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CORRELATIONS BETWEEN THE TEMPERATURE AT THE SOUTH ORKNEYS AND THE RAINFALL IN THE ARGENTINE REPUBLIC.

BY N. A. HESSLING.

IN searching for a possible influence of Antarctic temperatures on the weather in the Argentine Republic, I have found some very interesting results. Some of these results have been published in the "Boletín Mensual de la Oficina Meteorológica Argentina," and others are at present in course of publication.

Comparing the winter temperatures at South Orkneys with the subsequent rainfall in various regions of the Argentine Republic very marked correlations are shown. With two years interval between the temperatures and the rainfall the correlation is negative, being most marked at General Acha, in Pampa Central. With $3\frac{1}{2}$ years interval the correlation is positive and is most marked at Buenos Aires and the eastern part of the province of Entre Rios.

In Table I. are given the temperatures for April to November at the South Orkneys since 1903, the rainfall at General Acha for July to December since 1905, and the Rainfall at Buenos Aires for October to March, and for July to June since 1906.

I think that the explanation is that the ocean water is cooled more or less according to the ice conditions in the antarctic waters, and this cooling in turn has an effect on the pressure of the air overlying the ocean. The negative correlation might then be explained by the annual ice, and the positive correlation by ice which has broken away from the permanent ice-barrier. The greater thickness of this ice would explain the longer interval before its influence is felt. Of course, I cannot prove this connection, as I have no data at hand of the water temperature and the pressure over the ocean, but whatever the explanation is, if the correlations continue to be as marked as they have been hitherto since the South Orkney observatory was established, the temperatures can be used directly for seasonal forecasts. Even if their influence in future should be less marked, it seems probable that they could at any rate be used as factors in making such forecasts.

TABLE I.

Mean	DEPARTURES FROM MEAN.															Correlation Coefficient
	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	
Temp. at S. Orkneys, April to November	-0.3	-1.0	+0.2	0.0	-0.6	+2.4	+0.1	+1.9	+1.5	-1.6	-0.2	+0.8	-2.2	-1.1		
Rainfall at Gen Acha, July to December ...	mm. 188	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916				-0.82
	-27	+20	+50	+25	+41	-121	+77	-50	-45	+92	-15	-50				
Rainfall at B. Aires, October to March ...	538	1906-7	1907-8	1908-9	1909-10	1910-11	1911-12	1912-13	1913-14	1914-15	1915-16	1916-17				+0.88
	-92	-204	-49	-108	-253	+448	+89	+146	+173	-88	-77					
July to June	1026	-150	-371	-317	-228	-169	+572	+140	+484	+386	-384					+0.92

TABLE II.

Temp. at Stykkisholm	33	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	-0.56		
Pressure at P. Delgada	mm. 765.02	-0.1	+0.8	+0.2	-0.1	+0.3	+0.1	-0.7	+0.2	+0.6	-0.6	-0.8	-0.2	+0.2	-0.4	-0.8	+0.9	+0.3	-0.5	+0.1				
Temp. at Stykkisholm	32	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908		-0.52		
Temp. at Jacobshavn	-5.9	+0.3	+0.7	-1.8	0	+0.9	+0.3	0	+0.4	+0.2	-0.6	+0.3	+0.7	-0.5	-0.7	-0.1	+0.3	-0.3	-0.7	+1.0				
Temp. at Jacobshavn	-5.9	1890-91	91-92	92-93	94-95	95-96	96-97	97-98	98-99	99-1900	1900-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	+0.69	
Pressure at P. Delgada	mm. 765.02	-1.1	0	+1.1	-1.0	-0.7	-0.4	-1.5	-1.8	-1.3	+0.9	+1.5	+1.1	+0.9	+0.6	+0.9	+0.5	-0.5	+0.5					
Pressure at P. Delgada	mm. 765.02	1894-5	95-96	96-97	97-98	98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12				+0.82	
		-1.12	-0.78	+0.50	-0.48	-1.53	-0.84	-0.12	-1.00	-0.56	+0.20	+0.33	+0.86	+1.36	+1.44	+0.43	+0.30	+0.82	+0.14					

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As the data from the South Orkneys as yet cover a comparatively short period, I have sought for similar correlations in the northern hemisphere to corroborate these results. Unfortunately I have not been able to procure monthly data, but have tried with the annual values of Stykkisholm in Iceland and Jacobshavn in Greenland

The annual temperatures of Stykkisholm compared with the rainfall at Albany, N.Y., two years later, give a correlation co-efficient of -0.30 in a period of 62 years. The same temperatures compared with the rainfall at Paris also two years later give a co-efficient of $+0.36$ in a period of 55 years. The temperatures of Jacobshavn compared with the rainfall at Greenwich one year later give a co-efficient of $+0.36$ in a period of 35 years. These values are not very large, but it is possible they would be greater if one compared the winter-temperatures with selected periods of rainfall.

