. As it is, the ratio is usually determined by the size of the page. In Dr. Mill's exquisite charts the bottom of the main channel suggests a section through the Cañons of the Rocky Mountains rather than the undulating base of a Scottish loch.

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#### A SHOWER OF FISH ON JUNE 15TH.

In early times, records of the occurrence of showers of fish, corn, &c., were regarded as alarming portents.

Then came the time when they were regarded as fictitious—like the African lakes, Albert and Victoria Nyanza, which were erased from the maps for nearly 100 years—to be restored in the present century.

So with the fishes. We now know that the records of their falling are true, and we know where they come from. A whirlwind sucks up the water of a stream or pond, the water and the fishes are carried aloft—like the hay out of a field—and dropped down, a veritable shower of water and fish.

Here is the record from our observer, Mr. W. C. V. Burton, J.P., of Carrigaholt Castle, County Clare, Ireland:—

“On the 15th, a very hot day, some heavy heat drops fell about midday, when a number of small fishes (mostly about  $1\frac{1}{2}$  or 2 inches long) fell in the pleasure grounds, where some men were working. I sent a sample to the English and Irish *Times*, but I think that no notice was taken of them. I have a large one in spirits, and several people saw the fish.”

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#### THE HEAT IN SOUTHERN RUSSIA.

The Odessa Correspondent of the *Daily News* writes on August 5th: The oppressive heat continues unabated over the whole of Southern Russia and the Crimea. Yesterday the temperature on the South Crimean coast was 106 deg. Fahr. in the shade at 8 o'clock in the morning. At Kieff it was 104 deg. in the shade. Here, from

day to day, one looks vainly for the merest fleck of cloud in the lurid expanse of sky and horizon in the hope of discovering some sign of coming rain or thunderstorm. The country has a scorched and withered appearance, except in such happy oases and thinly-scattered patches where vegetation is kept alive by irrigation. The wells are drying up, and in many districts water-famine is added to the miseries of the general drought. The cattle have no green fodder, and the usual aftermath of hay is this season an entirely absent quantity. It is more than six weeks since we had rain, and during that period the weather has been gradually growing hotter day and night. To-day our temperature at noon was 108 deg. Fahr.

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### A TIDAL WAVE?

"One of those sudden and violent disturbances of the sea which the late Mr. R. Edmonds, of Plymouth and Penzance, attributed to submarine earthquakes, was witnessed on the north shores of Mount's Bay from 4.45 to 5.30 on Saturday evening, 10th. A tidal wave unexpectedly swept into the harbour of Penzance and Newlyn. At the latter place the pilchard fleet were under sail. One craft was swept against a steamer; others were hurried from the middle to the inner parts of the port. At Penzance boys who were pulling boats in the harbour were bewildered on finding themselves swirled helplessly hither and thither, and even the small steamers could barely stem the rush. It will be interesting to compare the disturbance with any others reported from the sea or the land."—*Western Mercury*, August 12th, 1895.

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### STORM CENTRES IN SWITZERLAND.

Professor Hess, of Frauenfeld, has published two interesting essays upon storm centres in Switzerland. His materials are partly taken from 4,000 weather reports issued by the Swiss Meteorological Institute, and partly from 200 observations of storms made by himself during the year 1892. He finds that the greater proportion of storms, 35 per cent., have their starting-point in the Swiss "middleland," that is, between the Alps and the Jura; 28½ per cent. in the region of the fore Alps, or Pilatus, Rigi, Niesen, &c.; 25 per cent. in the Jura; while only 11½ per cent. have their "Ausgangspunkt" in the high Alps. The "thickest" storm-centre, that is the greatest brooding spot of Swiss storms, lies in the Basler and Solothurner-Jura district. The second "thickest" is the upper part of the Lake Zürich, and the third is about the foot of the Sentis in the lands of Appenzell and St. Gallen.

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## CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JANUARY, 1895.

STATIONS.  (Those in <i>italics</i> are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
°		°		°	°	°	0-100	°	°	inches			
England, London .....	51·9	20	17·2	29	38·1	29·1	30·6	88	69·1	16·2	1·96	16	6·5
Malta.....	67·5	17	39·3	30	60·2	48·3	44·9	79	119·1	33·0	1·91	10	5·7
<i>Mauritius</i> .....	87·5	12	70·1	5	85·4	74·7	69·2	73	137·3	62·8	2·14	17	6·2
Calcutta.....	84·0	12	49·1	20	77·1	55·8	56·0	73	135·0	41·5	·00	0	1·0
Bombay.....	84·1	4	60·8	23	80·7	66·8	63·5	70	132·1	51·0	·00	0	0·9
Ceylon, Colombo .....	90·7	29	66·8	31	86·9	72·4	69·4	75	149·5	55·0	5·00	12	4·7
<i>Melbourne</i> .....	99·0	24	49·5	16	77·0	56·6	53·6	63	148·1	39·8	1·81	4	4·7
<i>Adelaide</i> .....	104·5	12	51·7	16	84·9	62·9	51·0	45	174·0	43·9	1·22	4	3·7
<i>Sydney</i> .....	90·3	25	59·0	27	74·3	64·8	61·3	77	151·1	54·0	8·07	25	7·7
<i>Wellington</i> .....	79·0	25	47·0	22	72·6	57·5	55·7	72	145·0	35·0	6·04	12	4·2
<i>Auckland</i> .....	79·5	27	57·0	17 <sup>a</sup>	74·8	61·9	62·2	81	142·0	54·0	2·72	15	5·3
Jamaica, Kingston.....	88·6	31	63·6	6	86·2	66·7	65·6	76	...	...	·05	1	2·0
Grenada.....	84·6	5	69·0	29 <sup>b</sup>	81·3	72·0	68·8	73	165·0	...	5·09	21	3·7
Toronto .....	42·2	21	—0·6	29	28·1	14·0	19·0	83	...	—6·0	4·65	20	7·2
New Brunswick, Fredericton .....	41·1	12	—12·7	26	24·7	5·1	14·0	83	...	...	4·50	...	5·4
Manitoba, Winnipeg ..	26·0	19	—37·9	30	2·2	—17·3	...	...	...	...	1·54	14	4·9
British Columbia, Esquimalt .....	53·6	12	25·2	3	41·0	32·9	35·0	90	...	...	6·94	21	8·1

<sup>a</sup>—and 20. <sup>b</sup>—and 30.

## REMARKS.

MALTA.—Adopted mean temp. (53°·3), 0°·3 below the average. Mean hourly velocity of wind 13·1 miles. Thunderstorms on 2nd and 3rd, and lightning on 4 other days. Hail on 6 days. Sea temp. fell to 55°·5, the lowest recorded.

J. F. DOBSON.

*Mauritius*.—Mean temp. of air 1°·1 above, dew point 0°·6 below, and rainfall 5·11 in. below, their respective averages. Mean hourly velocity of wind 12·7 miles, or 1·3 above the average; extremes, 38·8 on 13th and 1·9 on 7th; prevailing direction, E.S.E. to E. by N. Thunder on 12th.

C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms on 14th, 15th, 19th and 22nd, and lightning on 12th, 13th and 20th.

D. G. MANTELL.

*Adelaide*.—Mean temp. 0°·5 below the average of 38 years. Rainfall 40 in. above the average, and nearly all falling on one day, the 4th.

C. TODD, F.R.S.

*Sydney*.—Mean temp. 2°·3 below, humidity 4·5 above, and rainfall 4·32 in. above, their respective averages. Very heavy S. to S.E. gale, and tremendous seas at the end of the month.

H. C. RUSSELL, F.R.S.

*Wellington*.—Heavy rain during the early part of the month, 1·15 in. falling on 3rd, and 2·25 in. on 9th, and showery up to 12th, after which generally fine and pleasant weather, with moderate winds from N.W. Mean temp. 2°·4, and rainfall 2·14 in. above the average.

R. B. GORE

*Auckland*.—Mean temp. and rainfall very close to the average of 28 years.

T. F. CHEESEMAN.

JAMAICA, KINGSTON.—Mean hourly velocity of wind 4·6 miles. In Kingston the rainfall was nearly 1·50 in. below the average, and over the island generally was only 35 per cent. of the average.

R. JOHNSTONE.

SUPPLEMENTARY TABLE OF RAINFALL,  
 JULY, 1895.

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

Div.	STATION.	Total Rain. in.	Div.	STATION.	Total Rain.
II.	Dorking, Abinger Hall.	5·71	XI.	Lake Vyrnwy .....	5·79
"	Birchington, Thor .....	3·29	"	Corwen, Rhug .....	...
"	Hailsham .....	3·60	"	Carnarvon, Cocksidia ...	4·97
"	Ryde, Thornbrough .....	3·84	"	I. of Man, Douglas .....	3·18
"	Emsworth, Redlands ...	4·67	XII.	Stoneykirk, Ardwell Ho.	2·48
"	Alton, Ashdell .....	4·90	"	New Galloway, Glenlee	6·11
III.	Oxford, Magdalen Col...	3·54	"	Melrose, Abbey Gate ...	5·83
"	Banbury, Bloxham .....	3·22	XIII.	N. Esk Res. [Penicuik]	4·00
"	Northampton, Sedgebrook	2·72	"	Edinburgh, Blacket Pl.	4·66
"	Alconbury .....	3·15	XIV.	Glasgow, Queen's Park.	3·81
"	Wisbech, Bank House..	1·68	XV.	Inverary, Newtown .....	5·31
IV.	Southend .....	2·83	"	Islay, Gruinart School..	3·66
"	Harlow, Sheering ...	4·00	XVI.	Dollar .....	5·59
"	Colchester, Lexden .....	3·67	"	Balquhider, Stronvar..	5·58
"	Rendlesham Hall .....	3·86	"	Ballinluig .....	2·59
"	Diss .....	3·61	"	Dalnaspidal H.R.S. ...	4·90
"	Swaffham .....	3·63	XVII.	Keith H.R.S. ....	3·56
V.	Salisbury, Alderbury ...	3·13	"	Forres H.R.S. ....	2·37
"	Bishop's Cannings .....	...	XVIII.	Fearn, Lower Pitkerrie.	2·75
"	Blandford, Whatcombe ..	3·05	"	Loch Shiel, Glenaladale	...
"	Ashburton, Holne Vic. ...	4·31	"	N. Uist. Losh Maddy ...	6·06
"	Okehampton, Oaklands.	4·06	"	Invergarry .....	4·46
"	Hartland Abbey .....	3·37	"	Aviemore H.R.S. ....	2·85
"	Lynmouth, Glenthorne.	3·99	"	Loch Ness, Drumnadrochit	2·14
"	Probus, Lamellyn .....	3·26	XIX.	Invershin .....	4·33
"	Wellington, Sunnyside..	...	"	Scourie .....	3·32
"	Wincanton, Stowell Rec.	3·63	"	Watten H.R.S. ....	2·48
VI.	Clifton, Pembroke Road	3·37	XX.	Dunmanway, Coolkelure	7·05
"	Ross, The Graig .....	2·59	"	Fermoy, Gas Works ...	6·11
"	Wem, Clive Vicarage ...	3·36	"	Killarney, Woodlawn ...	5·86
"	Cheadle, The Heath Ho.	4·99	"	Caher, Duneske .....	2·98
"	Worcester, Diglis Lock	3·33	"	Ballingarry, Hazelfort...	3·57
"	Coventry, Coundon .....	3·14	"	Limerick, Kilcornan ...	3·95
VII.	Ketton Hall [Stamford]	2·78	"	Ennis .....	3·35
"	Grantham, Stainby .....	2·65	"	Miltown Malbay .....	5·40
"	Horncastle, Bucknall ...	...	XXI.	Gorey, Courtown House	2·86
"	Workshop, Hodsck Priory	3·79	"	Athlone, Twyford .....	4·89
VIII.	Neston, Hinderton .....	3·99	"	Mullingar, Belvedere ...	5·77
"	Preston, Haighton ...	...	"	Longford, Currygrane...	4·40
"	Broughton-in-Furness..	6·66	XXII.	Woodlawn .....	5·32
IX.	Ripon, Mickley .....	4·72	"	Crossmolina, Enniscoe..	6·00
"	Melmerby, Baldersby ...	5·77	"	Collooney, Markree Obs.	5·03
"	Scarborough, South Cliff	4·85	"	Ballinamore, Lawderdale	...
"	Middleton, Mickleton..	6·87	XXIII.	Lough Sheelin, Arley ..	4·76
X.	Haltwhistle, Unthank..	4·77	"	Warrenpoint .....	3·91
"	Bamburgh .....	4·43	"	Seaforde .....	4·31
"	Keswick, The Beeches...	...	"	Belfast, Springfield .....	5·84
XI.	Llanfrechfa Grange .....	4·17	"	Bushmills, Dundarave...	3·09
"	Llandovery .....	5·38	"	Stewartstown .....	3·79
"	Castle Malgwyn .....	4·24	"	Buncrana .....	4·36
"	Builth, Abergwessin Vic.	6·85	"	Lough Swilly, Carrablagh	5·10
"	Rhayader, Nantgwillt..	5·06			

JULY, 1895.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.						TEMPERATURE.						No. of Night below 32°.	
		Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours		Days on which $\frac{1}{10}$ or more fell.	Max.		Min.		In shade.	On grass.			
				Dpth	Date		Deg.	Date	Deg.	Date.					
													inches.	inches.	in.
I.	London (Camden Square) ...	3.42	+ .74	.57	27	12	82.0	8	47.7	7	0	0			
II.	Maidstone (Hunton Court)...	4.87	+ 2.69	1.80	20	12	...	...	...	...	0	0			
III.	Strathfield Turgiss .....	4.03	+ 1.64	.63	27	19	80.3	17	43.5	8	0	0			
III.	Hitchin .....	4.78	+ 2.06	1.10	21	14	82.0	8	42.0	31	0	...			
IV.	Winslow (Addington) .....	3.63	+ .34	.76	20	15	83.0	8	43.0	13	0	0			
IV.	Bury St. Edmunds (Westley)	4.39	+ 1.82	.93	21	17	74.0	8	49.0	13	0	...			
V.	Norwich (Brundall) .....	3.21	...	.66	27	16	81.0	8	46.0	6	0	0			
V.	Weymouth (Langton Herring)	2.38	+ .23	.57	19	12	71.0	26	49.0	15	0	...			
"	Torquay (Cary Green) ...	2.73	...	.73	23	12	70.7	28	50.2	5	0	0			
"	Polapit Tamar [Launceston]..	3.68	+ .27	.70	18	17	72.0	8	42.4	5	0	0			
VI.	Stroud (Upfield) .....	2.83	+ .74	.55	19	12	78.0	9	50.0	4	0	...			
"	Churchstretton (Woolstaston)	2.42	+ .55	.45	23	16	74.0	8	44.0	13	0	...			
"	Tenbury (Orleton) .....	2.58	+ .28	.74	21	13	79.0	8	41.0	13	0	0			
VII.	Leicester (Barkby) .....	2.95	+ .04	1.35	18	15	84.5	8	38.0	5	0	0			
"	Boston .....	1.95	+ .84	.35	23	17	85.0	7	45.0	30	0	...			
"	Hesley Hall (Tickhill).....	4.08	+ 1.41	1.11	18	17	81.0	8	44.0	5	0	...			
VIII.	Manchester (Plymouth Grove)	4.48	+ .69	1.12	25	19	77.0	8	43.0	29	0	...			
IX.	Wetherby (Ribston Hall) ...	4.36	+ 1.18	1.03	19	15	...	...	...	...	...	...			
"	Skipton (Arncliffe) .....	7.88	+ 2.24	2.66	25	22	...	...	...	...	...	...			
"	Hull (Pearson Park) ...	5.61	+ 3.02	1.62	25	17	82.0	8	42.0	5	0	...			
X.	Newcastle (Town Moor) .....	4.37	+ .85	1.23	25	19	...	...	...	...	...	...			
"	Borrowdale (Seathwaite).....	9.15	+ 1.84	1.96	25	22	...	...	...	...	...	...			
XI.	Cardiff (Ely) .....	4.76	+ .70	.74	23	16	...	...	...	...	...	...			
"	Haverfordwest .....	3.89	+ .32	.71	25	17	73.5	8	43.8	5	0	...			
"	Aberystwith (Gogerddan) ...	6.47	...	.95	24	13	77.0	6	34.0	4	0	...			
"	Llandudno .....	4.44	+ 1.44	.98	18	19	74.0	8	47.0	5	0	...			
XII.	Cargen [Dumfries] .....	5.99	+ 2.06	1.76	26	18	70.0	6	42.0	5	0	...			
"	Jedburgh (Sunnyside).....	5.48	+ 2.04	1.94	26	17	74.0	8	41.0	30	0	...			
XIV.	Colmonell .....	4.18	...	1.25	21	17	80.0	6	37.0	4	0	...			
XV.	Lochgilthead (Kilmory).....	4.32	+ .02	1.19	26	16	...	...	40.0	13	0	...			
"	Mull (Quinish) .....	5.12	+ 1.07	.73	7	19	...	...	...	...	...	...			
XVI.	Loch Leven Sluices .....	4.50	+ .88	1.00	27	14	...	...	...	...	...	...			
"	Dundee (Eastern Necropolis)	4.20	+ .74	.75	18	19	79.6	7	43.9	30	0	...			
XVII.	Braemar .....	3.19	+ .02	.56	18	21	71.0	6, 7	38.3	16	0	1			
"	Aberdeen (Cranford) ...	3.55	...	.70	26	18	75.0	6, 7	40.0	4	0	...			
XVIII.	Strathconan [Beaully] .....	5.50	+ 2.00	1.00	3	17	...	...	...	...	...	...			
"	Glencarron Lodge .....	7.42	...	1.06	21	24	67.0	8	37.5	19	0	...			
"	Cawdor [Nairn] .....	3.11	+ .19	.55	19	20	...	...	...	...	...	...			
XIX.	Dunrobin .....	3.94	+ 1.09	1.15	23	22	71.2	7	43.5	29	0	...			
"	S. Ronaldsay (Roeberry).....	2.41	+ .05	.58	9	17	73.0	7	46.0	25	0	...			
XX.	Darrynane Abbey .....	5.44	...	.91	25	21	...	...	...	...	...	...			
"	Waterford (Brook Lodge) ...	4.06	+ .53	1.02	25	16	71.0	12	45.0	23	0	...			
"	O'Briensbridge (Ross) .....	3.42	...	.48	25	19	...	...	...	...	...	...			
XXI.	Carlow (Browne's Hill) .....	3.14	+ .38	1.15	24	15	...	...	...	...	...	...			
"	Dublin (Fitz William Square)	4.50	+ 1.82	1.26	25	16	73.8	6	48.1	4	0	0			
XXII.	Ballinasloe .....	4.36	+ .81	1.17	25	16	67.0	26	37.0	4	0	...			
"	Clifden (Kylemore) .....	8.97	...	1.70	7	23	...	...	...	...	...	...			
XXIII.	Waringstown .....	4.48	+ .96	.76	2	21	79.0	6	43.0	14	0	...			
"	Londonderry (Creggan Res.)..	5.16	+ 1.04	1.16	26	22	...	...	...	...	...	...			
"	Omagh (Edenfel) .....	4.43	+ .71	.83	21	22	73.0	6	42.0	16	0	...			

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

# METEOROLOGICAL NOTES ON JULY, 1895.

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.

STRATHFIELD TURGISS.—In the early part of the month the weather was showery and unsettled; towards the middle it was more generally fine and dry. A wave of high temperature succeeded, but the end of the month brought heavy R storms, with T and L on the 21st and T on the 22nd.

ADDINGTON.—The long dry period was fairly broken on the 18th, and more or less R fell on every day until the 28th. The temp. was moderately high and vegetation of all kinds improved rapidly. T on 19th and 22nd, TS on 21st.

BURY ST. EDMUNDS, WESTLEY.—A wet month but the R came too late for the corn crops, which are the lightest remembered in West Suffolk. Vegetation made rapid growth, and the look out for stock is much improved. T on 1st, 19th, 21st, and 22nd. TS on 4th.

NORWICH, BRUNDALL.—Chiefly very fine and warm during the first fortnight, but very unsettled from the 18th to the end with copious rains. Mean temp.  $61^{\circ}\cdot4$ , or exactly the same as in July, 1893 and 1894, and in close agreement with the average. R about a quarter of an inch above the average. Slight TS on 19th, distant T on 21st. Sharp TSS on 22nd.

LANGTON HERRING.—Very high wind on the 2nd; from the 3rd to the 16th inclusive, fine bright weather; wet and unsettled from 17th to 27th. Distant T on the 19th. Dense fogs on the 24th, 25th and 26th. Mean temp. at 9 a.m.  $1^{\circ}\cdot6$  below the average. The variations of temp. were very slight throughout the month. The average max.,  $67^{\circ}\cdot9$ , was slightly below that of June.

TORQUAY, CARY GREEN.—Rainfall  $\cdot07$  in. below the average. Mean temp.  $60^{\circ}\cdot2$ , or  $1^{\circ}\cdot1$  below the average. Duration of sunshine 179 hours 10 minutes, being 3 hours less than the average; 2 sunless days.

POLAPIT TAMAR.—Very free from strong winds throughout, but wetter than the average. The nights from the 17th to 26th inclusive were very close and hot, but the month altogether was decidedly cooler than June. Heavy TSS on 1st and 19th.

STROUD, UPFIELD.—Prevailing winds, N.W. and S.W. T on the 19th.

WOOLSTASTON.—The dry weather continued till the 16th and the want of water was severely felt, pastures being quite burnt up. In the latter part of the month, R fell almost daily. Mean temp.  $58^{\circ}\cdot2$ .

TENBURY, ORLETON.—The first half of the month was dry and warm, but from the 16th to the end there was a considerable amount of R and very stormy unsettled weather. By a curious coincidence there was a considerable fall of R on the 1st, as was the case in both May and June. The temp. of the month was a little below the average. Frequent T—very heavy on the 21st—with a great fall of R for 20 minutes.

LEICESTER, BARKBY.—Continued drought till the 18th. T on 2nd, 19th, 21st, 26th and 27th. Mean temp.  $62^{\circ}$ .

MANCHESTER, PLYMOUTH GROVE.—The weather during the whole of the month was unsettled and cold. A great storm occurred on the 25th, and at Collyhurst the river wall of the Irk fell in and destroyed a small building; the rush of water was so great that a youth of 16 who was at work was swept away into the river and drowned. T and L and very stormy on 26th. Mean temp.  $59^{\circ}\cdot5$ .

HULL, PEARSON PARK.—T on 19th, 21st, 22nd, 25th and 26th.

## WALES.

HAVERFORDWEST.—The first few days were wet, followed by sunshine and warmth up to the 9th; damp days succeeded but it was again fine and bright

from the 11th to the 15th. From that date to the 27th almost constant R prevailed, although some of the days were fine with several hours of sunshine, the R falling at night. The last four days were beautifully fine and summer like. Stormy weather prevailed from 16th to 21st, causing heavy seas in the Irish Channel. Corn crops and cereals much improved by the damp warm weather, and grass lands looking well. Prevailing winds, S. W., S. E. and N. W.

GOGERDDAN.—Very stormy throughout the month, but “growing” weather.

#### SCOTLAND.

CARGEN.—A cold rainy sunless month. In only three years since 1860, viz., 1862, 1888 and 1890 has there been a lower mean temp. or less sunshine recorded at this station during the month of July. On the 25th and 26th a total fall of 2·88 in. of R was registered—yet another “record” in 1895,—the heaviest fall hitherto during two consecutive days being 2·60 in. on 13th and 14th July, 1882. The R caused a great improvement in pastures, hitherto hardly deserving that title but came too late to benefit the hay—barely half an average crop—the harvesting of which it made tedious and difficult. Cereals made good progress. T on 1st and 21st. T and L on 2nd and 26th.

JEDBURGH.—The weather was very variable and wet and vegetation advanced quickly. Cereal crops look well on the whole. Hay good but short, turnips are very good.

COLMONELL.—Rainfall ·75 in., above the average of 19 years. Mean temp. 57°·9 or 0°·7, below average.

MULL, QUINISH.—The drought of the last two months broke up on July 1st, and the month was very favourable for vegetation and crops. The R came too late to improve the rye grass but other crops improved immensely.

ABERDEEN, CRANFORD.—The frequent R was disastrous to the strawberry crops in this quarter which would have been “grand.” Strong gales from N. W. on 10th and on 15th. N. and E. winds prevailed after the 16th.

ROEBERY.—A fair month upon the whole but colder than July, 1894 by 2°·7. Mean temp. 54°·6.

#### IRELAND.

DARRYNANE ABBEY.—A very wet and cold month. 1·05 in. of R fell in seven hours on 17th.

O'BRIENSBRIDGE, ROSS.—Fair until 15th, but temp. low for the season, a fortnight of continuous R to the 27th, without sunshine and with still lower temp. Occasional T and L but not serious.

DUBLIN.—A cool, changeable month, setting in with heavy rains. Then high and squally S. W. to N. W. winds. Frequent rains from 15th to 25th inclusive. Fine, but cloudy at the close. TSS occurred on 19th and 21st; H fell on the 19th.

WARINGSTOWN.—The heavy rains although rather interfering with hay-making were most beneficial to the crops generally, which in this district promise to be very good, except upland hay which of course is short; turnips are making up for lost time rapidly.

EDENFEL.—A generally cloudy and unsettled month with temp. about the average and R considerably above it which—except by increasing the labour of saving the hay still in the fields—was of great benefit to grass and all crops.



# SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

CCCLVI.]

SEPTEMBER, 1895.

[PRICE FOURPENCE,  
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## THE YORKSHIRE WHIRLWIND OF AUGUST 10TH.

HAPPILY, it is rare for a whirlwind to pass over a thickly populated district, and happily, also, the one of which we are about to give a description was not a severe one ; but persons who have never been in the track of one, or visited it afterwards, are always so incredulous that we think it well, from time to time, to give full details. Usually we have to rewrite the account, so that the various facts may be in true sequence of time and of locality, but the account in the *Sheffield and Rotherham Independent* is fairly correct in both respects, and we therefore reprint it verbatim. We have left the word "cyclone" as used in the newspaper, although we do not consider that it ought to be employed for disturbances of such small diameter.

We would direct especial attention to the statement of Police Sergeant Barclay as extremely good.

The account was, of course, written for persons acquainted with the locality ; we prefix a few words to make it generally available. The place of first reported damage is within a mile of where the first batch of rain-gauge experiments was made at Rotherham, in S.W. Yorkshire (Lat.  $53^{\circ} 25' N.$ , Lon.  $1^{\circ} 20' W.$ ) ; it passed over the Eastern side of Rotherham and down into the valley of Eastwood, then over Parkgate and up to Rawmarsh. The track is slightly E. of N., but not N.E., as stated in the newspaper.

The track herein described is slightly over two miles in length, but there seems some probability that the damage at Eckington (Derbyshire), mentioned in another account, was an earlier manifestation of the same whirlwind, because the Rotherham—Rawmarsh track produced 8 miles backwards would pass over Eckington ; and as regards the thunderstorm—not the whirlwind—it may be of interest to mention that the track produced 11 miles Northwards would almost pass over the village where several houses were struck by lightning.

## CYCLONIC STORM AT ROTHERHAM AND PARKGATE.

A storm of an exceptional kind devastated some parts of the Don Valley on Saturday. The thunderstorm began shortly before seven o'clock, and for a time it was accompanied with black clouds and a darkening of the heavens. Rain descended in torrents. The lightning flashed brilliantly, illuminating the earth.

The clouds assumed a striking aspect, being lighter at some points of the compass, and elsewhere of a deep purple hue. The cyclone began its ravages first in Rotherham in the neighbourhood of Red House, Moorgate, having probably started to the west of that locality. From the appearance of its traces, it would extend to a width of from 100 to 150 yards. The effects were made known at Red House, doing damage to a shed. Then it passed across towards Broom Wood. Trees were uprooted and others left standing stripped of leaves and branches. The crops ripening for the harvest on the farms of Mr. Ibbotson and Mr. Leedham were laid low. At Broom Wood the cyclone levelled several trees, and the roadway was blocked by a large elm. The highway was bestrewn with branches of trees, massive boughs from the parent stem. Crossing the road, the cyclone lifted the roof and part of the structure of the reserved and members' stands on the racecourse. The cricket field of the town club is adjacent, the pavilion and some sheds being on that side next the racecourse. The Wincobank and Town club teams had ceased to play and were sheltering. The roof of the stands from the racecourse dropped on the top of the cricketers' places of refuge with a force that must have frightened the timber wielders underneath. The fencing of the racecourse adjacent to Badsley Moor lane was levelled for a distance of about 70 yards. The effects of the cyclone were felt at the top of Clifton lane. In Badsley, Gilberthorpe, and Lister-streets branches were stripped off the ornamental trees and the gardens of the cottagers sustained much damage. Mr. Millett, of Gilberthorpe-street, had the skylight of his house damaged. The cyclone appeared to strike the houses at the east end of the street with the greatest force. Mr. Horne had a bedroom window blown in and a looking-glass placed on the bed without either being broken. Mr. Dean's fruit garden fared badly. Apple and pear trees were split and torn up by the roots. Ridge tiles and slates were removed from his dwelling. The roof of Mr. Hemphshall's house was partially wrecked. The house of Mr. T. A. Cocking had the lead wrenched from the window top, and that occupied by our reporter, Mr. J. Bainbridge, was dealt with in a like fashion, and the ridging tiles of the roof and a window in the garret destroyed. Other damage was done at the rear of the premises. The remaining houses of the street did not escape injury. The worst sufferer in this locality was Mr. John Green, market gardener and farmer, who sustained loss through the damage to his garden, cow sheds, outhouses, and wash-kitchen. The Clifton Park presented a similar spectacle to that after the great wind storm of last January. Branches were torn from the trees, and valuable elm, beech, and hawthorns uprooted. An idea of the force of the wind was shown by one of the heavy iron seats having been lifted up and carried a distance of from 20 to 30 yards. Leaving the park by the gate opposite Cranworth-road, the cyclone continued its destructive powers in the grounds of Ald. George Neill, J.P., and Mr. C. B. Clarke, J.P. Passing from thence, by way of Cranworth-road, the cyclone was felt in Bethel-road, Eastwood Vale. Several yards of brick walling belonging to Mr. Eyre were thrown down, and the windows of Mr. Tee's house broken. Other property damaged in this neighbourhood include the Shakespeare Inn. and dwellings belonging to Mr. Lowe, Mr. Bowers, and Mr. Grafton. At Parkgate there were several narrow escapes of persons out in the storm, but no one has been reported as injured within the borough.

STATEMENTS BY EYE-WITNESSES.

Our reporter was away from home attending to his duties in another part of

the district. He had, therefore, no opportunity personally of watching the progress of the cyclone or describing it as an eye-witness. His eldest son, a youth of 18, has, however, furnished him with the following account of the incidents of the evening :—I was at home in this (the sitting) room looking at Eugene Stock's "Lessons on the Acts of the Apostles," with little baby sister asleep. The other members of the family were away engaged in various duties, so that practically I was alone. The storm began about a quarter to seven o'clock with some slight showers. Gradually the rain became heavier, the lightning flashed, and the thunder rolled. I noticed, as I glanced up from my book the lightning was forked and sheet, and of a deep blue colour, but there were one or two flashes of a crimson tint. The lightning was very vivid and bright, and the thunder like what I should imagine the noise of a battle would be when the artillery and rifles were fully in operation. Of course, after the recent heavy storm I did not consider there was danger ; I did not very much trouble myself about what was going on outside for some time. But there was some peculiarity, and perhaps the increasing severity of the lightning, thunder, and rain forced my attention from my preparation for Sunday. I stopped reading and looked out of the window. The rain was coming down in immense quantities, and there were one or two hail showers. The atmosphere, too, was uncomfortably oppressive. I had had the door leading into the yard open, and closed it. Every time the lightning flashed the rain descended in torrents, and then somewhat abated. It seemed as if the heavy showers immediately preceded and accompanied the lightning. This lasted for about 20 minutes. Semi-darkness prevailed, and the clouds appeared surcharged with electricity. I was looking towards the north, the view from the window being in that direction, so that I had my back to the approaching cyclone. I could not have seen it coming, from the room. But I heard and felt sure enough to satisfy me for a life-time. There was a tremendous flash of lightning and heavy thunder. In a few minutes the wind began to roar. At first it heralded its approach by blowing strongly at the front of the house. Then there was a frightful whizzing noise. I could hear it travelling in this direction, and wondered what it meant. My curiosity was quickly satisfied. No, it was not a hissing sound. One of my friends, who was in Nelson-street, and out of the range of the cyclone, has told me he could only liken it to steam blowing loudly out of the safety valve of a number of boilers. It was worse than that here. Simultaneously, the back door was forced open, the ridging tiles of the roof were dashed to atoms in the yard, and a window was smashed in the garret. Doors were banged to upstairs and downstairs. The whole structure of the building seemed to shake. I wish never to experience another few seconds like that. It took some force to close and lock the back door, smoke and soot came down the chimney and filled the room. I went upstairs to the front bedroom. The window was open a few inches from the top, but through the aperture had come more ventilation than was expected, for it managed to bring down the curtains, pole, and rings. In the garret a pane of glass was broken. A piece of some building, belonging perhaps to our neighbours in the next street, had been carried with such force that it passed through the window and dashed against the wall at the opposite side, and was knocked into pieces down the garret stairs. The glass of the window pane was broken into scores of little bits. What did I see of the storm outside ? Well, there were clouds of dust, then leaves and branches twirling in the most

fantastic manner, but I did not see very much of it. The real cyclone came with a mighty speed, and was here and gone in a few seconds. Little pebbles seemed to be striking the window and the walls. Besides, the atmosphere was suffocating, and events inside had crowded on me so fast. As you know the wind went over into the park, but spoiled my kidney beans on its way. When the wind subsided, which it did suddenly, I went to the garden gate and looked up and down Lister-street. Everybody had apparently rushed from their houses, and were enquiring of each other about the damage. The streets had the appearance of having been bombarded. I heard some of the people say they thought the world was coming to an end. I did not think that, but it was the most uncomfortable few seconds of my life. It was almost incredible—baby slept throughout the commotion." Coming in at a later hour, a younger boy's greeting was, "You look as if you had been in the wars in this locality." A resident at the other side of the street watched the progress of the cyclone. It had the appearance, he says, of a cloud of steam, capped by a cloud of dense blackness.

