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Professor Cleveland Abbe.

New York, 3rd December, 1838—October, 1916.

We learn with much regret of the death of the veteran American Meteorologist, Professor Cleveland Abbe, who was more widely acquainted with the meteorologists of the world than any of his contemporaries and a frequent visitor to this country. Professor Abbe was proud of his purely English ancestry, and among the many honours which he received we believe that none afforded him greater gratification that the Symons Medal of the Royal Meteorological Society, awarded him in 1912, which appealed to him in a special degree because of his life-long friendship with the late Mr. Symons. Abbe was educated at the Universities of Michigan (Ann Arbor), and Harvard. After four years in the U.S. Coast and Geodetic Survey he completed his special astronomical and meteorological training in Russia at the famous Paulkova Observatory, near Petrograd, in 1864-66. In 1868 he was appointed Director of Cincinnati Observatory and in the succeeding year organized the weather service of that institution, from which followed, in 1871, the U.S. Government Weather Bureau. When this Bureau was founded Abbe was appointed Professor of Meteorology, and it was in this capacity that he exercised an influence on the progress of meteorology greater than perhaps any other man of his time. He was meteorologist to the U.S. Scientific Expedition to the west coast of Africa, 1889-90. In 1891 he attended the International Meteorological Congress held in Munich, as U.S. delegate, and in a similar capacity was present at the Kelvin Jubilee in 1896. His contributions to astronomical and meteorological literature although forming but a small part of his activities, were very numerous. Among his more important works may be mentioned a series of papers in two volumes on the Mechanics of the Earth's Atmosphere published in 1891 and 1908, his Treatise on Meteorological Apparatus and Methods, issued in 1888, the article "Meteorology" in the last two editions of the Encyclopaedia Britannica, and a memoir on the Physical Basis of Long Range Forecasts. He also initiated the preparation (1881-95) of the General Bibliography of Meteorology,

and founded the Abbe Meteorological Library of the John Hopkin's University, Baltimore. He was associate editor of the American "Meteorological Journal," 1891-94, and of the "Beiträge zur Physic der freien Atmosphäre," 1905, but his greatest literary monument is the "Monthly Weather Review" of the U.S. Weather Bureau.

He founded this important journal in 1893, and edited it until June, 1909, when the "Review" was re-organized by other hands, and for a time lost the literary and scientific character which, under Professor Abbe's fostering care had raised it to the highest position amongst the meteorological journals of the world. It was not long, however, before the Review resorted to its old traditions and in 1914, despite the burden of 76 years, Professor Abbe resumed the responsibilities of editorship. There is a peculiar fitness in his last years being devoted to the maintenance of the great publication with which his name was linked during the brilliant period of the development of American meteorology.

Professor Abbe, for fully a quarter of a century, was professor of Meteorology in George Washington University, Washington, resigning this appointment in 1910.

The friendship between the editor of this Magazine and Professor Abbe began in Edinburgh, in 1884, and for more than 30 years it grew through correspondence and intercourse at International scientific gatherings in many lands, so that his death removes not only an honoured colleague, but a friend who never grudged help and counsel.

METEOROLOGY OF THE SOUTH ORKNEYS IN 1915.

By R. C. Mossman, F.R.S.E.

Through the courtesy of Mr. George O. Wiggin, Director of the Argentine Meteorological Office, we have been favoured with an abstract of the meteorological observations made at Laurie Island, South Orkneys, during 1915. As Sir Ernest Shackleton's Expedition was in the Weddell Sea to the south of the South Orkneys during the whole year, it is obvious that results of considerable value will emerge from the discussion of the two series of data. Meanwhile it is of interest to draw attention to some of the more prominent features of the year's work. The year 1915 was remarkably cold at the South Orkneys, the mean temperature (20°·6) being the lowest on record during the thirteen years covered by the observations, and 3°·4, below the average. August was unusually cold with a mean of −0°·4 or 16°·4 below the average (a record), while the four months May to August were 9° colder than the average. Only in October and November were the monthly mean temperatures in excess of the average. Even in February, the

warmest month, the average temperature in 1915 was only 31°·3. Although 1915 was so inclement at the South Orkneys the exceptional conditions did not extend into lower latitudes in the South Atlantic, as at both the Falkland Islands and Punta Arenas, in Magellan Strait, the mean annual temperatures were just the average. It is of interest to note that in May and August barometric pressure was higher in the South Orkneys than at the Falkland Islands, while this inversion of the normal conditions also took place between Punta Arenas and the South Orkneys in the months of May, July and August. In May barometric pressure was ·08 in. above the normal at Laurie Island, but ·29 in. below the normal at Punta Arenas, the departures in July and August being equally pronounced. It is of interest to compare the very abnormal conditions at the South Orkneys with those obtaining at other places in the Southern Hemisphere. Dealing with the temperature data given in the climatological table which appears monthly in this magazine, supplemented by other promptly published records, it was found that in 1915 the mean annual temperature was just the normal at Johannesburg, Auckland, Hobart and Adelaide. At Cape Town, Dunedin (New Zealand), Sydney and Perth (West Australia), the mean temperature was a degree in excess of the average, while at St. Helena (a Meteorological Office station) the year was a very warm one in marked contrast to the South Orkneys, the mean temperature being 1°·7 above the average, and July was the only month with a mean under the average. Speaking generally the year 1915 in the southern hemisphere had a relatively high temperature in middle latitudes, the only marked exception, judging from the data at our disposal, being at Hokitika, on the west coast of New Zealand where the temperature was 1°·4 under the normal.

Dealing with other climatic elements at the South Orkneys, cloud amount, rainfall, and relative humidity were all below the average, and sunshine and barometric pressure were above the average. The air was also unusually calm, the mean annual wind velocity being the lowest yet noted, January and each month from August to December establishing a record for low wind velocity. The annexed table gives, as far as our space permits, a translation from metric to the old familiar British units of some of the more important data at the South Orkneys last year along with the monthly departure from the average of pressure and temperature. The former is at 32° sea level and gravity.

With regard to other elements the mean relative humidity was 89, being 1 per cent. below the average. Bright sunshine amounted to 575 hours, with a maximum 79 hours in November and a minimum of 8 hours in June. The highest barometric pressure, 30·19 in, occurred on May 26th, and again on June 3rd, and the lowest 28·12 in., on July 22nd. The mean daily range of temperature varied from 16°·9 in July to 4°·0 in February.

Laurie Island, South Orkneys, 1915.

