Symons's Meteorological Magazine.

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Colonel Michael Foster Ward.

1826—1915.

COLONEL MICHAEL FOSTER WARD, who died at his home, Upton Park, Slough, in his 90th year, served as an officer in the 90th Light Infantry, and after retiring from the Army became Colonel Commandant of the North Wilts Volunteers in 1864. He was one of the rainfall observers enlisted by Mr. Symons for the first volume of *British Rainfall*, published in 1862. From 1863 to 1868 he carried out at Castle House, Calne, Wiltshire, a series of observations designed to test the effect of size of aperture of rain gauges and height above ground on the amount of the catch of rain. Later the Rev. C. H. Griffith, of Strathfield Turgiss Rectory, continued these comparisons for many years. While engaged on these experiments Colonel Ward employed a clever local watchmaker named Rowdon to assist him in constructing various forms of rain gauge. Colonel Ward informed us that Rowdon suggested the use of a vertical rim above the sloping part of the funnel, and to the best of his belief, when Mr. Symons, then a very young man with coal black hair, visited Calne in 1865, he first saw the pattern now so familiar as the Snowdon rain gauge, which in Colonel Ward's opinion ought really to have been called the Rowdon rain gauge.

Colonel Ward co-operated with Mr. Symons in many interesting pieces of work. One of these was the discovery, in the Bodleian Library at Oxford, of the old Meteorological document, the M.S. of the Rev. William Merle's Journal of the Weather, 1337—1344, and its reproduction in facsimile in 1891. Colonel Ward spent much of his time in travelling on the Continent, and for a long time spent part of every year at his house in Partenkirchen, in Bavaria, and in 1885 he communicated to the Royal Meteorological Society an account of researches on a remarkable Alpine storm. Colonel Ward was at Partenkirchen when the war broke out in August, 1914, and although treated throughout with courtesy and consideration by the Bavarian authorities, he was not allowed to return to England until May, 1915. His journey home was protracted to the intolerable length of a month, but he reached Slough in safety, and wrote to us after his return with all the old interest in the Rainfall Organization and the kindliness of manner which was so characteristic of him at all times.

FLOODS IN THE NORTH-EAST OF SCOTLAND.

On the morning of Friday, September 24th, there was little on the Daily Weather Map to indicate that within 24 hours a considerable portion of the north-east of Scotland would be enveloped in a rainstorm associated with floods which have not been equalled in many districts since the famous Moray Floods of August, 1829. On that memorable occasion rain gauges were very sparsely distributed so that the maximum fall of 3·75 in. then recorded at Huntley Lodge, Aberdeenshire, in the 24 hours ending 5 a.m. of August 4th, 1829, was undoubtedly considerably less than what fell among the mountains to the west. Even after the lapse of nearly a century the representation of rainfall stations in this area leaves much to be desired. Through the kindness of Mr. A. Watt, M.A., Secretary to the Scottish Meteorological Society, we have been able to supplement the data received, so that the preparation of maps showing approximately the general distribution of rainfall on the 24th, 25th, and 26th, has been rendered possible. The remarkable rains in the north-east of Scotland appear to have been associated with the advance of a depression which as early as the 21st was approaching the West of Ireland. The Weather map of the 22nd shows no essential change in the pressure distribution, but heavy rain fell all day in Ireland, as much as two inches in some exposed western stations. By the morning of the 23rd the barometer was falling briskly in the west, and although the chart for the 24th shows no decided change in the pressure distribution, over an inch of rain fell in parts of the south of Scotland and over half an inch in the central Highlands. At 7 a.m. on Saturday, the 25th, a well marked cyclonic area with a minimum pressure of 29·5 in. lay over the south of Scotland and north of England, which during the day moved slowly northward along the Scottish coasts. The area of maximum rainfall was located on the shores of the Moray Firth near Inverness, the maximum falls reported being 4·07 in. at Fortrose; 3·78 in. at Nairn; 3·64 in. at Inverness; and 3·33 in. at Rothiermurchus. More than two inches fell in the north of Sutherland and Caithness, this wet zone being separated from the region of maximum rainfall by an area round the Dornoch Firth, in which less than an inch fell. By the morning of the 27th the low pressure system had travelled eastward to Denmark, the northerly gale subsiding to a fresh breeze. The rainfall for the 24 hours ending 9 a.m. of the 27th exceeded an inch in a considerable area between Nairn and Huntley, the maximum fall being 1·69 in. at the former station. The following shows the stations where more than four inches fell during the rainstorm which, although spread over three rain days, really occupied about 40 consecutive hours in most districts.

Station.	County.	24th. in.	25th. in.	26th. in.	Total. in.
Nairn	Nairn ..	·00	3·78	1·69	5·47
Fortrose	Ross ..	·09	4·07	·70	4·86
Elgin Manse	Elgin ..	·14	2·94	1·36	4·44
Gordon Castle ..	Banff ..	·11	2·65	1·48	4·24

The damage effected in the flood devastated zone was so great that details cannot be given within the limits of this notice. A few of the more noteworthy features of the visitation of wind and rain may be referred to. At Buckie Harbour on the shores of the Moray Firth the storm played havoc with the reclaimed ground covered by the extension works. The breakers striking the back of the new sea wall leapt 100 feet into the air and broke over in dense masses of spray. Many thousands of tons of material were carried seawards. At Nairn the river overflowed its banks and swept down an immense quantity of trees and shrubs and sheaves of corn. Sixteen bridges and culverts were carried away, and embankments and roadways seriously damaged. The Highland Railway was under water at many places following on more than 40 hours rainfall. Valuable agricultural land was inundated, crops destroyed, and towns isolated owing to the interruption of traffic. In the Grantown district the storm continued with unabated severity, whole fields were swept clear of corn, sheaves being carried down at certain points at the rate of 100 or 200 per hour. In Elgin the River Lossie at its highest point was only four inches below the high water mark of 1829. In the valley of the River Findhorn extensive flooding took place at Brodie and Moy, and passengers and mails from the east and west were motored to Forres, to join the south-going trains.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

WET DAYS IN SEPTEMBER.

I HAVE taken rainfall readings here for the past 28 years. The rainfall of 2·56 in. on 24th September, 1915, is the greatest amount I have recorded in any one day. There was rain here from 1 p.m. to 6 p.m., but by far the largest portion, more than two inches, fell between 3 and 5 o'clock. The rain was very straight with scarcely a breath of S.E. wind, and no thunder.