But more conclusive seem to be the results obtained by comparing the above-mentioned temperatures with the pressure at Ponta Delgada, Azores. If we compare this pressure with the temperatures at Stykkisholm the year before, we get a correlation co-efficient of -0.56 , and with the same temperatures four years before, -0.52 . The biannual means of temperature at Jacobshavn with the biannual means of pressure at the Azores four years later give a co-efficient of $+0.69$. These data are given in Table II. The temperature as well as the rainfall and pressure have been taken from the Memoirs of the Indian Meteorological Department, Vol. 21, Part x. to xii.

The positive correlation with Jacobshavn is probably due to icebergs breaking away from the glaciers of Greenland in warm years.

It seems, then, that the influence of the Arctic and Antarctic temperatures can be traced several years after they occur in the temperate zones of both the northern and southern hemisphere.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE TEMPERATURE ELEMENT IN CLIMATOLOGY.

I HAVE been much interested in Mr. Bonacina's contributions to your Magazine on "The Temperature Element in Climatology," but would suggest that in addition to the points mentioned by him there is required a suitable and easily understandable expression of the frequency and rate of rapid changes in temperature, whether during the day or from day to day, as this is a point of importance, especially to invalids.

JOHN H. PEASE.

Carlbury Hall, Piercebridge, 23rd June, 1917.

THE LATE SIR ALEXANDER R. BINNIE.

My attention has been called to your notice of the death of Sir Alexander R. Binnie in your June number of "Symons's Meteorological Magazine," wherein you state that "he planned the extensive works in the Nidd Valley" for Bradford. This statement is quite inaccurate; he neither planned nor carried out any part of "the extensive works in the Nidd Valley." JAMES WATSON, M.Inst.C.E.,
Waterworks Engineer.

Town Hall, Bradford, 18th June, 1917.

[We much regret the erroneous insertion of the definite article in referring to "the extensive waterworks" in the Nidd Valley. Sir Alexander Binnie planned extensive waterworks in the Nidd Valley for which an Act of Parliament was obtained in 1890, and it is to this that we referred. We did not suggest that he carried out any works in that valley.—ED. S.M.M.]

 THE DEMERITS OF RAIN GAUGES "ONE FOOT FROM THE GROUND."

THE investigation of the enormous rain of June 28th-29th was attended by two difficulties, a new one and an old one.

A new one—"summer" time, and an old one—the doubt whether "insplashing" had not unduly increased the amounts.

But it may be well, in view of such a rain as this, to ask for re-consideration of the rule that puts the mouth of the gauge only 1 foot from the ground. One has only to look at a garden door after heavy rain to see mud splashes, often more than 2 feet from the ground. It follows that whereas a properly constructed gauge will let no rain splash out, it cannot prevent "insplashing." In heavy rains one may see the ground hidden in a mist of spray, and some of this *must*-get into the gauge. Further there is the splash off the broad leaves of vegetables in kitchen gardens, sometimes the only place for a gauge. A gauge mouth 2 feet or 3 feet from the ground would be very rarely affected by the growth of vegetables. At 1 foot there is hardly a crop that can be grown near the gauge without risk.

There is also the "insplashing" off the leaves of *trees*, which has been a disturbing element in the measurement of the great Somerset rain. This *cannot* be avoided. But one might count by hundreds, possibly by thousands, the gauges in kitchen gardens which would be unaffected by the low growing vegetables, if only their mouths were 2 or 3 feet from the ground. First class observing stations can take care of themselves, but it is the multitude of amateur

Observers that alone makes possible any detailed study of a phenomenal rain, and the results obtained from these would, it seems to me, be more trustworthy if the gauge mouths were higher above ground.

H. A. BOYS, F.R.Met.Soc.

North Cadbury, Somerset, August 3rd, 1917.

[The general question of the height of a rain gauge was dealt with very fully by Mr. Symons in the early volumes of *British Rainfall* and the height of 1 foot was determined upon after mature consideration. We do not think it should be altered. Rain of the intensity of that in the Somerset fall of June 28th cannot be expected to recur more often than perhaps once in a century, or it may be two centuries. Meanwhile an elevated rain gauge registers less than a rain gauge at 1 foot in the proportion of one per cent. of the annual fall for every foot of height in excess of 1 foot, and a change to 2 or 3 feet would disturb the comparison of actual and past rainfall to a serious extent. We fully appreciate the difficulties pointed out by Mr. Boys, but the way to overcome them is to keep a six foot circle free from any vegetation except short grass round the gauge and this is done by the vast majority of Observers even when the site is in a kitchen garden. With regard to the special instance of the Somerset fall of June 28th we have recently visited a number of rain gauges in the central area of that tremendous phenomenon and found that many of the records must have fallen short of the true amount on account of the employment in too many cases of old fashioned shallow rimmed gauges. from which outsplashing must have far exceeded insplashing. The moral is that all Observers should use gauges of the Snowdon or Meteorological Office pattern and expose them according to the simple rules prescribed.—ED. S.M.M.]

ROYAL METEOROLOGICAL SOCIETY.

THE final Meeting of this Society for the present session took place on Wednesday, June 20th, at the Society's rooms, Major H. G. Lyons, F.R.S., President, in the chair.

