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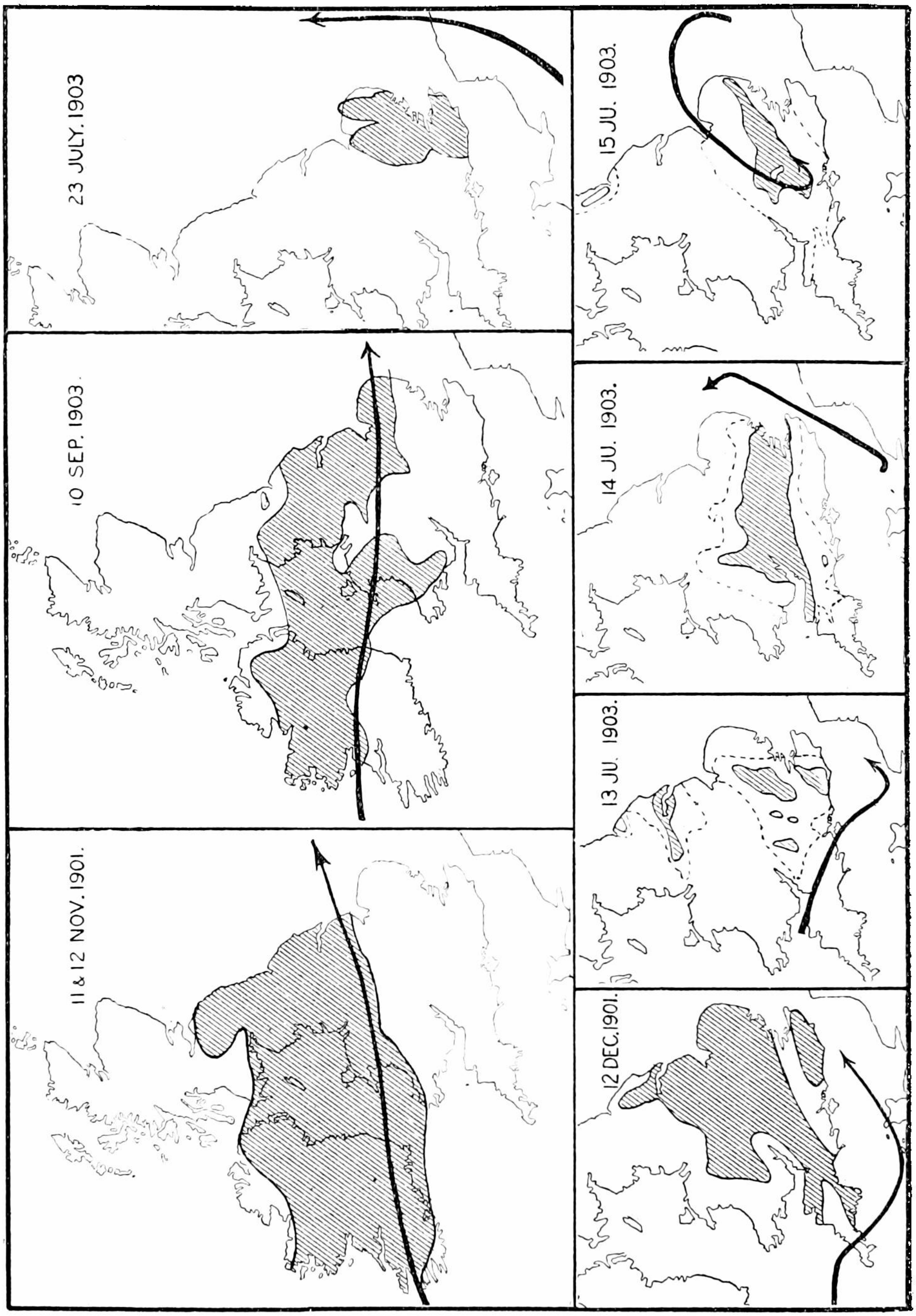
METEOROLOGY AT THE BRITISH ASSOCIATION.

On the Unsymmetrical Distribution of Rainfall about the Path of a Barometric Depression.

By Hugh Robert Mill, D.Sc.

In the course of studying the distribution of rainfall for publication in the annual volumes of *British Rainfall* much attention has always been paid to individual days on which heavy rain fell. These heavy rains are divisible into two categories, which for convenience may be termed Thunderstorm Rains and Cyclonic Rains. The former are typically of irregular distribution and short duration, the rainfall sometimes exceeding 3 inches in a single hour in patches separated by stretches of country where no rain falls. The latter are typically of uniform distribution over wide areas, with falls sometimes exceeding 3 inches in 24 hours, but rarely falling at a rate greater than ·50 in. per hour. Cyclonic rains are characteristic of the winter months, although they may occur at any time of the year.

Ten instances of severe and widespread cyclonic rains have been investigated by the author. The method adopted was to plot upon a map the rainfall for the day in question (9 a.m. to 9 a.m.) at all stations for which the figure was available and then to draw lines limiting the areas within which the falls exceeded ·50, 1·00, 2·00, 3·00, and 4·00 inches respectively. No cases were investigated in which there was not a considerable area with more than one inch of rain. The number of points from which the map was drawn varies from a few hundred to 2000 or more, according to the extent of surface affected. The maps, reduced to a small scale, have been published in *British Rainfall* during the last four years. The position of the lines may be relied upon as correct on the scale shown, the probable error lying in most cases within the thickness of the lines as drawn. For the present discussion the path of the barometric depression associated with the rain is added from the monthly summary of the *Weekly Weather Report* of the Meteorological Office.


23 JULY. 1903.
10 SEP. 1903.
11 & 12 NOV. 1901.
15 JU. 1903.
14 JU. 1903.
13 JU. 1903.
12 DEC. 1901.

In the ten maps prepared the path of the depression was directed towards different points of the compass. The positions of the centre are marked for the hours of observation from 8 a.m. on one day to 8 a.m. on the next, thus corresponding very closely with the rainfall day, 9 a.m. to 9 a.m. Seven of these are reproduced in the accompanying maps.

The ten cases include two in which the centre described a path nearly from S. to N.

(1) *27th October, 1903.*—Path from the Lizard along the eastern border of Wales to the Solway. The area with rainfall over one inch extended from S. to N., reaching considerably beyond the position of the centre at 9 a.m., and a larger area, though perhaps not a greater volume of rain, lay to the right of the track than on the left. This is the only instance of the kind in the ten cases.

(2) *23rd July, 1903.*—The centre travelled north-eastward from near Ushant through France and passed into the North Sea northward from Holland. The area with more than one inch of rain extended due north from the coast of Sussex and Kent to the Wash, and in the centre the falls exceeded 3 and at some points 4 inches. The whole wet area lay well to the left of the path. (See map).

In two cases the path was first directed towards the S.E. and curved round to N.E.

(3) *12th December, 1901.*—At 8 a.m. on the 12th the centre was in the Bristol Channel, at 6 p.m. in the English Channel south of the Start, and at 8 a.m. on the 13th south of Selsey Bill. The rainfall exceeded an inch from Cornwall to Kent on the south-east and to the Tees on the north-east, the whole lying well to the left of the path. (See map).

(4) *8th October, 1903.*—The centre at 8 a.m. was on the coast of Cardigan, at 6 p.m. near Oxford, and at 8 a.m. on the 9th out in the North Sea in the latitude of Flamborough Head. The rainfall exceeded an inch in the eastern half of Great Britain from the Humber to the Forth, and exceeded 3 inches on the coast of Northumberland. The whole wet area lay on the left of the path.