At two other places within a mile of Aston House the rainfall for September 24th was 2·64 in. and 2·67 in. respectively.

JOHN DOVER.

Totland Bay, Isle of Wight, 1st October, 1915.

In this district yesterday after a fairly fine day slight rain commenced about 5.30 p.m., and from 9 p.m. and throughout the night heavy rain with a strong N.W. gale prevailed. At 9 a.m. this morning I measured 2·16 in. of rain. I have records since 1903, and this is the heaviest rainfall I have measured. The barometer yesterday morning was 29·7, and to-day 29·43.

JNO. W. HAYWARD.

Western House, Whitstable, September 29th, 1915.

Between 6 p.m. on September 28th, and 9 a.m. on the 29th, there was 2·16 in. of rain here. (This is precisely the amount reported in the *Times* to-day as having occurred at Whitstable). The wind backed from south through east to north. During cyclonic weather we seem more liable to heavy soaks with east winds than with any other winds.

G. WESTON.

The Vicarage, Bethersden, Ashford, Kent, October 1st, 1915.

September, 1915, has been remarkable for its few "rain" days—seven in all, and also for its heavy fall on the 28th, of 2·08 in., which fell between 6 p.m. and 9 a.m., and is so far as I can at present hear, the heaviest fall on that day in our neighbourhood, amounting to as nearly as possible one-thirteenth of our average annual rainfall at Detling, viz., 27 inches.

RICHARD COOKE.

The Croft. Detling, Maidstone, October 1st, 1915.

SNOW-DRIFT ON BEN NEVIS, AUGUST, 1915.

I have just seen a photograph of the snow-drift that remained on the summit of Ben Nevis on August 13th. It must have been unusually extensive for so late a period in the summer. The taker of the photograph informs me that the drift was many yards in length and three or four feet deep. Hailing from Boston, Mass., he was disinclined to believe that our little British hills could harbour snow in late summer, until he made the ascent of the Ben on the day in question, when he realized at least that the snow formed an excellent refrigerator for the bottle of refreshment with which he had toiled to the summit.

E. L. HAWKE.

Meteorological Office, S.W., September 8th, 1915.

ON WEATHER FORECASTS AND THE TEMPERATURE PREDICTIONS OF STRÖMBERG.

By Dr. Hans Pettersson.

(*Continued from p. 126.*)

In Figure 4 are reproduced four of the largest temperature-waves found by Dr. Strömberg in the temperature record of Upsala; the underlined numbers denote the length of each wave in days, the numbers within brackets the years from which the record has been analysed. The resemblance between the waves found in the first and the second half of the record is seen to be most pronounced, particularly for the wave of 29·60 days, which shows a remarkable persistence all through the very long record from which it has been extricated. This resemblance is obviously a most convincing proof of the actual existence of the waves. For if they were only an artificial result of the method of investigation, there is no reason whatever why the *same* waves should be found in both the two independent halves of the investigated records.

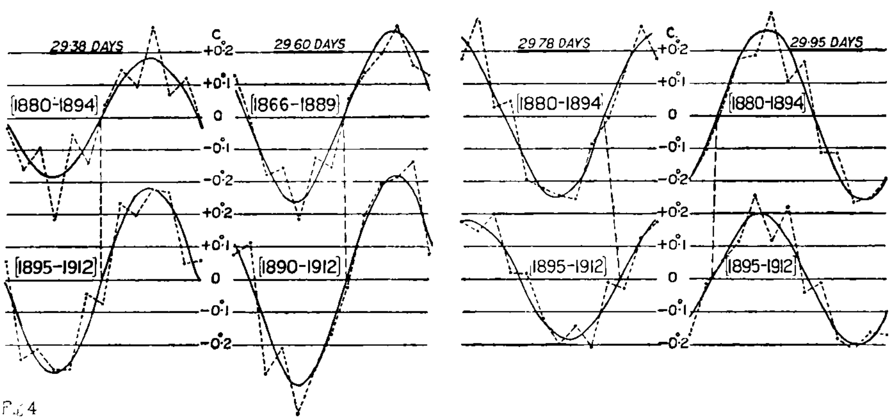
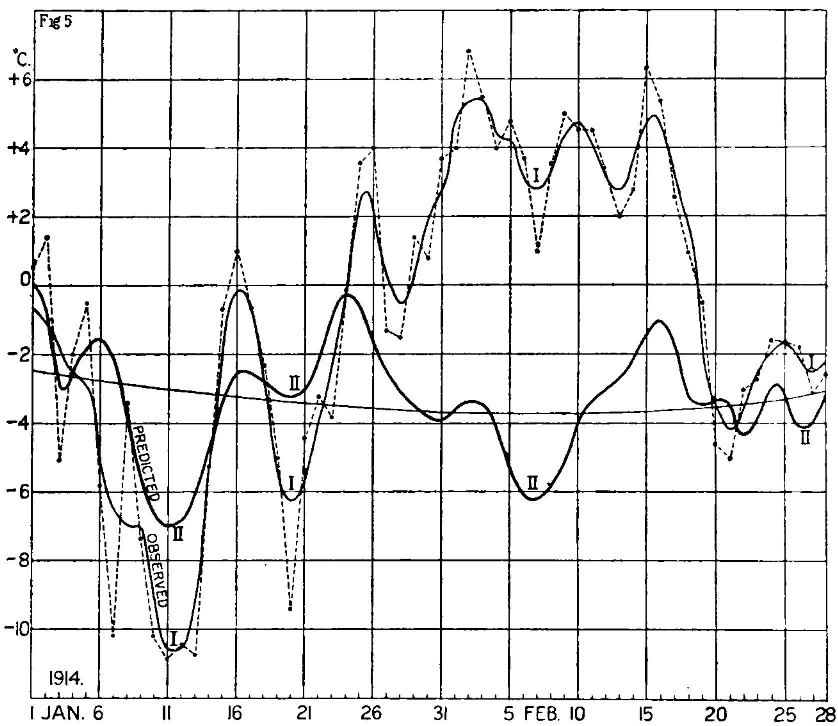


Fig. 4

It appears at present premature to try to give any physical interpretation of this remarkable phenomenon, viz., the occurrence of rythmical oscillations of sharply defined periods in the air-temperature. It is, however, certainly a curious coincidence that the group of four important waves reproduced here should agree so closely in length with one of the principal lunar periods, the synodical month (29·53 days).

