RECORDING ANEMOMETER AT COLOMBO, SHOWING BIRD'S NEST INSIDE.

SYMONS'S

METEOROLOGICAL

MAGAZINE

Edited by HUGH ROBERT MILL, D.Sc., LL.D.

VOLUME THE FIFTY-SECOND

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THE DUTY OF CARRYING ON.

It is the imperative duty of everyone who can either in a military capacity or by working for the war needs of the nation help in any way to win the war, to give his whole strength and his whole thought to that purpose, Recognizing this some people have clamoured for the suppression of every form of public or private activity that does not minister directly to the prosecution of the war. On the face of it the suggestion is as attractive as the proposal once made solemnly in a letter to *The Times* that to cope with the rush of workers to the City in the morning the trains on the tube railway from the City to the suburbs should be entirely suspended and all trains run only to meet the demand for transport from the suburbs to the City. The fallacy here is too clear to require statement; but the fallacy that all work not directly tending to win the war should be stopped is not so plain. We propose to consider only the bearing of such a proposal on meteorological work; if it were put in force with regard to extravagant amusements we should raise no objections. Even with regard to Meteorology so great an authority as Dr. A. Schuster once suggested that it would be well if all observations could be stopped for a time and the Observers occupy themselves with the discussion of results already obtained. If gifted men of science were in the habit of spending their whole time in reading instruments and adding up records there would be much force in the call for suspension, but this is not the case.

In the present national crisis there are unhappily millions unable to take any active part in war or war-work. All who can are doing or should do their utmost by economy and thrift to conserve the resources of the country if they cannot add to them; but out of the millions a few thousand are in the habit of spending a few minutes daily in reading instruments which record meteorological phenomena, mainly rainfall, and if they were induced to stop this because it was not helping to win the war, the time saved individually would be quite negligible in the day's work. But the loss of the observations would mean an irreparable break in records which to be useful

must be continuous. It would mean the loss of a national asset of substantial importance which should be kept available for the great time of reconstruction which must follow the war. Fortunately such a catastrophe is not likely to happen. There is no appreciable falling off in the total number of the volunteer rainfall Observers in this third year of war, only in many cases—as in all other branches of essential work—the experienced has yielded his place to a less competent substitute. Here, as in other departments of life, the remarkable fact has been demonstrated that those who a few years ago would be branded as "unfit" and relegated to idleness can carry on the work of the "fit" with a tolerable degree of efficiency. The war has abundantly justified the principle of voluntary enterprise. Again and again voluntary organizations have shown the way to Government institutions. The Volunteers, for example, forced themselves on a most reluctant authority as a force for home defence. A little less pertinacity on the part of those who showed their rulers the way and that valuable force would have withered away and could not be recalled at the moment of need. In the time of reconstruction which is to come the voluntary meteorological Observers of this country will, we are confident, find their proper place; their plain duty for the present is to carry on, to make the best of a difficult situation, and not to break continuity.

Our fifty-second volume shrinks of necessity by a few pages, but we hope to keep it going without raising the price or retarding the date of publication. The withdrawal of most of our old competent assistants for military work makes it necessary to reduce the monthly statistical work and the main Rainfall Table has been cut down from two pages to one by omitting the cumulative values. This, we hope, is only a temporary change. A few well-known stations have to disappear, again only for a time, we hope. The most serious loss is the daily record from Seathwaite, which was continuous for 72 years, but Observer after Observer has been called up for the Army just as he was getting into the work, and ill-health has compelled the last substitute to leave her task unfulfilled.

METEOROLOGICAL NEWS AND NOTES.

Black Rain, is reported by the *Oban Times* to have fallen in Mull on December 2nd, 1916, the phenomenon being accompanied by an intensely black cloud, necessitating artificial light. The sea near the coast was covered with a thick black scum, resembling that frequently seen on a city river. The wind was south-easterly, veering to the north. A similar occurrence was reported in the previous week from Loch Skipport, North Uist. In South Wales also black dust has frequently fallen on the snow.

William Marriott.

London, 9th August, 1848—28th December, 1916.

We much regret to have to record still another loss to Meteorology in the year 1916. Mr. William Marriott, so long and closely associated with the Royal Meteorological Society, died very suddenly on December 28th. Mr. Marriott after a course at University College, London, entered the Royal Observatory, Greenwich, in 1869, where he was an assistant under the late Mr. Glaisher. His interest in the meteorological side of his work led to his appointment, in 1872, as Assistant Secretary to the Royal Meteorological Society, a position which he filled with conspicuous success and ability until failing health rather than advancing years compelled him to retire in 1915. Mr. Marriott was an ideal Observer, extremely accurate in reading and recording instruments, and keenly interested in the minutest details of weather. He was in addition gifted with the very rare power of instructing others to observe, and the still rarer instinct of criticising their failures with perfect frankness without giving offence. This is, we believe, one of the most uncommon qualities, and it made Mr. Marriott, during the many years before the Royal Meteorological Society ceased to concern itself with the collection of meteorological records, a perfect inspector of stations. His reports of inspections made annually to the Council might strike one unfamiliar with his methods and personality, as somewhat severe ; but no one who has had the privilege of seeing him gradually convincing an obstinate Observer to recognize and acknowledge that he was in error could fail to appreciate the firmness and kindness which were the foundation of his success. The complete understanding of the difficulties which present themselves to the average mind first turning to scientific thought and of the aspects of the subject which appeal most strongly to the " man in the street," also made Mr. Marriott a very successful popular lecturer. Perhaps he showed all his gifts at their best while presiding over the exhibits of the Society at the Royal Agricultural Society's annual Shows. Here he had just the sort of audience to which he could appeal most successfully and with the instruments before him and diagrams of records all round he made meteorology real and interesting to his shrewd and practical audiences. For the same reason his books and pamphlets, although unambitious, never failed to hit their mark, and his " Hints to Meteorological Observers " remains of great practical utility.

Of Mr. Marriott's kindly and obliging ways it is unnecessary to speak, for they are known to all who have had occasion to visit the rooms of the Royal Meteorological Society during the last forty years. He was punctual and methodical in arranging the business of the many Committee and Council meetings,and his mastery of all details of the Society's work, and all the incidents of its history, were of invaluable service to many successive honorary officers.

ROYAL METEOROLOGICAL SOCIETY.

THE Annual General Meeting of the Society was held on January 17th, at Caxton Hall, Major H. G. Lyons,, F.R.S., in the Chair.

The report of the Council for 1916 was adopted. The following were elected Officers and members of the Council for the ensuing year :—

President, Maj. H. G. Lyons, D.Sc., F.R.S. ; *Vice-Presidents,* W. H. Dines, F.R.S., R. H. Hooker, H. Mellish, D.L., J.P., Carle Salter ; *Treasurer,* F. Druce ; *Secretaries,* W. W. Bryant, W. Sedgwick ; *Foreign Secretary,* R. G. K. Lempfert ; *Councillors,* H. B. Adames, C. E. P. Brooks, Capt. C. J. P. Cave, R.E., C. Chree, Sc.D., L.L.D., F.R.S., J. E. Clark, J. S. Dines, W. Vaux Graham, C.E., Baldwin Latham, C.E., Col. H. E. Rawson, C.B., Maj. G. I. Taylor, Prof. H. H. Turner, D.Sc., F.R.S., F. J. W. Whipple.

The President referred to the great loss the Society had sustained during the past year by the deaths of three past presidents, and of Mr. W. Marriott, the late assistant secretary, who had devoted the greater part of his life to the Society's interests.

Major Lyons, then delivered an address on " The Winds of North Africa." It was now thirty years since the distribution of pressure over the region lying to the south of Europe had been discussed, and during this period many new stations had been established. From the Mediterranean to the Equator material was now available from about eighty stations, and a more reliable estimate of the distribution of pressure over North Africa, and the consequent flow of the air currents could now be formed. Maps had been prepared to show the isobars for each month of the year, the characteristics of each were discussed, and the division of the year into a summer type and a winter type with brief transition periods was shown. The prevalent wfnds were indicated in the same maps and the circulation of the surface air currents round the dominant areas of high and low pressure was strongly indicated, although the region was one which had been described as showing a typical convective circulation. An attempt was also made to indicate the general circulation at higher levels, 1,000, 2,000 and 3,000 metres. The pressures at these altitudes had been computed for a number of stations, and in conjunction with the observations from the high level stations of Algeria and Abyssinia, they had been utilized to draw isobars. The air circulation thus indicated over North Africa was compared with such evidence as was available from the movement of clouds and observations with pilot-balloons.

The following were elected Fellows at this and the previous meetings :—Maj. J. L. Baird, C. Baxter, Lieut. J. W. Bishpam, J. B. Clark, R. W. Cohen, H. H. Deacle, J. F. Duffin, E. W. Harris, Lieut. H. G. Harris, Lieut. T. Harris, Rev. E. Lascelles, H. MacFarlane, Lieut. A. G. Maddock, Lieut. A. Norval Pennel, Rev.

F. Bavin, E. G. Bilham, Capt. G. E. Boulter, Lieut. J. Crichton, John Christie, Lieut. F. W. Crowther, Capt. S. G. Dale, Lieut. W. B. Daniels, Lieut. A. E. M. Geddes, Lieut. A. E. Gendle, Capt. R. M. Groves, G. A. Hansard, Lieut. W. B. Hervey, J. H. Hewlitt, Capt. C. J. Higgins, Lieut. G. W. Hill, F. Holroyd, C. G. Jackson, F. N. Keen, Flt.-lieut. I. G. Kelby, Lieut. F. Kidson, Lieut. G. J. Lamb, E. Honoratus Lloyd, Capt. J. Moodie, A. F. Pease, Com. The Master of Sempill, Lieut. W. F. Stacey, Lieut. C. D. Stewart, G. Midgley Taylor, T. V. West, S. L. Wong.

SCOTTISH METEOROLOGICAL SOCIETY.

The Annual Business and General Meeting of the Society was held on December 15th, 1916, in the Goold Hall, Edinburgh, Professor R. A. Sampson, F.R.S., President, in the Chair.

A Report from the Council was adopted and the following Council and Office-bearers were elected for the ensuing twelve months :— *President*, Prof. R. A. Sampson, F.R.S.; *Vice-Presidents*, Dr. A. Crichton Mitchell and Mr. M. M'Callum Fairgrieve; *Council*, Mr. J. Watt, Sir R. P. Wright, Prof. T. Hudson Beare, Dr. J. D. Falconer, Mr. J. Mackay Bernard, Mr. D. A. Stevenson, Mr. R. Cross, Mr. S. B. Hog, and Mr. G. Thomson; *Honorary Secretary*, Capt. E. M. Wedderburn, R.E.; *Hon. Treasurer*, Mr. W. B. Wilson.

A paper on "Weather Observation from an Aeroplane," by Lieut. C. K. M. Douglas, Royal Flying Corps, was communicated by Mr. M. McC. Fairgrieve. Lieut. Douglas had counted himself fortunate to have been for some months almost daily amongst the clouds of Northern France, and had studied the formation of both stratus and cumulus clouds at close quarters. Anticyclonic stratus was usually formed by the arrival of warm air at the height of a few thousand feet; but examples were given of its formation owing to the arrival of cool air from the North Sea near the surface and its disappearance when the temperature above the clouds had fallen. Once a large cumulus had formed it might penetrate through a thin stratus cloud. The author, when flying, had made many observations with a freely exposed thermometer and was inclined to classify as stratus those clouds above which the temperature gradient was zero or negative, and as cumuli all clouds without a rise of temperature above them. Cirrus and cirro-stratus almost certainly consisted of thin snow. It was shown that a knowledge of the temperature gradient would be very useful in forecasting thunderstorms, and that a quite stable gradient might exist when the surface pressure conditions suggested the possibility of thunderstorms. The summer of 1916 in France had, however, afforded no opportunity of observing a hot weather thunderstorm.