Lat. 60° 44′ S. Long., 44° 39′ W. Height, 20 ft.

	Barometric Pressure.		Temperature in Shade.						
	Mean.	Diff. from Aver.	Mean.	Diff. from Aver.	Highest.	Lowest.	Precipitation.	Cloud 0-10.	Wind vel. mi. per hr.
	in.	in.	°	°	°	°	in.		
Jan ..	29·15	—·13	30·9	—1·1	41·0	21·6	·76	9·8	5·5
Feb.	·16	—·08	31·3	—1·4	39·0	23·4	1·02	9·5	8·9
Mar. ..	·38	+·15	30·9	—0·2	45·3	18·0	1·30	8·6	13·0
April ..	·10	—·15	23·7	—2·7	38·1	2·3	1·57	9·2	11·7
May ..	·37	+·08	12·0	—8·1	32·9	—21·6	·99	7·6	8·5
June ..	·30	—·10	7·9	—6·5	32·0	—25·4	1·56	7·4	9·3
July ..	·42	+·05	6·3	—4·8	32·4	—20·6	·80	6·2	10·7
Aug. ..	·45	+·06	—0·4	—16·4	33·4	—23·4	·95	6·5	7·1
Sept. ..	·47	+·16	20·8	—0·3	33·1	—10·5	1·34	8·9	8·0
Oct. ..	·52	+·23	25·9	+1·3	38·7	—4·0	·60	8·9	8·5
Nov. ..	·27	+·09	28·6	+0·8	36·9	16·2	·54	8·6	6·7
Dec. ..	·31	—·06	29·5	—1·1	37·0	19·9	·44	8·8	5·8
Year ..	29·33	+0·3	20·6	—3·4	45·3	—25·4	11·87	8·4	8·6
Average	29·30	..	24·0	..	46·4	—28·8	17·52	8·5	12·3

THE PERMANENT SNOW BEDS OF THE BEN NEVIS GROUP.

By Rev. R. P. Dansey.

In March, 1905, an article by the present writer appeared in the *Meteorological Magazine* on this subject, and in May, 1906, one in the *Geographical Journal* by Mr. V. H. Gatty. As I had not been in Scotland for ten years, and then in June, I resolved to pay a visit to the snow beds in the second half of last September, when they might be expected to be at nearly their minimum. From Crianlarich Ben More and Ben Lui were ascended, but there was no trace of snow in any of their corries, though two large drifts could be seen on the Cairngorms, quite 60 miles distant, on their Western slopes; this was surprising, as the few permanent snow beds on these mountains are all on the N.E. side; possible they were not old beds but the result of a summer snowstorm; although so distant they were just discernible to the unaided eye. On Ben Nevis there were about a dozen patches of old snow on September 20th, none was large with the exception of the bed in the Observatory Gully described by the writer and Mr. Gatty ten years ago; this bed though long was narrow, but owing to bad weather it was the only one I was able actually to reach, and then in such a storm of wind, mist, hail and snow, that progression in the teeth of the gale was only possible by sheltering the face with the hands, so that a full inspection was hope-

less. Only the bottom end was reached, where the depth was about 4 feet, and a tunnel ran right through the bed where it crossed the main gully at right angles to the general line of its bed ; temperature was 33° ; fresh snow was lying, and there was no sign of thawing on or under the bed. No doubt the bed was very much deeper than this in the main gully to my left. On another day I secured a photograph of this bed from the top of the cliffs, some 800 feet above the bottom of the bed, which shows well its attenuated character. During my nearly three weeks' stay there were only two days when the heights above 4000 feet were *partially* clear for about an hour or so, this photograph was taken in one of these precious minutes.

Ten years ago I was struck with the enormous masses of snow under Aonach Mor and Aonach Beag in June. These mountains form a ridge running parallel to Ben Nevis, about 5 miles N.E. of it. Aonach Mor has a broad flat summit especially favourable to drifting, and it was my conviction then that Aonach Mor might harbour snow beds equal to or larger than any on Ben Nevis. In my first visit to ascertain this I was foiled by mist and rain, but not before two large snow beds appeared now and again through the clouds from the corrie below. A few days after, though the tops were still in cloud, I traversed the whole summit ridge of Aonach Mor to Aonach Beag and when just about to turn back from the top the clouds dispersed for an hour—the second clearance only during my stay at Fort William—and revealed three snow beds, two of which were certainly larger than any on Ben Nevis, with the possible exception of the bed previously described, which is larger but much narrower. One of these beds—the smallest and seemingly shallowest—was under the N.W. side of the N.E. ridge of Aonach Beag (4,060 feet) ; the other two were under the cliffs of Aonach Mor (4,000 feet). These two were rectangular in shape and in depth might have been anything between 8 and 20 feet, as a deep "bergschrund" was visible against the cliff at their upper end. Three photographs were secured looking down at them from about 500 feet above. I should say that these are both permanent snow beds, but that the Aonach Beag one may possibly sometimes disappear. Several other small patches of old snow were also in evidence. On the day of my visit there was a drift of new snow from 1—3 feet deep all along the cliff edge, though with the warmth of the first half of October, and the heavy rains in Scotland, this probably soon melted. It was extremely unfortunate that owing to the bad weather it was impossible in the time at my disposal to get to these beds, but I hope to have another and more successful visit to them next autumn.

[With reference to Mr. Dansey's suggestion that the snow he saw on the western side of the Cairngorms in September might have

been the result of a summer snowstorm, we are able to state that this was not the case. During the month of July large and persistent beds of snow on the western side of the Cairngorms were visible from the Spey Valley, and residents in the neighbourhood assured us that they had not been absent since the great snowstorms of March. Later information up to the middle of August satisfies us that the snow remained unmelted up to that time and was beginning to increase in area by early autumn falls.—Ed., *S.M.M.*]

REPORT ON ATMOSPHERIC POLLUTION.

(Continued from page 139).

Elaborate instructions were given for analysis of rain water and solids deposited in the gauge.

Thirty-eight gauges were set up in various parts of the country, of which ten were in Manchester and six in the County of London.

The results obtained are set out in detail in a series of tables and the exact position of the gauges is shown in Ordnance maps of one inch to the mile.

The total solids are lowest at Malvern, with 2·05 tons per square kilometre per month, Bowdon has 5·69 tons, and Birmingham S.W. 6·04 tons. Twenty-two stations get between 5 and 15 tons per square kilometre per month and fourteen between 15 and 25 tons.

