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METEOROLOGY AT THE INTERNATIONAL AMERICAN SCIENTIFIC CONGRESS, BUENOS AIRES, JULY, 1910.

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

A highly successful scientific Congress was held at Buenos Aires, from the 10th to the 25th of July, under the auspices of the Argentine Scientific Society. A large number of foreign delegates were present, from Europe, the United States, and South American republics. Great Britain was officially represented by Admiral Field, F.R.S., who delivered an interesting and much appreciated address on recent advances in Hydrography, before the section devoted to Naval Science, over the meetings of which he several times presided. Several papers of Meteorological interest were read, of which the following is a short resumé.

Mr. W. G. Davis, Director of the Argentine Meteorological Office, gave a description of the work carried on under his superintendence. The meteorological service in the Argentine Republic was established in the year 1872, under the direction of Dr. B. A. Gould, the American astronomer, who came to this country in 1870, to establish the National Astronomical Observatory. After two years residence Dr. Gould was impressed with the necessity of obtaining meteorological data from as many points as possible throughout the Republic, as up to that time the climatology of the southern part, or, in fact, of the whole of South America, was very little known. During the the first years of the organization of this office, observations were made of the temparature, barometric pressure, direction and velocity of the wind, and the rainfall at a limited number of stations; the work being conducted on these lines up to the time of Dr. Gould's retirement in the year 1884. The results of these observations were published in four volumes, giving data from some 20 stations, so distributed as to give a general knowledge of the climatology thoughout the Republic.

On the retirement of Dr. Gould the direction of the office passed to the present Director. Up the end of the year 1900 the service was carried on in the same conditions as when under Dr. Gould's direction. The number of stations at that time, that is up to the year 1900, was 40 stations of the first class where the principal

atmospheric elements were observed, and 165 rain stations. In the year 1901 the Government decreed the organization of the daily weather map, and on the 1st January of the year 1902 the first weather map was published, compiled from the 2 p.m. observations. In the month of September of the same year the hour was changed to 7 a.m., and on the 1st January, 1904, to 8 a.m. Since September, 1904, two maps are made, one from the 8 a.m. observations, and the other from those taken at 8 p.m., but until July 1st, 1910, only the former was published. From the evening observations a synopsis of the weather is made, which is given to the papers to be published in their morning editions. The forecasts are made from the morning observations for the 36 hours following, and any changes resulting from the variations during the day from the morning forecasts are noted in the evening synopsis.

At the present time the meteorological service consists of 32 first class stations, equipped with automatically registering instruments; 148 second class stations, where observations are made at 8 a.m., 2 p.m., and 8 p.m.; 10 third class stations; and 862 fourth class stations. All of these are within the limits of this Republic and of Paraguay. From Brazil observations at 12 stations are received, from Chile 10, and from Uruguay 6. Thus the daily weather map shows the meteorological conditions reigning from Para (Brazil) situated on the equator, to the southernmost limits of this Republic, extending over a region of 55° latitude, data being now received by wireless telegraphy from New Year's Island and Ushuaia in 55° S. latitude. The number of maps printed daily exceeds 1900 and is rapidly increasing. The two central offices where comparisons of instruments are made, and where special meteorological observations are carried on, are at Córdoba and at Chacarita, the latter on the outskirts of Buenos Aires. At the South Orkney station in latitude 61° south, there is a fully equipped meteorological and magnetic station, occupied by a special commission sent every year during the month of January or February, the only season when a vessel can reach the station, as during the remaining months of the year it is icebound.

In the year 1903 the Hydrometric service of the office was started with the object of installing river-gauges on all the principal streams and lake outlets thoughout the Republic, to aid the special studies for determining the practicability of irrigation of the contiguous lands, as well as for the determination of the hydraulic power that can be developed from the water supply. At the present time there are 111 river-gauges installed at which daily observations are made. The depths of the water at the principal ports and shallow passes of the navigable rivers are published in the daily weather map, and timely warning is given of the approach of freshets in the rivers where damage is liable to be caused.

In the year 1904 the Magnetic Service was founded, with the central office at Pilar, Province of Córdoba, the office being also

equipped with the necessary instruments for the observation of sun spots and sprectroscopic observations of the corona, as well as for other studies of a like nature. Determinations of the three principal magnetic elements have been made throughout the country, and in the year 1908 the results of these observations were made known in the publication of an Isogonic Chart. At the present time there is a trained staff of assistants employed in making still further detailed studies of the magnetic variations in the remotest confines of the Republic.

The Office has under its charge the printing for all the departments of the Ministry of Agriculture, employing from 60 to 120 hands. A large number of these are skilled workmen employed in the lithographic department, for the establishment does the typographical and lithographic work connected with the entire publications of the Ministry. The total number of employees, as shown by the pay-sheet, is 350. Of these, 101 compose the Staff of the Central and Sub-Offices. The Rain Observers are all unpaid.

From the foregoing it will be seen that the Meteorological Office embraces not only the meteorological work of the country, but also the Magnetic and Hydrometric Services, to which must be added a Seismological Service, which, at the present time, is confined to the stations of Pilar and Chacarita, but will shortly embrace a line of stations from Salta to Santa Cruz, along what is practically the whole extent—from north to south—of the Argentine Republic.

Mr. Davis also read papers on "Temperatures of the Argentine Republic compared with those of the other countries of the world," and "The Climate of the Argentine Republic and the basin of the River Plate." In the former paper he divided the Argentine Republic into seven zones, according to their mean annual temperature, and showed the areas covered by similar zones around the globe. Between isotherms drawn around the globe he shaded regions having the same annual rainfall, and discussed the general climatic features of these regions in their bearing on agricultural subjects. In the second paper he gave a resumé of the principal results of his recently published work on the "Climate of the Argentine Republic."

Mr. Henry Helm Clayton read a paper on "A New Method of Forecasting the Weather," in which he showed that the ordinary oscillations of temperature may be separated by harmonic analysis into waves of different lengths, that is with different intervals of time between maxima and minima. When this is done it is found that the short waves, that is those with a short interval between maxima, progress rapidly from the pole to the equator, while longer waves progress more slowly. He showed that oscillations of temperature with a wave length of about two days progressed from Punta Arenas to Rio de Janeiro in about three days, while waves of five days took twice as long, and waves of nine days three times as long. In other words the rate of progress of the different waves was in proportion to their wave length. Short waves travel rapidly, and long waves

slowly. Further analysis showed that waves with an interval of thirty days or more between the maxima progressed in an opposite direction to the shorter waves. That is, they moved from the equator toward the polar regions. Since these waves move slowly, it is possible to anticipate their coming for the southern stations of Argentina by two or three weeks, and it is possible that forecasts of the prolonged periods, or spells of similar weather which these waves cause, may be of greater service to commerce, to agriculture and to ordinary intercourse than the more rapid weather changes.

Mr. Clayton also read a paper on the "Exploration of the Air with Kites and Balloons," in which he briefly described the recent knowledge obtained by means of researches in the upper air. He said that so far all, or nearly all of the observations had been made in the northern hemisphere, but that research work of this kind was about to be established in the Argentine Republic by Mr. Davis.

A paper on the "Cyclones and Anticyclones of South America," was communicated by Mr. Herbert Solyam, Chief of the Weather Forecast Division of the Argentine Meteorological Office, in the course of which he remarked that the paths followed by cyclones and anticyclones in southern South America are determined, primarily by the positions and variations of six permanent barometric "centres of action," *i.e.*, the Atlantic and Pacific highs, central in latitude 30° in their respective oceans; the Weddell and Bellingshausen lows, in about latitude 55° in the seas of corresponding name; the Brazilian low over central Brazil and the Graham's Land high, probably a lobe of the Antarctic high. The three northern centres are much more pronounced than the three southern ones. Another controlling factor is the Andean mountain chain which, between the equator and latitude 55° S. presents only one gap of dimensions sufficient to facilitate the transit of atmospheric disturbances. This gap lies about latitude 40° S.

The cyclones which reach the continent from the Pacific travel mostly in high latitudes. A few cross directly over the mountains, others move north-east to the gap above mentioned, traverse central Argentina, turn to the south-east and move with the winds of the Atlantic high toward South Georgia. The majority, however, travel over, or to the south of Terra del Fuego, moving slightly north of east till in the neighbourhood of the Falklands, then turn south-east toward the Weddell sea low. Other cyclones are formed apparently by the detachment of portions of the southern lobe of the Brazilian low. They travel south or south-east. Still others develop in central Argentina during the passage of a high latitude cyclone. They travel north-east to the valley of the Paraná and then turn south-east toward the Weddell sea.