#### THE CYCLONE AT PARKGATE.

From several of the residents in Parkgate our representative late on Saturday night obtained accounts. They had been eye-witnesses of the storm. Police-sergeant Barclay, one of the steadiest and most respected members of the West Riding Constabulary, had a good opportunity to watch the course of the cyclone. He was in the neighbourhood of Manghani Quarry, and had a wide range of view. He described the scene as awfully grand, transcending anything he had ever witnessed. The clonds were light-coloured, turning round and rolling forward at the same time, meanwhile descending to earth and then rising higher. They varied in density, whirled round in a circle, and went in a north-easterly direction, but not in a direct straight line. They moved with rapidity, occupying but a short time in coming into and going beyond the range of vision. The noise was extremely great, and as if a lot of railway trains were running about at a breakneck speed to different parts of the globe. Mr. Newbould, jeweller, Broad-street, was standing at his shop door. The street had the appearance of the smoke and dust and flame of a huge puddling or blast furnace which had just been damped down. As he was looking out a slate struck the woodwork of the entrance door with much violence. The noise was deafening, and he heard the falling of chimney pots, tiles, slates, and the breaking of glass.

Entering Parkgate the cyclone first attacked Dilke's Buildings, or as they are generally known, Salt Lake. The gables of the cottages were damaged, the bricks falling into the bedrooms and smashing the furniture and crockery. The slates and roofing were carried away. Tiles and slates were strewn about in large quantities. Continuing towards the town, the cyclone stripped off slates from the blast engine house and fitting shops of the Parkgate Iron and Steel Company. Trees were torn up in the adjacent grounds of the company known as Parkgate House, Lloyd-street. At Eggleston's aerated water manufactory a new chimney stack was destroyed, and part of the house of the proprietor of the establishment was blown down. A shutter of the shop of Mr. F. L. Sharpe, butcher, at the corner of Broad Street and Lloyd Street, was seen to be lifted across the highway and over the Wesleyan Chapel opposite. Broad Street was a sad scene of wreckage, with glass, tiles, slates, chimney pots, and other *debris*. Half the roof had gone from the premises of Mr.

Binney, pork butcher. Three cottages behind the "Sportsman" Inn had suffered. The one occupied by Mr. W. H. Jarvis, a labourer at the steel works, had lost parts of the roof and gable. The bricks had fallen on the bedroom and demolished the contents, blocking up the stairs. The supports of the bedstead were forced through the ceiling into the living room. The windows of the house on both sides were smashed. In the next house Joseph Crabtree had three panes of glass broken, and William Harrison, the lamp-lighter, was similarly inconvenienced. The spouts and slates were dashed to the ground. The Sportsman Inn roof was damaged. Messrs. Bool Bros. had a rug in their yard which had been carried a distance of 200 yards, from Mason's, the pawnbroker. At the shop of Mr. Parkin, fruiterer, a large plate-glass window was smashed, and a hamper belonging to him was carried up Rawmarsh Hill beyond the Co-operative Stores. A large piece of leather belonging to Mr. J. Smith, draper, &c., was afterwards discovered in the same locality. A new plate-glass window, in size probably 12 ft. by 9 ft., was literally blown to pieces, at the shop kept by Mr. Schonut, pork butcher. The signboard of the Clarence Hotel was wrested from its fastenings and deposited higher up the street, near the shop of Mr. J. Smith. At the latter's shop a plate-glass window, about 9 ft. square, was destroyed. Mr. Smith had removed many of the goods usually hung outside the shop, but those left in the doorway were spun round like tops. The iron lamp-post belonging to the Urban Council, and used for street lighting purposes, was twisted and rendered useless. Nearly opposite, in a vacant piece of ground, Mr. P. J. Gilling had erected a substantial wooden structure in which to carry on business as an auctioneer. This was blown down, and Mr. Gilling estimates his damage alone at about £50. The course of the cyclone from the bottom of Rawmarsh Hill is not so clearly marked, but the work of destruction was not ended at this point. Half a mile away, in Stocks Lane, slates were torn off the house of Mr. Ward, newsagent, and the gable end of the cottage of Mr. N. Fieldsend, was forced in, and the furniture, &c., of the bedrooms demolished.

Mr. Wilson, the proprietor of vehicles running between Rotherham and Parkgate, was standing in the street at Parkgate with an omnibus. The horses became restive, and Mr. Wilson endeavoured to control them. Either by the force of the wind or some other cause the vehicle was overturned. Mr. Wilson was much bruised, and sustained a severe shock. A miner named Garbutt and his wife, who were in the vehicle, had a narrow escape.

A woman named Lound was in the shop of Mr. Schonut, pork butcher, when the window was broken, and was knocked against the counter and sustained fracture of two ribs.

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## A TIDAL WAVE.

*To the Editor of the Meteorological Magazine.*

SIR,—Referring to the tidal wave reported to have occurred in Mount's Bay, between 4.45 p.m. and 5 p.m. on August 10th, of which you quote particulars in your August number, some confirmation of the theory therein alluded to—viz., that tidal waves may be attributed to submarine earthquakes—may perhaps be gained from the following facts.

It is, I believe, considered by many that there is a connection between earth tremors and the force of the magnetic currents. If this be so, it may be of interest to mention that on examining the photographic curves from the self-recording declination, horizontal force and vertical force magnetographs at the Falmouth Observatory, I find that there was a considerable disturbance between the hours of 3 p.m. and 8.30 p.m. on the 10th of August. The most violent movement occurred shortly before 5 p.m. For several hours after 8.30 p.m. the photographic traces are of a particularly steady character. There does not appear to have been any simultaneous disturbance in the meteorological conditions, as the curves all run smoothly. The hourly values were—

		BAROMETER. at 32° in.		TEMPERATURE.			WIND.	
				Dry.	Wet.		Direction.	Velocity. miles.
4 p.m.	...	29.363	...	63.3	61.6	...	S.S.E.	10.5
5 p.m.	...	29.367	...	61.0	59.8	...	S.	12.0
6 p.m.	...	29.355	...	60.2	59.2	...	S.	14.0

It may be mentioned that our Observatory is distant about 24 miles in a direct line from Mount's Bay, where the force of the tidal wave was so severely felt.—Yours faithfully,

W. L. FOX.

*Falmouth, 28th August, 1895.*

## MOCK-MOON PHENOMENON OF MAY 31ST.

*To the Editor of the Meteorological Magazine.*

SIR,—Having full view of this phenomenon from my windows, I made careful notes and drawings of it, from which the accompanying description and photograph are copied.

The evening was very mild, and a gentle breeze was moving from the S.E. The sky was veiled with a continuous but uneven film of cloud. I first noticed the phenomenon at 10.20 p.m., when the appearance was noted as follows:—The moon is surrounded with a silvery halo, which extends into four arms, two vertical, and two not quite horizontal, but curving upwards. The horizontal arms point to two large bright spots (mock-moons) of triangular shape, and iridescent with the red toward the moon. From these spots comet-like tails extend outwards and slightly upwards, and can be traced as far outwards from the spots as the latter are from the moon. The mock-moons are joined by a faint ring, which is *elliptical*, with the greater axis horizontal. There is no trace of a mock-moon at the lowest point; but at the highest point there is a nebulous patch having a convex lower border, and forming a kind of tangent arc.

10.45 p.m.—A second arc, of about 120°, has appeared above the main ring, and at a distance of one radius from it (or perhaps a trifle less). This second arc is as bright as the mock-moons, and *like them is iridescent, with the red edge toward the moon.*

11.0 p.m.—All has become faint, except the north mock-moon and the upper crescent.

11.6 p.m.—These have also faded away.

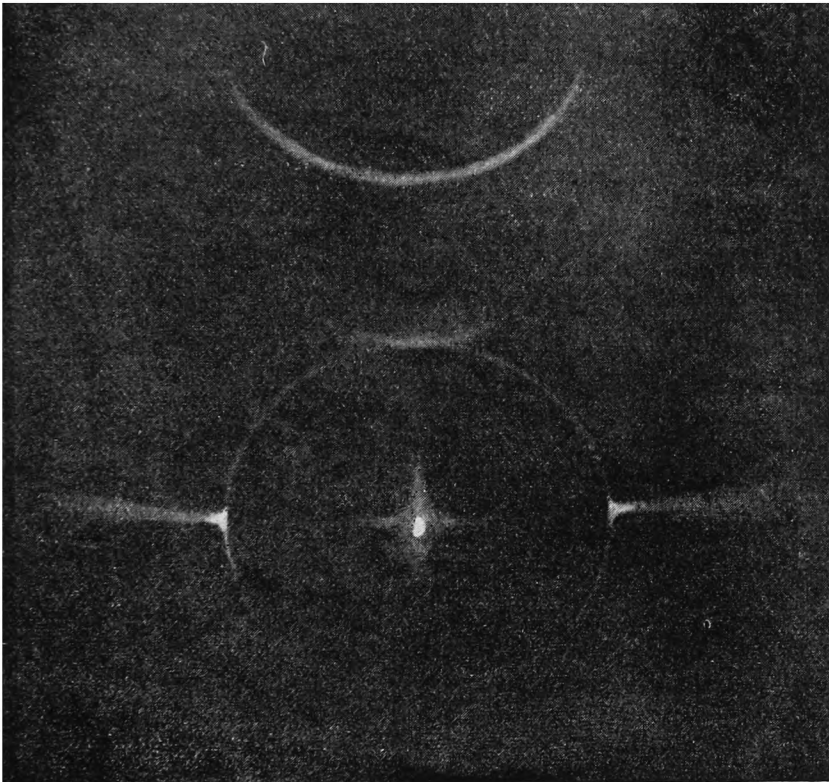
11.30 p.m.—A large filmy cloud to the S., having a large bright patch where the south mock-moon had previously been.

Within a minute or two of the last note, the whole phenomenon had disappeared ; and the sky was quite changed, being clear and flecked with light and drifting clouds.

I regret that I had no instruments at hand to measure the angles subtended by the rings, &c.

F. J. ALLEN.

*Mason College, Birmingham, July 15th, 1895.*



## LUNAR RAINBOW.

*To the Editor of the Meteorological Magazine.*

SIR,—We observed a very fine lunar rainbow here last night, at 10.15 p.m. It spanned the northern sky in a perfect arc of brilliant white, its inner rim being pale blue, and its outer of an orange tint.

The conditions were very favourable to the production of these phenomena. It was the most magnificent of these rare phenomena I have ever observed. Weather very unsettled, and showery ever since.—I am, Sir, your obedient Servant,

CUMMINGS TRIPP.

*Pinckney, Malmesbury, N.W. Wilts, August 3rd, 1895.*

## THE THUNDERSTORMS OF SEPTEMBER 7TH.

*To the Editor of "The Times."*

SIR,—As you have allowed me to give brief accounts of most of the thunderstorms of this year, it seems a pity to leave out those of Saturday morning. I was myself absent, but, as will presently appear, this was probably advantageous, as the automatic recording instruments here, coupled with the reports of Mr. Sowerby Wallis and of some of our assistants, enable me to give details not merely for this station, but for other localities also.

I was spending the night at Mr. Prince's observatory at Crowborough, about eight miles south-west of Tunbridge Wells. The observatory is on almost, or quite, the highest inhabited land in Sussex, and commands one of the largest sweeps of country I know of; Rochester, Hastings, Brighton, Eastbourne, Leith-hill, Knockholt Beeches were all visible from the top of the old observatory. We saw lightning over Lewes about 9 p.m. on the 6th, and at intervals till about 10.30 p.m., when we began also to hear long but distant thunder. The storm remained distant until about midnight, when it became severe, but was never within a mile of the hill; so that, while there was a blaze of light, no harm was done, and I do not think that the damage was proportional to the intensity of the storm, as most of the discharges passed from cloud to cloud, not from cloud to earth. Dr. J. Roberts, F.R.S., of the Starfield Observatory, which is almost adjoining, has a recording rain gauge, and it showed a fall of rain of 0.20 in. in about 15 minutes (midnight to 0.15 a.m.) and of another tenth before 2 a.m., after which no rain fell. This total, 0.30 in., was almost identical with Mr. Prince's, which was 0.33 in. We saw also much lightning about 4 a.m., probably that of the metropolitan storm, which was then in full action.

Turning now to Camden-square, I gather that, as regards frequency and brilliancy of lightning and loudness of thunder, the 4.30 a.m. storm much resembled that of the evening of August 22. The barometric disturbance and the rainfall were, however, greater.

The barometer fell 0.03 in. between 9 p.m. and midnight, and nearly 0.10 in. more by 3.10 a.m.; it was then steady for about an hour. At 4.15 a.m., when the storm burst over here, the first effect was a sudden further fall of 0.02 in. followed within a few minutes by a rise of nearly a tenth of an inch; the subsequent storms produced only slight effects.

The rain was very heavy, but not approaching the intensity of June 23rd, 1878. No rain fell till 3.15 a.m., when there was a sharp shower for a few minutes, yielding 0.03 in.; then at 4.20 a.m. came



a rush of rain, 0.42 in. being recorded by 4.30 a.m. (*i.e.*, 0.39 in. in ten minutes). It rained less heavily until 5.5 a.m., when 0.65 in. had fallen. Thence till 5.55 a.m. no rain fell, but in the next half-hour another two-tenths fell. From 6.30 to 7.35 no rain fell, but this was followed by a fall of 0.38 in. in little over a quarter of an hour, so that the total measured at 9 a.m. was 1.24 in.

There were at this station practically four storms—at 3.15 a.m., 4.20 a.m., 6.10 a.m., and 7.35 a.m. respectively.

It is too early to lay down the limits of the greatest rainfall, but the following records may be of interest:—Chiddingfold, Surrey, 0.30 in. ; Starfield, Crowborough, Sussex, 0.30 in. ; Observatory, Crowborough, Sussex, 0.33 in. ; Crouch Hill, Middlesex, 1.10 in. ; Upton, Slough, Bucks, 1.21 in. ; Camden Square, London, 1.24 in. ; Willesden, Middlesex, 1.48 in. ; Cherry Orchard, Staines, Middlesex, 1.52 in. ; \*Bagshot, Surrey, 1.53 in. ; Strathfield Turgiss, Winchfield, Hants, 1.78 in. ; \*Monk Sherborne Rect., Hants, 2.04 in.—Your obedient Servant,

G. J. SYMONS, F.R.S.

62, Camden Square, N. W., September 9th.

### BELGIAN RAINFALL.

WE have often expressed the belief that it is because of its smallness that the *Meteorological Magazine* is read so carefully ; whatever may be the cause, we hold that it is a great compliment. Written as most of it is at high speed, it would be supra-human if it did not sometimes contain mistakes. Of course, we should prefer that there be none, but next to that we rejoice in their being corrected. This month we have to deal with two. As regards the first, a question of priority, we mentioned at the foot of page 103 that in M. Lancaster's handsome map of Belgian rainfall he had adopted the excellent plan of indicating length of observation by gradation in the prominence of type ; we did not say that it was new (experience has taught us that it is dangerous to say that of anything), but we thought that it was. A correspondent, however, has pointed out that the plan was adopted 25 years since by Prof. Raulin in his *Observations Pluvio-métriques, France Méridionale*. M. Lancaster, therefore, was not the first to use the plan, but he did well to adopt it.

The other correction is, also, rather the supplying of additional information than the correction of an error. On p. 88, writing of Brussels Observatory, we said, "It is apparently the case that this observatory, upon which thousands of pounds have been spent, does not possess either a recording or a storm rain-gauge. We can arrive at no other conclusion from the fact," &c. M. Lancaster has asked us to state that the observatory has two self-recording rain-gauges, but that one was undergoing repairs, and the other failed. This, of course, was very aggravating, and we can quite sympathise with M. Lancaster in his annoyance ; but we object to rain-gauges which fail at the critical moment, and we think that their names ought to be known as warnings of what patterns to avoid.

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\* Additional Records.

[The abstract of Dr. Forster's paper upon the above subject, which is given in *The Geographical Journal* (the official organ of the Royal Geographical Society), is of such interest to Meteorologists, that we are sure that our readers will be glad to see the following extracts from Mr. Dickson's excellent summary.]

### TEMPERATURES OF EUROPEAN RIVERS,

By H. N. DICKSON.

IT seems almost inexplicable that, although important information is to be expected, and has indeed in many cases been obtained, from observations of river-temperatures, there is still only a small fraction of the meteorological stations situated on river banks which makes the recording of this element part of the ordinary routine. In a paper published recently by the University Geographical Institute of Vienna, Dr. Adolf E. Forster has collected most of the records of temperatures of European rivers which cover a long enough period to make them really useful, and the data are discussed with striking ability after the statistical methods still in most frequent use in this country. Each record is first criticized and valued on its own merits, the probable errors involved in different observational methods are discussed, and an attempt is made to reduce observations made at different hours to a true daily mean. The material available for ascertaining the form of the daily curve of temperature is extremely scanty, the most extensive hourly record being that of M. Renou in the Loire at Vendôme. The usual diurnal course seems to be a minimum at 8 a.m. in winter and 7 a.m. in summer, a maximum at 3 p.m. all the year round, the mean being crossed between 11 a.m. and noon. For a daily mean, however, single observations at 11 a.m., or two at 7 a.m. and 3 p.m., can leave little residual error. Observations at the two last-named hours give differences closely representing the daily range, and these exist for a considerable number of stations. The average range, as well as the mean variability, shows that in all cases the temperature of a river is in the first place controlled by that of the atmosphere, and this view is confirmed by the monthly and annual changes. Other factors—radiation, cloudiness, rainfall, evaporation, friction, thermal conductivity, heat capacity, &c.—are not without influence; but the most important is, as stated by Hertzner, certainly the temperature of the air.

Following this line, Dr. Forster devotes the main part of his paper to the relations between the temperatures of air and water at different seasons, and classifies the difference curves into four distinct types—rivers flowing from glaciers, from lakes, from springs and mountains, and rivers flowing through plains. Glacier streams, like the Rhine at Rheineck, the Inn at Fiefenbach, the Sill at Innsbruck, or the Rhone at St. Maurice, are markedly warmer than the air in winter, and colder in summer, the temperatures being equal about April and October. The defect in summer is usually sufficient to make the annual mean of the water at least  $1.8^{\circ}$  Fahr. below that of the air. To what distance the glacier influence may make itself felt depends,

of course, upon circumstances : on the Rhone it is distinctly recognizable 84 miles from the glacier, and on the Rhine 99 miles. Rivers flowing from lakes show a differential curve of a curiously characteristic type, strongly marked in the Rhone at Geneva, the Rhine at Alt-Briesach, the Ticino at Pavia, and the Mälar at Stockholm. In this case the mean annual temperature of the water is always above that of the air, the water being the warmer during the winter half-year to a much greater extent than it is the colder during summer. The outflowing water, in fact, closely follows the temperature of the surface layers of the lake, which remains relatively high during winter, inasmuch as the supply entering the lake from mountain and glacier streams, being colder than the main body, is denser and goes to the bottom, floating the warmer water up towards the surface. The Lake of Geneva and the Lake of Constance, for example, form in this way a kind of heat distributor, which tends to prevent the formation of ice in the Rhone and the Rhine. In the Rhine the lake influence is distinctly marked at Kehl, and even as far as Speyer ; but in the Rhone the effect is neutralized by the rapid fall and the glacier waters of the Arve before Lyons is reached.

Streams derived from springs have the peculiarity that the water cools faster with low air temperatures than it warms with high, chiefly because the water is kept at a low temperature by the soil, and by melting snow and ice. This characteristic, however, seldom persists for any great distance from the source. In mountain streams, which give a nearly similar curve, the greater slope of the bed and the frequent occurrence of deep narrow valleys, protecting from radiation, make the typical form recognizable further than usually happens where the spring influence acts alone, and the transition to the last or plain type of curve is delayed. The distinguishing feature of rivers of the plains is that their waters have a higher mean temperature than the air in all months of the year ; and such rivers can be further classified in three divisions—according as the excess is in summer greater than in winter, is equal in both seasons, or is in summer less than in winter. The first includes the true rivers of the plain—the Elbe, the Saale, the Weser, the Loire, the Seine, the Marne, and the Thames ; the second rivers, which so far as has been observed, do not quite get rid of the marks of origin in mountain springs—the Vistula, the Warthe, the Zilligerbach, the Main, the Danube (Dillingen), the Egge, the Lech, and the Wien ; while the third is simply an intermediate form, represented by the Oder, the Moldau, the Schloitzbach, and perhaps the Saône. It is obvious that the tendency must always be for all types to degenerate into the first division of the last, becoming gradually rivers of the plain. As Dr. Forster points out, there are probably really two forms of this type—that just noticed, where the water is always warmer than the air, and another where it is always colder. The latter form must be confined to countries where protracted frosts do not occur, and we have no example of it in Central Europe.

## CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, FEBRUARY, 1895

STATIONS.  (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.	
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.		
	Temp.	Date.	Temp.	Date.										
England, London .....	46·2	23	7·3	8	36·1	22·5	21·1	61·00	76	80·8	5·0	inches ·12	4	5·8
Malta.....	70·5	27	34·2	19	62·0	50·3	47·6	80	121·6	31·7	1·08	9	6·7	
<i>Mauritius</i> .....	89·5	18	66·8	14	85·4	72·5	67·8	72	136·6	58·2	2·97	14	5·3	
Calcutta.....	87·9	27	52·5	8	82·2	58·7	56·4	65	145·8	43·3	·02	2	1·3	
Bombay.....	91·4	21	61·4	4	83·0	68·2	64·4	68	141·4	49·8	·07	1	1·7	
Ceylon, Colombo .....	91·7	21	69·8	...	88·7	72·9	69·6	73	144·0	57·0	·81	5	1·5	
<i>Melbourne</i> .....	100·6	13	50·3	11	82·4	58·0	54·8	61	150·6	38·5	·74	5	4·0	
<i>Adelaide</i> .....	105·4	12a	53·0	9	87·2	64·5	52·1	44	165·0	43·7	·02	2	3·1	
<i>Sydney</i> .....	90·2	28	60·8	3	75·9	64·9	62·1	74	146·0	52·9	6·67	21	5·8	
<i>Wellington</i> .....	88·0	20	49·8	8	70·7	56·3	53·1	69	142·0	30·0	5·32	10	3·9	
<i>Auckland</i> .....	85·0	18	55·5	24	73·7	62·0	61·1	81	145·0	52·0	2·20	9	4·9	
Jamaica, Kingston.....	88·5	1, 2	64·1	6	85·3	67·0	66·0	76	...	...	2·20	3	4·0	
Grenada.....	86·0	12c	69·0	20b	81·7	71·6	66·8	69	156·4	...	4·87	15	2·6	
Toronto .....	44·3	27	—21·2	6	24·1	8·7	15·0	81	...	—27·0	·40	17	6·3	
New Brunswick, Fredericton.....	41·0	19	—12·5	1	26·6	3·5	10·3	78	...	...	2·30	12	5·4	
Manitoba, Winnipeg...}	41·2	26	—45·5	5	11·7	—11·5	...	...	...	...	1·18	11	4·7	
British Columbia, Esquimalt.....	54·1	26	30·2	10	47·5	38·1	38·9	85	...	...	2·62	18	8·1	

a—and 13. b—and 21. c—and 27.

## REMARKS.

**MALTA.**—Adopted mean temp. (55°·3), 1°·6 above the average. Mean hourly velocity of wind 12·8 miles. Average temp. of sea 58°·5. Thunderstorm on 7th. Dew point ranged from 27°·9 on 19th to 56°·0 on 26th. The min. on grass on the 19th is the lowest reading recorded here. J. F. DOBSON.

**Mauritius.**—Mean temp. of air equal to, dew point 2°·2 below, and rainfall 3·09 in. below, their respective averages. Mean hourly velocity of wind 9·1 miles, or 2·1 below average; extremes, 23·1 on 24th and 0·0 on 11th; prevailing direction, E.S.E. Lightning on 2nd, 5th, 16th and 28th. C. MELDRUM, F.R.S.

**CEYLON, COLOMBO.**—Lightning was seen on the 3rd, 4th and 5th. Thunderstorms occurred on the 24th and 25th. D. G. MANTELL.

**Adelaide.**—Mean temp. 2°·1 above the average of 38 years. Rainfall very light, ·60 in. below the average. C. TODD, F.R.S.

**Sydney.**—Mean temp. 0°·5 below, humidity 4 below, and rainfall 1·15 in. above, their respective averages. H. C. RUSSELL, F.R.S.

**Wellington.**—Showery up to the 11th, with moderate N.W. and S.E. winds. Rain on the 11th, 3·39 in., causing floods, with light S. wind. Lightning on night of 10th. The remainder of the month fine, with northerly winds, except showers on 21st, 23rd, and 24th. Max. shade temp. (88°) the highest ever recorded in Wellington. R. B. GORE.

**JAMAICA, KINGSTON.**—Weather fine excepting the last week. Mean hourly velocity of wind 4·3 miles. Rainfall three times the average. R. JOHNSTONE.

SUPPLEMENTARY TABLE OF RAINFALL,  
AUGUST, 1895.

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

Div.	STATION.	Total Rain. in.	Div.	STATION.	Total Rain.
II.	Dorking, Abinger Hall.	3·39	XI.	Lake Vyrnwy .....	5·72
„	Birchington, Thor .....	1·74	„	Corwen, Rhug .....	1·58
„	Hailsham .....	2·27	„	Carnarvon, Cocksidia ...	2·66
„	Ryde, Thornbrough .....	2·65	„	I. of Man, Douglas .....	5·28
„	Emsworth, Redlands ...	2·95	XII.	Stoneykirk, Ardwell Ho.	4·47
„	Alton, Ashdell .....	2·56	„	New Galloway, Glenlee	7·75
III.	Oxford, Magdalen Col...	2·40	„	Melrose, Abbey Gate ...	4·09
„	Banbury, Bloxham .....	1·74	XIII.	N. Esk Res. [Penicuik]	6·35
„	Northampton, Sedgebrook	1·78	„	Edinburgh, Blacket Pl..	5·12
„	Alconbury .....	2·18	XIV.	Glasgow, Queen's Park.	6·02
„	Wisbech, Bank House..	2·64	XV.	Inverary, Newtown .....	12·01
IV.	Southend .....	2·03	„	Islay, Gruinart School..	5·03
„	Harlow, Sheering ...	1·96	XVI.	Dollar .....	10·60
„	Colchester, Lexden .....	1·60	„	Balquhider, Stronvar..	8·65
„	Rendlesham Hall .....	1·70	„	Ballinluig .....	6·44
„	Diss .....	4·13	„	Dalnaspidal H.R.S. ...	7·13
„	Swaffham .....	3·32	XVII.	Keith H.R.S. ....	3·10
V.	Salisbury, Alderbury ...	2·13	„	Forres H.R.S. ....	2·90
„	Bishop's Cannings .....	3·34	XVIII.	Fearn, Lower Pitkerrie.	2·16
„	Blandford, Whatcombe.	3·16	„	Loch Shiel, Glenaladale	10·17
„	Ashburton, Holne Vic. ...	4·13	„	N. Uist, Loch Maddy ...	5·86
„	Okehampton, Oaklands.	4·54	„	Invergarry .....	6·22
„	Hartland Abbey .....	3·16	„	Aviemore H.R.S. ....	3·42
„	Lynmouth, Glenthorne.	5·34	„	Loch Ness, Drumnadrochit	3·64
„	Probus, Lamellyn .....	2·54	XIX.	Invershin .....	4·94
„	Wellington, Sunnyside..	...	„	Scourie .....	4·68
„	Wincanton, Stowell Rec.	4·02	„	Watten H.R.S. ....	2·16
VI.	Clifton, Pembroke Road	3·57	XX.	Dunmanway, Coolkelure	7·37
„	Ross, The Graig .....	2·22	„	Fermoy, Gas Works ...	...
„	Wem, Clive Vicarage ...	2·87	„	Killarney, Woodlawn ...	4·81
„	Cheadle, The Heath Ho.	3·53	„	Caher, Duneske .....	4·80
„	Worcester, Diglis Lock	2·20	„	Ballingarry, Hazelfort...	4·38
„	Coventry, Coundon .....	2·86	„	Limerick, Kilcornan ...	3·78
VII.	Ketton Hall [Stamford]	2·05	„	Ennis .....	3·64
„	Grantham, Stainby .....	1·49	„	Miltown Malbay .....	5·30
„	Horncastle, Bucknall ...	2·22	XXI.	Gorey, Courtown House	4·92
„	Workop, Hodsck Priory	1·30	„	Athlone, Twyford .....	5·88
VIII.	Neston, Hinderton .....	2·29	„	Mullingar, Belvedere ...	6·32
„	Preston, Haighton ...	4·49	„	Longford, Currygrane ...	...
„	Broughton-in-Furness..	5·61	XXII.	Woodlawn .....	6·06
IX.	Ripon, Mickley .....	3·23	„	Crossmolina, Enniscoe..	6·23
„	Melmerby, Baldersby ...	2·22	„	Collooney, Markree Obs.	4·66
„	Scarborough, South Cliff	...	„	Ballinamore, Lawderdale	...
„	Middleton, Mickleton..	2·53	XXIII.	Lough Sheelin, Arley ..	5·95
X.	Haltwhistle, Unthank..	4·80	„	Warrenpoint .....	6·85
„	Bamburgh .....	4·15	„	Seaforde .....	6·56
„	Keswick, The Beeches...	...	„	Belfast, Springfield .....	5·95
XI.	Llanfrehfa Grange .....	4·34	„	Bushmills, Dundarave...	3·91
„	Llandovery .....	5·67	„	Stewartstown .....	4·79
„	Castle Malgwyn .....	3·61	„	Buncrana .....	...
„	Builth, Abergwessin Vic.	5·87	„	LoughSwilly, Carrablagh	5·92
„	Rhayader, Nantgwillt..	4·88			

## AUGUST, 1895.

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 Nights below 32°.	
		Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours		In shade.	Max.		Min.		On grass.					
				Dpth	Date		Deg.		Date	Deg.		Date.				
inches.	inches.	in.														
I.	London (Camden Square) ...	3.09	+ 1.21	.67	10	18	81.3	21	46.0	25	0	0				
II.	Maidstone (Hunton Court)...	1.45	— .24	.50	10	11	...	...	...	...	...	...				
III.	Strathfield Turgiss .....	1.77	+ .06	.38	13	18	79.4	19	40.5	25	0	0				
IV.	Hitchin .....	5.03	+ 3.21	1.35	21	15	80.0	22	44.0	24	0	...				
V.	Winslow (Addington) .....	2.19	+ .22	.43	13	17	81.0	22	40.0	25	0	...				
VI.	Bury St. Edmunds (Westley)	4.08	+ 1.88	1.39	13	13	77.0	22	47.0	25	0	...				
VII.	Norwich (Brundall) .....	3.45	...	1.18	13	16	80.4	22	44.2	25	0	0				
VIII.	Weymouth (Langton Herring)	2.69	+ .76	.72	12	16	71.0	22	48.0	25	0	...				
IX.	Torquay (Cary Green) .....	2.41	...	.66	10	16	70.4	19a	47.8	8	0	0				
X.	Polapit Tamar [Launceston]..	3.29	+ .81	.56	7	17	73.0	18	38.5	25	0	0				
XI.	Stroud (Upfield) .....	3.07	+ .98	.60	5	20	77.0	22	48.0	7	0	...				
XII.	Church Stretton (Woolstaston)	2.70	— .06	.80	10	18	76.0	22	44.0	25	0	...				
XIII.	Tenbury (Orleton) .....	2.40	+ .28	.51	12	16	77.8	22	37.8	25	0	0				
XIV.	Leicester (Barkby) .....	1.63	— .81	.25	5	18	81.0	22	36.0	24	0	1				
XV.	Boston .....	2.61	+ .49	.65	5	13	84.0	18	57.0	14	0	...				
XVI.	Hesley Hall [Tickhill].....	1.42	— .74	.36	3	18	80.0	18	39.0	25	0	...				
XVII.	Manchester (Plymouth Grove)	3.55	+ .46	.80	26	17	80.0	26	42.0	24	0	...				
XVIII.	Wetherby (Ribston Hall) ...	3.50	+ 1.16	.92	11	10	...	...	...	...	...	...				
XIX.	Skipton (Arncliffe) .....	5.28	+ .95	1.06	26	21	...	...	...	...	...	...				
XX.	Hull (Pearson Park) ...	3.65	+ 1.01	.84	6	16	79.0	21	41.0	25	0	...				
XXI.	Newcastle (Town Moor) .....	3.86	+ 1.15	1.38	4	16	...	...	...	...	...	...				
XXII.	Borrowdale (Seathwaite).....	15.21	+ 6.76	4.44	26	24	...	...	...	...	...	...				
XXIII.	Cardiff (Ely).....	4.38	+ .77	1.14	12	18	...	...	...	...	...	...				
XXIV.	Haverfordwest .....	4.61	+ 1.43	1.08	10	20	73.3	17	42.9	8	0	...				
XXV.	Aberystwith (Gogerddan) ...	5.63	...	1.40	26	16	80.0	18	34.0	7, 24	0	...				
XXVI.	Llandudno .....	1.79	— .57	.34	26	19	78.0	18	47.8	1	0	...				
XXVII.	Cargen [Dumfries] .....	6.62	+ 3.63	.78	26	23	76.4	17	43.0	25	0	...				
XXVIII.	Jedburgh (Sunnyside).....	3.33	+ 1.09	.81	5	21	80.0	17	45.0	15	0	...				
XXIX.	Colmonell .....	5.08	...	.73	26	21	75.0	20	44.0	7	0	...				
XXX.	Lochgilthead (Kilmory).....	6.62	+ 2.06	1.11	29	24	...	...	40.0	24	0	...				
XXXI.	Mull (Quinish).....	5.95	+ 1.80	1.22	28	25	...	...	...	...	...	...				
XXXII.	Loch Leven Sluices .....	6.50	+ 3.56	1.50	5	19	...	...	...	...	...	...				
XXXIII.	Dundee (Eastern Necropolis)	4.55	+ 1.98	.55	28	23	77.3	18	39.9	25	0	...				
XXXIV.	Braemar .....	4.93	+ 1.60	1.65	23	25	70.3	17	36.3	15	0	1				
XXXV.	Aberdeen (Cranford) .....	3.52	...	.56	11	22	77.0	17	42.0	8	0	...				
XXXVI.	Strathconan [Beaul] .....	6.60	+ 3.30	1.40	12	16	...	...	...	...	...	...				
XXXVII.	Glencarron Lodge .....	7.95	...	2.19	29	24	72.6	17	43.0	3	0	...				
XXXVIII.	Cawdor [Nairn] .....	3.21	+ .96	.45	13	24	...	...	...	...	...	...				
XXXIX.	Dunrobin .....	3.30	+ .90	.68	29	18	71.0	18	43.0	25	0	...				
XL.	S. Ronaldsay (Roeberry).....	2.17	— .39	.83	29	15	69.0	17	46.0	24c	0	...				
XLI.	Darrynane Abbey.....	5.63	...	.99	10	23	...	...	...	...	...	...				
XLII.	Waterford (Brook Lodge) ...	4.78	+ 1.36	1.04	25	17	70.0	14	41.0	25	0	...				
XLIII.	O'Briensbridge (Ross) .....	5.69	...	1.22	20	25	...	...	...	...	...	...				
XLIV.	Carlow (Browne's Hill) .....	4.95	+ 1.98	1.12	22	25	...	...	...	...	...	...				
XLV.	Dublin (Fitz William Square)	3.55	+ 1.03	.70	10	27	71.7	28	46.3	25	0	...				
XLVI.	Ballinasloe .....	4.47	+ 1.29	1.20	26	26	70.0	17	44.0	24	0	...				
XLVII.	Clifden (Kylemore) .....	8.44	...	1.18	22	25	...	...	...	...	...	...				
XLVIII.	Waringstown .....	4.57	+ 1.46	.56	26	25	75.0	16b	42.0	7, 24	0	...				
XLIX.	Londonderry (Creggan Res.)..	5.65	+ 1.53	1.26	3	27	...	...	...	...	...	...				
L.	Omagh (Edenfel) .....	6.65	+ 3.16	.77	23	25	70.0	16	42.0	4	0	...				

