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HAIL INSURANCE.

IN the *Meteorological Magazine* for November, 1876, the following short letter appeared :—

HAIL STORMS—AN EXPLANATION NEEDED.

To the Editor of the Meteorological Magazine.

SIR,—I enclose a proposal for an insurance against hail, and you will see in the last paragraph that “ All crops growing within twelve miles of Somersham railway station, Huntingdonshire, are charged double the usual rate,” and this is the custom of all insurance companies. I shall be very glad if any of your correspondents can explain why there should be twice as many hail storms in that district as in any other district in England.

I think it is an interesting subject for meteorologists.

I am, yours faithfully,

A. S. LESLIE MELVILLE.

The Long Hills, Lincoln, Oct. 1876.

Fourteen summers have passed, we have heard of no exceptional storms in the district singled out for double charges, and the explanation needed in 1876 is equally needed in 1890.

We are not the only ones puzzled by this rule. Mr. Todd, the assistant at Cambridge Observatory, has been making enquiries, and for many years has been watching the local newspapers to see if any heavy hail storms were reported, but has not succeeded in detecting any special destructiveness in the storms in that neighbourhood, or in obtaining any evidence to warrant the extra charge.

On the contrary, in his last letter he tells us that in 1882 he received letters from Mr. Westwood Oliver, asking for any trustworthy accounts of heavy hail storms in the Somersham district, in which Mr. Oliver stated that the insurance companies had, first doubled their rates, and then finding that that arrangement failed to yield a profit, resolved to decline insurances altogether.

Somersham is on the edge of the Fen district ; we have, therefore, searched Miller and Skertchley's *The Fenland*, because, both on account of the elaborate nature of the work, and of Mr. Miller's reputation as a meteorologist, any special phenomenon was pretty sure to be mentioned, but we have read the whole chapter on meteorology, extending from p. 226 to p. 293, of that work, and can-

not find even the word hail! Moreover (as our older readers will remember) Mr. Miller published during 1874-5-6 & 1877 a monthly periodical, *The Fenland Meteorological Circular and Weather Record*, and although, of course, it contains some accounts of hail storms, we have not found one within the area of which the companies seem so much afraid.

Agreeing perfectly with Mr. Leslie Melville, that this is a question for meteorologists, we invite any information bearing upon it.

Our impression is, that, in the early days of Hail Insurance, two, or perhaps three, heavy losses were incurred in that district, and thereupon some clever manager jumped to the conclusion that it was a dangerous district. The rates were put up accordingly, and they have remained excessive because there is no competition between the companies, and because the farmers have not combined to insist upon a reduction.*

The area thus surcharged is 452 square miles, or nearly 300,000 acres; it extends from near Cambridge to near Peterboro', and includes March, Ely, Chatteris and Huntingdon. Why do not the farmers form a company of their own, instead of paying double charges to strangers?

If there is any justification for the charge, we shall be very glad to afford space for its insertion.

SHARPEST FROST IN OCTOBER FOR HALF-A-CENTURY.

WHOLE winters pass sometimes without a frost as sharp as that of October 28th, 1890; we therefore give a few particulars of it.

The following table gives in column 1 the date of every year since 1840 in which the temperature at Greenwich has in October fallen below 30°; column 2 gives the lowest air temperature in those Octobers; and column 3 the date on which it was recorded. The last two columns refer to Camden Square, London, and give the minima for the same months and years as were characterized by exceptional frosts at Greenwich.

* We have often had to refer to the good work done for Meteorology by the Rev. Leonard Jenyns (now Rev. Leonard Blomefield), and although we are not aware at what date this surcharge was first made, we have an impression that Mr. Jenyns's *Observations in Meteorology* (1858), which we have just been reading while it accords remarkably with the above hypothesis, possibly gives the actual date of the origin. The following is an epitome of the facts he records. On August 2th, 1843, tremendous thunderstorms occurred in various parts of England, and in the vicinity of Cambridge (which is only just outside the surcharged area—about two miles outside to the S.S.E.), it was accompanied by tremendous hail, many rooks and pigeons, as well as smaller birds, were killed by it, the damage in the University and town was considered to exceed £25,000. One farmer at Quy (about two miles outside the radius to the S.E.) suffered to the extent of £2,000, and three hours after the storm the hail in that parish was so deep that a gentleman's horse could not pull the carriage through it, and when the owner got out to make a track for the wheels, he *sank up to his knees*. If all this had but happened inside the area instead of outside, we should have considered the puzzle solved. Is it possible that the authorities were shaky as to their geography?

It will be noticed that occasionally the dates are very different.

YEAR.	LOWEST TEMPERATURE IN OCTOBER.			
	GREENWICH.		CAMDEN SQUARE.	
	Temperature.	Date.	Temperature.	Date.
1842	28 ^o ·3	20	No observations.	
1843	28·5	18		
1859	26·5	24	26·6	24
1862	28·5	30	31·8	30
1868	29·3	20	27·8	19
1869	27·9	28	26·6	28
1872	29·1	14	31·8	13
1873	26·7	29	26·2	30
1877	28·2	18	30·9	19
1880	29·2	30	29·6	30
1881	26·2	17	27·3	17
1887	25·3	13	25·4	26
1888	27·9	8	28·2	8
1890	24·7	28	23·8	28

It is remarkable that instead of the last 25 years including, as theoretically it should have done, half of the instances of low temperature, it contains 10 out of 14; moreover, the lowest, and the lowest but one, have both occurred in the last four years. This last October gives the absolute lowest both for Greenwich and for Camden Square.

But it was still colder in the more central parts of England. We cannot vouch for all the following readings being from verified thermometers, with no spirit at the top of the tubes, and duly hung in Stevenson's screens, but their general consistency shows that there is not much the matter. We give the readings in the order of temperature, starting with the lowest, and in order to keep the table within reasonable length, stopping at 22°; but we may add that in the greater portion of Scotland and Ireland the weather was not at all severe.