Most of the anticyclones are offshoots of the Pacific high, and travel almost due east across the continent, uniting later with the Atlantic high. Other highs, of brief duration and uncertain path, originate over the Argentine provinces. Still others, suspected of

being only extensions of the Atlantic high, appear on the Brazilian or Uruguayan coast, remain almost stationary for a while and then disappear. Lastly highs appear, not infrequently in the extreme south, being probably offshoots of the Antarctic anticyclone. They travel north or north-east over Patagonia, and finally either blend with the Atlantic high or turn south-east in about latitude 35° S., and move toward South Georgia.

The west coast rains occur mostly in the east, or south-east, quadrant of a low pressure area; those of the east coast in the southern or south-western quadrant of a low or, quite frequently, as a fringe along the advancing edge of a high moving north-east. The north of Chile and the central west of Argentina are thus left almost rainless.

Mr. R. C. Mossman read a paper on the Meteorology of South America in relation to Antarctic conditions. In this paper the inter-relations between Antarctic conditions and the temperature and rainfall over South America, south of the tropic of Capricorn, are discussed by seasons for the eight years 1902-1909.

Data for the Antarctic were obtained from various expeditions that have explored the region during the last ten years, and especially from the observations taken at the Argentine Meteorological Station on the South Orkneys, since March, 1903. It is shown that, as regards temperature, the influence of Antarctic conditions extends along the Atlantic coast of South America as far as latitude 35° S. This relation was most marked in winter and summer, was also present in autumn, but was hardly noticeable in the spring months.

Generally speaking, when there is little ice in the south, the winter rainfall over the greater part of the Argentine Republic is below the average; when there is much ice it is above the average. The cause of this is that the track of cyclonic storms, in their movements from west to east, varies with the position of the ice-belt. When the ice is far north the track of the storms is also far north, and when the ice is south then the storm track is also south.

In cold winters at the South Orkneys, which are always associated with a northern extension of the pack, the weather map of the Officina Meteorologica Argentina shows that the storm centres, instead of following the usual route to the south of Cape Horn, are deflected northward, reaching the coast of Chile between the parallels of 38° and 45° S. These storms produce heavy rains on the Chilean littoral, and to a less degree on the adjoining Argentine provinces on the eastern slope of the Andes, extending even as far as to the Atlantic coast.

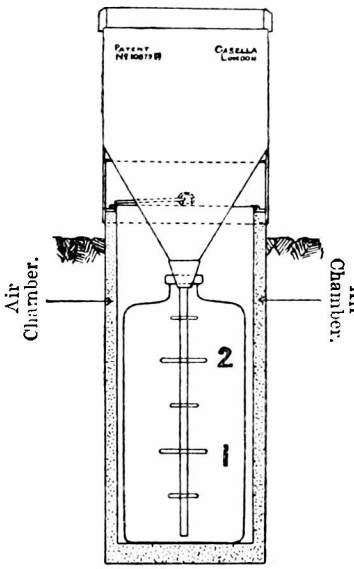
In open seasons, as in 1903, 1908 and 1909, when there was little ice in the south, the tracks of the storms were also far to the south, and a drought prevailed very generally on the coast of Chile, between 35° and 40° S., and also over the Argentine Republic, It is shown that the height of the Rio Negro reflects the southern conditions, because the depth of water of the Paso de Pizarro, and the tempera-

ture at the South Orkneys vary inversely, the probability amounting to 86 per cent.

Other intimate correlations are also shown to exist between South American weather and Antarctic conditions, depending on the position of two atmospheric "Centres of Action" situated in the South Atlantic and South Pacific, about the latitude of the Antarctic circle.

CASELLA'S INSULATED RAIN GAUGE.

For all ordinary rainfall observations the Snowdon pattern rain gauge is the most accurate, convenient and economical form of instrument to employ. When showers fall in very hot weather there is, as in all other rain gauges, a slight tendency to loss by evaporation, and in very cold weather there is a tendency to allow the contents to freeze, which is an inconvenience, even if the bottle or containing vessel is not damaged. We have always felt, and have urged upon instrument makers, the importance of having a rain gauge so constructed as to resist change of temperature. We have suggested the use of a section of a large bamboo, or a papier-maché cylinder, or some other light and water-tight material for the outer casing of a gauge, the funnel of which must, of course, be metal; but instrument makers are very conservative, and do not care to handle unfamiliar materials. Messrs. Casella & Co. have, however, succeeded in showing that the ordinary metal rain gauge may be effectively insulated so as to resist evaporation and greatly retard freezing. The arrangement is absurdly simple. A narrow ledge projects round the mouth of the outer cylinder on the inside, and the inner can is made a little shorter and narrower than the outer with a flange round the top, which rests upon the ledge of the outer cylinder. The inner can thus hangs free, and is separated by an air space from all other contact with the outer walls. The ordinary bottle placed in the inner can interposes an additional non-conducting layer between the atmosphere and the collected rain.



Casella's Insulated Rain Gauge.

At our suggestion Messrs. Casella & Co. carried out a series of experiments with the following results, using a felt-insulated gauge as well as the air-insulated and ordinary pattern both in copper and galvanised iron. The four experimental gauges were charged with water at the temperature of the air, about 49° F., and were then immersed in a bath containing a freezing mixture at about —3° F.

The temperature of the water in the gauges after the lapse of various intervals of time is given in the following table, which shows that after 54 minutes the water in the ordinary rain gauges had fallen to the freezing point; after the lapse of 115 minutes the temperature in the felt-protected gauge was still 42°, having lost only 6° in nearly two hours, while that in the air-insulated gauge was 38°, a total loss of 11°, and still 41° above the outside temperature.

TABLE I.—*Experiment with Freezing Mixture.*

Temperature of Water in Gauge at beginning about 49° F.; of Freezing Mixture —3° F.

	After 2 mins.	After 5 mins.	After 12 mins.	After 22 mins.	After 25 mins.	After 30 mins.	After 54 mins.	After 75 mins.	After 115 mins.
Insulated Copper (felt)	48°	48°	47°	45°	45°	45°	43°	42°	42°
,, Iron (air).	47°	46°	45°	44°	43°	43°	41°	39°	38°
Ordinary Copper ...	43°	40°	37°	34°	33°	33°	32°	—	—
,, Iron	44°	41°	38°	35°	34°	34°	32°	—	—

A second experiment with 1 lb. of hot water in the rain gauges and the temperature of the external air about 50° F. gave the following differences in the rate of cooling between the two gauges.

After hrs.	mins.		Galvanized Iron. F.		Galvanized Iron, Air-Insulated. F.
0	0	.....	141°	.....	141°
0	20	.....	125°	.....	138°
0	38	.....	104°	.....	124°
1	46	.....	75°	.....	95°
2	16	.....	68°	.....	88°
2	41	.....	64°	.....	79°

Here after 38 minutes the temperature of the water in the air-insulated gauge was 20° higher than that in the ordinary pattern, and after 2 hours 41 minutes it was 15° degrees higher, showing that the insulation exercised a very substantial influence in retarding change of temperature.

We have used a copper air-insulated rain gauge for more than a year at Camden Square for taking a weekly record, which is a much more severe test than a daily record. The result was to show that when the insulated gauge was in use the individual weekly readings came considerably nearer the sum of the daily readings for the week taken by a gauge placed close by, than was the case in earlier years when an ordinary Snowdon gauge was used for the weekly record. The difference, though occasionally quite pronounced, was never so great as to cast any doubt on the substantial accuracy of the standard pattern; though we believe for gauges read once a month the insulation would prove a distinct advantage.

THE WEATHER OF OCTOBER.

By FRED. J. BRODIE.

ONE of the most striking features in the weather of last month was the almost entire absence, over a large portion of England, of sharp touches of cold, such as are commonly experienced at some time during the mid-autumn season. In London, where the thermometer failed to sink below 44°, and probably in many other parts of our eastern, midland and southern counties the absolute minimum screen temperature of the month was the highest recorded in October for at least 40 years past. Even on the surface of the ground the exposed thermometer in central London (at Westminster) did not once fall as low as the freezing point. At Kew and Greenwich, and in many rural districts, slight ground frosts were experienced on the mornings of the 21st and 23rd, but over England as a whole there was, throughout the month, no nocturnal cold of sufficient severity to cause any material damage to vegetation.

