Symons's Meteorological Magazine.

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William Dillworth Howard, F.I.C.

1832—9th December, 1913.

We regret to announce the death in London, at the age of 81, of William Dillworth Howard, son of John Eliot Howard, F.R.S., and a grandson of the well-known meteorologist, Luke Howard. Mr. Howard was one of the contributors to "British Rainfall" in 1860-61, having made observations at Tottenham from 1850 to 1864.

By his death the small band of surviving original Observers is reduced to eight. After his school education he studied chemistry under the late Prof. A. Williamson, F.R.S., at the Birkbeck Laboratory of University College, and was for many years a Fellow of the Chemical Society, and also one of the original members of the Institute of Chemistry. For nearly half a century Mr. Howard displayed a keen interest in the work of the British Rainfall Organization, to the funds of which he subscribed liberally.

Edmund Douglas Archibald, M.A.

1851—30th November, 1913.

The name of Douglas Archibald will be chiefly remembered in connection with his pioneer work in modern upper air research. In 1882 he revived the use of kites for meteorological observations, and at the same time brought forward a comprehensive programme for the exploration of the air by means of kites, which has since been more than realised. This scheme was outlined at a meeting of the Royal Meteorological Society on November 15th, 1882, but during the next three or four years Mr. Archibald's experiments—in the absence of meteorographs—were confined to ascertaining the increase of wind velocity with elevation. To effect this, four registering anemometers were attached at different points on the kite wire, and thus differential measurements of the velocity of the wind up to a height of 1,200 feet were obtained. Archibald was the first to substitute steel pianoforte wire for the string, the weight, size and cost of the line being thereby diminished. In 1887 he invented the captive kite balloon, and in the same year took the first photograph from a kite.

Mr. Archibald was elected a Fellow of the Royal Meteorological Society in 1877, and served on the Council from 1881 to 1885, being Vice-President in 1883 and 1884. He was an M.A. of Oxford University and a Corresponding Member of the German Meteorological Society. His published works include a portion of the well-known "Report of Krakatoa Eruption," to which he contributed in collaboration with Rollo Russell the chapter on "Sun-glows." He also wrote "Rainfall of the World in connection with Sun-spots," a monograph on the "Climate of Calcutta," being one of the *Indian Meteorological Memoirs*, and "The Story of the Earth's Atmosphere." He was for some time, about 1877, Professor of Mathematics under the Bengal Education Department at Bankipore, and at a later period held a chair in the University of Calcutta.

ROYAL METEOROLOGICAL SOCIETY.

THE second meeting of this Society for the Session was held on Wednesday evening, the 17th December, at the Institution of Civil Engineers, Great George Street, Westminster, S.W., Mr. C. J. P. Cave, President, in the chair.

Mr. Carle Salter, Assistant Director of the British Rainfall Organisation, read a paper, by Mr. Mossman and himself, on the "Great Rainstorm at Doncaster, September 17th, 1913," in the course of which he remarked that on the day in question during a period of disturbed weather characterised by heavy rains in widely separated localities, a remarkably heavy and, in its maximum phase, extremely local fall of rain took place at Doncaster. The storm lasted 14 hours, during which more than 4 inches of rain fell at nine stations, four stations reporting 5 inches or more. The maximum fall observed was 5·50 in. at Brodsworth Gardens, and while more than 5 inches fell over an area of only 27 square miles, no less than 2336 miles experienced a fall exceeding half-an-inch. The area of the storm was roughly oval in shape, the isohyets increasing steadily to a single focus, and so far as could be seen the contour of the land exercised no influence on the outline of the isohyets. The paper dealt in some detail with the rate of fall of the rain at various places in Doncaster and vicinity, from which it was shown that one of the most pronounced features of the storm was the occurrence of very heavy downpours of short duration throughout the day.

There was nothing in the appearance of the weather charts to explain the special local nature of the disturbance in the neighbourhood of Doncaster. An Observer 18 miles south-east of Doncaster reported hail at 9.30 a.m., and further noted that the clouds were moving slowly from the east in the upper, and from the north-west in the lower atmosphere. Thunder and lightning were continuous all day in the central area. The paper concluded with a synopsis of previous remarkable rains experienced in the British Isles.

The President remarked upon the difference in direction of the upper air and surface air currents, and said he had himself experienced a fall of 4 inches of rain in 12 hours in the West Indies when there was a different current above than below.

Mr. F. J. Brodie said such a storm was the despair of the forecaster. East and north-east winds were usually regarded as dry winds, but he cited many instances of heavy rain or snow storms when the wind had been in the N.E. quarter. If a south wind was blowing over a wind between E. and N. there must be a cooling effect resulting in heavy rainfall.

Col. Rawson and Mr. Mellish also took part in the discussion.

"Recent Studies of Snow in the United States" formed the subject of a paper sent by Dr. T. E. Church, Director of the Mount Rose Meteorological Observatory, University of Nevada, U.S.A. A description was given of the various types of snow samplers, weighers and gauges in use, and various aspects of the snow problem were considered, such as the density and water equivalent, the evolution of snow in the field, and the relation of mountains and forests to the conservation of snow.

A paper on "The Meteorological Conditions of an Ice-sheet and their Bearing on the Desiccation of the Globe" was communicated by Mr. C. E. P. Brooks, B.Sc. The first part of the paper dealt with the meteorological conditions over existing ice-sheets and summarised the views of various authorities regarding the distribution of barometric pressure in the Polar regions, from which it was concluded that an extensive ice-sheet will give rise to a permanent anticyclone. The precipitation in a glacial anticyclone was then considered, and found rarely to exceed the equivalent of ten inches of rain, and it was further shown that over a large ice-sheet evaporation is very small, so that the glaciation will increase with quite a moderate snowfall. It was inferred that during the glacial period permanent anticyclones covered the areas occupied by similar ice-sheets, the maximum extent of glaciation taking place simultaneously in different regions and coinciding over the areas without glaciers, in a period of greater rainfall than that which prevails now. A general decrease in temperature would lead to a decrease in the amount of evaporation and hence of precipitation, so that while the general precipitation may have been somewhat less than now taking the globe as a whole, over the ice-sheets so little fell that the remainder falling upon the unglaciated areas rendered these considerably moister than now.

Since the ice-age reached its climax, desiccation has advanced with the recession of the ice. Slight interruptions have taken place, a striking example being from the ninth to the thirteenth centuries when there occurred a cold period in the north, which was associated in the more southerly regions with an increased rainfall.

Dr. W. N. Shaw, initiating the discussion, said that there was one point that greatly interested him, that was the question of the

Antarctic anticyclone. Dr. Hildebrandsson held that the entire region was occupied by a vast cyclonic depression, and M. Teisserenc de Bort had shown that in the upper air, the north and south poles were a sort of focus of cyclonic systems. The speaker had suggested that the surface circulation at the poles was not the same as it was above. His impression was that at a height of 4 kilometers (2½ miles) the circulation was cyclonic, but that near the surface, somewhere about the Antarctic Circle the immense masses of cold air produced a circulation in an opposite direction. He thought that the polar anticyclone was, in fact, partly the creation of meteorologists, and partly due to the reduction of the pressure to sea level. Dr. Shaw suggested that the flowing down of cooled air from the great height of 15,000 feet to the lower levels would at sea-level set up an anti-cyclonic circulation, while the blizzards so characteristic of the Antarctic were more likely to be cascades of air, than specimens of that circulation.

Captain Lyons said that in N.E. Africa all signs of a period of heavy rain, if any ever existed, had long since disappeared.

Mr. E. Gold said that Dr. Church, in his paper, showed that between temperatures of 25° and 30° F. the evaporation in 12 hours was about ·10 in. He thought that in taking snow depths as a measurement of rainfall it was difficult to distinguish between recent falls and accumulated snow, and Mr. Brooks had perhaps not taken sufficient account of evaporation of snow in the period of observation.