Lowest Temperatures on 27th-28th Oct., 1890.

County.	Station.	Observer.	Temp.	Date.
Leicester ...	Barkby Vic.	Rev. E. N. Pochin...	16 ^o ·0	27th
Derby	Willington	Rev. G. A. Smallwood.	16·0	28th
Roxburgh ...	Melrose, Abbey Gate ...	Mr. Dodds	17·8	28th
Ayrshire....	Old Cumnock	Mr. J. Ballantine	18·0	27th
Herts	Broxbourne	G. J. Newbery, Esq. ...	19·0	27th
Bucks	Winslow, Addington ...	Mr. Mathison	19·0	28th
Surrey	Reigate, Holmfels	Miss Baker	19·4	28th
Leicester ...	Loughboro', Victoria St..	W. Berridge, Esq.	20·0	28th
Lincoln	Boston	W. H. Wheeler, Esq. CE	21·0	28th
"	Horncastle (Hemingby).	Rev. E. S. Bengough ..	21·0	28th
Montgomery.	Carno (Tybrith)	Miss Marsh	21·0	27th
Yorkshire ...	Wakefield	Dr. Clarke	21·2	28th
Hampshire ..	Strathfield Turgiss	Rev. C. H. Griffith ...	21·7	28th

GREENWICH MEAN TEMPERATURES.

To the Editor of the Meteorological Magazine.

SIR,—May I point out how misleading the Greenwich method of calculating the mean temperature of months is apt to be? I do not precisely understand what that method is, but it certainly is *not* the mean of the max. and min. temperatures, but a value obtained by the aid of certain corrections, which, as we are expressly warned, are not applicable to localities other than Greenwich. This must be clearly borne in mind in making comparisons between the mean temperature of Greenwich and that of other places, as probably most people's idea of mean temperature is the mean of the max. and min. ; certainly it is that of the large majority who only read their thermometers once in 24 hours.

For instance in the paper on the "Climate of Brighton," quoted in your September number, Mr. Sawyer places the mean temperature of Brighton and of Greenwich for September, October and November in parallel columns, and heads them, "arithmetical mean daily max. and min. temperatures." This is no doubt a correct description of his own Brighton values, but a totally incorrect one of the Greenwich values. The following are the actual values for Greenwich on the mean of 1841-88 :—

	Max.		Min.		Mean.	Mean in Mr. Sawyer's paper.
September.....	67·2	.....	49·1	.....	58·1	56·6
October	57·8	.....	43·2	.....	50·5	49·5
November	48·8	.....	37·6	.....	43·2	42·4

thus agreeing very closely with the Brighton values, and the whole theory as to the higher mean temperature of the latter place falls to the ground. I have taken the period 1841-88, for Greenwich, as the longest during which observations have been kept on a uniform system at the observatory, and the results made accessible to outsiders, though perhaps it would be more accurate to have taken exactly the same period as at Brighton, but Mr. Sawyer does not state distinctly what that was. I have discovered with some trouble that what Mr. Sawyer has adopted for Greenwich, are certain values called "mean temperature at Greenwich for 118 years," and probably he knows no more than I do how they have been obtained. It must, however, be evident that they are quite unsuitable for comparison with ordinary people's mean values, which in nine cases out of ten are the mean of the max. and the min.

It seems a pity that some uniform method of calculating mean temperature is not settled on authority, so that all values may be strictly comparable.

Yours faithfully,
G. VON U. SEARLE.

BAROMETRIC DEPRESSIONS.

To the Editor of the Meteorological Magazine.

SIR,—I have been very much interested in the computation by Mr. Dines, of the energy stored up in our storms in the form of vapour to be set free on its condensation. It is a little singular that, with the exception of Prof. Mohn, of Christiania, no theorist has undertaken such calculation, as far as I know, though it would seem a legitimate field for airy fancies. I can see that in Europe where storms (cyclones) have erratic paths, and very slow motion, Espy's stationary cyclone theory might be accepted largely, but in this country where storms not infrequently have velocities of 40 or 50 miles per hour, such a theory seems doubtful. More than that, it is conceded that the upper part of a storm travels twice as fast as the lower part; so Mr. Dines's steam cylinder, which must be vertical if it is to act at all, in a very few minutes would become nearly horizontal, and he would lose his ascending current, and all its supposed power. In this country, too, nearly all our rain, thunderstorms and tornadoes occur 400 miles from the storm centre. It seems to me this consideration alone is fatal to all his computations. To take a certain rainfall over a limited area, and compute the amount of energy to be developed by determining the amount of steam in the free air, would be about as valuable as it would be to compute the amount of energy stored up in an ice house, and set free when it is set on fire. If there were a rarefaction as supposed in the atmosphere due to the liberation of latent heat, would not this partial vacuum be filled almost at once by the surrounding air rushing in? Would it be possible to maintain such an uprushing current as theory demands more than a very few minutes? The great need of meteorology to-day is to establish the fact of an uprush of air in the centre of our storms, and after that is done, that would be the best proof in the world that that has nothing to do with our storms, because there is no rain there, just exactly where it should be if there is any uprush.

H. A. HAZEN.

October 21, 1890.

To the Editor of the Meteorological Magazine.

SIR,—It appears to me that when Mr. Ryves complains of the treatment he has received, he should remember the proverb, "He who plays at bowls must expect rubbers."

With respect to his letter to you, pp. 138-9, I remark when he speaks of "the piling up of air in huge anti-cyclones," he has virtually assumed what, if I remember correctly the beginning of the discussion, was the point to be proved. The term "depression" was originally applied to the curve in the daily barometric chart as affected by a cyclonic or other storm. Then when weather charts of large districts became common, the idea of depression was strengthened by the similarity to maps of districts drawn with contour lines to

denote the physical features of the earth ; but that such charts denote a pit in the atmosphere any more than an anti-cyclonic area denotes a piling up, seems opposed both to observation and sound reasoning.