At the beginning of October the weather was influenced rather seriously by a "V-shaped" depression (acting as secondary to a large Icelandic disturbance) which moved rapidly north-eastward across England between the 2nd and 3rd. The winds accompanying the progress of such systems are usually of no great strength, but on this occasion a violent gale from south-west and west blew all along the south coast, and a strong gale from north-west in the Irish Sea and the north of Ireland. The southerly current in the front of the disturbance was unusually warm, the thermometer on the 2nd rising to 70° and upwards in many parts of England, and touching 74° at Cromer. As the depression passed away to northern Europe, a large anticyclone extended north-eastward from the Atlantic, and for nearly a week the weather over the United Kingdom was fine and dry. Temperature remained at a fairly high level, but the nights became rather cool, and between the 4th and 7th a slight ground frost was experienced at many northern stations, the exposed thermometer falling to 29° at West Linton and to 30° at Crathes and Newton Rigg. On the 10th and 11th, when another "V-shaped" depression advanced eastwards across the United Kingdom, a warm air again spread up from the southward, the thermometer rising above 65° in several parts of England, and touching 69° at Greenwich and at Geldeston, near Beccles. Between the 12th and 15th the weather in all the more northern districts was influenced by a large anticyclone which drifted over from the north-westward, and, with a clear sky, sharp night frosts were experienced in many places. Between the nights of the 13th and 15th the sheltered thermometer fell below 32° in several parts of northern and central Scotland, and reached 29° at Wick and Balmoral, while on the surface of the grass a slight frost was reported also in the northern parts of England and Ireland. On the 16th, however, the anticyclone passed away to the continent and in the course of the next two days, when a couple of cyclonic disturbances moved eastward

THAMES VALLEY RAINFALL — OCTOBER, 1910.

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

Rainfall Stations reporting

Isohyetals.

across the United Kingdom, a mild air from between south and west set in, the thermometer rising slightly above 60° in many places. In the rear of the second depression, the wind shifted to the northward, and temperature fell decidedly, a sharp ground frost being experienced on the night of the 19th in the west of Scotland and the north west of England. After the 21st the weather in all but the south-western districts was influenced by a large anticyclone whose central portion lay over Scandinavia, the wind blowing generally from east or south-east. The days were cloudy and fairly mild, but night frosts were experienced at some time or another in all but the most southern districts. In the extreme south-western parts of the country, and later on in all southern localities, the conditions were affected by a large barometrical depression which extended very gradually from the Atlantic over the Bay of Biscay and France, and caused heavy rain in Cornwall and the Channel Islands. The closing days of the month witnessed two rapid changes in pressure, caused by the successive movements from the Icelandic region of an anticyclone, followed immediately by a deep cyclonic disturbance. The brisk southerly extension of the latter system on the 31st was accompanied by a heavy fall of rain in all our more western and northern districts, and by strong gales from the westward over nearly the entire kingdom.

The mean temperature of the month was above the average in all districts, the excess being greatest (about four and a half degrees) in the east and south-east of England. Bright sunshine was generally rather deficient, but was slightly in excess of the normal in the Hebrides. At Westminster the total duration, 54 hours, was 15 below the average, and was the smallest recorded in October since 1902.

THE TEMPERATURE OF OCTOBER, 1910, IN LONDON.

THE mild nature which the present autumn has so far exhibited having given occasion for an examination of the conditions in previous years, we have been interested to observe that the last few years have produced in London a succession of mild Octobers, to which the half-century of observations at Camden Square can show nothing approaching a parallel. With two exceptions, in 1899 and 1905, the last fourteen Octobers all had a mean temperature in excess of the average, which for the 50 years is exactly 50°·0. The average temperature for October during these 14 years amounted to 51°·6, or 1°·6 in excess, and 6 Octobers out of the 14 had a mean temperature more than 3°·0 in excess, a feature all the more noteworthy from the fact that in the previous 39 years so great an excess had been observed in three years only.

October, 1910, proved no exception to the run of mild seasons, the mean temperature for the month being 53°·8, or 3°·8 above the average, and the highest with four exceptions in the whole period. The feature of the month, which was most abnormal, was the

prevalence of high minima and the complete absence of the early autumn ground frost which October so rarely escapes. The mean shade minimum temperature for the month, 48°·3, was above the average by 4°·7, having been exceeded once only (49°·0 in 1898), and the mean grass minimum was 42°·8, or 3°·5 above the average; this has been six times higher in previous years. The lowest readings recorded during the month were **41°·6** in the shade and **35°·3** on the grass, being respectively **9°·6** and **8°·2** above the average. Both these figures stand without precedent in our long record as the highest absolute minimum temperatures recorded during the month of October. The maximum temperatures, although less noteworthy than the minimum, were worthy of remark, the mean, 60°·6, being 3°·0 above the average, and ranking fourth in order of magnitude since 1858. The lowest maximum recorded was 52°·2, or 4°·4 above the average lowest, and this has been excelled on only four occasions.

INTERNATIONAL BALLOON ASCENTS, IN MAY, 1908.

By W. H. DINES, F.R.S.

May 7th, 1908.

Starting Point.	Country.	A miles.	B ° F.	C miles.	D ° F.	E miles.	F
Uccle	Belgium	6·4	—65	11·9	—62	51	E.S.E.
Lindenberg....	Germany....	6·4	—71	9·1	—60	34	N.N.E.
Trappes	France.....	6·4	—62	10·2	—66	62	E.S.E.
Munich.....	Germany....	?	—67	11·5	?	94	S. by E.
Pavia.....	Italy.....	6·4	—58	7·0	—60	41	S.E.
Pavlowsk.....	Russia	5·6	—63	7·5	—51	72	S.E.
Nigin Oltchedaeff		6·0	—60	?	?	30	N.E.

A=Height in miles of commencement of isothermal column.
B=Temperature, F°., at bottom of column.
C=Greatest height of reliable record in miles.
D=Temperature, F°., at greatest height.
E=Distance in miles of point where balloon fell.
F=Bearing of falling point from starting point.

None of the English balloons were found, a somewhat unusual occurrence. The temperatures are very uniform, and a little below the average, but the height of the isothermal column is well below the average. The general drift of the atmosphere was towards the east and south-east.

A region of low pressure stretched from the North to the Black Sea, with higher pressures both to the north and south.

HEAVY RAINFALL IN BARBADOS.

THE following details are taken from an interesting note on the exceptional rainfall of May, 1910, in Barbados. The total rainfall in St. Peters, St. Josephs and St. James, was nearly 20 inches, and in Christ Church and St. Philip, St. John, St. George and St. Michael varied from 10 to 12 inches. St. Nicholas is in the north of Barbados, and is about 600 feet above sea level; Ebworth is two or three miles to the east and is 200 to 300 feet lower down.

Rainfall, May, 1910.

St. Nicholas.

	in.		in.
May 1	·07	May20	·18
,, 3	·67	,, 21	·10
,, 5	·04	,, 22	5·48
,, 6	·13	,, 23	1·86
,, 7	·10	,, 24	3·40
,, 8	·03	,, 25	·89
,, 11	·10	,, 26	·10
,, 12	·54	,, 27	1·00
,, 13	·10	,, 28	·28
,, 14	2·99	,, 29	·81
,, 15	·30	,, 30	1·46
,, 17	·53	,, 31	
,, 18	·18		
,, 19	·12	Total	21·46

Ebworth.

	in.		in.
May 2	·13	May22	2·84
,, 3	1·12	,, 23	5·13
,, 6	·14	,, 24	4·51
,, 7	·12	,, 25	3·02
,, 8	·05	,, 26	·16
,, 10	·16	,, 27	·80
,, 12	1·17	,, 28	·38
,, 14	2·82	,, 29	·83
,, 17	1·02	,, 30	1·83
,, 20	·50	,, 31	
,, 21	·18		
		Total	26·91

WATERSHEDS WITH AN EXAMPLE.

EVERY now and then one reads in the newspapers of a house which lies in two counties, or two wards, giving rise to some trouble in settling the district in which the inhabitant should vote or pay rates; and such references are useful in impressing on the mind the sharpness of the dividing line between large areas, the "imaginary line" of bye-gone schooldays when the diagrams of the book rather than the definitions of the mathematicians gave the schoolmaster the crude materialistic conception from which he tried to escape by an appeal to imagination. Maps as a rule show the artificial boundaries, counties, parishes and the like, according to scale, with greater clearness than the fundamental natural dividing lines which separate the slopes dipping to different valleys, and it may be to different seas. It is unfortunate that the term *watershed* is used in two senses; the geographer rightly employs it as meaning the line which sheds the water to one side and the other, as a Scots lassie "sheds her hair" with a comb; but engineers usually mean by watershed the whole area of land draining to a particular point. It is not uncommon to use the neutral phrase *water-parting* or *divide*, in which there is no ambiguity; but we must confess to a liking for the old word in its true meaning, the English *watershed* exactly equivalent to the German *Wasserscheide*.