Lieut. Douglas answered various questions, and Major Gold, D.S.O., Dr. Knott, R. Cross, G. Williamson, and A. Watt spoke.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

SOUND OF THE EXPLOSION OF JANUARY, 19th.

SINCE the occurrence of the great explosion in East London on January 19th, I have been engaged in the attempt to determine the areas over which the sound was heard. From the large number of observations which I have received, it is clear that there were two sound-areas, one including the source of sound, the other lying some hundred miles to the north, and extending over Norfolk and the south of Lincolnshire to the west of Nottingham. Between these two areas, there was apparently a " zone of silence," occupying a large part of Essex and Suffolk, the southern halves of the counties of Cambridge and Huntingdon and central Northamptonshire.

There are still, however, two points on which I am anxious to obtain information, and on which I venture to appeal to your readers for their kindly help. (i.) In order to determine the boundaries of the sound-areas with accuracy, it is essential to know a number of places at which, so far as known, the sound was *not* heard(say, between 6.55 and 7.5 p.m.), and I should be very grateful to any of your readers who could tell me that, after asking among their friends, they have been unable to find anyone who heard the sound. This would apply specially to the district indicated above as the zone of silence. (ii.) It is probable that the detachment of the sound-areas and the peculiar form of the area surrounding London are due to the directions of the surface and upper winds. Notes on the direction of either or both would be of great value.

CHARLES DAVISON.

16, Manor Road, Birmingham, January 29th,

A RECORDING aneroid at my office, 8, Chiswell Street, Finsbury Square, E.C., showed on the trace at about 6.50 p.m. on the 19th, a vertical rise and fall of over 0·13 in., of which two-thirds is below the tracing, as if the effect of rarefaction had been greater than condensation. All windows were of course closed, though they shook violently. Had they been open no doubt the air wave effect would have been more marked. It would be interesting to hear how far off similar instruments were affected. J. EDMUND CLARK,B.A., B.Sc.

Asgarth, Purley, 22nd January, 1917.

[The question suggests itself whether the effect described by Mr. Clark may not have been due to the jarring of the delicate spring of the instrument by the vibration of the air and not to actual differences of pressure. The Redier mercurial barograph at Camden Square not much further away from the locality in question showed no indication of the explosion.—Ed., *S.M.M.*]

COLD JANUARIES.

It may interest your readers to illustrate the coldness of the daytime during the greater part of January this year. The month came in with a few exceptionally warm days. Thrushes which came to be fed at breakfast almost every day deserted their nest in a fuschia bush with two eggs in it on January 29th. I append the table for the five cold Januaries during the last thirty years at Totland Bay :—

Temperature in Screen.

January.	Extreme range.	Average of Max.	Min.	Mean.	Frosty Nights.
1891 ..	49—19	40·1	30·6	35·4	18
1894 ..	50—14	43·8	35·6	39·7	9
1895 ..	49—19	39·3	30·7	35·0	19
1897 ..	49—24	40·5	33·1	36·8	17
1917 ..	52—25	38·6	33·7	36·1	16

JOHN DOVER.

Totland Bay, I.W., 2nd February, 1917.

FROST IN GUERNSEY.

We are now having some very sharp weather and lower temperatures are being registered than any taken since January, 1907. On January 25th the screen maximum temperature at Les Blanches failed to exceed 31°·9, a *very* low reading for Guernsey, and the day's mean, 29°·8, was no less than 13°·4 below the normal. January, 1916, with a mean temperature of 47°·7, was the warmest in 24 years while January, 1917, with 38°·3 was the coldest.

BASIL ROWSWELL.

Guernsey, February 1st, 1917.

COMPARABLE STATIONS.

From a recent brief visit I am convinced that Torquay, as regards its recorded temperature conditions, is not comparable with Paignton. At Torquay the thermometer-screen is sheltered by *dracœnas* (trees or shrubs belonging to the lily family, and always in leaf) and by the steeps of the Rock-Walk. The situation at Paignton is open, with a great sky-exposure. Accordingly, it is not surprising that the December, 1916, minimum temperatures showed a difference of 8° (Torquay, 27°, Paignton, 19°). No doubt, in both cases, the observations are correct for their localities, but they are not comparable. A short description of the situation of each should surely be given in the reports.

E. G. ALDRIDGE, F.R.Met.Soc.

Barnstaple, 10th January, 1917

REVIEW.

Variations in Precipitation as affecting Water Works Engineering. By C. P. Birkinbine [Journal of the American Water Works Association. Vol. 3, No. 1. March, 1916]. Philadelphia, 1916. Size, 9 × 6. Pp. 103. Plates.

Mr. Birkinbine gives an able and comprehensive account of the broader features of the precipitation of the United States as viewed from the standpoint of the water engineer. The problems which confront the modern American engineer, though essentially similar to those in our own country, are frequently modified by the wider range of meteorological phenomena encountered in a continental climate. Large areas of the States receive an annual rainfall smaller than that in any part of the British Isles, but with this exception the geographical variations of mean annual fall are not vastly different. The fluctuations of rainfall in time are, however, occasionally of a very remarkable nature : the annual fall at Los Angelos, for example, during the 38 years, 1877-1914, varied from 38·18 in. to 5·59 in., or from 243 per cent. of the average in the wettest year to 35 per cent. in the driest. As a contrast it is interesting to note that the wettest year in London gave a fall of 38·10 in., almost the same as that at Los Angoles, but the driest year gave no less than 16·93 in., these figures being respectively 152 and 68 per cent. of the average. Numerous instances are recorded of 24 hour rainfalls exceeding 8 inches in amount and at Galveston, in Texas, more than 14 inches fell in one day on two occasions within sixteen months. Still more extraordinary are recorded falls of 18·00 in. in 7½ hours at Catskill, N.Y., on July 26th, 1819 ; of 16·00 in. in 3 hours at Concord, Pa., and 13·00 in. in 3 hours at Newtown, Pa., both on August 5th, 1843 ; of 3·95 in. in 14 minutes at Galveston on June 4th, 1871, and 1·50 in. in 5 minutes at Fort McPherson, Neb., on May 27th, 1868. We do not remember having seen these intense rainfalls quoted in any meteorological work, and mention them entirely on the author's authority, coupled with the remark that with a few exceptions the most extreme instances referred to relate to a period when rainfall observing was not so fully understood as it has become during the last 40 years.

Statistics of some of the more severe droughts recorded are given and discussed in some detail, but we doubt whether these are fully representative of the less rainy parts of the United States. Attention is also given to the rainfall recorded in periods immediately preceding dry spells, an important point to the water engineer.

With regard to the relation between rainfall or snowfall, both normal and abnormal, and the run-off from catchment areas numerous interesting records are quoted, indicating that this difficult problem has been studied with great care in the case of certain water-supplies, but the conclusion of the whole matter is the inevitable one that each gathering ground is a law unto itself and none but the vaguest generalizations are possible. C.S.

THAMES VALLEY RAINFALL, JANUARY, 1917.

Symons's Meteorological Magazine.

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

THE WEATHER OF JANUARY.

JANUARY had a low mean temperature especially noticeable in the day values, a precipitation in general under the average, and a preponderance of northerly and easterly winds. The only mild weather occurred during the first three or four days when south-westerly winds prevailed. On the 1st and 2nd the screen temperature rose to 58° or more at some places in the north of England and Wales, the highest maximum reported, however, being 59° at Kilkenny on the 2nd. Maxima of 54° occurred at some Scotch stations on the 3rd. On the 5th the wind changed to the north, and the temperature fell considerably, but the readings were not unusual until after the middle of the month. On the 17th the shade thermometer at Cahir fell to 16°, a value closely approached by several other Irish stations. During the last ten days of the month temperature remained persistently under the freezing point at some places in the Midland counties and south of England, the lowness of the day readings being quite exceptional.

Taking the British Islands as a whole the mean temperature of the month was about 2°·5 below the average. Over the north of Scotland and the north-east and east of England, the mean temperature was only 1°·5 under the average, the departure from the normal being most pronounced in what are usually in winter the most favoured areas, *viz.*, the south-west of England, Channel Islands, and south of Ireland, where the deficit was about 4°.

Bright sunshine in most parts of the United Kingdom was about, or slightly under, the average. In the west of Scotland there was a small excess, but in such widely separated localities as the eastern counties of England and in the Channel Islands the deficiency amounted to nearly an hour per diem.

The month was, on the whole, dry, especially in the south of England and Wales, where very wide areas had less than 2 inches. This was also the case in central Ireland and a small area in the east Midlands of Scotland. Less than 50 per cent. of the average fell over the greater part of Wales, and in parts of Ireland. The only districts over which the rainfall of the month exceeded the average were in the east of Great Britain, more particularly between Flamborough Head and the Firth of Forth, where more than 4 inches fell over considerable tracts, the rainfall approaching double the average in eastern Yorkshire. The general rainfall of the countries expressed as a percentage of the average was :—England and Wales, 78 per cent.; Scotland, 75 per cent.; Ireland, 61 per cent.; British Isles, 72 per cent.

In London (Camden Square) the mean temperature was 35·°5 or 3°·0 below the average, the month being the coldest January since 1897. The duration of bright sunshine was 16·5 hours, and the duration of rainfall, 54·4 hours. Evaporation, ·11 in.

RAINFALL TABLE FOR JANUARY, 1917.