Mr. C. E. Brooks, M.Sc., communicated a paper on "The Reduction of Temperature Observations to mean of 24 hours, and the Elucidation of the Diurnal Variations in the Continent of Africa." In order to render temperature data inter-comparable the means obtained from the several combinations of hours should be reduced to the mean of the 24 hourly values. In countries where numerous thermograph records are available this is easily done by the simple process of interpolating lines of equal correction over the country and applying the results to records from stations where there are no hourly data. This process is not possible in Africa,

for which an alternative method is given by representing the diurnal variation of temperature by means of the first two terms of a Fourier series :— $T_h = a_0 + a_1 \sin (H + A_1) + a_2 \sin (2H + A_2)$. This gives six variables and a_0 can be found from three observations a day and two of the constants. The results apply also to mean maximum and mean minimum temperatures. The connection of the various constants with physical factors was also examined. A discussion followed in which Prof. Turner, Mr. Bryant, and Dr. Chree took part.

Mr. F. J. W. Whipple, M.A., read a paper on "Autographic Records of the Air-Wave from the East London Explosion, January 19th, 1917." Records from barographs and those from the recorders used for indicating the pressure in gas mains were made use of. As a large number of records were available in the vicinity of London the intensity of the air wave could be mapped in considerable detail for the vicinity of the Metropolis. A pronounced disturbance was shown as far to the north-west as Enfield, and as far south as Whyteleafe, but the range to the north-east was very restricted. Prof. Turner and Messrs. Bryant, Salter and Sedgwick took part in the discussion, and Mr. Whipple replied.

Mr. R. C. Mossman, F.R.S.E., read a note on 'Some Aspects of the Cold Period, December, 1916, to April, 1917,' based on the records of 130 stations in the British Isles, and 58 on the Continent. The mean temperature of the British Isles during this period was 3·4 F. below the normal, greatest at Belvoir Castle in Leicester, 5°, and least, 0°·9, at Castle Bay, in the Hebrides. Except in December the cold was general over western and north-western Europe. and was most pronounced in Holland, where the mean temperature was 4°·9 under the average. It was shown that when the eastern portions of the British Isles had a mean temperature under the normal in each month from December to April, an event that had only occurred five times during the last 153 years, there was a marked tendency for the depression of temperature to continue until the end of the year. The frequent absence of historic frosts during long periods of uniform cold over the British Isles was also referred to.

The following candidates for Fellowship were elected into the Society, *viz.*:—J. A. Hardcastle, H. W. Hole, J. A. Hutton, Lieut.-Com. W. J. Jenks, Mrs. C. Joan Pease, Rev. P. Shipley, Rev. I. Roberts, Flt.Lieut. S. E. Taylor, C. A. Weatherby, W. R. A. Weatherhead.



HEAVY RAINFALL IN THE SOUTH EAST OF ENGLAND.

UNUSUALLY heavy and persistent rain fell over the South-east of England, between July 29th and August 4th, reaching its maximum intensity in Kent. Owing to the rainfall being spread over portions of two months we are not yet able to give full particulars of this remarkable fall, which, however, will be fully discussed in *British Rainfall, 1917*. In the meantime we have been favoured with reports from some 25 stations, from which the following particulars have been culled. As different Observers sent in data referring to various groups of days terminating on dates ranging from August 1st to 5th, we have selected for examination in the present instance, the rainfall for the three days July 30th to August 1st, and for the six days ending August 3rd. Both of these periods are of equal interest, the first for the heaviness of the rainfall, and the second for its long continuance. The following particulars for London (Camden Square) may be quoted.

	Rainfall. in.	Duration of Rain. hours.	Sunshine. hours.
July 29	·20	2·4	1·5
„ 30	1·66	16·5	·1
„ 31	·43	13·5	—
Aug. 1	·98	12·0	—
„ 2	·09	2·4	—
„ 3	·42	9·3	·2
Total ...	3·78	56·1	1·8

The rainfall exceeded a total of three inches at the following places during the three days July 30th to August 1st.

	in.		in.
Maidstone (The Croft)	6·18	Teynham	4·10
Canterbury (St. Thomas Hill)	5·82	Lewisham (Clarendon Road)...	3·81
Meopham	5·58	Deal.....	3·62
Kennington	4·80	Woking (Pyrford)	3·38
Margate (Cliftonville)	4·72	Staines (St. Ann's Cottage) ...	3·36
Kingston Rectory (nr. Canterbury)	4·63	Tunbridge Wells	3·31
Canterbury (High Street)	4·56	London (Camden Square)	3·07

In the six days ending August 3rd, more than seven inches fell at a number of places; as much as 10·31 in. at Canterbury (St. Thomas Hill), 8·09 in. at Maidstone, 7·55 in. at Canterbury (High Street), 7·51 in. at Kingston Rectory, 7·32 in. at Teynham, Kent, and 7·05 in. at Margate. At Meopham 7·01 in. fell in the five days ending August 2nd.