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

a—and 30.

b—and 17.

c—and 25, 27, 29.

# METEOROLOGICAL NOTES ON AUGUST, 1895.

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.

STRATHFIELD TURGISS.—The month opened with very unsettled weather, with frequent and heavy R accompanied by T, and continued so until the 14th. Towards the middle of the month a gradual improvement set in, with fine and bright weather to the close. TSS on 10th, 21st and 22nd; T on 1st, 2nd and 6th.

ADDINGTON.—The first fortnight was unsettled with a good deal of R. On the 4th a violent TS occurred with R but no H, while at Winslow, two miles distant, a heavy H storm did much damage to vegetables, &c.; T on the 10th and again at 2 a.m. on the 22nd with almost constant L, and another heavy TS at 8 a.m. the same morning. The remainder of the month fine.

BURY ST. EDMUNDS, WESTLEY.—The first half of the month was very wet with many TSS. Large H stones fell on the night of the 10th during a TS; the 13th was very wet, the rain coming from the S.E. and N.E. The latter half of the month was very fine and warm. TSS on 2nd, 6th, 10th, 12th and 21st, and T on 3rd, 4th, 5th, 13th, 14th and 22nd.

NORWICH, BRUNDALL.—To the 14th very showery and unsettled, but the last half of the month chiefly very fine with many warm days. Mean temp. of the month  $61^{\circ}\cdot9$ , about  $1^{\circ}$  above the average, and about  $2^{\circ}\cdot5$  above August, 1894. TSS on 2nd, 7th, 10th, 12th, 13th and 22nd; T on 6th and 14th.

LANGTON HERRING.—From the 1st to 14th inclusive very unsettled weather; fine but rather hot from the 16th to the 24th. The night of the 21st and 22nd—during which there was a TS—was very hot, the min. temp. being  $62^{\circ}$ . Beautifully fine summer weather for the last five days. The average temp. at 9 a.m.,  $61^{\circ}\cdot8$ , is  $0^{\circ}\cdot3$  below the average of 23 years, but the average min. is  $0^{\circ}\cdot4$  above the average. Fogs on the 22nd and 23rd.

TORQUAY, CARY GREEN.—Rainfall  $\cdot45$  in. below the average; mean temp.  $60^{\circ}\cdot1$  or  $1^{\circ}\cdot4$  below the average. Duration of sunshine 188 hours, being 20 minutes above the average; 1 sunless day.

POLAPIT TAMAR.—The first fortnight was very wet, the total for the month being considerably in excess of the average.

STROUD, UPFIELD.—Prevailing winds S.W. and W. T on 4th and 23rd; T and L between 1.30 and 2.30 a.m. on 22nd.

WOOLSTASTON.—A very fine harvest month. T and L on 10th, and very vivid sheet L on 22nd. Mean temp.  $58^{\circ}\cdot5$ .

TENBURY, ORLETON.—The first half of the month was wet and rather cooler than the average, but from the 16th to the end was very fine and warm, with a larger proportion of sun than usual. Mean temp. of the whole month more than  $1^{\circ}$  above the average of 34 years. T on the 2nd, 4th, 10th and 22nd; T and L on the 22nd.

LEICESTER, BARKBY.—Wet (but not heavy R) almost every day for the first two weeks. A very warm month, with warm nights except on the 24th. L and T on 2nd, 10th and 22nd. Continuous sheet L on the nights of 23rd and 24th. Corn harvest not completed at the end of the month, about an average yield. Mean max. temp.  $72^{\circ}\cdot8$ , mean min.  $50^{\circ}\cdot2$ , mean temp.  $61^{\circ}\cdot5$ .

MANCHESTER, PLYMOUTH GROVE.—The weather up to the 15th, was unsettled, but from the 16th to the 23rd summer weather prevailed. From the 24th to the end of the month the weather was unsettled and much colder. T and L on the 23rd and 27th. Mean temp.  $61^{\circ}\cdot5$ .

HULL, PEARSON PARK.—TS with H on 6th, and TSS on 10th, 14th, 22nd and 27th.

## WALES.

HAVERFORDWEST.—This month was characterised by much sultry heat, although no very high temperature prevailed. The nights were oppressive and the rainfall was considerable. Aurora was seen on two or three nights. Prevailing wind S.W. TS on 23rd.

ABERYSTWITH, GOGERDDAN.—Stormy throughout the month and very growing weather. T frequent.

#### SCOTLAND.

CARGEN.—The light rainfall of the first six months is being compensated for by an excess of 5·38 in. in the months of July and August. The heavy fall of July, so much exceeding the average, has been followed by a heavier and almost equally excessive amount in the past month. During the two months 12·61 in. has fallen, an amount never previously registered for these two months since observations commenced 36 years ago. The average R for July and August is 7·23 in.; the nearest approach to this year's record is 11·95 in. in July and August, 1873, and 11·78 in. in July and August, 1877. In only two other years, 1861 and 1891, has the rainfall of these months reached double figures. Sunshine is considerably below the average. A remarkable feature of the month has been the prevalence of southerly wind, south wind prevailing during 17½ days, while the average for the month is only four and a half, and the highest previous record nine. The damage done to the cut and growing corn is most serious, the muggy wet weather causing sprouting within a very few days of cutting. A great quantity of meadow hay must be irretrievably damaged. Potato disease made somewhat sudden appearance towards the end of the month. On the other hand the turnip crop shews great improvement, and pastures were never more luxuriant at this season. T and L on 6th, 11th and 14th, and T on 10th and 27th.

JEDBURGH.—The weather was very unsettled, the showers being often heavy. Good crops of turnips and potatoes, and the latter free from disease.

COLMONELL.—Rainfall 1·09 in. above the average of 19 years.

ABERDEEN, CRANFORD.—The month was very hot, with very little sunshine. Considerable electrical disturbance around, the TSS following the line of the mountains, and being very severe from 30 to 40 miles to west and north, in the line of the Grampians and Benachie.

ROEBERRY.—A very fine month. Mean temp. 57°·2.

#### IRELAND.

DARRYNANE ABBEY.—A very wet month, cold and windy also. Great TS (very unusual here in summer) between 9.30 p.m. and 11.30 p.m. on 22nd, with heavy R; very heavy R also (·71 in.) between 2 and 4.30 p.m. on 10th.

WATERFORD, BROOK LODGE.—A heavy wet month with a good deal of L. Thick fog on five or six days.

O'BRIENSBRIDGE, ROSS.—A most unfavourable month, involving delay and serious damage to the hay crop. T and L frequent and especially severe on the night of the 22nd, and attended with many casualties. Range of temp. high; prevalent wind S.W.

DUBLIN.—Like August, 1894, this month was very rainy, R falling on 27 days. Unlike August, 1894, however, the month was fairly warm, the mean temp. being slightly above the average. This was due to comparative warmth by night, the mean min. temp. being 54°·2, compared with the average 53°·6, while the mean max. was exactly the average, namely 65°·8. There was an overwhelming prevalence of S.W. and W. winds. Two-thirds of the sky was clouded throughout the month, compared with three-fourths in August, 1894. TS on 11th.

WARINGSTOWN.—Rain very frequent and consequently a bad month for hay making. Weeds rampant.

EDENFEL.—A humid, warm and wet month, with R nearly double the average, deposited mostly in torrential showers. Harvest delayed, and late meadows in a precarious state. After-growth of vegetation abnormally luxuriant.



# SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

CCCLVII.]

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## THE BRITISH ASSOCIATION AT IPSWICH.

Although there were not many meteorologists at the Ipswich Meeting, meteorology came more to the front than usual. The President (Sir Douglas Galton, K.C.B.) devoted to it the following portion of his address :—

### METEOROLOGY.

At the first meeting, in 1831, Professor James D. Forbes was requested to draw up a report on the state of meteorological science, on the ground that this science is more in want than any other of that systematic direction which it is one great object of the Association to give. Professor Forbes made his first report in 1832, and a subsequent report in 1840. The systematic records now kept in various parts of the world of barometric pressure, of solar heat, of the temperature and physical conditions of the atmosphere at various altitudes, of the heat of the ground at various depths, of the rainfall, of the prevalence of winds, and the gradual elucidation not only of the laws which regulate the movements of cyclones and storms, but of the influences which are exercised by the sun and by electricity and magnetism, not only upon atmospheric conditions, but upon health and vitality, are gradually approximating meteorology to the position of an exact science. England took the lead in rainfall observations. Mr. G. J. Symons organised the British Rainfall System in 1860 with 178 observers, a system which until 1876 received the help of the British Association. Now Mr. Symons himself conducts it, assisted by more than 3,000 observers, and these volunteers not only make the observations, but defray the expenses of their reduction and publication. In foreign countries this work is done by Government officers at the public cost. At the present time a very large number of rain gauges are in daily use throughout the world. The British Islands have more than 3,000, and India and the United States have each nearly as many; France and Germany are not far behind; Australia probably has more—indeed, one colony alone, New South Wales, has more than 1,100. The storm warnings now issued under the excellent systematic organisation of the Meteorological Committee may be said to have had their origin in the terrible storm which broke over the Black Sea during the Crimean War on November 27th, 1855. Le Verrier traced the progress of that storm, and, seeing how its path could have been reported in advance by the electric telegraph, he proposed to establish observing stations which should report to the coasts the probability of the occurrence of a storm. Le Verrier communicated with Airy, and the Government authorised Admiral FitzRoy to make tentative

arrangements in this country. The idea was also adopted on the Continent, and now there are few civilised countries north or south of the equator without a system of storm warning. (It has often been supposed that Le Verrier was also the first to issue a daily weather map, but that was not the case, for in the Great Exhibition of 1851 the Electric Telegraph Company sold daily weather maps, copies of which are still in existence, and the data for them were, it is believed, obtained by Mr. James Glaisher, F.R.S., at that time Superintendent of the Meteorological Department at Greenwich).

The subject of Meteorology was also mentioned in Mr. Vernon Harcourt's Presidential Address to Section G. (Mechanics).

*Meteorology in Relation to Engineering.*—The maximum pressure that may be exerted by the wind has to be allowed for in calculating the strains which roofs, bridges, and other structures are liable to have to bear in exposed situations; and continuous records of anemometers for long periods are required for determining this pressure. The force of the wind also, and the direction, duration, and period of occurrence of severe gales, are important to the maritime engineer for estimating the effects of the waves in any special locality, for determining the quarter from which shelter is needed, and for ascertaining the seasons most suitable for the execution of harbour works, the repair of damages, and the carrying out of foundations of lighthouses and beacons on exposed rocks. The harbour engineer must, indeed, of necessity be somewhat of a meteorologist, for the changes in the wind and weather, the oscillations of the barometer, and the signs of an approaching storm are indications to him of approaching danger to his works, which he has to guard against; for the sea is an insidious enemy which soon discovers any weak spot, and may in a few hours destroy the work of months.

Continuous records of rainfall, as collected regularly by Mr. Symons from numerous stations in the United Kingdom, are extremely valuable to engineers for calculating the probable average yield of water from a given catchment area, the greatest and least discharges of a river or stream, the size of drainage channel needed to secure a low-lying area from floods, and the amount of water available for storage or irrigation in a hot, arid district. The loss of water by evaporation at different periods of the year, and under different conditions of soil and climate, the effect of percolation in reducing evaporation, and the influence of forests and vegetation in increasing the available rainfall, while equalising the flow of streams, are subjects of equal interest to hydraulic engineers and to meteorologists.

Countries periodically visited by hurricanes, cyclones, or earthquakes, necessitate special precautions, and special designs for structures; and every additional information as to the force and extent of these visitations of nature is of value in enabling engineers to provide more effectually against their ravages.

A considerable portion of the address of the Chairman of the Conference of Delegates (Mr. G. J. Symons) dealt with matters of a similar nature:—

1. *Meteorological Observations in general.*—Do not encourage the keeping of records from any but good instruments, properly placed. A hard frost occurs, and forthwith there is a crop of wonderful records, some from thermometers badly placed, some from thermometers which never were good, some from good

thermometers allowed to go wrong. An incorrect statement is much worse than none at all; see to it, then, that such records as you publish are worthy of your Society. I say no more on this head because the Royal Meteorological Society has published almost at cost price (1s.) an amply illustrated pamphlet, "Hints to Observers," which will show anyone what, and when, and how, observations ought to be made. It is by no means necessary to start with an elaborate and costly set of instruments; but see to it that the instruments which you do have are good, and that no records except from good and tested instruments, properly placed, ever appear in your volumes.

2. *Sea and river temperature.*—I have interpolated the words "and river" because I ought to have put them in the syllabus originally, and because my attention has been drawn to the subject by an excellent summary of Dr. Adolf Forster's work upon the temperatures of European rivers, by Mr. H. N. Dickson, given in the September number of *The Geographical Journal*. You will remember that for a few years there was a Committee of the British Association studying river temperature; and I am sure that if your societies took up the investigation, a fresh committee could be appointed, so that we should not need to go to a German book to learn the details of the temperature of the Thames. The work is easy, healthy, and inexpensive. Easy, because it merely involves a walk to a bridge, a jetty, or a pier head, the lowering of the thermometer into the water, entering the reading, and carrying it home again; healthy, from the regularity of the walk; and inexpensive, because the verified K. O. thermometer and its copper case, cord and everything could be sent to any part of the country complete for a sovereign.

3. *Earth temperature at shallow and at great depths.*—The second half of this subject has often been brought before you, because the Underground Temperature Committee is the oldest one of the British Association. It, as you know, deals chiefly with the temperature in mines and in deep shafts and wells. Anyone who can obtain good records at depths of, or exceeding, 1,000 feet can do useful work, but I am doubtful whether much more can be learned in this country by observations at depths between 10 feet and 1,000 feet than we already know. I insert the words "in this country," because I do not think that the law of decrease for tropical and for arctic localities is known. Unfortunately we have no representatives of such localities here, or we might sow a productive seed. Observations at shallow depths—say 3 inches to 10 feet—are becoming less rare than they were, and the time is not distant when the law of temperature variation for shallow depths will be known with sufficient accuracy. That much has yet to be ascertained, many persons learned by burst water pipes last winter. I mention this as an illustration of the application of scientific records to the welfare of mankind, not as an indication that I consider the mischief to have been wholly produced by soil temperature; but I must not digress.

4. *Phenological work.*—I am afraid that this word, phenological, has not proved very acceptable. I once heard an inquiry what meteorology had to do with prisons—and it turned out that the querist had overlooked the "h," and reading it as "penological," thought that it must have something to do with punishment. However, I need not tell you that it means the laws of the life history of plants and animals; in fact, an endeavour to record the progress of the seasons, not by thermometers or by rain gauges, but by plants, trees, insects and birds, and the study of the relations between the indications of the natural history

phenomena and those of the instruments, and efforts to separate cause and effect. It has always seemed to me a class of work peculiarly adapted for the Local Scientific Societies, for their Botanical and Entomological Sections. The Royal Meteorological Society has spent a considerable sum in promoting this work, and in the hands of Mr. E. Mawley it is progressing. Personally, I am not competent to pronounce any criticism upon the work beyond this, that Mr. Mawley has devoted himself to it, and has produced tables and diagrams of great interest. But I do say this, that I think that the naturalists should either co-operate heartily with the meteorologists, or else should show that the meteorologists are attempting the impossible or the undesirable.

5. *Early meteorological records.*—It is a prevalent idea (especially with executors) that old manuscript books of observations are useless. I have every reason to believe that a long deceased relative of my own assisted in burning part of the oldest record of the rainfall in this country—that begun at Townley in Lancashire in 1677; and what she did, at the beginning of this century, has been done by scores of others, and will be until mankind are much more thoughtful and much better informed than they yet are. But I am not addressing you in the capacity of executors, but as representatives of large local bodies, many of them with museums and libraries; and I invite you to see to it, that any such records that you have are properly cared for.

Another suggestion—The practice is fortunately rapidly spreading of publishing the early parochial registers. If each society represented here would make it a rule to go through all such publications as have been issued within its area, and print in chronological order all the notes on earthquakes, storms, frosts, floods, &c., which can be collected, much good would be done. Of course, this can be done for unpublished as well as for published records.

6. *Records of river and well levels.*—The second half of this subject has so often been brought before you by Mr. de Rance, the Secretary of the British Association Committee on Underground Water, that I need merely mention it. The first part refers to a subject involved in my next and last heading, and to which, therefore, I will at once proceed.

7. *Records of floods and the placing of flood-marks.*—It is very strange that Englishmen (Britons I had better say, for our Irish and Scotch friends are equally bad) are so nearly the worst nation in Europe for looking after their rivers. I do not refer to fouling by sewage and by manufacturing refuse, or to defective engineering—I do not know where we stand in those respects—but I refer to records of river levels, to automatic recorders of their rise and fall, to arrangements for warning the owners of low-lying property when floods are probable, to scale marks on the bridges, and to the classification, levelling, and publication in full, of particulars as to the old flood-level marks, and the due marking of new ones when floods occur. I do not suggest that your Societies should themselves do all this, but that they should bring it before their Parish and County Councils, and couple their request with the offer of any assistance in their power. Of course the suggestion will be received politely, the great cost will be urged, and in many cases nothing will be done. Forgive my detaining you to hear a little true story. Years ago I suggested such arrangements to an influential man in York—nothing was done. In 1892 York had a flood, not so bad as some on record, but one which cost

the Corporation a very large sum ; they paid it, and, that steed having been stolen, they have figuratively locked the stable door, by adopting every one of the arrangements suggested above. If the Councils do not take your advice, they must remember that your attendance will be on their Minutes, to be referred to when their town or district suffers as York did.

### REPORT ON UNDERGROUND TEMPERATURE.

Professor J. D. Everett read this report, which contains a description of temperature observations made in a bore-hole at Cremorne, near Port Jackson, New South Wales. The hole is 2,929 ft. deep, and showed a temperature gradient of  $1^{\circ}$  F. in 80 ft. This being smaller than the average, it might be thought that the proximity of Sydney Harbour was affecting the distribution of temperature. Observations on the water of the harbour showed, however, that the gradient was less than in the bore-hole. This was the first observation in the Southern Hemisphere.

Lord Kelvin suggested that the African mines might furnish a new field for future observations of underground temperature.

### REPORT ON SOLAR RADIATION.

The Committee which was appointed some time ago to consider the best methods of recording the direct intensity of solar radiation, reported that for various reasons no experiments had been made with the Balfour Stewart actinometer since the last meeting of the Association. As Mr. W. E. Wilson had undertaken to continue the experiments, the Committee asked for re-appointment, and the unexpended balance of the previous grant.

### REPORT ON EARTH TREMORS.

Mr. G. J. Symons read this report. During the year two bifilar pendulums have been purchased from the Cambridge Instrument Company, similar to those with which experiments were made in 1893 and described in the report for that year. Several modifications have, however, been made, such as were mentioned in last year's report. Each pendulum has a photographic recording apparatus. The committee hope to compare the records of the two instruments during the coming year. An appendix to the report, by the secretary (Mr. C. Davison) gives the history and bibliography of the horizontal and bifilar pendulums. These he groups into three classes—(1) those in which the rod or mirror is suspended by two wires, the centre of gravity of the rod or mirror lying either (a) between the points of attachment of the suspending wires or (b) outside them ; (2) those in which the rod is supported by one wire and one steel point ; (3) the pendulum of Rebeur-Paschwitz, which is supported on two steel points. Mr. Symons said the instruments could detect a tilt of the earth through an angle equal to that between two straight lines diverging from each other by only one inch in 1,000 miles. They are quite unaffected by short-period movements such as are produced by ordinary street traffic. The object was not merely to record distant earthquakes or tremors, but also to record any tilting in the earth's surface, with the ultimate view of determining whether this tilting was caused by tidal waves, large changes and disturbances of atmospheric pressure, or other agencies.

## REPORT ON THE APPLICATION OF PHOTOGRAPHY TO METEOROLOGY.

Mr. G. J. Symons presented the report from this Committee, and gave an interesting account of what Mr. Clayden, the secretary, had done in the direction of cloud photography, and explained that, although it would be some time before they could hope to get any considerable number of photographs, the cameras for this purpose had been purchased and electrically connected, and little more was now required beyond the necessary time and attention. Mr. Symons handed round a photograph of a rainbow—the first of the kind that he had seen—which had been sent to him with the following letter :—

“ Steeple Croft, Coventry.

“ Dear Sir,—At the meeting of British Association a couple of years ago, I promised to obtain for you, if possible, some photographs of lightning; but circumstances have not been favourable. I send you, however, a couple of prints from negatives of a rainbow recently taken. It was, I think, the finest bow I have ever seen. One marked peculiarity was the brighter or lighter colour of the cloud inside the bow, and this is clearly shown in the photograph. Another peculiarity was that the green and violet seemed to be duplicated or triplicated inside the bow, and the albumenised print shows some traces of this. The outer bow is also visible in the prints. The lens I used was a symmetrical doublet, four inches focal length, exposure three seconds.—Yours, &c.,

“ WILLIAM ANDREWS, F.G.S.”

Professor Schuster said it was a most interesting and beautiful photograph, showing how the inside of the rainbow was much brighter than the outside. It was also an instructive photograph, as a means of showing students what we had been teaching them without being able to prove to them.

## REPORT ON METEOROLOGICAL OBSERVATIONS ON BEN NEVIS.

Extracts from this report were read by the Secretary. The hourly eye observations by night as well as by day have been made without interruption during the year on Ben Nevis, and continuous records have been made at Fort William low-level observatory. Rainband observations are inserted in the report for the first time, as are also the records of mean hourly velocity of the wind at the top of the mountain. At Fort William the mean temperature of the year was  $0^{\circ}8$  higher than the mean of previous years, while the top of the mountain was  $0^{\circ}9$  higher than the mean. The lowest mean monthly temperatures were in January,  $39^{\circ}3$  at Fort William and  $21^{\circ}7$  on the summit. The former is  $0^{\circ}7$  above, the latter  $2^{\circ}1$  below, the average; so that during the month there existed a large difference of temperature between the two places, attributable to absence of anticyclonic weather and a great want of sunshine, the total sunshine registered on the top of the mountain being only three hours for the whole month. In September and October, on the other hand, maxima of sunshine were recorded. The highest mean temperatures were reached in July at both observatories. November showed the greatest excess of temperature above the average of past years, amounting to  $4^{\circ}1$  at the bottom and  $3^{\circ}2$  at the top of the mountain. The cause is to be found in the south-westerly

winds which predominated to a greater extent than for the past 40 years. The coldest day was January 6th, the lowest temperature recorded being  $0^{\circ}\cdot7$  at the top and  $20^{\circ}\cdot8$  at Fort William. Details of the observations and weather of this day are given in the report. Much work has been done in re-copying the observations at the two observatories in order to examine the bearings of the differences of readings on the meteorology of North-Western Europe. This work is being carried on by Dr. Buchan and Mr. Omond; among the chief phenomena considered are cyclones and anticyclones, differences of temperature and wind between the two stations, especially occasions when the temperature was higher on the top than at the sea-level, and days when the difference of temperature greatly exceeded the normal amount. An inquiry into the connexion of these occurrences with coming storms and with each other will, it is hoped, lead to valuable results; it already points to the necessity for most important modifications in the present theory of cyclones held by meteorologists. Four tables are added to the report, showing the mean hourly variations of pressure at Magdeburg and San José on fine and cloudy days respectively. These two stations are chosen because Magdeburg has a dry climate contrasting with the wet one of Ben Nevis, and San José, at about the same height above the sea as the top of the Ben, is only 10 deg. from the equator. The characteristically low morning maximum and the very high evening maximum during cloudy days at Ben Nevis and Magdeburg, in all seasons, do not occur at San José in similar weather. The two daily minima do, however, occur there, the morning one being larger on cloudy than on sunny days, and the afternoon one less.

### REPORT ON EARTHQUAKES IN JAPAN.

Prof. John Milne gave an account of the long report of the Committee on Seismological Phenomena in Japan. This commences by a reference to the great loss caused by the recent fire at Prof. Milne's house and observatory, after which follows a description of the records of the Gray-Milne seismograph. Attached to the report is a catalogue of 8,331 earthquake shocks recorded in Japan between 1885 and 1892, giving full particulars of the centre and area of disturbance. It enables the approximate *weight* of each to be found, and permits the division of Japan into fifteen distinct seismic districts. The next section of the report deals with the rate of propagation of earthquake disturbances from Japan to Europe. The small tremors which occur in the ten seconds or so before an earthquake shock are transmitted to Europe, but they are spread over half an hour; it appears, therefore, that the preliminary tremors either travel more quickly, or reach Europe by a shorter route than the main shock. The latter is known to travel along the surface at about 3,000 metres per second. Do the tremors travel at 8,000 to 11,000 metres per second, or do they pass through the earth, not round it? If the latter, we may hope for some further knowledge concerning the interior of the globe. Prof. Milne has set up horizontal pendulums in nearly a score of places, and finds great differences in their behaviour. They all exhibit a general displacement, *i.e.*, tilt, in the same direction, and similar long-period movements. Examined from hour to hour, however, some of them show the existence of a diurnal wave. After a long and very laborious search, graphically described to the Section by Prof. Milne, he succeeded in tracing this diurnal effect to the local removal of load from the

alluvium by greater evaporation from exposed areas. At night the movement is slight, and is probably accounted for by the condensation, at the cold surface, of aqueous vapour after rising through the warm earth. Some observations have been made on the disturbance of the pendulums by earth tremors. Their cause has not been ascertained, but they always occur with greatest intensity between 5 and 9 a.m. They are most marked with a steep barometer gradient and consequent wind, local or distant.

Lord Kelvin said it was possible to determine mathematically the time of arrival of the first earthquake shock reaching any point from any other point. Such calculations would, however, tell us nothing about the rigidity of the interior of the earth.

Prof. Gray referred to the enormous loss sustained by Prof. Milne in the burning of his books and instruments. He hoped the Association would make a grant enabling Prof. Milne to continue his work.

As Prof. Milne has now returned from Japan, and the earthquake catalogue is completed, the Committees on Earth Tremors and Seismological Phenomena have united under the latter name. The new Committee is a large one, and with Prof. Milne and Mr. Davison as joint secretaries, it ought to do good work.

#### REPORT OF THE COMMITTEE ON UNDERGROUND WATERS.

This was read by Mr. C. E. De Rance, the Secretary, who has practically done all the work for many years. We have not a full note of the report, but understand that it was the final one, and that arrangements are proceeding with a view to the publication of a volume giving a synopsis of the large mass of data as to wells and their yield in all parts of the country.

#### REPORT ON COSMIC DUST.

Dr. John Murray said that at the bottom of the Pacific Ocean, 1,000 miles from any coast, the red clay deposits contain three classes of magnetic particles. These are (1) crystalline fragments of magnetic or titaniferous iron; (2) dark, shiny spherules; and (3) brownish spherules, known as chondres. The dark spherules contain iron particles which, when the spherule is ground down, become coated with copper if treated with a solution of copper sulphate. They are probably volcanic, and of terrestrial origin. The brown spherules are extra-terrestrial. They occur in the various layers of manganese nodules, along with the black spherules, but they are not found except at the place mentioned in the Pacific Ocean. They have been looked for in many places, but without success. Most probably they are hidden by the presence of other matter, as their amount is very small, say, about 20 lb per square mile per century. He wanted advice as to the best means of procedure, in order to collect this dust in other parts of the globe.

In reply to Lord Kelvin and Professor Fitzgerald, Dr. Murray said that the dust from Ben Nevis and the Greenland glaciers contained no cosmic matter.

The following were the ordinary papers which dealt with meteorological subjects:—

#### E. S. BRUCE—*On Probable Projective Lightning Flashes.*

The object of this paper was to suggest the possibility of projective lightning flashes, whose existence would increase the difficulties of classification. Ordi-



nary sheet lightning is the reflection of a lightning flash by a cloud, images from different points being superposed. If, however, a cloud intervenes between the flash and the reflecting cloud, containing one or more openings, the light from the flash will be faintly reflected from a few points only of the reflecting cloud, and we shall have as many inverted images of the flash as there are openings. If the reflecting cloud is of irregular shape the images will be distorted, and a straight flash may appear to possess angles. This was illustrated by lantern slides and experiments, a drawing of an actual thundercloud with four apertures being exhibited. He doubted whether such reflected flashes would be intense enough to affect a photographic plate.

Mr. G. J. Symons thought there should be a patch of brighter light at the angle of a reflected flash, if formed in the manner suggested by Mr. Bruce, and he failed to see the parallelism between the experimental conditions and those of nature.

Mr. Bruce, who was thanked for the manner in which he had brought so interesting a subject before the meeting, contended that he had conclusively proved the possibility of a projection lightning flash.

(To be concluded in our next.)

## SALT HAIL.

IN the *Met. Mag.*, vol. xxiv. (1889), p. 105, occurred the following lines :—

“Mr. W. Rogers, of Ensfield Farm, Tunbridge, was walking over his farm, accompanied by his dog. The dog, seeing the large hail-stones hopping about as they fell, ran after them, and began to eat some. This led Mr. Rogers to taste them, and he found that they all tasted of salt.” The statement was (in subsequent numbers) ridiculed by Mr. R. J. Lecky, and discredited by the Rev. J. Slatter, but supported by Dr. Muirhead and by Dr. Burder, who, having exposed a slip of glass to catch Krakatoa dust, found, where a hail-stone had melted, chloride of sodium.

We have just noticed, in the *Jamaica Weather Review* for June, 1895, the following report :—

“VALE ROYAL. (*H. F. Kilburn*).—On the afternoon of June 6th, “between 3 and 4 p.m., there was a remarkably heavy fall of hail at “Vale Royal. It lasted fully half an hour. The stones were the “largest I had ever seen, being about  $\frac{3}{4}$  inch diameter. On tasting “a couple, I found that they were quite salt. Nobody on the “Estate can tell me of hail ever having fallen here before.”

### RAINFALL IN PALESTINE IN THE SECOND CENTURY.

DR. HERMANN VOGELSTEIN took, for the subject of his *Diplôme Dissertation*, "Agriculture in Palestine in the time of the Mishnah. Part I. The Cultivation of Corn." (Published at Breslau, 1894).

In the *Zeitschrift* for April, 1895, Dr. Hann gives an account of that portion of Dr. Vogelstein's dissertation which refers to rainfall. It is of such interest that we believe that a free translation will be generally acceptable.

Dr. Vogelstein gives an account of agriculture in Palestine in the first two centuries of the Christian era, based upon the records of the Mishnah, Tosefta, &c.

