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THE RAINFALL OF 1918.

By Carle Salter.

At the time of writing it is not possible to give more than a preliminary survey of the broader features of the rainfall distribution during 1918, based upon a selection from the 3,000 returns so far received. In doing so we follow the usual practice of comparing the total fall with the average of the 35 years 1875-1909. The general values are computed by taking the mean of a number of records distributed as equally as possible over the country.

The following table gives in summary form the general percentage values for each month :—

	England & Wales.	Scotland.	Ireland.	British Isles.		England & Wales.	Scotland.	Ireland.	British Isles.
January ..	123	104	110	113	July ...	146	141	126	140
February ...	107	154	166	140	August ...	74	103	83	85
March ...	62	48	65	58	September	247	150	209	207
April ...	106	49	56	74	October ...	71	124	123	100
May	113	94	91	100	November	79	105	102	95
June	51	77	61	61	December	153	98	139	132

The outstanding feature of the year was the very unusual wetness of September, which was undoubtedly the most rainy since that of 1896. The wet February and July were also notable, but the spring and early summer were, generally speaking, dry, particularly in Scotland and Ireland, and, after September, the autumn months, although marked by lack of sunshine and prevalence of damp, foggy weather, were normal in regard to total rainfall. December was also damp and exceptionally mild, but with more rainfall generally.

The total rainfall for the year was nearly everywhere in excess of the average, the exceptions being the east of Scotland, the extreme north-east of England, part of the Midlands, and a narrow strip extending along nearly the whole of the south coast of England. There were very slight deficiencies at one or two stations in the east of Ireland. The deficiency was greater than 10 per cent. from Aberdeenshire to Northumberland, including part of the area in eastern Perthshire where the deficiency was more than 20 per cent. in 1917.

The areas over which the rainfall exceeded the average by more than 10 per cent. group themselves into three wide and roughly parallel bands running from south-west to north-east. The most westerly of these appears to have stretched unbroken from Co. Cork to Caithness. The only parts of this long strip with more than 20 per cent. excess seem to have been in Clare and Tipperary. A central and wider strip with more than 10 per cent. excess extended from north Cornwall and from Waterford to Scarborough and Glasgow, and embraced practically the whole of Wales and the Pennines. Considerable areas with more than 20 per cent. excess lay in North Wales, Lancashire, Yorkshire and the English Lake District, and one or two stations had as much as 30 per cent. more than the average. A third strip with excessive rainfall stretched with some breaks from Sussex to Norfolk. In this area there were no very remarkable departures from the average.

Summing up the rainfall of the larger divisions of the country in general values we find that in England the total for the year was 7 per cent. above the average, in Wales, 13 per cent., in Scotland, 6 per cent., and in Ireland, 11 per cent. For the British Isles as a whole there was an excess of 9 per cent.

CONGRESS OF SCANDINAVIAN GEOPHYSICISTS IN GOTHENBURG, AUGUST 28th—31st, 1918.

By Dr. Hans Pettersson.

At the invitation of Dr. G. Ekman, Prof. O Nordenskjöld, Prof. O. Pettersson and other scientists of Gothenburg, Sweden, a highly representative congress of about fifty Danish, Norwegian and Swedish geophysicists met in that city during the latter part of August, 1918. Representatives from Finland had also been invited, but were unable to be present.

At a public meeting, on August 28th, the Congress was opened by the representative of the King of Sweden. Prof. Hildebrandsson, of Upsala, was unanimously elected president supported by three vice-presidents, *viz.*, Director Ryden (Denmark), Prof. Bjerknes (Norway), and Prof. Nordenskjöld (Sweden); General Secretary, Dr. Hans Pettersson.

At the first general meeting which was open to the public, three papers were read. (i.) By Prof. Bjerknes, of Bergen, on "Weather Forecasting," describing a new and most successful method of short range prognostics for agricultural purposes established in West Norway during the summer of 1918, based on synoptic observations, especially of the wind, from a large number of meteorological stations along the west coast of Norway, the percentage of correct forecasts having been between eighty-five and ninety. (ii.) Prof. Knudsen, of Copenhagen, read a paper on "Hydrographical observations on the west coast on Greenland by the late Dr. T.

Wulff." (iii.) Prof. Arrhenius, of Stockholm, read a paper on "Some observations of the Aurora Borealis."

During the following days general and sectional meetings were held. In all thirty papers were read, many of these being of very great interest. One afternoon was devoted to the phenomena of the Aurora Borealis, a forenoon to weather forecasting, and the last afternoon was occupied by very animated discussions regarding future Scandinavian co-operation in different branches of geophysical science. Finally resolutions were moved and adopted by the Congress *in pleno*, and a committee formed with the object of calling together a second Congress in due course.

A publication, giving abstracts of the papers read before the Congress, and the resolutions adopted, will shortly be published.

Among the papers read were the following :—

August 28th :—Prof. Vegard (Christiania), "Results from observations of the Aurora Borealis, at Haldde"; Prof. Störmer (Christiania), "Photographic altitude measurements of the Aurora Borealis in Christiania, 1917 and 1918"; Dr. Stenqvist (Stockholm), "On the desirability of making observations of the polarization of diffuse daylight, especially in North Scandinavia"; Dr. K. Modin (Stockholm), "Observations of the Aurora Borealis in Sweden since 1881."

August 29th :—Prof. De Geer (Stockholm), "On a possible method of estimating post-tertiary solar activity"; Prof. Helland-Hansen (Bergen), "Investigations of surface-temperatures in the North Atlantic and their prognostic value"; Dr. A. Wallén (Stockholm), "Forecasting the flow of water in rivers"; Prof. Hesselberg (Christiania), "Turbulent motion in the atmosphere"; Dr. Wallén (Stockholm), "Atmospheric precipitation as dependent on the wind, the altitude and the geographical situation in south Sweden"; Dr. Sandström (Stockholm), "The distribution of atmospheric pressure and its causes"; Dr. Angström (Upsala), on "Temperature variations in the upper strata and their relationship with atmospheric transmission and solar activity"; Dr. Sondén (Stockholm), "Hygienic importance of vertical circulation"; Dr. Gaarder (Bergen), "Influence of the atmospheric variations over North Europe on hydrographic changes in the Christianiafjord"; Dr. Hans Pettersson (Gothenburg), "Vertical movements in the sea on the west coast of Sweden."