Colonel Rawson remarked that he had collected data of, and himself experienced, heavy rain in the centre of an anti-cyclone.

Mr. Hooker, Mr. Tripp and Mr. Bryant also took part in the discussion.

The following new fellows were elected :—Mr. Harris Booth, B.A., Major W. S. Brancker, Mr. A. Samler Brown, Mrs. Lucy Cave, Mr. Henry Coanda, Mr. Alexander Gross, Mr. J. M. Hatfield, Lieut. F. Vesey Holt, Mr. James Hutcheon, M.A., Lieut. J. R. F. Lecky, Major H. Musgrave, The Lady Tredegar, Mr, W. H. Weldon, C.V.O., Staff-Surgeon H. V. Wells, Captain H. F. Wood.

SCOTTISH METEOROLOGICAL SOCIETY.

The Annual Business Meeting of the Society was held in the Goold Hall, Edinburgh, on the 17th December, 1913, Mr. T. Mackay Bernard, of Dunsinnan, B.Sc., F.R.S.E., President, in the chair.

The proceedings opened with the reading of the Report from the Council, which contained the following important announcement :—

"In their Report to the Society in December, 1912, the Council stated that they had in March, 1912, lodged an application with the Registrar-General for Scotland for a grant sufficient to defray the entire cost of the reports supplied to him by the Society. That application was forwarded by the Registrar-General to the Scottish Office, and by the Secretary of State for Scotland to the Treasury, and was finally referred to the Meteorological Committee, London, which is responsible for the expenditure of the Parliamentary grant for meteorology. Dr. Shaw, as Chairman of this Committee and Director of the Meteorological Office, visited Edinburgh, and discussed the situation with a Committee of the Council, and ultimately an arrangement was come to between the Council on the one hand, as representing the Society, and the Meteorological Committee on the other hand. It was agreed that as regards the publication of statistics and the supply of information to the public the Society should enter into close relations with the Meteorological Office, confining its independent activities to the furthering of what may be called the primary purposes of the Society—that is, the encouragement of research and the publication of scientific papers. On the financial side, an annual payment of £100, which has been made to the Society since 1894 in consideration of the reports supplied to the Registrar-General for Scotland, will be continued, and, in addition, an annual grant of £350 will be made by the Meteorological Committee. In consideration of these payments from Government sources the Society will maintain a Public Office in Edinburgh, and will supply to the Registrar-General for Scotland and to the Meteorological Office, London, the reports and observations required for their purposes."

The Chairman, in moving the adoption of the report, called special attention to those paragraphs dealing with the financial position of the Society and its new relations to the Meteorological Office. They would, he said, have noticed that Government grants of the total annual amount of £450 would be available in future, and that in consideration of those grants the Society was under obligation to maintain an office and staff, and to furnish such reports and statistical information for the Scottish area as might be required by the Meteorological Office and the Department of the Registrar-General for Scotland. In addition, the public would have, under suitable regulations, a right of access to the original returns on which such reports were based. They would have noted also that a Committee, composed of three representatives of the Society and three representatives of public departments, had been constituted for the administration of those grants. The allocation of a considerable sum of Government money naturally involved some new body of control, and advantages might be expected to result from the interchange of views amongst the members of the new Committee as to the ways in which the information available might be made most useful to the public. It was a matter of gratification to the Council that the Society's services to the public over a long period of years had received recognition, and that the Society's office was now, as regarded one side of its activities, to fill the place of a public Central Office for Scotland. It remained for the Society as a Society to devote its energies to the promotion and encouragement of scientific research.

The following were appointed office-bearers and Council for the ensuing twelve months :—

President—J. Mackay Bernard, of Dunsinnan, B.Sc., F.R.S.E. ; *Vice-Presidents*—Gilbert Thomson, Professor R. A. Sampson, D.Sc., F.R.S. ; *Council*—G. G. Chisholm, M. M'Callum Fairgrieve, Professor A. Crum Brown, Dr. J. R. Milne, T. S. Muir, Dr. C. G. Knott, James Watt, W.S., Dr. A. Crichton Mitchell, Sir R. P. Wright ; *Hon. Secretaries*—Dr. R. T. Omond, E. M. Wedderburn, D.Sc., W.S. ; *Hon. Treasurer*—W. B. Wilson, W.S.

Thereafter Dr. E. M. Wedderburn read a paper "On the Appearance of the Surface of Fresh-Water Lochs in Calm Weather," in the course of which he discussed the appearance of oily patches and of scum, which recently formed the subject of correspondence in *The Scotsman.* Samples of scum collected on Lochs Earn and Voil, and analysed by Professor James Ritchie, seemed to show conclusively that the cause of the scum was not soot carried by winds from large cities, and the conclusion come to was that the scum was due to decomposing matter resting on the bottom and shores of lochs, agitated and brought to the surface during stormy weather by wind-produced currents. The oily patches so often seen on the surface of fresh water, and which were often supposed to be an indication of changeable and wet weather, appeared to be caused by oils coming from various sources of pollution, frequently from the fats set free on the decomposition of organic matter. They were most frequently seen in changeable weather, as during settled weather, either fair or foul, the oils were evenly distributed over the surface of the water, and only when winds were light and variable did the patches make their appearance.

SOUTHERN HEMISPHERE SEASONAL CORRELATIONS.

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

(of the Argentine Meteorological Office).

Seventh Article—(*concluded*).

In conclusion, as regards the practical value of this class of research, some glimpses of which have been obtained in the foregoing series of articles, while it certainly opens up prospects of the possibility of long range weather forecasts in some instances, yet until we obtain some definite knowledge regarding the physical processes by which the observed correlations are brought about and the permanence or otherwise of the leading features, we cannot with any degree of confidence utilise the information. Are the correlations such as that observed from 1876 to 1894 between the Trinidad rainfall from April to September and that at Ajo for the following six months, fortuitous phenomena or subject to a cyclical repetition? If so, will the next period of agreement be of the same length as that already observed? Time only can settle such questions, unless we can in the meanwhile obtain a clue as to what is at the root of the matter. It is almost certain that the inter-action is world-wide, but even to-day we have not weather data for many regions to enable us to investigate the meteorological inter-relations existing between regions far distant.

We must, therefore, make an examination of the normal meteorological conditions, based on world maps deduced from the greatly extended, improved and homogeneous, mass of material that has accumulated since Buchan—a quarter of a century ago—issued his celebrated "*Challenger*" *Report on Atmospheric Circulation.* As an essential feature of this study another polar—a bi-polar—campaign is required with numerous fixed stations at work during a minimum period of 2½ years, so as to give a complete representation of the meteorology of the Arctic and Antarctic zones. In this connection a station at the South Pole should be set up and maintained — this is merely a matter of expense, combined with improved methods of transport. Stations are also required on the islands strewn over the ocean wastes, particularly those in the southern hemisphere. The equatorial belt should be specially investigated, and research ships should be kept cruising about in areas not covered by ordinary trade routes, or having islands available on which to establish observatories. Materials for the preparation of daily maps of the whole globe would thus be ready, the study of which would pave the way for the application of the data to the elucidation of the utilitarian problems in hand. The International Arctic campaign of the years 1882-83 was restricted to the northern hemisphere, the Antarctic co-operation of 1901-1904 stopped short at the thirtieth parallel of south latitude; we require now the extension of the area of synoptic observation over the whole world.