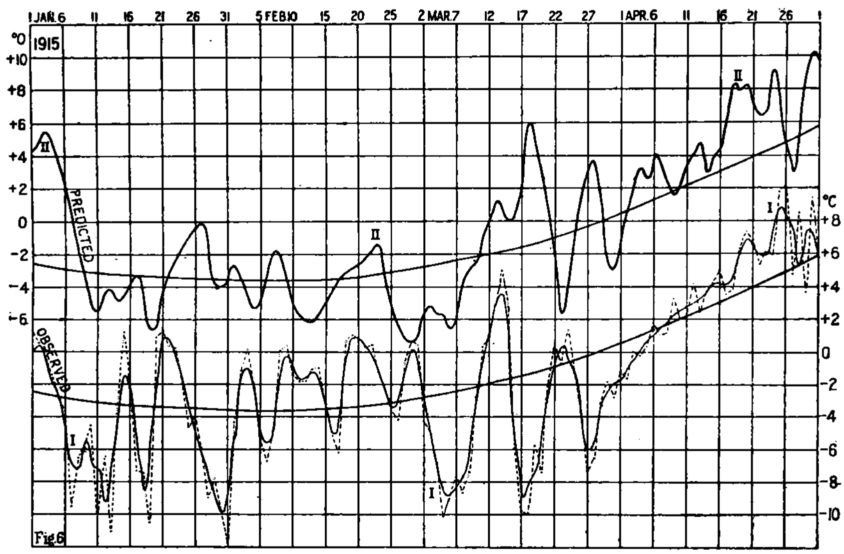
It must be observed that the analysis in its present shape is far from complete. Only the temperature-waves of between 20 and 40 days have been systematically investigated, and but a few still shorter and longer waves have been extricated. Moreover the analysis has not been carried out on the raw curve of daily averages, but on a kind of smoothed curve, obtained from the former by plotting the mean from each set of three consecutive days, so that instead of the average temperature for each day the mean is taken from that value and those of the preceding and the following day. In spite of this simplification (by which all periodicities shorter than three days are suppressed), the calculations have been extremely laborious, and occupied a whole staff of trained assistants for several months.

Dr. Strömberg has not hesitated to draw practical conclusions from his investigations. Already during the latter part of 1913 monthly temperature predictions were issued in the daily papers. Since then "Strömberg Calendars" have been published giving the predicted curves for the air-temperature of Stockholm, both



for 1914 and 1915, the latter also with curves for Lund and Gothenberg, whereas a separate calendar published in Norway gives a similar curve for Christiania. All these curves closely resemble that for Stockholm, so that the regularities found by Dr. Strömberg appear to be common to a large part of Scandinavia.

In a number of cases conspicuous breaks in the weather have been successfully foretold to the day. Taking a few instances from 1913; changes from warm to cold weather were duly predicted for June 6th; August 7th; October 20th; and December 12th: whereas changes in the opposite direction were correctly foretold for June 14th and July 12th. A very remarkable hit was the accurate prediction of the most intense spell of cold weather during the following winter, which occurred between the 10th and the 13th of January, 1914. I have reproduced in Figure 5 the predicted (II.), and the observed (I.), curve, the latter obtained from the raw curve of observed daily averages (broken curve), by the smoothing-out process before mentioned. There is a striking *qualitative agreement* between prediction and observation during the first four weeks of the year. In both curves the same crests and hollows are visible, although they are considerably larger in reality than according to the predictions. From a quantitative point of view the predicted curve for February is a failure, as the temperatures actually recorded happened to be several degrees too high. But on the other hand there is an unmistakable



parallelism between the two curves, as perfectly *simultaneous* changes occur in both, although at different levels of temperature. The impression is exactly the same as when a large single roller breaks into a harbour and lifts on its back the system of smaller regular waves high above their normal level.

This example demonstrates at the same time both the merits and the demerits of Dr. Strömberg's predictions. At their best they show an unmistakable *conformity* with the curve of subsequent observations, so that much the same changes occur in both, although one of them may temporarily seem a couple of degrees below or above the other. On the other hand, it is only fair to admit that in a number of cases Dr. Strömberg's predictions have failed to foretell notable changes in the temperature, either completely or with a considerable exaggeration or underestimation of their magnitude. As a further example we may take the predicted and observed curves for the first four months of 1915. (upper and lower curves in Figure 6). The slightly concave line is the annual temperature wave, *i.e.*, the gradual rise in the temperature from winter to summer as calculated from a very large number of years. Round this normal curve the daily average temperature is seen to fluctuate. In both curves there is a pronounced drop during the first decade of the year followed by variations of increasing amplitude. During the next month the agreement of details is not very good, but it is worthy of notice that the *general character* of both curves is much the same, the fluctuations of the temperature being middle-sized in February, very large in March, and quite small during April, but increasing in magnitude towards the end of that month. One should also

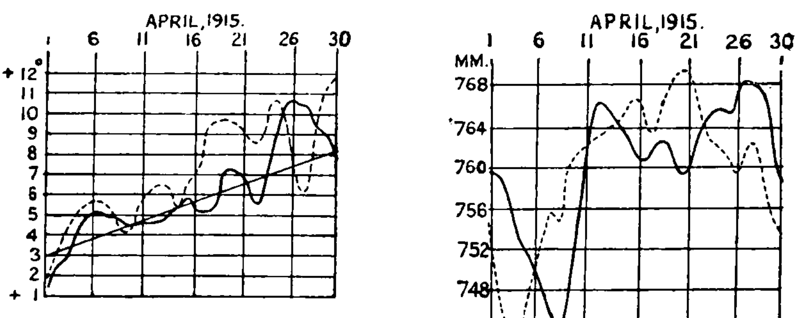


Fig 7.

observe that if the predicted curve had been displaced backwards by about four days from the 15th of March and onwards, the agreement during the following three weeks would have been striking, for not only would crests and troughs occur simultaneously in both curves, but even the length of the slopes are almost exactly alike.

The observed and predicted temperature curves for April are given separately in Fig. 7 together with similar curves for the barometric pressure (predicted curves full-drawn, observed curves broken). Dr. Strömberg has also tried to apply his methods to the pressure although hitherto not with quite as good results as for the air-temperature. The large minimum in the early part of the month is seen in both curves but here also the predicted curve has to be displaced by four or five days in order to give a good agreement.