Many of these amounts are doubtless unprecedented, thus the Observer, Col. Honeyball, at Teynham, Kent, describes the rainfall of the six days under notice as “altogether beyond any previous record of mine during forty-five years’ observations.” The wettest day was either July 30th or August 1st, and the heaviest falls reported at stations quoted in the above table were 2·96 in. at Maidstone, and 2·85 in. at Meopham on the 30th, and 2·50 in. at Margate, and 2·48 in. at Canterbury (St. Thomas Hill) on August 1st. Although outside

the limits of this notice, a fall of 1.73 in. at Newport, Essex, on August 5th, is worthy of mention, as it indicates a local renewal of the rain-storm after a relatively dry day on the 4th. As an indication of the great scarcity of rain in other parts of the country, it may be of interest to quote from a letter received from Mr. Vint, the Observer at Sunderland, who remarks under date August 8th.

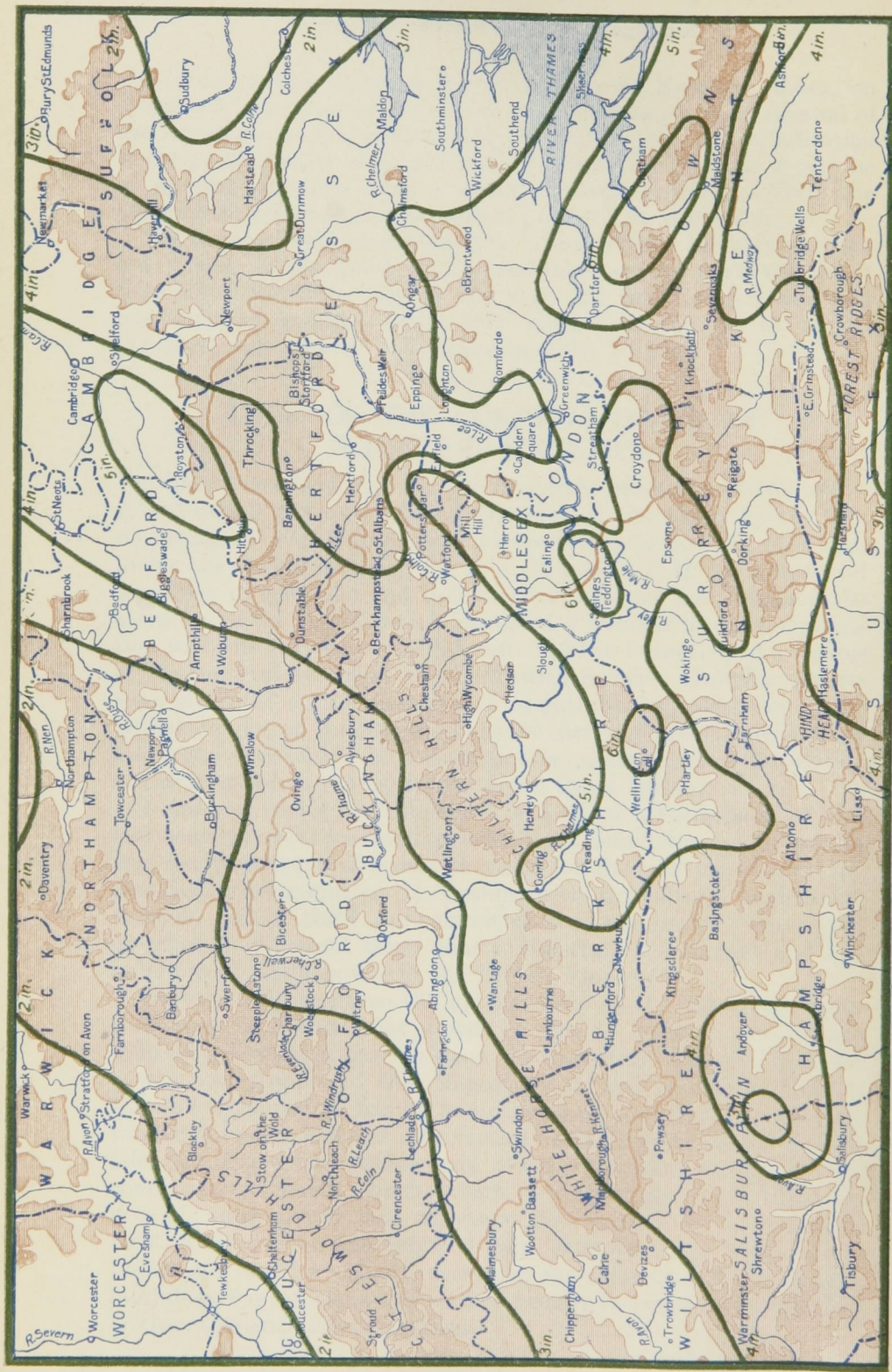
"It is not a little remarkable that whereas there has been so much heavy rain in the South of England, here on the north-east coast from May 19th to the date of this note, the total rainfall has been less than an average July. The rainfall in the period named (81 days), was 2.45 in. Average rain, July, 2.64 in."