The Mishnah distinguishes two seasons, the time of the rains and the time of drought. In average years the early rains fell soon after the autumnal equinox. The great importance of these rains, as governing the fertility of the land, is repeatedly indicated both in the Bible and in the Mishnah. During the normal season for rain, daily prayers were offered for it. When rain did not fall at the usual dates, fast-days and prayer days were appointed, which of course indicate periods of drought. The recognition of the importance of rain to agriculture had (even in the time of the Mishnah) led to fairly accurate measurements and observations. The depth of rain was measured in a vessel. There should, in the first, second, and third period of the early rains, fall respectively 1, 2, and 3 Tefahs = about  $3\frac{1}{2}$ , 7, and  $10\frac{1}{2}$  inches. In the second period there should be seven consecutive days of rain.

The early rains were important for the sowing, the later rains, in Nisan (March and April) for the harvest. The change from the rainy period, in which also hailstorms destructive to the springing crops were not rare, to the dry season was gradual. The rains diminished, and finally ceased. In the dry season, rain or a thunderstorm was extremely rare, but the dew was excessive, so that in the morning the ground was as wet as if rain had fallen; this was the only refreshment for the thirsty earth, and therefore of the greatest importance to the growing crops.

So far, Dr. Vogelstein and the Mishnah. The rainfall was therefore regularly measured in Palestine in the first century after Christ, and the average for the early rains was estimated at about 6 Tefahs, or 21 inches, which agrees fairly well with modern records—for instance, with that at Jerusalem. Perhaps Dr. Vogelstein may yet find a record of the total yearly fall of rain in Palestine in the first century of the Christian era.

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Since the above was in type we have been favoured by Dr. Hann with a copy of Dr. Vogelstein's *Dissertation* (82 pp., German, but with a mass of Hebrew, Syriac, Arabic, Greek and Latin notes). We have also received some important papers from Dr. Chaplin, who took daily observations in Jerusalem from 1860 to 1882. We therefore hope to return to the subject at an early date.

# BELGIAN RAINFALL.

*To the Editor of the Meteorological Magazine.*

SIR,—It was by an inexplicable error, the origin of which I cannot trace, that I wrote “*Deux pluviomètres conjugués ont constamment servi aux observations.*” The fact is that the gauges represented on p. 102 of the *Met. Mag.* were used from 1833 to 1854, and not from 1833 to 1866, as you supposed. The gauges by which in 1855 they were supplanted were observed uninterruptedly at Brussels until 1890, and others of the same pattern are in use at Uccle.

Comparisons of the two systems were made by Quetelet during 22 months (*Annales* xi., p. 273). The original gauges were of tin, and they were abandoned because the rust on their surface caused (towards the end of their existence) greater loss than usual from retarded flow of the water into the receivers.

The mean by the old gauges (1833-54) was 724 mm. (28.50 in.); the mean of the subsequent 22 years (1855-76) by the new ones was 695 mm. (27.36 in.)

These contradict your argument on p. 103, in which you did not call attention to the dryness of the period, 1857-65, over the whole of Western Europe, which sufficiently explains the difference between the periods 1833-66 and 1867-90.

I am sure that the observations from 1833 to the present time are *strictly comparable*, and that the differences are due to secular variation alone.

The details as to the pattern, &c., of gauges are intentionally reserved for a later part of the work.

Observations made in the same town are usually placed in one series, unless two or more records were kept simultaneously, then necessarily they are separated. By exception, the early records for Brussels are separated from the Observatory observations, in order that the full value of the latter should in no way be impaired.

I was entirely unaware that Prof. Raulin had adopted the method of typographically indicating the length of series of observations. We have, therefore, independently arrived at the same plan.

Yours truly,

A. LANCASTER.

*Uccle, October 2nd, 1895.*

[Considering the opening sentence of the above, it would not be courteous for us to pursue the subject, but we really cannot pass the words which we have put in italics. Uccle is nearly 4 miles from the old Observatory, and more than 100 feet higher. The mean for 5 years (1886-90) was at Uccle 711 mm. (27.99 in.), and for the same years at the old Observatory, 760 mm. (29.92 in.), an excess of nearly seven per cent. How can these be regarded as strictly comparable?

## CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MARCH, 1895.

STATIONS.  (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
England, London .....	63·7	22	23·7	3	51·0	35·6	37·6	84 <sup>0·100</sup>	102·6	22·4	1·42	14	6·9
Malta.....	81·6	30	41·8	20	63·9	49·4	47·3	76	132·5	36·3	·80	9	4·5
Mauritius.....	85·0	6,7	70·1	19	81·9	74·1	71·3	81	134·1	66·3	24·11	26	7·4
Calcutta .....	97·5	29	59·2	21	91·3	68·7	65·2	65	153·9	53·0	·18	1	2·0
Bombay .....	89·3	6	71·0	26	86·1	73·9	70·5	73	138·5	61·2	·00	0	1·3
Ceylon, Colombo ...	91·0	...	71·8	...	89·0	75·4	71·7	74	147·5	63·0	1·84	13	2·8
Melbourne.....	95·0	13	46·0	21	73·4	54·8	52·9	70	142·6	36·1	1·80	8	5·5
Adelaide .....	100·5	12	50·7	30	80·5	58·8	51·9	53	155·3	43·0	1·79	9	3·9
Sydney .....	83·2	17	55·3	20	74·6	63·2	61·0	75	145·9	44·6	1·46	13	4·1
Wellington .....	71·0	19	43·0	23	66·2	53·6	50·2	70	132·0	27·0	2·40	10	4·6
Auckland .....	75·0	18	52·0	28	70·6	58·0	54·6	71	140·0	48·0	1·91	14	4·8
Jamaica, Kingston.....	90·2	29	64·0	4	85·4	67·9	66·8	78	...	...	·43	6	3·5
Trinidad .....	91·0	20	64·0	19a	86·9	67·3	68·0	76	170·0	62·0	2·27	14	...
Toronto .....	49·9	24	—1·6	14	32·5	15·7	19·2	75	...	—3·0	·93	18	5·0
New Brunswick, Fredericton .....	47·3	25	—8·7	12	33·8	11·9	18·6	69	...	...	2·16	12	4·6
Manitoba, Winnipeg ...	49·0	31	—32·5	13	26·6	1·30	...	...	...	...	·55	11	4·9
British Columbia, Esquimalt .....	58·6	27	25·7	14	50·1	35·9	28·6	86	...	...	1·38	19	6·1

a—and 31.

## REMARKS.

MALTA.—Adopted mean temp. (55°·0), 0°·9 below the average. Mean hourly velocity of wind 11·8 miles. Average sea temp. 59°·0. Thunderstorm on 27th. Lightning on 6th and 20th. Hail on 6th and 7th. J. F. DOBSON.

*Mauritius*.—Mean temp. of air 0°·1 above, of dew point 1°·4 above, and rainfall 15·38 in. above their respective averages. Mean hourly velocity of wind 11·7 miles, or 1·7 mile above average; extremes, 25·5 miles on 18th and 2·1 on 5th; prevailing direction, E.S.E. to E.N.E. Thunder and Lightning on 5 days. An unusually wet month, the rainfall in different parts of the island being from 21 to 50 inches.

CEYLON, COLOMBO.—Thunderstorms occurred on 6 days, and lightning was seen on 8 other days. C. MELDRUM, F.R.S.  
D. G. MANTELL.

*Adelaide*.—Mean temp. 0°·9 below the average of 38 years. Rainfall 75 in. above the average. C. TODD, F.R.S.

*Sydney*.—Mean temp. 0°·3 below, humidity 1°·3 and rainfall 4·04 in. below their respective averages. H. C. RUSSELL, F.R.S.

*Wellington*.—Showery at the beginning of the month; dry, but generally unpleasant from the 4th to the 20th, with strong N.W. winds; from 21st to the end showery, with intervals of fine weather. Thunder on 23rd. Mean temp. 2°·2 and rainfall 1·14 in. below the average. R. B. GORE.

AUCKLAND.—A dry month with little of importance to report. Mean temp. and rainfall both below the average of 28 years. T. F. CHEESEMAN.

JAMAICA, KINGSTON.—Hourly velocity of wind 4·2 miles. Kingston rainfall one-third, and island rainfall two-thirds, of the average. R. JOHNSTONE.

TRINIDAD.—Rainfall 40 in. above the average of 30 years.

J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL,  
SEPTEMBER, 1895.

[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 .	·63	XI.	Lake Vyrnwy .....	3·22
„	Birchington, Thor .....	·79	„	Corwen, Rhug .....	·48
„	Hailsham .....	·76	„	Carnarvon, Cocksidia ...	1·50
„	Ryde, Thornbrough .....	·46	„	I. of Man, Douglas .....	·86
„	Emsworth, Redlands ...	·84	XII.	Stoneykirk, Ardwell Ho.	·63
„	Alton, Ashdell .....	·98	„	New Galloway, Glenlee	1·21
III.	Oxford, Magdalen Col.	·64	„	Melrose, Abbey Gate ...	...
„	Banbury, Bloxham .....	·94	XIII.	N. Esk Res. [Penicuik]	1·35
„	Northampton, Sedgebrook	·64	„	Edinburgh, Blacket Pl.	·63
„	Alconbury .....	·47	XIV.	Glasgow, Queen's Park..	1·40
„	Wisbech, Bank House...	·57	XV.	Inverary, Newtown .....	4·43
IV.	Southend .....	·89	„	Islay, Gruinart Schools..	1·99
„	Harlow, Sheering.....	·86	XVI.	Dollar .....	2·53
„	Colchester, Lexden .....	1·26	„	Balquhider, Stronvar...	2·94
„	Rendlesham Hall .....	·93	„	Ballinluig .....	1·34
„	Diss .....	·56	„	Dalnaspidal H.R.S. ....	2·57
„	Swaffham .....	·61	XVII.	Keith H.R.S. ....	1·98
V.	Salisbury, Alderbury ...	1·41	„	Forres H.R.S. ....	1·59
„	Bishop's Cannings .....	1·30	XVIII.	Fearn, Lower Pitkerrie..	1·36
„	Blandford, Whatcombe .	·39	„	Loch Shiel, Glenaladale	...
„	Ashburton, Holne Vic...	·61	„	N. Uist, Loch Maddy ...	3·66
„	Okehampton, Oaklands.	1·53	„	Invergarry .....	4·48
„	Hartland Abbey .....	·66	„	Aviemore H.R.S. ....	2·25
„	Lynmouth, Glenthorne.	1·16	„	Loch Ness, Drumnadrochit	2·27
„	Probus, Lamellyn .....	·29	XIX.	Invershin .....	1·42
„	Wellington, Sunnyside..	...	„	Scourie .....	2·39
„	Wincanton, Stowell Rec.	·67	„	Watten H.R.S. ....	1·62
VI.	Clifton, Pembroke Road	1·22	XX.	Dunmanway, Coolkelure	2·25
„	Ross, The Graig .....	1·01	„	Fermoy Gas Works .....	...
„	Wem, Clive Vicarage ...	·93	„	Killarney, Woodlawn ...	1·09
„	Cheadle, The Heath Ho.	·74	„	Caher, Duneske .....	1·19
„	Worcester, Diglis Lock	·29	„	Ballingarry, Hazelfort...	·54
„	Coventry, Coundon .....	1·00	„	Limerick, Kilcornan ...	1·33
VII.	Ketton Hall [Stamford]	·72	„	Ennis .....	...
„	Grantham, Stainby .....	·70	„	Miltown Malbay .....	1·07
„	Horncastle, Bucknall ...	·27	XXI.	Gorey, Courtown House	1·48
„	Worksop, Hodsock Priory	·97	„	Athlone, Twyford .....	·55
VIII.	Neston, Hinderton .....	1·05	„	Mullingar, Belvedere ...	·20
„	Preston, Haighton ...	1·70	„	Longford, Currygrane...	·38
„	Broughton-in-Furness ...	1·77	XXII.	Woodlawn .....	1·30
IX.	Ripon, Mickley .....	1·41	„	Crossmolina, Enniscoe ...	1·88
„	Melmerly, Baldersby ...	1·08	„	Collooney, Markree Obs.	1·16
„	Scarborough, South Cliff	...	„	Ballinamore, Lawderdale	...
„	Middleton, Mickleton ...	·73	XXIII.	Lough Sheelin, Arley...	·37
X.	Haltwhistle, Unthank...	·99	„	Warrenpoint.....	·48
„	Bamburgh .....	·30	„	Seaforde .....	·38
„	Keswick, The Beeches...	...	„	Belfast, Springfield .....	·60
XI.	Llanfrechfa Grange .....	1·53	„	Bushmills, Dundarave..	·88
„	Llandovery .....	1·17	„	Stewartstown .....	·55
„	Castle Malgwyn .....	·61	„	Buncrana .....	1·14
„	Builth, Abergwessin Vic.	1·51	„	LougeSwilly, Carrablagh.	1·86
„	Rhayader, Nantgwillt ...	1·05			

## SEPTEMBER, 1895.

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 Nights below 32°.	
		Total Fall.	Differ- ence from average 1880-9.	Greatest Fall in 24 hours			Max.		Min.					
				Dpth	Date		Deg.	Date	Deg.	Date.	In shade.	On grass.		
inches.	inches.	in.												
I.	London (Camden Square) ...	1·28	— 1·23	1·24	6	2	82·8	24	42·6	22	0	0		
II.	Maidstone (Hunton Court)...	·35	— 2·24	·25	10	2	...	...	...	...	...	...		
III.	Strathfield Turgiss .....	2·15	— ·30	1·78	6	6	87·0	25a	38·4	14	0	0		
III.	Hitchin .....	·92	— 1·58	·84	6	5	82·0	24a	34·0	21	0	...		
IV.	Winslow (Addington) .....	·69	— 1·98	·61	6	5	85·0	24	33·0	20b	0	4		
IV.	Bury St. Edmunds (Westley)	·58	— 2·12	·53	6	3	74·0	2, 26	42·0	22	0	...		
V.	Norwich (Brundall) .....	·46	...	·41	6	3	81·0	2	38·2	21	0	4		
V.	Weymouth (Langton Herring)	·54	— 1·88	·27	6	4	75·0	26	46·0	21	0	...		
"	Torquay (Cary Green) ...	·28	...	·27	30	2	73·9	28	45·4	18	0	0		
"	Polapit Tamar [Launceston]..	·66	— 3·05	·29	10	10	81·8	9	34·7	22	0	1		
VI.	Stroud (Upfield) .....	·98	— 1·93	·50	6	10	79·0	9	44·0	20c	0	...		
"	Church Stretton (Woolstaston)	1·08	— 1·42	·27	5	10	80·0	24a	41·0	22	0	...		
"	Tenbury (Orleton) .....	·70	— 1·91	·29	24	7	82·1	24	33·0	22	0	3		
VII.	Leicester (Barkby) .....	·44	— 2·20	·22	6	6	82·0	24a	30·0	21d	3	5		
"	Boston .....	·48	— 2·29	·37	6	3	84·0	26	40·0	23	0	...		
"	Hesley Hall [Tickhill] .....	·78	— 1·38	·45	6	6	84·0	2	33·0	22e	0	...		
VIII.	Manchester (Plymouth Grove)	1·44	— 2·03	·80	6	6	84·0	28	43·0	20	0	...		
IX.	Wetherby (Ribston Hall) ...	·97	— 1·49	·34	7	5	...	...	...	...	...	...		
"	Skipton (Arncliffe) .....	3·00	— 1·76	1·21	11	10	...	...	...	...	...	...		
"	Hull (Pearson Park) ...	1·08	— 1·36	·47	6	7	78·0	2, 9	35·0	23	0	...		
X.	Newcastle (Town Moor) .....	·44	— 2·34	·21	3	5	...	...	...	...	...	...		
X.	Borrowdale (Seathwaite).....	5·35	— 6·38	1·61	11	14	...	...	...	...	...	...		
XI.	Cardiff (Ely) .....	1·29	— 2·45	·49	6	9	...	...	...	...	...	...		
"	Haverfordwest .....	·98	— 3·42	·42	4	10	77·4	28	37·2	22	0	3		
"	Aberystwith (Gogerddan) ...	1·70	— 2·57	·44	4	7	85·0	28	30·0	21	1	...		
"	Llandudno .....	1·24	— ·98	·84	4	7	84·0	9	47·0	20	0	...		
XII.	Cargen [Dumfries] .....	·22	— 3·34	·14	2	3	79·0	28	36·6	21	0	0		
"	Jedburgh (Sunnyside) .....	·29	— 2·40	·10	17	6	84·0	9, 13	37·0	23	0	...		
XIV.	Colmonell .....	·60	...	·17	17	7	81·0	27	36·0	19	0	...		
XV.	Lochgilphead (Kilmory) .....	3·04	— 2·09	1·10	10	11	...	...	39·0	19	0	...		
XV.	Mull (Quinish) .....	5·42	+ ·39	1·26	16	20	...	...	...	...	...	...		
XVI.	Loch Leven Sluices .....	1·10	— 1·69	·40	17	6	...	...	...	...	...	...		
XVI.	Dundee (Eastern Necropolis)	·80	— 1·71	·45	16	10	74·1	25	38·8	21	0	...		
XVII.	Braemar .....	1·89	— ·97	·61	16	12	73·2	29	34·0	6	0	3		
XVII.	Aberdeen (Cranford) ...	1·44	...	·45	16	14	74·0	25a	36·0	22	0	...		
XVIII.	Strathconan [Beaul] .....	3·25	— ·43	·70	12f	10	...	...	...	...	...	...		
"	Glencarron Lodge .....	6·41	...	1·07	17	19	77·1	9	39·0	6	0	...		
"	Cawdor [Nairn] .....	1·76	— ·99	·80	17	11	...	...	...	...	...	...		
XIX.	Dunrobin .....	...	...	...	...	...	...	...	...	...	...	...		
"	S. Ronaldsay (Roeberry) .....	2·23	— ·43	·37	17	17	67·0	27	45·0	12	0	...		
XX.	Darrynane Abbey .....	·88	...	·32	4	10	...	...	...	...	...	...		
"	Waterford (Brook Lodge) ...	2·08	— ·84	·82	4	9	75·0	28	40·0	13g	0	...		
"	O'Briensbridge (Ross) .....	1·49	...	·41	10	7	...	...	...	...	...	...		
XXI.	Carlow (Browne's Hill) .....	1·10	— 1·72	·38	4	8	...	...	...	...	...	...		
XXII.	Dublin (Fitz William Square)	·54	— 1·43	·18	2, 4	7	72·0	2	43·0	22	0	0		
XXII.	Ballinasloe .....	·57	— 2·22	·34	10	7	84·0	26	35·0	23	0	...		
"	Clifden (Kylemore) .....	2·31	...	1·00	10	9	...	...	...	...	...	...		
XXIII.	Waringstown .....	·29	— 2·87	·14	11	5	81·0	27	38·0	...	0	...		
"	Londonderry (Creggan Res.) ..	1·53	— 2·25	·52	2	11	...	...	...	...	...	...		
"	Omagh (Edenfel) .....	·76	— 2·62	·24	10	7	75·0	29	36·0	22	0	...		

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

a—and 27. b—and 21, 22. c—and 21. d—and 22. e—and 23. f—and 18. g—and 20.

# METEOROLOGICAL NOTES ON SEPTEMBER, 1895.

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.

STRATHFIELD TURKISS. — Very fine and dry until the night of the 6th, when a very heavy TS passed over, after which hot weather returned and continued until the end of the month, with a slight TS on the 24th. During the last fortnight the max. temp. was the highest in September since the record began in 1875.

ADDINGTON. — This September has given us the least rainfall and the highest temp. of any September recorded here. The max. temp. was 70° and upwards on 17 days, 80° and upwards on 6 days, the last 8 days having an average max. of 80°. The night temp. was with a few exceptions high, and on three nights a minimum of 60° was recorded. Violent TS at 3 a.m. on 7th.

BURY ST. EDMUNDS, WESTLEY. — The driest September since 1865, when the fall was 11 in. The drought was accompanied by great heat and much sunshine, many days being without a cloud. TS on 6th, distant T on 3rd and 10th.

NORWICH, BRUNDALL. — Probably the finest, warmest and driest September since 1865. The last week was abnormally warm. A similar week at the end of September seems, according to old MSS. in my possession, to have occurred in East Anglia in 1832. Distant TS on 3rd; TS 5.45 to 6.45 a.m. on 7th.

LANGTON HERRING. — The driest September in the last 24 years. A warm month with many cloudless days. The average min. (54°·4) is 3°·2, and the average max. (67°·9) 4° above the average of 23 years. The temp. throughout was equal to that of the preceeding July and higher than that of August. The last week of the month was the hottest in the year, with an average temp. of 66°·2. On ten days the temp. rose to 70° or above. T and L on the 3rd, 4th, 7th, 24th, 26th and 30th. Fogs on the 6th and 25th.

TORQUAY, CARY GREEN. — Rainfall 2·06 in. below the average. Mean temp. 60°·9, or 3°·1 above the average. Duration of sunshine 213 hours 45 minutes, or 49 hours 20 minutes above the average; one sunless day.

POLAPIT TAMAR. — A most memorable month; remarkable for absence of strong breezes, for excessive heat, and for the exceptionally small quantity of R, the smallest in September since 1880. The rainfall for the first 9 months of 1895 is only 18·19 in., or less than half the annual average (37·36 in.) The average max. shade temp. was very high, 71°·5. Heavy TS at midnight on 6th.

STROUD, UPFIELD. — TSS to the E. on 3rd, E. and S.E. on 6th, and to the W. on 24th; L on 23rd. Max. temp. above 70° from 23rd to 30th inclusive.

WOOLSTANTON. — A very hot and dry month, the heat during the last fortnight especially being most intense. Fruit-bearing trees of all kinds produced enormous crops, but the want of water was greatly felt. Mean temp. 60°·1.

TENBURY, ORLETON. — The hottest and, with the single exception of September, 1888, the driest September since 1865. The mean temp. of the month was 60°·0, or 3°·2 above the average of 34 years, and was nearly 2° lower than that of 1865; but the mean max. was nearly 1° higher than in that year, and the thermometer reached 70° on 22 days, as against 21 in that year. The hottest weather too was in the last week of the month, whereas in 1865 the last week was cold. Brilliant sunshine prevailed through the whole month. T on the 3rd and 24th. L on 3rd, 23rd and 24th. Fog on 12 days.

LEICESTER, BARKBY. — Remarkable for great heat and drought. The mean max. temp. is the highest for the year. Streams, wells and pits are dry all round the district, and the scarcity of water is great and serious. Mean max. temp. 73°·8. Mean min. 44°·8. Mean 59°·3. Fortunately the Borough of Leicester has an additional water supply this year. L, T and H on 3rd. L on 24th.

HULL, PEARSON PARK. — TS on 3rd. Fog on 14th and 16th, and daily from 22nd to 30th, excepting the 24th.

## WALES.

HAVERFORDWEST.—The first 9 days were more or less wet, after which a fine, hot, almost cloudless condition set in, much haze rendering the distant landscape invisible for nearly a fortnight. The temp. was above  $70^{\circ}$  on eight days, seven of which occurred in the last week. The fine weather enabled the harvest to be gathered in in fine condition, and such a superabundance of grass has seldom been seen at this season of the year. One of the driest Septembers on record, and the warmest.

## SCOTLAND.

CARGEN.—This month still further adds to the remarkable meteorological phenomena of 1895. Although the mean temp. has been twice exceeded during 36 years, the average temp. of the last seven days ( $63^{\circ}\cdot5$ ) is unprecedented in September. On ten days the max. exceeded  $70^{\circ}$ . The max. temp. of the month ( $79^{\circ}$  on the 28th) has only once been exceeded ( $80^{\circ}\cdot4$  on September 4th, 1880), and once equalled. The high mean pressure is also noticeable, while the number of hours of sunshine exceeds the average by 54. Wind force slight and southerly winds prevalent. The rainfall has only once been less in September, and only on three occasions in any month. Unusually heavy dews made up for the absence of R, and pastures were never more luxuriant at this season. The effects of the warm weather are seen in the enlargement of the buds of bush fruit and flowering trees, and several species of rhododendron blossomed a second time.

JEDBURGH.—The temperature was higher than in any September for 30 years. The grain crops have been secured in good condition, and potatoes are a full crop and free from disease. Tree fruit abundant and excellent. The temp. on 12 days was above  $70^{\circ}$ . A good deal of fog before 9 a.m. Rainfall the smallest in any month since March, 1865, when  $\cdot17$  in. fell.

COLMONELL.—Rainfall  $3\cdot56$  in. below the average of 19 years. T and L on 9th.

ABERDEEN, CRANFORD.—A very warm month, with winds from S.W. and W., and very light. Crops all cut about Aberdeen.

ROEBERRY.—The first part wet, the latter warm and foggy. Mean temp.  $55^{\circ}\cdot3$ .

## IRELAND.

DARRYNANE.—A very fine and warm month.

O'BRIENSBRIDGE, ROSS.—Fine average harvest weather for the first three weeks. On the night of the 23rd a violent storm of T and L set in at 8 p.m., and continued for three hours, followed next day by an extraordinary rise in temperature, and for 6 days the heat far exceeded that of midsummer.

DUBLIN.—As in both 1893 and 1894, September proved a favourable month. The heat was tempered by a sea breeze but the sunshine was above the average, and the mean amount of cloud was only  $4\cdot2$ . Towards the close of the month heavy dews and dense night fogs became very prevalent. Mean temp.  $59^{\circ}\cdot1$ , or  $3^{\circ}\cdot3$  above the average. High winds occurred on 7 days, and attained the force of a gale on the 10th and 11th. L on the 23rd.

WARINGSTOWN.—A remarkable September, the warmest since 1865. Max. in 1865,  $82^{\circ}$ ; in 1895,  $81^{\circ}$ . Mean, 1865,  $59^{\circ}\cdot7$ ; 1895,  $58^{\circ}\cdot5$ . Mean for the 14 years, 1861 to 1874,  $54^{\circ}\cdot3$ . A magnificent harvest was secured in prime condition.

EDENFEL, OMAGH.—Another remarkable September, with the smallest rainfall except 1894, and much the highest temp. for at least 31 years; indeed, during that period a max. temp. of  $70^{\circ}$  has been only twice reached in the latter half of September, viz.,  $71^{\circ}$  on 19th September, 1881, and  $70^{\circ}$  on 17th September, 1883, while during the last week of the past month the max. ranged from  $75^{\circ}$  to  $70^{\circ}$  on five days, and on the night of the 25th the minimum was the highest of the year,  $61^{\circ}$ . Coming after the wet August, vegetation has been phenomenal. The autumn tints have hardly touched the trees, and it was only on October 4th that the extraordinary change ushered in by October seemed to have re-awakened the migratory instincts of the swallows from their "midsummer night's dream."



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SEPTEMBER, 1895.

THE very exceptional weather of September was occasioned by the persistence of anti-cyclonic conditions over Western Europe. In the early part of the month the centre of the high pressure area was well to the east of France, and irregular distribution of pressure over the British Isles on the 5th and 6th produced thunderstorms and rain very generally. On the 11th and 12th a depression passed across the North of Scotland, and falls of rain exceeding an inch occurred at many stations. From the 13th to 17th the centre of high pressure lay over England, but on the 18th, a cyclone coming in from the Atlantic apparently forced it eastwards. From the 19th to 21st the centre again extended to England, but thence to the end of the month, during the period of great heat, it was to eastward, but generally extending well to the north.

## RAINFALL.

That the rainfall for the month was generally very small is clearly shown by the regular table on p. 146, where we find only one plus sign (at a station on the west coast of Scotland—roughly speaking, furthest from the centre of high mean pressure for the month), but the well-known irregularity of distribution of thunderstorm-rains makes it difficult to convey a clear idea of the fall.

Of the 50 stations in the table above referred to, thirteen had less than one-quarter of the average rainfall :—

STATION.	COUNTY.	Rainfall in.	Rainy days.	Per cent. of average.
Cargen [Dumfries] .....	Kirkcudbright ...	·22	3	6
Waringstown .....	Down .....	·29	5	9
Jedburgh, Sunnyside .....	Roxburgh .....	·29	6	11
Maidstone, Hunton Court .....	Kent .....	·35	2	14
Newcastle, Town Moor .....	Northumberland.	·44	5	16
Leicester, Barkby .....	Leicester .....	·44	6	17
Boston .....	Lincoln .....	·48	3	17
Polapit Tamar [Launceston].....	Devon .....	·66	10	18
Ballinasloe .....	Galway .....	·57	7	20
Weymouth, Langton Herring ...	Dorset .....	·54	4	22
Bury St. Edmunds, Westley ...	Suffolk .....	·58	3	22
Omagh, Edenfel .....	Tyrone .....	·76	7	22
Haverfordwest .....	Pembroke .....	·98	10	22

Seventeen more stations had less than half the average :—

STATION.	COUNTY.	Rainfall in.	Rainy days.	Per cent. of average.
Winslow, Addington .....	Bucks .....	·69 ...	5 ...	26
Dublin, Fitzwilliam Square .....	Dublin .....	·54 ...	7 ...	27
Tenbury, Orleton .....	Worcester .....	·70 ...	7 ...	27
Dundee, Eastern Necropolis.....	Forfar .....	·80 ...	10 ...	32
Stroud, Upfield .....	Gloucester .....	·98 ...	10 ...	34
Cardiff, Ely .....	Glamorgan.....	1·29 ...	9 ...	35
Hesley Hall [Tickhill] .....	Nottingham ...	·78 ...	6 ...	36
Hitchin .....	Hertford.. ..	·92 ...	5 ...	37
Wetherby, Ribston Hall .....	York .....	·97 ...	5 ...	39
Loch Leven Sluices.....	Kinross .....	1·10 ...	6 ...	39
Carlow, Browne's Hill .....	Carlow .....	1·10 ...	8 ...	39
Aberystwith, Gogerddan .....	Cardigan .....	1·70 ...	7 ...	40
Londonderry, Creggan Res. ....	Londonderry .....	1·53 ...	11 ...	41
Manchester, Plymouth Grove ...	Lancashire .....	1·44 ...	6 ...	42
Church Stretton, Woolstaston ...	Shropshire .....	1·08 ...	10 ...	43
Hull, Pearson Park .....	York .....	1·08 ...	7 ...	44
Borrowdale, Seathwaite.....	Cumberland .....	5·35 ...	14 ...	46

As out of the 50 stations there are only 41 for which the average is available, it may be taken as a rough generalization that over one-third of the kingdom the rainfall of the month was less than one-quarter of the average, and over three-quarters of the kingdom was less than half.

#### DROUGHT.

That there was no remarkable intensity of drought is shown by the following table, the stations in which were selected for their fairly representative geographical distribution, without reference to their total rainfall :—

#### *Droughts in September, 1895.*

ABSOLUTE DROUGHTS.—Periods of more than 14 consecutive days absolutely without rain.

PARTIAL DROUGHTS.—Periods of more than 28 consecutive days, the aggregate rainfall of which does not exceed 0·01 in. per diem.

STATION AND COUNTY.	A SOLUTE DROUGHTS.			PARTIAL DROUGHTS.			
	Began.	Ended.	Lasted.	Began.	Ended.	Lasted.	Amount
London, Camden Square, <i>Middlesex.</i>	Sept. 11	Sept. 30	Days. 20	None.	...	...	..
Denver, ... <i>Norfolk.</i>	Sept. 7	Sept. 30	24	None.	...	...	...
Torquay, Cary Green, ... <i>Devon.</i>	Aug. 27	Sept. 10	15	Aug. 14	Sept. 29	47	·27
Bamburgh, ... <i>Northumberland.</i>	Sept. 12	Sept. 29	18	Aug. 27	Sept. 30	35	·35
	None.	...	...				

At the following stations, neither an absolute nor a partial drought occurred : Ross, The Graig, *Hereford* ; Leicester, Barkby, *Leicester* ; Preston, Houghton, *Lancashire* ; Hull, Pearson Park, *York, E.R.* ; Haverfordwest, *Pembroke* ; Llandundno, *Carmarvon* ; Edinburgh, Blacket Place, *Edinburgh* ; Keith, H.R.S., *Banff* ; Caher, Duneske, *Tipperary* ; Omagh, Edenfel, *Tyrone*.

It will thus be seen that at 10 out of the 14 stations neither partial nor absolute drought occurred, and that the four absolute and two partial droughts recorded are not of remarkable duration.

## TEMPERATURE.

As regards temperature, the records for September, 1895, appear to be much more remarkable, but we have not readily available for comparison the results of back years at a large number of stations.