However careful one must naturally be at the tracing of similar analogies, where a subjective element is almost unavoidable, still one must admit that there is an unmistakable *partial correctness* in the predictions. One has an impression that irregular influences will occasionally set in, displacing and even perturbing the temperature variations which would occur, if the regular elements were allowed to develop undisturbed. Now this is exactly what one might expect from the incomplete character of the analysis and the probable existence of other influences on the air-temperature than those of a regular periodical character.

The results already gained appear to me so promising that an extension of Dr. Strömberg's investigations seems most desirable, both as regards the perfecting of the method itself and also an analysis of the temperature records from other localities, say that of London. The great expense required for this work, if carried out with the aid of human assistants, make it almost indispensable for Dr. Strömberg to employ a mechanical analysator like those used for tidal predictions. There is unfortunately no instrument of that kind available in Sweden.

Taking a parallel from practical life one might compare the work on weather predictions to that of prospecting for gold. The simple rules of the sailor and the farmer are like the largest nuggets found by the first untrained explorers. Then meteorological science steps in sifting the fine grains of gold, the less obvious regularities, from the " ore " of unaccountable changes in the weather. But the very finest gold dust, the invisible regularities and hidden periodicities can apparently only be extricated by more subtle methods like that of Dr. Strömberg. In its present shape his analysis can obviously not resolve the record completely, but only extricate some of its periodical elements, while a large part of the temperature variations must still be left as unforeseeable, the incalculable work of chance. Perhaps it may always be so, the weather predictions of the future never attaining but a partial correctness. But on the other hand it may also be possible that what is now considered freaks of the weather, irreducible irregularities in the temperature curve, will yield to a still more complete and refined method of analysis, so that " all the ore is converted into gold." If so we shall one day be able to predict the variations of the thermometer with the same almost infallible accuracy with which we can now foretell the rise and fall of the ocean's tides.

METEOROLOGY AT THE BRITISH ASSOCIATION.

The eighty-fifth meeting of the British Association was held at Manchester under the Presidency of Professor Arthur Schuster, from September 7th to 11th, this being the first occasion on which the meeting lasted less than a complete week. The work of most of the Sections related to matters directly or indirectly connected with the war, and the reports in the Press were concerned almost entirely with educational and economic papers. There was a very poor attendance of Meteorologists and no Meteorological Luncheon was held. We were unfortunately unable to be present at the meeting, but Dr. F. G. Ogilvie, C.B., was good enough to send us an account of the proceedings. Professor Schuster's Presidential

Address broke from the usual custom of dealing in a technical manner with the President's own special department of science, and was devoted mainly to a discussion of the characteristics of the scientific mind. The title he chose for it being "The Common Aims of Science and Humanity." In Section A, Mr. F. J. W. Whipple dealt with the mechanism of Cyclones, the abstract of his paper being as follows :—

The distribution of pressure and temperature in cyclones in the Temperate Zone has been learned from the analysis of the records from the meteorographs carried by pilot balloons Up to a height of eight or nine kilometres the cyclone is composed of air cooler than its surroundings ; at greater heights, *i.e.*, in the stratosphere, the cyclone contains comparatively warm air The lower limit of the stratosphere is depressed in the cyclone. This temperature distribution indicates that the air constituting the lower part of the cyclone has recently ascended, whereas the upper air has recently fallen, and accordingly the arrival of a cyclone is marked by an outflow of air at the bottom of the stratosphere and an inflow below. At the beginning of the present paper the amount of this displacement of air is estimated on the assumption that there is no direct exchange of heat and it is shown that the outflow is concentrated between the seventh and tenth kilometres, and is about 6·5 times the net loss of air as estimated by the fall of pressure at the earth's surface. It is pointed out that a cyclone may be regarded as a disturbance in the stream of air which flows from West to East in the Temperate Zone and the form of the isobars obtained by superimposing the permanent pressure distribution and the temporary cyclonic distribution is discussed. It is shown that when due allowance is made for the curvature and the progressive motion of these isobars, the gradient wind at certain heights is much less than it would have been if the curvature were inappreciable, so that at these heights the air supply from the rear to the front of the cyclone fails and the cyclone appears to move under the influence of suction applied at the base of the stratosphere. The explanation may be summarised as follows :—

If the flow of air at any level were entirely horizontal and along the isobars, and if changes of density were negligible, then the condition for continuity would require the velocity to be inversely proportional to the distance between the isobars, *i.e.*, the velocity would be directly proportional to the pressure gradient. This condition is not satisfied, however, in regions where the air-trajectories are curved to the left. The pressure has to produce the centripetal acceleration in the curved path in addition to overcoming the tendency to turn to the right, which is the feature of all horizontal motion in out hemisphere. Accordingly the actual velocity where the isobars are curved is less than it should be to secure continuity and maintian a stationary distribution of pressure. The effect of curvature in reducing the velocity is greatest at the heights where the winds are strongest, and therefore the suction effect is concentrated near the base of the stratosphere.

The general argument is supported by the analysis of two special cases.

In Section E, the President, Major H. G. Lyons, dealt with the Modern Science of Geography, and in the course of his address referred in the following terms to the importance of the study of rainfall and the results obtained by the work of the British Rainfall Organization. In speaking of Physical Geography he said :—

Even here there is room for much more work of the detailed and critical type, which is not merely general and descriptive, but starts from the careful collection of data, proceeds to the critical discussion of them, and continues by a comparison of the results with those obtained in similar observations in other regions.