WORK OF THE CONJOINT BOARD OF SCIENTIFIC SOCIETIES.

WE have been favoured by the Honorary Secretary of the above Board with a memorandum of the work of the Board for the first six months of 1917 as reported to a meeting held on June 13th last, under the chairmanship of Sir J. J. Thomson, O.M. A number of questions of scientific and industrial importance has occupied the attention of the Board, which has decided to enter into communication with the various bodies interested in the formation of a Census of the mineral resources of the British Empire. Interim reports were presented on the necessity of an anthropological survey of the British people, on the best methods for carrying on the International Catalogue of Scientific Literature and on enquiring into the question of the adoption of the metric system in Great Britain.

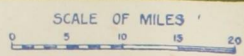
A sub-committee recommended a detailed investigation of two test areas in order to ascertain whether a detailed magnetic survey was likely to prove of economic value for the location of iron ore. Another sub-committee is dealing with agricultural engineering matters, and a third sub-committee was nominated "to report on what is at present being done to ascertain the amount and distribution of water power in the British Empire."

We especially welcome the appointment of the last named sub-committee, and trust that it will be able to bring to a focus the diffused information bearing upon the important question of water power. As readers of this Magazine are well aware the British Rainfall Organization has by more than half a century of strenuous work collected a body of information on the rainfall of the British Isles unsurpassed in volume and utility by similar records in any country in the world. Such records form the basis of all computation of water power, and although they require to be extended most in the remote and elevated parts of the country where water power can best be utilized, a scheme for carrying out a complete rainfall survey of those regions could easily be prepared in the light of the experience already gained.



ALTITUDE
SCALE

Below 250 feet	250 to 500 feet	500 to 1000 feet	Above 1000 feet
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THE WEATHER OF JULY.

THE outstanding features of the weather of July were the marked excess of bright sunshine, and (except in the south of England) the scarcity of rain. For a sunny month in which the mean temperature was everywhere in excess of the average, the absence of high shade maxima was also worthy of note, as well as the sharp ground frost which was experienced on the 1st of the month. The temperature on the grass on this occasion fell to 28° at West Linton, 29° at Harrogate, and to 30° at a large number of inland stations in Scotland and the north of England, many plants were destroyed by the frost, even bracken being damaged in the Border counties. No frost occurred in the screen 4 feet above the ground, but West Linton reported a shade minimum of 33°, Rhayader (S. Wales) one of 35°, while numerous stations from Balmoral to Shrewsbury had values of 36°. The mean temperature of the month, taking the country as a whole, was 0°·8 F. above the normal, the excess ranging from about 1°·5 in the northern parts of England and Scotland, and in Ireland to about 0°·1 in the south-east, and south-west of England. The month opened with anticyclonic conditions over the British Isles, with north-east winds in the south, and after the passage of one or two shallow depressions a new anticyclone spread in from the Atlantic on the 9th. It was shortly followed by a large shallow depression which came in slowly from the westward, and on the 14th a slight secondary which passed over the south of England was associated with high temperatures and thunderstorms in many places. On the 14th shade maxima of 85° at Greenwich and 83° at London (Camden Square) were recorded in the Glaisher stand, and Geldeston, Norfolk, reported a value of 83° in the Stevenson screen. At this time cool weather prevailed in the north with maxima on the 14th of only 60° at Lerwick and 63° at Wick. During the second half of the month pressure conditions over the greater part of the United Kingdom were in general anticyclonic. Relatively high temperatures were again recorded on the 27th when the maximum rose to 84° at Little Massingham (Norfolk), and 83° at Geldeston and Camden Square. During the last three days of the month the weather in the south completely broke down, rain falling heavily. (See ante p. 79.)

Bright sunshine was above the average in all parts of the United Kingdom except in the south-west of England, including the English Channel and the south of Ireland, where it was under the average. Rainfall was in general under the average. This is well shown in the Rainfall Table for July, in which only nine of the fifty-three stations there given had a rainfall above the average. At some stations less than one-third of the normal fell the lowest values being 29 per cent. of the average at Worksop and Newcastle, 30 per cent. at Mull (Quinish), and 32 per cent. at Southport and Dunrobin.

In England to the north of a line passing through Barmouth, Shrewsbury, Leicester and Cromer few stations, except in the normally wet areas of the west, had as much as two inches, and a considerable number had less than an inch. The wettest areas were in the south and south-east where from four to over six inches fell, the highest rainfall being in parts of Kent and in the Thames Valley. (See map.) In Scotland comparatively few stations had as much as two inches, this applying equally to the normally wet west coast as to the usually dry east coast. The least rainfall under an inch was recorded at places as far apart as Castle Bay in the Hebrides, and Dunrobin Castle near the Dornoch Firth. In Ireland the wettest area was in the vicinity of Killarney where over five inches fell, and the driest in Londonderry with about an inch. Over the Kingdom as a whole the general rainfall expressed as a percentage of the average was:—England and Wales, 76 per cent.; Scotland, 50 per cent.; Ireland, 81 per cent.; British Isles, 69 per cent. In London (Camden Square) the mean temperature was 63°·9 or 0°·4 above the average. Duration of rainfall 64 hours, of sunshine 190 hours. Evaporation, 2·81 in.