Sulphuric acid is generally in the same proportion as the total solids; the agreement is quite striking. The exceptions are Bolton, London (Victoria Park), Manchester (Whitefield), comparatively richer in acid, Newcastle-upon-Tyne, Oldham, Sheffield (Attercliffe), and Paisley comparatively poorer, but there is only the difference of one class in any case. Chlorine is rather more irregular; the classification agrees with that for sulphuric acid in twenty-eight cases. The chlorine is relatively conspicuous by its presence at the Meteorological Office, Sheffield (Attercliffe) and Meersbrook Park), Greenock, and Paisley, specially so at Sheffield (Attercliffe) and relatively in defect at Birmingham Central, London (Southwark Park, Victoria Park, and Golden Lane), Manchester (Ancoats), and Coatbridge.

Ammonia.—The results for ammonia are very similar to those for tar. The Liverpool result is much influenced by a very large figure for a single month.

The following summary shows the deposit per acre per month arranged in classes. Class A has less than 5 tons of solids per square kilometre per month; Class B from 5 to 15 tons; Class C from 15 to 25 tons and Class D from 25 or more tons.

Deposit per Acre per Month.

	Tar.	Carbonaceous other than tar.	Ash.	Loss of ignition.	Ash.	Total solids.	Sulphuric Acid.	Chlorine	Ammonia
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
CLASS A (The Malvern type)	0·23	4·5	9	3·4	6·8	23	4·5	1.4	0·23
CLASS B (The Ravenscourt Park or Cheadle type)	0·9	18	36	13·5	27	90	18	5·4	0·9
CLASS C (The Liverpool or Embankment Gardens type)...	1·8	36	72	27	54	180	36	10·8	1·8
CLASS D (The Oldham type)	Over 2·25	Over 45	Over 90	Over 34	Over 68	Over 225	Over 45	Over 14	Over 2·3

The average atmosphere may be expected to deposit upon a square kilometre in any one winter month 15 tons of solid matter, which may be regarded as made up of 0·15 ton of tarry matter, 3 tons of carbonaceous matter other than tar, 6 tons of insoluble inorganic dust, besides soluble salts, which include 3 tons of sulphuric acid, a ton of chlorine, and 0·3 ton of ammonia. Taking 250 acres to the square kilometre, 1 ton per square kilometre works out at rather less than a hundredweight to 12½ acres, or 9 lb. per acre. Hence, on the average, the atmospheres of the several classes represent deposit per acre in a month as shown in the table of deposit per acre given above.

By the use of the method indicated above we can gain an insight into the relation between the various elements of atmospheric pollution and the season of the year. It may be expected beforehand that there should be a relation, because the production of pollution by domestic fires is one of the most noteworthy characteristics of the colder seasons; the question which is put here, therefore, is for which of the elements the variation is most conspicuous. Another point is suggested by the fact that the closing months of 1914 were extremely rainy, and the exaggerated rainfall of December is certainly associated, as a rule, with large amounts of pollution collected. This is in itself surprising, because with frequent rainfall the roads and roofs are kept well washed. The only explanation seems to be that the December pollution came down locally with the rain instead of being dispersed over a wider area; but this conclusion can only apply to those gauges which are near sources of pollution, such as Embankment Gardens, to take a special instance. With a properly distributed serie of gauges for the country as a whole we ought to find an improvement of the

atmosphere in country localities in consequence of the "washing" of the air in the neighbourhood of centres of production of pollution.

A seasonal variation with a maximum in winter and a minimum in summer is clearly disclosed in the summary for total solids.

Spring is the most productive of grit, summer and winter are equal in this respect, and autumn is least.

Carbonaceous matter other than tar (smuts and fragments of plants) shows no discrimination between the seasons: the slight preponderance of spring over summer may be regarded as fortuitous.

Ammonia is the only one which shows itself as a summer product.

The effect of the exceptionally wet month of December or July is a noticeable feature perhaps in tar, and certainly in the soluble compounds, loss on ignition, and soluble ash. It also appears quite clearly in total solid, and as it is not specially noteworthy in insoluble ash or smut the principal effect of the rain must be looked for in the dissolved constituents. Thr rain apparently takes out the dissolved constituents without much effect upon the insoluble ones. It may be that the effect which the rain would have in bringing down mineral dust is compensated by the absence of solid constituents of that nature in rainy weather, while the supply of dissolved or soluble constituents is undiminished.

The effect of the rainy month is clearly shown in the tables for sulphuric acid and chlorine, but less so with ammonia. How far the marked preponderance of the various products in winter is due to the fact that the particular winter under review was a rainy one is an open question.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

PECULIAR LIGHTNING.

DURING a sudden squall, about 2 a.m., on the 31st, after a normal distant lightning flash, a second followed in the west or north-west while I was at a south window. But instead of a flash this was more like a deluge of light, hardly varying in intensity during the three seconds or more that it lasted, lighting up a house some thirty yards distant with a curiously even glow. The following evening brought further distant lightning and another sharp squall about 10 o'clock. These seem to have been characteristic of the recent stormy weather, for besides the serious case at Chesterfield I have

heard of another doing much damage in the Dedham district in Essex.

My cousin, Joseph Clark, of Street, Somerset, writing on Sunday's storm records that on Sunday morning the 5th inst., "The wind dropped at about 1 a.m. but came on again at 2 a.m. At 4.20 there came the longest flash of lightning I ever remember, thoroughly alarming me. I got out of bed quickly and went to the window, for I really thought that the house or farmyard was on fire. I heard no thunder." The latter fact may have been due to the storm as here, where also the wind would have drowned any but a heavy peal.

J. E. CLARK.

Purley, Surrey.

REMARKABLE HAILSTONES.

About 1.20 p.m. to-day a short but most remarkable hailstorm took place here. It followed very frequent thunder, the centre of the storm passing some distance to the west, the wind being about S.S.E. The hailstones were roughly circular, the larger ones being about ¾ of an inch in diameter, and in great numbers. The outer surface was granulated, and in general appearance as if a number of small hailstones had been frozen together. I had no opportunity to examine them minutely till nearly half an hour later; even then the granulated appearance was quite noticeable, much like figure 25 on page 143 of Scott's *Elementary Meteorology*. I cut several through the centre, and there was in most instances a darker core or centre, varying from about an eighth to a quarter of an inch in diameter, with lines radiating from this centre to the outer surface.