STATION.	COUNTY.	RAINFALL.						
		Aver. 1875—1909. in.	1917. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	1·83	1·30	— ·53	71	·25	5	18
Tenterden	*Kent*	2·14	1·51	— ·63	71	·35	7	17
Arundel (Patching)	*Sussex*	2·59	1·50	—1·09	58	·41	7	12
Fordingbridge (Oaklands)	*Hampshire*	2·67	1·21	—1·46	45	·41	7	8
Oxford (Magdalen College)	*Oxfordshire*	1·78	1·43	— ·35	80	·33	8	14
Wellingborough (Swanspool)	*Northampn*	1·90	2·48	+ ·58	131	·75	10	19
Bury St. Edmunds (Westley)	*Suffolk*	1·70	2·01	+ ·31	118	·38	7	18
Geldeston [Beccles]	*Norfolk*	1·53	1·94	+ ·41	127	·36	7	20
Polapit Tamar [Launceston]	*Devon*	3·59	2·17	—1·42	60	·62	7	12
Rousdon [Lyme Regis]	,,	2·94	1·19	—1·75	41	·53	7	8
Stroud (Field Place)	*Gloucester*	2·33	...	...	...	...	...	...
Church Stretton (Wolstaston)	*Shropshire*	2·51	1·55	— ·96	62	·49	7	11
Boston	*Lincoln*	1·54	2·36	+ ·82	153	·59	8	18
Worksop (Hodsock Priory)	*Nottingham*	1·70	2·73	+1·03	160	1·02	8	23
Mickleover Manor	*Derbyshire*	1·95	2·77	+ ·82	142	·75	8	16
Buxton	,,	4·41	2·70	—1·71	61	·63	2	17
Southport (Hesketh Park)	*Lancashire*	2·55	1·94	— ·61	76	·68	7	12
Arncliffe Vicarage	*York, W.R.*	6·26	...	...	...	...	...	...
Goldsborough Hall	,, ,,	1·91	2·39	+ ·48	125	·54	7	17
Hull (Pearson Park)	,, *E.R.*	1·70	3·29	+1·59	194	·90	8	24
Newcastle (Town Moor)	*North'land*	1·90	3·41	+1·51	179	·80	7	21
Borrowdale (Seathwaite)	*Cumberland*	13·44	...	...	...	...	...	..
Cardiff (Ely)	*Glamorgan*	3·65	1·36	—2·29	37	·35	7	15
Haverfordwest	*Pembroke*	4·69	1·57	—3·12	33	·39	7	8
Aberystwyth (Gogerddan)	*Cardigan*	3·91	2·48	—1·43	63	·77	7	8
Llandudno	*Carnarvon*	2·51	·96	—1·55	38	·39	7	10
Cargen [Dumfries]	*Kirkcudbrt.*	4·10	1·93	—2·17	48	·65	7	15
Marchmont House	*Berwick*	2·40	4·48	+2·08	187	·90	8	21
Girvan (Pinmore)	*Ayr*	4·78	3·96	— ·82	83	·82	3	12
Glasgow (Queen's Park)	*Renfrew*	3·53	1·89	—1·64	54	·42	3	11
Islay (Eallabus)	*Argyll*	4·78	3·98	— ·80	83	·77	10	13
Mull (Quinish)	,,	5·55	2·99	—2·56	54	·75	2	13
Balquhidder (Stronvar)	*Perth*	8·74	2·60	—6·14	30	·67	2	7
Dundee (Eastern Necropolis)	*Forfar*	2·01	1·48	— ·53	74	·33	10	23
Braemar	*Aberdeen*	2·92	2·50	— ·42	86	·50	8	15
Aberdeen (Cranford)	,,	2·36	2·93	+ ·57	124	·56	2	24
Gordon Castle	*Moray*	1·99	2·99	+1·00	150	·55	3	18
Drumnadrochit	*Inverness*	3·63	4·85	+1·22	134	1·70	13	17
Fort William	,,	9·20	4·08	—5·12	44	1·15	3	18
Loch Torridon (Bendamph)	*Ross*	9·42	6·87	—2·55	73	1·49	12	13
Dunrobin Castle	*Sutherland*	2·75	3·49	+ ·74	127	1·09	3	12
Killarney (District Asylum)	*Kerry*	5·94	3·15	—2·79	53	·80	8	17
Waterford (Brook Lodge)	*Waterford*	3·78	2·59	—1·19	69	·84	26	10
Nenagh (Castle Lough)	*Tipperary*	3·88	1·19	—2·69	31	·37	10	14
Ennistymon House	*Clare*	4·30	2·07	—2·23	48	·74	10	13
Gorey (Courtown House)	*Wexford*	3·19	1·84	—1·35	58	·39	13	15
Abbey Leix (Blandsfort)	*Queen's Co.*	3·15	1·31	—1·84	42	·32	10, 26	15
Dublin (Fitz William Square)	*Dublin*	2·14	1·29	— ·85	60	·24	13	19
Mullingar (Belvedere)	*Westmeath*	3·10	1·68	—1·42	54	·38	27	16
Crossmolina (Enniscoe)	*Mayo*	5·35	4·33	—1·02	81	1·00	25	16
Cong (The Glebe)	,,	4·79	2·87	—1·92	60	·46	26	15
Collooney (Markree Obsy.)	*Sligo*	3·87	2·98	— ·89	77	·63	10	17
Seaforde	*Down*	3·41	2·01	—1·40	59	·52	11	15
Ballymena (Harryville)	*Antrim*	3·73	3·17	— ·56	85	·59	10	18
Omagh (Edenfel)	*Tyrone*	3·46	2·51	— ·95	73	·51	10	16

SUPPLEMENTARY RAINFALL, JANUARY, 1917.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Warlingham, Redvers Road..	1·84	XI.	Lligwy	1·40
,,	Ramsgate	2·66	,,	Douglas, Isle of Man	...
,,	Hailsham	1·23	XII.	Stoneykirk, Ardwell House...	3·18
,,	Totland Bay, Aston House...	1·09	,,	Carsphairn, Shiel	4·04
,,	Stockbridge, Ashley..	1·39	,,	Langholm, Drove Road	4·27
,,	Grayshott	1·58	,,	Selkirk, The Hangingshaw..	3·13
III.	Harrow Weald, Hill House...	1·55	XIII.	North Berwick Reservoir.....	2·92
,,	Pitsford, Sedgebrook....	1·42	,,	Edinburgh, Royal Observaty.	1·76
,,	Woburn, Milton Bryant.....	1·55	,,	Biggar.....	2·54
,,	Chatteris, The Priory..... ...	1·39	XIV.	Maybole, Knockdon Farm ...	2·62
IV.	Elsenham, Gaunts End	1·56	XV.	Buchlyvie, The Manse.....	...
,,	Shoeburyness	1·13	,,	Ballachulish House	4·37
,,	Colchester, Hill Ho., Lexden	1·46	,,	Oban.....	2·01
,,	Ipswich, Rookwood,Copdock	1·85	,,	Campbeltown, Witchburn ..	2·87
,,	Aylsham, Rippon Hall.... ..	2·06	,,	Holy Loch, Ardnadam.....	3·86
,,	Swaffham	2·32	,,	Tiree, Cornaigmore	2·64
V.	Bishops Cannings	1·26	XVI.	Dollar Academy	1·98
,,	Wimborne, St. John's Hill ...	1·41	,,	Glenlyon, Meggernie Castle..	2·99
,,	Ashburton, Druid House.....	1·67	,,	Blair Atholl	1·78
,,	Cullompton	1·30	,,	Coupar Angus	1·04
,,	Lynmouth, Rock House	1·02	,,	Montrose, Sunnyside Asylum.	1·42
,,	Okehampton, Oaklands... ...	2·22	XVII.	Alford , Lynturk Manse.....	2·89
,,	Hartland Abbey.....	1·19	,,	Fyvie Castle	3·59
,,	St. Austell, Trevarna	2·87	,,	KeithStation	4·41
,,	North Cadbury Rectory.....	1·07	XVIII.	Rothiemurchus	2·96
VI.	Clifton, Stoke Bishop	·91	,,	Loch Quoich, Loan	12·20
,,	Ledbury, Underdown..... ...	1·53	,,	Skye, Dunvegan	4·17
,,	Shifnal, Hatton Grange.....	2·16	,,	Lochmaddy, Bayhead	...
,,	Droitwich.....	1·78	,,	Fortrose.....	3·35
,,	Blockley, Upton Wold.....	2·12	,,	Glencarron Lodge	7·51
VII.	Grantham, Saltersford.....	2·27	XIX.	Altnaharra	...
,,	Market Rasen	2·60	,,	Melvich	4·45
,,	Bawtry, Hesley Hall	2·46	,,	Loch More, Achfary	10·41
,,	Whaley Bridge, Mosley Hall	2·92	XX.	Dunmanway, The Rectory ..	5·22
,,	Derby, Midland Railway.....	2·49	,,	Glanmire, Lota Lodge.....	4·20
VIII.	Nantwich, Dorfold Hall	2·94	,,	Mitchelstown Castle.....	2·56
,,	Chatburn, Middlewood	...	,,	Darrynane Abbey.....	3·83
,,	Lancaster, Strathspey	2·16	,,	Clonmel, Bruce Villa	3·35
IX.	Langsett Moor, Up. Midhope	2·48	,,	Broadford, Hurdlestown.....	1·31
,,	Scarborough, Scalby	4·26	XXI.	Enniscorthy, Ballyhyland...	3·43
,,	Ingleby Greenhow	4·25	,,	Rathnew, Clonmannon	1·54
,,	Mickleton	4·00	,,	Ballycumber, Moorock Lodge	1·19
X.	Bellingham, High Green Manor	4·35	,,	Balbriggan, Ardgillan	1·62
,,	Ilderton, Lilburn Cottage ...	3·29	,,	Castle Forbes Gardens.....	1·64
,,	Keswick, The Bank.....	2·65	XXII.	Ballynahinch Castle.....	4·81
XI.	Llanfrechfa Grange	1·24	,,	Woodlawn	2·13
,,	Treherbert, Tyn-y-waun	3·31	,,	Westport, St. Helens	3·64
,,	Carmarthen, The Friary	2·62	,,	Dugort, Slievemore Hotel ...	5·79
,,	Fishguard, Goodwick Station.	1·12	XXIII.	Enniskillen, Portora.....	1·86
,,	Crickhowell, Tal-y-maes.....	2·70	,,	Dartrey [Cootehill]	1·81
,,	New Radnor, Ednol	1·72	,,	Warrenpoint, Manor House ..	1·50
,,	Birmingham WW., Tyrmynydd	2·56	,,	Belfast, Cave Hill Road	2·16
,,	Lake Vyrnwy	2·42	,,	Glenarm Castle	2·90
,,	Llangynhafal, Plas Drâw.....	2·11	,,	Londonderry, Creggan Res...	3·28
,,	Dolgelly, Bryntirion.....	3·39	,,	Dunfanaghy, Horn Head ...	3·05
,,	Bettws-y-Coed, Tyn-y-bryn...	3·21	,,	Killybegs	5·48

Climatological Table for the British Empire, August, 1916.

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	85·3	1	44·3	31	74·4	55·7	55·0	77	132·0	42·9	5·57	16	6·5
Malta	91·6	19	70·4	22	83·9	72·7	...	76	142·0	...	·32	1	1·1
Lagos	88·2	17	71·0	10*	83·1	72·9	71·3	78	158·0	67·0	·98	10	7·9
Cape Town	74·1	5	39·7	14	63·4	48·1	48·2	75	...	...	5·13	17	5·7
Johannesburg	71·4	31	29·5	26	64·3	40·9	29·1	52	...	27·3	·00	0	0·6
Mauritius	78·4	19	54·1	12	75·2	61·5	59·0	74	...	48·0	1·10	18	5·9
Bloemfontein	75·0	31	23·1	15	65·0	32·5	28·0	49	..	...	·00	0	1·0
Calcutta...	91·7	4	74·9	27	87·6	78·5	78·4	89	...	73·3	18·94	24	9·3
Bombay...	87·7	31	76·0	2	84·7	78·2	76·7	86	129·0	72·8	17·19	31	8·4
Madras	100·2	14	75·6	25	94·1	77·9	73·4	73	161·3	74·3	2·20	10	6·1
Colombo, Ceylon ...	86·1	17	71·3	2	84·9	76·2	74·1	84	157·9	68·7	4·91	17	7·8
Hongkong	92·4	5	75·5	22	88·5	78·6	76·4	83	...	...	5·04	16	6·9
Sydney	72·1	27	42·3	7	62·3	48·6	43·9	67	119·2	30·2	2·76	14	3·9
Melbourne	66·6	26	32·9	1	57·6	42·8	42·3	69	118·8	25·2	2·24	20	6·2
Adelaide	71·1	26	39·4	10	60·1	46·3	46·0	76	125·1	31·2	3·99	21	5·3
Perth	66·8	8	40·0	28	61 9	48·5	47·2	75	130·2	30·2	6·20	23	7·5
Coolgardie	83·4	31	35·0	19	64·6	42·8	36·3	44	134·4	27·0	·31	5	3·8
Hobart, Tasmania ...	64·0	26	33·3	7	54·7	41·7	39·4	69	115·7	26·1	2·93	23	7·0
Wellington	59·1	31	35·0	26	54·6	43·6	43·3	80	120·5	23·0	4·35	17	6·5
Auckland	...	...	...	...	...	...	...	...	...	...	...	...	...
Jamaica, Kingston ...	92·7	17	70·2	22	88·6	73·5	72·5	79	...	...	5·92	13	...
Grenada	91·0	28	72·0	9†	86·0	74·0	...	78	134·0	...	7·60	24	4·5
Toronto	97·9	21	46·0	31	83·9	60·0	60·0	72	156·4	31·7	1·57	9	3·0
Fredericton	94·0	21	38·0	2	78·3	54·6	58·8	74	...	...	1·29	9	4·2
St. John, N.B. ...	79·6	6, 22	46·5	14	68·3	53·4	55·4	82	138·9	43·0	1·69	10	5·7
Victoria, B.C.	85·5	3	47·7	19	67·2	51·2	51·0	76	139·8	39·2	...	...	2·6

* 12, † 13, 26.