August 30th :—Dr. Wallén (Stockholm), "On the run-off and evaporation in the Lagan valley"; Dr. Sandström (Stockholm), "Weather forecasting for airmen"; Captain Wallgren (Stockholm), "Local weather forecasting according to simple observations"; Prof. Hamberg (Upsala), "Movements of the ice on Lake Sommen in February and March, 1918."

The afternoon of the 30th was devoted to an excursion to the Trollhättan waterfalls.

August 31st :—Prof. O. Pettersson, "Cosmic influences on the internal movements in the sea and the atmosphere"; Dr. Ahlmann and Dr. Sandström, "Geophysical studies in West Norway"; Prof. Hesselberg (Christiania), "Scandinavian co-operation in aërological science"; Prof. Helland-Hansen (Bergen), "Scandinavian co-operation in geophysical science."

Resolutions adopted by the Congress.

I.—In favour of an extension of the existing system of simultaneous photographic altitude measurements of the Aurora Borealis started by Prof. Störmer to comprise the whole of Scandinavia during the winter, 1918-19. (Moved by Prof. Störmer, of Christiania).

II.—In favour of the plan proposed by Prof. De Gerr, that measurements of the yearly deposits of loam occurring in lakes blocked by ice, and in shallow bights, which derive from the melting o Scandinavian and Arctic glaciers, should be carried out in conf nection with De Geer's geochronological measurements of the annual-striæ in post-tertiary deposits of similar origin. (Moved by Prof. De Geer.)

III.—In favour of establishing a system of continuous synoptic observations of the internal movements in the sea round the coasts of Scandinavia compared with simultaneous meteorological phenomena and fishery statistics. (Moved by Dr. Hans Pettersson, Sweden, and others.)

IV.—In favour of the establishment of ærological observations in different parts of Scandinavia. (Moved by Prof. Hesselberg, Christiania.)

V.—Emphasizing the need for co-operation between the geophysicists of the Scandinavian countries, both with regard to laboratory and field research, which proposal the governments of these countries are requested to facilitate as much as possible.

VI.—In favour of the project that a first-class scientific institute shall be established in Gothenburg for oceanography, marine meteorology and aerology, with the object of studying the dynamics of the movements occurring in the atmosphere and the sea, which determine the climate and the weather of the Scandinavian countries, and of studying the influence of these factors on agriculture, fisheries, navigation and aëronautics. (Moved by Prof. O. Pettersson and seconded by ten representatives for Denmark, Sweden and Norway.)

WORK AND WATER POWER.

By Hugh Robert Mill.

(*concluded.*)

Whenever the full benefit of the natural water-power is wanted, nature must be assisted by some method of storage so that a uniform flow of water can be maintained either during normal working hours or throughout the twenty-four hours of every day in the year. Here the professional skill of the water-engineer is necessary before the mechanical or electrical engineer can make use of the natural power, and the water-engineer has to depend on certain natural laws and relationships which have been worked out by the scientific study of the results obtained by Observers of rainfall.

Let us suppose that there is a lake situated in a valley 500 feet above sea-level, with 50 square miles of land draining into it and a river flowing out by a steep course to the sea. An engineer on examining the district has fixed upon a site for a power-station at which 400 feet of fall can be utilized, and he proposes to build a dam across the outlet of the lake in order to raise its level and increase the storage of water so that he can draw off a uniform supply for the turbines at the power-station. Before he can decide on the amount of storage required or on the power which will be available he must know the average annual rainfall on the ground—this is necessary because it would take many years to measure the fluctuations in the flow of the stream. I have explained in some detail the way in which the rainfall of a gathering ground can be ascertained in a paper on "The Rainfall of the Forth Valley and the Construction of a Rainfall Map," in *British Rainfall, 1915*, to which the reader is referred for the manner of ascertaining the average rainfall of an area. It depends, of course, on long-continued records of rainfall, but the important fact, and one which is not generally realized, is that such records need not all be upon the area in question. Observations in contiguous, and sometimes even in rather remote areas, are necessary in order to give certainty as to the general distribution of rain over the countryside of which the gathering ground forms part. In this way the daily readings of a rain gauge in a little cottage garden may provide the essential data for determining the value of a water-power many miles away. Let us suppose that the general rainfall is 60 inches over the gathering ground for an average of 35 years. Experience has shown that the mean annual rainfall of the three driest years likely to occur consecutively is 80 per cent. of the average, and engineers have adopted this figure in calculating the water available in any gathering ground. A certain part of the annual rainfall is lost by evaporation from the surface, transpiration through vegetation and percolation into the ground. For this loss an amount equal to from 12 to 16 inches of rainfall is usually allowed, according to local conditions, and for our purpose we may take it as 14 inches. The available rainfall from our hypothetical area is thus 80 per cent. of 60 inches, less 14 inches; that is to say, 34 inches per annum. In the case of water taken for the supply of distant towns Parliament usually requires that from one-quarter to one-third of the available rainfall shall be returned to the streams by way of compensation for the water abstracted; but in power works, where the water may be diverted from the stream for only a short distance, no definite practice has yet been established, and, for the present, compensation water may be ignored.

Now 34 inches over 50 square miles is 1,700 square-mile-inches, and 1 square-mile-inch in a year is equivalent to very nearly 40,000 gallons per day, the whole available volume of water on the area would be 68 million gallons, or 680,000,000 lbs, in a day, or 472,000 lbs. per minute, day and night throughout the year. With an effective fall of 400 feet, as assumed, this would equal 188,800,000 foot-pounds per minute, or 5,721 horse-power, which, with 70 per cent. efficiency of the turbines and dynamos, would correspond to 4,000 electric horse-power, or 2,984 kilowatts continuously developed.