What I should like to know is how the hail stones exhibited the central dark core, suggesting pressure, and at the same time the undoubted granulated surface, suggesting that the whole was built up of a large number of small stones frozen together.

C. E. B. DEACON.

Alderwasley Parsonage, Wirksworth, October 27th, 1916.

ABNORMAL TEMPERATURES.

October this year boasts of a higher mean temperature than May or June, as follows:—

	May.	June.	October.
Mean Max. ..	59°3	60°5	58°2
,, Min. ..	45·6	45·2	49·0
Mean	52·4	52·8	53·6

It will be noted that the October nights were nearly 4° warmer than June. During the first ten days of October the mean temperature was 59°·6, while for June 1-10th it was only 49°·4.

During a period of 33 years I have no instance of this kind to compare with the above. ARTHUR F. PARBURY.

Crediton, Exeter, November 1st, 1916.

SUMMER TIME.

THE Summer Time scheme was brought forward with a view of economizing the resources of the country, and so assisting us to win the war. The object in view, no doubt, meets with general approval; it is the means used to attain it which has caused considerable dissatisfaction.

It is clear that considerable ecomony in coal must be effected by getting up and going to bed an hour earlier during the summer months, but it is not clear that this can only be brought about by altering the clocks. The Rev. H. A. Boys has suggested that the time tables might be altered for the summer months; if this were done, and if the Banks and Government offices took similar action, it is probable that other business establishments would fall into line. This would avoid the necessity for changing the clocks and the consequent confusion in meteorological returns: there would still, however, remain the inconvenience mentioned in your article of June, viz., that an Observer may not be able to adhere to the old time and catch a train on the new time table.

But this inconvenience seems a trivial matter when compared with even the lowest estimate of the probable saving. In these times we have all to put up with inconvenience and extra work, and the ultimate question which should settle all such points surely is, "Will it help to win the war?"

LAWRENCE GIBBS, F.R.Met.Soc.

Wirksworth, Derbyshire.

METEOROLOGICAL NEWS AND NOTES.

WEATHER PROPHECIES for long periods still continue. A.B.M., writing in the *Glasgow Herald* of October 27th, predicts a mild winter on the basis of the Greenwich temperatures, while Mr. Hugh Clements, in the daily press at the beginning of this month, forecasts an exceptionally cold winter. The only alternative forecast is that the temperature of the coming winter will be exactly the average, and there seems no doubt that whatever the event may prove the supporters of one or other of these remarkable forecasts will be gratified.

A NEW MONTHLY WEATHER REVIEW, commencing with January, 1916, is promised shortly by the Argentine Meteorological Office. Since 1909 this office has published useful monthly maps of the principal meteorological elements including one showing the excess or deficiency of the month's rainfall over the Republic. It will be a great advantage to have this valuable material under one cover along with the statistical data on which the maps are based.

MR. J. J. HICKS, the head of the well known firm of instrument makers, died on October 25th in his 79th year. He leaves a reputation for high-class work, which makes his name worthy of memory.

REVIEW.

Results of Meteorological Observations in the five years, 1911-15, also of Underground Temperatures in the twelve years, 1898-1910, made at the Radcliffe Observatory, Oxford, under the Direction of Arthur A. Rambaut, M.A., F.R.S. Radcliffe Observer. Size, 10 × 6. Oxford, 1916. Pp. 215. Plates.

SOME changes have been made in the arrangement of the volume as compared with first issues of the same series. A special grant received in 1911 enabled the arrears of printing to be overtaken, and the results of the observations to be printed off year by year. In the volume under notice the five annual parts dealing with the period 1911-1915 have been bound togther. It was found impossible, owing to the depletion of the staff on account of the war to continue the evaluation from the photographic records of the hourly tabulations of pressure and temperature. A considerable portion of the volume is taken up with the daily observations of underground temperature, five platinum resistance thermometers being employed. The daily results for all five thermometers for the whole period of twelve years, 1899-1910, are brought together, the results being shown graphically on three plates for depths ranging from 6½ inch to 10 feet. At depths of 6½ inch and 1½ feet the mean monthly temperature is highest in July, at 3½ feet and 5 feet 8½ inch the maximum is retarded until August, and at 10 feet occurs a month later. The minimum occurs in February at all depths except the deepest, where it is a month later. All the curves agree in showing a general falling off in the mean annual temperature amounting to about 2° in the twelve years for which observations are available. A useful appendix gives the monthly and annual values of the various elements of climate, mostly since 1890, in continuation of those previously published. Tables giving monthly values of bright sunshine and mean wind velocity since 1881 appear for the first time. The old familiar units are adhered to throughout, which facilitates the comparison with previous volumes of the series.