Your obedient servant,

JOHN SLATTER.

Whitchurch, Oxon, 23rd Oct., 1890.

To the Editor of the Meteorological Magazine.

SIR,—Nothing could possibly have been further from my intention than to inflict pain by recommending study. That the tone of my letters should have produced this result is to me a matter of deep regret.

Not being surprised that Mr. Ryves should prefer to my garrulity the reserve of my friend, the Hon. Ralph Abercromby, I wonder that he does not himself follow the wiser path. However, he has given us an interesting historical account of conclusions to be derived from Sir J. Herschel's theory, which is very far from being "unmitigated nonsense."

To return to modern times, those readers who wish to follow the most recent development of the question will find, in addition to Ferrel's works, much of interest in late papers in the "Amer. Met. Journal;" also on the anti-condensation view in the American Weekly "Science," and above all in Prof. Hann's most valuable "Remarks on the Temperature in Cyclones and Anti-cyclones," "Met. Zeitschrift," Sept. 1890, pp. 328-344.

I hope hereafter to shew that the high temperature prevailing at the altitude of a few thousand feet in our winter anti-cyclones is the necessary concomitant of the downward flow of the atmosphere in these systems. The subject, which is highly important, is too wide for a letter.

I should be the last man to wish, or to dare, to administer a "knock" to Dr. Muirhead. He appealed to common sense, and his appeal was unanswerable ; observation proves that in every cyclone the winds near the earth incurve towards the centre, and curve out aloft, and in every anti-cyclone curve out near the earth's surface, and incurve above ; so that we can (for once without mathematics), conclude that the air ascends in the first kind of system, and in the second descends. Thus, in a cyclone the isobaric surfaces, near the earth, are convex to the latter ; somewhere above they are concentric to it ; and further up they are concave to it. In an anti-cyclone, near the earth, isobaric surfaces are concave to the earth's surface ; somewhere further up they are concentric to it ; and further up still they are convex to it. Observation, however, everywhere indicates.

I. That these systems are far from extending to any hypothetical limit of the atmosphere.

II. That their axes are rarely, if ever, perpendicular to the earth's surface.

III. That these lines are usually far from being right lines.

Yours truly,

W. CLEMENT LEY.

REVIEWS.

Note sur une trombe d'eau dont la bouche est en bas et dont le corps est horizontal et peut avoir quinze cents fois son diamètre, par M. D. COLLADON. [Extrait des *Archives des Sciences physiques et naturelles.*] Genève, 1890. 8vo. 10 pages.

THE first half of this paper deals chiefly with the views of M. Faye, as stated in his *Sur les tempêtes*, and with the very beautiful arrangement whereby Prof. Colladon produced artificial waterspouts by rotating the surface of water in a large vessel. The author also refers briefly to a case in which the upward movement of the air was rendered very conspicuous by its whisking a lot of linen laid out to dry, up to an altitude of more than 1,500 feet, and then scattering it on the other side of the town. As the sun was shining, the white linen enabled the whole phenomenon to be traced with ease.

In the latter part of the paper (in illustration of which he has been kind enough to send us two photographs) he describes a very curious phenomenon, which he calls a horizontal waterspout, which is produced at some sluices at Geneva. The sluices are of a form not usual in England, but the nature of which may be indicated by some homely illustrations. Imagine a bridge very strong, and with arches of only 4 ft. span; imagine, secondly, a series of planks like very thick Venetian blinds, which, instead of drawing up like blinds, can be rolled up like a carpet; if one of these rolls is unrolled and dropped in front of the arch it will close it, and if all the rolls are let down no water can go through the bridge. It is found that occasionally, when the centre sluices are down (*i.e.*, closed), and the side ones are up, so that the water is running through the two ends, a hollow snake-like tube of air is formed from each end, which runs back, and the two join into one; this tube varies in size, but is from half-an-inch to four inches in diameter, and has sometimes been seen to be 50 ft. long.

Water swirls have, of course, received consideration in treatises on hydrodynamics, and their parallelism with air motions has been considered, especially by Hirn*, but Professor Colladon has carried the research much further. The phenomenon is certainly a very curious one, and we are glad that its study is in such competent hands.

* *Etude sur une classe particulière de Tourbillons qui se manifestent, sous de certaines conditions spéciales, dans les liquides. Analogie existant entre le mécanisme de ces Tourbillons et celui des Trombes*, par G. A. HIRN. Paris, 1878. 8vo., 40 pages, 3 plates.

A Comparison between the Jordan and Campbell-Stokes Sunshine Recorders. By F. C. BAYARD, LL.M., F.R.Met.Soc. [From *Quar. Jour. Roy. Met. Soc.*]

WE call attention to this paper because we believe that few persons are aware of the difference between the records of *sunshine* by the Campbell-Stokes burning instrument, and of the *sunlight* by the Jordan photographic one.

Mr. Bayard, as the result of observations on 355 days during 1888 and 1889, found the duration to be—

	Sunshine.		Sunlight.
Summer	100	.....	121
Autumn	100	.....	120
Winter	100	.....	146
Spring	100	.....	131
Year ..	100	.....	130

Stronger evidence of the necessity for avoiding confusion between the two modes of observation could hardly be imagined.

A WARM DRY SEASON.

To the Editor of the Meteorological Magazine.

SIR,—As another month has closed with a rainfall very much below the average, I think it well to write to you to mention the following facts relating to this very extraordinary season. The total rainfall for the first ten months of this year is only 19·05 in., the smallest amount registered at this place since 1830, except in the years 1842, 1844, 1854 and 1887, in all of which it was slightly less. While in London and the eastern part of the country, the ground was soaked with rain in June and July, here it has been so dry all through the summer and autumn that it has been almost impossible to work it. In many places springs have failed and are failing now, that have never been known to fail before.