RAINFALL TABLE FOR JULY, 1917.

STATION.	COUNTY.	RAINFALL.						
		Aver. 1875— 1909. in.	1917. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours.		No. of Days
						in.	Date.	
Camden Square.....	London.....	2·57	4·13	+1·56	161	1·66	30	11
Tenterden.....	Kent.....	2·21	3·35	+1·14	152	·79	29	13
Arundel (Patching).....	Sussex.....	2·46	3·16	+·70	129	·90	3	10
Fordingbridge (Oaklands)...	Hampshire.....	2·14	3·38	+1·24	158	·80	30	13
Oxford (Magdalen College)...	Oxfordshire.....	2·43	3·53	+1·10	145	1·17	8	11
Wellingborough (Swanspool)...	Northampton.....	2·54	1·77	—·77	70	·41	8	13
Bury St. Edmunds (Westley)...	Suffolk.....	2·68	2·84	+·16	106	1·14	8	9
Geldeston [Beccles].....	Norfolk.....	2·37	3·76	+1·39	159	1·21	8	10
Polapit Tamar [Launceston]...	Devon.....	2·74	1·88	—·86	69	·42	17	13
Rousdon [Lyme Regis].....	".....	2·68	2·63	—·05	98	·50	3	12
Stroud (Field Place).....	Gloucester ..	2·75	2·37	—·38	86	·86	8	13
Church Stretton (Wolstaston)...	Shropshire..	2·58	1·46	—1·12	57	·43	17	8
Boston.....	Lincoln.....	2·35	1·05	—1·30	83	·53	18	9
Worksop (Hodsock Priory)...	Nottingham.....	2·35	·68	—1·67	29	·21	18	8
Mickleover Manor.....	Derbyshire.....	2·57	1·27	—1·30	49	·61	18	11
Buxton.....	".....	4·05	...	...	...	...	...	...
Southport (Hesketh Park)...	Lancashire.....	2·92	·93	—1·99	32	·31	18	6
Arncliffe Vicarage.....	York, W.R.....	4·75	2·10	—2·65	44	·83	18	4
Goldsborough Hall.....	".....	2·61	1·19	—1·42	46	·36	18	9
Hull (Pearson Park).....	" E.R.....	2·39	1·12	—1·27	47	·45	30	10
Newcastle (Town Moor).....	North'land.....	2·90	·86	—2·04	29	·50	27	6
Borrowdale (Seathwaite)...	Cumberland.....	8·91	3·80	—5·11	43	2·30	18	4
Cardiff (Ely).....	Glamorgan.....	3·26	2·52	—·74	77	·54	3	16
Haverfordwest.....	Pembroke... ..	3·39	3·83	+·44	113	1·05	3	8
Aberystwyth (Gogerddan)...	Cardigan.....	4·03	2·23	—1·80	55	·87	17	11
Llandudno.....	Carnarvon.....	2·52	·93	—1·59	37	·25	24	9
Cargen [Dumfries].....	Kirkcudbrt.....	3·20	2·48	—·72	78	1·12	18	13
Marchmont House.....	Berwick.....	3·30	1·88	—1·42	57	·98	18	5
Girvan (Pimmore).....	Ayr.....	3·73	1·89	—1·84	51	·57	29	9
Glasgow (Queen's Park)...	Renfrew.....	2·91	...	...	...	...	...	...
Islay (Eallabus).....	Argyll.....	3·41	1·35	—2·06	40	·43	18	14
Mull (Quinish).....	".....	4·12	1·22	—2·90	30	·34	23	15
Balquhider (Stronvar).....	Perth.....	4·34	1·82	—2·52	42	·44	18	10
Dundee (Eastern Necropolis)...	Forfar ..	2·84	2·09	—·75	74	·90	18	8
Braemar.....	Aberdeen ..	2·65	1·73	—·92	65	·65	29	9
Aberdeen (Cranford).....	".....	3·00	2·47	—·53	82	1·20	18	10
Gordon Castle.....	Moray.....	3·25	2·32	—·93	71	...	...	...
Drumnadrochit.....	Inverness ..	3·37	1·25	—2·12	37	·40	18	12
Fort William.....	".....	4·92	2·04	—2·88	42	·51	26	14
Loch Torridon (Bendamph)...	Ross.....	5·35	1·93	—3·42	36	·50	25	10
Dunrobin Castle.....	Sutherland.....	2·91	·92	—1·99	32	·26	18	6
Killarney (District Asylum)...	Kerry.....	3·53	3·21	—·32	91	·86	10	25
Waterford (Brook Lodge)...	Waterford.....	3·13	2·60	—·53	83	1·01	17	13
Nenagh (Castle Lough).....	Tipperary... ..	3·02	2·21	—·81	73	·52	27	16
Ennistymon House.....	Clare.....	3·57	2·26	—1·31	63	·73	17	18
Gorey (Courtown House)...	Wexford ..	2·90	2·83	—·07	98	·56	17	15
Abbey Leix (Blandsfort)....	Queen's Co.....	2·99	1·47	—1·52	49	·45	23	14
Dublin (Fitz William Square)...	Dublin.....	2·60	1·86	—·74	72	·35	20	12
Mullingar (Belvedere).....	Westmeath.....	3·16	3·40	+·24	108	·93	25	15
Crossmolina (Enniscoe).....	Mayo.....	3·26	2·41	—·85	74	·38	17	18
Cong (The Glebe).....	".....	3·72	3·32	—·40	89	·66	17	19
Collooney (Markree Obsy.)...	Sligo.....	3·36	3·20	—·16	95	·73	15	19
Seaforde.....	Down.....	3·32	2·25	—1·07	68	·64	18	11
Ballymena (Harryville).....	Antrim.....	3·44	3·60	+·16	105	1·51	27	12
Omagh (Edenfel).....	Tyrone.....	3·34	1·90	—1·44	57	·54	27	15