To take a single branch of Physical Geography, the study of Rivers; the amount of accurate material which has been adequately discussed is small. In our own country the rainfall of various river basins is well known through the efforts of a Meteorological Association, but the proportion of it which is removed by evaporation, and of that which passes into the soil, has only been very partially studied. Passing to the run-off, which is more easy to determine satisfactorily, the carefully measured discharge of streams and rivers are not nearly so numerous as they should be if the hydrography of the rivers is to be adequately discussed; for although the more important rivers have been gauged by the authorities responsible for them in many cases, the results have usually been filed, and the information which has been published is usual a final value, but without either the original data from which it has been deduced, or a full account given of the methods of measurement which have been employed. For the requirements of the authority concerned such a record is no doubt adequate, but the geographer requires the more detailed information if he is to co-ordinate satisfactorily the volume discharged with local rainfall, with changes in the rates of erosion or deposition, and the many other phenomena which make up the life-history of a river. Here, too, it is usually only the main stream which has been investigated; the tributaries still await a similar and even fuller study. A valuable contribution to work of this kind exists in the hydrographical study of the Medway and of the Exe, which has been undertaken by a Committee of the Royal Geographical Society during recent years, and this may serve as a guide to other workers; but, however welcome such a piece of work may be, I should much prefer to see the hydrography of a tributary of a river system worked out by a geographer as a piece of individual work, just as the geology or the botany or the zoology of a single restricted area is investigated by those whose interests are centred in these subjects.

In the same way we still know too little of the amounts of the dissolved and suspended matter which is carried down by our streams at various seasons of the year and in the different parts of their course. This class of investigation does not need very elaborate equipment, and may provide the opportunity for much useful study, which may be extended as information is increasingly acquired. In this way when numerous individual workers have studied the conditions prevailing in their own areas, and traced them through their seasonal and yearly variations, we shall possess a mass of valuable data with which we may undertake a revision of the results which have been arrived at in past years by various workers from such data as were then at their disposal.

RAINFALL TABLE FOR SEPTEMBER, 1915.

STATION.	COUNTY.	Lat. N. ° ′	Long. W. [*E.] ° ′	Height above Sea. ft.	RAINFALL OF MONTH. Aver. 1875—1909. in.	1915. in.
Camden Square	*London*	51 32	0 8	111	2·00	1·86
Tenterden	*Kent*	51 4	*0 41	190	2·25	3·39
Arundel (Patching)	*Sussex*	50 51	0 27	130	2·58	3·18
Fawley (Cadland)	*Hampshire*	50 50	1 22	52	2·60	3·78
Oxford (Magdalen College)	*Oxfordshire*	51 45	1 15	186	1·98	2·68
Wellingborough (Swanspool)	*Northampton*	52 18	0 41	155	2·13	1·29
Shoeburyness	*Essex*	51 31	*0 48	13	1·70	2·23
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	2·18	1·29
Geldeston [Beccles]	*Norfolk*	52 27	*1 31	38	2·13	1·29
Polapit Tamar [Launceston]	*Devon*	50 40	4 22	315	3·11	1·83
Rousdon [Lyme Regis]	,,	50 41	3 0	516	2·69	1·50
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	2·39	1·61
Church Stretton (Wolstaston)	*Shropshire*	52 35	2 48	800	2·40	·81
Boston	*Lincolnshire*	52 58	0 1	11	2·07	1·24
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	1·84	·70
Mickleover Manor	*Derbyshire*	52 54	1 32	280	2·11	·85
Macclesfield	*Cheshire*	53 15	2 7	501	2·92	·71
Southport (Hesketh Park)	*Lancashire*	53 39	2 59	38	3·09	·96
Arncliffe Vicarage	*Yorkshire, W.R.*	54 8	2 6	732	4·55	·93
Wetherby (Ribston Hall)	,, ,,	53 59	1 24	130	2·11	1·37
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	2·05	1·35
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	2·00	1·69
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	11·28	2·08
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	3·61	1·10
Haverfordwest	*Pembroke*	51 48	4 58	90	3·91	3·10
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	3·89	2·05
Llandudno	*Carnarvon*	53 20	3 50	72	2·50	1·29
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	3·34	...
Marchmont House	*Berwick*	55 44	2 24	498	2·67	2·50
Girvan (Pinmore)	*Ayr*	55 10	4 49	207	4·30	2·16
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	2·99	1·12
Inveraray (Newtown)	*Argyll*	56 14	5 4	17	6·15	2·12
Mull (Quinish)	,,	56 34	6 13	35	5·20	1·40
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	2·34	1·19
Braemar	*Aberdeen*	57 0	3 24	1114	2·73	3·56
Aberdeen (Cranford)	,,	57 8	2 7	120	2·69	3·10
Gordon Castle	*Moray*	57 37	3 5	107	2·58	5·75
*Fort Augustus (S. Benedict's)	*E. Inverness*	57 9	4 41	68	3·54	2·72
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	7·28	4·54
Dunrobin Castle	*Sutherland*	57 59	3 56	14	2·51	2·15
Wick	*Caithness*	58 26	3 6	77	2·57	3·39
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	3·79	2·58
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	3·19	1·81
Nenagh (Castle Lough)	*Tipperary*	52 54	8 24	120	3·16	1·93
Ennistymon House	*Clare*	52 57	9 18	37	4·22	2·14
Gorey (Courtown House)	*Wexford*	52 40	6 13	80	2·78	1·62
Abbey Leix (Blandsfort)	*Queen's County*	52 56	7 17	532	2·93	2·14
Dublin (FitzWilliam Square)	*Dublin*	53 21	6 14	54	2·06	·91
Mullingar (Belvedere)	*Westmeath*	53 29	7 22	367	3·02	1·17
Crossmolina (Enniscoe)	*Mayo*	54 4	9 16	74	4·42	3·72
Cong (The Glebe)	,,	53 33	9 16	112	4·05	3.02
Collooney (Markree Obsy.)	*Sligo*	54 11	8 27	127	3·65	2·11
Seaforde	*Down*	54 19	5 50	180	3·25	1·38
Bushmills (Dundarave)	*Antrim*	55 12	6 30	162	3·49	...
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	3·39	1·83