There is no reason why the preliminaries of such a scheme should not begin at once, at least in so far as the getting of normals is concerned. There are apparently no Buchans to tackle this work single-handed, nor is this indeed desirable considering the enormous labour and delay involved in individual effort. A Bureau to deal with World-Meteorology is required, one of the first duties of which would be to prepare the homogeneous normals referred to above, and especially to discuss abnormals and to explain their causes. A good deal of trouble would accompany this preliminary work in so far as the meteorology of the ocean is involved, because there are few means available over a series of years for specific areas from which abnormals could be discussed, while large portions of the ocean are practically unrepresented by data from one year to another. For example, there is little difficulty in dealing with the monthly abnormals of a fixed land station; but if we wish to discuss the same data for, say, any given 10° ocean square, we should have—except in rare instances already specially investigated—to go to the individual logs contained in the various Hydrographical and other offices dealing with Maritime Meteorology, and combine the whole, so as to get means for each of the months and the years of the period we wish to investigate. This appears to be the great stumbling-block in the work outlined above, but its subjugation is practically a matter of co-operation, organization and expense.

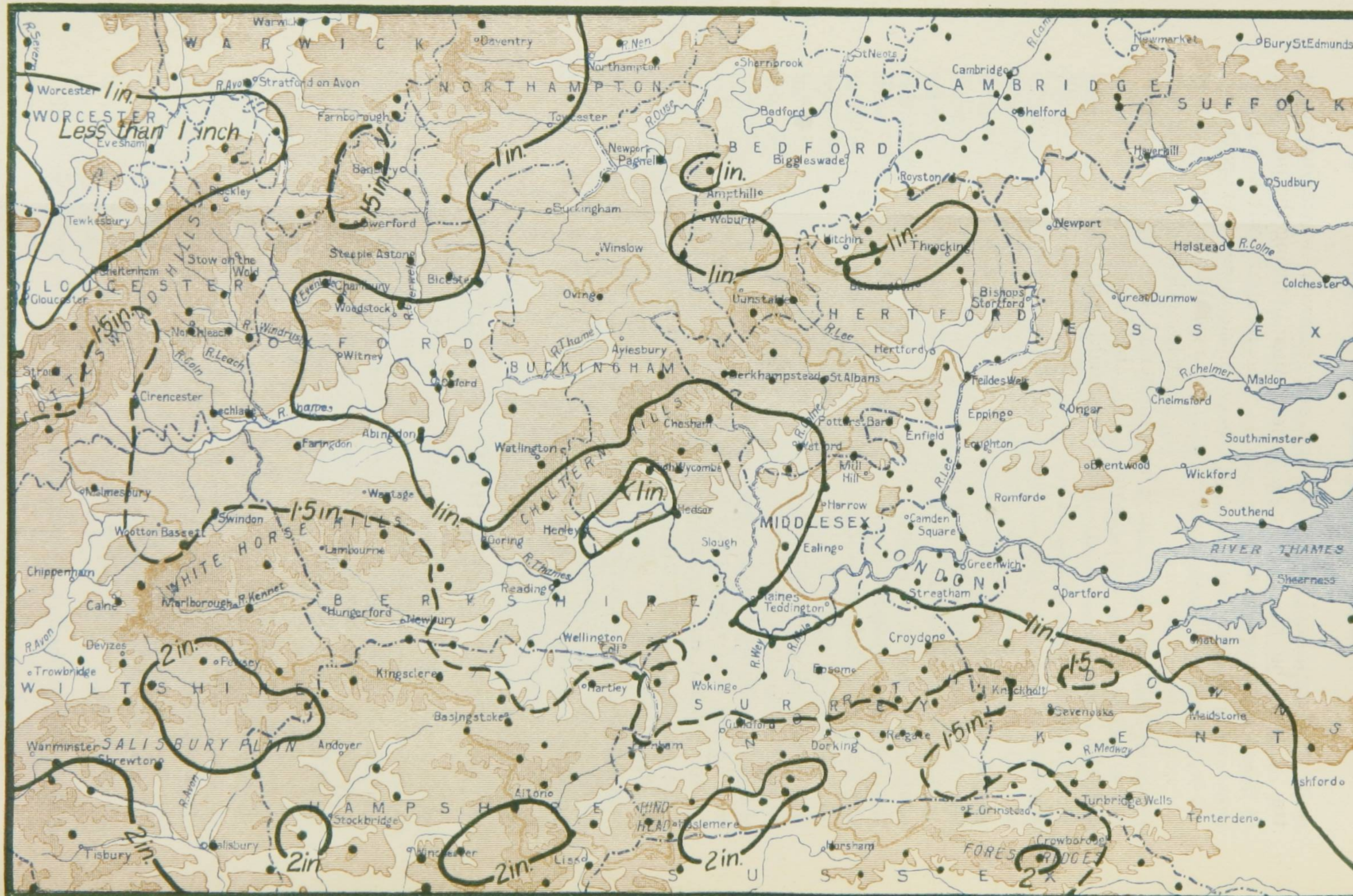
The principal bar to progress in working out the problems associated with long range weather forecasting, doubtless lies in the inadequate State support given to most Government Meteorological Services. That the Powers that be recognize their utility is not disputed, since they would not otherwise exist, but in almost every case the extensions which an enlightened Director would like to initiate are hampered and curtailed through want of funds. Research work, on which progress really depends, has been and continues to be largely subordinated to labours of a routine character, being done in what may be ironically termed "the spare time" of an office. Data arrive in shoals without cessation and most of the available resources are expended in their reduction and publication. No one will deny for a moment that invaluable and indeed, indispensable, information is not thus being gathered, and that the seeds of modern methods, incorporating much patient research, are not yielding valuable fruit. But the field of vision is too contracted, because, when such an occurrence as a great frost, heat wave, drought, rainy period, or indeed any phenomenon of an important character takes place, while we may rely on the production of a report, excellent, one might say, in many cases perfect, in its—from a geographical stand-point—local aspects, there is seldom a line as to what has taken place in regions far distant. Our horizon seems to be narrow, and we do not stop to speculate as to whether the failure of the rainy season in some portion of the sub-tropical or equatorial regions was not responsible for the unseasonable weather that manifested itself, perhaps, several months later, in some portion of the North or South Temperate Zones.

The establishment of a World Bureau seems the only way to meet the situation, and the sooner such an institution is set on foot the better. It is most desirable that knowledge, in so far as it bears on such practical and vital questions as are involved in long range forecasting, should be common property, disseminated through the agency of a responsible institution.

What would the public think if a band of speculators in grain formed a little bureau of this character for their own special benefit? One can readily picture the economic disturbance that would be associated with the cornering of, say, the world's wheat supply, based on fore-knowledge of a failure of the crops over the greater portion of the wheat belts of the globe. Doubtless for some time those taking part in operations of this nature would still be gamblers, but the dice would be heavily loaded.

In drawing to a close what many may be inclined to designate a

THAMES VALLEY RAINFALL — DECEMBER, 1913.



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 Teddington, and River Lee above Feildes Weir.

Rainfall Stations reporting

Isohyetals.

somewhat unprofitable, and in some respects even bizarre, investigation, it may be pointed out that the method of using the preceding weather in one part of the Earth as a means of arriving at a knowledge of what will subsequently take place in another part, has already had practical application. The probable intensity of the Indian Monsoon is arrived at by just such methods, which are also successfully employed in the determination of the height of the Nile flood. Hunt, in Australia, is obtaining cable information from South America and other regions, which he is making practical use of, and there is no doubt that the methods described, initiated by the genius of Hildebrandsson, are capable of wide application. In spite of the apparently fortuitous and irregular manner in which correlations between pairs of stations begin, persist and terminate, the impression gained is that there is a regularity underlying the seemingly capricious nature of the observed phenomena. In other words, the "action centres" of the globe are probably subject to a cyclical oscillation of a more or less fixed period, and the uncertainty underlying the persistence of correlation and non-correlation is due to most of the pairs of stations utilized being located not in "action centres" but in transitional zones; some, doubtless, coming at intervals under the influence of more than one pair of "action centres."