The work done by water falling down hill, is, as in the case of the bottle-smashing illustration, with which this article began, the exact equivalent of the work done in carrying the water up-hill to begin with. And since in our country water is always falling down-hill day and night all the year round, water to the same amount must be being carried up-hill all the time. It is carried through the air in the form of vapour mainly from the surface of the sea probably at great distances from the land, and it is all raised by the action of heat, the heat of the sun acting it may be as far away as the tropical ocean. However, it comes there we know with absolute certainty that every gallon of water dropped from the clouds on the top of Ben Nevis has required the expenditure of at least 44,000 foot-pounds of work to bring it there, and this is altogether independent of the heat required to change the water from the liquid to the gaseous state, or to move it horizontally against the friction of the air. It follows that the fall of the gallon of water from the top of Ben Nevis to the sea would, if it could all be utilized, produce 44,000 foot-pounds of work which could by appropriate means be transformed into an equivalent amount of any other form of energy. Hence, if we look on falling water as the weight which drives a clock, the heat of the sun is the hand that winds it up. As the winding up by the sun never ceases so the falling of water is a source of power which is always renewed.

Fuel as a vehicle of energy is equally a result of solar radiation, though in this case it is a slow business, for much time is required for the leaves of a plant to store up the carbon and hydrogen which the sun's light separates from the oxygen of carbonic acid gas and water, and an enormously greater time for vegetable matter to assume the density of coal. A very short time, indeed, suffices to re-unite the carbon and hydrogen with the oxygen of the air, hence mineral fuel as a source of energy can be exhausted if used to its full available extent, while water-power is renewed to its full extent for ever as long as the sun continues to shine. Burning coal is like living on capital, harnessing water-power is like living on income; but the source of capital, which is only saved income, and of current income alike is the sun.

There is a tendency for people to whom the value of water power is a new idea to exaggerate its utility. As compared with coal or other fuel water-power labours under the disadvantage that it can only be generated in places where the necessary fall can be obtained. Although electrical energy can be transmitted for 200 miles or more from the place where it is generated by water-power long transmission lines are very costly, and they may only be economically possible in cases where water-power can be utilized very cheaply and where the alternative use of fuel is very costly. In this country it may be said roughly that the proportion of the natural water-power which it would pay to utilize depends on the price of coal. As the cost of fuel rises it becomes worth while to draw on sources of water-power, which from remoteness, or cost of works, could never pay while coal is cheap.

The utilization of tidal power is quite different in character, for though water is the medium the work obtained from it through the tide-raising power of gravitation is taken not from solar heat but from the rotation of the Earth itself. In the long run a full utilization of tidal power would make the Earth rotate more slowly and increase the length of the day, although by an amount too slight to be perceptible in the probable duration of human existence.

METEOROLOGICAL NEWS AND NOTES.

Phenological Observers, Royal Meteorological Society. —Fresh helpers would be greatly valued especially in the less populous regions in the west and north of Great Britain and in all parts of Ireland. Forms and a sample copy of the annual report will be gladly sent by the Assistant Secretary, 70, Victoria Street, S.W.1.

Mr. H. E. Carter, chief computer to the British Rainfall Organization, has, we are glad to report, returned from Germany, where he had been confined as a prisoner of war since March, 1918. He took up his duties in the Office of the Organization again on January 1st, 1919.

Correspondence.

To the Editorof Symons's Meteorological Magazine.

WEATHER CONDITIONS ILLUSTRATED BY FLOWER PHENOLOGY.

My local flower counts for (*a.*) December, and (*b.*) the Christmas to New Year period, aim at determining the characteristics of the transition period from the old phenological season to the new. The former values (*a*) illustrate primarily the lingering on from the old, secondarily the amount of pre-seasonal stimulation for the new season by the number of flowers reasonably assignable to the same. The latter values (*b.*) indicate the extent of December influences in destroying the former and checking the latter. The value for this purpose is well brought out by the striking local contrast caused by the almost unprecedented warmth of last month, with 50° or above (57°·5 twice) on nineteen days and frost on the ground only on the 24th, 25th and 26th, compared with December, 1917, as exceptionally cold. In that year only three flowers opened first after November 30th, against sixteen in 1918.

Except to note the usefulness of roses, space will not allow further indicating the facts illustrated by the table ; but comparison is easier as both years gave nearly the same December total and that differs little from the fourteen years mean.

Flowers in bloom at Purley (330-400 ft.), and Wild Flowers casually noted in District :—

	Wild Flowers	Roses.	Other Garden Flowers.	Total.	Fresh Season's Flowers.	
					Garden.	Wild.
1917.................. *a*	46	32	62	140	20	2
1917/8.............. *b*	11	2	30	43	...	...
1918.................. *a*	44	25	65	134	17	3
1918/9.............. *b*	37	16	56	109	...	...
4 years mean...... *a*	40	30	52	122	17	3½
,, ,, ... *b*	30	14	44	88	...	..

a—During December.
b—From Sunday before Christmas to Sunday of or after New Year's Day.

Asgarth, Purley, January 5th, 1919.

J. EDMUND CLARK.

BAROMETRIC PRESSURE AND THUNDERSTORMS.

In respect to Mr. Weston's letter in the November number I have often pointed out in this Magazine what I think is officially well-known, that in this country the real thunderstorms occur with a complex and irregular pressure distribution, especially in the neck or between anti-cyclones. Thunder showers or storms of a milder kind often occur with a definite cyclonic distribution; but, speaking generally, true cyclonic conditions involving much general wind motion are not favourable in this country to severe electrical development. Personally I never take a summer thunderstorm seriously if there is anything like a conspicuous amount of general surface wind on the day in question, and I find it a golden rule. Mr. Weston might study the condition attending the series of terrific thunderstorms that characterized the two very hot Mays of 1917 and 1918. L. C. W. BONACINA.

Hampstead, December 4th, 1918.

CLOUD BURST NEAR HEMEL HEMPSTEAD.

At 18h. 20m., upon the roof of the small conservatory off my dining-room, there was a sound as of a violent hail-storm. There was, however, no hail, but rain in veritable sheets, so thick that I could hardly see the clouds which were very low and sombrely threaten' ing. The duration of rain was about three minutes. At 21h. the rain was standing on the lawn, and I measured 8·3 mm.

The total duration of rain between 9h. and 21h. was at the outside an hour, from 17½h. to 18½h., and the rain was ordinary rain fairly heavy, nearly the whole of the rain falling in the three minutes of the cloud-burst.