The first table gives the daily maxima at 29 stations from the 23rd to the 29th, and includes all days in the latter half of September, on which we have records of 80° or upwards from British stations. There was another period of high temp. about the 9th, but although some stations recorded the absolute max. for the month on that date, the heat was neither so prolonged nor so remarkable as in the latter half of the month :—

*Maximum Temperatures, September 23rd to 29th, 1895.*

STATIONS	23rd.	24th.	25th.	26th.	27th.	28th.	29th.
Kensington (Edith Road) .....	68·7	85·8	81·9	83·9	82·7	80·4	77·3
London (Old Street), E.C. ....	77·0	74·7	76·2	72·2	81·6	80·1	76·8
„ (Regent's Park, Roy. Botanic Soc.)	70·2	82·8	79·0	80·0	80·0	77·8	75·0
„ (Camden Square) ( <i>Stevenson Screen</i> )	73·7	83·2	81·0	82·4	82·3	79·2	77·1
„ ( „ „ ) ( <i>Glaisher „</i> )	73·3	82·8	80·6	82·4	82·6	79·2	77·1
West Norwood (Thornlaw Road) .....	81·2	85·5	81·4	81·8	80·7	77·7	74·9
Brixton (Acre Lane) .....	79·0	86·0	83·0	85·0	84·0	81·0	78·0
Greenwich (Royal Observatory) .....	80·8	87·3	84·0	84·2	83·2	80·5	77·6
Dungeness .....	70·0	74·0	72·0	71·0	71·0	69·0	68·0
Great Berkhamstead (Rosebank) .....	77·9	82·2	79·4	81·7	82·1	79·6	76·2
Winslow (Addington Manor) .....	79·2	84·2	79·2	80·2	81·0	77·7	72·2
Oxford (Radcliff Observatory) .....	78·0	82·0	79·0	82·0	83·0	81·0	76·0
Cambridge Observatory .....	78·0	84·0	83·0	82·0	82·0	80·0	77·0
Chelmsford .....	74·3	78·4	80·9	79·4	77·1	75·6	73·9
Norwich, (Brundall) .....	77·2	75·8	79·0	80·0	75·0	77·0	72·6
Weymouth, (Langton Herring) .....	70·0	71·0	67·0	75·0	72·0	73·0	73·0
Cheltenham (Southam Villa) .....	78·0	82·2	77·6	81·3	83·0	81·4	78·0
Ketton Hall [Stamford] .....	80·0	85·0	84·0	82·0	84·0	82·0	79·0
Bolton, (The Park) .....	73·3	78·0	75·2	76·3	79·2	81·1	76·6
York (Philosophical Society) .....	74·0	81·0	80·0	82·0	81·0	82·0	82·0
Pembroke (St. Ann's Head) .....	69·0	66·0	64·0	71·0	72·0	74·0	72·0
Llandudno .....	73·0	71·6	73·6	76·4	77·5	82·4	81·4
Edinburgh (Blacket Place) .....	69·8	68·0	78·3	73·3	73·1	68·7	59·1
Nairn (School House) .....	69·0	65·0	77·0	68·0	75·0	63·0	67·0
Parsonstown .....	74·0	72·0	70·0	76·0	77·0	75·0	77·0
Seaforde .....	64·0	67·0	66·0	68·0	67·0	69·0	67·0
Jersey .....	77·0	82·0	72·0	81·0	85·0	84·0	76·0
Paris .....	87·0	89·0	88·0	88·0	89·0	86·0	84·0
Berlin .....	70·0	73·0	64·0	68·0	72·0	72·0	73·0
Brussels .....	81·0	84·0	85·6	86·0	82·0	77·0	77·0

It will be noticed that there is an excess of records for the neighbourhood of London, the reason for which will be mentioned later.

A second table gives the absolute maxima at additional stations provided with Stevenson screens :—

September 23rd to 29th.

STATIONS.	Max. temp	Date	STATIONS.	Max. temp	Date.
Wallington .....	84·7	24	Cheadle(The Heath House)	78·5	24
Birchington (Thor) .....	81·0	25	Worcester (Diglis Lock)..	83·0	27, 29
Oxford (Mag. Coll. Laboratory)	80·0	27	Workop (Hodsock Priory)	82·2	24
Ashburton (Druid House) .....	76·7	27	Belper (Northfield).....	79·6	24
Tavistock (Rose Villa) .....	82·7	27	Driffeld (York Road).....	78·0	26
Ross (The Graig) .....	81·2	27	Killarney (Woodlawn) ...	76·0	28

At Camden Square the results for September are —

	Absolute Max.	Average Max.	Average Min.	Mean of Max. & Min.
1895 ... ..	82°·8	73°·7	51°·5	62°·6
Average 36 years ...	77°·0	67°·2	49°·6	58°·4
Excess of 1895 ...	5°·8	6°·5	1°·9	4°·2

In the 36 years the average max. has been exceeded only by 76°·4, in 1865, and the mean of the max. and min. by 65°·5, in the same year. The average min. has been exceeded six times, but this would naturally be expected, as comparatively clear skies and considerable radiation at night are component parts of a fine warm month.

The absolute max. has been exceeded in six years, but in considering this element, due allowance must be made for the lateness of the date on which the reading occurs. This will be most clearly shown by setting out all readings above that of September 24th, 1895.

1858 ...	85°·0 on 12th.	1868 ...	84°·0 on 4th.
1865 ...	84°·0 „ 7th.	„ ...	86°·5 „ 6th.
„ ...	85°·0 „ 8th.	„ ...	91°·0 „ 7th.
„ ...	84°·8 „ 15th.	1872 ...	83°·1 „ 3rd.
„ ...	85°·0 „ 16th.	1880 ...	83°·3 „ 3rd.
		„ ...	88°·3 „ 4th.
		1886 ...	84°·2 „ 1st.

The latest of these dates is the 16th, or eight days earlier than the max. in September, 1895.

In September, 1865, the temp. rose above 80° on ten days, and in September, 1868, on five days, in no other year was 80° recorded on as many days as in 1895. So that although the max. of September, 1895, is unprecedented at so late a date, the month, as a whole, must clearly yield precedence to 1865.

The Greenwich values for the month, given by the Astronomer Royal in a letter to the *Times*, are :—

	Absolute Max.	Average Max.	Average Min.	Mean temp.
1895 ... ..	87°·3	75°·4	51°·3	62°·2
Average 50 years ...	—	67°·3	49°·1	57°·2
Excess of 1895 ...	—	8°·1	2°·2	5°·0

For the nine days, September 23rd to October 1st, the mean max. was 17°·2 above the average, and the mean temp., 11°·3 above the

average. In September, 1895, there were ten days on which the temp. rose above  $80^{\circ}$ , a greater number than in any previous September from 1841.

The maxima for each of the eight days (September 23rd to 30th), and the mean temperatures for each of the seven days (September 24th to 30th) exceed those for the corresponding days in any year from 1841.

Reference has already been made to the disproportionate number of London stations quoted in the table of maxima from September 23rd to 29th, the object being to show the great variation in the temperatures recorded in different parts of the metropolis. It will be seen that the difference of pattern of stand cannot account for it, as at Camden Square the mean in the Stevenson screen for the seven days is in excess of that on the Glaisher by only  $0^{\circ}\cdot 1$ , and it will further be seen that the maxima at Greenwich (where also a Glaisher pattern stand is used) were generally above those at other stations, thus by no means supporting the suggested heating up of the interior of a Stevenson screen.

On 23rd	the values range from	$81^{\circ}\cdot 2$	at	West Norwood	to	$68^{\circ}\cdot 7$	at	Kensington.
„ 24th	„	„	„	87·3	„	Greenwich	„	$74^{\circ}\cdot 7$ „ Old Street.
„ 25th	„	„	„	84·0	„	„	„	„
„ 26th	„	„	„	85·0	„	Brixton	„	$72^{\circ}\cdot 2$ „
„ 27th	„	„	„	84·0	„	„	„	$80^{\circ}\cdot 0$ „ Regents Park.
„ 28th	„	„	„	81·0	„	„	„	$77^{\circ}\cdot 7$ „ West Norwood.
„ 29th	„	„	„	78·0	„	„	„	$74^{\circ}\cdot 9$ „ „ „

The range on the 23rd and 24th is very striking, and the Old Street values suggest that London smoke resisted the penetration of the heat for several days. The following letter from the Observer at Kensington throws considerable light on the matter :—

SIR,—I do not know whether a few lines showing the curious differences of temperature produced by fog at stations near together may be of interest to your readers. Yesterday (September 23rd) the max. at the London Station (Brixton) was  $79^{\circ}$ . My max. was  $68^{\circ}\cdot 7$ . A thin white fog prevailed all day, though the sun shone through it pretty strongly. A difference of  $10^{\circ}$  or more is not uncommon in winter fogs, but I have never seen anything like this in summer.—Yours faithfully,

G. VON U. SEARLE.

*Edith Road, West Kensington.*

#### FOREIGN.

In his monthly *résumé* for September, 1895, M. E. Renou, of the Observatory of Parc St. Maur, Paris, says :—“The true daily mean temperature ( $65^{\circ}\cdot 6$ ) appears to be the highest that has been observed for a century and a half, but it is difficult to make absolute comparisons with the old observations, because of the different positions of the instruments. For September, 1865, the mean of the daily max. and min. gives  $66^{\circ}\cdot 9$  ; at the Parc St. Maur the same calculation for this year gives  $67^{\circ}\cdot 1$ .”

"It is unprecedented to record 11 days of maxima above  $86^{\circ}$ , but this number of days has been the same at Vendôme, in a very good position. Although during a century and a half no higher maximum than  $89^{\circ}4$  had been recorded, the maximum on September 7th, 1895, reached  $95^{\circ}9$ ."

"The insignificant rainfall ( $\cdot004$  in.) is also unprecedented."

Speaking of Brussels, M. Lancaster, in *Ciel et Terre*, says:—"During 60 years before 1895 September has only once been warmer than the summer months, viz., in 1841. September, 1895, was probably the most beautiful, the warmest, and the driest for two centuries. The mean temperature ( $64^{\circ}2$ ) exceeded the average for September by  $5^{\circ}9$  and the average for July by  $0^{\circ}5$ , and the highest mean previously recorded ( $63^{\circ}0$  in 1865) by  $1^{\circ}2$ . On 15 days the maximum attained  $77^{\circ}$ , compared with an average of  $1\cdot3$  days and a previous maximum of 7 days."

## OBSERVERS' NOTES.

In conclusion, we quote a few extracts from letters received from our correspondents:—

*Tenterden, Kent*.—We have had no September to compare with this since 1865. Mean max. temp.,  $73^{\circ}$ ; mean min.,  $51^{\circ}$ ; 6 days over  $80^{\circ}$ ; max.,  $84^{\circ}5$  in Stevenson screen. Two hotter days occurred in September, 1886, but earlier in the month. Temp. above  $70^{\circ}$  on 9 days, against 8 in 1884 and 1886.—J. ELLIS MACE.

*Hitchin, Herts*.—Tuesday, the 24th, was the hottest day at present this year,  $82^{\circ}5$ . The mean temperature of the month was  $60^{\circ}4$ , the average for September being  $54^{\circ}8$ . Since 1849 we have once had a higher mean in September, that was in 1865, when it was  $60^{\circ}5$ , but the maximum in that month never reached  $80^{\circ}$ . With the exception of 1891, when we had  $80^{\circ}$ ,  $81^{\circ}$  and  $80^{\circ}$  consecutively, I have no previous record of  $80^{\circ}$  or upwards in Sept.—W. LUCAS.

*Hillington Rectory, Norfolk*.—The highest temperature recorded was  $83^{\circ}3$  on the 25th;  $80^{\circ}3$  was registered on the 24th, and  $80^{\circ}1$  on the 26th. (The highest during the month was  $84^{\circ}5$  on the 2nd.) It is very rare here for readings to exceed  $80^{\circ}$  in September. The only instances since 1863 are:—

1868	.....	$80^{\circ}$ on 6th, and $83^{\circ}$ on 7th.
1871	.....	$80^{\circ}$ on 1st.
1880	.....	$84^{\circ}$ on 3rd, and $85^{\circ}$ on 4th.
1884	.....	$84^{\circ}$ on 17th.
1891	.....	$82^{\circ}$ on 10th, and $81^{\circ}$ on 11th.

In September, 1888, the temperature did not rise to  $68^{\circ}$ . The mean of maxima during the week 22nd to 28th was  $78^{\circ}3$ ; of minima  $49^{\circ}$ ; mean of all readings  $62^{\circ}9$ ,  $10^{\circ}$  above average. Sunshine was very abundant. There was no rainfall, but  $0\cdot02$  in. was yielded by dew, which was very heavy.—H. FOLKES.

*Heath Lodge, Cheltenham, Gloucester.*—In the early part of September, 1868, we had six days above  $80^{\circ}$ ; on the 7th the maximum was  $88^{\circ}$ . In 1880 the 2nd, 3rd and 4th of September were above  $80^{\circ}$ , that on the 4th being  $89^{\circ}$ . The occurrence of a hot period so late in the month as in 1895 is unusual.

Sept. 23	.....	$82^{\circ}2$		Sept. 27	.....	$87^{\circ}0$
„ 24	.....	$86^{\circ}0$		„ 28	.....	$85^{\circ}7$
„ 25	.....	$80^{\circ}5$		„ 29	.....	$82^{\circ}0$
„ 26	.....	$85^{\circ}0$				

The highest minimum was  $62^{\circ}0$  on the 25th.—M. A. SMELT.

*The Graig, Ross, Hereford.*—The temperature rose above  $70^{\circ}$  on 19 days, and above  $80^{\circ}$  on 4 days. The average max. was  $72^{\circ}2$ ; the only other September with an average max. above  $70^{\circ}$  since 1859 being 1865, when it was  $73^{\circ}3$ . The only falls of rain of consequence were on the 6th and 24th, and the drought was beginning to be felt at the close.—H. SOUTHALL.

*Hodsock Priory, Notts.*—The mean temp.,  $59^{\circ}4$ , is  $3^{\circ}9$  above the average, and the highest in September in 19 years. Though the absolute max. ( $82^{\circ}2$  on 24th) has once been exceeded, temperatures of  $80^{\circ}$  have never before been recorded in the second half of the month.—H. MELLISH.

*Blacket Place, Edinburgh.*—The maximum shade temperature recorded to-day (September 25th), namely,  $78^{\circ}3$ , is absolutely the highest registered so late in the season during 55 years. In the following table will be found a list of all the September days on which the temperature exceeded  $75^{\circ}$  in the shade :—

Year.	Date.	Temp.	Year.	Date.	Temp.
1841	.. 12	$77^{\circ}0$	1868	..... 6	$81^{\circ}7$
„	..... 13	$76^{\circ}0$	„	..... 7	$77^{\circ}0$
1844	..... 1	$77^{\circ}0$	1873	..... 27	$76^{\circ}2$
1846	..... 11	$78^{\circ}0$	1890	..... 8	$76^{\circ}0$
„	..... 12	$78^{\circ}0$	„	..... 7	$75^{\circ}1$
„	..... 14	$76^{\circ}6$	1891	..... 10	$77^{\circ}0$
1848	..... 23	$76^{\circ}0$	„	..... 12	$79^{\circ}8$
1857	..... 5	$78^{\circ}0$	1895	..... 25	$78^{\circ}3$
„	..... 6	$77^{\circ}9$			

It will be seen that only two higher maxima are on record, viz. September 6th, 1868,  $81^{\circ}7$ , and September 12th, 1891,  $79^{\circ}8$ . The average temperature of to-day ( $66^{\circ}7$ ) is a phenomenally high mean for the time of year. Forbes, in his “Climate of Edinburgh,” gives  $64^{\circ}5$  as the highest mean for any day in the second half of September, the period dealt with being the forty years 1795–1805, 1821–1850. I have examined the Edinburgh observations taken subsequent to 1850, as well as a number of other older registers, but no instance of such extreme heat as we have experienced to-day has been registered so far on in September. September 28th, 1802,

was possibly warmer, the thermometer at noon standing at  $75^{\circ}$  in the shade, but there was no registering instrument in use at that time.—R. C. MOSSMAN.

### OCTOBER, 1895.

It is remarkable that a September with a period of heat in some respects unprecedented, should be followed by an October including a period as unprecedentedly cold.

At Camden Square the min. in shade for October, 1895, is  $26^{\circ}\cdot6$  on the 28th. Frost occurred in shade on seven days in the month, and those seven days were consecutive, from 24th to 31st. Looking back through the 38 years over which the observations extend we find that the absolute minimum has been lower in only three Octobers :—

$26^{\circ}\cdot2$	on October 5th,	1873.
$25^{\circ}\cdot4$	„	26th, 1887.
$23^{\circ}\cdot8$	„	28th, 1890.

That in only one other October has frost in shade been recorded on seven days (in 1887), and that the greatest number of consecutive days with temp. falling to freezing point in previous Octobers, is four, in 1859, and in 1873.

A comparison of the seven days, 24th to 30th of September, with the corresponding seven days of October, is very striking :—

	Mean.		Max.	Min.	Mean. temp.
	9 a.m.	9 p.m.			
	°	°	°	°	°
1895, September 24th to 30th...	63·5	61·9	80·3	54·9	65·0
1895, October 24th to 30th ...	32·9	36·6	44·8	28·2	35·9
Fall of temp. in one month ...	30·6	25·3	35·5	26·7	29·1

### BELGIAN RAINFALL.

We are very glad to find that M. Lancaster did not, by the expression “strictly comparable,” intend to imply that the rainfall at Uccle could be treated as a continuation of the Brussels register, but that the gauges and the conditions of exposure are similar at the new observatory to what they were at the old one. As the sentence stood, on p. 143, we did not see any indication that M. Lancaster realized the fact that the difference between the mean fall in the old locality, and in the new one (which he now puts at 30 mm. [1·18 in.]) must be allowed for, before any determination as to secular change can be arrived at. Now that he has cleared up this point, we have nothing more to say, except that we shall be glad to welcome Part II. of his great work.



THE BRITISH ASSOCIATION AT IPSWICH.

(Concluded from p. 141).

MILLER CHRISTY, F.L.S.—*About Rockall.*

The author said that very few persons seemed to know of the existence of Rockall, although it is a British possession. It is a lonely rock of pyramidal shape, 184 miles west-half-south from St. Kilda, in the Outer Hebrides, and 290 miles from the nearest point of the Scottish mainland. The rock, which at its base has a circumference of about 250 feet, is composed of coarse dark-coloured granite, and is said to be highly magnetic. Its summit is always whitened by the dung of sea-birds, and persons sighting the Rock from a distance almost invariably take it for a vessel in full sail. Owing to the prevalence of the Atlantic swell, it is only possible to land upon the Rock in the finest weather. To the man of science, Rockall presents many points of considerable interest. It is highly desirable that some effort should be made to examine the rock, and to investigate its organic inhabitants in a thoroughly scientific manner. Even if there is no naturalist both willing and able to make the journey to Rockall, surely there are plenty of yachtsmen who would be glad to have a definite and useful object for a cruise. To such he suggested a trip to Rockall, and he would be glad to give all the information required concerning the matters to which special attention should be given by any intelligent person visiting the Rock.

The Chairman said that for purposes of meteorological observation residence on the island would be necessary. Seeing that at some seasons of the year landing is very difficult, any person landing should be prepared for a long stay.

Mr. G. J. Symons said that some years ago application was made to the Royal Meteorological Society for financial assistance in establishing a station on the island; but the Society came to the conclusion that nothing could be done without considerable expenditure, inasmuch as buildings as strong as a lighthouse and a cable connecting with the mainland would be necessary.

Dr. H. R. Mill asked whether it would not be advisable to have preliminary observations made by self-recording instruments before approaching the Government to establish a meteorological station.

Mr. Dickson stated that Rockall lay in the track of the greater number of cyclones approaching the British Islands, and that telegraphic information from it would be of great importance for weather warnings.

The Chairman closed the discussion by advising Mr. Christy to keep "pegging away" at the subject, and, if possible, bring it to the attention of someone who might be inclined to follow the example of the Prince of Monaco.

DR. THISELTON DYER.—*Exhibition of Photographs and Specimens of a Cedar Struck by Lightning.*

This was a very fine Deodar completely ruined by a single stroke. The wood was not splintered so much as oaks usually are.

PROF. SCHUSTER, F.R.S.—*Some Observations with Lord Kelvin's Portable Electrometer.*

During a recent visit to the Engadine, Prof. Schuster has made observations on the atmospheric electricity near the ground at different heights above sea-level. The readings were taken with Lord Kelvin's portable electrometer, which worked very satisfactorily and seems well adapted for such purposes. In all cases positive charges were found, increasing with height, but in an apparently erratic fashion. The normal positive charge at the foot of a glacier was found to be strengthened by a wind blowing down it, and Lenard's observa-

tions on the negative electricity of waterfalls were all confirmed. The daily curve of atmospheric potential in the valley of Pontresina shows a maximum at 11 a.m., dipping a little and rising again to an afternoon maximum at 5 p.m., then rapidly descending as the evening breeze sets in. Discussion on the paper related chiefly to the behaviour and temperature errors of portable electrometers, the latter being somewhat large and quite unexplained. Prof. Ayrton suggested a crucial experiment to determine whether atmospheric electricity is due to an actual distribution in the air, or to induction from the earth's surface.

PROF. MICHIE SMITH.—*Indian Thunderstorms.*

This paper gave the results of observations made at Madras. There, he said, sheet lightning occurs every evening for several months, always near the horizon and directed towards the south-west. The time of occurrence varies from day to day, but is always evening, and generally not later than 9 p.m. It is not a reflection of distant lightning flashes, but consists of an actual discharge of electricity from cloud to cloud, or between two portions of the same cloud, and it takes place in the upper portions of low-lying clouds. When morning lightning occurs its direction is north-east. Hence the lightning is always to be looked for in the regions of still air, where the land and sea breezes meet. The time of occurrence depends on the hour when the sea breeze sets in, the display being about three hours later than this. Cumulus clouds rise together in pairs, and the discharge takes place between them, sometimes possibly within them. He thought that the electrical conditions of the clouds might be accounted for by the fact that the sea breeze is moist and dustless, while the land breeze is dry and dusty. It is known that the air is negatively electrified relatively to the ground when the air and earth are both dusty, while the sea breeze brings a strong positive electrification. The equalization of the electric conditions of these clouds will result in sheet lightning. The presence of dust in the clouds is shown when they sink rapidly; the dust is then seen at their edges, and gives the iridescent or nacreous appearance frequently observed.

Mr. John Aitken said that his observations on the Rigi confirmed Professor Michie Smith's theory. He believed that thunderstorms resulted from an influx of pure air into dusty regions; the thunderstorm was the effect of purifying the air, not the cause of it. In support of this view he gave an instance of thunderstorms occurring for several days in succession without any apparent purification of the air; eventually the air was purified and the thunderstorms ceased.

Professor Schuster said he had counted 25 new theories of thunderstorms, all put forward during the past 12 years; in some years as many as four or five theories had been proposed. In connection with the electrification of air he thought Lenard's observation of the electricity of waterfalls was important; Lenard found that the air coming from a spray of a fall of pure water was charged negatively, that from salt water, on the other hand, is positively electrified. This accounts for the positive charge of the sea breeze. He thought the dust in air was generally gathered up locally, excepting that at high levels, as in the case of the Krakatoa eruption. He supposed Professor Michie Smith would not deny the possibility of nacreous clouds being due to a current of air rising through the stationary cumulus cloud. He had often observed nacreous clouds in England, when the light was favourable; but he had connected them with cirrus rather than cumulus clouds, and attributed their iridescence to ice particles instead of dust.

Professor Michie Smith, in reply, said that the iridescence of nacreous

clouds occurred so near the edge of the cumulus and fitted it so closely, that he regarded the phenomenon as produced by it.

G. J. SYMONS.—*Notes on Autumn Floods of 1894.*

The facts quoted in this paper having all been given either in the paper read before the Royal Meteorological Society by Messrs. Symons and Chatterton, or in *British Rainfall*, 1894, it is unnecessary to set them out, but the author concluded by pleading strongly for some organised system of preserving records of floods, by collecting the inscriptions on such iron plates as are at present to be found on some rivers, marking the flood levels by insuring a more methodical record in future, and other similar means.

The President of the Section (Mr. Vernon Harcourt) supported Mr. Symons's suggestions respecting flood marks and records, and urged that further steps should be taken to prevent floods on rivers, and that communication should be systematically established between the different points on a river, in order that the sluices might be opened in time to avert flooding.

Mr. Symons, in replying, mentioned that in France there was along the rivers an almost perfect system of taking and recording levels, and of telegraphing down when floods were approaching.

W. H. WHEELER.—*The Effect of Wind and Atmospheric Pressure on the Tides.*

The author has been making observations on this subject for many years. From an analysis of two years' tides at the Port of Boston (Lincoln), excluding occasions when the element of wind would affect the case, he found that out of 152 observations, 61 gave results opposite to that which would have been expected by the readings of the barometer alone; for a high barometer was frequently accompanied by a high tide, and a low barometer by a low tide. On the other hand it was found, with few exceptions, that when the wind blows with any force along a coast in the same direction as the main stream of the flood tide, the tides at all the ports along the coast will be higher than the calculated height given in the tide-tables; and when the wind blows against the flood tide, high-water will be lower than calculated. According to figures quoted in the paper, the effect of wind is such as to affect the tide as much as 5 to 6 feet, and a difference of as much as 8 feet has been observed between two succeeding tides. An analysis of the register of tides at Boston Dock for two years showed that 24 per cent. of those recorded were sufficiently affected by the wind to vary 6 inches from the calculated height. Thirty varied by 2 feet, seven by 3 feet, six by 3½ feet, three by 4 feet, two by 4½ feet, one by over 5 feet, and one by 6 feet 3 inches. From the observations Mr. Wheeler has deduced the approximate rule that with a given force of wind of 3 on the Beaufort scale a tide will be raised or depressed by half an inch for every foot of range. With a force of from 4 to 6, the variation may be expected to be 1 inch for every foot, with a gale force of 7 to 8 it will be 1½ inches, and if the gale increases to 10 it will be 2 inches. It will be seen that the subject is one which possesses not only scientific interest, but considerable practical importance to mariners; and as far as we are aware, Mr. Wheeler is the first who has obtained quantitative results of this nature. In the discussion which followed, it was pointed out that the time element would have to be given its due value.

W. H. WOOD.—*On the Zodiacal Light considered as an Atmospheric Phenomenon.*

W. H. WOOD.—*On the Local Origin of the Aurora Borealis.*

We are unable to obtain abstracts of these two papers.

## CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, APRIL, 1895.

STATIONS.  (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.	
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.		
	Temp.	Date.	Temp.	Date.										
England, London .....	67·1	29	29·1	1	57·9	40·8	41·2	0·100	77	113·6	25·4	1·34	13	6·4
Malta.....	80·4	27	51·3	2	70·3	56·5	54·0	77	133·5	45·6	·12	2	4·9	
<i>Mauritius</i> .....	83·4	3	63·8	27	81·1	71·4	68·5	79	133·0	54·8	2·62	12	5·6	
Calcutta .....	99·4	28	66·6	8	92·2	73·9	72·2	71	158·2	60·4	1·76	4	3·7	
Bombay .....	93·0	19	74·1	6	88·5	77·1	73·4	74	140·8	64·8	·00	0	0·9	
Ceylon, Colombo .....	93·2	29	73·0	...	90·9	75·6	73·8	80	146·5	68·0	9·34	24	6·3	
<i>Melbourne</i> .....	84·9	19	39·9	13	70·0	51·3	48·9	71	135·1	31·1	1·55	11	2·3	
<i>Adelaide</i> .....	86·9	2	45·4	11	71·7	55·6	51·1	64	143·2	38·8	4·18	16	5·9	
<i>Sydney</i> .....	79·0	20	50·8	24	70·9	58·1	58·0	80	134·0	43·6	2·32	13	4·6	
<i>Wellington</i> .....	66·0	7	41·0	4b	59·2	47·9	45·1	73	121·0	28·0	11·23	19	5·2	
<i>Auckland</i> .....	71·0	21	43·0	10	65·4	52·5	46·6	66	128·0	40·0	1·78	14	5·0	
Jamaica, Kingston.....	90·3	20	67·8	14	86·5	71·1	69·7	78	...	...	·98	8	4·4	
Trinidad .....	92·0	27a	64·0	1	89·5	69·1	68·8	68	174·0	63·0	2·52	8	...	
Grenada .....	85·6	27	72·0	12c	82·6	74·1	67·6	67	148·6	...	4·05	15	2·7	
Toronto .....	69·1	19	23·7	...	51·2	35·5	32·9	66	...	16·2	1·52	12	5·6	
New Brunswick, Fredericton .....	66·7	21	11·2	12	51·1	28·7	27·8	60	...	...	3·15	10	4·6	
Manitoba, Winnipeg ...	70·7	17	19·2	25	62·1	32·6	...	...	...	...	·62	8	6·3	
British Columbia, Esquimalt.....	63·4	21	30·2	5	54·4	39·0	42·3	83	...	...	2·02	16	6·8	

a—and 28; b—18 and 30; c—and 30.

## REMARKS.

MALTA.—Adopted mean temp. (62°·0), 2°·2 above the average. Mean hourly velocity of wind 10·6 miles. Temp. of sea rose to 65°·4. Lightning was seen on the 20th. J. F. DOBSON.

*Mauritius*.—Mean temp. of air 0°·5 below, of dew point 0°·2 above, and rainfall 3·18 in. below, their respective averages. Mean hourly velocity of wind 8·2 miles, or 2·3 below average; extremes, 19·9 on 1st, and 1·7 on 8th and 10th; prevailing direction, E.S.E. Thunder and lightning on 4th. Lightning on 16th and 17th, and thunder on 20th. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms occurred on 18 days. D. G. MANTELL.

*Adelaide*.—Mean temp. 0°·5 below the average of 38 years. Rainfall 2·51 in. above the average. C. TODD, F.R.S.

*Sydney*.—Mean temp. same as the average; humidity 2 above, and rainfall 3·53 in. below, their respective averages. H. C. RUSSELL, F.R.S.

*Wellington*.—Showery in the early part; but on the 12th heavy rain commenced, with a gale from S.E., and continued without ceasing until the night of 15th, the total fall being 9·90 in. A few fine days followed, but the last part of the month was showery. Altogether most unpleasant and stormy. Mean temp. 3°·4 below, and rainfall 7·71 in. above, the average. R. B. GORE.

AUCKLAND.—An unusually dry and cool month, the rainfall being barely more than half the average, and the mean temp. 3° below the average. A strong N.E. gale from the 13th to the 15th, and S.E. gale on 27th and 28th. T. F. CHEESEMAN.

JAMAICA, KINGSTON.—Mean hourly velocity of wind 4·3 miles. Rainfall a little below the average. R. JOHNSTONE.

TRINIDAD.—Rainfall ·49 in. above the average of 30 years. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL,  
OCTOBER, 1895.