Malta.—On the 18th squall from 4.30 to 5 p.m., clouds of dust, hot blast of air; damage to trees, boats capsized, broken telephone wires.

Johannesburg.—Bright sunshine, 321·5 hours.

Bloemfontein.—A cold month.

COLOMBO, CEYLON.—Mean temp. 80°·6, or 0°·5 below, dew point 0°5 above, and R 2·18 in. above, averages. Mean hourly velocity of wind 6·1 miles.

HONGKONG.—Mean temp. 82°·6; mean hourly velocity of wind 6·5 miles. Bright sunshine 217·8 hours.

Melbourne.—Mean temp. 0°·9 below, and R ·44 in. above, averages.

Adelaide.—Mean temp. 0°·8 below, and R 1·52 in. above, averages.

Perth.—Violent wind storm on 9th, maximum gust 62 miles per hour. A very bleak month.

Coolgardie.—Temperature normal. Rainfall below average.

Hobart.—Temp. 0°3 below and R 1·13 in. above, averages.

Wellington.—Mean temp. 0°·6 above, and R ·31 in., above, averages. Bright sunshine 132.9 hours, frosts in 9 days.

JAMAICA.—Hurricane on the 15th.

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THE FROST OF JANUARY AND FEBRUARY, 1917.

By L. C. W. Bonacina.

The mild weather which commenced on December 28th, 1916 did not last very long, and by January 8th frost had definitely returned, and continued with increasing intensity till mid-February, the cold period having proved the most protracted severe frost over Europe as a whole since 1895.

During the second half of January the cold weather was of that pronounced easterly type, which, in the depth of winter, is usually indicative of intense cold on the Continent. But as regards the British Isles the cold in January, continuous though it was, could not be called severe—as judged by the standard of the climate—and in some recent winters decidedly lower minima over the country generally have occurred during spells of frost like that which characterized November, 1915, and intermittently the winter of 1908-1909. Nevertheless the stinging easterly wind from off the frozen continent was keenly felt, especially as it at times rose to gale force.

The amount of snow which fell during the month of January was in many parts of the United Kingdom very great, and it would appear that the Pennines suffered a repetition of March, 1916. The High Peak of Derbyshire, however, gets snowed up with such unfailing regularity every year that perhaps the highest tribute one can pay to the genius of its climate is pass over the recent occurrence with the comment "as usual." More special meteorological interest attached to the very heavy snowfalls which took place in most parts of Ireland, especially in the south, showing the special liability of the moister parts of the kingdom to snow whenever there prevails a suitable degree of cold. Essex and other parts of south-eastern England had some deep falls at times, but London escaped deep falls, although the number of days on which snow fell, for the most part in small quantities, was abnormally large, amounting, in fact, to 20. In *The Times* of February 2nd it was stated that snow fell in London on 11 days only, but this probably referred to a measurable quantity of moisture in the rain gauge and not to the visible occurrence of snow. On many days the dry flakes fell in perfect crystals of diverse patterns, and the snow on reaching the ground would be blown about like dust.

A letter from Milan in the middle of January informed me of 6 inches of snow on the ground followed on the day of writing by a renewal of the snowstorm of such intensity as to suggest it would "never leave off." Exactly! The climate of the North Italian plain does things thoroughly. It knows no half-measures.

As in 1895 the January frost proved to be the prelude to intense European cold in February, zero temperatures having occurred in the English Midlands, whilst a noteworthy feature of the present hard winter from December on has been the intensity of the cold throughout Ireland. London, as usual, had a relatively mild experience in consequence of its reservoirs of artificial heat; but a fall of 3 inches of snow on Sunday, February 4th, was followed by night frosts of 10 or 12 degrees in the more open parts, and skating commenced even on the Serpentine.

In Devon and Cornwall the cold was intense, and Dartmoor again this season appears to have been entirely snowbound. The *Illustrated Western Weekly News* for February 17th contained numerous photographs of skating on the Rivers Tamar and Exe—the first occasion since 1895. At some places up the Thames Valley minus temperatures occurred. A minimum of —6° was reported from Market Harborough, in Leicestershire, and the following air minima are quoted from the long list of stations in the Weekly Weather Report for the very cold week, February 4th to 10th :—in England, —4° at Wallingford, Berks., +4° at Hereford and Buxton, 5° at Geldeston, Norfolk, and at Wisley, Surrey, 8° at Nottingham, 9° at Norwich, 10° at Lincoln, 12° at Cullompton, Devon, 13° at Durham, 14° at Stonyhurst, Lancashire, and at Kew, 15° at Hampstead; in Wales, 4° at Rhayader, 10° at Bettws-y-Coed, 13° at Aberystwyth; in Scotland, 2° at West Linton, 4° at Balmoral, 10° at Eskdalemuir and Fort Augustus, 14° at Nairn, 15° at Crieff; in Ireland, 7° at Markree Castle, 9° at Kilkenny, 12° at Birr Castle.

Altogether the figures indicate that the distribution of extreme cold showed little relation to the distribution of mean winter isotherms, except, of course, in the case of an altogether exceptional region like the Scilly Isles, where the minimum was only 30°. The reading of —4° at Wallingford (36° of frost) is exceptional for England; the Irish figures are also rather unusual; but the reading of 12° at Cullompton is not especially remarkable for a part of Devonshire (the Tiverton district) which is subject to severe frost in winter.

The Scottish temperatures were not, on the whole, so low as the English, and it is noteworthy that Scotland, whose climate is so conspicuous for brief local spells of intense cold in ordinary winters, is often milder during periods of general cold than the south of England and neighbouring parts of the Continent where Arctic spells occur less often.

The frost gradually gave way after the middle of February, but

though the general temperature rose decidedly above the freezing point it took a long time for the thick coating of ice on lakes and ponds to disappear, the reason being that the air has been very stagnant becoming consequently so much chilled in contact with the ice that melting has been greatly retarded.

ROYAL METEOROLOGICAL SOCIETY.

An ordinary meeting of the Society was held at 70, Victoria Street, S.W., on February 21st, Major H. G. Lyons, F.R.S., President, n the Chair.

Owing to an unforeseen delay the manuscripts and proofs of the papers had not been received from the printer, and in the absence of Mr. W. H. Dines his paper on "The Heat Balance of the Atmosphere" was taken as read. We have subsequently received a copy and are able to give the following synopsis :—

The paper traces as far as may be the history of the solar radiation from the time it reaches the outer limit of the atmosphere until it is radiated back into space, assigning from the data available limits to the amounts absorbed, transmitted and reflected by the air, and to the amounts mutually radiated between the earth, the air and outer space.

The following point is also of interest in connection with the solar raditaion. Taking the temperature of the sun as 6200° A. the temperature of a "black" perfectly conducting sphere at the earth's distance should be 297° A. (75° F.) This requires the acceptance of the fourth power law, but not the value of the constant. The rotation of the earth and the convective effect of wind remove practically the condition of perfect conducting power, since they secure temperatures that do not differ by a large percentage from the mean, except for the comparatively small areas near the poles. The effect may be extended to a "grey" body, for if we suppose the earth's surface to consist of perfectly black and perfectly reflecting portions arranged in any small geometrical pattern, the reflecting parts will have no effect upon the temperature, but will take the temperature of 297° A. by conduction from the adjacent black parts, and the arrangement is equivalent to a "grey" surface. The effect may be extended to a small black or grey satellite revolving close to the earth in any plane that contains the sun, for the loss of solar radiation during the time of the sun's eclipse is just balanced by the earth's continual radiation. Under these circumstances the effective radiative temperature of the earth ought to be about 300 A. (81° F.), but is supposed to be about 255° A. (0° F.). Also the selective properties of the air are supposed to raise the mean temperature of the earth, the so-called greenhouse effect, in which case that temperature should be well over 300° A. (81° F.) instead of 288° A. (59° F.).

Mr. C. E. P. Brooks gave an account of his paper on "Continentality and Temperature." His summary is as follows :—

"The distribution of temperature over the surface of the earth is complex, being related to various factors, latitude, height, distance from the sea, etc. Further, since even smoothed isotherms reduced to sea-level often show very little relation to lines of latitude, it is evident that in some cases geographical conditions must exercise a predominant effect. This effect was investigated in the case of the distribution of temperature over Europe and Western Asia during January and July. Fifty-six representative stations were selected, and by the method of partial correlation regression equations were constructed, showing how the temperature of any place in the area may be built up from its height, its latitude, and the percentage of land in the area surrounding it. The function taken to represent latitude was the quantity of heat which would be received on a horizontal surface with a transmission coefficient of 0·7, on the shortest day and the longest day respectively (the last proviso allowed a lag of about three weeks in the thermal effect of the sun's radiation). That this gives a good measure of heat received is shown by the correlation coefficient of +·944 found between it and the temperature in January. From these regression equations the temperatures of the original stations were calculated, and over a range of 50° F. in January the average error was found to be about 4° ; in July the error was much less. Finally the equations were applied to the altered geography of the early Neolithic period, and it was found that this entirely accounted for the altered climate of that period, and the various astronomical theories which have been brought in to explain it are quite unnecessary."

Sir Napier Shaw exhibited and described a number of extremely beautiful and instructive cloud-transparencies produced by Mr. G. A. Clarke, of Aberdeen. Of these, one of alto-cumulus lenticularis (ripple-cloud) was particularly worthy of mention, showing very well marked ripples in several directions.

The following were elected fellows of the Society :—Lieut. L. C. H. Cave, Major F. D. Scott Gethin, Lieut. S. A. M. Dobson, G. H. Kemp, Lt.-Col. M. O'Gorman, C.B., Com. G. Paine, C.B., M.V.O., Lieut. J. Forgan Potts, R.N.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

WATER DROPS BELOW FREEZING POINT.

I AM much interested in Mr. Boys's description of the fog bow seen by him on November 28th, 1916.

The only bow which appears opposite the sun of the size of a rainbow and showing prismatic colours is a true rainbow formed by the *internal reflection of the sun's rays within a transparent sphere.* Mr. Boys speaks of the bow as being formed "upon a film of thin lofty cirrus," this is a strong support of the contention made in my paper on "Coronæ and Iridescent Clouds" * that cirrus clouds may be formed, under certain conditions, of drops of water and not of ice particles.

It may be contended that the cloud was not really cirrus; it is difficult, however, to imagine that such an experienced Observer as Mr. Boys cannot recognize cirrus cloud when he sees it. But even if he gave the cloud the wrong name we must allow him his adjective, "lofty." I have no means here of finding the temperature in England on the day in question, but I think I am justified in assuming that the temperature of a "lofty" cloud in England in November must have been below the freezing point. We can, therefore, at least say that Mr. Boys's observations prove that on November 28th, 1916, over England there was a cloud of water drops at a temperature below the freezing point.

The question of the possibility of water existing as spherical drops at very low temperatures is one of great importance in physics as well as in meteorology. The discussion on my paper referred to above showed that meteorologists had great difficulty in accepting the idea of liquid water at temperatures well below zero Fahrenheit, and Dr. Mill especially expressed the difficulties he experienced. I must admit that at the time, while I was absolutely convinced of the proof of the existence of transparent spheres of water, I was not satisfied with the explanation that these were supercooled water drops. During the last year or two I have become more familiar with the literature of colloidal chemistry, and it now appears to me that this branch of science is able to help us.