Then again, although the mean temperature of the four months, June, July, August and September, was higher than in any year since 1878, except 1884 and 1887, the maximum temperature (77°·3) is the lowest but two since 1860. In the year 1862, the thermometer never rose above 75°, and in 1883, never above 77°. In 1879, the coldest summer but one (1888) on record, the thermometer reached 77°·7 one day which is slightly above the maximum for this year, and in 1888 it touched 81°·3 on the 10th of August. If, however, the number of days be taken on which the thermometer has reached 70°, it will be found that the number for this year is vastly in excess of that for either of the other years. This year the number has been 52, and in 1862, 1879, 1883 and 1888 it was respectively, 19, 15, 39 and 19.

Another curious thing about this year is that from June 8th to October 8th, the maximum was never below 60°, a length of time which is, I think, almost unprecedented.

Yours truly,

T. H. NEWPORT DAVIS.

Orleton, Tenbury, November 6th, 1890.

SUPERNUMERARY RAINBOWS.

THERE must have been exceptional uniformity in the rain showers which passed over the South-East of England on the afternoon of Sunday, August 24th, for supernumerary rainbows were seen by Captain Maclear, R.N., and by Rev. H. G. Wooley, from the neighbourhood of Guildford, and by Mr. Symons from Brighton. The phenomenon is not a very common one; it consisted of a series of bands of colour close to the violet on the inside of the primary bow. Captain Maclear described them as (proceeding inwards) Red, Green, Purple, Green, Purple; Mr. Wooley, in the same order, called them Neutral, Purplish red, Neutral, Purplish red, Neutral, Purplish red; and Mr. Symons as Red, Green, Red, Green, Red, Green.

Captain Maclear very neatly describes them as "not very bright nor definite, but patchy in density and colouring, and this patchiness varied in position." These supernumerary arcs were at no time more than 20° of the total bow, but they were sufficiently distinct to attract the attention of many who were not meteorologists.

GREAT RAINS AT MADRAS, 1803-88.

To the Editor of the Meteorological Magazine.

SIR,—In the account of the great rainfall at Hong Kong in your May number there is a reference to the fall at Madras in 1846. Perhaps the enclosed return (sent me by a brother) of the rainfall registered at the Royal Observatory, Madras, in 24 hours, during the present century, may interest some of your readers.—Yours faithfully,

C. S. PRINGLE.

Beckenham, 15th September, 1890.

Rainfall in 24 hours in the present century, as registered at the Royal Observatory, Madras.

		Inches.			Inches.
1803.	Nov. 18	8·27	1836.	Nov. 27	7·77
1811.	May (?)	16·38	„	Nov. 20	9·65
1813.	Nov. 3	7·90	1846.	Oct. 21	20·58
1815.	Nov. 28	8·63	1851.	May 4	11·45
1819.	Sept. 12	10 00	„	Nov. 4	7·90
1820.	May 9	11·12	1857.	Oct. 24	18·04
1822.	Nov. 4	7·83	1864.	Nov. 18	9·35
1825.	Oct. 29	8·88	1866.	Dec. 5	7·99
1827.	May 9	12·08	1872.	May 18	13·01
			1888.	Oct. 31	9·20

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE,
1889.

REGULAR readers of the *Magazine* will be familiar with the fact that in the Annual Summaries of the Climate of the British Empire, the extremes are monopolised year after year by the same stations.

For the last five years Adelaide has recorded the highest temp. in shade, reaching $112^{\circ}\cdot4$ in 1886, but Calcutta has once or twice approached it very nearly. The opposite extreme is similarly held by Winnipeg, but without rivalry, for only once does any other station come within 20° of it. With an extreme min. of $-46^{\circ}\cdot4$, or nearly 80° below freezing point, a rival is perhaps neither to be expected nor desired. Winnipeg might well boast of a *lively* climate, for in addition to the above it holds the first rank for extreme range (the temp. in 1886 having risen to 103°) for mean daily range, for lowest mean temp., and is robbed by Toronto of another well deserved glory from the fact that readings of the min. on grass are not taken. Still one more honour has to be added to the long list, for this year Winnipeg has the smallest rainfall.

The least mean daily range is affected by the absence from the table of Barbados, but Mauritius has an almost equally uniform climate. Similarly Bombay usurps the place usually held by Colombo, which year after year records a mean temp. exceeding 80° .

Adelaide, in addition to the highest temp. in shade and in sun, has the driest atmosphere, the mean humidity in the five years ranging from 56 to 63; this station has also once recorded the smallest rainfall.

For moisture several of the insular stations run very closely together, but London—perhaps by the aid of its fogs—carries off the palm most frequently, and for amount of cloud it comes near the head of the list.

Malta, with little more than half the cloud of London, added to its other attractions, seems very enticing to a denizen of the metropolis with its winter mantle of fog.

SUMMARY.

<i>Highest Temperature in Shade</i>	$109^{\circ}\cdot0$ at Adelaide on January 13th.
<i>Lowest Temperature in Shade</i>	$-42^{\circ}\cdot6$ at Winnipeg on February 23rd.
<i>Greatest Range in Year</i>	$139^{\circ}\cdot2$ at Winnipeg.
<i>Least Range in Year</i>	$26^{\circ}\cdot4$ at Mauritius.
<i>Greatest mean Daily Range</i>	$24^{\circ}\cdot5$ at Winnipeg.
<i>Least mean Daily Range</i>	$9^{\circ}\cdot9$ at Mauritius.
<i>Highest mean Temperature</i>	$80^{\circ}\cdot5$ at Bombay.
<i>Lowest mean Temperature</i>	$35^{\circ}\cdot9$ at Winnipeg.
<i>Driest Station</i>	Adelaide mean humidity, 63.
<i>Dampest Station</i>	London mean humidity, 81.
<i>Highest Temperature in Sun</i>	$170^{\circ}\cdot7$ at Adelaide.
<i>Lowest Temperature on Grass</i>	$-18^{\circ}\cdot6$ at Toronto.*
<i>Greatest Rainfall</i>	$73\cdot79$ in. at Trinidad.
<i>Least Rainfall</i>	$14\cdot95$ in. at Winnipeg.
<i>Most Cloudy Station</i>	London, average amount, 6·6.
<i>Least Cloudy Station</i>	Malta, average amount, 3·7.