The squall marked the passage of the trough of a depression, the motion of which across the Midlands appears to have been rather irregular. Heavy rain occurred at Amersham (about 18h. 15m.), and at Aylesbury. There was also rain in some parts of London between 18h. and 19h., though none was recorded at Kew Observatory or at the Meteorological Office. The squall occurred at Richmond at 18h. 33m., when the maximum wind speed was 19 miles per second, and the wind direction changed from W.S.W. to W.N.W.; not only was there an absence of rain, but another characteristic feature of the true line squall was lacking in the South Kensington record; there was no sudden drop of temperature, but a slight rise from 18h. to 19h., though this was followed by a steady fall of 2°·5 (centigrade) in the next hour.

Reference must also be made to a remarkable difference in character between the barometric conditions before and after the passage of the squall. During the period when the pressure was falling generally, there were continuous oscillating disturbances so that the microbarogram for South Kensington is marked by a series of serrations. A rapid rise of pressure took place about 9h. 40m. (?), and from 19h. 50m. onwards there was hardly any variation.

I do not understand the rapid rise at 9h. 40m. as my barograph shows roughly a fall of half an inch between 0 and 6h. on the 18th, was steady from 6h. to 11½h., fell nearly half an inch from 11½h. to 18h., and then exhibited a slight steady rise.

Golden Parsonage, Hemel Hempstead. ELLIOTT KITCHENER.

VOLUNTARY OBSERVERS AND THE NEW STAR.

ANENT your interesting paragraph, "Voluntary Observers and the New Star," in the *Meteorological Magazine* for September, one at any rate of the 5,000 odd Observers connected with the British Rainfall Organization was an independent "discoverer" of the new star in Aquila. That Observer was myself. From my youth up astronomy and astronomical phenomena have had a fascination for me, and on that eventful Saturday night, June 8th, as is almost invariably my nightly custom, I went out of doors about 10.40 o'clock (G.M.T.) to look round the sky and at the weather.

It was a fine starlit night, and on gazing eastward among a number of bright, familiar orbs, I was attracted by a specially bright one I could not name. I knew it was not a planet, and I could think of no such brilliant star (just a trifle fainter than Altair, near by) at that particular spot. I was convinced then and there that I was looking at a *nova* and, on going indoors, settled the matter by reference to books. It was a rather startling discovery, and equally a piece of rare good luck.

The next night the increased brightness was further confirmation of the fact that a brilliant new star had apparently suddenly blazed out. The question was : When had it been first seen? for no outside news of the discovery had so far come. I had to wait for the answer until the Tuesday morning when Monday's English papers came to hand, then I knew that I had been among the earliest to see the intruder.

Miss Grace Cook, of Stowmarket, was credited with being the first to see the stranger light. This she did at 9.30 G.M.T., and rather more than an hour later I was fortunate enough to detect it myself. Had I telegraphed my discovery to Greenwich Observatory on the Sunday morning I should perhaps have figured with other Observers in the Astronomer Royal's letters to *The Times*. But I did not do so, and consequently lost the chance of honourable mention in connection with an astronomical event so exceedingly interesting and so rare. BASIL T. ROWSWELL.

Les Blanches, St. Martin's, Guernsey, October 28th, 1918.

HEAVY RAIN IN CEYLON.

I HAVE an interesting record which has been sent to me by my brother in Ceylon, Mr. T. H. Chapman, Director of Public Works, Columbo. He tells me that on November 17th, at Jaffna, there were 20·63 in. of rain in 16 hours. Previous records at the same gauge are :—1884—9·92 in. in 24 hours ; 1913—9·64 in. in 24 hours.

SAMUEL C. CHAPMAN.

Town Hall, Torquay, January 7th, 1919.

ROYAL METEOROLOGICAL SOCIETY.

A MEETING was held on December 18th, at 70, Victoria Street, S.W., Sir Napier Shaw, F.R.S., President, in the Chair.

A paper was read by Capt. C. J. P. Cave, R.E., entitled, "A Cloud Phenomenon." On April 15th, 1915, a cloud, with an approximately straight front, approached South Farnborough from the north-west, coming overhead at 9.33 a.m., after which the sky was overcast. At all stations in the eastern and south-eastern counties the record was similar, though the times of cessation of sunshine differed considerably. By comparing the records it was possible to draw an isochronous map showing the times when the cloud front was approximately overhead. At 9 a.m. the line ran from the Isle of Wight to Cromer, at 10 a.m. from the east end of the Isle of Wight, through south-east London, to the sea north off Yarmouth, and at 2 p.m. from between Pevensey and Bexhill to Westgate. The map showed the travel of the cloud front from 7 a.m. to 3 p.m. moving at about 12 miles per hour.

Mr. J. E. Clark, Capt. Wilson-Barker, Mr. R. H. Hooker, Mr. Carle Salter and the President, took part in the discussion, in which the analogy with the isochronous lines of the snow-storm of December 25th-26th, 1906, was referred to (*See British Rainfall*, 1906, p. 25).

A paper by Mr. C. E. P. Brooks, on "A Meteorological Journal at Wei Hai Wei, kept by Comm. A. E. House, 1910 to 1916," was also read. Wei Hai Wei, in the north of China, has a cool summer with a moderate rainfall and a dry bracing winter. Meteorological observations were taken by Comm. House four times daily and include pressure, temperature, humidity, rainfall, wind and weather. These have been summarized and discussed, with notes on the relation of the various elements to wind direction, and on the general climatology and possibilities of Wei Hai Wei.