* m.m

RAINFALL TABLE FOR SEPTEMBER, 1915—*continued.*

RAINFALL OF MONTH (*con.*) Diff. from Av. in.	% of Av.	Max. in 24 hours. in.	Date.	No. of Days	RAINFALL FROM JAN. 1. Aver. 1875—1909. in.	1915. in.	Diff. from Aver. in.	% of Av.	Mean Annual 1875-1909. in.	STATION.
— ·14	93	1·51	28	5	17·92	22·17	+4·25	124	25·11	Camden Square
+1·14	151	2·14	28	9	18·32	22·55	+4·23	123	27·64	Tenterden
+ ·60	123	2·21	28	8	20·02	26·77	+6·75	134	30·48	Patching
+1·18	145	2·01	24	9	21·18	27·65	+6·47	131	31·87	Cadland
+ ·70	135	1·52	24	7	17·45	20·58	+3·13	118	24·58	Oxford
— ·84	61	·68	24	8	18·25	17·20	—1·05	94	25·20	Swanspool
+ ·53	131	1·95	28	9	13·17	16·27	+3·10	124	19·28	Shoeburyness
— ·89	59	·71	28	8	18·14	17·75	— ·39	98	25·40	Westley
— ·84	61	·70	28	11	16·33	21·45	+5·12	131	23·73	Geldeston
—1·28	59	·60	1	16	24·90	29·45	+4·55	118	38·27	Polapit Tamar
—1·19	56	·44	28	11	22·54	21·74	— ·80	96	33·54	Rousdon
— ·78	67	·73	1	7	21·12	21·94	+ ·82	104	29·81	Stroud
—1·59	66	·31	24	6	22·71	26·89	+4·18	118	32·41	Wolstaston
— ·83	60	·54	1	10	16·67	17·68	+1·01	106	23·35	Boston
—1·14	38	·51	24	4	17·54	17·12	— ·42	98	24·46	Hodsock Priory
—1·26	40	·39	24	9	19·25	22·19	+2·94	115	26·65	Mickleover
—2·21	24	·30	14	6	24·85	25·92	+1·07	104	34·73	Macclesfield
—2·13	31	·45	24	6	22·70	22·14	— ·56	98	32·70	Southport
—3·62	20	·50	24	9	42·14	37·75	—4·39	90	61·49	Arncliffe
— ·74	65	...	..	...	19·08	20·15	+1·07	105	26·87	Ribston Hall
— ·70	66	·43	24	9	18·57	19·35	+ ·78	104	26·42	Hull
— ·31	84	·47	24	12	19·65	16·79	—2·86	85	27·94	Newcastle
—9·20	18	·50	24	13	88·04	73·24	—14·80	83	129·48	Seathwaite
—2·51	30	·43	28	14	28·63	24·19	—4·44	84	42·28	Cardiff
— ·81	79	·60	24	13	30·96	31·38	+ ·42	101	46·81	Haverfordwest
—1·84	53	·33	1	16	30·92	30·41	— ·51	98	45·46	Gogerddan
—1·21	52	·34	1	11	20·55	22.27	+1·72	108	30·36	Llandudno
...	...	...	...	...	29·83	...	...	...	43·47	Cargen
— ·17	94	·81	24	12	23·89	21·52	—2·37	90	33·76	Marchmont
—2·14	50	·55	7	13	33·67	31·68	—1·99	94	49·77	Girvan
—1·87	37	·55	24	12	25·03	20·05	—4·98	80	35·97	Glasgow
—4·03	34	·46	13	13	46·21	43·76	—2·45	95	68·67	Inveraray
—3·80	27	·23	6	18	37·87	31·97	—5·90	84	56·57	Quinish
—1·15	51	·31	25	10	20·54	19·65	— ·89	96	28·64	Dundee
+ ·83	130	·88	25	12	24·16	28·08	+3·92	116	34·93	Braemar
+ ·41	115	·83	25	14	22·78	23·52	+ ·74	103	32·73	Aberdeen
+3·17	222	2·65	25	16	21·39	26·33	+4·94	123	30·34	Gordon Castle
— ·82	77	1·53	25	17	30·26	23·99	—6·27	79	44·53	Fort Augustus
—2·74	62	1·46	25	16	56·79	52·85	—3·94	93	83·93	Bendamph
— ·36	86	·53	25	11	22·41	...	...	...	31·90	Dunrobin Castle
+ ·82	132	...	..	...	20·68	17·01	—3·67	82	29·88	Wick
—1·21	68	·85	22	20	36·76	33·84	—2·92	92	54·81	Killarney
—1 38	57	·41	13	11	27·45	24·50	—2·95	89	39·57	Waterford
—1·23	61	·47	22	17	27·73	27·28	— ·45	98	39·43	Castle Lough
—2·08	51	·76	22	19	32·47	31·87	— ·60	98	46·52	Ennistymon
—1·16	58	·54	22	10	24·41	22·42	—1·99	92	34·99	Courtown Ho.
— ·79	73	·58	24	14	25·70	24·23	—1·47	94	35·92	Abbey Leix
—1·15	44	·21	24	16	19·89	20·19	+ ·30	102	27·68	Dublin
—1·85	39	·30	24	12	26·19	29·63	+3·44	113	36·15	Mullingar
— ·70	84	·83	22	19	35·74	34·62	—1·12	97	52·87	Enniscoe
—1·03	75	1·28	22	17	33·88	32·31	—1·57	95	48·90	Cong
—1·54	58	·94	22	18	30·14	31·51	+1·37	105	42·71	Markree
—1·87	42	·47	22	13	27·63	25·43	—2·20	92	38·91	Seaforde
...	...	...	...	...	26·32	...	...	...	37·56	Dundarave
—1·56	54	·60	24	12	28·05	27·40	— ·65	98	39·38	Omagh

SUPPLEMENTARY RAINFALL, SEPTEMBER, 1915.