Two cases in which the path was nearly straight from W. to E.

(5) *11th and 12th November, 1901.*—The centre was near Valencia on the 11th, about Tipperary at 8 a.m. on the 12th, to the south of Carnarvon at 6 p.m., and in the North Sea off Grimsby at 8 a.m. on the 13th. Falls exceeding an inch prevailed over Ireland, western Wales and north-western England on the 11th, and over north-eastern Ireland, northern England, and southern Scotland on the 12th, extending on each day from 150 to more than 200 miles to the left of the path, but on neither day more than 50, and rarely more than 25, miles to the right. (See map).

(6) *10th September, 1903.*—This storm will be remembered by visitors to the British Association at Southport. The path ran Clare to Norfolk, the centre was off the Arran Islands on the 10 2 p.m., south of Carnarvon at 6 p.m., and in the middle of the N

Sea at 8 a.m. on the 11th. This centre crossed the British Isles in about 16 hours, while No. 5 required at least 30 hours; but although the centre moved more quickly, the area over which an inch or more of rain fell was not much smaller. It extended for about 130 miles to the left of the path, and, except for a narrow strip along the coast of Wales, only for from 5 to 30 miles to the right of the path. (See map). If the paths of the two depressions Nos. 5 and 6 are superimposed to allow for the slight difference in direction, the similarity of the broad, wet strip to the left and the narrow wet strip to the right is most striking.

Three consecutive days in June, 1903, showed remarkable features.

(7) *13th June, 1903.*—The path ran from the Bristol Channel to the Isle of Wight, and at 8 a.m. on the 14th was close to the French coast and turning northwards. The whole area of rainfall over half-an-inch lay to the left, and contained large tracts in the Thames basin, East Anglia and Sussex with more than an inch.

(8) *14th June, 1903.*—The centre turned north-eastward, passed through the Strait of Dover, and at 8 a.m. on the 15th it was in the North Sea off Yarmouth. A broad belt of rainfall exceeding one inch stretched across the whole of England from the Bristol Channel to the coast of Essex with patches where over two inches fell. This lay entirely to the left of the path.

(9) *15th June, 1903.*—The path suddenly curved round, and shortly after 6 p.m. the centre entered the Wash and passed southwestward across England, being near Southampton at 9 a.m. on the 16th, when it was curving eastward. This is a direction exactly opposite to that usual for cyclones crossing England; but, again, almost the entire extent of a large area with a rainfall exceeding one inch lay to the left of the path, *i.e.*, on the southern and eastern side, instead of on the northern and western side as in other cases.

During the three days in which this depression described an elliptic path round the lower Thames Valley and East Anglia, rain fell within that area continuously for about 60 hours, and amounted in that time to from 3 to 4 inches, producing a state of matters for which no precedent can be found. (See map).

One case remains.

(10) *30th December, 1900.*—The path ran from Cornwall through Portsmouth to the coast of France. The area with over an inch of rain stretched from the south coast to the Humber and Suffolk, and within it a large area had a fall exceeding 3 inches. So little of England lay south of the track that it is impossible to be quite sure, but the map certainly suggests that the greater part of the precipitation was on the left.

The conclusion drawn from the consideration of these instances is that *the belt of cyclonic rains is much wider on the left of the path than on the right, and the heaviest falls occur in advance of the centre.*

At present the fact is merely stated and the evidence collected during the last four years put forward. When more cases have been investigated it should not be impossible to extend the conclusions, especially with regard to the parallelism or divergence of the wet belt with reference to the path, and perhaps, as a result, to improve the accuracy of regional forecasts. The interest of the question in the light of Dr. Shaw's discussion of the trajectories of the air in a cyclone is apparent. It is not known to the author with what degree of precision the position of the centre is given on the Meteorological Office charts, the paths shown were copied as accurately as possible from the official maps; but of course no allowance could be made for secondary depressions.

It is remarkable that the wide-spread cyclonic rains appear to bear no relation to the physical features of the country, however, the data are not yet sufficient to enable this question to be fully discussed.

Address to the Sub-Section Cosmical Physics,

By Sir John Eliot, K.C.I.E., M.A., F.R.S.

(*Continued from p. 147.*)

The preceding statements have shown that variations of rainfall for prolonged periods similar in character have occurred, and may hence occur again, over the very large area including the Southern Asian peninsulas, East and South Africa, Australia, and, perhaps, the Indian Ocean. The abnormal actions or conditions giving rise to these large and prolonged variations must hence be persistent for long periods, and be effective over the whole of that extensive area, and hence cannot be inferred with certainty from the examination of the data of one small portion of the area affected —*e.g.*, India. The variations undoubtedly accompany variations in the complete atmospheric circulation over the Indo-oceanic area, and the effective forces or actions must be such as to influence the whole movement in a similar manner in the two monsoons or seasons of inverse conditions in Southern Asia. This inference furnishes a very strong reason for the conclusion that the meteorology of the whole area similarly affected from 1892 to 1902 should be studied as a whole, and not in fragmentary detail by various weather bureaus, and as at present without any co-ordination of the results of these bureaus.

The discussion has also indicated that the south-west monsoon current is a periodic or intermittent extension of the permanent circulation of the south-east trades to the peninsulas of Southern Asia, and also that variations in the strength, volume, and direction of movement of the latter affect the extension, volume, aqueous vapour contents, and precipitation of the south-west monsoon currents in Burma, India, and Abyssinia. This fact further emphasises the necessity for the co-ordination and systematisation of the work of observation in the Indo-oceanic meteorological province and the continuous and systematic examination and discussion of observations for the whole of that area.

It is, of course, possible that it may be necessary to extend this work to a larger area than the Indo-oceanic region. For Sir Norman Lockyer and Dr. Lockyer have shown that similar pressure variations to those of Bombay occur over a large portion of the Eastern Hemisphere, and variations of opposite sign (similar to those of Cordova) over a considerable part of the Western Hemisphere.

The Indian Meteorological Department, with the sanction of the Government of India, is now arranging to collect and tabulate data for the whole area between the Central Asian winter anticyclone and the permanent South Indian Ocean anticyclone, and to utilise the information for the investigation of the causes of the large and general variations of rainfall in Burma and India from year to year. This extension of its labour is recognised as necessary for the improvement of the seasonal forecasts, an important feature of the work of the Department, the value and importance of which are fully recognised by the Government of India.

Possibly the practice of the Indian Meteorological Department in the preparation and issue of long-period or seasonal forecasts is considered to be not only unscientific, but not justified by comparison with facts. Professor Cleveland Abbe, in his paper on "The Physical Basis of Long-range Weather Forecasts," expresses his opinion that "we are warranted in saying that during the thirteen years (1888—1900) the only real failure has been that of the prediction of the monsoon season of 1899, the year of phenomenally great drought in that country." This opinion is probably more favourable than I should myself give, but it is the opinion of an independent meteorologist eminently qualified to give a judgment in the matter.

My own opinion with respect to weather forecasts is that there appears to be too strong a desire for absolute accuracy, possibly due to public and newspaper criticism. Certainty is not possible in weather forecasts based on imperfect information, and in which the introduction of a single unknown factor in regions beyond observation—*e.g.*, the upper or middle atmosphere—may completely alter the course of events. Percentages of success are an inadequate measure of the utility of forecasts. To be of real value as estimates of utility they should be calculated rather on the information required, and which might be reasonably expected, than on that actually given.

It appears to me that the striving after perfection in short-period forecasts to the exclusion of other claims is impeding the extension and progress of meteorology in other useful directions. It is absolutely essential that officials preparing or utilising forecasts should recognise that every forecast is based on imperfect information and experience, and hence that all important forecasts should be expressed as probabilities, and, whenever desirable, an estimate of the value of each probability be given.