What is a cloud but a colloidal solution of water in air? It is also a solution in which the "disperse phase" may be either gas, liquid or crystal. Now the way in which crystalline colloid particles are formed has given much difficulty to physical-chemists. From observations made on sulphur in 1870 Vogelsang arrived at the conclusion that the small sphere is always the first stage in the formation of a crystal; this conclusion has been confirmed by

* Quar. Jour. Roy. Met. Soc., Vol. 38, No. 164, Oct., 1912.

Garnett in the case of gold, silver, and copper, and other workers have extended it to other substances. These minute spheres which ultimately develop into crystals are in an unstable state, but a state which, in favourable circumstances, might exist for a considerable time. Here, then, is the solution of our problem. The transparent spheres which give rise to fog bows, coronæ and iridescent clouds when the temperature is far below the freezing point are preliminary droplets in the process of the formation of water crystals in the air.

It is almost inconceivable that it would ever be possible to produce in the laboratory this intermediate stage in the formation of a water crystal, therefore our meteorological observation is of direct use to the physical-chemist in adding one more method by which he can study the evolution of a crystal. G. C. SIMPSON.

India Meteorological Department, Simla, 26th January, 1917.

UNDERGROUND WATER AND THE BOURNE FLOW IN THE WANDLE GATHERING GROUND.

THE date of the appearance of the Bourne flow in the Kenley Valley has been foretold for many years past with great accuracy by observation of the depth to the line of saturation as indicated by the water level in wells between the point where the Bourne first appears, near the Rose and Crown Inn, and the springs at the head of the River Wandle in Croydon. As is now well know the gradient of the line of saturation is a measure of the resistance of the strata to the passage of the water so that in dry seasons the gradient is flat. As the quantity of water to be discharged at the springs increases in wet seasons, so the gradient becomes steeper until it becomes in " Bourne " years so steep as to cut the surface of the ground when the released water passes down the surface channel.

The Bourne in the Kenley Valley always first appears at the same spot from which it is clear that the gradient of the line of saturation must be nearly uniform in the valley below, thus enabling very accurate forecasts to be made of the time when it will break out. This is, however, by no means the case in the valley above the point where the Bourne first appears, and it is interesting that observations of water levels in the upper part of the valley afford little guide to the date of the appearance of the Bourne.

The Bourne has broken out now for three winter seasons in succession, viz., February 2nd, 1915, January 26th, 1916, and December 20th, 1916, and the height of the water above O.D. in a well three miles up the Valley on these dates was 395, 388 and 370 feet respectively. It is evident, therefore, that the gradient of the line of saturation in the upper part of the valley depends more upon the incidence of the rainfall than is the case lower down.

5, Queen Anne's Gate, S.W., Feb 28th, 1917. W. VAUX GRAHAM.

JANUARY, 1917.

THERE is one feature of this month which seems worth notice, viz., the extremely small mean range of temperature.

In my record, commencing October, 1878, I have only two months with a mean range less than 7°·0 ; it was 6°·6 in February, 1879, and 6°·5 in January, 1897 ; in January of this year I have :—

Mean Max. 35°·8 Mean Min. 31°·2 Range 4°·6

or 2°·0 less than any other month in 38 years. The above seems to be confirmed by Mr. Dover's letter on page 7 of the February number, where as far south as the Isle of Wight the mean range is given as 4°·9. In the Edinburgh record, 1840-1900, the smallest is 5°·8, in January, 1856, and in the Greenwich record the smallest is 6°·5, in December, 1844. It seems probable that there is no precedent for so small a range. CHARLES LEWIS BROOK.

Harewood Lodge, Meltham, Yorks, March 3rd, 1917.

SPECIMEN WEATHER FORECASTS.

As a specimen of my system of Weather Forecasting, I have pleasure in submitting herewith the following, and I shall esteem it a favour if you will check these forecasts by official reports, and by those communicated to the Press by Shipmasters.

Forecasts, January 1st to April 6th, 1917.

These apply particularly to the British Isles, and to the North Atlantic but I am unable to give the track of a depression.

Between any two of the given dates (*e.g.*, January 1st to 11th), depressions more or less marked may be expected to occur. In some cases, two or more will occur between those dates, and the weather will then be very stormy ; but, of course, this does not mean that every day will be so. The depression will attain to a maximum, and then die away again.

January	1st to 11th.	February	19th to March 5th
,,	15th to 24th.	March	8th to 18th
,,	26th to Feb. 2nd.	,,	20th to 27th.
February	3rd to 16th.	,,	28th to April 6th.

In January the weather will be bitterly cold : there will be fierce storms and heavy falls of snow. In February there will be bitter local storms, particularly along the West Coasts, with rough seas ; and this kind of weather may be expected right up to April 6th, during which time, the North Atlantic Ocean will feel the full force of terrific gales.

The British Isles will suffer severely, as they lie right in the track these storms may be expected to follow.

EDWARD M. DARKEN.

327 West 22nd Street, New York, U.S.A., December 26th, 1916.

REVIEW.

Climate of the South Orkneys. Anales de la Oficina Meteorológica Argentina Tomo XVII. 2 parts. Pp. viii + 1034. Plates, 22. Size, $12\frac{1}{2} \times 10$. Buenos Aires, 1912-1913.

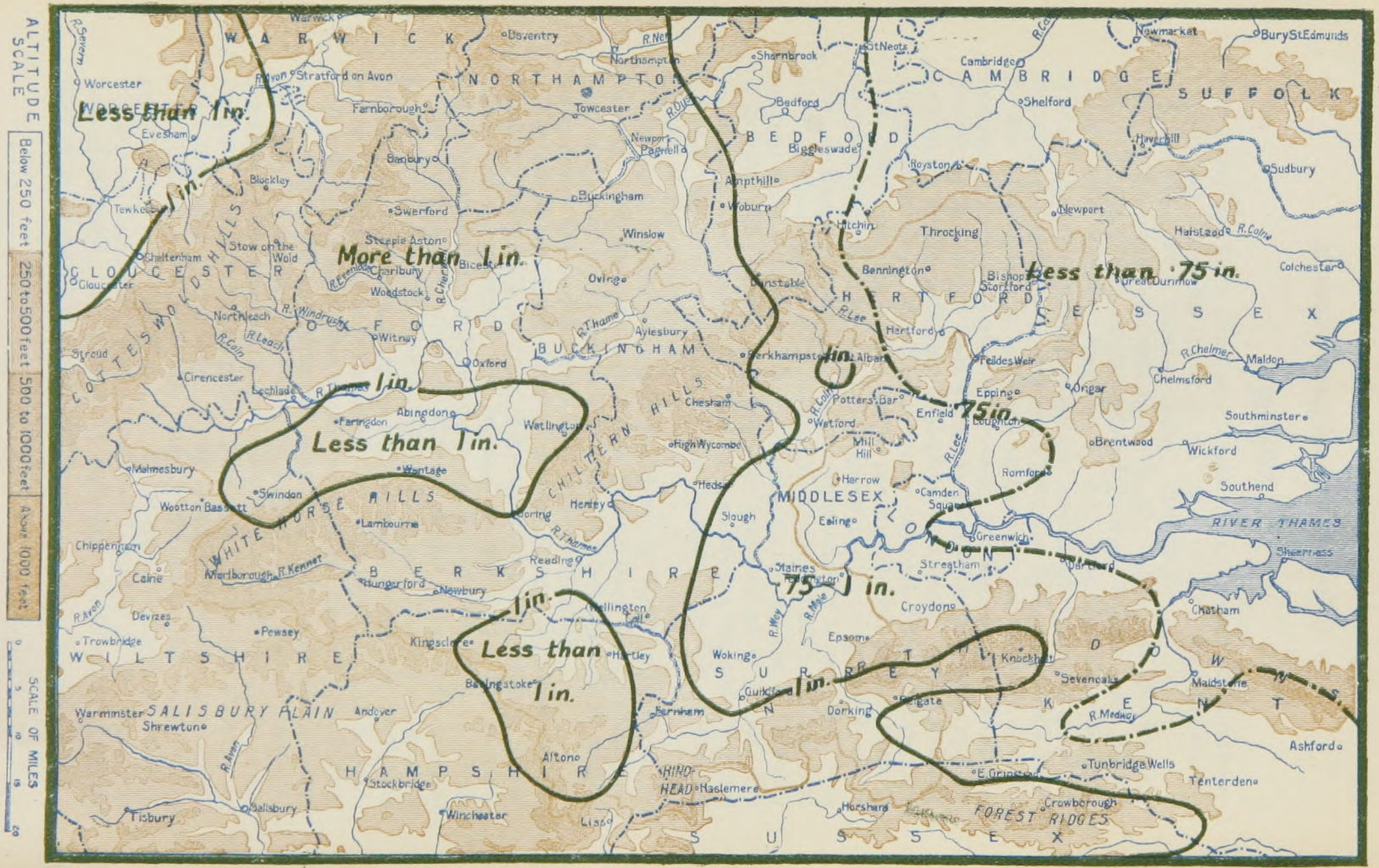
THIS station was established in March, 1903, by the Scottish Antarctic Expedition which wintered in these islands. Mr. W. G. Davis, until recently Director of the Argentine Meteorological Service, has embodied the results in two large volumes, in which the data are discussed in great detail, for the eight years, 1903-1910. At the South Orkneys there are really only two seasons, a short summer and a long winter, and, except for the comparatively ice-free seas in the summer there is little to distinguish the general appearance of the landscape in that season from midwinter. The maximum temperature was 47°·8, which occurred during a Föhn on February 14th, 1907, and the lowest—40°·1 on August 3rd, 1904. Föhn is comparatively common and has occurred during every month of the year, so that while the absolute monthly minima have varied from 21°·1 in February to —40° in August, a range of 61°·1, the absolute maxima show a range of only 10°·3 between the months of February and July. The mean daily range of temperature is lowest, 6°·0 in January, and highest, 17°·0 in July, showing a marked difference between the oceanic climate of the summer and the continental climate of the winter months.

The mean annual barometric pressure is 744·2 millimetres, or 29·30 in. The annual curve shows low pressure from January to May, and again in November. Pressure is relatively high in winter, being above the annual mean from June to October.

The air of the South Orkneys is very damp, the mean relative humidity being 90·4 per cent., with a minimum in January, 87 per cent., and a maximum in August, 94 per cent. The absolute minimum observed was 35 per cent., on October 3rd, 1909, at 9 a.m.

The wind velocity shows a distinct double period with maxima at the equinoxes and minima at the solstices. The annual mean is 13 miles per hour, being highest in March and September, 14·7 miles per hour, and lowest in December, 10·6 miles per hour, and in June, 11·8 miles per hour. The South Orkneys are located in the great cloud belt of the sub-Antarctic area, the mean amount (overcast sky or fog = to 100) being 85. In August, 1904, the sky remained cloudless for 61 consecutive hours, the longest spell observed. Clear days are very rare in summer. There are 188 sunless days in the year, and only 14 per cent. of the possible sunshine is recorded. Precipitation amounts to 447 mm. (17·60 in.) in the year, with a maximum, 58 mm. (2·28 in.) in April, and a minimum, 23 mm. (·91 in.) in December. Rain occurs on 113 days in the year, true hail on 27 days, and graupel, or soft hail, on 59 days. Drifting snow is noted annually on 185 days. R.C.M.

THAMES VALLEY RAINFALL, FEBRUARY, 1917.



SUMMER TIME AGAIN.