* There being no grass min. thermometer at the other Canadian stations.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE FOR 1889.

STATIONS.	ABSOLUTE.				AVERAGE.				ABSOLUTE.		TOTAL RAIN.		AVER- AGE.	
	Maximum.		Minimum.		Max.	Min.	Mean.	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>														
England, London ...	84.5	June 6	19.2	March 4	56.8	42.7	49.8	43.2	81	126.3	13.5	23.84	169	0-10
Malta	104.1	July 20	40.8	March 17	72.3	58.9	65.6	55.6	75	158.8	34.9	26.04	89	6.6
<i>Cape of Good Hope.</i>	98.3	January 24	32.4	August 2	70.2	53.5	61.9	...	...	...	...	30.98	...	3.7
<i>Mauritius</i>	84.4	January 2, 14	58.0	June 18	78.5	68.6	73.6	64.8	76	142.3	48.5	56.19	208	5.0
Calcutta	101.8	May 2	48.6	January 2	86.7	71.1	78.9	70.8	75	161.2	37.4	57.47	129	5.9
Bombay	94.3	March 6	63.8	January 15	86.1	74.9	80.5	71.9	76	147.7	49.8	67.84	103	4.1
<i>Melbourne</i>	99.8	December 26	31.3	July 12	67.2	50.0	58.6	48.6	71	152.3	23.4	27.14	125	3.9
<i>Adelaide</i>	109.0	January 12	36.3	July 19	71.7	53.9	62.8	49.3	63	170.7	29.0	30.87	143	5.9
<i>Wellington</i>	80.0	January 24	31.5	June 13	62.1	48.6	55.4	47.2	75	139.0	23.0	31.37	155	5.1
<i>Trinidad</i>	96.0	May 10	60.0	January 19	88.8	70.1	79.5	72.4	78	161.5	54.0	73.79	...	4.1
Toronto	88.7	July 8	-11.3	February 6	53.2	37.7	45.5	39.1	77	...	-18.6	31.24	179	6.3
New Brunswick, } Fredericton..... }	91.7	May 19	-33.0	February 24	52.7	32.7	42.7	37.3	74	...	...	39.15	148	5.8
Manitoba, } Winnipeg	96.6	August 30	-42.6	February 23	48.2	23.7	35.9	30.2	77	...	...	14.95	132	5.2
British Columbia, } Victoria	85.0	July 8, 9	24.0	January 14	58.7	41.8	50.2	...	...	...	...	18.56	103	...

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, APRIL, 1890.

STATIONS. <i>(Those in italics are South of the Equator.)</i>	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	Temp.	Date.	Temp.	Date.									
England, London	64·3	30	30·5	5	54·9	38·7	37·6	83	110·9	23·2	2·02	16	5·9
Malta.....	75·9	18	45·3	30	67·0	54·7	51·9	78	132·3	37·3	·64	5	4·7
<i>Cape of Good Hope</i> ...	91·3	1	44·2	14	62·8	54·7	...	...	...	...	2·14	...	5·9
<i>Mauritius</i>	82·4	1	66·8	27	79·3	70·7	68·7	83	139·4	58·8	10·24	22	6·8
Calcutta.....	105·6	24	67·2	28	95·1	76·5	74·6	71	155·8	61·0	1·00	3	2·5
Bombay.....	92·8	12	74·5	1	88·4	78·0	74·1	74	144·2	63·5	·01	1	3·0
Ceylon, Colombo	90·1	2	73·0	29	87·6	75·3	72·9	79	149·0	70·0	14·27	27	7·1
<i>Melbourne</i>	87·5	7	40·0	28	69·6	50·6	50·2	71	136·2	34·8	1·82	6	4·6
<i>Adelaide</i>	85·1	5,6	46·4	17	74·4	55·1	49·8	58	144·0	37·6	1·00	7	4·3
<i>Wellington</i>	72·0	11	43·0	24	65·5	53·3	51·0	73	135·0	35·0	3·71	11	4·7
<i>Auckland</i>	72·0	1	50·0	23	68·4	57·3	54·5	74	135·0	40·0	5·52	18	6·6
Jamaica, Kingston.....	90·3	20	65·0	25	86·3	67·9	66·9	72	...	...	·26	...	...
Trinidad	88·0	11a	66·0	3	84·4	70·0	70·1	80	157·0	61·0	7·62	21	...
Toronto	68·4	13	23·5	1	51·7	32·8	32·3	69	...	15·0	2·11	14	5·1
New Brunswick, } Fredericton } Manitoba, Winnipeg } British Columbia, } Victoria	67·8	23	11·7	2	47·7	27·5	24·0	52	...	...	1·77	7	4·2
	69·8	19	8·4	1	49·2	26·0	29·3	70	...	...	1·21	10	4·9
	70·0	28b	24·0	12	55·7	36·9	...	...	...	...	·86	6	...

a And 21, 28. b And 29, 30.

REMARKS.

MALTA.—Mean temp. 59°·3; mean hourly velocity of wind 11·8 miles. Sea temp. rose from 60°·6 to 62°·9. J. SCOLES.

Mauritius.—Mean temp. of air 1°·7 below, of dew point 0°·6 above, and rainfall 4·61 in. above, their respective averages. Mean hourly velocity of wind 8·2 miles, or 2·6 below the average; extremes 21·7 on 6th, and 1·8 on 24th; prevailing direction E.S.E. to E. by N. T and L on nine days; L on five days. Unusually bright and prolonged skyglows before sunrise and after sunset after the 24th. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms occurred on sixteen days, and L only was seen on ten days. J. C. H. CLARKE, Lt. Col. R.A.