Div.	STATION.	Rain inches	Div.	STATION.	Rain inches
II.	Warlingham, Redvers Road .	2·31	XI.	Lligwy	1·54
,,	Ramsgate	2·34	,,	Douglas	1·15
,,	Hailsham	2·91	XII.	Stoneykirk, Ardwell House...	·53
,,	Totland Bay, Aston House...	3·75	,,	Carsphairn Shiel	2·47
,,	Stockbridge, Ashley	3·16	,,	Beattock, Kinnelhead	1·82
,,	Grayshott	2·17	,,	Langholm, Drove Road	1·54
III.	Harrow Weald, Hill House...	1·84	XIII.	Meggat Water, Cramilt Lodge	1·42
,,	Caversham, Rectory Road ...	2·93	,,	North Berwick Reservoir	2·80
,,	Pitsford, Sedgebrook	1·50	,,	Edinburgh, Royal Observaty.	2·73
,,	Woburn, Milton Bryant	1·73	XIV.	Maybole, Knockdon Farm ...	1·39
,,	Chatteris, The Priory	1·00	XV.	Ballachulish House	2·14
IV.	Elsenham, Gaunts End	1·99	,,	Campbeltown, Witchburn ..	·88
,,	Colchester, Hill Ho., Lexden	1·61	,,	Holy Loch, Ardnadam	1·88
,,	Ipswich, Rookwood, Copdock	1·44	,,	Islay, Eallabus	1·92
,,	Blakeney	1·45	,,	Tiree, Cornaigmore	...
,,	Swaffham	1·07	XVI.	Dollar Academy	2·46
V.	Bishops Cannings	1·78	,,	Balquhidder, Stronvar	3·15
,,	Wimborne, St. John's Hill ...	2·40	,,	Glenlyon, Meggernie Castle..	2·07
,,	Ashburton, Druid House.. ...	1·49	,,	Blair Atholl	1·89
,,	Cullompton	·97	,,	Coupar Angus	1·77
,,	Lynmouth, Rock House	1·13	,,	Montrose, Sunnyside Asylum.	1·36
,,	Okehampton, Oaklands.. ...	1·52	XVII.	Alford, Lynturk Manse	3·24
,,	Hartland Abbey	1·14	,,	Fyvie Castle	3·24
,,	Probus, Lamellyn	1·18	,,	Keith Station	5·94
,,	North Cadbury Rectory	2·92	XVIII.	Rothiemurchus	5·58
VI.	Clifton, Pembroke Road	1·64	,,	Loch Quoich, Loan	4·10
,,	Ross, The Graig	·86	,,	Drumnadrochit	4·14
,,	Shifnal, Hatton Grange	·86	,,	Skye, Dunvegan	3·11
,,	Droitwich	·90	,,	Lochmaddy, Bayhead	4·09
,,	Blockley, Upton Wold	·84	,,	Glencarron Lodge	4·62
VII.	Market Overton	1·13	XIX.	Invershin	2·36
,,	Market Rasen	·86	,,	Melvich	5·84
,,	Bawtry, Hesley Hall	·61	,,	Loch Stack, Achfary	5·97
,,	Derby, Midland Railway	·89	XX.	Dunmanway, The Rectory ..	5·10
,,	Buxton	·88	,,	Glanmire, Lota Lodge	2·10
VIII.	Nantwich, Dorfold Hall	·55	,,	Mitchelstown Castle	1·98
,,	Chatburn, Middlewood	...	,,	Darrynane Abbey	5·85
,,	Lancaster, Strathspey	·76	,,	Clonmel, Bruce Villa	1·87
IX.	Langsett Moor, Up. Midhope	·72	,,	Newmarket-on-Fergus, Fenloe	1·79
,,	Scarborough, Scalby	3·05	XXI.	Laragh, Glendalough	1·97
,,	Ingleby Greenhow	1·70	,,	Ballycumber, Moorock Lodge	1·63
,,	Mickleton	·90	,,	Balbriggan, Ardgillan	·65
X.	Bellingham, High Green Manor	4·33	XXII.	Ballynahinch Castle	4·48
,,	Ilderton, Lilburn Cottage ...	1·94	,,	Woodlawn	2·03
,,	Keswick, The Bank	·96	,,	Westport, St. Helens	1·93
XI.	Llanfrechfa Grange	1·00	,,	Dugort, Slievemore Hotel ...	3·45
,,	Treherbert, Tyn-y-waun	2·39	,,	Mohill Rectory	1·68
,,	Carmarthen, The Friary	1·79	XXIII.	Enniskillen, Portora	1·75
,,	Fishguard Goodwick Station.	2·17	,,	Dartrey [Cootehill]	1·90
,,	Crickhowell, Tal-y-maes	1·20	,,	Warrenpoint, Manor House ..	1·01
,,	New Radnor, Ednol	1·45	,,	Banbridge, Milltown	·95
,,	Birmingham WW., Tyrmynydd	·87	,,	Belfast, Cave Hill Road	1·67
,,	Lake Vyrnwy	...	,,	Ballymena Harryville	1·02
,,	Llangynhafal, Plâs Draw	1·14	,,	Londonderry, Creggan Res...	1·49
,,	Dolgelly, Bryntirion	2·24	,,	Dunfanaghy, Horn Head ...	2·48
,,	Bettws-y-Coed, Tyn-y-bryn...	2·69	,,	Killybegs	3·33

THAMES VALLEY RAINFALL —— SEPTEMBER, 1915.

THE WEATHER OF SEPTEMBER.

During the early days of September very cold weather for the season prevailed with day maxima in many instances below 60°, while minima under 35° were not uncommon. Northerly and north-westerly winds prevailed, Great Britain being under the influence of low pressure systems over the North Sea, while areas of high barometric pressure were located to the N. and S.W. of our Islands. On the 4th at West Linton the shade thermometer fell to 26°, and on the grass to 24°, while ground frosts were common over a very extensive region. Thunderstorms were experienced very generally on the 1st and 2nd, and more locally on the 3rd. Showers during this time were common in most districts. From about the 3rd to the 23rd the general distribution of pressure was on the whole anti-cyclonic, although after the middle of the month the eastern portions of the country, particularly Scotland, had rather more than the average rainfall. The weather, speaking generally, was extremely dry with many warm days, long cloudless periods, and a large daily range of temperature. In the south of England cool weather prevailed till about the 12th. Elsewhere it was rather warm. On the 8th the temperature at Manchester rose to 76°, and at Gordon Castle in Banffshire to 77°, which was also reached at Nairn on the 10th. The highest temperatures were noted after the 15th, reaching 80° at Camden Square on the 16th and 17th, and also at Raunds, Northamptonshire and at Tottenham on the latter day. On the other hand the maximum at Harrogate on the 17th was only 68°. Several low minima were recorded on various dates. At Balmoral 31° was noted on the 12th in the screen, a similar value on the grass occurring at Greenwich on the 19th.

On the 23rd the long partial drought over the southern counties terminated. In London (Camden Square), in the 39 days ending the 23rd, only ·30 in. of rain fell, the total duration of rain being only six hours. After the 23rd some remarkably heavy rains occurred in various localities. On the 24th heavy rain fell in the West of Ireland, the south of Scotland and in some other places, notably in the Isle of Wight and adjacent coastal areas, where at Totland Bay 2·56 in. fell. On the 25th and 26th the north-east of Scotland was devastated by a northerly gale accompanied by a rainstorm and floods of almost unexampled intensity (see note p. 138), and on the 28th a heavy rainfall yielded maximum falls exceeding 2·50 in. in many places situated in the S.E. counties of England, particularly Kent.