When seeking for the most appropriate divisions of a country for the purpose of grouping the rain gauges we have been confronted with the choice between the natural division into drainage areas or river basins bounded by watersheds, and the artificial but familiar division into counties. County boundaries are marked clearly on all maps; but few people realize how greatly the representation of these lines varies on maps of different date and scale, nor how difficult it is in some cases to arrive at a really authoritative settlement. We know several rainfall observers who give the name of their county as that in which they believe they ought to be included, though they

know that the best maps place them in another county, and they reluctantly confess, on pressure being applied, that they pay rates to the county of the map not to that of their choice. But when it comes to watersheds it is surprising how few people know or care where the stream by the side of the road on a rainy day is running to when it vanishes through a grating in the gutter; and when one turns to the map, though the towns and villages of the riverside and the lower slopes can be allocated at a glance, there is no guide as to how the solitary farmhouses on the Downs or the moorlands are to be placed. Even with an Ordnance Survey map on the scale of 6 inches to a mile it is often extremely difficult to draw the line which separates the waters. It is never a straight line, it is not always the

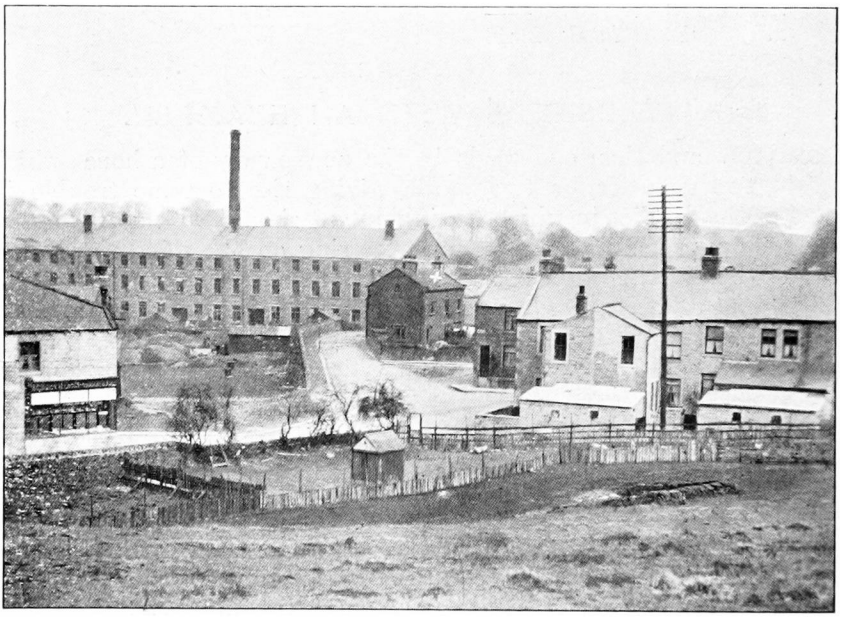

FIG. 1.—GENERAL VIEW FROM SOUTH. MR. J. WIDDUP'S HOUSE MARKED WITH A CROSS.

line following the highest ground, and the larger the scale of the map the more difficult is it to say in which direction a given plot of land near the watershed really drains. It cannot always be determined precisely even by an inspection of the ground.

Our attention has been specially called to watersheds lately by making an attempt to divide counties for rainfall purposes into drainage areas, so that each division would apply to one river only, and the parts of the same river basin in various counties could be easily picked out. Whether we succeed in this scheme or not the investigation has been full of interest, and in the course of it we have come across some instances of houses standing astride of watersheds so that the ridge of the roof is itself a true watershed, the rain

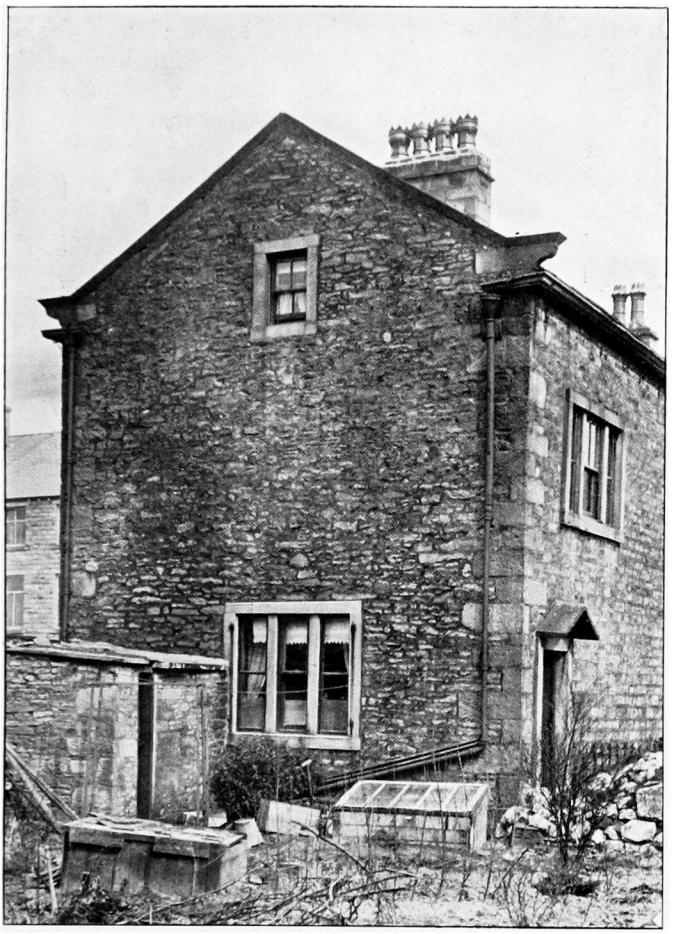

FIG. 2.—MR. J. WIDDUP'S HOUSE AT BARNOLDSWICK.
SOUTH-WEST GABLE END.

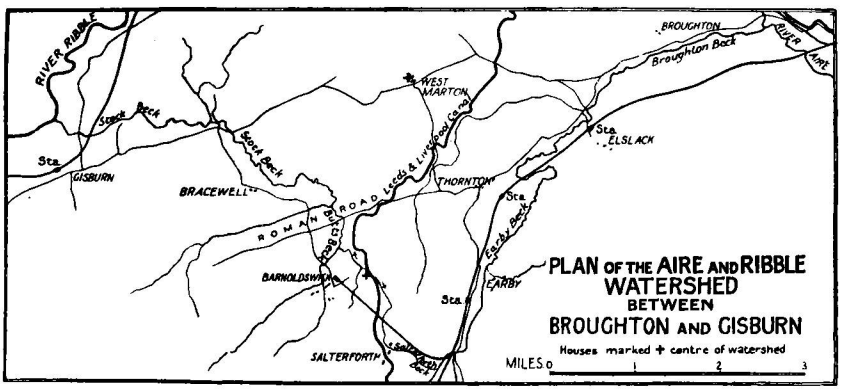

FIG. 3.

falling on one side of the roof running off to one river and that falling on the other side to another. A raindrop alighting on the actual ridge and broken up by the shock may send one half of its substance to the Irish Sea and the other half to what used to be called the German Ocean.

For full particulars of the most interesting of these cases I am indebted to the kindness of the Rev. Arthur Shipham, lately of Barnoldswick, and of his son, Mr. Shipham, who took the photographs which we reproduce. The house in Barnoldswick occupied by Mr. John Widdup is shown in the middle of the photograph (fig. 1) which is taken looking north, the gable of the house is seen, and the slope of the roof on the right which faces the east is marked with a white cross. It will be seen from the picture that the ground, though

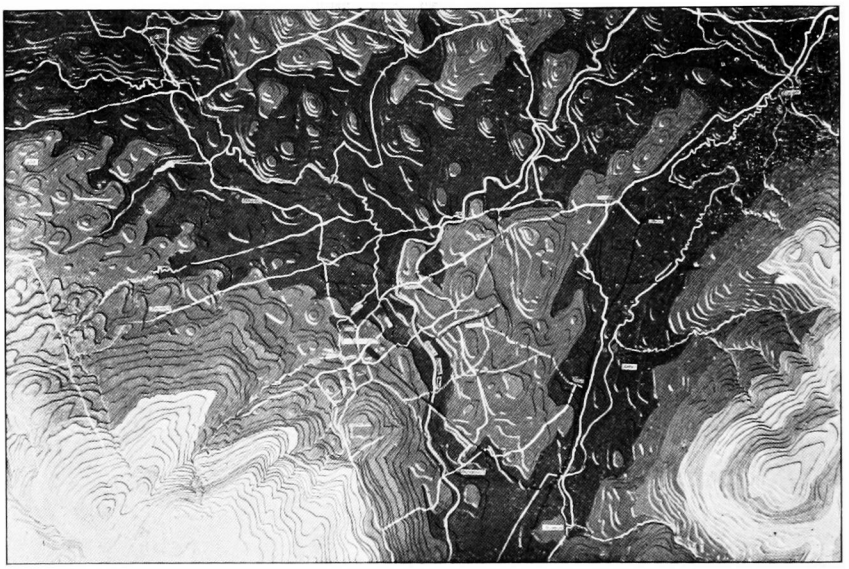

FIG. 4.—CONTOUR MAP OF THE BARNOLDSWICK DISTRICT. THE DARKEST TINTING INDICATES THE LOWEST ALTITUDE. THE WHITE LINES DENOTE ROADS AND RIVERS.

nearly level, slopes from the house both to the east and to the west, so that the ridge on the roof is a true watershed, and the water which falls on the eastern slope would naturally flow to the Aire and the North Sea, while that which falls on the western slope would naturally flow to the Ribble and the Irish Sea. The larger scale photograph of the gable (fig. 2) shows that the water from the western side is conducted by the pipe on the left-hand side to the drain which carries it to the Ribble; but that the pipe on the right-hand side, receiving the water which falls on the eastern slope of the roof, is bent sharply to the left and diverts the water to the Ribble also. Only when the down-pipes are choked and the gutters overflow can the natural action of the ridge watershed assert itself; but this

does not affect the interesting position of the roof. The sketch-map shows the streams which rise nearest the house we have been describing, and the shaded map, which is a photograph of a contoured model of the district built up of cardboard layers by Mr. A. G. Petty, B.Sc., of Skipton, gives a graphic representation of the country side.