The Government of India desires to have these seasonal forecasts, and has ordered its Meteorological Department to furnish them. The Government encourages the work, provides the additional means required by the department for its proper performance, and issues the forecasts only to those who will use them as probabilities for practical guidance.

The Government of India have sanctioned large changes in its Meteorological Department in order to enable it to carry out the extensions of work that recent experience has shown to be desirable. The Department is kept in touch with scientific opinion and judgment at home through the Observatories Committee of the Royal Society. The relations to other scientific departments in India are maintained by a special committee termed the Board of Scientific Advice. The scientific staff has been largely increased.

The solar physics observatory at Kodaikanal and the magnetic observatory at Bombay have been placed under the Meteorological Department with a view to the complete co-ordination of the departments of scientific investigation for which they are maintained. Observational data for the whole Indo-oceanic area are now being collected and tabulated with a view to the early publication of daily and monthly weather reports and charts of that area.

The area to be dealt with (viz., the Indo-oceanic area) is partially covered by a number of independent meteorological systems, including those of Egypt, East, Central and South Africa, Ceylon, Mauritius, the Straits Settlements, and Australia. Large areas, as, for example Arabia, Persia, Afghanistan, Thibet, and the greater number of the islands of the Indian Ocean, are now almost completely unrepresented.

The departments controlling these systems work independently of each other, chiefly for local objects, and are in no way officially correlated or affiliated. Their methods of observation and of discussion and publication of meteorological data differ largely. It is hence difficult, if not almost impossible, to make satisfactory comparisons of the data, and trace out for the work of current meteorology the extension or field of similar variations, their relations to each other, and their probable influence on the future weather.

The work which should be carried out in order that the investigation of the meteorology of the Indo-oceanic area might be effective and as complete as possible includes the following :—

(1.) The extension of the field of observation by the establishment of observatories in unrepresented areas, and the systematic collection of marine meteorological data for the oceanic area.

(2.) The collection and tabulation of the data necessary to give an adequate view of the larger abnormal features of the meteorology of the whole area.

(3.) The direction by some authoritative body of the registration, collection, and tabulation of observations by similar methods in order to furnish strictly comparable data for discussion.

(4) The preparation of summaries of data required as preliminary to the work of discussion, and for the information of the officers controlling the work of observation in the contributory areas. The earliest publication of the data should be regarded as essential for the use of officers issuing seasonal forecasts.

(5) The scientific discussion of all the larger abnormal features in any considerable part of the area and their correlation to corresponding or compensatory variations in the remainder of the area, by a central office furnished with an adequate staff.

(6) Possibly, sufficient authority on the part of the central office to initiate special observations required for the elucidation of special features for which there are no arrangements in the general work of the various systems.

The Indian Meteorological Department is making preparations to carry out a portion of this work; and will undoubtedly do the best it can single-handed with its limited means. It cannot do the work fully and as it ought to be done. It can do nothing which requires authoritative control over the remaining meteorological systems in the Indo-oceanic field. It is collecting information from those who are willing to supply it, and will utilise it for its special purposes.

It is evident the work can only be carried out fully by the co-operation of the various systems subject to limited control by a central office with acknowledged imperial or general authority behind it. The most important part of the work from the standpoint of the science of meteorology is the comparison and discussion of the whole body of observations. The constitution, position, and authority of the central office is hence of the greatest importance. It is quite certain that none of the meteorological systems directly concerned can provide such a central office. If the work is to be carried out fully and systematically it can only be arranged for in England, and by the British Government assuming the general direction and control.

At the present time a section of the British Meteorological Office is devoted to the study of oceanic meteorology for the information of mariners. Another section should be created for the study of imperial meteorology for the benefit of its dependencies and colonies. I have reason to believe that the Government of India would contribute its share towards the cost of this extension of work.

In the preceding remarks are given the chief reasons for an important extension of work now in progress in the Indian Meteorological Department, an extension which can only be carried out imperfectly by that Department, but which could be performed with most valuable scientific results by the co-ordination of the labours of the weather bureaus concerned, with a central institution or investigating office in England under Government control.

Perhaps I may be permitted, from my Indian experience, to add some general remarks bearing on the methods and progress of meteorological inquiry.

In India the collection and publication of accurate current data relating to rainfall and temperature is required for the information of Government in its various Departments. The collection and examination of pressure and wind data by a central office with a view to the issue of storm and flood warnings is equally necessary. This work may, perhaps, be described as pertaining to descriptive or economic meteorology.

Economic meteorology, so long as it deals only with actual facts of observation, is not a science. Forecasts belong to the same department or branch of meteorology. They may be based on scientific theory and be obtained by scientific methods or the utilisation of empirical knowledge. The latter method is probably sufficient for by far the greater part of short-period forecast work, but the final development of that work and the preparation of long-period forecasts require the application of exact scientific methods and knowledge. And it is, perhaps, not too much to say that the extension of the range or period of forecasts is a measure of the progress of meteorology as a science. India, by the simplicity and massiveness of its meteorological changes (and perhaps Australia and Africa), appears to be best suited for the earliest experiments in this work.

India is, however, poor, not only in material wealth and capital as compared with England, but also in the appliances and means of scientific investigation, and hence looks to England for assistance and guidance in scientific matters. Unfortunately, England lags behind, not only the United States and Germany, but even behind India, in the important field of scientific meteorological inquiry. It will suffice to give a single illustration of the anomalous and inferior position which England takes in such matters.

All meteorologists and scientific men generally are agreed that the exploration of the middle and upper atmosphere by any available means—*e.g.*, kites, balloons, &c.—is of the utmost importance at the present stage of meteorological inquiry. The United States, France, and Germany have taken up the work vigorously. The British Meteorological Office is unable, for want of funds, to share or take any part in the work. The force of scientific and public opinion is apparently powerless to move the British Government to grant an extra five hundred pounds annually for this work. The British Government, on the other hand, some time ago suggested that the Indian Meteorological Department should assist. The Government of India, recognising the importance of the work, has provided the funds and sanctioned the arrangements necessary in order that its Meteorological Department may march with the most progressive nations in this investigation.

India has no body of voluntary observers or independent scientific workers and investigators. Whatever is required to be done to extend practical and theoretical meteorology can only be effected by the Government Department to which that work is assigned, with the sanction and at the cost of the Government—which naturally considers chiefly its practical wants in relation to its limited resources. It is, from one point of view, a painful if not quite an unexpected experience to me, on my retirement, to find that the Government of India is, in its attitude towards meteorological inquiry, more advanced, more liberal and far-sighted than the British Government, and that England has not yet taken up seriously the work of scientific meteorological investigation. There are undoubtedly too many observations and too little serious discussion of observations. The time has arrived when investigation should go hand in hand with accurate observation, and should direct and suggest the work of observation, and also that the sciences directly related to meteorology should be considered concurrently with it. There are undoubtedly definite relations between certain classes of solar phenomena and phenomena of terrestrial magnetism. The probability of definite relations between solar and terrestrial meteorological phenomena is also generally admitted.

Data for the determination of these relations are being rapidly accumulated, and numerous problems connected therewith are waiting and ripe for investigation. They are too large and complex to be undertaken by present English methods, and can only be attacked by a body of trained investigators under arrangements securing the continuity of method and thought requisite for the prolonged systematic inquiry gradually leading up to their complete solution.