One way of clearing up the point would be to examine the data for those stations in north-western Europe for which we possess long-period records, extending in any cases over the last 150 years. If correlations, either simultaneous, or separated by an interval of time, flashed up between pairs of stations and disappeared for regular periods, then the recurring nature of the occurrence would be recognised, and a distinct advance made on the, at present, unsatisfactory and, doubtless to many, unconvincing situation.

THE WEATHER OF DECEMBER.

THE month opened with a continuation of the abnormal warmth that was so marked a feature of the past autumn. Westerly to south-westerly winds of gale force prevailed, and heavy rain fell in Scotland, Ireland and the western portions of England during the first three days of the month. On the 1st at Southampton and Ventnor, and on the 2nd at Bath, the temperature rose to 56°, and on the latter date at Exmouth 57° was recorded. On the 3rd a secondary depression appeared over Great Britain, with strong winds and gales, and snow and sleet in various northern districts. Numerous stations in Scotland, Ireland and the north-west of England, reported more than an inch, the heaviest falls on the 3rd being 2·68 in. at Greenside Mines Westmorland, 2·67 in. at Peny Gwryd in Snowdonia, and 2·13 in. at Keswick. Heavy rain also fell on the 2nd and 4th. On the 3rd and 4th snow fell in the Peak, Snowdon, Lake and Lammermuir districts, and in the west of Ireland. On the 5th, when these Islands were under the influence of a ridge of high pressure, severe frost was experienced in Scotland, the sheltered thermometer falling to 7° at Balmoral, while on the 6th at Nairn the temperature did not rise above 23°, with maximum temperatures under the freezing point over most of the northern districts. By the morning of the 7th a large and rapid increase of temperature had set in over the north of Scotland (although locally great cold prevailed, *e.g.*, at Balmoral, minimum 5°), which became general over Great Britain on the 8th, as our islands came under the influence of a deep depression centred over Iceland. The highest temperatures were noted over Scotland, where in many places shade values exceeding 55° were noted on the 8th and 9th. As far north as Gordon Castle on the 9th the thermometer rose to 59°, and at Balmoral the temperature rose 50° in little more than 24 hours. In England lower day temperatures prevailed, the maximum however rising to 57° at Hawarden on the 8th. From about the 8th to the 16th pressure was highest to the southward of our islands, with westerly winds, high temperature and little rainfall, except in the few normally rainy localities in the north-west of Scotland, where from the 11th to the 15th daily falls exceeding an inch were measured, the maximum being 1·69 in. at Glencarron on the 15th. On the 16th the south-west of the country was covered by an anticyclone which had moved up from that direction, and temperature fell generally from its previous high level, but until almost the close of the month the general mean was in excess of the normal. On the 23rd southern England came under the influence of a depression which the day previous was located to the west of Lisbon, and temperature fell. On the 26th a rapid rise of temperature of short duration set in, which was associated with heavy rains in the north-west of Scotland and in the Lake district. The heaviest falls reported were 2·98 in. at Seathwaite on the 25th and 2·54 in. at Peny Gwryd on the 26th, but in Scotland the maximum falls did not much exceed an inch. From the 27th to the 29th snow fell in many places, the depth in central and western Perthshire being six inches. The year closed with sharp frost over the greater portion of our islands, with minima as low as 4° at Hawick and 17° at Birr Castle. The general rainfall of the month expressed as a percentage of the average was: England and Wales, 64; Scotland, 92; Ireland, 82; British Isles, 77.

THE RAINFALL OF 1913.

THE year that has just closed was characterised in each of the three main divisions of the British Isles by a rainfall which differed but little from the average, so that the general fall for the whole country was within one per cent. of the normal. The following short Table shows that Scotland was the driest country with a deficiency of 6 per cent., in England and Wales there was a deficit of 2 per cent., while in Ireland the excess amounted to 5 per cent., the general results showing a deficiency of 1 per cent.

General Rainfall of 1913 *expressed as a percentage of the Average.*

MONTH.	England and Wales.	Scotland.	Ireland.	British Isles.
January	166	95	174	147
February	60	80	71	69
March	169	159	145	159
April	180	138	154	161
May	112	129	154	128
June	73	123	100	93
July	43	29	33	37
August	50	41	37	44
September	94	77	119	96
October	98	72	106	93
November	109	126	116	116
December	64	92	82	77
Year 1913	98	94	105	99

July was the driest month everywhere, with little more than one-third of the average, Scotland in this month having 29 per cent., Ireland 33 per cent. and England and Wales 43 per cent. of the normal. August was also dry, England and Wales having exactly half the average fall, while Scotland and Ireland had 41 per cent. and 37 per cent. respectively. In the west of Scotland and some parts of the English Lake District the drought continued throughout September, so that in many of the normally wet localities the summer season, from the point of view of the holiday maker, was the finest on record, especially as these places, in contrast to most other districts, enjoyed more than the normal amount of sunshine. At Ambleside the combined rainfall for the third quarter of the year formed only 9 per cent. of the total for 1913, and at Rothesay in the Island of Bute, where we have a record extending back to the year 1800, the rainfall corresponding to the third quarter of the year has never been so low. Other parts of the country, however, were not so favoured and in a period of disturbed weather in September there occurred several rainstorms of great intensity, the most notable being those at Newcastle-on-Tyne, on September 16th, and at Doncaster on the day following.

The wettest month in the year, taking the country as a whole, was April with an excess of 61 per cent., and in England and Wales the excess was as much as 80 per cent. In Scotland, March was the wettest month with an excess of 59 per cent., and in Ireland the maximum occurred in January with 74 per cent. above the average. Speaking generally, January, March and April were wet months, and July and August dry months, the other months of the year not showing any marked departure from the average.

As regards the geographical distribution of the rain, the most note-worthy departures from the normal were (1) the marked deficiency, amounting to 20 per cent, that occurred on the eastern littoral from Orkney to the Wash, and (2) the moderate excess over the greater part of Ireland, the whole of Wales, the south-west and south of England, and in a less marked degree in the central part of Scotland. The most striking feature was thus the deficiency in the east and the excess in the west of the country.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE STEVENSON SCREEN.

As the correspondents in the last three numbers of your Magazine have been discussing the accuracy of the temperatures given by thermometers in the Stevenson Screen might I be permitted to refer to some tests made of that and other screens, the results of which were communicated in four papers to the Royal Society, Edinburgh, during the years 1883-87. It is there shown that the Stevenson Screen gives too high a reading on all days when there is sunshine, and the error is greatest when the wind is light and blowing from the south, that is, from the sun heated side of the screen. The true temperature of the air for these tests was taken by means of a thermometer placed inside an enclosure through which a strong current of air was kept up by means of a fan, and special precautions were taken to prevent any heating of the enclosure radiating to the bulb. Compared with the readings given by this standard the Stevenson Screen generally read in sunshine from 1° to 3° too high. As the maximum error does not occur on all days at the time of maximum temperature it does not necessarily show in the maximum readings, yet in a series of maximum readings taken in August the error varied from 1°·6 to 2°·6, and an error of 2°·5 was also observed in a calm day in November.

It is also shown that if the Stevenson Screen be closed at the bottom, so as to cut off the radiation from the grass, that the error is reduced. Dr. H. N. Dickson checked this result by observations made on Ben Nevis. He says the readings for 34 days gave a mean max. of ·45° lower in screen with closed bottom than in the one with open bottom. Further it is shown that a second top to the screen, with an open air space between the two, also tends to make the readings more correct, by preventing the heat passing through the top and affecting the thermometers. This source ef error can be shown by placing one thermometer near the top and one lower down; after the screen has been exposed to an hour or two of sunshine the top one sometimes reads degrees higher than the lower. It is also pointed out that the state of the paint on the screen has also an effect. A newly painted screen may easily be ·5° lower than a dirty one.