RAINFALL TABLE FOR OCTOBER, 1916.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	RAINFALL OF MONTH. Aver. 1875—1909. in.	1916. in.
		° ′	° ′			
Camden Square	*London*	51 32	0 8	111	2·72	3·25
Tenterden	*Kent*	51 4	*0 41	190	3·48	4·91
Arundel (Patching)	*Sussex*	50 51	0 27	130	4·01	6·24
Fordingbridge (Oaklands)	*Hampshire*	50 56	1 38	135	3·97	5·82
Oxford (Magdalen College)	*Oxfordshire*	51 45	1 15	186	2·82	3·46
Wellingborough (Swanspool)	*Northampton*	52 18	0 41	155	2·60	2·03
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	2·72	2·85
Geldeston [Beccles]	*Norfolk*	52 27	*1 31	38	2·84	2·46
Polapit Tamar [Launceston]	*Devon*	50 40	4 22	315	4·84	6·35
Rousdon [Lyme Regis]	,,	50 41	3 0	516	3·81	6·63
Stroud (Field Place)	*Gloucestershire*	51 44	2 13	226	3·21	5·47
Church Stretton (Wolstaston)	*Shropshire*	52 35	2 48	800	3·77	5·45
Boston	*Lincolnshire*	52 58	0 1	11	2·75	1·99
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	2·77	1·72
Mickleover Manor	*Derbyshire*	52 54	1 32	280	2·81	3·38
Macclesfield	*Cheshire*	53 15	2 7	501	3·53	...
Southport (Hesketh Park)	*Lancashire*	53 39	2 59	38	3·74	5·81
Arncliffe Vicarage	*Yorkshire, W.R.*	54 8	2 6	732	6·48	13·48
Goldsborough Hall	,, ,,	54 0	1 25	119	3·16	4·24
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	3·19	2·84
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	3·20	2·74
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	12·71	23·01
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	4·87	8·98
Haverfordwest	*Pembroke*	51 48	4 58	90	5·51	9·39
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	5·38	8·43
Llandudno	*Carnarvon*	53 20	3 50	72	3·78	4·13
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	4·45	8·14
Marchmont House	*Berwick*	55 44	2 24	498	3·83	4·25
Girvan (Pinmore)	*Ayr*	55 10	4 49	207	5·38	6·97
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	3·36	6·39
Islay (Eallabus)	*Argyll*	55 47	6 15	68	4·95	7·19
Mull (Quinish)	,,	56 34	6 13	35	5·87	7·87
Balquhidder (Stronvar)	*Perth*	56 21	4 23	422	7·29	12·46
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	2·81	4·53
Braemar	*Aberdeen*	57 0	3 24	1114	3·88	6·63
Aberdeen (Cranford)	,,	57 8	2 7	120	3·23	4·13
Gordon Castle	*Moray*	57 37	3 5	107	3·38	3·86
Drumnadrochit	*E. Inverness*	57 20	4 29	138	3·49	6·06
Fort William	,, ,,	56 49	5 6	171	7·32	16·20
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	8·38	9·39
Dunrobin Castle	*Sutherland*	57 59	3 56	14	3·15	4·17
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	5·59	13·60
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	4·00	7·89
Nenagh (Castle Lough)	*Tipperary*	52 54	8 24	120	3·48	7·51
Ennistymon House	*Clare*	52 57	9 18	37	4·40	9·97
Gorey (Courtown House)	*Wexford*	52 40	6 13	80	3·75	7·40
Abbey Leix (Blandsfort)	*Queen's County*	52 56	7 17	532	3·53	5·40
Dublin (FitzWilliam Square)	*Dublin*	53 21	6 14	54	2·88	5·95
Mullingar (Belvedere)	*Westmeath*	53 29	7 22	367	3·19	7·58
Crossmolina (Enniscoe)	*Mayo*	54 4	9 16	74	5·27	10·65
Cong (The Glebe)	,,	53 33	9 16	112	4·60	11·42
Collooney (Markree Obsy.)	*Sligo*	54 11	8 27	127	4·21	8·56
Seaforde	*Down*	54 19	5 50	180	3·65	7·39
Ballymena (Harryville)	*Antrim*	54 52	6 13	150	3·78	6·35
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	3·76	7·54

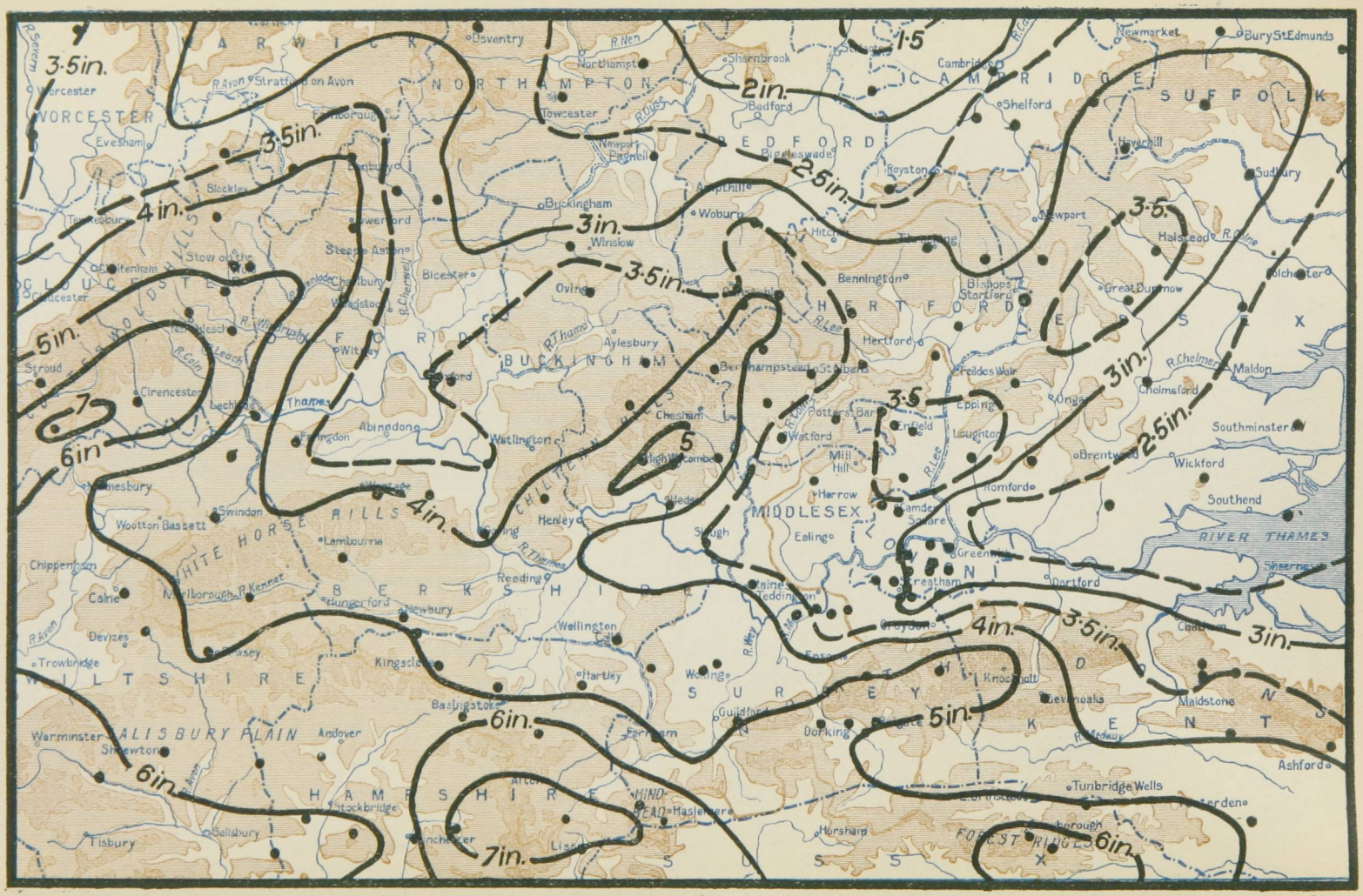
RAINFALL TABLE FOR OCTOBER, 1916—*continued.*