Mr. Shipham discovered a second case of a roof watershed between the Aire and Ribble at West Marton, about five miles from Barnoldswick. A joiner's shop stands on the height of land between the two slopes, the water from one side of the roof flowing to Earby and the Aire, that on the other side to Gisburn and the Ribble. Of this he has also supplied photographs, but the first example is sufficient for our purpose.

It sometimes happens, though rarely, that a stream flows along a watershed and bifurcates, part flowing down one slope, part down another. Something similar occurs at Barnoldswick (a name which the inhabitants economise into "Barlick" in familiar speech) in the case of the Leeds and Liverpool Canal, the top lock of which is on this ridge, and when this lock is opened at one end the water flows out to the west; when opened at the other end it flows out to the east.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

RAINFALL VAGARIES.

YOUR mention of the exceptional rainfall here on September 7th prompts me to make a few observations on the subject, my excuse for which must be that so little is known of the causes which determine the localities of these small "cloud-bursts," that any contribution in the shape of facts bearing on the subject may be of some value.

During the period from September 6th to 13th these islands were under the influence of an immense anticyclone extending from the south of France almost to Iceland, and causing northerly and north-easterly winds to prevail. These would probably have been dry had there not been a south-westerly current between the north of Scotland and Iceland, which may have supplied it with moisture; and the northerly current on reaching the north of Kent discharged itself as shown below. The three stations given stand almost in a straight line from north-east to south-west; they are (1) Sharsted Court, on the north slope of the North Downs, and 278 ft. above sea level; (2) Harrietsham Rectory, at the foot of the steep southerly slope of the same range, and (3) Ulcombe Place, on the southerly slope, half way up from the foot of the next or Lower Greensand range. The height of the North Downs is about 600 ft., and that of the Lower Greensand about 500 ft. Harrietsham is about 7 miles from Sharsted Court and 3 from Ulcombe. The rainfall on September 7th was as follows:—

Sharsted.	Harrietsham.	Ulcombe.
·26 in.	·42 in.	·74 in.

This is precisely in the reverse order of what would be expected in the case of a warm, moist current striking a colder range of hills; but in this case the current was probably as cold as the hills.

On September 12th and 13th the following falls occurred at the same places:—

Sharsted.		Harrietsham.		Ulcombe.	
	in.		in.		in.
12th ...	·09	12th } ...	·71	12th ...	·10
13th ...	·38	13th }		13th ...	·40
	·47		·71		·50

The bulk at Harrietsham was on the 12th, as I was caught in it near there on the way to Ulcombe. The difference in the amount of water on the road between the north and south side of the Greensand ridge was very marked. Both this fall and that on the 7th at Ulcombe were of the torrential character generally associated with thunderstorms, but no thunder or lightning was observed in either case.

These "bursts" did not reach far to the south. At Tenterden the total fall for the month was only ·48 in., and at Hastings there was no rain either on the 7th or 12th. On the other hand, Ramsgate, with a rainfall for the month of 1·45 in., probably experienced something of the same kind.

I have to thank the Rev. C. B. Marsham, Rector of Harrietsham, and Mr. T. C. Court, Sharsted Court, for information as shown above.

ALFRED O. WALKER.

Ulcombe, Kent, October 28th, 1910.

In the October number of *Symons's Meteorological Magazine* mention is made of a curious local storm at Ulcombe in Kent, so I thought perhaps a rather heavy fall which took place here on the night of 11th October might be of interest to you and other readers of the Magazine. Between 5.30 p.m. on 11th and about 6.30 or 7 a.m. on 12th, I registered 1·40 in. I see that there was rather under half an inch in London, and rather over half an inch was recorded at Berkhampstead, the other side of us beyond Watford.

JOHN DURST.

Grove End, Bushey Hall Road, Watford, November 5th, 1910.

[The feature of the Ulcombe storm lay rather in its isolation in time than in space, occurring as it did during the prevalence of a remarkable drought, which was unbroken at many neighbouring stations. On October 11th falls of rain exceeding 1·00 in. were recorded over a large area in the east of England, and the patchiness to which our correspondent calls attention is a perfectly normal circumstance in connection with this well known type of rain-storm. Editor, *S.M.M.*]

I THINK the rainfall of the 11th, 12th and 13th inst. is worth notifying, although it seems to have been pretty general throughout the south of England.

		in.
On the 11th I registered		·84
,, 12th	,,	1·54
,, 13th	,,	·85
Total for the 3 days ...		3·23

GEORGE SHEDDEN.

Spring Hill, East Cowes, I.W., October 15th, 1910.

OCTOBER, 1910.

PROBABLY your correspondents will refer freely to the unusual warmth of the nights during October. Here, at 360 feet above sea level, the lowest record was 41° on the 21st, the highest minimum being 54° on the 8th, and the maximum 71° on the 2nd.

Associated naturally with this, was unusual air clearness in London, exceeded only in 1899 and 1903 since I began records in 1897 of the quarter hours in daytime when I required artificial light at my desk in a City office between 9 a.m. and 5 p.m.

The following Table may be of interest:—

Year.	Darkness before 2 p.m. Days.	Hours. 9 a.m. to 2 p.m.	2 p.m. to 5 p.m.	Earliest Date.
1897	3	3	½	Oct. 1
1898	1	½	2	,, 13
1899	0	0	6	Nov. 17
1900	2	2	6	Oct. 16
1901	4	6	9	Sept. 25
1902	5	4	7	,, 19
1903	0	0	2	Nov. 9
1904	3	8½	5	Oct. 11
1905	...	...	...	...
1906	2	2¼	9¼	Oct. 30
1907	8	6¾	16	Aug. 26
1908	6	11¼	12	Sept. 22
1909	6	9½	2¼	,, 20
1910	0	0	11¾	Nov. 4

The large number of hours this year after 2 p.m. (really from about 3.30 p.m.) was undoubtedly due to the unusual cloudiness without real fog, of which the evenings have been as free as the mornings.

J. EDMUND CLARK.

Asgarth, Riddlesdown Road, Purley, Surrey, November 4th, 1910.

LIGHTNING STORM ON NOVEMBER 1st.

FROM 9 p.m. to 10 p.m. on November 1st a very bright display of sheet lightning was visible in S.E., S., and S.W., the flashes averaging three per minute, a cloudless sky prevailing at the time. A count of the flashes between 9.18 and 9.31 p.m. gave a total number of 41. Three distinct centres of activity were present, but the discharge was

most frequent from a point almost due S. At the S.E. point of disturbance the flashes were of a markedly blue colour. The barometer at 9 p.m. stood at 29·13 (cor. and red.) with a tendency for pressure to increase, the shade temperature being 42°.

For so late a date in the season, the frequency and brightness of the display were exceptional.

SPENCER C. RUSSELL.

Epsom, November 5th, 1910.

THE ANGLE AT WHICH RAIN FALLS.

I VENTURE to write again to you and air my views on a rainfall problem. My views are, of course, those of an amateur and may be of little value, but I give them for what they are worth.

It is well-known that if two gauges be placed one on each slope of a ridge roof, the one on the leeward slope collects most rain—in some cases very much the most rain. Similarly it is, I think, generally found that a gauge on the lee side of a range of hills of moderate elevation collects more rain than one on the windward side, though here the difference is much less marked. The reasons for this are well explained in an article and diagram which appeared in *British Rainfall*, 1871, p. 21. I have, however, long had reason to suspect that the horizontal rain gauges do not tell a true story as regards the amount of rain deposited on the sloping surface. I have, in my yard, an arrangement of water butts, a 50 gallon water butt which receives the rain from a roof surface sloping south-west, and two 40 gallon water butts, the water passing from one, when full, into the other, which receive the rain from about an equal surface of roof facing north-east. If rain falls vertically an equal quantity of water, roughly speaking, is stored in each place, but if there is any wind the differences are very great, and exactly the opposite to what would be indicated by rain gauges as mentioned above. A notable instance recently occurred. With a strong wind from south-west ·34 in. fell in large driving drops. The 50 gallon butt was filled to overflowing, while barely fifteen gallons reached the others. I have no doubt that most of the drops which passed over the ridge shot clear of the roof facing north-east, but of course a horizontal gauge would have intercepted them. This looks as though a gauge, to measure correctly the rain actually falling on a district, should have its surface not horizontal, but parallel, if possible, to the general plane of the surface of the district immediately round it. This, of course, would be in most cases impracticable; but it seems to me that records of extraordinary rainfall at places like the Stye, for example, must be received with some hesitation as representing the actual fall at those spots. Probably the water actually deposited is really greater on the Wasdale slope of the Stye Head Pass than on the Borrowdale slope, exactly contrary to what is measured.