While the Stevenson Screen frequently gives too high readings I quite agree with Mr. R. H. Curtis, in your December number, that the readings obtained by a thermometer in a N. verandah will be too low, as it will be surrounded by large objects which do not get heated to the temperature of the air, and if it is hung near a north wall it will be very much too low.

JOHN AITKEN.

WEATHER FALLACIES.

Mr. R. H. Curtis asks, *re* high temperatures in the Stevenson Screen, how the thermometer in the N. verandah was hung. It was on a wooden trellis 5 in. distant from the wall.

I am obliged to Mr. Dechevrens for his explanation of the cold S.W. and warm E. winds. My aim has been simply to record facts, not to explain them—there are too many pitfalls on that road!

ALFRED O. WALKER.

Ulcombe Place, Nr. Maidstone.

GLAZED FROST.

May I add a note on the remarks of Mr. Bonacina and Mr. Dines on the question of glazed frost. Both writers express their belief that supercooling does not occur and that glazed frosts are due to cold water falling upon colder solid objects; that a glazing may be produced in the way mentioned I think no one will dispute; but that fact does not *disprove* the supercooling advanced as an explanation of the occurrence of a glazed frost such as that of January 17th and 18th, 1912.

If small drops of water fall through air below the freezing point they will be cooled with great rapidity, and the difficulty appears to me to be to explain why the drops do not solidify. I have made a rough calculation (using some results of de Quervain) of the cooling of a drop 2 mm. (·08 in.) in diameter, and find it to be at the rate of a degree (Centigrade) for every metre of fall if the temperature of the air is 2° C. below that of the drop, neglecting the effect of evaporation, which will be to increase the rate of cooling (the drop in falling acts as a wet-bulb). Thus with an air temperature below —2° C. (29° F.) the drop would lose sufficient heat in falling through 100 m. (328 feet) to turn it to ice. With a temperature of 31° F. it would take a fall of about 300 m. (984 feet) to freeze the drop (with smaller drops the cooling would be more rapid).

The question of supercooling might be tested by measuring the temperature of the falling rain on an occasion of glazed frost by collecting it in some form of calorimeter from which the effect of the air temperature could be excluded, Or possibly Mr. Dines' experiment could be tried during a hard frost by using water at 32° F., and sending it from an upper window in order that the drops might have a long enough flight to give them a reasonable chance of freezing. If they did not freeze but produced glazing, one might take it that they were supercooled, even although the converse could not be assumed.

One question presents itself to which I can find no answer. As the drop cannot be cooled sufficiently to solidify it all before any solidification takes place, where does it begin to solidify? At the outer surface where it is cooled?

I may point out that in the glazed frost of January, 1912, the wind at the surface was easterly, and the clouds, strato-cumulus, were also moving from the east. On January 11th, 1913, when Mr. Bonacina observed solid spherules, the temperature did not fall below freezing point at Kew or at South Kensington. E. GOLD.

OUR WINTERS.

A RECURRENCE at 5 years' interval seem to be often suggested by our winters. Apropos of the present winter, it is interesting, I think, to tabulate the Greenwich numbers of frost days (September—May) for the winters 1844, 49, 54, 59, &c. (*i.e.*, the winters *ending* in these years). Here are the figures, with relations to the average (54) :—

	Frost days.	Relation to average.
1844	48	— 6
1849	46	— 8
1854	58	+ 4
1859	40	—14
1864	50	— 4
1869	41	—13
1874	50	— 4
1879	85	+31
1884	23	—31
1889	60	+ 6
1894	42	—12
1899	42	—12
1904	45	— 9
1909	54	0
average	48·8	(= —5·2)

Thus, a large preponderence of mild winters, only 3 of the 14 severe. Only one winter (1879) with more than 60 frost days (greatly more, indeed). The winters of 1843, 48, &c., tell a like tale; only 3 severe out of 15; 2 with more than 60 frost days. On the other hand, winters of the years ending in 0 and 5 present a very different state of things; 9 severe out of 14; only 2 under 49; average of the 14 = 63·0 (against 48·8 of the above list).

Do these facts throw any light on our present case?

It is right to say that mild winters, as above measured, are more frequent than severe ones ALEX. B. MACDOWALL.

10, New Parade, Worthing, 26th December, 1913.

THE DONCASTER RAIN STORM.

In connection with the great Rain Storm at Doncaster, on September 17th last, it may be of interest to you to hear as to the character of the weather on that day in other parts of the North of England. I, therefore, send you the following notes as to the conditions here.

The early morning was magnificently fine, calm and cold (min. temp. 41°·1 in screen). The sun shone brightly in an almost cloudless sky till about 10.30, when the max. temp. for the day, 61°·8, was reached. A few clouds (cumulo-stratus) appeared in the eastern horizon about 9 a.m., and slowly spread westwards before a light E. breeze, partly obscuring the sun after 10.30. These clouds gradually became absorbed as they were carried westwards, and during the whole day the sky over the north-west of the Fylde plain and over the sea off Fleetwood remained practically cloudless. There was very little sunshine here during the afternoon, the sky being lightly clouded with, however, a few blue patches. Further to the east, over the high moors on the Yorkshire boundary and beyond, the sky was quite overcast during the afternoon and evening, and after 3 p.m. slight rain was evidently falling in West Yorkshire from what appeared to be ill-defined, almost spent showers. These rapidly became further spent as they approached this station, but gave us a few drops of rain at intervals from about 4 to 7 p.m., the total yield being ·005 in. The wind remained light from E. all day, and the air felt dry, cool and invigorating. The distance from here to Doncaster is about 73 miles.

ALBERT WILSON, F.L.S., F.R.Met.Soc.

Bruna Hill, Garstang, Lancs., Dec. 10th, 1913.

THE SNOWDON GAUGE.

On my return from abroad a few days ago, I read in *Symons's Meteorological Magazine* for July last, p. 108, Mr. Gilbert's letter saying I was wrong as to the origin of the Snowdon gauge. I am not wrong, and if he, on his return home, will refer to p. 23 mentioned he will see that Mr. Symons did not give the credit to any one, and that the gauges were erected on Snowdon " under the joint auspices of Capt. Mathew and Mr. Symons " in 1864. This was only a few months after Mr. Symons was with me, in July, 1863, when he saw and was much pleased with Mr. Rowden's gauge, which was alongside of my ordinary low rimmed 8 in. gauge.

Mr. Rowden, as I mentioned in my former letter of February, p. 52, *invented* the gauge with the vertical cylinder made by our tinsmith in Calne, and Mr. Symons during his four days stay with me in stormy weather saw that it invariably collected more than its neighbour with the ordinary low rim, and forthwith proceeded to copy it and call it *Snowdon* because there erected.

MICHAEL FOSTER WARD.

Upton Park, Slough, 22nd Dec., 1913.

RAINFALL TABLE FOR DECEMBER, 1913.