RAINFALL OF MONTH (*con.*)					RAINFALL FROM JAN. 1.					
Diff. from Av. in.	% of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days	Aver. 1875–1909. in.	1916. in.	Diff. from Aver. in.	% of Av.	Mean Annual 1875–1909. in.	STATION.
+ ·53	119	·64	17	23	20·64	26·79	+6·15	130	25·11	Camden Square
+1·43	141	·86	17	22	21·80	24·62	+2·82	113	27·64	Tenterden
+2·23	156	1·00	17	23	24·03	28·08	+4·05	117	30·48	Patching
+1·85	147	·78	30	23	24·30	30·76	+6·46	127	31·06	Fordingbridge
+ ·64	123	·67	2	24	20·27	23·96	+3·69	118	24·58	Oxford
— ·57	78	·40	2	18	20·85	20·68	— ·17	99	25·20	Swanspool
+ ·13	105	·48	27	20	20·86	26·81	+5·95	128	25·40	Westley
— ·38	87	·39	24	22	19·17	...	...	...	23·73	Geldeston
+1·51	131	·81	27	25	29·74	30·60	+ ·86	103	38·27	Polapit Tamar
+2·82	174	1·03	30	25	26·35	28·82	+2·47	109	33·54	Rousdon
+2·26	170	·85	2	26	24·33	28·29	+3·96	116	29·81	Stroud
+1·68	145	1·25	27	26	26·48	27·26	+ ·78	103	32·41	Wolstaston
— ·76	72	·36	3	19	19·42	22·84	+3·42	118	23·35	Boston
—1·05	62	·35	29	19	20·31	19·14	—1·17	94	24·46	Hodsock Priory
+ ·57	120	·51	2	23	22·06	25·16	+3·10	114	26·65	Mickleover
...	...	...	...	...	28·38	...	...	...	34·73	Macclesfield
+2·07	155	1·72	13	24	26·44	26·27	— ·17	99	32·70	Southport
+7·00	208	1·63	5	26	48·62	57·30	+8·68	118	61·49	Arncliffe
+1·08	134	·67	13	25	22·67	24·04	+1·37	106	27·29	Goldsborough Hall
— ·35	89	·70	13	22	21·76	23·08	+1·32	106	26·42	Hull
— ·46	86	·68	4	22	22·85	23·90	+1·05	104	27·94	Newcastle
+10·30	181	3·15	4	23	100·75	110·65	+9·90	110	129·48	Seathwaite
+4·11	185	1·55	2	28	33·50	41·06	+7·56	122	42·28	Cardiff
+3·88	171	1·42	2	25	36·47	34·50	—1·97	,95	46·81	Haverfordwest
+3·05	157	1·75	27	25	36·30	39·32	+3·02	108	45·46	Gogerddan
+ ·35	109	·83	2	24	24·33	25·81	+1·48	106	30·36	Llandudno
+3·69	183	1·17	5	25	34·28	43·66	+9·38	127	43·47	Cargen
+ ·42	111	·61	13	24	27·72	35·74	+8·02	129	33·76	Marchmont
+1·59	130	·68	14	25	39·05	41·49	+2·44	106	49·77	Girvan
+3·03	190	·92	5	24	28·39	36·19	+7·80	127	35·97	Glasgow
+2·24	145	·88	4	28	37·73	42·58	+4·85	113	48·79	Eallabus
+2·00	134	1·11	11	26	43·74	40·28	—3·46	92	56·57	Quinish
+5·17	171	3·20	14	25	57·07	62·15	+5·08	109	73·77	Stronvar
+1·72	161	·69	29	23	23·35	33·05	+9·70	142	28·64	Dundee
+2·75	171	·95	14	22	28·04	38·00	+9·96	136	34·93	Braemar
+ ·90	128	·75	5	20	26·01	28·41	+2·40	109	32·73	Aberdeen
+ ·48	114	·82	6	20	24·77	30·98	+6·21	125	30·34	Gordon Castle
+2·57	174	1·76	14	20	28·96	41·72	+12·76	144	36·13	Drumnadrochit
+8·88	221	4·50	11	25	58·84	65·22	+6·38	111	75·80	Fort William
+1·01	112	2·14	14	22	65·17	67·83	+2·66	104	83·93	Bendamph
+1·02	132	·93	11	17	25·56	29·97	+4·41	117	31·90	Dunrobin Castle
+8·01	243	5·35	21	28	42·35	53·47	+11·12	126	54·81	Killarney
+3·89	197	1·62	1	22	31·45	30·52	— ·93	100	39·57	Waterford
+4·03	216	1·27	5	29	31·21	34·44	+3·23	110	39·43	Castle Lough
+5·57	227	1·52	5	30	36·87	41·78	+4·91	113	46·52	Ennistymon
+3·65	197	1·01	29	25	28·16	30·88	+2·72	109	,34·99	Courtown Ho.
+1·87	153	·51	26	26	29·23	32·09	+2·86	110	35·92	Abbey Leix
+3·07	207	·79	2	24	22·77	30·11	+7·34	132	27·68	Dublin
+4·39	138	1·00	14	30	29·38	38·16	+8·78	130	36·15	Mullingar
+5·38	202	1·14	5	30	41·01	48·92	+7·91	119	52·87	Enniscoe
+6·82	148	1·46	1	30	38·48	43·98	+5·50	114	48·90	Cong
+4·35	203	·84	6	31	34·35	43·01	+8·66	125	42·71	Markree
+3·74	205	1·29	2	27	31·28	34·04	+2·76	109	38·91	Seaforde
+2·57	168	·80	4	29	32·92	36·57	+3·65	111	40·84	Ballymena
+3·78	201	1·27	4	30	31·81	35·71	+3·90	112	39·38	Omagh