Twenty-five years ago I remember noticing the large amount of water which appeared to flow out of Mosedale, near Wasdale Head,

in proportion to the dimensions of that little valley, and I wrote to Mr. Symons asking whether there was a gauge there. He sent me back a map showing that there was one, and I examined its records in *British Rainfall* and found them not very remarkable. I have little doubt, however, that more water actually falls there than the other side of Great Gable, where so much more is measured.

F. J. WARDALE.

Shrewton, Wilts.

TRANSVAAL METEOROLOGICAL OBSERVATIONS.

YOUR "Contributor" in his letter on the Meteorological Outlook in South Africa, remarks that

"the barometric observations made at Johannesburg are printed in millimetres, whereas those for the Transvaal out-stations are printed in inches."

He continues:

"every meteorologist is capable of converting the one into the other, but it is hardly fair to expect him to do such a work of supererogation. Is it impossible to have the conversion into inches done at headquarters before publication?"

May I state that it is so done and the figures published alongside those for the out-stations, so that an immediate comparison is available. If your "Contributor" will refer to any of the annual reports he will see this at once; in particular, in the last report published (1908-09), he will find the figures he suggests printed on page 100.

R. T. A. INNES,

Johannesburg, 14th October, 1910. *Director Transvaal Observatory.*

METEOROLOGICAL NEWS AND NOTES.

THE METEOROLOGICAL OFFICE has now completed the transference of its staff and property to their new quarters situated over the recently erected post office buildings in Exhibition Road. The address in future will be, "Meteorological Office, South Kensington, S.W." We expect in the next number of this Magazine to be able to give an illustrated account of the new premises, touching on the enlarged scope which it is hoped the increased facilities will bring to the work of the Office.

LECTURES on "Modern Meteorology, Dynamical and Statistical," will be given by Dr. W. N. Shaw, F.R.S., at the Meteorological Office, Exhibition Road, S.W., on November 21st and 28th. No tickets will be required for admission.

THE COST OF SNOWSTORMS forms one of the items in the Manchester Corporation accounts for the year 1909-10, where it is stated that to clear away falls aggregating 15 inches in depth during that one winter, cost the sum of £5,941, and gave employment to no fewer than 15,640 men.

RAINFALL TABLE FOR OCTOBER, 1910.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	RAINFALL OF MONTH. Aver. 1875—1909. in.	1910. in.
		° ′	° ′			
Camden Square	*London*	51 32	0 8	111	2·72	2·00
Tenterden	*Kent*	51 4	*0 41	190	3·48	2·77
Steyning	*Sussex*	50 53	0 20	80	4·15	*3·30?*
Southampton (Cadland)	*Hampshire*	50 50	1 22	52	4·07	5·27
Hitchin	*Hertfordshire*	51 57	0 17	238	2·77	2·72
Oxford (Magdalen College)	*Oxfordshire*	51 45	1 15	186	2·82	3·87
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	2·72	1·95
Geldeston [Beccles]	*Norfolk*	52 27	*1 31	38	2·84	·92
Polapit Tamar [Launceston]	*Devon*	50 40	4 22	315	4·84	5·73
Rousdon [Lyme Regis]	,,	50 41	3 0	516	3·81	4·86
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	3·21	3·70
Church Stretton (Wolstaston)	*Shropshire*	52 35	2 48	800	3·77	4·46
Coventry (Kingswood)	*Warwickshire*	52 24	1 30	340	3·20	2·28
Market Overton	*Rutland*	52 44	0 41	475	3·10	1·77
Boston	*Lincolnshire*	52 58	0 1	25	2·75	2·14
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	2·77	2·17
Macclesfield	*Cheshire*	53 15	2 7	501	3·53	2·60
Southport (Hesketh Park)	*Lancashire*	53 38	2 59	38	3·74	3·23
Wetherby (Ribston Hall)	*Yorkshire, W.R.*	53 59	1 24	130	3·18	2·79
Arncliffe Vicarage	,, ,,	54 8	2 6	732	6·48	6·32
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	3·19	1·89
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	3·20	3·69
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	12·71	6·71
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	4·87	5·01
Haverfordwest	*Pembroke*	51 48	4 58	95	5·52	4·28
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	5·38	4·69
Llandudno	*Carnarvon*	53 20	3 50	72	3·78	3·57
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	4·45	2·53
Marchmont House	*Berwick*	55 44	2 24	498	3·83	3·44
Girvan (Pinmore)	*Ayr*	55 10	4 49	207	5·38	2·01
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	3·36	2·01
Inveraray (Newtown)	*Argyll*	56 14	5 4	17	6·50	3·44
Mull (Quinish)	,,	56 36	6 13	35	5·87	3·13
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	2·81	1·77
Braemar	*Aberdeen*	57 0	3 24	1114	3·88	4·75
Aberdeen (Cranford)	,,	57 8	2 7	120	3·23	2·21
Cawdor	*Nairn*	57 31	3 57	250	2·95	1·08
Fort Augustus (S. Benedict's)	*E. Inverness*	57 9	4 41	68	4·14	1·76
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	8·38	3·36
Dunrobin Castle	*Sutherland*	57 59	3 56	14	3·15	1·39
Wick	*Caithness*	58 26	3 6	77	3·14	1·70
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	5·59	2·93
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	4·00	4·28
Nenagh (Castle Lough)	*Tipperary*	52 54	8 24	120	3·48	2·17
Miltown Malbay	*Clare*	52 52	9 26	400	4·31	1·72
Gorey (Courtown House)	*Wexford*	52 40	6 13	80	3·75	3·24
Abbey Leix (Blandsfort)	*Queen's County*	52 56	7 17	532	3·53	2·38
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	2·88	2·22
Mullingar (Belvedere)	*Westmeath*	53 29	7 22	367	3·19	1·65
Ballinasloe	*Galway*	53 20	8 15	160	3·19	1·51
Crossmolina (Enniscoe)	*Mayo*	54 4	9 18	74	5·27	2·29
Collooney (Markree Obsy.)	*Sligo*	54 11	8 27	127	4·21	3·10
Seaforde	*Down*	54 19	5 50	180	3·65	1·47
Bushmills (Dundarave)	*Antrim*	55 12	6 30	162	3·60	1·92
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	3·76	2·13
Aug. ... Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	4·23	9·11
Sept. ... ,, [,,]	,,	,,	,,	,,	3·34	1·06