STATION.	COUNTY.	Lat. N. ° ′	Long. W. [*E.] ° ′	Height above Sea. ft.	RAINFALL OF MONTH. Aver. 1875—1909. in.	1913. in.
Camden Square	*London*	51 32	0 8	111	2·13	·79
Tenterden	*Kent*	51 4	*0 41	190	2·77	1·21
Arundel (Patching)	*Sussex*	50 51	0 27	130	2·91	1·84
Fawley (Cadland)	*Hampshire*	50 50	1 22	52	3·23	2·31
Oxford (Magdalen College)	*Oxfordshire*	51 45	1 15	186	2·06	·76
Wellingborough (Croyland Abbey)	*Northampton*	52 18	0 41	174	2·13	·85
Shoeburyness	*Essex*	51 31	*0 48	13	1·71	·81
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	2·14	·90
Geldeston [Beccles]	*Norfolk*	52 27	*1 31	38	2·07	·89
Polapit Tamar [Launceston]	*Devon*	50 40	4 22	315	4·46	3·88
Rousdon [Lyme Regis]	,,	50 41	3 0	516	3·68	2·03
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	2·71	1·25
Church Stretton (Wolstaston)	*Shropshire*	52 35	2 48	800	2·99	1·78
Coventry (Kingswood)	*Warwickshire*	52 24	1 30	340	2·66	1·14
Boston	*Lincolnshire*	52 58	0 1	11	1·88	·62
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	2·17	1·34
Macclesfield	*Cheshire*	53 15	2 7	501	3·35	2·02
Southport (Hesketh Park)	*Lancashire*	53 38	2 59	38	3·10	1·86
Arncliffe Vicarage	*Yorkshire, W.R.*	54 8	2 6	732	6·75	4·56
Wetherby (Ribston Hall)	,, ,,	53 59	1 24	130	2·27	1·67
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	2·32	1·56
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	2·46	1·33
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	15·14	14·07
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	4·70	2·35
Haverfordwest	*Pembroke*	51 48	4 58	90	5·18	3·31
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	4·66	3·21
Llandudno	*Carnarvon*	53 20	3 50	72	2·84	2·20
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	4·84	3·37
Marchmont House	*Berwick*	55 44	2 24	498	2·83	2·45
Girvan (Pinmore)	*Ayr*	55 10	4 49	207	5·48	5·68
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	3·95	3·74
Inveraray (Newtown)	*Argyll*	56 14	5 4	17	8·57	9·11
Mull (Quinish)	,,	56 34	6 13	35	6·59	4·97
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	2·67	1·29
Braemar	*Aberdeen*	57 0	3 24	1114	3·13	2·22
Aberdeen (Cranford)	,,	57 8	2 7	120	3·43	2·11
Cawdor	*Nairn*	57 31	3 57	250	2·53	2·65
Fort Augustus (S. Benedict's)	*E. Inverness*	57 9	4 41	68	5·62	5·81
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	9·86	...
Dunrobin Castle	*Sutherland*	57 59	3 56	14	3·09	4·27
Wick	*Caithness*	58 26	3 6	77	3·11	3·51
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	6·92	4·62
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	4·32	1·66
Nenagh (Castle Lough)	*Tipperary*	52 54	8 24	120	4·34	3·22
Ennistymon House	*Clare*	52 57	9 18	37	5·03	4·97
Gorey (Courtown House)	*Wexford*	52 40	6 13	80	3·42	1·46
Abbey Leix (Blandsfort)	*Queen's County*	52 56	7 17	532	3·41	1·64
Dublin (FitzWilliam Square)	*Dublin*	53 21	6 14	54	2·27	1·86
Mullingar (Belvedere)	*Westmeath*	53 29	7 22	367	3·39	3·06
Crossmolina (Enniscoe)	*Mayo*	54 4	9 16	74	6·11	5·53
Cong (The Glebe)	,,	53 33	9 16	112	5·42	5·24
Collooney (Markree Obsy.)	*Sligo*	54 11	8 27	127	4·34	5·18
Seaforde	*Down*	54 19	5 50	180	3·77	3·15
Bushmills (Dundarave)	*Antrim*	55 12	6 30	162	3·87	3·81
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	3·91	4·47

RAINFALL TABLE FOR DECEMBER, 1913—*continued.*

RAINFALL OF MONTH (*con.*)					RAINFALL FROM JAN. 1.					
Diff. from Av. in.	% of Av.	Max. in 24 hours. in.	Date.	No. of Days	Aver. 1875—1909. in.	1913. in.	Diff. from Aver. in.	% of Av.	Mean Annual 1875-1909. in.	STATION.
—1·34	37	·27	23	8	25·11	22·41	—2·70	89	25·11	Camden Square
—1·56	44	·62	23	11	27·64	26·06	—1·58	94	27·64	Tenterden
—1·07	63	·88	23	11	30·48	37·47	+6·99	123	30·48	Patching
— ·92	72	·82	24	15	31·87	32·47	+ ·60	102	31·87	Cadland
—1·30	37	·20	6	12	24·58	21·76	—2·82	89	24·58	Oxford
—1·28	40	·35	4	11	25·17	22·29	—2·88	89	25·17	Croyland Abbey
— ·90	47	·33	23	12	19·28	19·73	+ ·45	102	19·28	Shoeburyness
—1·24	42	·35	4	13	25·40	22·81	—2·59	90	25·40	Westley
—1·18	43	·24	30	17	23·73	22·25	—1·48	94	23·73	Geldeston
— ·58	87	·75	23	19	38·27	42·57	+4·30	111	38·27	Polapit Tamar
—1·65	55	·62	23	14	33·54	31·40	—2·14	94	33·54	Rousdon
—1·46	46	·41	6	13	29·81	29·27	— ·54	98	29·81	Stroud
—1·21	60	·56	4	16	32·41	35·39	+2·98	109	32·41	Wolstaston
—1·52	43	·53	4	8	28·98	25·82	—3·16	89	28·98	Coventry
—1·26	33	·21	29	10	23·35	22·90	— ·45	98	23·35	Boston
— ·83	62	·46	29	9	24·46	22·34	—2·12	91	24·46	Hodsock Priory
—1·33	60	·35	3	18	34·73	30·99	—3·74	89	34·73	Macclesfield
—1·24	60	·41	4	17	32·70	28·89	—3·81	88	32·70	Southport
—2·19	68	1·14	25	20	61·49	56·79	—4·70	92	61·49	Arncliffe
— ·66	74	...	...	...	26·87	22·17	—4·70	83	26·87	Ribston Hall
— ·76	67	·46	29	14	26·42	20·49	—5·93	78	26·42	Hull
—1·13	54	·47	26	10	27·94	27·01	— ·93	97	27·94	Newcastle
—1·07	93	2·98	25	21	129·48	124·07	—5·41	96	129·48	Seathwaite
—2·35	50	·50	6	21	42·28	45·48	+3·20	108	42·28	Cardiff
—1·87	64	·51	6	17	46·81	53·19	+6·38	114	46·81	Haverfordwest
—1·45	69	·49	6	22	45·46	56·63	+11·17	124	45·46	Gogerddan
— ·64	77	·48	26	15	30·36	31·78	+1·42	105	30·36	Llandudno
—1·47	70	1·05	3	20	43·47	47·38	+3·91	109	43·47	Cargen
— ·38	87	·66	3	15	33·76	26·07	—7·69	77	33·76	Marchmont
+ ·20	104	1·18	3	20	49·77	46·85	—2·92	94	49·77	Girvan
— ·21	95	1·18	3	18	35·97	35·24	— ·73	98	35·97	Glasgow
+ ·54	106	1·34	2	24	68·67	72·50	+3·83	106	68·67	Inveraray
—1·62	75	...	...	...	56·57	54·20	—2·37	96	56·57	Quinish
—1·38	48	·88	3	11	28·64	23·24	—5·40	81	28·64	Dundee
— ·91	71	·48	3	18	34·93	30·92	—4·01	89	34·93	Braemar
—1·32	62	·95	3	14	32·73	25·83	—6·90	79	32·73	Aberdeen
+ ·12	105	·52	3	10	29·33	22·95	—6·38	78	29·33	Cawdor
+ ·19	103	·89	2	19	44·53	45·50	+ ·97	102	44·53	Fort Augustus
...	...	...	...	...	83·93	...	...	...	83·93	Bendamph
+1·18	138	·57	3	19	31·90	26·32	—5·58	83	31·90	Dunrobin Castle
+ ·40	113	·48	3	21	29·88	24·48	—5·40	82	29·88	Wick
—2·30	67	1·45	3	18	54·81	58·86	+4·05	107	54·81	Killarney
—2·66	38	·47	3	10	39·57	40·42	+ ·85	102	39·57	Waterford
—1·12	74	·75	3	14	39·43	42·26	+2·83	107	39·43	Castle Lough
— ·06	99	1·54	3	20	46·52	52·20	+5·68	112	46·52	Ennistymon
—1·96	43	·57	5	9	34·99	33·80	—1·19	97	34·99	Courtown Ho.
—1·77	48	·47	3	13	35·92	40·59	+4·67	113	35·92	Abbey Leix
— ·41	82	·55	3	12	27·68	28·84	+1·16	104	27·68	Dublin
— ·33	90	1·02	3	17	36·15	38·18	+2·03	106	36·15	Mullingar
— ·58	91	1·39	3	22	52·87	60·21	+7·34	114	52·87	Enniscoe
— ·18	97	·95	25	20	48·90	51·64	+2·74	106	48·90	Cong
+ ·84	119	·77	3	21	42·71	45·64	+2·93	107	42·71	Markree
— ·62	84	·78	26	13	38·91	40·31	+1·40	104	38·91	Seaforde
— ·06	98	·57	4	21	37·56	31·76	—5·80	85	37·56	Dundarave
+ ·56	114	·65	2	21	39·38	40·64	+1·26	103	39·38	Omagh