SUPPLEMENTARY RAINFALL, JULY, 1917.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	4·91	XI.	Lligwy	·92
„	Ramsgate	3·71	„	Douglas, Isle of Man	1·76
„	Hailsham	2·43	XII.	Stoneykirk, Ardwell House...	1·84
„	Totland Bay, Aston House...	3·18	„	Carsphairn, Shiel	1·58
„	Stockbridge, Ashley..	4·51	„	Langholm, Drove Road	2·29
„	Grayshott	4·45	XIII.	Selkirk, The Hangingshaw..	1·26
III.	Harrow Weald, Hill House...	5·34	„	North Berwick Reservoir.....	1·07
„	Pitsford, Sedgebrook.....	1·36	„	Edinburgh, Royal Observaty.	1·41
„	Woburn, Milton Bryant.....	3·51	XIV.	Biggar	1·80
„	Chatteris, The Priory.....	2·70	„	Maybole, Knockdon Farm ...	2·19
IV.	Elsenhams, Gaunts End	3·25	XV.	Buchlyvie, The Manse	1·44
„	Shoeburyness	3·52	„	Ballachulish House	2·66
„	Colchester, Hill Ho., Lexden	2·14	„	Oban.....	1·70
„	Ipswich, Rookwood, Copdock	2·45	„	Campbeltown, Witchburn ..	3·78
„	Aylsham, Rippon Hall	2·83	„	Holy Loch, Ardnadam	1·90
„	Swaffham	2·71	„	Tiree, Cornaigmore	·97
V.	Bishops Cannings	3·89	XVI.	Glenquey	2·10
„	Weymouth.....	2·55	„	Glenlyon, Meggernie Castle..	1·98
„	Ashburton, Druid House..	3·09	„	Blair Atholl	1·20
„	Cullompton	2·50	„	Coupar Angus	1·26
„	Lynmouth, Rock House	2·11	„	Montrose, Sunnyside Asylum.	1·37
„	Okehampton, Oaklands.....	2·31	XVII.	Balmoral	2·02
„	Hartland Abbey.....	3·63	„	Fyvie Castle	1·86
„	St. Austell, Trevarna	1·69	„	Keith Station ..	1·82
„	North Cadbury Rectory.....	4·29	XVIII.	Rothiemurchus	2·08
VI.	Clifton, Stoke Bishop	1·96	„	Loch Quoich, Loan	5·10
„	Ledbury, Underdown	2·29	„	Skye, Dunvegan	1·88
„	Shifnal, Hatton Grange.....	2·25	„	Fortrose .....	...
„	Droitwich.....	2·01	„	Glencarron Lodge	3·33
„	Blockley, Upton Wold.....	2·64	XIX.	Altnaharra	2·32
VII.	Grantham, Saltersford.....	1·48	„	Melvich	1·74
„	Market Rasen	·23	„	Loch More, Achfary	1·53
„	Bawtry, Hesley Hall	·91	XX.	Dunmanway, The Rectory ..	4·15
„	Whaley Bridge, Mosley Hall	1·84	„	Glanmire, Lota Lodge.....	1·92
„	Derby, Midland Railway.....	1·21	„	Mitchelstown Castle	1·94
VIII.	Nantwich, Dorfold Hall	1·15	„	Darrynane Abbey.....	3·26
„	Chatburn, Middlewood .....	...	„	Clonmel, Bruce Villa	2·09
„	Lancaster, Strathspey	1·29	„	Broadford, Hurdlestown.....	2·59
IX.	Langsett Moor, Up. Midhope	1·26	XXI.	Enniscorthy, Ballyhyland...	2·14
„	Scarborough, Scalby	1·55	„	Rathnew, Clonmannon	1·85
„	Ingleby Greenhow	1·32	„	Ballycumber, Moorock Lodge	2·57
„	Mickleton	·90	„	Balbriggan, Ardgillan	2·55
X.	Bellingham, High Green Manor	1·46	„	Castle Forbes Gardens.....	3·50
„	Ilderton, Lilburn Cottage ..	1·06	XXII.	Ballynahinch Castle.....	3·59
„	Keswick, The Bank	1·33	„	Woodlawn	3·05
XI.	Llanfrechfa Grange	2·53	„	Westport, St. Helens ..	1·50
„	Treherbert, Tyn-y-waun	5·23	„	Dugot, Slievemore Hotel ...	2·52
„	Carmarthen, The Friary	4·14	XXIII.	Enniskillen, Portora	2·80
„	Fishguard, Goodwick Station.	2·47	„	Dartrey [Cootehill]	3·47
„	Crickhowell, Tal-y-maes.....	3·50	„	Warrenpoint, Manor House ..	3·79
„	New Radnor, Ednol	2·62	„	Belfast, Cave Hill Road	2·39
„	Birmingham WW., Tyrmynydd	2·21	„	Glenarm Castle	2·80
„	Lake Vyrnwy	3·09	„	Londonderry, Creggan Res...	3·28
„	Llangynhafal, Plas Drâw.....	1·19	„	Dunfanaghy, Horn Head ...	1·89
„	Dolgelly, Bryntirion.....	2·93	„	Killybegs	2·88
„	Bettws-y-Coed, Tyn-y-bryn...	1·78			