It would hence be desirable to enlarge the scope of the central institution I have suggested, so as to include in its field of labour the investigation of the relation between solar and terrestrial meteorology and magnetism, so far as they can be solved by the comparison of the observations of the British Empire.

The central institution would thus have large and definite fields of work and most interesting problems for investigation. It would hence contribute towards the formation of a body of scientific meteorological investigators adequate to the importance and wants of the empire, and be of the highest educational as well as scientific value.

My predecessor in this position, Dr. Shaw, the head of the British Meteorological Office, made some remarks in his Address last year which deserve repetition in connection with this idea. He said:—"The British Empire stands to gain more by scientific knowledge, and to lose more by unscientific knowledge, of the matter than any other country. It should from its position be the most important agency for promoting the advance of meteorological science, in the first place because it possesses such admirable varying fields of observation, and in the second place because with due encouragement British intellect may achieve as fruitful results in this as in other fields of investigation."

The establishment of the central institution as suggested above would provide a remedy for the defects pointed out by Dr. Shaw. The reorganisation of the British Meteorological Office is, I believe, under consideration. Is it too much to hope that a strong expression of opinion on the part of the British Association, and the influence of the learned university at which its present meeting is held, would induce the British Government to spend an additional £5000 or £10,000 annually for the promotion of meteorological investigation and the establishment of a central imperial institution in London in connection with its Meteorological Office?

The Relation between Pressure, Temperature, and Air Circulation over the South Atlantic Ocean.

By Commander CAMPBELL HEPWORTH, C.B., R.N.R.

THE South Atlantic offers an excellent field for the study of air circulation on a comprehensive scale and under normal conditions. An ocean covering an extensive area, connected north and south with great oceans and completely open to the south, it is, at the same time, free from the disturbing influences of island groups, and is bounded east and west by continents having coastlines that are for the most part exempt from large irregularities of outlines. The atmospheric circulation over the South Atlantic may therefore be recorded as one vast wind system, its air-currents undisturbed over the northern half by the occurrence of aerial eddies for the most part, and over the southern half, although at times interrupted, yet not effaced by them.

The anticyclone, or area of high barometric pressure, is the great controlling agent of the system, and round this central high pressure the winds revolve.

The circulation of the air is assisted on the eastern side of the ocean by the relatively low pressure over South Africa, on the northern side by the low pressure over the equatorial regions of the Atlantic, on the western side by the relatively low pressure over South America, and on the southern by the lower pressure of higher latitudes. The direction of the wind about the core of high pressure, stated generally, is southerly to south-easterly between it and the African coast, south-easterly and easterly towards the equator, easterly to northerly on its western side, and north-westerly to south-westerly on its southern. Over the eastern and northern segments of the system the flow of the air-current is steady; over the western and southern, particularly over the former, the circulation is less persistent. Southward of 30° S. lat., and even further to the northward, on the western side of the South Atlantic the apparent normal circulation of the surface wind, in harmony with the course of the average isobars, is largely masked by the incursion of low-pressure systems travelling eastward or south-eastward.

On the eastern margins of the South Atlantic and South Pacific north of 30° S. lat., and in a measure also on the western margin of the former, north of the same parallel, when the conditions of the atmosphere are stable, there appears a marked inclination for the wind to follow the course of the littoral. This probably is connected with the tendency of the barometric pressure over the land to conform to the contour of the coastline.

Throughout the twelve months the shape of the isobar bounding the area of highest pressure (30·1 or 30·2) is approximately that of an ellipse. The major axis, however, does not always make the same angle with the meridian, and the axes vary, not only in position, but also in length.

Over the South Pacific throughout the twelve months there is an area of high barometric pressure, the South Pacific anticyclone, which is elliptical in shape, and is bounded by an isobar of 30·2, except during the four months March to June inclusive, when the highest value shown is 30·1.

A table given furnishes particulars of the intensity, position, and extent of the high-pressure area over the South Atlantic and eastern margin of the South Pacific, and of the mean latitude of the belt of doldrums in the North Atlantic.

The area over which the south-east trade-wind blows steadily, and the region over which westerly winds predominate, vary from month to month in harmony with the change in the position of the South Atlantic anticyclone, and with that of its intensity and extent. These variations are pointed out.

There is a general relation to be found between the direction of the prevailing wind and the average temperature of the air in the shade over the South Atlantic, on either side of the permanent area of high pressure.

Throughout the year there is a marked tendency for the air-isotherms to extend along a line drawn from the Cape of Good Hope to the Island of Ascension under the influence of the relatively cool air of the south-east trades which blow on the African side of the high pressure, and in sympathy with the cool sea-surface current setting north-westward; while, at the same time, the relatively warm north-east wind on the American side of the anticyclone, which is in sympathy with the warm sea-surface current setting south-westward, exercises a similar influence upon the air-isotherms in the vicinity of South America.

Gale frequency on the South Atlantic is indicated in a table giving the latitude and longitude of the principal points in gale-frequency curves for different seasons.

Cyclonic storms of the South Atlantic appear to reach that ocean in two ways. They cross the continent of South America somewhere between 25° S. and Cape Horn, more frequently travelling over Patagonia; or they avoid the land altogether and round Cape Horn to the eastward, following the general drift of air and sea-surface.

The percentage curves seem to show that not infrequently the cyclonic system, instead of rounding Cape Horn or crossing the land, strikes northward or north-westward up the Pacific at a distance of 5° to 10° from the west coast of South America.

The Temperature of the Air in Cyclones and Anti-Cyclones, as shown by Kite-flights at Blue Hill Observatory, U.S.A.

By A. LAWRENCE ROTCH, B.S., M.A., Director of the Observatory.

A STUDY of the data obtained during 34 kite-flights at Blue Hill, at different seasons, and in areas of low and high barometric pressure, up to a height of about 12,000 feet, shows the mean decrease of temperature, computed by stages of 1,600 feet, to be nearly constant, averaging 1° Fahr. per 376 feet of ascent. Whether the whole column of air in a cyclone is warmer than the corresponding air in an anti-cyclone (as the convectional theory of its formation requires) depends chiefly upon whether its initial temperature at the ground is higher than that of the anti-cyclone, which is usually the case. If the data obtained from kite-flights on consecutive days be plotted for the same height (as was first done at Blue Hill in 1899), it is seen, that up to the height of 12,000 feet, it is generally warmer at all levels over areas of low barometric pressure than it is over the adjacent areas of high pressure.

Kite-flights on Blue Hill are usually made once a month upon a day fixed by the International Committee for Scientific Aeronautics. During 1903, the average of the highest points reached in the 15 flights was 7264 feet above sea-level, and the greatest height in any flight was 13,970 feet. From January to July, inclusive, this year, the nine flights have given an average elevation of 8284 feet, the highest one reaching 14,660 feet. During the present summer, it is hoped to extend the observations of temperature in the free air, by means of *ballons sondes* liberated from St. Louis, to an altitude never before obtained above the American continent.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE WETTEST SPOT IN THE UNITED KINGDOM.

REFERRING to Mr. Bonacina's interesting letter in last months Magazine on the above subject, and with a view to furthering the idea to find out the wettest spot in the United Kingdom, I beg to point out what appear to be conclusive facts, showing that if the surroundings and contour of the hills, above 3000 feet, in Keirry are as favourable as The Stye and Snowdon, the precipitat on at the wettest spot in Ireland ought to be higher than any place in England and Wales, for the following reasons :—

1.—As the direction of Kerry and Cumberland runs practically parallel with the general track of the Atlantic depressions, passing over the British Isles, the amount of precipitation due to the proximity to the mean path of the depressions, is as favourable at Kerry as at Cumberland and Carnarvonshire.