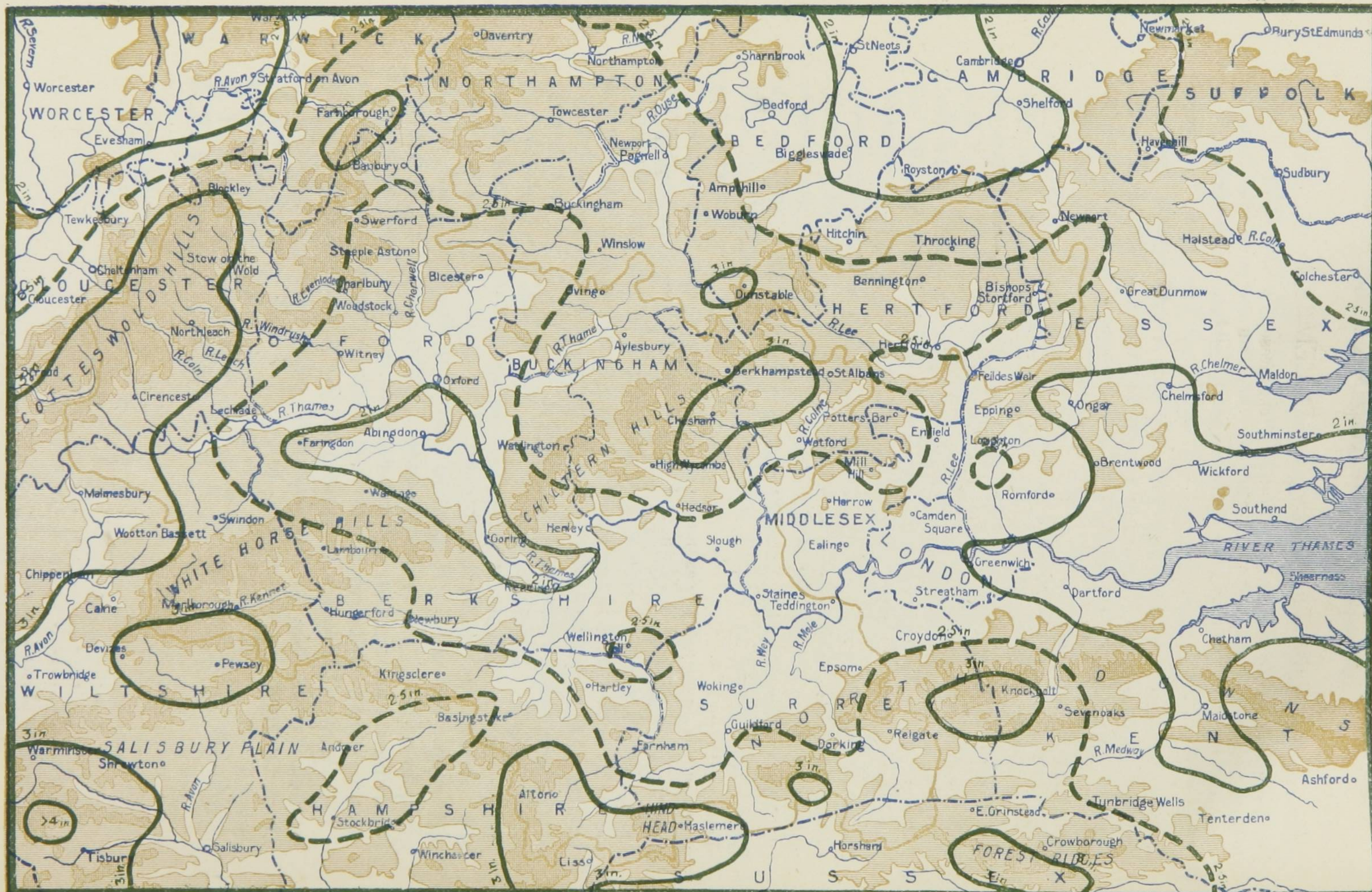
Sir Napier Shaw in expressing the indebtedness of meteorologists to Comm. House, and to Mr. Brooks for enabling these valuable results to be placed on record, suggested that climatologists were apt to push too far the principle of the monsoon as a factor of climate and as a consequence to neglect other important features.

A paper on "Annual Symmetrical Variation and the Choice of Seasons," was read by Capt. E. H. Chapman, R.E. The mean monthly temperatures for the Midland counties are most symmetrical for the year from February to January. The mean monthly values of various meteorological elements are symmetrical for the calendar year January to December. Mean weekly temperatures for the Midland counties are symmetrical for a year commencing with the 5th week of one year and ending with the 4th week of the following year. The method used to show annual symmetry was to draw the first half of the curve forwards and the second half backwards along the ordinates of the first half, the nearness of the two portions of the curve showing the degree of symmetry. Annual symmetrical variation makes the division of the year into seasons a difficult matter. There is evidence in favour of making March a winter month. The usual meteorological three monthly seasons are too early in the year, while the astronomical seasons are too late. An alternative suggestion of three monthly seasons, from the middle of December to the middle of March, etc., was put forward.

An animated discussion took place turning on the choice of seasons for meteorological purposes. Mr. C. Harding strongly advocated calling December a winter month and March a spring month, relying principally upon temperature and sunshine data. Mr. L. C. W. Bonacina spoke of the contrasts between the weather of the solstitial seasons, and Dr. C. Chree of the seasonal magnetic variations suggesting November to January as the true winter period. Major Taylor called attention to the earlier temperature seasons in the atmospheric strata at a level of 14 kilometres above the Earth. Sir Napier Shaw in deprecating any attempt to define too rigidly the seasonal limits mentioned that these varied widely in different parts of the globe, and also that the names of the seasons had a traditional significance in literature which they would probably retain in spite of any attempt to restrict their meaning for particular purposes.

The following candidates were balloted for and elected Fellows of the Society :—Miss M. Proctor, Messrs. G. E. Barton, F. L. Halliwell, J. Morrison, A. Payze, W. H. Rose, W. A. Ru Keyser, G. F. Simpson, W. H. G. Spindler, J. S. Turner, J. F. Woodroffe, J. B. Williamson, L. Whitwam.

THAMES VALLEY RAINFALL DECEMBER, 1918



ALTITUDE SCALE

Below 250 feet	250 to 500 feet	500 to 1000 feet	Above 1000 feet

SCALE OF MILES
0 5 10 15 20

Symons's Meteorological Magazine

Watershed of River Thames above Taddington, and River Lee above Feildes Weir.

Isohyetals

THE WEATHER OF DECEMBER.

THE ruling feature, so far, in the weather of the present winter, has been the almost ceaseless arrival on our shores of Atlantic storm systems, bringing with them volumes of air, usually mild and very humid, and, in short, of distinctly oceanic origin.