Melbourne.—Mean temp. of air 0°·9, and of dew point 0°·8 above average, humidity 1, amount of cloud 1·3 and R·45 in. below average. Prevailing winds N., S.E., and S. Strong on four days. Heavy dew on nine days, L on the 21st. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 0°·5 above the average. The weather, on the whole, was fine and pleasant, but somewhat dry for the season. C. TODD, F.R.S.

Wellington.—Strong winds on the 1st and 2nd, but generally fine weather up to the 11th; from 11th to 18th very showery, unpleasant and oppressive; the remainder of the month fine, with moderate winds, chiefly N. and N.W. Mean temp. 2°·4 above, and rainfall very near, the average. R. B. GORE.

Auckland.—A wet stormy month, the rainfall being 2½ in. above the average. Mean temp. slightly above the average. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL,
OCTOBER, 1890.

[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.	1·25	XI.	Castle Malgwyn	4·98
„	Margate, Birchington...	1·43	„	Builth (Llanwrtyd Wells)	5·24
„	Littlehampton	1·29	„	Rhayader, Nantgwilt...	4·61
„	Hailsham	1·61	„	Carno, Tybrith	3·24
„	Ryde, Thornbrough	1·24	„	Corwen, Rhug	2·66
„	Alton, Ashdell	1·57	„	I. of Man, Douglas	2·17
III.	Oxford, Magdalen Col...	1·14	XII.	Stoneykirk, Ardwell Ho.	2·59
„	Banbury, Bloxham	1·13	„	New Galloway, Glenlee	3·65
„	Northampton	1·31	„	Melrose, Abbey Gate...	1·88
„	Cambridge, Fulbourne..	2·16	XIII.	N. Esk Res. [Penicuick]	4·35
„	Wisbech, Bank House..	1·07	XIV.	Ballantrae, Glendrishaig	2·19
IV.	Southend	·89	„	Glasgow, Queen's Park.	3·00
„	Harlow, Sheering	1·67	XV.	Islay, Gruinart School..	5·02
„	Rendlesham Hall	1·33	XVI.	Dollar	5·15
„	Diss	1·49	„	Balquhiddy, Stronvar..	6·52
„	Swaffham	1·89	„	Coupar Angus Station..	2·06
V.	Salisbury, Alderbury ...	·56	„	Dunkeld, Inver Braan..	2·18
„	Warminster .....	...	„	Dalnaspidal H.R.S. ...	7·17
„	Bishop's Cannings	1·23	XVII.	Keith H.R.S.	5·04
„	Ashburton, Holne Vic....	2·67	„	Forres H.R.S.	2·88
„	Hatherleigh, Winsford.	...	XVIII.	Fearn, Lower Pitkerrie.	2·54
„	Lynmouth, Glenthorne.	3·09	„	Loch Shiel, Glenaladale	19·61
„	Probus, Lamellyn	3·11	„	N. Uist, Loch Maddy ...	9·23
„	Launceston, S. Petherwin	3·16	„	Invergarry	7·75
„	Wincanton, Stowell Rec.	1·87	„	Aviemore H.R.S.	4·27
„	Taunton, Lydeard Ho...	...	„	Loch Ness, Drumnadrochit	4·54
„	Wells, Westbury	2·05	XIX.	Lairg H.R.S.	7·73
VI.	Bristol, Clifton	1·67	„	Scourie	8·18
„	Ross	1·25	„	Watten H.R.S.	4·63
„	Wem, Clive Vicarage ...	1·60	XX.	Dunmanway, Coolkelure	4·19
„	Cheadle, The Heath Ho.	2·30	„	Fermoy, Gas Works ...	1·53
„	Worcester, Diglis Lock	1·09	„	Tipperary, Henry Street	2·71
„	Coventry, Coundon	1·72	„	Limerick, Kilcornan ...	2·12
VII.	Ketton Hall [Stamford]	1·24	„	Miltown Malbay	3·65
„	Grantham, Stainby	1·11	XXI.	Gorey, Courtown House	1·51
„	Horncastle, Bucknall ...	·90	„	Navan, Balrath	1·19
„	Worksop, Hodsock Priory	1·01	„	Mullingar, Belvedere ...	2·06
VIII.	Neston, Hinderton	2·96	„	Athlone, Twyford	2·44
„	Knutsford, Heathside ...	2·36	„	Longford, Currygrane...	2·29
„	Lancaster, South Road.	3·26	XXII.	Galway, Queen's Coll...	2·81
„	Broughton-in-Furness ..	6·08	„	Clifden, Kylemore ...	6·12
IX.	Wakefield Prison	·65	„	Crossmolina, Enniscoe..	3·39
„	Ripon, Mickleby	·74	„	Collooney, Markree Obs.	4·18
„	Scarborough, West Bank	2·21	„	Ballinamore, Lawderdale	2·94
„	East Layton [Darlington]	1·60	XXIII.	Warrenpoint	1·37
„	Middleton, Mickleton ..	2·07	„	Seaford	1·47
X.	Haltwhistle, Unthank..	2·25	„	Belfast, New Barnsley..	3·14
„	Shap, Copy Hill	2·30	„	Bushmills, Dundarave...	3·47
XI.	Llanfrechfa Grange	1·23	„	Stewartstown	1·86
„	Llandovery	4·80	„	Buncrana	3·96

OCTOBER, 1890.