RAINFALL TABLE FOR OCTOBER, 1910—*continued.*

RAINFALL OF MONTH (*con.*)					RAINFALL FROM JAN. 1.					
Diff. from Av.	% of Av.	Max. in 24 hours.		No. of Days	Aver. 1875—1909.	1910.	Diff. from Aver.	% of Av.	Mean Annual 1875-1909.	STATION.
in.		in.	Date.		in.	in.	in.		in.	
— ·72	74	·36	11, 31	13	20·64	18·88	—1·76	91	25·11	Camden Square
— ·71	79	·44	31	17	21·80	21·46	— ·34	98	27·64	Tenterden
— *·85*	80	·60	13	14	26·22	*30·02?*	*+3·80*	114	33·58	Steyning
+1·20	129	1·32	12	19	25·25	24·67	— ·58	98	31·87	Cadland
— ·05	98	·93	11	14	20·59	19·27	—1·32	94	25·16	Hitchin
+1·05	137	1·79	11	15	20·27	18·71	—1·56	92	24·58	Oxford
— ·77	72	·46	11	11	20·86	21·96	+1·10	105	25·40	Westley
—1·92	32	·28	31	8	19·17	22·73	+3·56	119	23·73	Geldeston
+ ·89	118	·76	12	20	29·74	34·65	+4·91	116	38·27	Polapit Tamar
+1·05	128	1·03	27	16	26·35	26·61	+ ·26	101	33·54	Rousdon
+ ·49	115	·75	11	14	24·33	25·86	+1·53	106	29·81	Stroud
+ ·69	118	1·06	2	15	26·48	25·38	—1·10	96	32·41	Wolstaston
— ·92	71	·43	1	12	23·71	20·73	—2·98	87	28·98	Coventry
—1·33	57	·42	11	18	22·22	21·50	— ·72	97	27·10	Market Overton
— ·61	78	·88	1	12	19·42	19·43	+ ·01	100	23·35	Boston
— ·60	78	·95	11	15	20·31	18·34	—1·97	90	24·46	Hodsock Priory
— ·93	74	·90	31	12	28·38	29·90	+1·52	105	34·73	Macclesfield
— ·51	86	·98	18	13	26·44	27·41	+ ·97	104	32·70	Southport
— ·39	88	·52	17	17	22·26	24·79	+2·53	111	26·87	Ribston Hall
— ·16	98	2·19	31	15	48·62	54·86	+6·24	113	61·49	Arncliffe
—1·30	59	·46	11	16	21·76	19·73	—2·03	91	26·42	Hull
+ ·49	115	·64	1	17	22·85	22·24	— ·61	97	27·94	Newcastle
—6·00	53	3·91	31	11	100·75	102·85	+2·10	102	129·48	Seathwaite
+ ·14	103	·80	31	17	33·50	37·79	+4·29	113	42·28	Cardiff
—1·24	78	·61	27	17	36·48	33·07	—3·41	91	46·82	Haverfordwest
— ·69	87	1·08	31	14	36·30	42·00	+5·70	116	45·46	Gogerddan
— ·21	94	·83	18	11	24·33	27·17	+2·84	112	30·36	Llandudno
—1·92	57	1·36	2	6	34·28	43·08	+8·80	126	43·47	Cargen
— ·39	90	1·07	18	17	27·72	23·30	—4·42	84	33·76	Marchmont
—3·37	37	1·13	2	13	39·05	42·22	+3·17	108	49·77	Girvan
—1·35	60	·85	31	9	28·39	32·06	+3·67	113	35·97	Glasgow
—3·06	53	1·98	31	14	52·71	54·85	+2·14	104	68·67	Inveraray
—2·74	53	·94	31	16	43·74	42·87	— ·87	98	56·57	Quinish
—1·04	63	·77	18	13	23·35	23·38	+ ·03	100	28·64	Dundee
+ ·87	122	...	..	...	28·04	32·92	+4·88	117	34·93	Braemar
—1·02	68	·42	20	16	26·01	22·16	—3·85	85	32·73	Aberdeen
—1·87	37	·62	20	5	24·20	24·56	+ ·36	101	29·33	Cawdor
—2·38	43	·91	31	15	34·40	34·19	— ·21	99	44·53	Fort Augustus
—5·02	40	1·06	19	16	65·01	66·54	+1·53	102	83·61	Bendamph
—1·76	44	·78	31	9	25·56	23·49	—2·07	92	31·90	Dunrobin Castle
—1·44	54	·55	31	21	23·82	22·22	—1·60	93	29·88	Wick
—2·66	52	·72	3	22	42·35	47·25	+4·90	112	54·81	Killarney
+ ·28	107	·95	29	18	31·45	31·22	— ·23	99	39·57	Waterford
—1·31	62	·60	31	18	31·21	34·26	+3·05	110	39·43	Castle Lough
—2·59	40	·40	2	16	35·77	35·14	— ·63	98	45·11	Miltown Malbay
— ·51	86	1·77	2	17	28·16	28·62	+ ·46	102	34·99	Courtown Ho.
—1·15	68	·75	2	16	29·23	34·87	+5·66	119	35·92	Abbey Leix
— ·66	77	1·08	2	18	22·77	27·33	+4·56	120	27·68	Dublin
—1·54	52	·45	2	14	29·37	33·75	+4·38	115	36·14	Mullingar
—1·68	47	·41	2	14	29·36	28·95	— ·41	99	36·64	Ballinasloe
—2·98	44	·49	31	18	41·01	43·45	+2·52	106	52·87	Enniscoe
—1·11	74	·87	2	15	34·35	45·48	+11·13	132	42·71	Markree
—2·18	40	·38	2	11	31·28	29·20	—2·08	93	38·91	Seaforde
—1·68	53	·62	31	10	29·92	32·17	+2·25	108	37·56	Dundarave
—1·63	57	·40	19, 31	11	31·81	36·52	+4·71	115	39·38	Omagh
+4·88	215	1·94	28	21	26·49	39·49	+13·00	149	43·47	Cargen
—2·28	32	·46	26	5	29·83	40·55	+10·72	136	,,	,,

SUPPLEMENTARY RAINFALL, OCTOBER, 1910.

Div.	STATION.	Rain inches	Div.	STATION.	Rain inches
II.	Warlingham, Redvers Road	3·21	XI.	Llangyhanfal, Plâs Draw....	4·30
,,	Ramsgate	1·43	,,	Dolgelly, Bryntirion	5·13
,,	Hailsham	4·36	,,	Bettws-y-Coed, Tyn-y-bryn	5·93
,,	Totland Bay, Aston House.	5·05	,,	Lligwy	3·64
,,	Stockbridge, Ashley	4·13	,,	Douglas.....	3·39
,,	Grayshott.....	4·43	XII.	Stoneykirk, Ardwell House	1·74
,,	Reading, Calcot Place.....	4·15	,,	Dalry, The Old Garroch ...	3·99
III.	Harrow Weald, Hill House.	2·32	,,	Langholm, Drove Road.....	3·29
,,	Pitsford, Sedgebrook.....	2·31	,,	Moniaive, Maxwelton House	2·90
,,	Huntingdon, Brampton.....	1·48	XIII.	St Mary's Loch, Cramilt Ldge	4·53
,,	Woburn, Milton Bryant.....	2·88	,,	Edinburgh, Royal Observty.	2·16
,,	Wisbech, Monica Road.....	1·58	XIV.	Maybole, Knockdon Farm..	2·16
IV.	Southend Water Works.....	1·71	XV.	Campbeltown, Witchburn...	2·05
,,	Colchester, Lexden.....	1·39	,,	Glenreasdell Mains.....	2·40
,,	Newport	1·86	,,	Ballachulish House.....	4·98
,,	Rendlesham.....	1·28	,,	Islay, Eallabus	2·33
,,	Swaffham	1·40	XVI.	Dollar Academy	...
,,	Blakeney	1·56	,,	Balquhidder, Stronvar	3·92
V.	Bishops Cannings	4·31	,,	Coupar Angus	1·96
,,	Winterbourne Steepleton ...	5·08	,,	Blair Atholl.....	1·92
,,	Ashburton, Druid House ..	7·97	,,	Montrose, Sunnyside Asylum	1·45
,,	Honiton, Combe Raleigh ...	4·75	XVII.	Alford, Lynturk Manse ...	3·14
,,	Okehampton, Oaklands.....	6·42	,,	Keith Station	3·39
,,	Hartland Abbey	6·15	XVIII.	Glenquoich, Loan	10·90
,,	Lynmouth, Rock House ...	5·29	,,	Skye, Dunvegan.....	5·91
,,	Probus, Lamellyn	5·96	,,	N. Uist, Lochmaddy.....	1·37
,,	North Cadbury Rectory ..	...	,,	Alvey Manse	2·27
VI.	Clifton, Pembroke Road ...	5·23	,,	Loch Ness, Drumnadrochit.	1·83
,,	Ross, The Graig	3·74	,,	Glencarron Lodge	6·79
,,	Shifnal, Hatton Grange.....	3·25	,,	Fearn, Lower Pitkerrie.....	·90
,,	Blockley, Upton Wold	4·00	XIX.	Invershin	2·35
,,	Worcester, Boughton Park.	2·93	,,	Altnaharra	...
VII.	Market Rasen	1·98	,,	Bettyhill	3·03
,,	Bawtry, Hesley Hall.....	1·85	XX.	Dunmanway, The Rectory..	4·61
,,	Derby, Midland Railway ...	2·00	,,	Cork	4·03
,,	Buxton.....	3·07	,,	Mitchelstown Castle	3·94
VIII.	Nantwich, Dorfold Hall.....	2·70	,,	Darrynane Abbey	4·29
,,	Liscard	3·33	,,	Glenam [Clonmel]	3·50
,,	Chatburn, Middlewood	3·66	,,	Nenagh, Traverston	2·40
,,	Cartmel, Flookburgh	2·60	,,	Newmarket-on-Fergus, Fenloe	...
IX.	Langsett Moor, Up. Midhope	3·02	XXI.	Laragh, Glendalough	4·20
,,	Scarborough, Scalby	3·76	,,	Moynalty, Westland	2·05
,,	Ingleby Greenhow	3·77	,,	Athlone, Twyford	1·10
,,	Mickleton.....	3·36	XXII.	Woodlawn	2·14
X.	Bardon Mill, Beltingham ...	...	,,	Westport, St. Helens	2·13
,,	Ilderton, Lilburn Cottage...	3·18	,,	Achill Island, Dugort	1·62
,,	Keswick, The Bank	3·67	,,	Mohill	2·06
XI.	Llanfrechfa Grange.....	4·96	XXIII.	Enniskillen, Portora	2·16
,,	Treherbert, Tyn-y-waun ...	6·37	,,	Dartrey [Cootehill].....	2·07
,,	Carmarthen, The Friary.....	2·91	,,	Warrenpoint, Manor House	2·19
,,	Castle Malgwyn [Llechryd].	3·87	,,	Banbridge, Milltown	1·43
,,	Plynlimon.....	6·50	,,	Belfast, Springfield	2·21
,,	Crickhowell, Ffordlas.....	4·50	,,	Glenarm Castle.....	2·84
,,	New Radnor, Ednol	5·30	,,	Londonderry, Creggan. Res.	2·60
,,	Rhayader, Tyrmynydd	5·81	,,	Killybegs	3·93
,,	Lake Vyrnwy	5·31	,,	Horn Head	2·28

METEOROLOGICAL NOTES ON OCTOBER, 1910.