In the earlier half of December most of the disturbances passed northward or north-eastward, beyond the Irish and Scottish coasts. The prevailing winds were therefore southerly or south-westerly, often strong in force, and reaching a gale in the west between the 10th and 12th, when the gusts at Falmouth (Pendennis Castle), and Quilty (Co. Clare) attained a velocity of seventy miles per hour. The weather was, as a rule, extremely mild, more especially in the opening week, and again on the 12th or 13th. On each occasion the midday temperatures reached 55°, or more, in nearly all parts of the country, a reading as high as 60° being recorded at Dublin on the 4th, at Scarborough on the 5th, and at Birr Castle on the 8th. Scarcely any frost was experienced over England and Ireland, but in Scotland the nights of the 10th and 11th were seasonably cold, the shade temperature at two high level stations, Balmoral and West Linton, falling respectively to 24° and 25°.

In the latter half of the month, when the centres of the Atlantic disturbances advanced more directly over the United Kingdom, the wind occasionally got round to W. or N.W., and although mild weather still predominated, the fluctuations in temperature were rather considerable. The deepest depressions were those of the 19th to 20th, the 23rd and the 30th. In each case the wind rose to a gale on many parts of the coast, and at Aberdeen, on the 23rd, the gusts from the north-westward reached a velocity of 72 miles per hour. Sharp frost occurred in Scotland on the nights of the 19th and 20th, when the sheltered thermometer fell slightly below 20° in several places. On the grass a reading as low as 15° was recorded at Balmoral, and a reading of 14° at Eskdalemuir and West Linton. During a short spell of clear brisk weather which occurred over England, most opportunely, just at Christmas, frost was experienced further south, shade temperatures slightly below 25° being recorded at several English stations. Over North Britain the minimum readings were in many cases below 20°, and in a few places very little above 15°. Towards the end of the month mild southerly and south-westerly winds again became general, and on the 28th the midday temperature was in many districts as high as 55°.

The mean temperature of December was well above the average, the excess being greatest over eastern, central and southern England. Owing to an occasional brilliantly fine day the total duration of recorded sunshine differed but little from the normal.

Aurora was seen rather frequently in Scotland, and a brilliant display occurred on the 25th, not only over northern districts generally, but as far south as Norfolk and Worcestershire.

The total rainfall was, on the whole, excessive, falling below the average only in the east and centre of Scotland and in a small part of the south of England. More than 50 per cent. above the average fell in the north-west of England, in South Wales and part of the south of Ireland, and the total reached double the average at one or two stations in the north-west of England. Less than 3 inches fell over most of the south-east of England, and almost the whole of the east of Scotland, but hardly anywhere in Ireland. More than 6 inches was general over western districts, and the fall rose to more than 10 inches widely in Wales and other mountainous areas.

The general rainfall, expressed as a percentage of the average, was :— England and Wales, 153 ; Scotland, 98 ; Ireland, 139 ; British Isles, 132.

In London (Camden Square), the mean temperature was 45°·6, or 5°·9 above the average, and the highest value with two exceptions recorded in December in 61 years. The duration of sunshine was 12·1 hours, and of rainfall 60·1 hours. Evaporation, ·24 inches.

RAINFALL TABLE FOR DECEMBER, 1918.

STATION.	COUNTY.	RAINFALL. Aver. 1875—1909. in.	1918. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Date.	Nos. of Day
Camden Square................	*London*......	2·13	2·34	+ ·21	110	·41	10	25
Tenterden.......................	*Kent*	2·77	2·08	— ·69	75	·32	17	27
Arundel (Patching)...........	*Sussex*	2·91	2·50	— ·41	86	·44	9	23
Fordingbridge (Oaklands)...	*Hampshire*	3·35	3·10	— ·25	93	·48	10	26
Oxford (Magdalen College).	*Oxfordshire*	2·06	1·99	— ·07	97	·29	22	24
Wellingborough(Swanspool)	*Northampn*	2·13	2·24	+ ·11	105	·42	18	25
Bury St. Edmunds(Westley)	*Suffolk*	2·14	3·01	+ ·87	141	·54	18	25
Geldeston [Beccles]...........	*Norfolk*......	2·07	3·08	+1·01	149	·43	28	27
Polapit Tamar [Launceston]	*Devon*	4·46	6·54	+2·08	147	·55	4	30
Rousdon [Lyme Regis]	,, ...	3·68	3·19	— ·49	87	·47	21	27
Stroud (Field Place)	*Gloucester* ..	2·71	2·94	+ ·23	109	·78	20	15
Church Stretton (Wolstaston)	*Shropshire*..	2·99	4·67	+1·68	156	·48	2	19
Boston	*Lincoln*......	1·88	2·62	+ ·74	139	·41	28	27
Worksop (Hodsock Priory)	*Nottingham*	2·17	2·65	+ ·48	122	·45	19	20
Mickleover Manor	*Derbyshire*	2·38	3·87	+1·49	162	·54	22	23
Congleton (Buglawton Vic.)	*Cheshire* ...	2·89	5·09	+2·20	176	·60	28	28
Southport (Hesketh Park)..	*Lancashire*	3·10	6·68	+3·58	215	·88	15	27
Wetherby (Ribston Hall) ...	*York, W.R.*	2·27	5·08	+2·81	224	1·08	22	16
Hull (Pearson Park)	,, *E.R.*	2·32	3·10	+ ·78	134	·43	15	23
Newcastle (Town Moor) ...	*North'land*	2·46	3·60	+1·14	146	·77	30	18
Borrowdale (Seathwaite) ...	*Cumberland*	15·14	33·83	+18·69	223	...	...	...
Cardiff (Ely)....................	*Glamorgan*	4·70	7·03	+2·33	150	·85	26	30
Haverfordwest.................	*Pembroke*...	5·18	8·06	+2·88	156	·93	2	27
Aberystwyth (Gogerddan)..	*Cardigan* ...	4·66	8·09	+3·43	174	·87	2	26
Llandudno	*Carnarvon*	2·84	3·50	+ ·66	123	·54	15	25
Cargen [Dumfries]	*Kirkcudbrt.*	4·84	5·41	+ ·57	112	·85	30	24
Marchmont House	*Berwick*......	2·83	2·26	— ·57	80	·56	22	16
Girvan (Pinmore)	*Ayr*	5·48	6·82	+1·34	124	·65	23	28
Glasgow (Queen's Park) ...	*Renfrew* ...	3·95	3·98	+ ·03	101	·83	23	23
Islay (Eallabus)	*Argyll*	5·73	7·79	+2·06	136	·73	22	31
Mull (Quinish).................	,, ...	6·59	8·40	+1·81	127	·89	19	29
Balquhidder (Stronvar)......	*Perth*.........	8·83	...	...	...	...	...	..
Dundee (Eastern Necropolis)	*Forfar*	2·67	1·65	—1·02	62	·28	22	19
Braemar	*Aberdeen* ...	3·13	2·10	—1·03	67	·70	24	19
Aberdeen (Cranford)	,, ...	3·43	2·36	—1·07	69	·49	22	23
Gordon Castle	*Moray*	2·72	2·50	— ·22	92	·32	30	21
Drumnadrochit	*Inverness* ...	3·76	2·95	— ·81	78	·44	11	23
Fort William	,, ...	9·41	7·72	—1·69	82	·65	11	26
Loch Torridon (Bendamph)	*Ross*	9·86	9·07	— ·79	92	·73	26	27*
Dunrobin Castle	*Sutherland*	3·09	4·13	+1·04	130	·55	22	17
Glanmire (Lota Lodge)	*Cork*	5·29	6·84	+1·55	129	1·02	7	27
Killarney (District Asylum)	*Kerry*	6·92	9·56	+2·64	138	·95	7	30
Waterford (Brook Lodge)...	*Waterford*	4·32	5·50	+1 18	127	·65	14	22
Nenagh (Castle Lough)......	*Tipperary*...	4·34	7·18	+2·84	165	·80	18	25
Ennistymon House...........	*Clare*.........	5·03	8·21	+3·18	164	1·28	21	30
Gorey (Courtown House) ..	*Wexford* ...	3·42	6·20	+2·78	181	1·35	15	22
Abbey Leix (Blandsfort)....	*Queen's Co.*	3·41	4·89	+1·48	143	·68	18	24
Dublin(FitzWilliamSquare)	*Dublin*	2·27	2·53	+ ·26	111	·58	15	23
Mullingar (Belvedere)	*Westmeath*	3·39	4·16	+ ·77	123	·60	2	22
Crossmolina (Enniscoe)......	*Mayo*.........	6·11	7·67	+1·56	125	·95	17	30
Cong (The Glebe).............	,, ...	5·42	7·01	+1·59	129	·68	17	29
Collooney (Markree Obsy.).	*Sligo*	4·34	6·45	+2·11	148	·64	28	29
Seaforde	*Down*.........	3·77	4·89	+1·12	130	1·06	28	25
Ballymena (Harryville)......	*Antrim*......	3·97	5·10	+1·13	128	·71	28	29
Omagh (Edenfel)	*Tyrone*	3·91	5·06	+1·15	129	1·00	28	25