[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 .....	3·61	XI.	Lake Vyrnwy .....	5·17
	Birchington, Thor .....	2·82		Corwen, Rhug .....	3·42
	Hailsham .....	3·87		Carnarvon, Cocksidia ...	6·34
	Ryde, Thornbrough .....	4·02		I. of Man, Douglas .....	5·79
	Emsworth, Redlands ...	3·46	XII.	Stoneykirk, Ardwell Ho.	4·86
	Alton, Ashdell .....	3·50		New Galloway, Glenlee	4·32
III.	Oxford, Magdalen Col..	2·78		Melrose, Abbey Gate ...	...
	Banbury, Bloxham .....	3·32	XIII.	N. Esk Res. [Penicuick]	3·85
	Northampton, Sedgebrook	2·50		Edinburgh, Blacket Pl.	3·30
	Alconbury .....	2·19	XIV.	Glasgow, Queen's Park..	2·95
	Wisbech, Bank House...	2·66	XV.	Inverary, Newtown .....	3·40
IV.	Southend .....	2·88		Islay, Gruinart Schools..	3·43
	Harlow, Sheering.....	2·20	XVI.	Dollar .....	3·03
	Colchester, Lexden .....	1·80		Balquhiddy, Stronvar...	2·94
	Rendlesham Hall .....	2·66		Ballinluig .....	2·02
	Diss .....	2·52		Dalnaspidal H.R.S. ....	4·53
	Swaffham .....	2·11	XVII.	Keith H.R.S. ....	7·90
V.	Salisbury, Alderbury ...	3·36		Forres H.R.S. ....	4·60
	Bishop's Cannings .....	3·97	XVIII.	Fearn, Lower Pitkerrie..	3·24
	Blandford, Whatcombe .	4·33		Loch Shiel, Glenaladale	...
	Ashburton, Holne Vic...	5·23		N. Uist, Loch Maddy ...	4·77
	Okehampton, Oaklands.	7·60		Invergarry .....	4·79
	Hartland Abbey .....	6·78		Aviemore H.R.S. ....	3·80
	Lynmouth, Glenthorne.	8·48		Loch Ness, Drumnadrochit	3·93
	Probus, Lamellyn .....	7·99	XIX.	Invershin .....	3·03
	Wellington, Sunnyside..	...		Scourie .....	10·03
	Wincanton, Stowell Rec.	3·36		Watten H.R.S. ....	3·68
VI.	Clifton, Pembroke Road	4·25	XX.	Dunmanway, Coolkelure	5·81
	Ross, The Graig .....	2·68		Fermoy Gas Works .....	2·10
	Wem, Clive Vicarage ...	2·86		Killarney, Woodlawn ...	4·00
	Cheadle, The Heath Ho.	2·39		Caher, Duneske .....	3·13
	Worcester, Diglis Lock	2·24		Ballingarry, Hazelfort...	3·20
	Coventry, Coundon .....	3·75		Limerick, Kilcornan ...	4·68
VII.	Ketton Hall [Stamford]	1·75		Ennis .....	3·07
	Grantham, Stainby .....	3·74		Miltown Malbay .....	3·86
	Horncastle, Bucknall ...	2·09	XXI.	Gorey, Courtown House	2·60
	Worsop, Hodsack Priory	2·62		Athlone, Twyford .....	3·19
VIII.	Neston, Hinderton .....	4·75		Mullingar, Belvedere ...	3·14
	Preston, Haighton ...	...		Longford, Currygrane...	2·86
	Broughton-in-Furness ...	7·27	XXII.	Woodlawn .....	3·62
IX.	Ripon, Mickley .....	3·34		Crossmolina, Enniscoe ..	6·79
	Melmerly, Baldersby ...	2·95		Collooney, Markree Obs.	5·14
	Scarborough, South Cliff	...		Ballinamore, Lawderdale	...
	Middleton, Mickleton ...	3·62	XXIII.	Lough Sheelin, Arley...	2·56
X.	Haltwhistle, Unthank...	3·96		Warrenpoint .....	3·02
	Bamburgh .....	4·69		Seaforde. ....	3·29
	Keswick, The Beeches...	...		Belfast, Springfield .....	4·94
XI.	Llanfrechfa Grange .....	3·70		Bushmills, Dundarave..	6·90
	Llandovery .....	5·03		Stewartstown .....	3·78
	Castle Malgwyn .....	4·47		Buncrana .....	7·81
	Builth, Abergwessin Vic.	6·81		Louge Swilly, Carrablagh.	7·82
	Rhayader, Nantgwillt ...	6·49			

## OCTOBER, 1895.

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 Nights 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.				Deg.	Date	Deg.	Date.		
I.	London (Camden Square) ...	2.84	— .05	1.14	5	14	74.4	1	26.6	28	7	11	
II.	Maidstone (Hunton Court)...	3.07	— .39	.80	8	11	...	...	...	...	...	...	
III.	Strathfield Turgiss .....	3.69	+ .85	1.13	5	16	71.1	1	21.2	26	10	19	
III.	Hitchin .....	2.49	— .58	.73	8	14	72.0	1	24.0	25d	9	...	
IV.	Winslow (Addington) .....	2.65	+ .44	.85	8	15	74.0	1	19.0	28	9	12	
IV.	Bury St. Edmunds (Westley)	2.34	— .93	.34	5, 10	14	70.0	1	21.0	27	...	...	
V.	Norwich (Brundall) .....	4.00	...	.63	8, 29	23	75.0	1	25.0	29	6	14	
V.	Weymouth (Langton Herring)	3.27	— .27	.89	7	16	68.0	1	29.0	29	5	...	
"	Torquay (Cary Green) ...	3.91	...	.77	8	16	67.4	1	30.0	24	4	7	
VI.	Polapit Tamar [Launceston]..	6.45	+ 1.62	1.02	30	21	69.1	1	22.6	24	7	12	
VI.	Stroud (Upfield) .....	3.24	+ .21	.85	5	19	68.0	1	25.0	27	8	...	
"	Churchstretton (Woolstaston)	2.49	— 1.28	.67	21	16	64.5	1	22.0	24	11	11	
VII.	Tenbury (Orleton) .....	2.41	— .80	.65	21	15	67.5	1	21.5	28	11	15	
VII.	Leicester (Barkby) .....	3.05	— .10	.84	8	19	75.0	1	18.0	23	13	18	
"	Boston .....	2.73	— .38	1.02	8	15	75.0	1	25.0	24	8	...	
"	Hesley Hall [Tickhill] .....	2.55	— .55	.85	8	15	71.0	1	24.0	26c	10	...	
VIII.	Manchester (Plymouth Grove)	3.46	+ .09	.68	2	19	71.0	1	25.0	24d	11	14	
IX.	Wetherby (Ribston Hall) ...	3.74	+ .61	.98	10	13	...	...	...	...	...	...	
"	Skipton (Arneliffe) .....	5.94	— .09	1.26	3	20	...	...	...	...	...	...	
"	Hull (Pearson Park) ...	3.24	— .41	.80	8	17	71.0	1	23.0	26	10	14	
X.	Newcastle (Town Moor) .....	4.00	+ .88	1.09	15	18	...	...	...	...	...	...	
XI.	Borrowdale (Seathwaite) .....	10.78	+ .19	1.66	2	18	...	...	...	...	...	...	
XI.	Cardiff (Ely) .....	4.70	+ .16	1.13	5	17	...	...	...	...	...	...	
"	Haverfordwest .....	5.34	+ .19	1.24	1	24	66.3	1	31.0	28	2	14	
"	Aberystwith (Gogerddan) ...	6.96	+ 1.61	1.21	1	19	68.0	1	...	...	...	...	
XII.	Llandudno .....	6.28	+ 2.89	.85	1	24	68.0	1	32.0	29	1	...	
XII.	Cargen [Dumfries] .....	3.61	+ .35	.80	1	12	71.2	1	21.2	28	12	...	
XIV.	Jedburgh (Sunnyside) .....	5.19	+ 2.54	.73	13a	18	73.0	1	23.0	27c	12	...	
XIV.	Colmonell .....	4.84	...	1.00	1	18	70.0	1	21.0	22	13	...	
XV.	Lochgilphhead (Kilmory) .....	4.85	+ .06	.86	11	15	...	...	24.0	22	14	...	
XV.	Mull (Quinish) .....	4.23	— 1.06	.76	11	19	...	...	...	...	...	...	
XVI.	Loch Leven Sluices .....	2.30	— .66	.60	2	10	...	...	...	...	...	...	
XVII.	Dundee (Eastern Necropolis)	1.50	— .74	.35	1	13	64.1	12	26.6	28	8	...	
XVII.	Braemar .....	3.41	— .20	1.30	1	26	67.9	1	25.7	18	17	25	
XVIII.	Aberdeen (Cranford) .....	6.37	...	1.88	1	25	63.0	13	26.0	27	13	...	
XVIII.	Strathconan [Beaully] .....	5.15	+ .50	1.00	3	14	...	...	...	...	...	...	
"	Glencarron Lodge .....	11.20	...	2.72	11	25	73.0	1	25.5	29	12	...	
"	Cawdor [Nairn] .....	5.01	+ 2.28	1.06	2	22	...	...	...	...	...	...	
XIX.	Dunrobin .....	5.91	+ 2.60	1.14	24	18	60.0	13b	30.0	28	5	...	
XX.	S. Ronaldsay (Roeberry) .....	3.87	+ .14	.69	24	26	57.0	1	30.0	27	4	...	
XX.	Darrynane Abbey .....	5.58	...	.71	2	21	...	...	...	...	...	...	
"	Waterford (Brook Lodge) ...	2.41	— 1.41	.60	1	11	67.0	2	25.0	28	8	...	
XXI.	O'Briensbridge (Ross) .....	4.05	...	.69	3	15	...	...	...	...	...	...	
XXI.	Carlow (Browne's Hill) .....	2.43	— .86	.71	1	13	...	...	...	...	...	...	
XXII.	Dublin (Fitz William Square)	2.84	— .54	.59	1	16	65.8	1	29.6	29	5	12	
XXII.	Ballinasloe .....	3.24	+ .25	.80	14	18	60.0	4	23.0	23	12	...	
XXIII.	Clifden (Kylemore) .....	6.88	...	1.20	1	19	...	...	...	...	...	...	
XXIII.	Waringstown .....	3.95	+ 1.24	.78	1	15	71.0	1	24.0	22	11	14	
"	Londonderry (Creggan Res.) ..	7.64	+ 3.97	.77	1	25	...	...	...	...	...	...	
"	Omagh (Edenfel) .....	4.54	+ 1.44	.54	1	22	59.0	1	29.0	16	9	14	

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

a—and 14. b—and 19. c—and 28. d—and 27.

# METEOROLOGICAL NOTES ON OCTOBER, 1895.

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.

STRATHFIELD TURGISS.—The weather was very unsettled, with high temp. until the 10th of the month, when it became colder and finer. On the 26th and 28th the min. on the grass touched the lowest reading recorded at this station for the corresponding date in October since the record commenced in 1861, viz., 20°·1 on 26th and 19°·7 on 28th. Swallow last seen on 1st.

HITCHIN.—The coldest October since 1873.

ADDINGTON.—The min. shade temp. of the month (19°) has only once been equalled, viz., on October 28th, 1890. Although a nice quantity of rain fell, the land at the close was still very hard and dry. There was very little wind, and hardly any fog.

BURY ST. EDMUNDS, WESTLEY.—The month was normal till the 24th, when sharp frost set in, which continued till the end of the month with unusual severity. Distant T on 2nd, and T on 5th.

NORWICH, BRUNDALL.—Remarkable for giving the highest and lowest temperatures ever registered by me in the month of October; 75°·0 on 1st, and 25°·0 on 29th. The previous highest was 74°·6 in 1886, and the previous lowest 28°·2 in 1890. The shade temp. fell below 32° each night from 24th to 29th inclusive, and the grass min. below 20° from 26th to 29th inclusive, the lowest being 17°·0 on 28th. S on 29th. L on 23rd, 25th, 26th, and 28th.

LANGTON HERRING.—The first eight days of the month were wet, followed by a dry period of 12 days. S, sleet, and R fell on the 25th, 26th, and 28th. Very great and sudden variations of temperature occurred throughout the month. The great heat of the last week of September lasted to October 1st, when the max. was 68° and the 9 a.m. temp. 64°. On the 2nd the 9 a.m. temp. was 51°, and on the 17th was 10° lower than on the previous day. Another sudden fall occurred on the 22nd, when the max. (40°) was 12° below that of the 21st. From the 22nd to the 30th inclusive the temp. did not rise above 47°, the average min. of the seven days, 24th to 30th, being only 31°. Mean temp. of the month 47°·3, 2°·7 below the average of 23 years. T and L on 2nd, and T on 25th, 27th, 28th, and 29th.

TORQUAY, CARY GREEN.—R 43 in. below the average. Mean temp. 49°·6, or 1°·8 below the average. Duration of sunshine 100 hours 50 minutes, or 15 hours below the average; 4 sunless days.

POLAPIT TAMAR.—A marked contrast to the previous month, both as regards temp. and rainfall. The last fortnight was very cold, an inch of S falling on 26th, which in October is most unusual. The mean temp. was 13° below that of September. T on 2nd, 4th, and 15th; T and L on 25th; H on 8 days.

STROUD, UPFIELD.—S.W. gale in morning on 3rd. S fell to a depth of more than half an inch on 21st, melting rapidly, and to a depth of about three-quarters of an inch at night on 26th.

WOOLSTASTON.—The first three weeks were pleasant and genial, but on the 21st S fell heavily to a depth of nearly 6 inches, and it was intensely cold till the end of the month. T and very vivid L on 27th. Mean temp. 44°·2.

TENBURY, ORLETON.—A very cold month, the mean temp. being more than 4° below the average of 34 years, and colder than any October since 1887. Severe frost from the 23rd to 30th inclusive. S on the 22nd and 27th.

LEICESTER, BARKBY.—A great contrast to September, the mean temp. (44°·3) being exactly 15° lower. More than the average R fell; still, the land absorbed it nearly all. S fell on the 26th.

MANCHESTER, PLYMOUTH GROVE.—Very unsettled from the 1st to the 9th; fine autumn weather on 10th and 11th, and from 16th to 20th. Slight S on the 24th and 26th; fog on 28th, and dense fog on 29th; the last ten days very

winterly. On the 24th the min. on grass was  $18^{\circ}$ , the lowest in October in 28 years, with the exception of  $17^{\circ}$  on October 27th, 1890.

HULL, PEARSON PARK.—Fog on 1st, 18th, 25th, and 29th. Showers of H, sleet, and S on 26th.

#### WALES.

HAVERFORDWEST.—The change from the sultry heat and bright sunshine which characterized September was sudden and abrupt. Tempestuous weather prevailed during the first ten days, with a considerable fall of temp. The weather then improved, and the air was still and calm up to the 14th; the temp. then again fell, and weather of a most winterly character set in; several times the Precelly range was white with snow from end to end, and very sharp ground frosts prevailed from the 22nd to the close. Wind generally N.N.W. to N.E. Much T, L, and H.

GOGERDDAN.—Very stormy throughout the month, and very cold during the last ten days, with H and S.

#### SCOTLAND.

CARGEN.—Warm weather continued until the 1st, from which date the temp. fell rapidly, and the mean ( $43^{\circ}\cdot5$ ) has only once been lower ( $43^{\circ}\cdot1$  in 1892) in 36 years. The highest and lowest readings during the first 3 days were  $71^{\circ}\cdot2$  and  $35^{\circ}\cdot6$  respectively, giving a range of  $35^{\circ}\cdot6$  in 72 hours. On no previous occasion has the temp. exceeded  $70^{\circ}$  in October. Frost was registered on 12 days, and temperatures below  $21^{\circ}\cdot2$  have only twice been noted in October, namely,  $19^{\circ}\cdot4$  in 1892 and  $21^{\circ}\cdot0$  in 1894. Northerly winds were prevalent to an unprecedented extent, and there was considerably more than the average amount of sunshine. There was curling on 30th in the higher districts of Dumfriesshire and Ayrshire, and no record can be traced of the game having been previously played in October.

JEDBURGH.—The rainfall of the month is nearly twice the average, and the greatest in October for 30 years. The temp. was low, and on the whole the weather was ungenial. Some days in the early part had much sunshine, but there was almost none at the end. S at the end of the month.

COLMONELL.—Rainfall  $\cdot17$  in. below the average of 19 years. S on 21st. H on 23rd, 25th, 26th, and 27th. Mean temp. ( $41^{\circ}\cdot6$ )  $1^{\circ}\cdot3$  below the average.

ABERDEEN, CRANFORD.—The month was cold and wet.

ROEBERRY.—A very cold month. Mean temp.  $43^{\circ}\cdot1$ . Wind from the 9th to the end of the month, N. to N.E.

#### IRELAND.

DARRYNANE ABBEY.—Cold, stormy, and wet, a marked contrast to September. Slight aurora on 21st. The mountains white with S on 26th, 27th, and 28th.

WATERFORD, BROOK LODGE.—L on 26th and 27th. T on 13th and 31st. Dense fog on 14th and 15th.

O'BRIENSBRIDGE, ROSS.—Heavy R during the first week, followed by low temperature and frequent slight frosts.

DUBLIN.—A very cold October, with a great preponderance of N.W. winds. The mean temp. was nearly  $13^{\circ}$  below that of September, the change from the unusual warmth of the end of that month being singularly abrupt, and occurring on the morning of the 2nd. S lay on the Dublin mountains on the 2nd, and also from the 22nd to the end of the month. Mean temp. ( $46^{\circ}\cdot2$ )  $3^{\circ}\cdot5$  below the average. TS on 26th. L on 25th, 27th, and 28th. High winds on 9 days, attaining the force of a gale only on 2nd and 3rd. Fog on 7 days. H on 8 days. Sleet on 3 days. Solar halo on 30th.

LONDONDERRY, CREGGAN RESERVOIR.—S daily from 24th to 28th.

EDENFEL, OMAGH.—The first fortnight was wet and unsettled, the third week was very fine, and from the 23rd to the end there followed the coldest spell ever experienced here in October: strong polar winds, with heavy S and sleet and continuous night frosts; notwithstanding which, so great has been the luxuriance of the foliage, that the autumn tints were at least a fortnight later than usual.



# SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

CCCLIX.]

DECEMBER, 1895.

[PRICE FOURPENCE,  
or 5s. per ann. post free.]

## CLIMATE AND HEALTH.\*

It will be strange if the final unravelment of the connection between weather and disease occurs in the New World, which is as but of yesterday, and not in the Old World, where it has been written about for more than two thousand years. Such an event seems to us not improbable.

When the people of the United States make up their minds as to doing anything, they have funds, extent of country, means of inter-communication, and the will to expend those resources, to a greater extent than the nations of the Old World. It is not a question of the relative skill of an individual in one world or the other; but given two men of equal ability, one in England, one in Washington, the latter has far and away the best chance; he has an area twenty times as great, he has a staff of assistants of proportional magnitude, and need not trouble about the cost of printing and engraving.

We have been led to the above remarks by examining the work mentioned below, concerning which we have a little more to say. In the first place, we must own to some amusement, astonishment and grief at the origin of what may not improbably be a work of world-wide importance. We must first justify the rather contradictory sentiments which we have just named, and to do so we must reproduce the first few lines of the Preface.

"In December, 1893, the Honorable the Secretary of Agriculture in a communication to the Chief of the Weather Bureau, enclosed a copy of a monthly report of the Cornwall County (England) Council, and wrote among other things concerning it:—

'Besides meteorological data, it contains vital statistics which may be of service, and may possibly suggest to you some manner by which, through the Weather Bureau of this Department, the sanitary conditions throughout the various States of the Union may constantly be kept before the public.'

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\* United States Department of Agriculture, Weather Bureau. Climate and Health. Edited under the direction of Prof. Willis Moore, Chief of the Weather Bureau, by W. F. R. Phillips, M.D. Number One. Washington, 1895, 4to, 26 pages, 20 maps.

We were 'amused' because without in the least depreciating Mr. Trevail's little monthly table, the idea of its setting in motion such an organization as that revealed by the work before us is somewhat droll. We were 'astonished' and 'grieved' because it shows the extreme difficulty of making even those high in office at all aware of what has been done, and is being done, in other parts of world. The whole Preface reads as if the suggestion had for the first time dawned upon the human race. If the Secretary had but gone to another department in his own city of Washington and consulted the superb catalogue issued by the Surgeon-General's Office (a work which has no European rival), he would have learned something as to what has been done; but, perhaps, it is as well not. Prof. Willis Moore (Chief of the Weather Bureau) has wisely placed the editorship in the hands of a medical man (Dr. W. F. R. Phillips) and if he is not hampered with detail, but allowed time to study the facts sent in to him, it is by no means improbable that he may detect hitherto unrecognized relations. A still better plan—and one the cost of which would to the United States be insignificant—would be to offer short (say, three years) appointments to half-a-dozen students who have passed good examinations in Physics and in Medicine, and let each have nothing to do with the preparation of tables but, be required to give his whole attention to the distribution of a single disease both geographically and climatologically. It would probably be well to prohibit his publishing any opinion or suggestion within the first year of his appointment; this would prevent the exercise of the natural instinct to bolster up early pronouncements.

As the Preface states that "This first number is almost wholly experimental in the sort of information it contains," we do not enter into details. It is something after the style of the returns of the Registrars General of England, Scotland and Ireland, of the *Tableaux Mensuels de Statistique Municipale* of Paris, and we were about to add the *Tablettes Mensuelles de la Soc. Roy. de Méd. Publique de Belgique*, but, to our astonishment, we find that now they contain no meteorology, although they have a special classification for *Maladies saisonnières, météoriques ou telluriques*! It differs, however, from all the above publications in the number of maps which it contains—good maps, but in which clearness has been lost by endeavouring to convey too much information upon each map.

There is no indication of any price being charged for this publication, and we infer that the United States, with its usual liberality (except as to the Bibliography of Meteorology), would be willing to exchange with the numerous analogous publications in this and other countries.

## METEOROLOGICAL OBSERVATIONS IN MANCHURIA.

WE have been favoured by the Rev. Dr. Cairns Mitchell with a copy of a little book with the title "*Ten Years in Manchuria*" (Houlston and Sons), by Mr. Christie, a Presbyterian Medical Missionary, giving an interesting account of his work in that remote part of China; and giving also a summary of his daily meteorological observations during 1893. Mr. Christie gives no details as to the instruments or their position, but observations from that part of China are so scarce, that we thankfully accept this information, and hope that the Mission and the records may both go on successfully.

*Meteorological Results for 1893, Moukden, Manchuria, China.*

Lat. 41° 50' N. ; Lon. 123° 58' E. Altitude 320 ft.

1893.	THERMOMETER.					BARO-METER.	RAINFALL.				
	Maximum.		Minimum.		Mean for Month.		No. of days.			Max. in 24 Hours.	Total for Month.
	Highest.	Mean.	Lowest.	Mean.			Mean.	Rain.	Snow.		
January ...	40 <sup>o</sup> ·4	16 <sup>o</sup> ·3	-28 <sup>o</sup> ·2	- 9·3	3 <sup>o</sup> ·5	30·09	...	5	...	·75	
February..	37·0	25·5	-25·0	- 5·0	10·3	30·15	...	3	...	·45	
March .....	68·0	43·3	- 8·7	20·7	32·0	29·93	1	2	...	·40	
April .....	77·2	63·5	29·0	38·1	50·8	29·69	5	...	·32	·93	
May .....	86·9	73·3	32·7	49·0	61·1	29·69	7	...	·65	2·30	
June .....	96·1	83·5	51·9	60·8	72·2	29·56	8	...	2·20	5·27	
July .....	95·9	89·0	64·5	70·2	79·6	29·55	6	...	3·26	4·62	
August ...	95·2	85·3	48·6	63·8	74·5	29·59	7	...	3·35	4·63	
September	86·7	75·5	38·5	50·1	62·8	29·83	5	...	1·72	3·42	
October ...	76·1	54·3	23·1	34·7	44·5	29·94	4	2	·80	2·58	
November.	54·2	39·7	- 6·9	13·8	26·8	30·01	1	1	...	1·00	
December.	47·2	25·4	-17·4	4·0	14·7	30·11	...	5	...	·72	
Extremes	96·1	...	-28·2	...	..	..	44	18	3·35	27·07	
Means .....	...	56·2	...	32·6	44·4	29·84	...	...	...	...	

## A WONDERFUL QUEENSLAND RAIN RETURN.

IN the *Met. Mag.* for April and May, 1893, under the heading *Queensland Floods*, we reprinted several very remarkable records of rainfall, and expressed the hope that we might see some official and trustworthy statement by Mr. Wragge. We have heard of his predicting the weather for the whole continent of Australia, and of his starting a mountain station in Tasmania, but we have not seen a single report upon the rainfall of Queensland; and now that a friend has sent us the following, we do not know whether or not it is to be regarded as the wettest station in Australia. According to the *Melbourne Argus*, at Crohamhurst, in the Blackall Ranges, 77·31 in. of rain fell in the four days, Jan. 31st—Feb. 3rd, 1893, and at

Mooloolah 67 in. in three days, at about the same date, but as we have had no returns from Queensland of late years, we cannot say whether these stations are or are not wetter than Goondi—to all appearance it is hard to beat—and apparently that part of Queensland has water enough and to spare.

*Rainfall at Goondi Mill, Johnstone River, Queensland.*

MONTH.	Total Rainfall for Month.	No. of Days.	Greatest Fall in one day.	Date.	No. of days with 2 in. rain and upwards.
1894.	in.		in.		
January .....	26·77	25	5·05	16	4
February .....	24·55	15	7·54	23	6
March .....	38·36	23	6·40	20	7
April .....	71·44	25	15·69	6	10
May .....	8·28	19	1·11	8	...
June .....	8·61	13	4·53	22	1
July .....	5·87	11	2·37	2	1
August .....	6·44	10	2·27	18	2
September .....	2·38	11	1·20	18	...
October .....	3·34	16	·82	30	...
November .....	32·48	20	5·07	21	8
December .....	12·98	21	1·88	26	...
Total .....	241·50	209	15·69		39

WE have also been favoured by Captain Wilson-Barker, R.N.R., F.R.Met.Soc., with a weekly return for quite another district. We have reduced it, as nearly as practicable, to monthly values and append it. But, as a rule, we think that local returns should always go to the central office of the country. We are sure that Mr. Ellery's successor at Melbourne Observatory would welcome the assistance of Captain Wilson-Barker's correspondent at Warragul.

*Rainfall at Fern Hills, Warragul, Victoria, Australia.*

Month.	1893.	1894.	1895.
	in.	in.	in.
January .....	...	·92	1·29
February .....	...	1·37	·56
March .....	...	3·35	2·15
April .....	...	2·45	3·43
May .....	...	4·37	1·63
June .....	...	1·87	4·49
July .....	...	6·39	4·35
August .....	...	6·09	4·16
September .....	6·80	3·92	...
October .....	3·77	3·45	...
November .....	3·17	·33	...
December .....	4·91	2·75	...
Total .....	...	37·26	...

Snow on 21st and 22nd July, 1895.

## THE CLIMATE OF THE BRITISH EMPIRE IN 1894.

The Climatological Table and Summary for 1894 show many familiar features, and the extremes are mostly distributed among the usual stations. Australia records the highest shade temp., and Winnipeg, of course, the lowest. In the 12 years for which the annual summaries have appeared in this magazine, Adelaide has yielded the highest max. in 10 years, Melbourne in one, and Calcutta in one; Adelaide also has, in nine years, recorded the highest sun max.

Winnipeg has never been equalled for lowness of absolute shade min., and of mean temp., or for total range of temp., and has only twice failed to record the greatest mean daily range. As regards mean temperature, Ceylon, with values ranging only from  $80^{\circ}2$  in 1887 to  $81^{\circ}1$  in 1885, has always headed the list.

The least daily range has generally been recorded at a thoroughly insular station, but Bombay in one year—1892, was bracketed with Ceylon.

The lowest relative humidity has invariably occurred at Adelaide, while the highest relative humidity has in different years been recorded at Falkland Isles, Winnipeg, Barbados, London and Esquimalt.

The greatest rainfall has in six years been registered at Ceylon, three at Bombay, and three at Trinidad; while the least rainfall has been distributed among six stations—Adelaide, Melbourne, Malta, Winnipeg, Jamaica and London.

Malta comes out well at the head of the list for cloudlessness, having recorded the least in eight years, Bombay in four, and Calcutta in one.

These comparisons are, to a certain extent, affected by the changes that have occurred from time to time in the list of stations, but the great majority extend over the whole period. The Cape of Good Hope appeared from the commencement of the tables in "*The Colonies*" in 1874 very regularly for many years, but we have very reluctantly had to abandon it, for of late all our efforts to obtain regular returns have failed.

To return to the 1894 results. The shade max. at Adelaide,  $107^{\circ}0$ , has been exceeded in ten years, but the min. at Winnipeg,  $-46^{\circ}1$ , and the extreme range at the same station, have only twice been beaten.

Winnipeg, with a mean temp. of  $36^{\circ}5$ , can hardly be congratulated on having had a *warm* year, though that value is the highest for that station shown in the 12 years.

The max., in sun, at Trinidad,  $177^{\circ}0$ , has been exceeded only by  $180^{\circ}0$  at Adelaide in 1882.

The extreme rainfall ( $77.46$  in.) at Ceylon is, with one exception, the smallest in the 12 years, but the least rainfall is not remarkable.

Curiously enough, London and Esquimalt record the greatest amount of cloud, and each has done the same in two previous years



*Summary.*

Highest Temp. in Shade	...	107°·0 at Adelaide on Nov. 26.
Lowest " " "	...	—46°·1 at Winnipeg on Jan 24.
Greatest Range in year ...	...	141°·9 at Winnipeg.
Least " " "	...	25°·8 at Colombo, Ceylon.
Greatest Mean Daily Range	...	23°·1 at Winnipeg.
Least " " "	...	10°·6 at Bombay.
Highest Mean Temp. ...	...	80°·8 at Colombo, Ceylon.
Lowest " " "	...	36°·5 at Winnipeg.
Driest Station ...	...	Adelaide, mean humidity 63.
Dampest Station...	...	Esquimalt mean humidity, 88.
Highest Temp. in Sun ...	...	177°·0 at Trinidad.
Lowest Temp. on Grass...	...	—11°·2 at Toronto.*
Greatest Rainfall ...	...	77·46 in. at Colombo, Ceylon.
Least " " "	...	18·12 in. at Winnipeg.
Most Cloudy Stations ...	...	London and Esquimalt ; average amount 6·3.
Least " " "	...	Bombay and Grenada ; average amount 4·0.

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ROYAL METEOROLOGICAL SOCIETY.

THE opening meeting of the session was held in the new building of the Institution of Civil Engineers on Wednesday evening, November 20th, Mr. R. Inwards, F.R.A.S., President, in the Chair.

Mr. W. H. Dines, by the aid of a small fan fixed over a vessel of hot water shielded from draughts, showed an experimental illustration of the formation of a "Tornado cloud," or waterspout. The characteristic funnel cloud was readily seen extending from the tray of hot water to the fan, and when the draught was strong and the conditions were favourable, a decided protuberance was observed on the surface of the water just under the end of the cloud. Mr. Dines is of opinion that the cloud is formed by true dynamic cooling, as the air saturated by the vapour from the hot water comes under the influence of the decreased pressure at the centre.

The President, Captain Wilson-Barker, Messrs. Bayard, Tripp, Marriott, Dickson, Symons and Admiral Maclear took part in the discussion, and all who had seen the phenomena in nature spoke of the wonderful fidelity of the representation.

A paper by Mr. J. Eliot, F.R.S., followed "On the origin of the cold weather storms of the year 1893 in India, and the character of the air movement on the Indian Seas and Equatorial Belt, more especially during the South-west Monsoon period." This was a discussion of the data contained in the *Indian Monsoon Area Charts*, the

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\* The min. on grass is not recorded at Canadian Stations, except Toronto.

publication of which was sanctioned by the Indian Government for the two years 1893-4. Cyclonic storms are of frequent occurrence during both the N.E. and the S.W. Monsoons, but they differ in many important respects. The storms of the S.W. Monsoon originate almost invariably over a sea surface, and travel in very variable directions, and occasionally develop into intense and furious hurricanes. The cyclonic storms of the N.E. Monsoon almost invariably originate over the plateau of Persia or Baluchistan, or in North-Western India, and travel in an easterly direction at a velocity ranging between 15 and 20 miles an hour. These plateau-formed storms of the cold weather are the chief instruments of the distribution of the moderate rainfall essential for the great cold weather wheat and other crops of Northern India—and are the chief sources of the snowfall of the Western Himalayas. After giving an account of the more important cold weather storms in January and February, 1893, and the results of the tabulation of the wind observations for the Equatorial Belt, the author describes the “burst of the Monsoon.” Mr. Eliot says that the evidence of the year 1893 is strongly in favour of the supposition that the S.W. Monsoon currents in the Indian Seas are the direct continuation, north of the Equator, of the horizontal movement of the S.E. Trade Winds; and that the larger variations in the strength of the S.E. Trades near the Equator during the Monsoon period are reproduced in the Monsoon currents in the Indian Seas from June to September.

Mr. Baldwin Latham, while appreciating the value of the paper, did not think that it fully cleared up the matter. Mr. Scott said that an examination of the Monsoon Charts which were in the library of the Meteorological Office showed the great deficiency of observations over the sea. The Indian Government, in view of the importance of the subject, had authorized the issue of the Charts for three more years. Captain Wilson-Barker dwelt upon the extent and importance of the work and considered that the weak point was the scarcity of observations over the sea; he thought, that the effect of the Himalayas was hardly sufficiently taken into account. Mr. C. Harding spoke with great appreciation of the paper and of the foresight which Mr. Blanford has shown in arriving, from the imperfect evidence available in the absence of synoptic charts, at a similar conclusion to the author. He gave illustrations of the manner in which meteorologists might be misled by working entirely with mean values. Mr. H. N. Dickson thought that Mr. Eliot's work would be greatly aided by a knowledge of the conditions prevailing on the Northern side of the Himalayas.

A paper, by Mr. C. Davison, F.G.S., “On the Diurnal Variation of Wind Velocity at Tokio, Japan,” was also read.

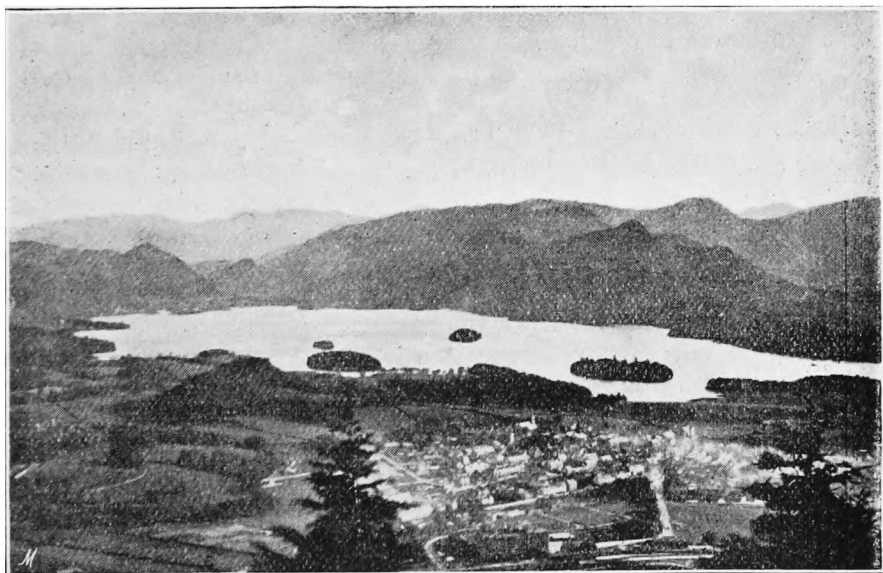


# REVIEWS.

*The English Lakes*, with Bathymetrical Maps and Illustrations, by HUGH ROBERT MILL, D.Sc., F.R.S.E. [From the *Geographical Journal*.] G. Philip and Son, London, 1895, large 8vo., 64 pages, 20 engravings and 8 large, folding, coloured maps.

It is very curious how frequently volunteer work is better than that produced by Government officials who, having National money to spend are unfettered as to cost.

This fascinating paper is a good illustration of what we have just said. As far as we can ascertain its origin is as follows :—Dr. Mill felt that it was a national disgrace that no survey had been made of the English Lakes. Their position and the configuration of the water surface had been laid down with absolute precision on the 6-inch Ordnance Maps, approximate statements as to the greatest depth in each lake had been given in *Black's Guide to the Lakes*, and a few soundings in some of them by Crosthwaite in 1792, and on some of the 6-inch Geological Survey Maps, but nothing of a complete nature had been done. Dr. Mill undertook to do it without remuneration, provided that the Royal Geographical Society would defray actual expenses ; the Society accepted the offer, and Dr. and Mrs. Mill and Mr. Heawood have done the work in a style worthy of all praise.



GENERAL VIEW OF DERWENTWATER FROM THE NORTH.

[Photograph by Mr. A. Pettitt, Keswick.]