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.	Difference from average. 1880-9	Greatest Fall in 24 hours.			Max.		Min.		In shade.	On grass.
				Dpth	Date.		Deg.	Date	Deg.	Date		
I.	London (Camden Square) ...	1·20	- 1·69	·28	25	13	68·5	4	23·8	28	2	7
II.	Maidstone (Hunton Court)...	1·05	- 2·41	·38	26	10	...	...	...	...	...	...
III.	Strathfield Turgiss	1·15	- 1·69	·31	25	16	67·0	5	21·7	28	4	8
IV.	Hitchin	1·57	- 1·50	·45	7	11	64·0	1, 4c	29·0	27	1	...
V.	Winslow (Addington)	1·24	- 1·85	·38	7	12	72·0	4	19·0	28	7	11
VI.	Bury St. Edmunds (Westley)	1·85	- 1·42	·54	7	13	...	...	...	...	...	...
VII.	Norwich (Cossey)	1·69	- 2·15	·32	31	14	...	...	...	...	...	...
VIII.	Weymouth (Langton Herring)	1·18	- 2·36	·27	25	14	65·0	6	32·0	28	1	...
IX.	Barnstaple	2·90	- 2·19	·62	31	14	69·0	15	33·0	20	0	...
X.	Bodmin (Fore Street)	4·50	- 1·50	·83	26	20	...	...	...	...	...	...
XI.	Stroud (Upfield)	1·37	- 1·66	·37	25	12	67·0	3	29·0	27	2	...
XII.	Church Stretton (Woolstaston)	2·12	- 1·65	·44	6	18	64·5	4	31·0	28	2	6
XIII.	Tenbury (Orleton)	1·33	- 1·88	·32	7	16	69·5	4	26·8	28	5	7
XIV.	Leicester (Barkby)	1·37	- 1·78	·43	16	13	68·0	6	16·0	27	5	14
XV.	Boston	·85	- 2·26	·18	15	11	75·0	4	21·0	28	4	...
XVI.	Hesley Hall [Tickhill]	·86	- 2·24	·20	28	11	69·0	12	24·0	28	3	...
XVII.	Manchester (Plymouth Grove)	2·38	- ·99	·45	16	18	70·0	12	23·0	27	2	8
XVIII.	Wetherby (Ribston Hall) ...	·62	- 2·51	·14	16a	5	...	...	...	...	...	...
XIX.	Skipton (Arncliffe)	4·45	- 1·58	·81	6	20	64·0	1	29·0	27	2	...
XX.	Hull (Pearson Park)	1·19	- 2·46	·24	26	14	...	...	...	...	...	...
XXI.	North Shields	2·42	- ·53	·65	26	16	65·0	5	...	...	...	4
XXII.	Borrowdale (Seathwaite)	11·64	+ 1·05	1·56	14	21	...	...	...	...	...	...
XXIII.	Cardiff (Ely)	2·15	- 2·39	·47	7	17	...	...	...	...	...	...
XXIV.	Haverfordwest	3·10	- 2·05	·65	6	18	64·0	6	35·1	9	0	4
XXV.	Plinlimmon (Cwmsymlog) ...	6·51	...	1·18	6	16	...	...	...	...	...	...
XXVI.	Llandudno	1·74	- 1·65	·32	25	16	66·3	10	35·8	23	0	...
XXVII.	Cargen [Dumfries]	1·50	- 1·76	·44	14	12	62·4	12	23·0	28	4	...
XXVIII.	Jedburgh (Sunnyside)	1·54	- 1·11	·26	14	13	64·0	4	29·0	28	3	...
XXIX.	Old Cumnock	3·70	+ ·30	·58	14	19	62·0	5, 10	18·0	27	9	...
XXX.	Lochgilhead (Kilmory)	6·33	+ 1·54	·97	14	27	...	...	27·0	27	3	...
XXXI.	Oban (Craigvarren)	8·76	...	1·75	2	26	58·0	12	32·5	26	0	...
XXXII.	Mull (Quinish)	7·83	+ 2·54	1·16	2	27	...	...	...	...	...	...
XXXIII.	Loch Leven Sluices	3·10	+ ·14	1·00	31	12	...	...	...	...	...	...
XXXIV.	Dundee (Eastern Necropolis)	2·00	- ·24	·50	30	12	64·6	5	29·0	28	3	...
XXXV.	Braemar	4·45	+ ·84	1·15	16	21	61·0	10	28·4	27f	3	11
XXXVI.	Aberdeen (Cranford)	3·54	...	·61	1	22	72·0	12	31·0	27	4	...
XXXVII.	Strome Ferry	10·41	+ 4·74	2·11	28	29	...	...	...	...	...	...
XXXVIII.	Inverness (Culloden)	3·73	+ 1·48	·77	1	...	63·0	5	29·0	26f	3	7
XXXIX.	Dunrobin .....	...	...	...	...	...	...	...	...	...	...	...
XL.	S. Ronaldsay (Roeberry)	4·74	+ 1·01	1·26	2	24	60·0	12d	32·0	27	1	...
XLI.	Cork (Blackrock)	1·24	- 2·43	·62	6	8	69·0	4	35·0	1, 26	0	...
XLII.	Dromore Castle	5·59	- ·05	1·50	6	14	64·0	7	32·0	26	1	...
XLIII.	Waterford (Brook Lodge)	1·46	- 2·36	·58	6	11	65·0	4	35·0	2g	0	...
XLIV.	O'Briensbridge (Ross)	3·43	...	1·26	6	16	67·0	1	37·0	16	0	...
XLV.	Carlow (Browne's Hill)	2·18	- 1·11	·75	6	17	...	...	...	...	...	...
XLVI.	Dublin (Fitz William Square)	·64	- 2·74	·16	25	11	65·2	5	34·2	27	0	3
XLVII.	Ballinasloe	2·01	- ·98	·30	24	18	60·0	10e	31·0	27	3	...
XLVIII.	Waringstown	1·80	- ·91	·32	6	15	64·0	4	31·0	26	2	5
XLIX.	Londonderry (Creggan Res.) ..	3·50	- ·17	·43	15	21	...	...	...	...	...	...
L.	Omagh (Edenfel)	2·81	- ·29	·32	6b	19	61·0	5	33·0	26	0	3

a And 30. b And 25, 30. c And 5, 6. d And 13. e And 11. f And 28. g And 26, 27.
+ Shows that the fall was above the average; - that it was below it.