SUPPLEMENTARY RAINFALL, DECEMBER, 1918.

Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	3·15
,,	Ramsgate	1·75
,,	Hailsham	2·65
,,	Totland Bay, Aston House...	2·68
,,	Stockbridge, Ashley..	2·82
,,	Grayshott	3·30
III.	Harrow Weald, Hill House...	2·15
,,	Pitsford, Sedgebrook....	2·41
,,	Woburn, Milton Bryant......	2·62
,,	Chatteris, The Priory...... ...	1·68
IV.	Elsenham, Gaunts End	2·69
,,	Shoeburyness	...
,,	Colchester, Hill Ho., Lexden	2·65
,,	Ipswich, Rookwood, Copdock	2·88
,,	Aylsham, Rippon Hall.... ..	3·75
,,	Swaffham	3·79
V.	Bishops Cannings	3·52
,,	Weymouth	2·59
,,	Ashburton, Druid House.. ...	8·34
,,	Cullompton	4·83
,,	Lynmouth, Rock House	7·19
,,	Okehampton, Oaklands... ...	7·65
,,	Hartland Abbey	5·66
,,	St. Austell, Trevarna	7·59
,,	North Cadbury Rectory.......	3·15
VI.	Clifton, Stoke Bishop	4·39
,,	Ledbury, Underdown...... ...	2·30
,,	Shifnal, Hatton Grange.......	3·59
,,	Droitwich	1·97
,,	Blockley, Upton Wold.........	3·26
VII.	Grantham, Saltersford.........	2·50
,,	Louth Westgate	3·46
,,	Bawtry, Hesley Hall	2·74
,,	Whaley Bridge, Mosley Hall	8·37
,,	Derby, Midland Railway......	3·78
VIII.	Nantwich, Dorfold Hall	4·96
,,	Bolton, Queen's Park	9·76
,,	Lancaster, Strathspey	7·51
IX.	Langsett Moor, Up. Midhope	5·48
,,	Scarborough, Scalby	5·25
,,	Ingleby Greenhow	3·59
,,	Mickleton	3·90
X.	Bellingham, High Green Manor	2·91
,,	Ilderton, Lilburn Cottage ...	2·15
,,	Keswick, The Bank	6·97
XI.	Llanfrechfa Grange	5·45
,,	Treherbert, Tyn-y-waun	...
,,	Carmarthen, The Friary	8·73
,,	Fishguard, Goodwick Station.	6·47
,,	Crickhowell, Tal-y-maes	7·50
,,	Gwern-y-argllwydd	3·80
,,	Birmingham WW., Tyrmynydd	10·91
,,	Lake Vyrnwy	11·05
,,	Llangynhafal, Plas Drâw	3 91
,,	Rhiwbryfdir	16·97
,,	Dolgelly, Bryntirion	9·23
XI.	Lligwy	6·56
,,	Douglas, Isle of Man	...
XII.	Stoneykirk, Ardwell House...	7·50
,,	Carsphairn, Shiel	9·57
,,	Langholm, Drove Road	5·32
XIII.	Selkirk, The Hangingshaw..	2·06
,,	North Berwick Reservoir	1·38
,,	Edinburgh, Royal Observaty.	1·50
XIV.	Biggar	2·63
,,	Maybole, Knockdon Farm ...	4·69
XV.	Buchlyvie, The Manse	...
,,	Ardgour House	12·10
,,	Oban	8·11
,,	Campbeltown, Witchburn ..	...
,,	Holy Loch, Ardnadam	9·39
,,	Tiree, Cornaigmore	...
XVI.	Glenquey	5·20
,,	Loch Rannoch, Dall	4·94
,,	Blair Atholl	2·76
,,	Coupar Angus	1·36
,,	Montrose, Sunnyside Asylum.	1·70
XVII.	Balmoral	2·34
,,	Fyvie Castle	2·72
,,	Keith Station	3·28
XVIII.	Rothiemurchus	2·13
,,	Loch Quoich, Loan	18·50
,,	Skye, Dunvegan	9·69
,,	Fortrose	2·34
,,	Glencarron Lodge	7·84
XIX.	Tongue Manse	4·64
,,	Melvich	4·70
,,	Loch More, Achfary	8·18
XX.	Dunmanway, The Rectory ..	12·41
,,	Mitchelstown Castle	5·77
,,	Gearahameen	18·00
,,	Darrynane Abbey	5·92
,,	Clonmel, Bruce Villa	4·81
,,	Broadford, Hurdlestown	7·35
XXI.	Enniscorthy, Ballyhyland...	6·02
,,	Rathnew, Clonmannon	4·04
,,	Ballycumber, Moorock Lodge	4·49
,,	Balbriggan, Ardgillan	3·30
,,	Castle Forbes Gardens	4·53
XXII.	Ballynahinch Castle	7·70
,,	Woodlawn	4·64
,,	Westport House	2·44
,,	Dugort, Slievemore Hotel ...	7·21
XXIII.	Enniskillen, Portora	4·76
,,	Dartrey [Cootehill]	4·40
,,	Warrenpoint, Manor House ..	4·24
,,	Belfast, Cave Hill Road	4·86
,,	Glenarm Castle	4·69
,,	Londonderry, Creggan Res...	5·43
,,	Milford, The Manse	5·42
,,	Killybegs	8·78