Under one inch of rain fell during the month over the extreme south-west of Scotland, the east of Ireland, the east and north of Wales and central England, N.W. of a line from Lincoln to Gloucester, and including most of Lancashire and the northern Pennines. In parts of Shropshire and Cheshire less than ·50 in. fell. More than five inches fell in the north of Scotland, Ireland W. and S.W., and in Snowdonia; while parts of the north and north-east of Scotland had more than six inches. A remarkable feature of the month was the fact that the rainfall along the west coast of Great Britain was much lower than in the east.

In the Thames Valley less than an inch fell in the N.W. only. The wettest part was in the centre stretching south from Watlington, Oxford, with over 3 inches, and reaching a maximum of 4·3 in. at Oakley, S.W. of Basingstoke. Over the Kingdom as a whole the general rainfall expressed as a percentage of the average was as follows: England and Wales, 59; Scotland, 75; Ireland, 60; British Isles, 64.

Sunshine was abundant in the south and west, scanty in the north and east. The following amounts were reported: Camden Square, 161 hours; Totland Bay, 194 hours; Copdock, 165 hours; Sidmouth, 196 hours; Weymouth, 200 hours; Felsted, 182 hours; Southport, 184 hours; Hull, 117 hours; Haverfordwest, 127 hours; Paisley, 133 hours; Loch Stack, 118 hours; Perth, 125 hours; Swinton, 128 hours.

In London (Camden Square), the mean temperature was 58°·3, or 0°·6 above the average. Duration of rain, 20·0 hours. Evaporation, 1·61 in.

Climatological Table for the British Empire, April, 1915.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute.				Average.				Absolute.		Total Rain		Aver.
	Maximum.		Minimum.										
	Temp.	Date.	Temp.	Date.	Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	72·8	30	31·2	1	57·6	39·1	39·5	73	115·6	25·2	1·13	9	5·3
Malta	71·1	9	47·0	12	63·3	54·7	...	85	141·0	...	2·87	6	1·6
Lagos	93·3	18	72·3	20	89·7	77·3	75·6	74	158·0	70·0	7·04	10	7·5
Cape Town	83·7	20	46·0	26	69·7	52·3	53·2	75	...	...	2·81	9	5·7
Natal, Durban ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Johannesburg	78·7	10	35·3	25	70·8	51·1	46·3	70	...	35·0	·32	3	2·2
Mauritius	85·6	7	64·8	27	83·2	71·1	70·4	81	...	59·7	2·81	22	4·7
Bloemfontein	83·7	9	33·9	25	74·3	44·0	41·0	56	..	...	·15	4	2·9
Calcutta...	103·4	17	68·9	24	97·0	76·6	70·8	64	...	63·9	1·57	2	2·3
Bombay...	93·0	14	75·6	9	90·1	78·6	73·8	72	138·0	61·1	·06	2	3·1
Madras	99·8	2	73·2	8	93·5	77·5	75·1	76	163·7	70·4	·52	3	1·6
Colombo, Ceylon ...	92·5	14	71·5	11	90·7	75·5	76·7	82	158·6	69·4	4·74	16	4·5
Hongkong	84·0	19	62·8	8	78·7	71·3	69·9	84	...	...	1·80	11	8·6
Sydney	82·7	18	50·2	25	70·3	58·3	57·1	78	133·2	42·6	10 56	17	5·4
Melbourne	81·0	8	40·0	25	67·2	51·6	48·4	66	133·0	29·7	2·31	12	5·7
Adelaide	86·8	16	45·2	27	72·0	53·7	49·8	62	138·8	32·3	2·42	10	4·7
Perth	89·9	3	53·0	7	77·8	59·8	53·8	58	154·2	45·0	1·44	6	4·5
Coolgardie	87·4	14	47·0	18	76·1	54·3	49·2	54	155·8	41·0	·58	5	3·2
Hobart, Tasmania ..	75·9	16	40·0	25	62·9	48·7	44·6	61	129·0	31·0	2·40	11	5·9
Wellington ...	70·2	19	36·0	24	61·8	49·0	47·0	73	124·6	21·2	·68	8	5·7
Auckland	71·0	15	42·5	24	64·9	52·9	52·9	82	137·0	39·0	4·45	16	5·1
Jamaica, Kingston ...	90·4	7	67·1	30	86·6	70·7	68·5	77	...	...	5·08	9	4·2
Grenada	88·0	22	71·0	24	83·6	75·1	...	77	135·0	...	3·93	14	3·5
Toronto	83·7	26	26·5	3	59·3	40·3	37·8	68	133·7	23·8	1·29	14	4·9
Fredericton	64·0	12, 20	21·0	6	49·5	32·2	33·4	76	...	...	3·37	13	6·8
St. John, N.B. ...	64·3	20	24·4	5	45·2	33·7	30·0	70	...	...	4·08	18	7·4
Alberta, Edmonton ...	79·2	16, 29	24·1	22	62·5	36·0	...	54	132·0	17·0	1·11	9	5·0
Victoria, B.C.	67·1	16	38·8	30	58·4	43·9	44·0	78	145·0	28·0	·57	9	4·9

Johannesburg—Bright sunshine, 288·2 hours.

Mauritius—Mean temp. 1°·3 above, dew point 2°·0 above, and R 1·17 in. below, averages. Mean hourly velocity of wind 2·4 miles below average.

COLOMBO, CEYLON—Mean temp. 83°·1 or 0°·3 above, dew point 1°·9 above, and R 2·57 in. below, averages. TS on 4 days, distant T and L on 25 days.

HONGKONG—Mean temp. 74·6. Mean hourly velocity of wind 13·6 miles. Bright sunshine 126·4 hours.

Melbourne—Mean temp 0°·2 below and R ·01 in. above, averages.

Adelaide—Mean temp 1°·1 below and R ·56 in. above, averages.

Coolgardie—Temp. 0°·2 above and R slightly below, averages.

Hobart—Temp. 0°·6 above average.

Wellington—Mean temp. 1°·5 below and R 3·34 in. below, averages. Bright sunshine 188·6 hours. Frost on grass on 6 days.

Auckland—Mean temp. below and R 1·40 in. above, averages. On the 2nd 2·43 in. of rain fell.

ALBERTA, EDMONTON—Warm and sunny. R above average. Frost on 9 nights. TSS on 2 days. Fog on one day. Three gales.