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.—The entire absence of ground frost and the persistent high minima were the most striking features in a fair to cloudy month. (See p. 185). Duration of sunshine, 56·7* hours, and of R 37·9 hours. Mean temp. 53°·8, or 3°·8 above the average. Shade max. 72°·8 on 2nd; min. 41°·6 on 21st. F 0, f 0.

TENTERDEN.—Fine and dry until 11th, afterwards a good many days with R, but no heavy falls. Duration of sunshine, 94·5† hours. Shade max. 69°·0 on 2nd; min. 43°·0 on 4th, 21st and 24th. F 0, f 0.

TOTLAND BAY.—Duration of sunshine 76·3* hours, or 32·8 hours below the average, and the smallest amount recorded in October. Shade max. 66°·3 on 5th; min. 42°·9 on 21st. F 0, f 1.

PITSFORD.—R ·77 in. below the average. Mean temp. 50°·5. Shade max. 69°·2 on 2nd; min. 40°·6 on 16th. F 0.

ROUSDON.—The first ten days were mild and genial, seven consecutive days having temp. above 60°. There was a great change on 10th, and during a local TS on 11th ·40 in. of R fell in 15 minutes. The least sunshine in any October in the last 27 years. Shade max. 64°·8 on 4th. F 0, f 0.

ROSS.—Shade max. 69°·7 on 1st; min. 40°·0 on 20th. F 0, f 0.

HODSOCK PRIORY.—A mild month, with an unusual absence of frost, the min. being the highest ever recorded in October. Shade max. 70°·7 on 5th; min. 37°·5 on 15th. F 0, f 2.

SOUTHPORT.—Notable for having more E. wind than any October in the 40 years' record. Duration of sunshine 83·5* hours, or 12·6 hours below the average. Duration of R 49·9 hours. Mean temp. 51°·4, or 2°·8 above the average. Shade max. 70°·2 on 1st; min. 37°·9 on 30th. F 0, f 4.

HULL.—Shade max. 70°·0 on 2nd; min. 41°·0 on 1st and 30th. F 0, f 0.

HAVERFORDWEST.—Very mild and somewhat stormy. Duration of sunshine, 79·1* hours. Shade max. 66°·4 on 6th.

LLANDUDNO.—Shade max. 72°·5 on 1st; min. 41°·5 on 20th. F 0, f 0.

MARCHMONT HOUSE.—Duration of sunshine, 69·6* hours on 20 days. Shade max. 68°·0 on 1st; min. 36°·0 on 9th and 18th. F 0, f 1.

EDINBURGH.—Shade max. 66°·5 on 1st; min. 37°·8 on 20th. F 0, f 0.

COUPAR ANGUS.—A fairly good and dry month until the last day, when there was a sudden R storm. Shade max. 69°·0 on 6th; min. 31°·0 on 30th.

FORT AUGUSTUS.—Shade max. 66°·0 on 2nd; min. 30°·0 on 15th. F 3.

CORK.—Shade max. 62°·0 on 4th; min. 34°·0 on 31st. F 0, f 1.

DUBLIN.—A mild, cloudy month of N.W. and E. winds Save for a fall of 1·08 in. during a TS on 2nd, the R, though frequent, was small. Gales on 13th and 31st. Mean temp. 51°·7. Shade max. 63°·4 on 1st; min. 37°·9 on 12th. F 0, f 0.

MARKREE.—Shade max. 65°·7 on 5th; min. 27°·9 on 31st. F 2, f 5.

WARRENPOINT.—On the whole a fine month, with a prevalence of E. winds. Shade max. 64°·0 on 4th; min. 42°·0 on 30th. F 0, f 0.

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* Campbell-Stokes. † Jordan.

Climatological Table for the British Empire, May, 1910.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	80·0	22	29·8	10	65·0	46·3	46·8	77	123·1	22·9	2·22	19	6·5
Malta	75·2	27	53·2	14	67·2	58·2	55·6	81	139·6	...	·14	1	5·0
Lagos	91·0	6	70·0	15*	88·7	74·0	74·9	74	159·0	67·0	8·79	8	8·3
Cape Town	80·8	3	39·2	6	68·3	51·6	53·3	81	...	...	4·39	11	4·6
Durban, Natal ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Johannesburg	73·7	21	31·6	25	65·3	46·0	40·3	63	128·8	31·6	·04	1	1·0
Mauritius	82·1	5	58·0	27	78·8	63·9	63·1	77	147·4	56·5	·94	10	5·1
Calcutta	101·7	2	71·2	9	96·8	77·9	75·6	73	...	69·8	4·80	7	4·1
Bombay	92·7	17	77·4	5	91·3	80·2	75·6	74	137·5	72·1	·03	2	2·7
Madras	112·9	20	77·6	2	100·7	81·6	72·8	64	148·4	75·2	·01	1	3·2
Kodaikanal	74·1	28	51·9	21	69·0	54·9	51·5	72	135·6	41·1	6·29	20	4·8
Colombo, Ceylon ...	90·7	5	73·8	7	87·8	78·0	75·7	80	153·9	71·2	2·32	17	6·1
Hongkong	90·1	13	70·3	21	84·1	75·1	71·0	77	139·8	...	1·96	5	5·5
Melbourne	70·9	1	38·2	6	63·1	49·5	46·2	69	119·6	33·9	2·47	20	6·5
Adelaide	77·8	8	44·7	3	66·9	52·6	50·4	73	145·9	33·6	4·41	17	6·9
Coolgardie	77·0	1	36·9	26	66·3	47·7	46·6	69	139·0	32·0	2·28	12	5·1
Perth	78·6	3	42·0	25	67·1	53·3	51·7	73	129·5	35·7	7·31	19	6·7
Sydney	79·5	2	46·3	31	67·0	53·0	49·0	76	121·7	38·2	3·19	18	5·0
Wellington	65·2	5	37·8	18	59·1	49·8	45·6	72	109·0	29·0	3·35	15	7·2
Auckland	70·0	5	41·5	19	63·0	52·3	54·3	88	138·0	37·0	5·03	18	6·3
Jamaica, Kingston ..	92·4	29	66·0	1	88·1	71·1	68·6	72	...	...	1·32	3	4·2
Grenada	85·6	sevl.	70·0	27	83·2	73·6	71·0	77	139·0	...	8·36	24	6·5
Toronto	79·6	28	32·2	15	61·2	43·7	...	...	99·2	27·8	2·73	17	5·5
Fredericton	76·0	25	28·0	6	62·0	39·1	...	71	...	...	2·51	9	6·4
St. John's, N.B. ...	70·0	28	29·5	6	55·9	42·2	...	...	...	...	3·49	13	6·3
Victoria, B.C.	74·4	21	38·7	1	64·4	45·2	...	70	...	...	·77	9	4·0
Dawson	75·0	30	22·0	8	59·7	31·5	...	...	...	...	·19	2	...

* and 20, 25, 29.

MALTA.—Mean temp. of air 62°·3. Average bright sunshine 9·9 hours per day.

Johannesburg.—Bright sunshine 287·8 hours.

Mauritius.—Mean temp. of air 1°·2, of dew point 2°·2, and R 2·80 in., below averages. Mean hourly velocity of wind 8·3 miles, or 2·0 below average.

KODAIKANAL.—Bright sunshine 204 hours. TSS on 28 days.

COLOMBO.—Mean temp. of air 80°·7 or 1°·6 below, of dew point 0°·3 above, and R 8·72 in. below, averages. Mean hourly velocity of wind 7·2 miles. TSS on 4 days.

HONGKONG.—Mean temp. of air 78°·9. Bright sunshine 261·3 hours, or 107·5 hours above, and R 10·33 in. below, averages. Mean hourly velocity of wind 9·4 miles, or 3·6 miles below average.

Melbourne.—Mean temp. of air 2°·3 above, and R ·34 in. above, averages.

Adelaide.—Rainfall 1·62 in. above average.

Coolgardie.—R 1·00 in. above the average.

Perth.—Mean temp. of air normal, and R 2·25 in. above average.

Sydney.—Mean temp. of air 1°·5 above, and R 1·83 in. below, averages.

Wellington.—Mean temp. of air 1°·6 above, and R 1·53 in. below, averages. Bright sunshine 122·1 hours.