A COMMITTEE appointed by the Home Secretary has enquired into the social and economic results of the Summer Time Act, 1916, has reported recommending that summer time should be renewed in 1917 and subsequent years. Evidence as to the effect of the Act was taken by the Committee, and Sir Napier Shaw told them that "a great deal of confusion arose with the Observers and the continuity of many series of observations had been interrupted." This we can fully endorse; but all we and the Observers can do by way of remedy is to follow the rule we gave last year—**While the clock shows summer time observe if possible at 10.0 a.m. (9 a.m. true time), but if it is not possible to do so observe at 9 a.m. (clock time) and mark the return from April 8th to September 16th, "9 a.m. S.T." Recording instruments should be kept running to true time.** The dates are those recommended by the Committee and are not to be followed unless Parliament so decrees.

THE WEATHER OF FEBRUARY.

THE characteristic features of the weather of February were a low mean temperature, scanty precipitation, and in general a deficiency of bright sunshine. The temperature, which forms the subject of a special article (see ante pp. 13-15) was 4° F. below the average, the deficit varying from about 1°·5 in the north of Scotland to 5°·5 in the south of England and the Midlands.

Bright sunshine varied from about one hour and a half per day in the Midlands to double this amount in such widely separated districts as the east of Scotland and the Channel Islands. In the latter area, and also over Scotland, there was a slight excess, but in the east of England, including the Midlands, the average daily deficiency was an hour. Ireland received the average amount.

Precipitation was everywhere light, the whole of the east of Great Britain had less than an inch, and in the west of England less than two inches fell, except in the very heart of the Lake District and the centre of Wales, the south and east of Ireland had rather less than two inches, the maximum fall hardly reaching three inches, except very locally as in Connemara. The widespread deficiency is shown by an inspection of the regular rain table every station there given having less than the average. In England and Wales 48 per cent. of the average fell, in Scotland 33 per cent., and in Ireland 60 per cent., the whole country showing a value of 46 per cent.

In London (Camden Square) the mean temperature was 35°·4, being 4°·3 below the average. Duration of rainfall, 20·5 hours. Bright sunshine, 38 hours. Evaporation, ·17 in.

RAINFALL TABLE FOR FEBRUARY, 1917.

STATION.	COUNTY.	RAINFALL. Aver. 1875—1909. in.	1917. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	1·66	·93	— ·73	56	·20	20	10
Tenterden	*Kent*	1·90	·85	—1·05	45	·21	20	9
Arundel (Patching)	*Sussex*	2·17	1·84	— ·33	85	·45	19	10
Fordingbridge (Oaklands)	*Hampshire*	2·34	1·15	—1·19	49	·30	19	12
Oxford (Magdalen College)	*Oxfordshire*	1·62	1·21	— ·41	75	·29	16, 19	11
Wellingborough (Swanspool)	*Northampn*	1·70	·86	— ·84	51	·20	20	13
Bury St. Edmunds (Westley)	*Suffolk*	1·59	·58	—1·01	36	·16	4	9
Geldeston [Beccles]	*Norfolk*	1·41	1·02	— ·39	72	·22	4, 20	15
Polapit Tamar [Launceston]	*Devon*	2·95	1·21	—1·74	41	·37	20	10
Rousdon [Lyme Regis]	,,	2·50	1·47	—1·03	59	·78	19	9
Stroud (Field Place)	*Gloucester*	2·12	1·06	—1·06	50	·30	19	10
Church Stretton (Wolstaston)	*Shropshire*	2·17	·98	—1·19	45	·36	23	8
Boston	*Lincoln*	1·53	·90	— ·63	59	·27	20	14
Worksop (Hodsock Priory)	*Nottingham*	1·64	·58	—1·06	35	·26	20	8
Mickleover Manor	*Derbyshire*	1·71	1·13	— ·58	66	·45	21	10
Buxton	,,	4·01	·97	—3·04	24	·24	19	9
Southport (Hesketh Park)	*Lancashire*	2·07	1·10	— ·97	53	·29	19	12
Arncliffe Vicarage	*York, W.R.*	4·88	...	...	...	...	...	...
Goldsborough Hall	,, ,,	1·75	·67	—1·08	38	·27	20	7
Hull (Pearson Park)	,, *E.R.*	1·78	·78	—1·00	44	·32	20	12
Newcastle (Town Moor)	*North'land*	1·63	·83	— ·80	51	·27	20	11
Borrowdale (Seathwaite)	*Cumberland*	10·96	2·06	—8·90	19	·54	19	19
Cardiff (Ely)	*Glamorgan*	3·07	1·56	—1·51	51	·63	19	14
Haverfordwest	*Pembroke*	3·42	2·17	—1·25	63	1·12	19	12
Aberystwyth (Gogerddan)	*Cardigan*	3·09	2·70	— ·39	87	·82	19	12
Llandudno	*Carnarvon*	2·11	1·30	— ·81	62	·45	19	9
Cargen [Dumfries]	*Kirkcudbrt.*	3·42	1·29	—2·13	38	·30	19	10
Marchmont House	*Berwick*	2·15	·96	—1·19	45	·38	20	11
Girvan (Pinmore)	*Ayr*	3·87	1·48	—2·39	38	·36	19	13
Glasgow (Queen's Park)	*Renfrew*	2·70	...	...	...	...	...	..
Islay (Eallabus)	*Argyll*	3·91	1·43	—2·48	37	·44	19	14
Mull (Quinish)	,,	4·45	1·19	—3·26	27	·22	20	18
Balquhidder (Stronvar)	*Perth*	6·33	1·12	—5·21	18	·40	1, 28	6
Dundee (Eastern Necropolis)	*Forfar*	1·91	1·31	— ·60	69	1·08	20	6
Braemar	*Aberdeen*	2·55	·59	—1·96	23	·20	20	6
Aberdeen (Cranford)	,,	2·36	·91	—1·45	39	·41	20	9
Gordon Castle	*Moray*	1·95	·76	—1·19	39	...	...	...
Drumnadrochit	*Inverness*	2·89	1·14	—1·75	39	·46	4	13
Fort William	,,	6·85	1·68	—5·17	25	·51	27	18
Loch Torridon (Bendamph)	*Ross*	7·53	2·42	—5·11	32	·36	27	16
Dunrobin Castle	*Sutherland*	2·58	·98	—1·60	38	·24	11	8
Killarney (District Asylum)	*Kerry*	4·99	1·61	—3·38	30	·62	19	14
Waterford (Brook Lodge)	*Waterford*	3·18	1·45	—1·73	46	·60	19	14
Nenagh (Castle Lough)	*Tipperary*	2·89	1·48	—1·41	51	·98	19	12
Ennistymon House	*Clare*	3·44	1·70	—1·74	49	1·13	19	11
Gorey (Courtown House)	*Wexford*	2·75	1·07	—1·68	39	·70	19	11
Abbey Leix (Blandsfort)	*Queen's Co.*	2·55	1·62	— ·93	64	·85	19	10
Dublin (Fitz William Square)	*Dublin*	1·93	1·70	— ·23	88	·94	19	11
Mullingar (Belvedere)	*Westmeath*	2·67	2·36	— ·31	88	·84	21	9
Crossmolina (Enniscoe)	*Mayo*	4·20	1·92	—2·28	46	·36	2	14
Cong (The Glebe)	,,	3·72	1·89	—1·83	51	·62	19	13
Collooney (Markree Obsy.)	*Sligo*	3·20	1·70	—1·50	53	·52	19	17
Seaforde	*Down*	2·81	2·36	— ·45	84	1·16	20	13
Ballymena (Harryville)	*Antrim*	2·99	2·10	— ·89	70	·60	19	17
Omagh (Edenfel)	*Tyrone*	2·68	2·20	— ·48	82	1·12	19	13

SUPPLEMENTARY RAINFALL, FEBRUARY, 1917.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Warlingham, Redvers Road..	1·11	XI.	Lligwy	1·21
,,	Ramsgate	·47	,,	Douglas, Isle of Man	...
,,	Hailsham	·95	XII.	Stoneykirk, Ardwell House...	2·02
,,	Totland Bay, Aston House...	1·36	,,	Carsphairn, Shiel	1·76
,,	Stockbridge, Ashley..	·77	,,	Langholm, Drove Road	1·17
,,	Grayshott	1·17	,,	Selkirk, The Hangingshaw..	·76
III.	Harrow Weald, Hill House...	·90	XIII.	North Berwick Reservoir.....	·50
,,	Pitsford, Sedgebrook...	1·20	,,	Edinburgh, Royal Observaty.	·58
,,	Woburn, Milton Bryant.....	1·00	,,	Biggar.....	1·15
,,	Chatteris, The Priory.....	·66	XIV.	Maybole, Knockdon Farm ...	1·51
IV.	Elsenham, Gaunts End	·64	XV.	Buchlyvie, The Manse.....	...
,,	Shoeburyness	·48	,,	Ballachulish House	1·18
,,	Colchester, Hill Ho., Lexden	·55	,,	Oban.....	1·01
,,	Ipswich, Rookwood,Copdock	·59	,,	Campbeltown, Witchburn ..	1·39
,,	Aylsham, Rippon Hall.... ..	1·15	,,	Holy Loch, Ardnadam.....	1·43
,,	Swaffham	·72	,,	Tiree, Cornaigmore	·99
V.	Bishops Cannings	1·30	XVI.	Dollar Academy	...
,,	Wimborne, St. John's Hill...	1·17	,,	Glenlyon, Meggernie Castle..	1·01
,,	Ashburton, Druid House.....	1·01	,,	Blair Atholl	·44
,,	Cullompton	1·71	,,	Coupar Angus	·62
,,	Lynmouth, Rock House	1·16	,,	Montrose, Sunnyside Asylum.	1·02
,,	Okehampton, Oaklands.....	1·07	XVII.	Alford , Lynturk Manse[.....	...
,,	Hartland Abbey.....	1·70	,,	Fyvie Castle	1·48
,,	St. Austell, Trevarna	1·82	,,	KeithStation	·77
,,	North Cadbury Rectory.....	1·40	XVIII.	Rothiemurchus	·66
VI.	Clifton, Stoke Bishop	1·31	,,	Loch Quoich, Loan	5·60
,,	Ledbury, Underdown..... ...	1·73	,,	Skye, Dunvegan	1·79
,,	Shifnal, Hatton Grange.....	1·08	,,	Lochmaddy, Bayhead	...
,,	Droitwich.....	·87	,,	Fortrose.....	·74
,,	Blockley, Upton Wold.....	1·34	,,	Glencarron Lodge	1·99
VII.	Grantham, Saltersford.....	·72	XIX.	Altnaharra	...
,,	Market Rasen	·71	,,	Melvich	1·07
,,	Bawtry, Hesley Hall	·57	,,	Loch More, Achfary	2·99
,,	Whaley Bridge, Mosley Hall	1·13	XX.	Dunmanway, The Rectory ..	2·72
,,	Derby, Midland Railway.....	·83	,,	Glanmire, Lota Lodge.....	1·69
VIII.	Nantwich, Dorfold Hall	1·40	,,	Mitchelstown Castle.....	1·92
,,	Chatburn, Middlewood	...	,,	Darrynane Abbey.....	...
,,	Lancaster, Strathspey	1·26	,,	Clonmel, Bruce Villa	1·22
IX.	Langsett Moor, Up. Midhope	·68	,,	Broadford, Hurdlestown.....	1·84
,,	Scarborough, Scalby	1·45	XXI.	Enniscorthy, Ballyhyland...	1·58
,,	Ingleby Greenhow	·54	,,	Rathnew, Clonmannon	·92
,,	Mickleton	1·00	,,	Ballycumber, Moorock Lodge	2·24
X.	Bellingham, High Green Manor	1·36	,,	Balbriggan, Ardgillan	1·82
,,	Ilderton, Lilburn Cottage ...	1·32	,,	Castle Forbes Gardens.....	1·72
,,	Keswick, The Bank.....	1·22	XXII.	Ballynahinch Castle.....	3·48
XI.	Llanfrechfa Grange	1·10	,,	Woodlawn	1·60
,,	Treherbert, Tyn-y-waun	2·23	,,	Westport, St. Helens	·99
,,	Carmarthen, The Friary	1·86	,,	Dugort, Slievemore Hotel ...	2·38
,,	Fishguard, Goodwick Station.	1·58	XXIII.	Enniskillen, Portora.....	2·12
,,	Crickhowell, Tal-y-maes.....	1·60	,,	Dartrey [Cootehill]	2·76
,,	New Radnor, Ednol	1·43	,,	Warrenpoint, Manor House ..	1·82
,,	Birmingham WW., Tyrmynydd	1·12	,,	Belfast, Cave Hill Road	2·15
,,	Lake Vyrnwy	1·25	,,	Glenarm Castle	1·73
,,	Llangynhafal, Plas Drâw.....	1·12	,,	Londonderry, Creggan Res...	2·83
,,	Dolgelly, Bryntirion.....	3·19	,,	Dunfanaghy, Horn Head ...	2·46
,,	Bettws-y-Coed, Tyn-y-bryn...	1·07	,,	Killybegs	1·98