SUPPLEMENTARY RAINFALL, OCTOBER, 1916.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road .	5·79	XI.	Lligwy	4·92
,,	Ramsgate	4·05	,,	Douglas, Isle of Man	8·39
,,	Hailsham	6·47	XII.	Stoneykirk, Ardwell House...	6·93
,,	Totland Bay, Aston House...	4·30	,,	Carsphairn, Shiel	12·25
,,	Stockbridge, Ashley..	6·30	,,	Beattock, Kinnelhead	11·14
,,	Grayshott	6·66	,,	Langholm, Drove Road	8·93
III.	Harrow Weald, Hill House...	3·42	XIII.	Selkirk, The Hangingshaw..	5·31
,,	Pitsford, Sedgebrook...	2·42	,,	North Berwick Reservoir	3·82
,,	Woburn, Milton Bryant.	3·25	,,	Edinburgh, Royal Observaty.	4·54
,,	Chatteris, The Priory	1·71	XIV.	Maybole, Knockdon Farm ...	5·66
IV.	Elsenham, Gaunts End	3·04	XV.	Buchlyvie, The Manse	10·39
,,	Shoeburyness	2·06	,,	Ballachulish House	15·28
,,	Colchester, Hill Ho., Lexden	2·23	,,	Oban	9·08
,,	Ipswich, Rookwood, Copdock	2·21	,,	Campbeltown, Witchburn ..	6·58
,,	Aylsham, Rippon Hall	2·60	,,	Holy Loch, Ardnadam	10·90
,,	Swaffham ..	2·68	,,	Tiree, Cornaigmore	6·76
V.	Bishops Cannings	5·74	XVI.	Dollar Academy	7·31
,,	Wimborne, St. John's Hill ...	5·75	,,	Glenlyon, Meggernie Castle..	10·81
,,	Ashburton, Druid House	9·63	,,	Blair Atholl	6·84
,,	Cullompton	6·56	,,	Coupar Angus	5·13
,,	Lynmouth, Rock House ..	7·60	,,	Montrose, Sunnyside Asylum.	4·08
,,	Okehampton, Oaklands..	8·10	XVII.	Alford, Lynturk Manse	5·90
,,	Hartland Abbey	6·32	,,	Fyvie Castle	6·15
,,	St. Austell, Trevarna	8·36	,,	Keith Station ..	4·74
VI.	North Cadbury Rectory.	6·22	XVIII.	Rothiemurchus	6·61
,,	Clifton, Stoke Bishop .	7·36	,,	Loch Quoich, Loan	28·50
,,	Ledbury, Underdown.	3·86	,,	Skye, Dunvegan	8·15
,,	Shifnal, Hatton Grange.	3·95	,,	Lochmaddy, Bayhead	4·83
,,	Droitwich	3·46	,,	Fortrose	5·39
VII.	Blockley, Upton Wold	4·68	,,	Glencarron Lodge	14·67
,,	Grantham, Saltersford	1·76	XIX.	Altnaharra	6·38
,,	Market Rasen	2·07	,,	Melvich	4·00
,,	Bawtry, Hesley Hall	1·53	,,	Loch More, Achfary	9·77
,,	Derby, Midland Railway	2·82	XX.	Dunmanway, The Rectory ..	13·42
VIII.	Buxton	6·35	,,	Glanmire, Lota Lodge	9·54
,,	Nantwich, Dorfold Hall	3·65	,,	Mitchelstown Castle	6·49
,,	Chatburn, Middlewood	10·19	,,	Darrynane Abbey	...
IX.	Lancaster, Strathspey	7·35	,,	Clonmel, Bruce Villa	6·51
,,	Langsett Moor, Up. Midhope	5·50	,,	Broadford, Hurdlestown	8·61
,,	Scarborough, Scalby	3·67	XXI.	Enniscorthy, Ballyhyland...	9·22
,,	Ingleby Greenhow	3·98	,,	Rathnew, Clonmannon	5·62
X.	Mickleton	8·70	,,	Ballycumber, Moorock Lodge	6·45
,,	Bellingham, High Green Manor	5·82	,,	Balbriggan, Ardgillan ..	7·33
,,	Ilderton, Lilburn Cottage ...	3·58	,,	Castle Forbes Gardens.	6·61
,,	Keswick, The Bank	13·28	XXII.	Ballynahinch Castle	14·61
XI.	Llanfrechfa Grange	10·50	,,	Woodlawn	7·49
,,	Treherbert, Tyn-y-waun	19·80	,,	Westport, St. Helens	10·10
,,	Carmarthen, The Friary	10·62	,,	Dugort, Slievemore Hotel ...	9·11
,,	Fishguard, Goodwick Station.	7·05	XXIII.	Enniskillen, Portora	5·98
,,	Crickhowell, Tal-y-maes	8·50	,,	Dartrey [Cootehill]	7·66
,,	New Radnor, Ednol	6·40	,,	Warrenpoint, Manor House ..	7·11
,,	Birmingham WW., Tyrmynydd	11·71	,,	Belfast, Cave Hill Road	7·78
,,	Lake Vyrnwy	12·88	,,	Glenarm Castle	6·10
,,	Llangynhafal, Plâs Drâw	5·15	,,	Londonderry, Creggan Res...	6·53
,,	Dolgelly, Bryntirion	10·43	,,	Dunfanaghy, Horn Head ...	7·16
,,	Bettws-y-Coed, Tyn-y-bryn...	11·88	,,	Killybegs	10·36

THAMES VALLEY RAINFALL —— OCTOBER, 1916.



Symons's Meteorological Magazine

Watershed of River Thames above Teddington, and River Lee above Feildes Weir

Rainfall Stations reporting Isohyetals

WEATHER OF OCTOBER.

THE outstanding features of the weather of October were the heavy rainfall, falling on a large number of days, and the persistence of unsettled stormy conditions, with hardly a break during the whole month. Heavy gales were of frequent occurrence, the most widespread occurring from the 9th to the 15th and about the close of the month.

The mean temperature of the month was above the average in all parts of the country, a result largely due to the unusual mildness characteristic of the first half of the month, as during the second half the mean temperature, except in Ireland, was below the average. Taking the whole country the mean temperature excess as compared with the average was 2°·3, being most pronounced in Ireland where it amounted to 3°·5, and least marked in the east of Scotland, where the average was very slightly exceeded. The month opened with rather cool weather, but, on the 4th, the temperature in the shade as far north as Gordon Castle rose to 70°, while, on the 6th, readings of 71° were recorded at Hawarden Bridge and Llandudno. A conspicuous feature of the first half of the month was the very high mean minimum temperature which in some parts of the south of England averaged from 55° to 57° over the whole period, the nights being relatively much milder than the days. After the middle of the month the temperature fell, the lowest readings being recorded either on the 17th or 21st. On the former date shade readings of 18° were recorded at Balmoral and West Linton, and at most of the Scotch stations the temperature fell well below freezing point.

Over England, except in the north-east, the lowest temperatures were recorded on the 21st, the minimum being 24° at Shrewsbury.

Ireland resembled Scotland in having the lowest temperatures just after the middle of the month, but no readings below 32° were recorded.