2.—Owing to Kerry being 300 and 200 miles more to the west and south than Cumberland, the rainfall would be likely to be more at

Kerry for the following reasons:—(*a.*) Higher average temperature. (*b.*) Surrounded by a larger expanse of the sea. (*c.*) More chances to obtain the precipitation, due to depressions passing northwards to the east of Kerry, and west of Cumberland, which, according to Dr. Mill's observation is heavier on the left side of the track.

3.—According to the general rule, places with a high yearly rainfall have a high number of rainy days. As the number of rainy days along the *sea coast* of Kerry is considerably more than the *sea coast* of Cumberland and Carnarvonshire, and assuming the mountain rainfall conditions are practically the same at Kerry as at The Stye, &c., the yearly precipitation on the Kerry hills ought to be more than at Cumberland, &c.

4.—The sea coast, or low level land rainfall,—viz., places *not* affected by any near hills—are probably the best guide or standard to ascertain the amount of yearly rainfall due to the geographical position and general track of the depressions, in regard to Kerry and Cumberland, &c, and the rainfall of these positions is well represented in the following places:—

Low-level and non-mountain standard for Kerry represented by	Valencia, Cahirciveen, and Darrynane Abbey, yearly average of—say 53 in.
Low-level and non-mountain standard for Cumberland—The Stye by	Maryport, Braystones, and Seascale of—say 36 in.
Low-level and non-mountain standard for Carnarvonshire—Snowdon by	Talarvor.Anglesey stations —say 36 in.

It will be seen from the map that the named sea coast places of Cumberland and Carnarvonshire are not affected by any mountain condensation from the *wet points*, but not having a contour map of Valencia and Darrynane in my possession, I cannot say whether Valencia would be partly affected by any low hills, but Darrynane appears unaffected. The wettest spot at Snowdon is situated 14 miles north-east of the sea coast standard station (viz., Talarvor), with an average rainfall of 190 inches, compared with 36 inches at Talarvor, therefore the combined high rainfall features, or points of Snowdon, give 5·3 times the sea coast standard.

The Stye is also situated practically 14 miles north-east of its sea coast standard (viz., Seascale), with about 175 inches, compared with 36 inches at Seascale,—giving the combined mountain rainfall features five times the standard. So we may take it roughly that the combined high rainfall points of the wettest places in England and Wales are five times the sea level standard.

Owing to the difficulty of finding any sea level standard rainfall along the west coast of Scotland, *not* affected on the weather side by the near hills, I have left Scotland out of the calculation, but I believe it is something like those of Cumberland and Carnarvonshire. and below Kerry. Taking the Kerry sea coast standard at 50 inches, and the combined high rainfall points of Brandon Hill (3127 ft.) and Carrantuohill (3414 ft.)—both practically the same height as Snowdon and Scafell—at only four times the standard, it is evident that Ireland could claim a wetter spot than either England or Wales. So, in conclusion, I beg to ask,—is there not an Irishman living who would undertake to ascertain the *actual* amount at the wettest spot in Kerry?

J. R. GETHIN JONES.

Bod Gethin, Deganwy, Oct. 6th, 1904.

HEAVY RAIN ON AUGUST 30th, 1904.

LAST night we had a sharp thunderstorm accompanied by an exceptionally heavy downpour of rain, quite the heaviest I have ever observed either here or elsewhere. The rain began at about 7.45 p.m., accompanied by very vivid lightning, which latter, however. did not last very long. The rain continued till 11.15 p.m., when it ceased quite suddenly; the total fall in the three hours and a-half was 3·65 in. I should be glad to know if at other stations anything like this was observed.

J. ELDON ELLISON.

Timolin Vicarage, Ballytore, Co. Kildare, August 31st, 1904.

THE RAINFALL OF MANCHESTER.

WE have extracted the following information from some interesting notes on the rainfall, at Withington, Manchester, covering the period 1851—1903, for which we are indebted to Mr. J. H. Casartelli, of that city. The mean annual rainfall for the 53 years was found to be 33·15 in., and ranged between 51·23 in. in the wettest year (1872) to 21·26 in. in the driest (1887). The rainfall of the five complete decades included in the series exhibits striking differences, the range between the wettest and driest of such periods amounting to 6·60 in. The figures are—

1851-60.	1861-70.	1871-80.	1881-90.	1891-1900
in.	in.	in.	in.	in.
34·86	31·84	37·28	32·33	30·68

Although the length of the period necessary to admit of an accurate monthly distribution is open to discussion, we think that in the present case the observations have extended over a sufficient length of time to give values approaching the truth. The monthly means as calculated by Mr. Casartelli are:—

Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
2·67	2·07	2·23	1·79	2·14	2·90	3·20	3·46	3·21	3·65	2·80	3·05

The largest monthly total recorded during the period discussed was 7·15 in., in July, 1872, and the smallest ·09 in. in Febuary, 1858. The greatest fall in 24 hours ending 9 a.m. was 2·10 in. on July 13th, 1872,—a very moderate fall considering the length of the period over which the observations extend. The average number of rainy days was 183, the greatest number ever registed being 240 in 1872, and the least 131 in 1887.

THE ST. SWITHIN'S DAY TRADITION.

AMONG the weather sayings which have long been current, and have obtained a considerable amount of credit, is that which relates to St. Swithin's Day. St. Swithin was Bishop of Winchester in the ninth century, and died on 2nd July, 862. The tradition is that at his own request, he was buried in the churchyard of Winchester. But a century later, having been canonised by the Pope, the monks considered this an unfit place for the sepulchre of a saint, and resolved to transfer his remains to the Cathedral. The day fixed upon for this translation was the 15th July, 962. But the weather proved so unfavourable on that day, and for 40 days thereafter, through violent rains, that the transference was delayed for that period of time,—thence arose the saying that if it rained on St. Swithin's day, it would continue to rain for 40 days after. The following table showing the state of the weather in regard to rainfall on the 15th July for the last eighteen years, and the number of days on which rain fell in the 40 days succeeding, with the amount thereof, may serve to test the accuracy of the saying :—

Years.	Rainfall on St. Swithin's Day, 15th July. in.	Amount of rainfall for the 40 days following St. Swithin's Day. in.	No. of days on which rain fell in that period.
1887	·00	3·02	18
1888	·35	7·14	28
1889	·26	6·52	28
1890	·08	4·51	16
1891	·11	4·42	27
1892	·00	4·33	18
1893	·00	5·54	26
1894	·06	2·32	25
1895	·00	7·93	34
1896	·01	3·60	17
1897	·00	4·85	24
1898	·00	3·52	16
1899	·00	0·84	11
1900	·14	7·79	28
1901	·51	4·52	21
1902	·00	4·30	16
1903	·70	3·85	22
1904	1·40	3·98	25

From the above table it will be seen that from 1887 to 1904 there was no year in which rain fell for 40 days after the 15th. The greatest number was 34, in 1895 ; and in that year no rain fell on the 15th. There were three years in which rain fell on 28 days, and in all these the 15th was wet, and the total amount ranged from 6·52 in. to 7·79 in. On the other hand the next heaviest rainfall to these was 5·54 in. in 1893, with 26 days in which it fell,—and in that year the 15th was dry—and in 1897, in which the 15th was also dry there were 24 days, with 4·85 in. of rain, the next largest amount to those above specified.

WM. ANDSON.

Dumfries, 10th September, 1904.