Climatological Table for the British Empire, September, 1916.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	72·3	7	37·8	15	66·1	49·7	50·9	84	118·9	36·1	1·48	13	6·9
Malta	85·1	1	61·8	25	77·9	69·0	...	64	136·5	...	1·57	4	0·4
Lagos	87·0	*25	70·0	5	84·6	72·6	72·2	78	154·0	68·0	4·07	9	8·0
Cape Town	80·6	24	43·9	17	66·1	49·7	51·0	76	...	...	1·82	12	5·7
Johannesburg	80·4	27	35·4	21	72·9	48·1	35·4	47	...	32·0	·00	0	0·8
Mauritius	79·7	23	57·9	8	75·7	63·9	60·3	74	...	50·2	2·60	22	6·4
Bloemfontein	86·0	27	29·1	4	75·2	42·2	34·0	42	..	...	·03	2	1·5
Calcutta...	92·7	6	75·7	16	88·8	78·5	77·7	85	...	74·3	17·90	18	8·5
Bombay...	89·8	2	75·5	6	84·8	77·6	76·4	86	130·0	71·3	14·59	25	7·7
Madras	...	...	...	...	...	...	...	...	...	...	...	...	...
Colombo, Ceylon ...	85·9	25	72·0	2	84·6	76·3	73·8	83	155·2	68·5	3·82	13	7·8
Hongkong	89·8	5	72·6	26	84·7	76·6	73·1	78	...	...	10.52	15	6·3
Sydney	83·1	16	46·3	+11	67·4	53·1	49·8	68	135·0	31·9	4·51	12	5·0
Melbourne	81·6	20	38·0	18	62·2	48·9	47·0	70	132·4	30·0	7·93	18	6·6
Adelaide	87·9	19	39·8	30	66·9	50·4	47·1	62	139·0	30·6	1·68	11	5·4
Perth	...	...	...	...	...	...	...	...	...	...	...	...	...
Coolgardie	90·0	6	41·6	23	72·5	52·2	43·7	46	145·4	36·0	1·38	6	4·6
Hobart, Tasmania ..	...	...	...	..	...	...	...	...	...	...	...	...	...
Wellington	63·5	5	36·5	16	58·2	46·7	45·4	76	123·0	25·7	2·92	11	5·7
Auckland	...	...	...	...	...	...	...	...	...	...	...	...	...
Jamaica, Kingston ...	92·3	15	70·0	2	89·6	73·1	72·6	79	...	...	·97	12	...
Grenada	90·0	13	70·0	8	86·0	74·0	...	89	135·0	...	11·32	21	3·0
Toronto	89·8	7	34·7	30	71·2	51·1	50·4	76	123·0	25·3	1·66	12	4·2
Fredericton	83·0	28	34·0	4	69·0	45·0	55·4	81	...	...	3·16	9	4·8
St. John, N.B. ...	79·6	14	40·0	20	63·3	48·7	51·0	81	132·7	32·5	1·82	12	5·2
Victoria, B.C.	79·7	15	43·0	30	64·4	48·9	48·0	78	130·0	29·5	·35	5	3·8

* 30, + 12.

Malta.—Thunderstorm on the 14th.

Johannesburg.—Bright sunshine, 328·3 hours.

Mauritius.—Mean. temp. 1°·0 below, average. Mean hourly velocity of wind 10°·7 miles.

COLOMBO, CEYLON.—Mean temp. 80°·5, or 0°·4 below, dew point 0°2 above, and R ·20 in. above, averages. Mean hourly velocity of wind 6·0 miles. TS on 5th.

HONGKONG.—Mean temp. 80°·5; mean hourly velocity of wind 15·3 miles. Bright sunshine 200·9 hours.

Melbourne.—The month's rainfall the largest during 61 years, the previous being 7·61 in October, 1869, continuous steady R for 63 hours, and for 9 days almost continuous. Rivers flooded and were over the lands, many cattle lost and a few cases of drowning.

Adelaide.—Mean temp. 1°·6 above, and R ·26 in. below, averages.

Coolgardie.—Temperature 3°·9 above.

Wellington.—Mean temp. 1°·3 above, and R 1·32 in., below, averages. Bright sunshine 168·7 hours. A mild spring month.

Symons's
Meteorological Magazine.

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AGRICULTURE AND CLIMATE.

The inclement Spring of 1917 has given as sharp an edge on the side of climate as the results of the submarine campaign have given on the side of agriculture to the method of adjusting farm work to meteorological conditions put forward by Mr. Wibberley in his paper "Farming on Factory Lines" read to the Newcastle meeting of the British Association last year. The fact that the British Association, which was founded in order to spread an interest in science over the whole country and to combat the tendency to centralizing scientific thought and activity in London, has unhappily decided to hold no meeting this year makes it the more important to call attention to this remarkable instance of its usefulness in bringing forward ideas which are as consistent with common sense as they are divergent from farming traditions. Many of our readers must be aware of the remarkable work of the voluntary Agriculture Organization Society which has done so much to extend the usefulness of the Board of Agriculture and Fisheries—a department that has itself been re-organized by the appointment of a well-known agriculturist, Mr. R. E. Prothero, as its Parliamentary head, and of a distinguished agricultural chemist, Mr. A. D. Hall, F.R.S., as its official head.

Mr. Wibberly contrasts the irregularity and uncertainty of work on the farm which is always being hindered, stopped or hastened by changes of weather with the steady uniform progress of work in a factory, where the weather does not matter. He sets himself to the task of re-arranging farm work so that whatever the weather may be at whatever season the farmer has always something on hand to which that weather is favourable, and the work of the farm is not stopped. He bases his methods on practise, and has tested all the schemes which he puts forward, so that whatever is theoretical in his views has been fairly confirmed by experience. He lays stress on the rush of work at the traditional seed time and harvest, and the loss and damage which result from unfavourable weather at these seasons. Then he shows how in the matter of rainfall the climate (which is the average weather) of different parts of the British Isles

differs enormously. The rainfall of the three chief tillage months February, March, April, is, he points out, nearly twice as great in Ireland as in Norfolk, making it obvious that the system of tillage suited for the one district is unsuited for the other. Again, he points out, perhaps without laying sufficient stress on geographical differences, that with the exception of some of the dead winter months the rainfall of the harvest month, August, is greater than that of any other month in the year. We may note that a harvest deferred to September, which, after all, is not uncommon, takes place in what is now the driest month of the year except early spring. Be that as it may it does not affect the two great principles which Mr. Wibberley is pressing on public attention at this critical time—first, that a special system of tillage should be devised to suit each definite climate, and, second, that by the method of continuous cropping the risks to agriculture due to weather uncertainties can be very largely eliminated. We believe that many farmers are in the habit of making use of climatic and weather data for their work, but we have nowhere seen the value of meteorological knowledge to the farmer set out so clearly as by Mr. Wibberley. He sees the need of more detailed and accurate mapping of climatic conditions for the several seasons. We would point out that once this need is realized by farmers to the extent that they set up meteorological observations as part of the farm work, the desiderated maps can readily be produced. As it is, average monthly maps of rainfall can be prepared from existing data which would go far to supply the need; but it is difficult to see how it could be done until the close of the war releases the skilled hands, without whose aid this work which seems so simple but is so complex, cannot be undertaken with any hope of success.

Mr. Wibberley's schemes of continuous cropping are too agriculturally technical for our pages; but his great principle is simplicity itself as he sets it forth :—

"It is past the wit of man to alter climatic conditions, but it is a comparatively simple thing, to alter our tillage system that it better fits in with climatic conditions. Nay more, we can so arrange our methods of cropping, that much of the rainfall, which at present hinders tillage operations, would facilitate them. Still further, whilst we cannot cause the sun to shine and ripen our corn crops, we can modify our corn growing methods so as to ensure our cereal crops receiving a greater amount of sunshine, during the ripening and harvesting period. We can in short conquer the climate, instead of as in the past, allowing the climate to conquer us."

METEOROLOGICAL OBSERVATIONS AT LU-KIA-PANG, CHINA, FOR 1916.

By Rev. J. De Moidrey, S.J.

I.—*Barometric Pressure. Millibars.*

	8 a.m.	2 p.m.	8 p.m.	Daily Mean.
Jan.	**1027·2**	**1025·4**	**1027·1**	**1026·6**
Feb.	22·5	20·8	21·7	21·7
Mar.	22·7	20·6	21·5	21·6
April	16·0	13·9	14·9	14·9
May	12·7	11·4	11·7	11·8
June	05·4	04·4	04·9	04·8
July	06·1	05·3	05·9	05·7
Aug.	*03·9*	*02·9*	*03·5*	*03·3*
Sept.	12·3	10·8	12·2	11·7
Oct.	21·8	19·8	21·0	20·8
Nov.	25·8	23·8	25·3	24·9
Dec.	26·5	24·5	25·8	25·6
Year	1016·9	1015·3	1016·3	1016·1

IV.

Mean amount of Cloud.	
Jan.	5·7
Feb.	**8·4**
Mar.	6·1
April	6·6
May	7·6
June	7·3
July	7·5
Aug.	6·3
Sept.	7·5
Oct.	6·7
Nov.	5·8
Dec.	*5·1*
Year	6·7

V.

Days with Thunder-storms.	
Jan.	—
Feb.	—
Mar.	—
April	3*a*
May	2
June	5
July	13
Aug.	3
Sept.	5
Oct.	—*b*
Nov.	—
Dec.	—
Year	31

a First, April 9. *b* Last September 22.

II.—*Temperature. Degrees Centigrade.*

	MEAN DAILY.			MINIMUM.				
	Mean.	Lowest.	Highest.	Mean.	Hour. h.	A.M. min.	Lowest.	Highest.
	°	°	°	°			°	°
Jan.	4·7	—*1·9*	12·2	*1·1*	4	30	—*7·7*	9·3
Feb.	*4·6*	1·6	8·6	2·0	4	45	—2·2	7·1
Mar.	7·1	3·5	14·1	3·5	4	10	—0·6	10·0
April	14·1	7·7	23·2	10·2	4	5	2·2	17·8
May	19·1	14·0	25·9	14·9	4	45	8·3	18·9
June	24·0	17·4	28·4	20·5	4	10	14·6	26·4
July	**26·8**	23·2	**30·1**	**23·5**	3	15	20·9	**26·6**
Aug.	26·4	23·0	28·6	23·3	4	20	19·3	26·0
Sept.	23·9	18·5	28·7	21·0	3	40	14·3	24·9
Oct.	17·0	13·4	19·5	13·6	4	25	9·5	17·4
Nov.	11·7	4·0	19·4	8·4	4	0	1·1	19·0
Dec.	5·4	—4·7	10·3	1·6	4	30	—7·6	7·3
Year	15·4	—4·9*a*	30·1*b*	12·0	4	15	—7·7*c*	26·6*d*

Latest frost, March 24th (—0°·6); earliest, December 15th (—0°·5).