Another cold snap occurred about the 27th, when the temperature fell to 22° at West Linton. The month closed with a strong gale from the S.W., and at Southport on the evening of the 30th the wind rose to 81 miles per hour.

The rainfall of this month was almost everywhere largely above the average, and in some places more than double the average fell. The driest area, where less than 2 inches fell, embraced a considerable region E. and W. of a line drawn from Doncaster to Cambridge. In the wet regions of the west an average daily rainfall of from ½ to ¾ of an inch was noted. In some parts of Ireland rain fell on every day of the month. The most noticeable rainstorms occurred on the 11th and 22nd. On the former date 4·50 inches fell in 11 hours at Fort William, and at Killarney on the 22nd 5·35 in. In the week ending the 14th 11·75 in. fell at Fort William and 8·50 in. at Ballachulish. In the Thames Valley map the least rainfall, under 2 inches, was in the vicinity of Cambridge, and less than 2½ inches fell in the estuary of the Thames. Over 7 inches fell in parts of Hampshire and Gloucester. Over the country, as a whole, the general rainfall expressed as a percentage of the average was :—England and Wales, 143 per cent; Scotland, 153 per cent.; Ireland, 209 per cent.; British Isles 162 per cent.

Sunshine, as in September, was everywhere deficient, especially in western districts. The percentage of the total possible recorded varied from 28 in the Channel Islands and 27 in the Midland Counties to 15 over Ireland and 17 in the west of Scotland. The general deficiency over the country as a whole was about 1 hour a day, the amount varying from 1/5 of an hour in Scotland East and the Midland Counties to over 1½ hours in Ireland. The amounts at individual stations were as follows :—Sidmouth, 92 hours; Weymouth, 99 hours; Totland Bay, 92 hours; Hodsock Priory, 81 hours; Southport, 78 hours; Perth, 72 hours; Swinton (Berwick) 71 hours; Haverfordwest, 64 hours; Hull, 61 hours; Camden Square, 80 hours; Bolton and Paisley, 52 hours; Loch More, 49 hours. In London (Camden Square) the mean temperature was 53°·1 or 3°·0 above the average. Duration of rain 55·2 hours. Evaporation, ·76 in.

Climatological Table for the British Empire, May, 1916.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	84·8	21	36·6	9	67·6	47·4	47·1	57	129·8	33·0	1·88	13	5·5
Malta	80·2	9	58·8	16	71·9	61·6	...	82	135·0	...	·08	1	2·1
Lagos	90·4	15	70·1	17	88·1	75·9	74·1	73	152·0	69·2	6·96	16	7·3
Cape Town	81·9	24	39·7	30	66·0	49·5	49·5	74	...	...	2·93	15	5·2
Johannesburg	71·8	18	28·0	23	62·9	42·5	31·8	56	...	26·3	·58	3	2·1
Mauritius	81·3	10	63·7	13	78·1	68·5	66·4	81	...	55·9	7·49	20	6·6
Bloemfontein	75·3	18	24·5	9	64·6	34·2	31·4	58	.	...	·04	2	1·9
Calcutta...	104·6	2	69·5	9	97·9	80·0	74·2	67	...	64·3	3·86	2	2·7
Bombay...	93·5	27	77·5	6	91·3	81·0	77·0	75	139·0	71·9	·07	2	4·0
Madras	103·4	4	74·7	31	96·8	80·7	75·5	72	155·6	74·7	·84	3	2·4
Colombo, Ceylon ...	89·3	3	69·2	19	86·9	75·0	75·0	85	158·0	68·0	30·99	23	8·2
Hongkong	90·5	28	70·0	3	82·9	74·5	72·6	83	...	...	12·94	14	6·7
Sydney	...	...	...	...	...	...	...	...	...	...	...	...	...
Melbourne	75·1	10	29·9	29	62·3	45·5	42·1	62	121·3	21·1	·96	7	5·5
Adelaide	81·6	10	41·4	24	67·5	50·3	47·0	64	135·0	30·1	1·19	7	5·5
Perth	84·4	4	40·2	13	68·8	53·4	52·0	74	137·2	29·2	4·80	17	6·0
Coolgardie	87·4	7	37·8	13	71·8	47·9	48·5	48	137·2	29·8	2·05	3	2·8
Hobart, Tasmania ..	71·6	2	32·0	27	57·0	44·1	39·8	63	124·0	25·1	·23	13	5·7
Wellington	67·8	16	38·4	18	60·2	49·5	49·0	80	93·8	26·0	3·58	17	6·7
Auckland	...	...	...	...	...	...	...	...	...	...	...	...	...
Jamaica, Kingston ..	91·2	20	70·1	6	86·5	72·4	71·8	79	...	...	11·92	11	...
Grenada	88·0	4*	72·0	30	86·0	75·0	...	73	135·0	...	3·52	12	2·5
Toronto	81·4	24	35·7	19	63·8	44·8	43·7	73	138·5	32·0	5·58	14	5·4
Fredericton	76·5	28	30·0	5	63·2	39·8	41·6	66	...	...	3·31	13	5·6
St. John, N.B. ...	63·8	27	34·0	1	55·3	40·5	38·5	70	125·2	31·2	1·81	15	6·6
Victoria, B.C.	67·3	24	36·1	7	57·4	43·9	42·0	76	140·0	28·3	·89	9	5·4

* And 16, 24, 28.

Johannesburg.—Bright sunshine, 287·1 hours.

Mauritius.—Mean temp. 0°·5, dew point 1°·6, and R 4·46 in. above averages.

Bloemfontein.—A cold month.

COLOMBO, CEYLON.—Mean temp. 81°·0, or 1°·7 below, dew point 0°·8 below, and R 17·67 in., above averages. Mean hourly velocity of wind 4·7 miles. TSS on ten days.

HONGKONG.—Mean temp. 78°·1, mean hourly velocity of wind 12·2 miles. Bright sunshine 194·2 hours.

Melbourne.—Mean temp. 0°·1 below, and R 1·20 in. below, averages. Early portion of the month warm and latter extremely cold and unexampled in the history of the State.

Adelaide.—Mean temp. 1°·2 above, and R 1·51 in. below averages.

Coolgardie.—Temp. 2°·1 above.

Hobart.—Mean temp. normal and R ·65 in. below average.

Wellington.—Mean temp. 2°·1 above, and R 1·22 in. below averages. Bright sunshine 131·6 hours.