METEOROLOGICAL NOTES ON OCTOBER, 1890.

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.—A fine mild open month with a high temperature in the early portion. A very sharp and short burst of cold occurred from 25th to 28th, the grass min. on the morning of the latter day, falling to 18°·9.

ADDINGTON.—There were many very fine days during the month, but dense fogs occurred on 11th and 22nd. Towards the end of the month a remarkable and sudden change of temp. occurred; on the morning of the 28th the min. in shade fell to 19°, it was cold all day, frosty in the evening up to 7 o'clock, when a change took place, and by 9 a.m. on the 29th the temp. had risen to 47° and to 59° by mid-day.

BURY ST. EDMUNDS, WESTLEY.—A beautiful autumnal month; very mild, except on the 27th, when there was a sharp frost; S fell on 26th.

LANGTON HERRING.—On the whole a very fine month. The temp. which in the last week was remarkably variable, was on the whole a little less than 1° above the average for 18 years. On the 28th the min. was 32°, on the 30th the max. was 61°, the greatest range remembered in so short a time. Fogs on 12th, 13th and 22nd; T on 26th.

BODMIN, FORE STREET.—Splendid weather to the 24th; on the 26th and 27th H, sleet, heavy R, high wind, T and L, then much milder to the end; the last night very stormy and wet.

STROUD, UPFIELD.—This neighbourhood was greatly in want of water, most of the springs having run dry, and many wells failed.

WOOLSTASTON.—A beautiful autumn month; mean temp. 49°·8. A heavy storm of H occurred on the 15th, and S fell lightly on 25th, and two following days.

ORLETON.—Another very fine dry month, with the R much below the average. Rather unusual extremes of temp. occurred; many of the days being quite hot, and others excessively cold for the time of year. Mean temp. of the month slightly above the average. A heavy snow storm on the morning of the 26th, covered the ground to a depth of 1½ inches on the high ground.

BARKBY.—A fine month. Sudden and very hard frost on the 16th, and the leaves of many kinds of trees came off in one night; considerable scarcity of water, brooks and springs very low. T and L on 15th, T L and H on 16th.

MANCHESTER, PLYMOUTH GROVE.—Fine autumn weather from 2nd to 13th and also on the 18th, 19th, 24th and 30th. On the morning of the 27th, the min. on grass fell to 17°, the lowest temp. in October for 24 years. The rest of the month very unsettled, cold, wet and stormy. H on 25th. Sleet on 28th. Mean temp. 48°·5.

HULL, PEARSON PARK.—The weather during the month was generally fine; often bright and clear, but showery from the 24th to the end.

WALES.

HAVERFORDWEST.—Generally damp and wet throughout, but some very fine days with bright sunshine, as R frequently fell during the night. On the 26th the wind veered to N.W., with much lower temp., H fell in vast quantities through the day, with squalls of wind, and a terrific display of L occurred from 6 to 9 p.m.; a terrible H storm, accompanied by loud T, occurred on the morning of the 27th, Precelly was white and the air very cold. The month ended wet and milder. Prevailing winds W. and N.W.

SCOTLAND.

CARGEN.—The mean temp. of the month 49°·4, is 1°·4 above the average, the fluctuations of the bar. and ther. during the month were very marked, pressure varying on several occasions upwards of half an inch in 24 hours. The first 17 days of the month were unusually mild, the mean temp. on eight nights

during the first thirteen, ranging from 50° to $55^{\circ}\cdot 8$. Sudden alterations in temp. occurred in the latter part of the month; the min. temp. on the night of the 28th being 23° , on the 29th $49^{\circ}\cdot 2$, on the 30th 34° , and the 31st 45° . On the whole the month was gloomy and damp. Sunshine considerably below the average.

JEDBURGH.—The weather on the whole was very seasonable and favourable for all out-door work, and the cereal crop in high districts was all secured in good order. Snow on 26th.

OBAN.—After so wet a summer such a large R in October was most unexpected. All harvesting ceased, and the corn remained out in many places to the close of the month.

MULL, QUINISH.—The wettest summer and autumn ever known in this district.

ROEBERRY.—A very rough and wet month throughout, with a heavy fall of S on 27th.

IRELAND.

CORK.—An unusually fine month. Mean temp. $53^{\circ}\cdot 3$.

DROMORE.—The latter part of the month was very wet and stormy, with very heavy showers of H on 25th and 26th. The mountains being white with S winter seems to be setting in very early.

WATERFORD, BROOK LODGE.—Mean temp. $51^{\circ}\cdot 8$. S on the Comeragh Mountains on the 26th; L on 27th

O'BRIENSBRIDGE, ROSS.—Two periods of six days each of very fine autumn weather occurred. Temp. high for the season; stormy winds from S.W. in the last week.

DUBLIN.—The month will be remembered as one of the driest, finest and mildest Octobers on record. During the first fortnight the temp. was almost always above the average; on the 25th a cold period set in, which culminated on the 27th, and was followed by mild, dull and damp weather to the end of the month. Mean temp. $51^{\circ}\cdot 7$, considerably above the average. High winds on 14 days, attaining the force of a gale on the 15th only. Fogs on the 8th, 9th, 11th, 12th and 22nd; L on the 26th; S and sleet on the morning of the 26th; H on the 15th.

WARINGSTOWN.—A most beautiful month on the whole; all late farming operations satisfactorily cleared up. Gardens in beauty to the end. Potato crops in this district excellent.

OMAGH, EDENFEL.—With but little intermission the weather was fine, mild and favourable up to the 23rd, thence to the end very wet, with heavy S on the night of the 25th. Bright aurora on 21st.