Although the book contains a mass of statistics it must not be assumed to be dry reading, quite the contrary, and whether one's tastes be merely æsthetic, or meteorological, or geological or cartographical, in each case we could strongly recommend the securing of a copy while any are to be had. We had occasion recently to refer to the beauty of Bartholomew's colour map printing, and the eight maps given here are worthy of their reputation, there is a general one of the country, and there are seven detail ones on the scale of two inches to the mile which leave nothing to be desired. As to the illustrations we have the pleasure of reproducing one of the twenty to speak for itself.

The paper is clearly and pleasantly written and should, we think, be read by all who take an intelligent interest in the most beautiful country in the British Isles.

As an indication of the thoroughness with which the work was done we find that the depth of the water was determined at 5068 spots along lines of soundings the aggregate length of which was 153 miles.

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*Clouds and Weather.* A study for navigators by CAPTAIN D. WILSON BARKER, F.R.S.E., F.R.Met.Soc. *Shipping World* Office, Arundel Street, Strand, 1895. 8vo., 22pp.

TWENTY-FOUR reproductions of photographs of clouds, a page of diagrams and the needful text offered at sixpence can hardly be accused of being costly. The little pamphlet is written for sailors by a sailor who has had wide experience and has made good use of it. The blocks are produced from Captain Wilson Barker's own photographs and have apparently been printed upon a newspaper printing machine, some have come out remarkably well, but others do not do justice to the photographs.

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*Meteorologische Volksbücher*, VON PROF. DR. HELLMAMN. Second ed. Paetel, Berlin, large 8vo, 68 pages.

WE pointed out the excellence of this work when the first edition appeared; our verdict has been confirmed by the sale of the whole edition, and the appearance of a second. It is considerably enlarged and brought thoroughly up to date. For instance, Firmin de Belleval is duly credited with the treatise, "De mutatione aeris," &c.; but there is no more information about Joannes de Sacro Bosco. We, as Englishmen, ought to find out more than was given in the *Met. Mag.*, Vol. xxvi. (1891), p. 133-134. Will one of our readers take it up? Some Yorkshireman might search for records of the Twelfth-century astronomer.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MAY, 1895.

STATIONS.  (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
	°		°		°	°	°	0-100	°	°	inches		
England, London .....	86·2	30	35·7	2	68·3	46·0	45·1	68	128·9	30·2	·34	5	4·0
Malta.....	81·6	24	53·1	9	72·7	59·3	57·2	75	136·6	47·4	·51	3	5·8
Mauritius.....	81·9	3	66·2	27 <i>b</i>	78·3	70·4	65·9	78	129·2	55·3	3·09	21	5·1
Calcutta .....	107·2	20	70·2	4	96·2	79·1	77·9	74	159·2	68·9	2·41	4	4·1
Bombay .....	91·8	19	78·3	4	90·3	80·6	75·0	73	140·9	73·7	·08	2	3·0
Ceylon, Colombo .....	93·7	1	74·6	16	89·4	78·7	74·0	78	157·0	68·0	10·09	25	7·0
Melbourne.....	66·3	3	31·3	26	59·7	45·7	45·5	76	119·0	26·7	·97	15	7·1
Adelaide .....	71·7	13	36·9	26	63·5	47·6	45·9	70	132·0	29·6	·84	9	5·3
Sydney .....	71·2	14	43·1	27	63·9	51·4	49·0	82	120·3	34·3	1·87	15	5·0
Wellington .....	65·0	9	39·0	19 <i>c</i>	57·6	47·0	43·7	73	109·0	27·0	4·70	15	5·0
Auckland .....	68·0	2	43·0	23	61·8	51·3	48·8	76	129·0	37·0	5·52	21	6·5
Jamaica, Kingston.....	89·5	14	70·4	4	87·8	73·2	71·1	76	...	...	1·98	8	4·6
Trinidad .....	95·0	11	65·0	20	90·3	70·4	69·7	70	169·0	64·0	2·11	9	...
Grenada.....	85·0	18 <i>a</i>	71·0	3	83·0	74·6	69·3	71	149·6	...	3·41	19	4·6
Toronto .....	93·4	30	27·9	13	62·3	44·5	44·6	70	...	23·0	2·31	8	4·3
New Brunswick, Fredericton .....	91·7	7	26·5	2	67·8	41·5	43·1	61	...	...	·95	16	5·5
Manitoba, Winnipeg .....	80·0	22	24·8	13	67·3	40·8	...	...	...	...	3·74	13	6·4
British Columbia, Esquimalt .....	82·0	15	36·1	5	61·1	44·1	47·3	87	...	...	1·60	17	6·1

*a*—24 and 26; *b*—and 29; *c*—and 23.

REMARKS.

MALTA.—Adopted mean temp. (64°·9), 0°·8 above the average. Mean hourly velocity of wind 8·9 miles. Temp. of sea rose to 70°·0. Thunderstorms on 5th and 6th. Lightning on 9th and 10th. Hail on 5th.

J. F. DOBSON.

*Mauritius*.—Mean temp. of air 1°·0 above, of dew point 1°·6 above, and rainfall ·91 in. below, their respective averages. Mean hourly velocity of wind 13·0 miles, or 3·0 miles above average; extremes, 30·2 on 6th, and 1·8 on 11th; prevailing direction, E.S.E.

C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms on nine days, and lightning on five other days.

D. G. MANTELL.

*Adelaide*.—Mean temp. 2°·1 below the average of 38 years. Very dry; rainfall 2·10 in. below the average.

C. TODD, F.R.S.

*Sydney*.—Mean temp. 0°·7 below, humidity 7 above, and rainfall 3·27 in. below, their respective averages.

H. C. RUSSELL, F.R.S.

*Wellington*.—A few fine days during the early and latter parts of the month, but generally showery and unpleasant weather and cold, with prevailing S. and S.E. winds. Hail on 17th. Fog on 14th, 21st and 22nd. Mean temp. 0°·3 above, and rainfall ·29 in. below, the average.

R. B. GORE.

*Auckland*.—An unusually rainy May, the rainfall being 1·41 in. over the average of 28 years. Mean temp. and barometrical pressure both slightly below the average.

T. F. CHEESEMAN.

JAMAICA, KINGSTON.—Mean hourly velocity of wind 4·4 miles. Rainfall in N. and W.C. divisions 43 and 9 per cent. above, and in N.E. and S. divisions 19 and 26 per cent. below, the respective averages, giving as the result an average fall for the island.

R. JOHNSTONE.

TRINIDAD.—Rainfall 1·54 in. below the average of 30 years.

J. H. HART.

## CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JUNE. 1895.

STATIONS.  (Those in italics are South of the Equator.)	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.									
	°		°		°	°	°	0-100	°		inches		%
England, London .....	83·9	23	42·2	15	73·6	50·6	47·6	62	135·3	34·4	·30	4	4·8
Malta .....	88·1	29	57·1	1	79·2	65·1	62·7	75	139·9	51·0	·00	0	3·2
<i>Mauritius</i> .....	77·6	3	54·8	22	74·8	65·6	61·2	75	123·2	45·6	2·85	19	5·5
Calcutta .....	95·3	14	72·8	1	90·1	77·7	78·4	84	157·8	71·3	11·82	16	6·4
Bombay .....	93·8	7	75·1	20	88·0	79·8	77·2	82	143·4	73·7	17·84	20	7·0
Ceylon, Colombo .....	90·2	11	73·6	14	87·9	77·5	74·3	82	151·5	70·0	13·99	24	6·1
<i>Melbourne</i> .....	66·1	6	29·5	17	57·6	42·6	42·7	78	114·1	20·4	1·74	13	6·4
<i>Adelaide</i> .....	68·5	6	39·6	5	61·0	46·7	46·1	75	129·0	31·5	2·89	16	5·8
<i>Sydney</i> .....	70·0	20	41·8	30	61·2	47·6	43·2	77	106·3	28·7	·93	13	3·8
<i>Wellington</i> .....	62·8	10	32·5	21	54·4	43·2	41·5	77	103·0	22·0	9·52	23	5·9
<i>Auckland</i> .....	63·0	12	40·0	21	58·3	48·4	46·0	76	116·0	36·0	6·14	25	6·6
Jamaica, Kingston .....	91·9	17a	69·7	1	89·0	73·4	69·7	70	...	...	·32	3	4·2
Trinidad .....	91·0	7	67·0	13b	88·6	70·3	70·6	76	171·0	66·0	5·00	13	...
Grenada .....	85·6	4	71·0	19	82·7	74·1	72·4	76	148·5	...	6·20	24	5·1
Toronto .....	93·1	2	45·8	8	79·0	56·7	55·6	67	109·5	39·4	·75	9	3·8
New Brunswick, Fredericton .....	91·7	12	37·5	9	77·5	51·3	50·1	57	...	...	2·86	11	4·6
Manitoba, Winnipeg British Columbia, Esquimalt .....	80·0	16	34·8	26	69·5	47·6	...	...	...	...	2·31	18	7·5
	75·2	7	39·4	2	65·3	48·4	52·8	89	...	...	·48	11	5·4

a—and 18; b—and 29.

## REMARKS.

MALTA.—Mean temp. 71° 0, 0°·6 below average; mean hourly velocity of wind 10·4 miles. Average temp of sea, 74°·0. J. F. DOBSON.

*Mauritius*.—Mean temp. of air 0°·1 below, of dew point 0°·6 above, and rainfall ·81 in. above, their respective averages. Mean hourly velocity of wind 12·8 miles, or 1·4 mile above average; extremes, 29·6 on 11th and 2·0 on 9th; prevailing direction E.S.E. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Lightning was seen on the 5th and 10th, and thunderstorms occurred on 8 days. D. G. MANTELL.

*Adelaide*.—Mean temp. 0°·3 above, and rainfall ·10 in. above, the average of 38 years. C. TODD, F.R.S.

*Sydney*.—Mean temp. same as the average; humidity 1 below, and rainfall 4·46 in. below, the average. H. C. RUSSELL, F.R.S.

*Wellington*.—Showery in the early part of the month, then a few fine days until 11th, when it rained heavily (2·27 in.), and continued showery almost for the remainder of the month. Wind variable and on the whole moderate. H on 18th and 19th. Fog on 16th, 17th, and 29th. Rainfall nearly twice the average. R. B. GORE.

*Auckland*.—An exceptionally wet and stormy month, the rainfall being nearly 1·50 in. above the average. Barometric pressure and mean temperature both slightly under the average. T. F. CHEESMAN.

JAMAICA.—Mean hourly velocity of wind 4·9 miles. Rainfall very deficient, being only half the average in the N. and W.C. divisions, and less than half in the N.E. and S. divisions. Hail at Kew Park on 28th, and at Vale Royal on the 6th, stones in the latter case being  $\frac{3}{4}$  inch in diameter, and tasting salt. Vale Royal is 3 miles from the sea, at an elevation of about 800 ft. R. JOHNSTONE.

TRINIDAD.—Rainfall 3·04 in. below the average of 30 years. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL,  
NOVEMBER, 1895.

[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 .	5 67	XI.	Lake Vyrnwy .....	7 51
„	Birchington, Thor .....	2 99	„	Corwen, Rhug .....	4 81
„	Hailsham .....	5 43	„	Carnarvon, Cocksidia ...	6 50
„	Ryde, Thornbrough .....	4 70	„	I. of Man, Douglas .....	3 81
„	Emsworth, Redlands ...	5 23	XII.	Stoneykirk, Ardwell Ho.	4 29
„	Alton, Ashdell .....	6 02	„	New Galloway, Glenlee	7 34
III.	Oxford, Magdalen Col.	4 17	„	Melrose, Abbey Gate ...	...
„	Banbury, Bloxham .....	4 94	XIII.	N. Esk Res. [Penicuick]	3 50
„	Northampton, Sedgebrook	3 72	„	Edinburgh, Blacket Pl.	2 60
„	Alconbury .....	3 14	XIV.	Glasgow, Queen's Park..	4 08
„	Wisbech, Bank House...	2 90	XV.	Inverary, Newtown .....	8 35
IV.	Southend .....	3 27	„	Islay, Gruinart Schools..	4 63
„	Hailow, Sheering.....	3 39	XVI.	Dollar .....	4 02
„	Colchester, Lexden .....	2 03	„	Balquhider, Stronvar...	11 68
„	Rendlesham Hall .....	1 87	„	Ballinluig .....	5 57
„	Diss .....	2 01	„	Dalnaspidal H.R.S. ....	9 18
„	Swaffham .....	3 07	XVII.	Keith H.R.S. ....	1 39
V.	Salisbury, Alderbury ...	5 97	„	Forres H.R.S. ...	91
„	Bishop's Cannings .....	5 85	XVIII.	Fearn, Lower Pitkerrie..	40
„	Blandford, Whatcombe .	7 09	„	Loch Shield, Glenaladale	...
„	Ashburton, Holne Vic...	13 03	„	N. Uist, Loch Maddy ...	4 45
„	Okehampton, Oaklands.	8 00	„	Invergarry .....	6 93
„	Hartland Abbey .....	5 19	„	Aviemore H.R.S. ....	2 68
„	Lynmouth, Glenthorne.	7 33	„	Loch Ness, Drumnadrochit	2 88
„	Probus, Lamellyn .....	6 44	XIX.	Invershin .....	79
„	Wellington, Sunnyside..	...	„	Scourie .....	3 02
„	Wincanton, Stowell Rec.	6 55	„	Watten H.R.S. ....	1 60
VI.	Clifton, Pembroke Road	5 38	XX.	Dunmanway, Coolkelure	10 92
„	Ross, The Graig .....	4 80	„	Fermoy Gas Works .....	...
„	Wern, Clive Vicarage ...	2 45	„	Killarney, Woodlawn ...	7 94
„	Cheadle, The Heath Ho.	3 62	„	Caber, Duneske .....	6 05
„	Worcester, Diglis Lock	3 25	„	Ballingarry, Hazelfort...	4 71
„	Coventry, Coundon .....	4 93	„	Limerick, Kilcornan ...	4 87
VII.	Ketton Hall [Stamford]	3 59	„	Ennis .....	...
„	Grantham, Stainby .....	3 86	„	Miltown Malbay .....	...
„	Horncastle, Bucknall ...	2 60	XXI.	Gorey, Courtown House	5 06
„	Workshop, Hodsck Priory	3 07	„	Athlone, Twyford .....	4 78
VIII.	Neston, Hinderton .....	2 87	„	Mullingar, B lvedere ...	4 25
„	Preston, Haighton .....	2 87	„	Longford, Currygrane...	3 95
„	Broughton-in-Furness ...	4 95	XXII.	Woodlawn .....	5 61
IX.	Ripon, Mickley .....	5 07	„	Crossmolina, Enniscoe ..	5 96
„	Melmerby, Baldersby ...	4 06	„	Collooney, Markree Obs.	3 72
„	Scarborough, South Cliff	...	„	Ballinamore, Lawderdale	...
„	Middleton, Mickleton ...	4 93	XXIII.	Lough Sheelin, Arley...	3 90
X.	Haltwhistle, Unthank...	3 24	„	Warrenpoint .....	4 29
„	Bamburgh .....	2 47	„	Seaford .....	4 95
„	Keswick, The Beeches...	...	„	Belfast, Springfield .....	3 25
XI.	Llanfrechfa Grange .....	6 76	„	Bushmills, Dundarave..	2 61
„	Llandovery .....	6 20	„	Stewartstown .....	3 46
„	Castle Malgwyn .....	6 08	„	Buncrana .....	3 97
„	Builth, Abergwessin Vic.	10 40	„	Lounge Swilly, Carrablagh.	4 62
„	Rhayader, Nantgwilt...	9 14			

## NOVEMBER, 1895.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which 40 or more fell.	TEMPERATURE.				No. of Nights below 32°.	
		Total Fall.	Differ- ence from average 1880-9.	Greatest Fall in 24 hours		Max.		Min.					
				Dpth	Date	Deg.		Date	Deg.	Date.			
I.	London (Camden Square) ...	inches. 3.17	inches. + .51	in. .58	28	19	63.5	16	32.0	18	1	8	
II.	Maidstone (Hunton Court)...	4.77	+ 1.84	.48	3	22	...	...	...	...	...	...	
III.	Strathfield Turgiss .....	5.12	+ 2.40	.84	5	24	63.5	16	27.3	18	5	11	
III.	Hitchin .....	3.83	+ 1.15	.95	5	20	63.0	16	28.0	2, 26	5	...	
IV.	Winslow (Addington) .....	4.88	+ 1.95	.98	10	21	62.0	16	27.0	18	3	6	
IV.	Bury St. Edmunds (Westley) ...	2.66	+ .11	.39	22	16	62.0	16	31.0	12	...	...	
V.	Norwich (Brundall) .....	2.67	...	.47	5	21	62.8	16	28.0	3	2	11	
V.	Weymouth (Langton Herring) ...	5.85	+ 2.19	.98	4	22	59.0	16	34.0	24	0	...	
"	Torquay (Cary Green) ...	7.98	...	1.35	10	20	64.1	16	37.2	18	0	1	
"	Polapit Tamar [Launceston]..	7.25	+ 2.91	1.07	5	23	62.0	16	29.4	18	2	4	
VI.	Stroud (Upfield) .....	5.02	+ 1.69	.67	10	25	60.0	16	33.0	17	0	...	
"	Church Stretton (Woolstaston) ...	4.31	+ .79	1.23	10	24	58.0	16	31.0	23	2	8	
"	Tenbury (Orleton) .....	4.70	+ 1.56	.91	10	22	62.0	16	26.3	18	2	6	
VII.	Leicester (Barkby) .....	3.63	+ 1.34	.68	29	24	63.0	16	27.0	18	6	14	
"	Boston .....	2.12	— .08	.38	10	14	60.0	16	30.0	18	2	...	
"	Hesley Hall [Tickhill].....	3.06	+ 1.04	.61	29	21	62.0	16	26.0	19	6	...	
VIII.	Manchester (Plymouth Grove) ...	2.42	— .58	.43	16	19	60.0	16	30.0	17	2	3	
IX.	Wetherby (Ribston Hall) ...	2.55	+ .48	.32	6	15	...	...	...	...	...	...	
"	Skipton (Arncliffe) .....	7.48	+ .73	.97	16	21	...	...	...	...	...	...	
"	Hull (Pearson Park) .....	2.25	+ .24	.41	27	17	63.0	16	25.0	19	4	5	
X.	Newcastle (Town Moor) .....	2.42	+ .02	.43	5	17	...	...	...	...	...	...	
X.	Borrowdale (Seathwaite).....	11.57	— 3.22	2.29	10	18	...	...	...	...	...	...	
XI.	Cardiff (Ely).....	5.14	+ .23	1.01	5	21	...	...	...	...	...	...	
"	Haverfordwest .....	5.10	— .76	.77	15	27	59.4	16	30.0	18	2	10	
"	Aberystwith (Gogerddan) ...	3.14	— 1.97	.66	10	19	56.0	8a	21.0	3	9	...	
"	Llandudno .....	3.71	+ .62	.70	16	17	63.4	15	32.0	4	1	...	
XII.	Cargen [Dumfries] .....	6.61	+ 2.05	.86	9, 21	18	57.6	15	28.2	1	5	...	
"	Jedburgh (Sunnyside) .....	2.83	+ .33	.51	16	17	55.0	10b	27.0	2	6	...	
XIV.	Colmonell .....	5.69	...	1.20	9	15	55.0	10	22.0	25	8	...	
XV.	Lochgilphead (Kilmory) .....	6.67	— .62	.91	5	20	...	...	27.0	22	4	...	
XV.	Mull (Quinish) .....	6.54	— .45	.90	10	21	...	...	...	...	...	...	
XVI.	Loch Leven Sluices .....	3.70	— .26	.50	22	18	...	...	...	...	...	...	
"	Dundee (Eastern Necropolis) ...	2.75	+ .05	.65	21	21	54.1	11	26.5	1	5	...	
XVII.	Braemar .....	3.74	— .84	1.00	10	18	51.0	11	20.6	3	8	19	
"	Aberdeen (Cranford) ...	3.95	...	.75	10	17	55.0	7, 10	25.0	1	8	...	
XVIII.	Strathconan [Beaul] .....	5.41	— 1.15	.90	16	14	...	...	...	...	...	...	
"	Glencarron Lodge .....	7.05	...	.86	7	19	58.0	6	23.0	2, 4	10	...	
"	Cawdor [Nairn] .....	1.53	— 1.32	.40	22	15	...	...	...	...	...	...	
XIX.	Dunrobin .....	2.02	— .81	.40	6, 21	12	51.0	7	28.5	2	10	...	
"	S. Ronaldsay (Roeberry).....	2.18	— 1.24	.60	10	18	51.0	10	34.0	22	0	...	
XX.	Darrynane Abbey .....	6.52	...	1.14	15	25	...	...	...	...	...	...	
"	Waterford (Brook Lodge) ...	6.20	+ 2.53	1.20	15	22	59.0	23	28.0	4	3	...	
"	O'Briensbridge (Ross) .....	3.34	...	.54	15	20	...	...	...	...	...	...	
XXI.	Carlow (Browne's Hill) .....	4.77	+ 1.71	.77	15	18	...	...	...	...	...	...	
"	Dublin (Fitz William Square) ...	3.58	+ .75	.89	15	21	58.8	15	34.3	4	0	5	
XXII.	Ballinasloe .....	4.83	+ .92	.65	15	22	53.0	7, 21	31.0	18	1	...	
"	Clifden (Kylemore) .....	7.58	...	1.11	10	23	...	...	...	...	...	...	
XXIII.	Waringstown .....	3.29	+ .19	.52	15	20	58.0	7	29.0	3, 17	5	13	
"	Londonderry (Creggan Res.) ..	3.14	— 1.38	.55	10	22	...	...	...	...	...	...	
"	Omagh (Edenfel) .....	4.56	+ .69	.95	10	21	53.0	10	29.0	17	3	10	

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

a—and 15, 16. b—and 15.

# METEOROLOGICAL NOTES ON NOVEMBER, 1895.

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.

STRATHFIELD TURGISS.—The weather was very changeable at the commencement of the month, R falling daily, with strong S. or W. gales, especially about the 5th, and again on the 10th, 15th, and 23rd. A break in the stormy weather occurred on the 24th, followed by a dull foggy period. Trees bare of leaves by the 13th. T on 11th.

ADDINGTON.—Rainfall the greatest, and max. temp. in shade the highest, ever registered here in November. A very open month; frost in the shade on only three days. High wind on 10th, 24th, 25th, and 26th. Dense fog on 4th and 22nd.

BURY ST. EDMUNDS, WESTLEY.—A very mild, foggy month, with very little sunshine and more R than usual. Distant L at night on 11th; S on 22nd.

NORWICH, BRUNDALL.—An exceedingly mild month, the mean temp. ( $46^{\circ}\cdot7$ ) being about  $4^{\circ}$  above the average. The max. rose to  $60^{\circ}\cdot8$  on the 15th and  $62^{\circ}\cdot8$  on the 16th, the last-named reading being the highest ever recorded in November by the observer. Fog in the evening on 1st; S.W. gale on 6th, and southerly gales on 10th and 16th. High wind from N. or N.E. on 23rd, 24th, and 25th. L on 11th.

WEYMOUTH, LANGTON HERRING.—A very wet and mild month. Average temp. at 9 a.m. ( $47^{\circ}\cdot9$ )  $3^{\circ}\cdot6$  above the average of 23 years. The weather was very stormy on the 10th, 16th, and 24th. Dense fog on the 8th, and fogs on the 7th, 22nd, and 27th. T and L on the 12th. The average min. is no less than  $2^{\circ}\cdot2$  higher than the average min. of October.

TORQUAY, CARY GREEN.—R  $3\cdot98$  in. above the average. Mean temp. ( $50^{\circ}\cdot3$ )  $3^{\circ}\cdot1$  above the average. Duration of sunshine 47 hours, being 14 hours 40 minutes below the average; 8 sunless days.

POLAPIT TAMAR [LAUNCESTON].—An abnormally wet month. It was generally warm, the average max. shade temp. being  $54^{\circ}\cdot1$ , and also rather stormy. Fog on 4 days. T on 9th and 11th. Gales from S.S.W. on 10th, and S.S.E. on 15th and 16th.

STROUD, UPFIELD.—S.W. gales on 5th, 6th, 10th, 15th, and 16th; E. gale on 25th. T and L on 5th, 11th, and 12th.

WOOLSTASTON.—A wet and stormy month. Heavy gales on 5th, 10th, 15th, and 16th. Only six days without rain. Mean temp.  $43^{\circ}\cdot8$ .

TENBURY, ORLETON.—A wet, warm month. With the exception of 1888, the wettest November since 1852. Mean temp.  $3^{\circ}\cdot3$  above the average of 34 years. Heavy T on 14th. Gales on 10th, 14th, and 25th. Fog on 8 days.

LEICESTER, BARKBY.—Continuous wet, but no heavy falls of R. Not much frost, and none severe. Mean temp.  $44^{\circ}\cdot7$ .

MANCHESTER, PLYMOUTH GROVE.—Mean temp.  $44^{\circ}\cdot5$ .

ARNCLIFFE.—A very wet month, with temperature higher than usual.

SEATHWAITE.—T and L at 6.30 p.m. on 13th. T and L and H at 4.15 p.m. on 14th. Fog on 7th, 11th, 20th, 22nd, 28th, and 30th.

## WALES.

HAVERFORDWEST.—The unusual severity of the weather at the end of October changed in character on the advent of this month to mildness and constant R, and on several occasions it was very stormy, especially from the 9th to the 14th. An almost entire absence of frost was characteristic of the whole month, and R fell on 27 out of the 30 days. Prevailing winds S.S.E., S.W., and W.

ABERYSTWITH, GOGERDDAN.—Gales and strong winds from S.E. from 6th to 16th, and from N.E. from 24th to 26th.

## SCOTLAND.

**CARGEN [DUMFRIES].**—A very unsettled month. Gales were experienced on 10th and 15th, the one on the latter date being exceptionally severe and causing considerable damage throughout the district. The mean temp. of the month slightly exceeds that of October, and is  $1^{\circ}\cdot9$  above the average. It is somewhat remarkable that while the number of hours of sunshine during this month is 5 less than the average for November for 36 years, it exceeds the average of the preceding 10 years by 11, the average sunshine for the years 1885-94 being only 54 hours. T and L were noted on the 14th. The open weather has been very favourable to the turnip crop, which exceeds all anticipations, and pastures still afford a fair "bite." S.W. gale on 10th and severe gale on 15th.

**JEDBURGH.**—The weather has shown no peculiarities during the month; on the whole it has been mild, except on the 11th, and it has been calm and dull. All out-door work has gone on unchecked.

**COLMONELL.**—Rainfall  $\cdot42$  in. more than the average of 19 years. Mean temp. ( $43^{\circ}\cdot5$ )  $2^{\circ}\cdot8$  above the average.

**ABERDEEN, CRANFORD.**—Strong gales on the 10th, 16th and 21st.

**S. RONALDSAY, ROEBERRY.**—Upon the whole a fair month. Strong gales from S.W. on the 11th, and from the S. on the 15th and 20th. Mean temp.  $42^{\circ}\cdot3$ .

## IRELAND.

**DARRYNANE ABBEY.**—A very wet month, and warm, except a few days in the middle. One vivid flash of lightning on 16th with loud thunder.

**WATERFORD, BROOK LODGE.**—Heavy fog on 3rd and 4th. Gale from S.W. on 5th, and heavy gale on 10th. T and L on 14th.

**DUBLIN.**—November proved an open, dull, squally and rainy month. It was perceptibly warmer than October, and no frost was recorded in the screen. On the grass the thermometer fell to, or below,  $32^{\circ}$  on 5 nights only, compared with 12 nights in October. The range of pressure was great—nearly two inches. Only twice in the last 30 years has November been milder than in the present year—in 1881, when the mean was  $50^{\circ}\cdot3$ , and in 1894, when it was  $47^{\circ}\cdot8$ . The mean temp. ( $47^{\circ}\cdot0$ ) is  $2^{\circ}\cdot3$  above the average. High winds were noted on 15 days, and attained the force of a gale on seven occasions. The atmosphere was more or less foggy on 6 days. Lunar halos were seen on the 4th and 30th. H fell on the 16th.

**KYLEMORE HOUSE.**—Very stormy in the second week, with T and L on the 11th, and T, L and H on 13th.

**OMAGH, EDENFEL.**—A typical November, with rainfall considerably, and temperature somewhat, above the average, accompanied during the second week by strong S.W. gales.



# SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

CCCLX.]

JANUARY, 1896.

[PRICE FOURPENCE,  
or 5s. per ann. post free.

## HIGH BAROMETRIC PRESSURE, JANUARY 9TH, 1896.

WHEN, in January, 1882, the pressure in London exceeded 30·9 in., Mr. Sowerby Wallis undertook to prepare for the Royal Meteorological Society an account of the phenomenon. He wrote the paper which occupies pages 146 to 154 of Vol. viii. of the Society's *Quarterly Journal*. We purpose extracting some of the leading facts stated in that paper, and in the discussion upon it, for comparison with the phenomena of January, 1896; and we shall not quote any values of less than 30·9 inches at sea level:—

					in.
1778.....	Dec.	26th	...London, Royal Society .....	2 p.m.....	30·918
" .....	"	"	" Sir G. Shuckburgh ...		30·935
1808.....	Feb.	24th	...Gordon Castle, Banffshire .....	9 p.m.....	31·007
1820.....	Jan.	8th	... " " " " .....	11 p.m.....	31·046
" .....	"	"	... Kinfauns, Perthshire .....	11 p.m.....	31·014
" .....	"	9th	... " " " " .....	9 a.m.....	31·056
" .....	"	"	...Leith .....	9 a.m.....	31·065
" .....	"	"	...Hermitage Hill, Leith .....	9 a.m.....	31·050
1825 .....	"	9th	... Royal Obs, Greenwich .....	10 a.m.....	30·943
" .....	"	"	... Mr. Belville, " .....		30·958
" .....	"	"	... Royal Society, Somerset Ho. ....	9 a.m.....	30·922
" .....	"	"	... " " " " .....	3 p.m.....	30·913
" .....	"	10th	... " " " " .....	9 a.m.....	30·914
" .....	"	9th	... Kinfauns, Perthshire .....	10 a.m.....	30·925
" .....	"	"	... New Malton, Yorks .....	Max. ....	30·927
1835.....	"	2nd	... Mr. Belville, Greenwich .....		30·908
1882.....	"	18th	... St. Leonards, Sussex .....	10.30 a.m...	30·990
" .....	"	"	... Camden Square, London .....	10.30 a.m...	30·975
1896.....	"	9th	... " " " " .....	9 p.m.....	30·934

From the above it will be seen that as regards the vicinity of London the reading of 30·975 inches on January 18th, 1882, had never before been reached, nor has it on the present occasion, the maximum being 30·934 inches at 9 p.m. on the 9th.

But as regards the British Isles generally, we think that 1896 will be found to have considerably surpassed every instance on record.

The highest in the above table is 31·065 inches at Leith at 9 a.m. on January 9th, 1820; but the *Daily Weather Report* of January 9th, 1896, shows for 8 a.m. 31·06 inches at Stornoway and at Aberdeen, and 31·09 inches at Ardrossan, Ayrshire, and as these are probably not the absolute maximum at those stations, and as probably they are not any one of them in the actual spot where pressure was greatest, we shall not be surprised if next month we have to report an indisputable record of 31·10 inches.

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*To the Editor of the Meteorological Magazine.*

SIR,—The pressure at 9 a.m. on the 9th, corrected and reduced to sea level, was 31·071 inches. This is unprecedented for Edinburgh, where the only records (since 1770 ?) of 30·9 in. or upwards have been :

			in.
1820.....	January 9th .....	9 a.m.....	31·058
1825.....	” ” .....	.....	30·961
1834.....	December 15th.....	.....	30·950
1835.....	January 2nd.....	.....	30·941
1854.....	March 4th.....	.....	30·902
1896.....	January 9th .....	9 a.m.....	31·071

It has therefore been 0·013 in. above any previous record.

Yours very truly,

R. C. MOSSMAN.

10, Blacket Place, Edinburgh.

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*To the Editor of the Meteorological Magazine.*

SIR,—I suppose that the sea level pressure here to-day has had no recorded precedent in England; it was exactly 31·000 in. at 8.15 a.m., and rose to, and remained at, 31·021 in. from 1 p.m., till about 1.45 p.m., and even as late as 10 p.m. it was 30·996 in. The above are corrected readings of a verified Fortin Standard.

Yours very truly,

CHARLES L. BROOK.

*Harewood Lodge, Meltham, Huddersfield, January 9th.*

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*To the Editor of the Meteorological Magazine.*

SIR,—The sea level pressure here at 10.20 a.m. to-day, as shown by a verified Standard by Hicks, was 31·013 inches.

Yours truly,

REGINALD BUSHELL.

*Hinderton Lodge, Neston, Cheshire, January 9th.*

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We have been favoured with several other records, but it would be endless to quote all—and therefore we have inserted only indisputable records exceeding 31 inches.

As far as we have at present ascertained, we believe that the

pressure exceeded 31 inches at every station north of latitude 53° N. An event for which there is no recorded precedent.

We have just heard from Mr. Mossman that at Fort William, Inverness, the pressure at 10 a.m. on the 9th reached 31·098 inches, or within ·002 inches of the 31·10 inches which we suggested on p. 182.

### ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Wednesday evening, December 18th, at the Institute of Civil Engineers, Great George Street, Westminster, Mr. R. Inwards, F.R.A.S., President, in the chair.

Mr. R. H. Scott, F.R.S., read a paper on "Some of the Differences between Fogs, as related to the weather systems which accompany them." In this it was shown that there are at least two distinct classes of phenomena described under the generic name of "fog." In the case of anticyclonic fogs, no rainfall takes place, the temperature is low in the morning, and there is a considerable rise of temperature during the day, while in the case of cyclonic fogs rainfall does take place, and the temperature is high in the morning, frequently approaching or even equalling the maximum for the day. Mr. Scott also investigated the cases of several well-marked fogs in London, and found that there was no direct relation traceable between the temperature accompanying them and the death-rate.