SUPPLEMENTARY RAINFALL, DECEMBER, 1913.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	1·46	XI.	Lligwy	2·23
,,	Ramsgate	1·26	,,	Douglas	...
,,	Hailsham	1·99	XII.	Stoneykirk, Ardwell House...	3·89
,,	Totland Bay, Aston House...	1·75	,,	Dalry, The Old Garroch	7·46
,,	Stockbridge, Ashley..	1·88	,,	Beattock, Kinnelhead	5·33
,,	Grayshott	1·87	,,	Langholm, Drove Road	2·92
III.	Harrow Weald, Hill House...	·99	XIII.	Meggat Water, Cramilt Lodge	3·48
,,	Caversham, Rectory Road ...	1·32	,,	North Berwick Reservoir	...
,,	Pitsford, Sedgebrook	·96	,,	Edinburgh, Royal Observaty.	1·72
,,	Woburn, Milton Bryant	1·20	XIV.	Maybole, Knockdon Farm ...	4·38
,,	Chatteris, The Priory	·76	XV.	Ballachulish House	7·02
IV.	Colchester, Hill Ho., Lexden	·74	,,	Campbeltown, Witchburn ..	3·77
,,	Newport, Belmont House ...	...	,,	Holy Loch, Ardnadam	7·60
,,	Ipswich, Rookwood, Copdock	·60	,,	Islay, Eallabus	5·29
,,	Blakeney	·51	,,	Tiree, Cornaigmore	4·05
,,	Swaffham	·52	XVI.	Dollar Academy	4·04
V.	Bishops Cannings	2·01	,,	Balquhidder, Stronvar	6·32
,,	Winterbourne Steepleton	...	,,	Glenlyon, Meggernie Castle..	6·18
,,	Ashburton, Druid House.. ...	3·57	,,	Blair Atholl	1·88
,,	Cullompton	2·33	,,	Coupar Angus	·91
,,	Lynmouth, Rock House	3·84	,,	Montrose, Sunnyside Asylum.	1·41
,,	Okehampton, Oaklands... ...	5·10	XVII.	Alford, Lynturk Manse	2·16
,,	Hartland Abbey	3·09	,,	Fyvie Castle	3·72
,,	Probus, Lamellyn	3·70	,,	Keith Station	3·11
,,	North Cadbury Rectory	2·43	XVIII.	Alvey Manse	...
VI.	Clifton, Pembroke Road	2·18	,,	Loch Quoich, Loan	26·90
,,	Ross, The Graig	·88	,,	Drumnadrochit	4·41
,,	Shifnal, Hatton Grange	1·28	,,	Skye, Dunvegan	7·46
,,	Droitwich	1·19	,,	N. Uist, Lochmaddy	...
,,	Blockley, Upton Wold	1·11	,,	Glencarron Lodge	12·51
VII.	Market Overton	1·05	XIX.	Invershin	2·49
,,	Market Rasen	·77	,,	Melvich	5·80
,,	Bawtry, Hesley Hall	·98	,,	Loch Stack, Ardchullin	12·32
,,	Derby, Midland Railway	1·01	XX.	Skibbereen Rectory	2·26
,,	Buxton	2·94	,,	Dunmanway, The Rectory ..	3·09
VIII.	Nantwich, Dorfold Hall	1·65	,,	Glanmire, Lota Lodge, No. 1	1·82
,,	Chatburn, Middlewood	3·32	,,	Mitchelstown Castle	2·13
,,	Cartmel, Flookburgh	3·46	,,	Darrynane Abbey	3·58
IX.	Langsett Moor, Up. Midhope	3·37	,,	Clonmel, Bruce Villa	1·31
,,	Scarborough, Scalby	1·67	,,	Newmarket-on-Fergus, Fenloe	3·59
,,	Ingleby Greenhow	2·09	XXI.	Laragh, Glendalough	3·42
,,	Mickleton	3·10	,,	Ballycumber, Moorock Lodge	2·99
X.	Bellingham, High Green Manor	2·75	,,	Balbriggan, Ardgillan	1·95
,,	Ilderton, Lilburn Cottage ...	1·16	XXII.	Woodlawn	4·62
,,	Keswick, The Bank	5·67	,,	Westport, St. Helens	4·29
XI.	Llanfrechfa Grange	2·21	,,	Dugort, Slievemore Hotel ...	6·52
,,	Treherbert, Tyn-y-waun	5·90	,,	Mohill Rectory	4·26
,,	Carmarthen, The Friary	2·65	XXIII.	Enniskillen, Portora	3·91
,,	Castle Malgwyn [Llechryd]...	2·33	,,	Dartrey [Cootehill]	3·94
,,	Crickhowell, Tal-y-maes	2·70	,,	Warrenpoint, Manor House ..	2·63
,,	New Radnor, Ednol	2·29	,,	Banbridge, Milltown	2·42
,,	Birmingham WW., Tyrmynydd	4·32	,,	Belfast, Cave Hill Road	3·82
,,	Lake Vyrnwy	3·36	,,	Glenarm Castle	5·23
,,	Llangyhanfal, Plâs Draw	2·85	,,	Londonderry, Creggan Res...	4·40
,,	Dolgelly, Bryntirion	4·47	,,	Dunfanaghy, Horn Head ...	5·42
,,	Bettws-y-Coed, Tyn-y-bryn...	...	,,	Killybegs	7·46

METEOROLOGICAL NOTES ON DECEMBER, 1913.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow; F for number of days Frost in Screen; f on Grass.

LONDON, CAMDEN SQUARE.—Dull or cloudy generally, but unusually dry and mild throughout. Mean temp. 41°·7 or 2°·0 above the average. Duration of sunshine 31·7* hours, and of R 23·7 hours. Evaporation ·32 in. Shade max. 55°·3 on 9th; min. 26°·9 on 25th. F 9, f 14.

TENTERDEN.—A dry month, but not a fine one, there being 15 sunless days. Duration of sunshine 53·0† hours. Shade max. 54°·5 on 1st; min. 26°·5 on 29th. F 8, f 17.

TOTLAND BAY.—Duration of sunshine 61·0* hours or 7·0 hours above the average. The first frost in the screen this winter occurred on the 21st, which is 30 days later than usual. Mean temp. 44°·0.

IPSWICH, COPDOCK.—A dry month with equable temp. until the last 9 days when the weather became markedly colder, and the lowest grass temp. of the year, 12°·3, was recorded on the morning of 31st. Mean temp. 39°·9. Shade max. 53°·2 on 9th; min. 23°·7 on 31st. F 13, f 16.