RAINFALL AND TEMPERATURE, SEPTEMBER, 1904.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1890-9.	Greatest in 24 hours. Depth	Greatest in 24 hours. Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date.	Min. Deg.	Min. Date.	No. of Nights below 32°. Shade	Grass
		inches	inches.	in.								
I.	London (Camden Square)	1·17	— ·90	·18	30	11	74·9	5	39·1	26	0	2
II.	Tenterden	1·28	— 1·11	·30	6	13	72·5	5	38·0	26	0	0
,,	Hartley Wintney	1·23	— ·97	·32	14	8	72·0	5	33·0	30	0	4
III.	Hitchin	1·12	— 1·01	·28	30	13	71·0	5	33·0	19	0	...
,,	Winslow (Addington)	1·41	— ·85	·34	30	11	73·0	5	33·0	30	0	4
IV.	Bury St. Edmunds (Westley)	1·17	— 1·32	·32	30	12	72·8	5	34·5	30	0	...
,,	Brundall	1·78	— ·67	·50	6	11	72·0	5	38·0	26, 30	0	0
V.	Alderbury	2·00	— ·39	·76	12	10	69·0	3	34·0	26	0	...
,,	Winterborne Steepleton	3·13	...	1·08	30	12	69·1	28	32·5	20	0	8
,,	Torquay (Cary Green)	1·81	...	·82	11	11	67·7	3	44·1	27	0	0
,,	Polapit Tamar [Launceston]	2·52	— ·78	·56	13	13	67·3	29	32·9	27	0	0
,,	Bath	1·37	...	·41	12	7	69·5	5, 17	37·0	30	0	8
VI.	Stroud (Upfield)	2·27	— ·17	·52	30	13	71·0	5	42·0	20	0	...
,,	Church Stretton (Woolstaston)	2·12	— ·29	·72	12	12	66·0	5, 28	39·0	27	0	...
,,	Bromsgrove (Stoke Reformatory)	1·96	+ ·20	·55	12	9	68·0	18	35·0	29	0	...
VII.	Boston	3·13	+ 1·15	1·25	1	11	69·0	5	40·0	27	0	...
,,	Bawtry (Hesley Hall)	1·16	— ·73	·48	30	11	79·0	5	40·0	22	0	...
,,	Derby (Midland Railway)	1·67	— ·34	·54	30	10	74·0	5	38·0	29	0	...
VIII.	Bolton (The Park)	1·73	— 2·43	·56	30	9	69·4	18	40·4	11	0	0
IX.	Wetherby (Ribston Hall)	·81	— 1·41	·30	2	11	...	...	...	...	...	...
,,	Arncliffe Vicarage	1·75	— 3·43	·45	30	13	...	...	...	...	...	...
,,	Hull (Pearson Park)	1·70	— ·53	·76	30	11	74·0	5	39·0	20, 28	0	0
X.	Newcastle (Town Moor)	1·18	— 1·00	·33	2	10	...	...	...	...	...	...
,,	Borrowdale (Seathwaite)	7·48	— 5·40	2·00	2	14	68·7	18	39·4	11	0	...
XI.	Cardiff (Ely)	4·03	+ ·28	·93	14	16	...	...	...	...	...	...
,,	Haverfordwest (High St.)	5·10	+ 1·30	·89	7	16	67·0	17	34·4	27	0	1
,,	Aberystwith (Gogerddan)	3·96	— ·11	·85	12	8	76·0	18	32·0	25	1	...
,,	Llandudno	1·15	— 1·72	·33	12	10	72·0	18	46·2	11	0	...
XII.	Cargen [Dumfries]	2·78	— ·97	·66	30	10	69·0	17*a*	35·0	27	0	...
XIII.	Edinburgh (Royal Observy.)	1·55	...	·55	25	10	68·4	17	41·6	21	0	1
XIV.	Colmonell	4·49	+ ·50	1·00	2	12	76·0	18*b*	36·0	26, 27	0	...
XV.	Tighnabruaich	7·26	...	1·31	5	15	60·0	1, 2*c*	38·0	10*d*	0	0
,,	Mull (Quinish)	4·61	— ·51	1·44	29	17	...	...	...	...	...	...
XVI.	Loch Leven Sluices	2·23	— ·68	·77	3	10	...	...	...	...	...	...
,,	Dundee (Eastern Necropolis)	2·35	+ ·12	·90	2	14	69·6	7	38·5	14	0	...
XVII.	Braemar	2·14	— ·98	·71	2	16	65·0	19	29·5	14	3	14
,,	Aberdeen (Cranford)	2·33	— ·40	·89	2	15	65·0	2	34·0	13	0	...
,,	Cawdor (Budgate)	1·73	— 1·36	·50	2	13	...	...	...	...	...	...
XVIII.	Glencarron Lodge	7·92	— ·61	1·26	29	18	70·0	18	36·4	21	0	...
,,	Bendamph	8·19	— ·74	1·47	29	19	...	...	...	...	...	...
XIX.	Dunrobin Castle	2·40	— ·19	·53	25	13	68·0	18	42·0	14	0	...
,,	Castletown	3·23	...	·77	13	22	66·0	6	32·0	22, 23	1	...
XX.	Killarney	3·42	— 1·26	·81	5	18	68·5	16	41·5	27	0	...
,,	Waterford (Brook Lodge)	4·40	+ 1·27	1·00	7	15	65·0	17	35·0	27	0	...
,,	Broadford (Hurdlestown)	2·97	+ ·10	·54	7	18	66·0	18	38·0	21, 24	0	...
XXI.	Carlow (Browne's Hill)	3·35	+ ·62	1·10	12	14	...	...	...	...	...	...
,,	Dublin (FitzWilliam Square)	2·34	+ ·22	1·20	12	17	71·6	5	41·1	29	0	0
XXII.	Ballinasloe	3·11	— ·03	·67	2	20	67·3	18	33·0	21	0	...
,,	Clifden (Kylemore House)	5·97	— ·87	1·26	29	16	...	...	...	...	...	...
XXIII.	Seaforde	3·71	+ ·56	·92	2	11	68·0	7	39·0	10	0	0
,,	Londonderry (Creggan Res.)	2·68	— 1·19	·61	2	17	...	...	...	...	...	...
,,	Omagh (Edenfel)	3·00	— ·71	·70	2	16	67·0	18	35·0	10	0	0

+ Shows that the fall was above the average; — that it was below it. *a* and 18, 20. *b* and 19. *c* and 6. *d* and 25, 26.