Major H. E. Rawson described the results of his analysis of the Greenwich Barometrical Observations from 1879 to 1890, with special reference to the declination of the sun and moon.

A paper by Mr. S. C. Knott was read, giving the results of his meteorological observations taken at Mojanga, Madagascar.

Mr. R. H. Scott also exhibited some specimens of the illustrations for the "International Cloud Atlas," which is now being prepared for publication.

### REVIEWS.

*Congrès de l'Atmosphère organisé sous les auspices de la Soc. royale de Géographie d'Anvers*, 1894. Compte rendu par le Chevalier Le CLEMENT DE S. MARCQ, Capitaine du Génie, Secrétaire général. Backer, Anvers, 1895. Large 8vo., 272 pp.

WE regret having been unable earlier to report upon the meeting at Antwerp in August, 1894, which, we understand, was an extremely pleasant one. But thanks to the kindness of the Secretary, the above excellent report of the business of the meeting places the papers upon record for years to come. As to the hospitality of the city it will not soon be forgotten by those who experienced it. We gave\* the programme and some details in advance, and therefore need merely point out how far they were fulfilled.

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\* *Met. Mag.*, Vol. xxix. (1894), p. 89.

There was an official reception at which the President, Lieut.-Gen. Wauvermans, delivered an address upon the progress of aerostation. Subsequently the work of the two sections went on simultaneously. We cannot report it all, but among the more important subjects were:—

Variation in wind velocity, according to altitude and to geographical position; and on the origin of storms; by M. Plumandon, of the Observatory on the Puy de Dôme.

The wind in squalls; by M. E. Durand-Gréville. (A very interesting and suggestive paper.)

The direction of upper currents as indicated by astronomical observations; by M. Ventosa, of the Madrid Observatory.

On synoptic weather charts; on the nature of wind; and on the force of the wind in Belgium; by M. Lancaster.

Experiments with, and theory of, Helices for balloons; by le Chev. Le Clément de S. Marcq.

Contribution to the bibliography of aerial navigation; by M. A. Wouvermans.

This last article occupies 35 pages and, although (as its author very modestly describes it) only a "Contribution," it is one of great value, which must not be overlooked by anyone who professes to give a complete bibliography.

On the whole, the volume is very interesting and generally useful.

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*U. S. Department of Agriculture. Weather Bureau. Reports of the Chief of the Weather Bureau, for 1891-92, and for 1893. Government Printing Office, Washington, 1893. 4to., 528 pp., 4 plates, and 1894, 319 pp., 2 plates.*

THESE being initial volumes of the U. S. reports under the civil administration, call for brief notice. They are signed by Prof. Harrington the first chief under the new régime. The first noticeable feature is the adoption of quarto size, instead of octavo. This is an indisputable improvement, as it enables the matter to be grouped very much in the manner recommended many years since by the International Meteorological Congress.

The list of observing stations is very good, and quite a model of condensed information. A single line of type gives the name of the station, what continuously-recording instruments it possesses, its latitude and longitude, the difference between local time and 75th meridian time, the altitude of the barometer above sea level, the height of the thermometer, rain-gauge, and anemometer above the ground, and the date at which the record commenced. We may mention one feature, which is very satisfactory, and one quite the reverse. We see with pleasure and surprise the large number of recording instruments in use—there are, for instance, 61 stations with Richard's recording barometers. On the other hand, we find that roof stations are almost universal, in fact out of about 171

stations, only 39 have either their thermometer or rain gauge within 6 ft. of the ground. The average height must be quite 50 ft., and 25 of them are over 100 ft. Among the highest are Boston 174 ft., Chicago 238 ft., Cincinnati 145 ft., Detroit 144 ft., New York 155 ft., Philadelphia 166 ft., Portland, Oregon, 196 ft., and San Francisco 154 ft.

We thought of comparing the records for New York at 155 ft. with those at the Central Park, which we imagined would be made at or near ground level, but on turning up Dr. Draper's volumes we find that his instruments are also on a roof 53 ft. above sea level.

There seem to be signs of a desire on the part of the authorities to decrease the number of these roof stations, and surely now that the office is under the Department of Agriculture, there ought to be no difficulty in getting observations made under normal conditions. At present we are at a loss to know how American engineers utilize the rainfall records of the Weather Bureau. We learn from the introduction that at most of the volunteer stations the heights are less, but in the long lists of the results from these stations, on pages 367 to 433, no information is given as to the heights of the gauges above ground, or above sea level.

There is an interesting note by Prof. Marvin as to the patterns of instruments mostly employed. Among them is one, Eccard's recording rain-gauge, which appears to be (except that it is arranged to suit a roof exposure) identical with that made by Mr. Apps in about 1864, and described in *Brit. Rain.*, 1878.

The volume for 1893 is, of course, generally similar to the previous one—but there are two special features. In the introduction, there is an engraving and description of the instrument used in the U.S. to record sunshine. It is neither on the Burning nor the Photographic principle which are the two chiefly, if not solely, employed in Europe, but is really a modification of Prof. Leslie's differential thermometer—and is therefore coming very near to the black and bright bulb recording thermometer shown by Marie Davy in the Montsouris Exhibit at the Paris Exposition of 1878, and in a modified form now quoted in the catalogue of MM. Richard Frères. The U.S. pattern works electrically which, in our opinion, is a disadvantage, but of one thing we are certain, namely, that at Washington, or some other station, there should be regularly worked, side by side, all the various modes of recording this element; as, until that is done, no one knows what relation the various records bear one to another.

Another departure from European practice, (the merit of which we doubt) and which is certainly fatal to rigorous comparison, is set out in the following sentences:—

#### COMPILATION OF SUNSHINE DATA.

“The Automatic records of sunshine obtained from both the thermometric and the photographic records are tabulated in monthly forms, giving hourly amounts of sunshine, from which daily and monthly sums and percentages are calculated. The following extracts

from existing instructions illustrate the manner of compensating for instrumental imperfections :—

**TWILIGHT CORRECTIONS**—When the sun is just above the horizon, either morning or evening, the intensity of its action is greatly diminished, even with clear skies, so that a portion of early morning and late afternoon sunshine will not generally be recorded; an allowance therefore must be made in order to ascertain more accurately the actual amount of sunshine. For convenience, this allowance will be called the “Twilight Correction.” In the forenoon, it will be the difference between the time of sunrise for the latitude of the station (as shown by table of sunrise and sunset) and the local time at which the sunshine record commenced, provided, the sun was not obscured by clouds or thick haze during the period. The afternoon twilight correction, similarly, will be the difference between the actual time of sunset and the time the record of sunshine stops. These corrections will be apportioned between the appropriate hours of early morning and late afternoon.

If the character of sunset is cloudy, the twilight correction will be regarded as zero, but when the observer knows that cloudiness has prevailed but a part of the time, he will employ such a value of twilight correction as will represent, in his judgment, the actual sunshine not recorded.”

Part VI. of the volume contains several papers of interest, especially the hourly observations on Pike's Peak, 14,134 feet above sea level. There are also interesting tables of the mortality (on land) by wind, averaging 258 deaths per annum, and by lightning, averaging 196 per annum.

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## A NEW OBSERVATORY FOR WEST AUSTRALIA.

WE hear from Sir Charles Todd, K.C.M.G., Government Astronomer for South Australia, that the Government of West Australia having decided to establish an observatory at Perth, asked Sir Charles if he would prepare detailed plans and specifications for the proposed observatory and for its equipment. This he has done, and it includes a 6-inch transit circle and an 8-inch equatorial.

An observatory without a director would be useless, and Sir Charles' chief assistant, Mr. Ernest Cooke, M.A., has been appointed.

It is hardly likely that such an establishment, which is to cost about £5,000 for equipment, will do nothing for meteorology—and if it is to be wholly astronomical we do not see why Sir Charles reported it to us—so we hope that, though not a single word is said as to meteorology or meteorological instruments, some good may come of the new Perth Observatory, to which we wish all success.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JULY, 1895.

STATIONS.	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
<i>(Those in italics are South of the Equator.)</i>													
	°		°		°	°	°	0-100	°	°	inches		
England, London .....	82·0	8	47·7	7	72·7	54·6	49·1	63	125·2	43·1	3·42	12	6·0
Malta.....	103·6	5	64·6	11	87·7	69·7	68·0	61	159·0	59·4	·60	0	1·2
<i>Mauritius</i> .....	77·3	12	59·0	17a	75·2	64·1	61·3	77	125·2	49·2	1·12	9	4·4
Calcutta.....	92·0	2	75·7	4	88·7	79·0	77·6	83	160·5	74·6	4·53	12	7·9
Bombay.....	89·0	4	74·6	11	84·7	77·7	76·2	85	135·0	72·2	18·04	28	8·7
Ceylon, Colombo .....	88·2	29	73·8	21	86·1	77·1	71·4	78	150·5	70·0	·52	5	5·8
<i>Melbourne</i> .....	63·2	18	33·3	5	54·7	40·3	39·9	75	112·2	24·2	1·78	14	6·5
<i>Adelaide</i> .....	65·9	17	37·1	25	57·9	43·5	43·5	77	120·7	30·1	4·48	20	6·5
<i>Sydney</i> .....	66·8	15	36·8	9	57·6	41·9	37·7	76	112·0	24·6	·35	8	1·9
<i>Wellington</i> .....	57·3	16	32·0	13b	51·2	38·3	36·5	73	105·0	20·0	4·35	17	4·7
<i>Auckland</i> .....	58·0	19	37·0	21	54·4	42·6	39·1	71	114·0	32·0	6·65	25	5·8
Jamaica, Kingston.....	92·8	25	71·4	12	89·8	73·3	69·8	71	...	...	·51	5	2·8
Trinidad .....	92·0	6	68·0	c	88·7	69·7	70·5	75	169·0	65·0	2·57	16	...
Grenada.....	84·8	31	71·0	21	83·1	74·3	69·9	73	146·2	...	7·89	23	4·6
Toronto .....	90·0	7	49·1	11	76·3	56·3	54·2	67	105·2	43·2	2·49	13	6·2
New Brunswick, } Fredericton .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Manitoba, Winnipeg ...	86·3	2	41·3	8	75·8	51·7	...	...	...	...	3·30	14	6·0
British Columbia, } Esquimalt.....	79·2	10	42·7	2	69·3	50·0	55·4	88	...	...	·12	6	4·2

a—and 19; b—and 26; c—various.

REMARKS.

MALTA.—Adopted mean temp. 78°·6, 1°·3 above the average. Mean hourly velocity of wind 6·8 miles. Temp. of sea rose to 82°·5. Lightning on the 6th.

J. F. DOBSON.

Mauritius.—Mean temp. of air 0°·6 above, of dew point 1°·8 above, and rainfall 1·20 in. below, their respective averages. Mean hourly velocity of wind 10·0 miles, or 1·8 miles below average; extremes, 25·9 on 23rd, and 1·7 on 2nd, 6th and 7th; prevailing direction, E.S.E.

C. MELDRUM, F.R.S.

Adelaide.—Mean temp. 0°·9 below the average of 38 years. Rainfall very heavy, 1·84 in. above the average. The rains were very general but rather light in the north, heavy over the southern portion of the colony.

C. TODD, F.R.S.

Sydney.—Mean temp. 2°·7 below, and rainfall 4·05 in. below, their respective averages.

H. C. RUSSELL, F.R.S.

Wellington.—Total rainfall under the average, although it was very showery during the latter part of the month. Variable winds, and on the whole moderate, and frequent calms; generally cold weather. Hail on 4 days. Fog on 3 days. Earthquake on 17th.

R. B. GORE.

Auckland.—An unusually cold, wet and stormy month. Rainfall two inches above the average of 28 years. Mean temp. 3°·8 below the average; barometrical pressure unusually low during most of the month.

T. F. CHEESEMAN.

JAMAICA, KINGSTON.—Mean hourly velocity of wind 4·8 miles. Fair in Kingston, with a fourth of the average fall of rain.

R. JOHNSTONE.

TRINIDAD.—Rainfall 6·88 in. below the average of 30 years.

J. H. HART.

## CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, AUGUST, 1895.

STATIONS.  (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
	°		°		°	°	°	0-100	°		inches		
England, London .....	81·3	21	46·0	25	72·2	54·2	53·4	75	123·8	41·0	3·09	18	5·8
Malta .....	91·9	1	61·4	26	87·1	68·8	67·6	70	144·6	...	·37	1	1·7
<i>Mauritius</i> .....	77·3	5	59·9	5	74·6	64·6	60·7	76	125·0	46·9	4·66	21	5·7
Calcutta .....	91·0	11	74·0	19	87·1	77·9	77·4	87	158·5	72·9	11·84	20	8·4
Bombay .....	86·4	18	74·0	30	83·9	76·7	75·4	85	133·8	71·8	15·97	28	8·6
Ceylon, Colombo .....	89·2	10	75·4	9	87·4	78·2	72·2	76	150·5	72·0	·92	11	5·7
<i>Melbourne</i> .....	72·9	24	34·9	8	60·5	45·8	44·6	73	120·5	26·5	1·81	17	6·5
<i>Adelaide</i> .....	73·2	17	38·8	15	63·7	47·1	45·9	70	133·1	31·3	2·42	20	6·6
<i>Sydney</i> .....	76·0	24	40·6	30	64·3	49·4	43·7	71	122·0	27·7	·42	11	4·1
<i>Wellington</i> .....	62·1	26	34·0	8	53·1	42·7	39·4	74	115·0	23·0	3·26	16	4·8
<i>Auckland</i> .....	66·2	29	37·0	3	56·4	44·1	40·7	70	118·0	32·0	1·63	15	5·0
Jamaica, Kingston .....	94·6	17	70·4	20	89·9	73·3	70·7	76	...	...	2·39	9	3·2
Trinidad .....	93·0	3	68·0	3a	89·3	70·6	72·8	76	178·0	67·0	4·86	20	...
Grenada .....	86·8	19	72·6	6	84·1	75·6	70·0	74	153·6	...	6·08	26	4·7
Toronto .....	84·0	12	43·2	22	75·6	56·2	56·2	75	99·5	37·3	3·02	13	4·6
New Brunswick, Fredericton .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Manitoba, Winnipeg...	88·3	15	32·8	20	74·8	48·1	...	...	...	...	1·01	13	5·3
British Colombia, Esquimalt .....	77·7	28	43·2	13	67·4	49·2	54·2	90	...	...	·45	3	5·7

a—and 10, 17

## REMARKS.

MALTA.—Adopted mean temp. 77°·6, 0°·6 below the average; mean hourly velocity of wind 6·3 miles. Average temp of sea, 80°·0. Lightning was seen on 4 days.

J. F. DOBSON.

*Mauritius*.—Mean temp. of air 0°·2 above, of dew point 1°·4 above, and rainfall 2°·38 in. above, their respective averages. Mean hourly velocity of wind 13·1 miles, or 0·8 mile below average; extremes, 35·5 on 24th and 2·0 on 2nd, 3rd and 22nd; prevailing direction E.S.E. Thunder and lightning on 13th. The wettest August in 21 years.

C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Lightning was seen on 5 days.

D. G. MANTELL.

*Adelaide*.—Mean temp. 1°·4 above, and rainfall ·05 in. above, the average.

C. TODD, F.R.S.

*Sydney*.—Mean temp. 1°·9 above, humidity 2 below, and rainfall 2°·43 in. below, their respective averages.

H. C. RUSSELL, F.R.S.

*Wellington*.—On the whole showery, with intervals of fine weather. Prevailing wind N.W., strong on nine days. Thunder and lightning on 24th; hail on 5 days. Rainfall 1°·94 in. below, and mean temp. 0°·1 below, the average. Earthquakes on 17th and 21st.

R. B. GORE.

*Auckland*.—An unusually dry and cool month, the rainfall being little more than one-third of, and the mean temp. 2°·2 below, the average. Barometrical pressure unusually high.

T. F. CHEESEMAN.

JAMAICA, KINGSTON.—Mean hourly velocity of wind 4·3 miles. Rainfall half the average. Sharp thunderstorm on 23rd for about 5 hours.

R. JOHNSTONE.

TRINIDAD.—Rainfall 5°·45 in. below the average of 30 years.

J. H. HART.



# SUPPLEMENTARY TABLE OF RAINFALL, DECEMBER, 1895.

[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 .	3·21	XI.	Lake Vyrnwy .....	5·59
„	Birchington, Thor .....	2·22	„	Corwen, Rhug .....	3·19
„	Hailsham .....	3·28	„	Carnarvon, Cocksidia ...	2·98
„	Ryde, Thornbrough .....	3·87	„	I. of Man, Douglas .....	3·73
„	Emsworth, Redlands ...	3·17	XII.	Stoneykirk, Ardwell Ho.	3·06
„	Alton, Ashdell .....	3·07	„	New Galloway, Glenlee	6·98
III.	Oxford, Magdalen Col.	1·92	„	Melrose, Abbey Gate ...	...
„	Banbury, Bloxham .....	2·18	XIII.	N. Esk Res. [Penicuik]	4·80
„	Northampton, Sedgebrook	1·71	„	Edinburgh, Blacket Pl.	2·27
„	Alconbury .....	1·78	XIV.	Glasgow, Queen's Park..	4·49
„	Wisbech, Bank House...	1·76	XV.	Inverary, Newtown .....	8·62
IV.	Southend .....	2·70	„	Islay, Gruinart Schools..	6·06
„	Harlow, Sheering.....	1·90	XVI.	Dollar .....	5·09
„	Colchester, Lexden .....	2·40	„	Balquhidder, Stronvar...	9·10
„	Rendlesham Hall .....	1·35	„	Ballinluig .....	5·13
„	Diss .....	2·46	„	Dalnaspidal H.R.S.....	8·11
„	Swaffham .....	1·91	XVII.	Keith H.R.S.....	5·05
V.	Salisbury, Alderbury ...	2·05	„	Forres H.R.S. ...	2·50
„	Bishop's Cannings .....	2·80	XVIII.	Fearn, Lower Pitkerrie..	2·30
„	Blandford, Whatcombe ..	3·47	„	Loch Shiel, Glenaladale	8·91
„	Ashburton, Holne Vic...	6·17	„	N. Uist, Loch Maddy ...	4·41
„	Okehampton, Oaklands.	7·26	„	Invergarry .....	7·68
„	Hartland Abbey .....	5·45	„	Aviemore H.R.S. ....	3·36
„	Lymouth, Glenthorne.	5·62	„	Loch Ness, Drumnadrochit	3·91
„	Probus, Lamellyn .....	7·35	XIX.	Invershin .....	1·88
„	Wellington, Sunnyside..	...	„	Scourie .....	3·17
„	Wincanton, Stowell Rec.	2·69	„	Watten H.R.S.....	3·94
VI.	Clifton, Pembroke Road	2·94	XX.	Dunmanway, Coolkelure	12·85
„	Ross, The Graig .....	2·13	„	Fermoy Gas Works .....	...
„	Wem, Clive Vicarage ...	1·67	„	Killarney, Woodlawn ...	9·42
„	Cheadle, The Heath Ho.	2·75	„	Caher, Duneske .....	5·49
„	Worcester, Diglis Lock	1·53	„	Ballingarry, Hazelfort...	3·65
„	Coventry, Coundon ....	2·13	„	Limerick, Kilcornan ...	...
VII.	Ketton Hall [Stamford]	1·58	„	Ennis .....	4·30
„	Grantham, Stainby .....	1·70	„	Miltown Malbay .....	...
„	Horncastle, Bucknall ...	1·92	XXI.	Gorey, Courtown House	4·84
„	Worksop, Hodsck Priory	2·12	„	Athlone, Twyford .....	3·76
VIII.	Neston, Hinderton .....	2·26	„	Mullingar, B-lvedere ...	4·60
„	Preston, Haighton .....	3·87	„	Longford, Currygrane...	4·11
„	Broughton-in-Furness ...	7·07	XXII.	Woodlawn .....	5·06
IX.	Ripon, Mickley .....	2·87	„	Crossmolina, Enniscoe ..	6·13
„	Melmerby, Baldersby ...	2·18	„	Collooney, Markree Obs.	4·66
„	Scarborough, South Cliff	...	„	Ballinamore, Lawderdale	...
„	Middleton, Mickleton ...	3·47	XXIII.	Lough Sheelin, Arley...	3·98
X.	Haltwhistle, Unthank...	3·44	„	Warrenpoint.....	3·93
„	Bamburgh .....	1·93	„	Seaforde .....	3·73
„	Keswick, The Beeches...	...	„	Belfast, Springfield .....	4·99
XI.	Llanfrehfa Grange .....	4·48	„	Bushmills, Dundarave..	5·13
„	Llandovery .....	4·13	„	Stewartstown .....	4·38
„	Castle Malgwyn .....	2·97	„	Buncrana .....	4·01
„	Builth, Abergwessin Vic.	6·84	„	LougeSwilly, Carrablagh.	5·24
„	Rhayader, Nantgwillt ...	5·68			

## DECEMBER, 1895.

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 1880-9.	Greatest Fall in 24 hours		Days on which $\geq 0.1$ or more fell.	Max.		Min.				
				Dpth	Date		Deg.	Date	Deg.	Date			
											inches.	inches.	in.
I.	London (Camden Square) ...	2.19	+ .12	.34	14	16	56.4	5	26.1	22	8	19	
II.	Maidstone (Hunton Court)...	1.72	— .52	.98	16	6	...	...	...	...	...	...	
III.	Strathfield Turgiss .....	2.28	+ .27	.38	14	21	56.0	5	20.4	11	14	22	
IV.	Hitchin .....	1.79	— .24	.38	14	17	54.0	5, 30	21.0	21	15	...	
V.	Winslow (Addington) .....	1.85	— .60	.40	14	17	53.0	5, 30	22.0	22	15	23	
VI.	Bury St. Edmunds (Westley) ..	1.97	— .27	.51	14	13	56.0	6	26.0	22	...	...	
VII.	Norwich (Brundall) .....	1.80	...	.28	12a	20	56.4	5	26.4	22	10	25	
VIII.	Weymouth (Langton Herring) ..	4.63	+ 1.53	1.09	17	20	55.0	5	30.0	20f	5	...	
IX.	Torquay (Cary Green) ...	5.65	...	.90	23	25	54.4	5	30.5	21	2	8	
X.	Polapit Tamar [Launceston]..	4.80	+ .57	.96	5	28	54.7	30b	21.7	21	3	8	
XI.	Stroud (Upfield) .....	2.05	— .40	.40	14	20	52.0	5, 30	23.0	7g	15	...	
XII.	Church Stretton (Woolstaston) ..	2.56	— .49	.52	12	21	53.0	5	25.0	21	17	23	
XIII.	Tenbury (Orleton) .....	2.08	— .29	.51	12	15	56.8	5	24.0	11	10	19	
XIV.	Leicester (Barkby) .....	2.26	+ .12	.46	12	18	55.0	5, 30	16.0	21	22	26	
XV.	Boston .....	1.58	— .27	.40	12	10	50.0	30	24.0	22	20	...	
XVI.	Hesley Hall [Tickhill] .....	2.09	+ .11	.40	12	13	55.0	4	23.0	22	19	...	
XVII.	Manchester (Plymouth Grove) ..	3.69	+ .25	.70	12	17	54.0	7, 12	25.0	21	11	12	
XVIII.	Wetherby (Ribston Hall) ...	1.50	— .94	.42	5	10	...	...	...	...	...	...	
XIX.	Skipton (Arncliffe) .....	6.93	+ .12	2.15	4	21	...	...	...	...	...	...	
XX.	Hull (Pearson Park) .....	2.37	+ .10	.40	28	13	55.0	5	27.0	8, 22	18	19	
XXI.	Newcastle (Town Moor) .....	1.42	— .88	.30	28	14	...	...	...	...	...	...	
XXII.	Borrowdale (Seathwaite) .....	14.15	— .66	4.02	4	20	...	...	...	...	...	...	
XXIII.	Cardiff (Ely) .....	4.57	+ .02	.67	15	25	...	...	...	...	...	...	
XXIV.	Haverfordwest .....	3.96	— 1.03	.44	23	28	54.4	5	23.0	21	7	14	
XXV.	Aberystwith (Gogerddan) ...	5.58	+ .70	.78	14	21	50.0	4c	16.0	20	15	...	
XXVI.	Llandudno .....	2.33	— .63	.32	12	21	54.0	5	23.5	21	...	...	
XXVII.	Cargen [Dumfries] .....	5.10	+ 1.08	.92	4	14	51.6	5	23.4	21	12	...	
XXVIII.	Jedburgh (Sunnyside) .....	1.58	— .62	.34	30	13	47.0	9	26.0	23	12	...	
XXIX.	Colmonell .....	5.11	...	.78	12	21	57.0	1	21.0	20	13	...	
XXX.	Lochgilphead (Kilmory) .....	7.58	+ .21	.84	4	22	...	...	24.0	21	10	...	
XXXI.	Mull (Quinish) .....	5.81	— 1.76	.79	28	18	...	...	...	...	...	...	
XXXII.	Loch Leven Sluices .....	4.10	+ .79	1.10	5	16	...	...	...	...	...	...	
XXXIII.	Dundee (Eastern Necropolis) ..	3.10	+ 1.02	.50	28	22	53.2	5	24.1	21	13	...	
XXXIV.	Braemar .....	4.44	+ 1.97	1.31	16	22	47.3	5	12.4	21	23	29	
XXXV.	Aberdeen (Cranford) .....	4.65	...	1.16	12	24	50.0	4, 5	25.0	20f	13	...	
XXXVI.	Strathconan [Beaully] .....	7.32	+ 1.55	1.80	4	13	...	...	...	...	...	...	
XXXVII.	Glencarron Lodge .....	7.76	...	1.79	4	19	49.5	14	24.0	20	14	...	
XXXVIII.	Cawdor [Nairn] .....	3.22	+ .76	.71	4	17	...	...	...	...	...	...	
XXXIX.	Dunrobin .....	3.01	+ .36	.50	12	16	49.0	4	26.0	22	13	...	
XL.	S. Ronaldsay (Roeberry) .....	5.91	+ 2.25	2.15	12	29	48.0	3	29.0	6	7	...	
XLI.	Darrynane Abbey .....	6.05	...	1.06	23	26	...	...	...	...	...	...	
XLII.	Waterford (Brook Lodge) ...	6.20	+ 2.56	1.27	22	24	57.0	4, 5	27.0	8f	7	...	
XLIII.	O'Briensbridge (Ross) .....	3.67	...	.43	15	24	...	...	...	...	...	...	
XLIV.	Carlow (Browne's Hill) .....	4.75	+ 1.63	.98	22	25	...	...	...	...	...	...	
XLV.	Dublin (Fitz William Square) ..	3.94	+ 1.78	.86	24	27	56.0	30	25.3	21	4	10	
XLVI.	Ballinasloe .....	3.81	+ .39	.58	11	28	51.0	29d	22.0	21	16	...	
XLVII.	Clifden (Kylemore) .....	9.75	...	1.29	23	26	...	...	...	...	...	...	
XLVIII.	Waringstown .....	3.31	+ .27	.58	29	24	52.0	29	20.0	21	19	24	
XLIX.	Londonderry (Creggan Res.) ..	5.06	+ .85	.73	12	25	...	...	...	...	...	...	
L.	Omagh (Edenfel) .....	5.16	+ 1.48	.73	29	21	50.0	14e	19.0	20	13	21	

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

a—and 14. b—and 31. c—and 5, 29. d—and 30. e—and 29, 30. f—and 21. g—and 20, 21.

# METEOROLOGICAL NOTES ON DECEMBER, 1895.

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 TURGIS.—The month commenced with unsettled and stormy weather, with rapid and considerable changes, and during the greater part of the month, and especially towards the close, it was very dull and gloomy, with many wet days, but little R. Gales on 3rd, 4th, 12th and 13th.

ADDINGTON.—December was not marked by any particular feature. A moderate quantity of R; occasional frosts of no great severity; a little S; very little fog, but generally dull weather.

BURY ST. EDMUNDS, WESTLEY.—A rough, windy, and mild month. L at night on 6th; S on 27th.

NORWICH, BRUNDALL.—A stormy, unsettled month, with gales at times. The rainfall half an inch under, and mean temp. slightly above, the average. Very dark, damp weather at the close. Terrific gale on 5th, gales on 12th, 13th, 24th, 25th, and 26th. L in N.E. on 6th; slight S on 7th.

WEYMOUTH, LANGTON HERRING.—On the whole a mild, unsettled, wet month, the mean temp. 2° above the average of 23 years. Very high winds from the 5th to the 7th, and also from the 23rd to the 25th, inclusive. Dense fogs on the 29th and 30th. Mean 9 a.m. temp. 41°·6.

TORQUAY, CARY GREEN.—R 2·50 in. above the average. Mean temp. 44°·2, or 1°·3 above the average. Duration of sunshine 26 hours 25 minutes, being 27 hours 5 minutes below the average; 15 sunless days.

POLAPIT TAMAR [LAUNCESTON].—A very wet month. N.N.W. gale on 6th; S.E. gale at night on 23rd. Warm, calm, and summerlike on 31st.

STROUD, UPFIELD.—N.W. gale in the evening on 6th; storm of H and R at 4 p.m. on the 11th; a few flakes of S on 19th.

WOOLSTASTON.—A cold and stormy month. A sharp spell of frost set in on the 6th, and continued till the 29th, S falling on five days. Mean temp. 37°·4. Gales on the 4th, 5th, and 12th.

TENBURY, ORLETON.—A fairly warm dry month, with a mean temp. about the average, and very little frost, the ther. in the screen falling below 30° on only four nights. S on the 6th, 18th, 24th, and 26th; T on the 12th. The last half of the month was singularly cheerless, neither sun, moon, nor stars being visible for days together.

LEICESTER, BARKBY.—A very mild and windy month. Mean temp. 37°·3.

MANCHESTER, PLYMOUTH GROVE.—Great storm of wind and R on the 6th; dense fog on the 20th and 21st. Fine winterly weather on 22nd, 23rd, 27th and 28th. Thick fog on the 31st, but mild as May. Mean temp. 44°·1.

SEATHWAITE.—Heavy R on 4th, 4·02 in.; S two inches deep at 9 a.m. on 7th, and one and a half inches deep on 25th. Fog on 2nd, 9th, 14th and 29th. H on 6th.

## WALES.

HAVERFORDWEST.—Except on the 7th and 20th, R or S fell on every day throughout the month, but no heavy fall at any time. The general character of the whole month was mildness and storm, with unusual dampness of the air. It was cold for a day or two about the 7th, followed by mild, damp, foggy weather, which continued up to the 17th. A cold period again occurred between that date and the 27th, sharp frost occurring on five nights, winding up with a S storm, which covered the high and low lands, accompanied by a violent gale from the east. It lasted fully four days. Prevailing winds S.S.W., S.E., E., and N.N.W.

ABERYSTWITH, GOGERDDAN.—Very stormy throughout the month. Very strong gales on 24th, 25th, and 26th from S.E. The last three days very mild.

## SCOTLAND.

CARGEN [DUMFRIES].—The feature of the month was the remarkable absence of sunshine, the number of hours being only 25 against an average of 54. In the ten years 1860-69, the average number of hours of sunshine in December was 66; in 1870-79, was 59; in 1880-89, 43; while in the six years 1890-95 it was only 40 hours. Light winds, mostly easterly, prevailed, and the mean temp. is  $1^{\circ}4$  below the average. T on 5th and 6th, S showers on 6th and 28th.

JEDBURGH.—The weather was foggy with little or no wind till the 28th. Frosts occurred, but not for more than a day at a time.

COLMONELL.—Rainfall  $\cdot 16$  in. above average of 19 years. S on 28th.

S. RONALDSAY, ROEBERRY.—A very wet, cold and windy month. The wettest December since 1872. Mean temp.  $38^{\circ}5$ .

## IRELAND.

DARRYNANE ABBEY.—A wet but very mild month. The last few days foggy, but mild as April. Frost on 19th and 20th.

WATERFORD, BROOK LODGE.—H showers on 6th. Dense fog on 19th and 20th. Heavy gale from S.E. on 22nd. S on 26th.

O'BRIEN'S BRIDGE, ROSS.—Rainfall moderate for the season, in no case amounting to  $\cdot 50$  in. in 24 hours, but very constant, with storms from S.E. to S.W. up to 27th. Very calm with high temp. at the close.

DUBLIN.—A gloomy, wet, stormy and generally inclement month. Fog also was often observed. Christmas week is memorable for a long continued south-easterly gale. Mean temp.  $41^{\circ}6$ ,  $0^{\circ}3$  above the average. Lunar halos were seen on 30th and 31st; solar halo on the 31st. High winds were noted on 15 days, and attained the force of a gale on seven. Foggy on 10 days. S or sleet on 8 days, H on 3 days, T was heard on the 12th, L seen on the 15th. Faint Aurora on the 7th.

BALLINASLOE.—S on 6th, 7th, 12th and 26th. Gales on 15th, 22nd, 23rd, 24th and 25th. Fog on 17th, 19th and 20th.

OMAGH, EDENFEL.—The first half of the month was persistently wet and unsettled, reaching to a strong gale on the night of the 4th. From the 18th to nearly the end a spell of strong easterly weather, more characteristic of February, prevailed, culminating in a steady gale on the 23rd, 24th and 25th of almost unvarying force, with a comparatively high and absolutely steady barometer and occasional downpours of rain. Although cold snaps were frequent they only lasted a few hours, and there was but little snow.