Climatological Table for the British Empire, February, 1917.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	49·9	26	19·1	7	40·7	30·7	32·4	89	59·0	19·2	·90	10	7·7
Malta	64·4	7	43·3	2	59·2	51·2	...	83	121·2	...	2·46	6	2·8
Lagos ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...
Cape Town	97·0	3	55·0	26	83·8	63·0	59·8	64	...	...	·03	1	2·3
Johannesburg	81·7	12	49·0	3	73·2	55·0	52·7	77	...	45·8	5·76	12	5·8
Mauritius ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...
Bloemfontein	93·2	14	55·1	8	80·5	59·5	56·0	65	...	...	5·66	12	5·7
Calcutta... ..	90·1	19	53·6	8	81·6	62·5	60·3	68	...	44·0	1·15	3	3·2
Bombay... ..	89·9	28	64·4	6	83·9	70·4	66·3	70	140·0	58·1	1·68	2	1·6
Madras	90·4	26	60·7	19	85·8	69·5	66·9	72	164·1	57·3	·06	2	2·9
Colombo, Ceylon	91·7	7	66·9	14	86·5	71·0	70·2	80	158·6	59·2	5·57	11	5·6
Hongkong	74·0	27	45·7	9	64·4	55·3	50·7	72	...	...	·41	8	6·4
Sydney	86·0	22	54·3	5	76·6	63·5	60·8	72	144·1	52·1	4·89	13	5·3
Melbourne	96·0	13	49·9	5	74·4	58·6	54·1	64	150·0	41·0	1·93	9	6·1
Adelaide	99·0	11	51·7	7	80·5	60·1	53·3	55	159·1	40·3	2·40	8	3·7
Perth	102·0	27	52·7	21	82·8	62·0	54·4	53	165·6	42·8	·81	2	3·4
Coolgardie	103·0	9	48·6	21	88·3	58·4	45·9	33	165·4	44·0	·00	0	2·2
Hobart, Tasmania	94·7	14	41·1	24	67·9	53·0	50·4	69	149·2	37·3	2·07	14	6·6
Wellington	80·6	2	48·0	20	73·0	...	54·8	73	151·0	38·2	1·66	11	5·6
Auckland ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...
Jamaica, Kingston	87·8	20	63·5	24	84·9	66·2	64·5	77	...	...	·16	4	2·6
Grenada	88·0	3	68·0	24	82·1	70·1	...	72	138·0	...	2·89	16	2·5
Toronto	45·4	26	—10·7	12	25·4	9·0	9·5	78	117·5	—13·4	·90	14	5·6
Fredericton	38·0	18*	—19·0	3	23·0	—2·0	6·5	88	...	...	2·84	14	4·5
St. John, N.B.	42·4	9	—17·2	3	26·2	7·1	9·0	69	112·5	—18·6	3·45	12	4·4
Victoria, B.C.	47·2	5†	22·3	23	41·0	34·1	34·0	88	109·0	13·0	2·11	16	8·3

* 26. † 12.

Johannesburg.—Bright sunshine 197·4 hours.

COLOMBO, CEYLON.—Mean temp. 78°·7 or 1°·2 below, dew point 0°·4 below, and R 3·42 in. above, averages. Mean hourly velocity of wind 3·8 miles. TS on three days.

HONGKONG.—Mean temp. 59°·4. Bright sunshine 134·5 hours.

Melbourne.—Mean temp. 66°·5 or 0°·9 below and R ·23 in. below, averages.

Adelaide.—Mean temp. 3°·8 below, and R 1·79 in. above, averages.

Coolgardie.—Temp. 2°·8 above, and R ·75 in. below, averages.

Wellington.—Mean temp. 1°·3 above, and R 1·63 in. below, averages. Bright sunshine 180·3 hours. Cloudy and showery month.