SUPPLEMENTARY RAINFALL, SEPTEMBER, 1904.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	1·82	XI.	New Radnor, Ednol	2·49
,,	Sheppey, Leysdown	·93	,,	Rhayader, Nantgwillt	3·12
,,	Hailsham	1·69	,,	Lake Vyrnwy	2·57
,,	Crowborough	2·30	,,	Ruthin, Plâs Drâw...........	1·44
,,	Ryde, Beldornie Tower......	1·93	,,	Criccieth, Talarvor...........	2·62
,,	Emsworth, Redlands.........	2·04	,,	Anglesey, Lligwy	2·37
,,	Alton, Ashdell	1·94	,,	Douglas, Woodville	3·74
,,	Newbury, Welford Park ...	1·51	XII.	Stoneykirk, Ardwell House	3·87
III.	Harrow Weald	1·50	,,	Dalry, Old Garroch	5·17
,,	Oxford, Magdalen College..	1·44	,,	Langholm, Drove Road......	2·92
,,	Banbury, Bloxham...	2·05	,,	Moniaive, Maxwelton House	3·68
,,	Pitsford, Sedgebrook.........	1·98	,,	Lilliesleaf, Riddell	·96
,,	Huntingdon, Brampton......	2·07	XIII.	N. Esk Reservoir [Penicuick]	2·00
,,	Wisbech, Bank House	1·99	XIV.	Maybole, Knockdon Farm..	2·05
IV.	Southend	·98	,,	Glasgow, Queen's Park	3·12
,,	Colchester, Lexden...........	·84	XV.	Inveraray, Newtown.........	6·25
,,	Saffron Waldon, Newport...	1·34	,,	Ballachulish, Ardsheal	8·82
,,	Rendlesham Hall	1·52	,,	Campbeltown, Redknowe...	5·33
,,	Swaffham	2·24	,,	Islay, Eallabus	4·90
,,	Blakeney	1·86	XVI.	Dollar	3·57
V.	Bishop's Cannings	2·06	,,	Balquhidder, Stronvar	7·60
,,	Ashburton, Druid House ...	2·83	,,	Coupar Angus Station	2·32
,,	Okehampton, Oaklands......	2·01	,,	Blair Atholl........	3·44
,,	Hartland Abbey	3·37	,,	Montrose, Sunnyside.........	1·79
,,	Lynmouth, Rock House ...	2·32	XVII.	Alford, Lynturk Manse ...	2·16
,,	Probus, Lamellyn	2·39	,,	Keith, H.R.S.............. ..	2·58
,,	Wellington, The Avenue ...	1·56	XVIII.	Fearn, Lower Pitkerrie......	2·34
,,	North Cadbury Rectory ..	2·27	,,	S. Uist, Askernish	...
VI.	Clifton, Pembroke Road ...	1·54	,,	Invergarry	5·72
,,	Moreton-in-Marsh, Longboro'	2·74	,,	Aviemore, Alvie Manse......	2·43
,,	Ross, The Graig	2·16	,,	Loch Ness, Drumnadrochit.	2·45
,,	Shifnal, Hatton Grange......	2·31	XIX.	Invershin	2·24
,,	Wem Rectory	1·62	,,	Altnaharra	2·97
,,	Cheadle, The Heath House.	1·97	,,	Bettyhill	2·49
,,	Coventry, Kingswood	1·89	,,	Watten, H.R.S.	2·79
VII.	Market Overton	1·91	XX.	Cork, Wellesley Terrace ...	3·88
,,	Market Rasen	2·27	,,	Darrynane Abbey	6·22
,,	Worksop, Hodsock Priory..	1·21	,,	Glenam [Clonmel]	4·57
VIII.	Neston, Hinderton...........	2·09	,,	Ballingarry, Hazelfort	2·25
,,	Southport, Hesketh Park...	2·24	,,	Miltown Malbay..............	4·52
,,	Chatburn, Middlewood	1·50	XXI.	Gorey, Courtown House ...	3·81
,,	Duddon Valley, Seathwaite Vic.	5·77	,,	Moynalty, Westland	3·49
IX.	Langsett Moor, Up. Midhope	1·49	,,	Athlone, Twyford	3·83
,,	Baldersby.......................	1·26	,,	Mullingar, Belvedere.........	2·98
,,	Scalby, Silverdale	1·32	XXII.	Woodlawn	3·09
,,	Ingleby Greenhow	1·71	,,	Westport, Murrisk Abbey..	4·40
,,	Middleton, Mickleton	·95	,,	Crossmolina, Enniscoe	3·81
X.	Beltingham	·63	,,	Collooney, Markree Obsy...	2·91
,,	Bamburgh......................	·41	XXIII.	Enniskillen, Portora	3·12
,,	Keswick, The Bank	2·23	,,	Warrenpoint	3·65
,,	Melmerby Rectory...........	·96	,,	Banbridge, Milltown	3·21
XI.	Llanfrechfa Grange...........	2·54	,,	Belfast, Springfield	3·89
,,	Treherbert, Tyn-y-waun ...	5·41	,,	Bushmills, Dundarave	2·85
,,	Llandovery, Tonn	2·99	,,	Stewartstown	4·83
,,	Castle Malgwyn	3·10	,,	Killybegs	3·32
,,	Llandefaelog-fach	1·60	,,	Horn Head	3·80

METEOROLOGICAL NOTES ON SEPTEMBER, 1904.

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.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—Fine and dry on the whole. There were a few very gloomy and unpleasant days at intervals, especially in the first half, but a great many very fine ones; the weather during the week ending on 22nd being particularly brilliant. Duration of sunshine 133·3* hours, and of R 34·5 hours. Six sunless days. Mean temp. 56°·2, or 1°·5 below the average.

TENTERDEN.—The first half was rather unsettled, but the 4th, 5th, and 11th were splendid days. The third week was brilliant, with much E. wind. Duration of sunshine 191 hours.

CROWBOROUGH.—Cool and pleasant, with wind chiefly E. and N.E. Mean temp. 55°·0.

HARTLEY WINTNEY.—A perfect summer month, with little R and much sunshine, and absence of wind and of T. Cloudless from 18th to 23rd. Fog in mornings from 26th to 30th. Ozone on 16 days. Mean 3·6.

PITSFORD.—Beautifully fine and bright. R ·62 in. below the average. Mean temp. 52°·0.

BRUNDALL.—Fine on the whole, although there were some unsettled periods, particularly during the first half. Mean temp. 1°·2 below the average. The max. exceeded 70° on one day only.

WELLINGTON.—Very fine and seasonable, with temp. equable, but rather lower than usual. R about ·75 in. below the average.

NORTH CADBURY.—Showery and very humid till the 14th; very dry from 15th to 29th. High winds to 23rd, but very calm from 24th to 29th. No extreme temp.

CLIFTON.—Unsettled till 15th, when fine weather set in under the influence of an anti-cyclone, lasting, with the exception of a shower on 24th, till 29th, with cloudless skies for the first week, and afterwards, cloud. Sudden break on 30th with R and wind. R less than half the average.

WORKSOP.—A fine and pleasant month, and a grand time for fallowing work but roots would have benefitted with more R.

BOLTON.—Singularly steady bar. caused by a series of high pressure systems. These gave rise to a fair amount of easterly wind and slight R. Absolute drought from 13th to 27th. Duration of sunshine well above the average.

SOUTHPORT.—Mainly characterised by an unusual prevalence of easterly and south-easterly winds. Dry generally, the total R being 1·07 in. below the average. Mean temp. 0°·5 below the average. Duration of sunshine 22 hours above the average.

HULL.—Fine autumn weather generally, with some very bright days and mild nights. Duration of sunshine 126 hours.

LLANDOVERY.—A very pleasant month. R very small, except on 2nd and 30th, on which days half the total occurred. Sunshine plentiful.

HAVERFORDWEST.—Fine and warm. R above the average, mostly falling at night. Very fine from 17th to 24th, with no R but strong winds. Duration of sunshine 140·3 hours. Crops everywhere were excellent and harvested in good condition.

DOUGLAS.—Very fine despite 3·74 in. of R, which all fell on nine days. From 17th to 28th was rainless and brilliantly fine, with drying winds, and the harvest was well saved. Strong N.W. gale on 9th, and a violent inshore (E.S.E.) gale on 12th, causing unusual dislocation of cross-channel traffic, and great difficulty in landing passengers here.

SCOTLAND.

CARGEN [DUMFRIES].—Notwithstanding the wet weather at the beginning a better harvest had not been experienced for many years. Potatoes and turnips, however, suffered.

* Campbell-Stokes.

MAXWELTON HOUSE.—The last three weeks were very fine, bright and dry and excellent for the harvest.

LILLIESLEAF.—R 1·11 in. below the average. The latter half of the month was quite lovely, but the leaves were beginning to turn at the end. Crops were good and heavy and well got in, and there was no R to do any damage.