NORTH CADBURY.—The early part was very gloomy, but in the middle and end of the month there were some beautiful days. It was mild to 18th, cool from 19th to 27th, and cold in the last 4 days. Shade max. 54°·5 on 9th; min. 24°·0 on 31st. F 9, f 15.

DROITWICH.—Mild up to 18th, the shade max. exceeding 50° on 11 days; colder after 21st. A bunch of Dorothy Perkins roses and one half-opened Mad. Berard rose were picked on the 24th. Shade max. 57°·0 on 1st; min. 21°·0 on 31st. F 9.

HODSOCK PRIORY.—Mild and dry up to Christmas, with rather heavy S and a sharp frost at the end of the month. Shade max. 55°·5 on 8th; min. 19°·2 on 31st. F 11, f 17.

SOUTHPORT.—An exceptional prevalence of strong W. winds. Duration of sunshine 43·1* hours, and of R 45·9 hours. Mean temp. 42°·6, or 3°·1 above the average. Evaporation ·30 in. Shade max. 53°·0 on 3rd and 8th; min. 22°·0 on 31st. F 4, f 10.

LILBURN.—Dry and mild till 25th; 5 inches of S fell 28th-30th.

HAVERFORDWEST.—Very mild, with small R. Duration of sunshine 57·6* hours. Shade max. 63°·8 on 9th; min. 25°·3 on 31st. F 3.

LLANDUDNO.—Shade max. 55°·0 on 3rd; min. 27°·0 on 31st.

MARCHMONT.—Duration of sunshine 29·1 hours on 15 days.

TIREE, CORNAIGMORE.—For 25 days the wind was westerly, and veered from S.W. to N.N.W. Often strong from W. and N.W., on 4 occasions blowing a gale.

COUPAR ANGUS.—Remarkable for unusually good weather. The R was below, and temp. much above, the average. The first week and the last few days were noteworthy for low temperature readings.

LYNTURK.—R about an inch under the average. Great scarcity of water for all purposes. Shade max. 54°·5 on 8th; min. 2°·0 on 30th. F 20.

DRUMNADROCHIT.—S fell to a depth of 5 inches on 27th, and an additional fall of 7 inches occurred on 28th.

LOCH STACK.—Duration of sunshine 8·5* hours.

WATERFORD.—The driest December since 1883. Shade max. 53°·5 on 2nd; min. 22°·0 on 31st. F 6.

DUBLIN.—The first half was mild and unsettled, with strong S.W. and W. winds. A dull anticyclonic period from 16th to 21st, after which it was cold except on 26th which was mild, but wet and stormy. Shade max. 56°·8 on 8th; min. 25°·6 on 31st. F 3, f 9.

WARRENPOINT.—The first half was mild, but in the latter half there was S, sleet and low temp. Shade max. 55°·0 on 8th; min. 21°·0 on 30th. F 8, f 13.

OMAGH.—Exceptionally mild to the last 3 days when hard frost set in.

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* Campbell-Stokes. † Jordan.

Climatological Table for the British Empire, July, 1913.

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	78·9	28	44·3	8	70·2	52·5	52·8	80	124·7	43·2	2·31	12	8·8
Malta	88·0	31	62·3	6	80·7	68·8	...	69	146·0	..	·00	0	2·4
Lagos	87·2	27	71·0	19	83·7	73·7	73·4	84	155·4	69·0	15·57	21	7·9
Cape Town	68·3	18	36·3	9	60·3	46·2	48·1	82	...	...	4·01	16	6·4
Natal, Durban ...	70·0	4, 29	48·0	17	64·4	54·3	50·0	71	...	...	1·86	2	3·0
Johannesburg	72·7	29	31·2	15	63·5	44·2	41·8	70	122·2	29·5	·14	1	1·9
Mauritius	75·7	17	53·1	26	73·8	58·9	57·5	75	136·5	46·0	·85	17	4·7
Bloemfontein	72·0	31	24·7	10	62·2	32·1	27·3	59	...	...	·01	1	...
Calcutta...	94·5	11	75·8	4	88·2	79·3	77·9	86	...	73·8	14·48	18	8·8
Bombay...	87·4	2	73·9	6	84·6	74·5	77·0	86	133·0	71·6	33·58	30	8·0
Madras	103·0	29	70·8	4	95·9	79·1	71·9	68	145·1	70·7	3·11	11	6·8
Colombo, Ceylon ...	86·5	6	70·8	3	84·5	76·4	73·9	80	150·9	69·8	7·11	16	7·9
Hongkong	92·0	20	75·3	31	88·1	78·8	76·9	82	...	...	15·05	20	6·7
Sydney	69·2	31	42·8	11	60·4	47·4	43·7	75	113·0	29·2	7·75	8	5·0
Melbourne	63·2	13	32·8	25	56·7	44·3	42·1	72	105·2	25·1	·70	16	6·2
Adelaide	69·6	13	34·8	5	60·6	44·8	42·9	71	127·3	24·7	·74	10	5·8
Perth	69·0	22	37·0	18*	62·8	46·9	45·8	71	132·9	31·9	6·98	19	4·9
Coolgardie	70·4	6	32·0	19	61·9	41·6	38·7	56	129·0	26·0	·74	7	3·4
Hobart, Tasmania ..	64·0	15	30·0	22	54·2	40·9	38·6	67	106·0	24·2	1·49	19	5·4
Wellington	61·6	29	31·4	13	55·0	44·4	42·5	77	106·4	24·0	3·15	21	6·5
Auckland	62·0	4	38·5	25	56·7	46·8	45·9	81	119·0	35·0	4·37	25	7·2
Jamaica, Kingston ...	92·9	24	68·1	4	89·7	72·3	69·7	74	...	...	·92	4	4·6
Grenada	87·0	9	73·0	3	84·4	79·4	...	75	139·0	...	4·23	21	4·0
Toronto	95·0	1	50·0	26	82·0	59·0	55·0	62	...	...	2·67	6	3·4
Fredericton	91·0	4	47·0	17†	76·0	55·0	...	77	...	...	5·11	14	6·2
St. John, N.B. ...	80·0	30	52·0	1	67·0	55·0	55·0	82	...	...	3·55	13	5·5
Edmonton, Alberta ...	87·0	24	41·2	12	71·0	49·6	...	67	138·9	35·8	5·15	17	4·6
Victoria, B.C.	85·0	20	45·0	29	72·0	52·0	51·0	70	...	...	·45	6	3·7
Malta..............*May*...	82·4	19	53·0	4	71·1	59·9	...	77	139·0	...	·81	5	4·0
,, ...*June*..	82·2	21	63·5	27	76·3	65·9	...	73	137·8	...	·00	0	2·0

* and 19. † and 31.

Johannesburg.—Bright sunshine 299·3 hours.

Mauritius.—Mean temp. 1°·9, dew point 2°·2, and R 1·79 in., below averages. Mean hourly velocity of wind 11·1, or 0·9 below average.

COLOMBO.—Mean temp. of air 80°·5, or 0°·5 below, of dew point 0°·2 below, and R 1·38 in. above, averages. Max. velocity of wind 42 miles per hour. TSS on 2 days.

HONGKONG.—Mean temp. of air 82°·8. Mean hourly velocity of wind 9·3 miles. Bright sunshine 233·8 hours.

Melbourne.—Mean temp. of air 2°·1 above, and R 1·16 in. below, averages.

Adelaide.—Mean temp. of air 1°·2 above, and R 1·92 in. below, averages, only two drier Julys in last 74 years.

Perth.—Temp. of air 1°·1 below average.

Coolgardie.—Temp. of air 1°·0 above, and R slightly below, averages.

Hobart.—Mean temp. of air 2°·3 above, and R ·61 in. below, averages.

Wellington.—Mean temp. of air 2°·3 above, and R 2·69 in. below, averages. Bright sunshine 108·0 hours.

Auckland.—Mean temp. of air and R slightly below averages.

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