Climatological Table for the British Empire, July, 1918.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	83·5	1	46·1	4	73·3	54·1	53·8	73	92·3	42·9	4·74	18	6·2
Malta	93·6	23	67·5	8	79·6	72·6	...	77	144·0	...	·00	0	1·4
Lagos	87·5	25	72·0	3	82·4	73·8	71·7	81	148·2	70·0	1·03	11	8·0
Cape Town	77·0	14	38·6	25	61·4	48·9	48·0	79	...	...	3·66	12	5·1
Johannesburg	68·2	18	25·1	28	59·6	41·1	34·0	64	...	24·1	·30	3	3·6
Mauritius	75·9	3	53·8	31	73·2	60·3	59·2	78	...	46·1	3·88	26	5·8
Bloemfontein	71·3	20	19·4	25*c*	60·5	33·8	33·6	68	..	...	1·74	5	3·3
Calcutta...	97·0	17	75·2	14	91·4	80·1	78·7	83	...	74·5	7·64	13	8·3
Madras	103·2	12	75·9	2	99·0	80·2	70·2	61	162·4	74·3	·65	5	4·8
Colombo, Ceylon ...	87·7	11	75·2	15*d*	86·4	78·1	73·2	77	153·6	72·5	3·11	13	7·6
Hongkong	91·2	14	74·2	1	86·5	78·4	76·5	84	...	...	11·64	19	7·9
Sydney	70·6	5	37·4	11	61·6	44·5	41·7	72	113·9	28·0	8·26	11	3·6
Melbourne	61·8	5	31·0	21	54·7	42·3	40·7	73	115·1	21·4	1·74	13	7·0
Adelaide	62·5	3	36·3	21	58·4	42·7	44·0	78	122·5	25·1	2·62	15	5·9
Perth	69·6	7	40·1	15	63·7	46·6	45·9	73	126·2	30·9	3·37	6	3·3
Coolgardie	76·8	7	35·5	16	61·0	41·6	39·9	62	131·0	29·2	·62	4	5·5
Brisbane	...	...	...	...	...	...	...	...	...	...	...	...	...
Hobart, Tasmania ..	58·9	6	31·9	22	52·5	39·7	37·3	68	107·0	26·9	3·20	27	6·3
Wellington ...	59·0	8	30·1	27	51·6	39·4	38·6	77	115·0	17·7	4·99	20	5·4
Jamaica, Kingston ..	92·7	11	70·6	9	90·0	73·5	70·6	74	...	...	·24	4	3·4
Grenada	87·0	17*a*	70·0	7	83·0	74·0	...	77	137·0	...	10·57	18	4·0
Toronto	92·4	21	48·0	2	80·5	58·8	58·8	73	144·8	45·0	2·32	7	4·8
Fredericton	91·5	27	48·0	25	74·7	56·8	60·1	82	...	...	7·35	21	6·8
St. John, N.B. ...	78·0	17*b*	39·0	30	61·2	45·4	45·0	83	133·3	31·3	2·25	13	7·0
Victoria, B.C.	78·5	17	46·0	2	66·6	51·2	51·0	77	136·0	39·0	·48	4	5·1

a—26, 29. *b*—12, 31. *c*—26. *d*—27.

Johannesburg.—Bright sunshine 260·7 hours.

COLOMBO, CEYLON.—Mean temp. 82°·2, or 1°·1 above, dew point 0°·8 below, and R 3·17 in. below, averages. Mean hourly velocity of wind 5·7 miles.

HONGKONG.—Mean temp. 81°·8. Bright sunshine 174·8 hours. Mean hourly velocity of wind 9·9 miles.

Sydney.—The lowest July temperature since 1890.

Adelaide.—Mean temp. 1°·0 below, and R ·30 in. below, averages.

Perth.—Rainfall 3·21 in. below average, lowest for July since 1889.

Coolgardie.—Temp. 0°·3 above, and R about ·25 in. below, averages.

Hobart.—Rainfall 1·21 in above average.

Wellington.—Mean temp. 1°·3 below, and R ·97 in. below, averages. Bright sunshine, 127·4 hours.