COLMONELL.—The first 9 days and the last 2 were wet, but the remainder was ideal weather for harvest, though there were slight falls on a few days and moderate to high winds.

TIGHNABRUAICH.—On 18th a slight earthquake shock was felt, preceded by a loud report at 4.10 a.m. No damage was done.

MULL, QUINISH.—Very warm and dry with E. wind from 10th to 25th. The harvest was unusually good.

CASTLETOWN.—Good harvesting weather throughout, most of the R falling during the night. Warm, damp winds from 18th to 24th.

IRELAND.

DARRYNANE ABBEY.—The first part was wet, followed by some very fine days from 18th to 26th. R 14 per cent. above the average.

MILTOWN MALBAY.—The first half was wet, the second dry and sunny and splendid for harvest.

DUBLIN.—A favourable month. R fell frequently up to 15th, very heavily on 12th but an anticyclone of much staying power and some intensity caused beautifully fine and bright weather from 16th to 25th. Mean temp. 56°·8. Duration of sunshine 161 hours.

MARKREE OBSERVATORY.—The first part was showery with no very heavy falls. Mild weather set in about 12th, and from that date very little R fell.

OMAGH.—The weather until the 16th was so persistently wet and unfavourable that fears for the harvest had become acute, when on the 17th a brilliant period of 12 days followed, and was taken advantage of so well that a harvest in this country has seldom been garnered in better order.

THE NINE MONTHS' RAINFALL OF 1904.

Aggregate Rainfall for January—September, 1904.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	15·61	97	Arncliffe	41·77	98	Braemar	20·45	86
Tenterden	17·64	95	Hull	17·81	101	Aberdeen	20·89	95
Hartley Wintney	18·34	105	Newcastle	17·54	96	Cawdor	17·42	79
Hitchin	17·04	104	Seathwaite	93·24	102	Glencarron	62·63	97
Winslow	18·02	108	Cardiff	33·70	125	Dunrobin	21·09	100
Westley	16·25	90	Haverfordwest	32·06	112	Killarney	38·92	103
Brundall	15·75	88	Gogerddan	33·65	114	Waterford	33·47	123
Alderbury	21·95	118	Llandudno	19·84	98	Broadford	29·72	125
Ashburton	40·13	125	Dumfries	30·06	100	Carlow	26·78	113
Polapit Tamar	32·76	133	Lilliesleaf	22·75	107	Dublin	19·16	99
Stroud	22·54	118	Colmonell	31·61	105	Mullingar	27·18	103
Woolstaston	22·23	110	Glasgow	27·37	108	Ballinasloe	30·32	117
Boston	16·89	116	Inveraray	51·62	105	Clifden	62·49	112
Hesley Hall	17·06	115	Islay	36·95	119	Crossmolina	46·37	131
Derby	16·72	102	Mull	43·72	114	Seaforde	28·30	111
Bolton	24·83	84	Loch Leven	26·95	108	Londonderry	31·15	106
Wetherby	21·07	124	Dundee	21·60	113	Omagh	33·12	118

Climatological Table for the British Empire, April, 1904.

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	67·9	14	35·8	22	59·0	42·4	42·4	77	112·3	27·4	1·02	10	5·6
Malta	74·6	12	45·2	1	68·9	55·6	53·1	77	124·5	43·7	·17	3	3·2
Lagos, W. Africa	90·0	25	70·0	20a	87·7	76·4	74·5	73	145·0	67·0	3·99	11	4·8
Cape Town	82·7	5	47·3	21	68·4	54·2	54·9	81	...	...	5·93	16	5·8
Durban, Natal	94·5	26	53·7	27	82·5	62·6	...	...	146·8	...	·65	5	2·7
Mauritius	84·4	5	62·3	13	80·4	68·4	67·2	79	149·1	55·2	4·00	21	6·4
Calcutta	101·5	23	69·4	10	95·2	77·4	74·6	72	157·3	67·0	·33	1	1·2
Bombay	91·1	28	75·2	18	89·0	77·9	73·5	74	140·6	68·8	·00	0	1·5
Madras	100·4	23	74·2	4	94·4	77·8	75·1	77	145·6	71·2	·00	0	2·1
Kodaikanal	77·3	6	48·8	15	70·4	54·0	49·7	64	140·8	37·3	4·21	11	4·0
Colombo, Ceylon	91·0	6, 7	73·6	19	88·9	77·8	74·3	78	153·4	68·6	5·40	13	5·5
Hongkong	83·8	26	59·7	1	75·2	67·8	66·6	86	139·0	...	1·91	12	8·3
Melbourne	86·9	14	41·8	18	71·3	50·9	51·9	73	140·1	34·2	·77	3	4·2
Adelaide	93·9	6	47·9	23	78·8	58·4	50·4	54	145·0	43·1	2·01	6	3·1
Coolgardie	97·5	5	42·9	18	79·8	55·7	48·3	49	160·3	36·8	·48	1	3·0
Sydney	77·0	3	53·3	21	69·6	59·2	57·9	86	116·3	41·9	12·60	28	6·2
Wellington	70·5	17	42·5	26	62·8	50·4	39·7	53	124·0	35·0	2·78	10	7·0
Auckland	71·5	4	48·0	28	65·7	54·9	52·1	74	134·0	40·0	5·33	12	5·0
Jamaica, Negril Point	89·3	12	66·9	1	85·1	70·1	69·5	73	...	...	5·82	9	...
Trinidad	90·0	17	65·0	sev.	83·9	67·6	73·0	84	159·0	60·0	2·50	9	...
Grenada	87·0	26	69·8	10b	82·7	73·6	68·6	73	146·2	...	3·35	17	3·9
Toronto	58·3	9	19·2	20	47·0	31·4	32·1	76	122·7	11·0	3·11	14	6·5
Fredericton	64·7	24	6·7	4	50·9	27·6	23·7	50	...	...	4·19	11	5·9
Winnipeg	...	...	...	...	...	...	...	...	...	...	...	...	...
Victoria, B.C.	73·6	12	35·2	7	57·4	44·0	...	...	...	...	·75	7	6·1
Dawson	57·5	24	0·0	3	45·5	23·1	...	...	...	...	·57	7	5·3

a and 28. *b* and 11

MALTA.—Mean temp. of air 60°·7 or 1°·1 above the average. Mean hourly velocity of wind 0·1 miles below average. Mean temp. of sea 63°·0.

Natal.—R 2·24 in. below 30 years average. Hot winds on 25th and 26th.

Mauritius.—Mean temp. of air 1°·2, dew point 1°·6, and R 1·20 in. below, averages. Mean hourly velocity of wind 8·8 miles, or 1·7 below average.

KODAIKANAL.—Mean temp. of air 60°·2. Bright sunshine 222 hours, daily wind velocity 287 miles.

COLOMBO.—Mean temp. of air 83°·1, or 0°·6 above, dew point 0°·3 below, and R 5·79 in. below, averages. Mean hourly velocity of wind 8 miles.

HONGKONG.—Mean temp. of air 70°·7. Bright sunshine 112·4 hours. Mean hourly velocity of wind 14·8 miles.

Adelaide.—Mean temp. of air 4°·6 above normal, and only once exceeded in 48 years. R ·18 in. above average.

Sydney.—Mean temp. of air 1°·6 below, humidity 7·7 above, and R 6·97 in. above, averages.

Wellington.—Mean temp. of air 4°·6 above, and R 1·73 in. below, averages.

TRINIDAD.—R ·38 in. above 40 years average.