II.—(*con.*)

	MAXIMUM.					RANGE.		
	Mean.	Hour. h.	P.M. m.	Lowest.	Highest.	Mean.	Lowest.	Highest.
	°			°	°	°	°	°
Jan.	9·7	1	5	—*2·4*	18·9	**8·5**	1·8	15·8
Feb.	*8·1*	1	15	4·5	14·7	*6·1*	1·6	12·0
Mar.	11·9	1	5	6·4	22·6	8·5	2·2	16·5
April	19·4	1	50	12·3	30·6	9·2	1·8	**18·0**
May	24·2	1	45	16·4	33·4	**9·3**	2·3	15·4
June	28·7	2	5	19·2	35·2	8·1	*0·6*	16·4
July	**31·2**	1	45	26·0	**36·8**	7·7	1·6	10·8
Aug.	31·1	1	30	25·8	34·1	7·8	3·7	11·1
Sept.	28·6	1	25	19·8	34·3	7·6	1·5	11·3
Oct.	22·0	0	50	15·2	26·6	8·4	2·7	13·6
Nov.	16·2	0	35	6·3	22·7	7·8	1·8	13·5
Dec.	10·4	1	0	—1·5	16·6	8·8	1·9	15·7
Year	20·1	1	20	—2·4*e*	36·8*f*	8·2	0·6*g*	18·0*h*

a Jan. 23. *b* July 3. *c* Jan. 25. *d* July 20. *e* Jan. 23. *f* July 21. *g* June 26. *h* Apr. 7.

III.—*Relative Humidity. Per cent.*

	RELATIVE HUMIDITY.			VAPOUR TENSION.		
	Mean.	Lowest.	Highest	Mean.	Lowest.	Highest.
Jan.	76	51	95	*5·1*	*1·8*	9·2
Feb.	78	53	97	*5·1*	3·0	8·0
Mar.	73	51	95	5·8	3·4	8·8
April	77	*46*	97	9·9	4·0	18·3
May	76	51	97	13·0	6·5	17·5
June	81	56	96	18·5	12·9	23·5
July	82	72	91	21·8	18·4	27·8
Aug.	81	71	90	21·5	16·2	26·1
Sept.	82	69	93	18·9	12·1	24·1
Oct.	78	60	96	11·7	8·9	14·1
Nov.	78	60	96	8·6	3·8	15·8
Dec.	77	52	95	5·4	1·9	7·9
Year	78	46	97	12·1	1·8	27·8

(To be continued.)

THE COLD APRIL WEATHER IN LONDON.

THE remarkable persistence of the cold, ungenial weather which has prevailed almost without interruption for more than four months is shown by the exceptionally low mean temperature at Camden Square for the first thirteen days of April. For this period the mean maximum temperature (in the Glaisher stand) was 46°·5, being highest, 51°·2, on the 8th and 15th, and lowest, 41°·0, on the 1st; the mean minimum temperature was 29°·6, the lowest being 26°·5, on the 2nd, and the highest, 33°·6, on the 9th. Frost in shade occurred on eleven nights, and snow fell on ten days, yielding practically the average rainfall for the whole month of April. The mean temperature (mean of maximum and minimum) was 38°·0, being 9° below the normal for the first thirteen days of April. Reference to the Camden Square records since 1858 show that the only April which approached the present month in point of severity was that of the year 1888. In this instance the mean of all the maxima was 48°·5, the mean of the minima 32°·3, and the mean temperature 40°·4. In April, 1888, the day values varied from 61°·9, on the 13th, to 42°·3, on the 8th, while the minima ranged from 27°·7 on the 6th, to 41°·8 on the 13th. Frosts, occurred on nine occasions during the first 13 days. Reference to existing records would indicate that the last occasion of such remarkable April cold occurred in the year 1837, which was the coldest April in London and Edinburgh in records extending over a century and a half. At both places the mean temperature of the whole month was under 40° F.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

APRIL SNOW AND FROST.

In the early morning hours of April 1st snow began to fall and by midday the depth was 6 inches ; again, about 5 a.m., on April 2nd, a further fall commenced, which, by 11 a.m., when it ceased, amounted to a further 6½ inches ; the total depth actually lying at that hour being about 10 inches.

The readings of the thermometer at 9 a.m. on the 2nd were:—

Maximum, 29°·8 Minimum, 10°·5 Ground (on the snow), 1°·6

No such temperatures have been recorded before in April at this station, though perhaps a minimum of 15°·0, on April 24th, 1908, is equally remarkable. CHARLES LEWIS BROOK.

Harewood Lodge, Meltham, Yorks., 3rd April, 1917.

My thermometer last night in the screen sank to 10°, and on the surface of the snow to —1°. Is not this an unprecedented reading for this locality in April ? I have recorded nothing like it, in either March or April, during the last thirty years. ROBERT CROSS.

Worstead, Norwich, 2nd April, 1917.

A marked feature of the unusual April snowfall yesterday was an interlude in the City from about 8.55 to 9.15 of fine grained " snow-hail." This fell in exceptional abundance. Although small grained and therefore very compact it became nearly an inch thick. It made walking on pavement or asphalte most slippery and the cart-horses had the utmost difficulty in getting along. The fall was altogether distinct in character from the ordinary spring scuds.

The snow here yesterday measured 8½ inches in twenty-four hours, making for the three successive days of snow just the foot, really *all* in April. J. E. CLARK.

Asgarth, Riddlesdown Road, Purley, Surrey, 3rd April, 1917.

SNOWFALL ON SALISBURY PLAIN.

For several nights past we have had snow, thawing by the following afternoon ; last night this culminated in a very heavy downfall, which, at 9 a.m. this morning, though already thawing, measured 11 inches in depth on the level and 1·92 when melted, being in this last respect the heaviest snowfall I have measured. Snow began about 6.30 yesterday evening with a light air from S. ; About 8 p.m. this had veered to W. and the snow was very heavy in very large flakes. F. J. WARDALE.

Shrewton, Wilts., 3rd April. 1917.

THE COLD WINTER.

THE mean temperature here was, 1916, December, 34°·7, 1917, January, 34°·7, February, 35°·0, March, 39°·7. The mean of the four months was 35°·9 or about 4°·2 below the average. Between the middle of November and end of March (136 days) there were eighty-eight occasions when the thermometer fell to 32° or below.

As the winter progressed I was led to conclude from the meteorological reports in the papers that the intensity of cold in the south-west of England was rather exceptional as compared with that experienced in many other parts of the country.

The mean temperature of the similar months of the cold winter of 1894-5 (at Montpelier, about three-quarters of a mile south-east from here) was 36°·7, so that the recent severity has been more prolonged (if the frosts were decidedly less severe in February) than in the last severe season twenty-two years ago.

For rain the comparison is 1894-5, 9·77 in.; 1916-7, 10·66 in.

The mildest period of the recent winter was from December 29th to January 4th. On the former date temperature rose to 55° in the afternoon and a queen wasp was observed flying about, having apparently mistaken December for May! W. F. DENNING.

Bristol, 1st April, 1917.

SMALL MONTHLY TEMPERATURE RANGE.

REFERRING to Mr. Brook's letter in the March Magazine I may note the two instances of smallest range here in the last thirty-one years. One was the warmest and the other almost the coldest December and January respectively :—

	Mean Max.	Mean Min.	Range.
December, 1898 ..	50°·7	46°·2	4°·5
January, 1917 ..	38°·6	33°·7	4°·9

JOHN DOVER.

Totland Bay, Isle of Wight, 20th March, 1917.

WATER DROPS BELOW FREEZING POINT.

WITH reference to Dr. G. C. Simpson's letter, on page 17 of March Magazine, I think that my description "Lofty Cirrus" may be trusted as quite exact. The term "Fog Bow" was *not* used by *me*, though printed at head of my letter in the December Magazine.

If it is any use to him the maximum temperature here in shade on November 28th was 48°. The minima the night before in shade, 26°·5, on grass, 16°; the night after, in shade, 43, on grass, 37·5.

H. A. BOYS.

North Cadbury Rectory, 3rd April, 1917.

DR. SIMPSON's letter brings up the interesting question of the life history of a crystal in its initial stages and of the point at which surface tension succumbs in its struggle to maintain a spherical or spheroidal shape in face of the orienting or vectorial powers of crystallisation. Wolfgang Ostwald quotes evidence of the spherical form being the antecedent of every crystalline growth, in his Chemistry. Wo. Ostwald, in "Colloid Chemie," does not credit surface tension with such supremacy, but allows that every crystal begins as a spheroid. Both base their deductions upon observations under the microscope, of the rounded edges of very small crystals. From W. W. Taylor (1915) may be obtained definite data which show that if a gram of water is sub-divided into 3×10^9 droplets, its surface energy would reach 4,500 ergs, or 15×10^{-5} ergs per droplet. Operating with the extremely small curvature (radius 3×10^{-4} cm.) this energy is the equivalent of that of a 6-inch spherical eggshell made of half-inch steel and strained to its elastic limit (13 tons per square inch). Compared with such energy that of crystalline orientation is almost powerless and the droplet would remain sensibly spherical until it had increased to maybe double the size. Its surface tension would then have lost 98 per cent. of its effectiveness and the spheroidal condition would so far prevail as to preclude any rainbow phenomena.

Such a growth (eightfold in weight) would call for a considerable vertical movement, in order to effect the necessary condensation by cooling. Growth of the droplets by coalescence may be left out of consideration owing to their great distance asunder, averaging 10^6 diameters, on the assumption that a cubic meter of cirrus air would contain 2 milligrams of condensed moisture.

As to undercooling, W. W. Taylor's figures are very definite, and show that the rate of condensation is intimately bound up with it as a storehouse for the "latent heat" released by a gas in condensing to a liquid. When, however, Dr. Simpson claims such undercooling as would permit of a cirrus cloud being largely composed of liquid droplets, he is asking much. All the evidence advanced by Wo. Ostwald relates to the formation of crystals and goes to prove that they begin with *solid* spheres. He might appeal to Wo. Ostwald's statement "Precipitation of an insoluble from liquids, seems always to occur primarily in the form of droplets, *i.e.*, in the state of undercooled liquid," but such an appeal would involve the conclusion that no solid particle could exist below a certain size, in the case of substances which expand at the moment of freezing or a few degrees above their freezing point, like water.

Doubtless a cirrus droplet would begin life as a sphere and would need undercooling in order that it might grow, but such undercooling does not preclude solidification : the difficulty lies in the reconciliation of the optical effects observed, with the existence of a skin of water on such a solid spherule of ice. In order to reconcile

them it is necessary to suppose an arrested process, such as would occur if the cirrus cloud ceased to ascend or reversed its movement. Further condensation would be thereby prevented and the amorphous ice spheres would become dry and capable of producing rainbow effects, albeit with a different refractive index. It would be interesting to know the angle subtended by Mr. Boys's rainbow.

EDWARD C. BARTON.

London, 3rd April, 1917.

ROYAL METEOROLOGICAL SOCIETY.

AT the meeting of the Royal Meteorological Society, held at Caxton Hall, Westminster, on March 21st, Major H. G. Lyons, F.R.S., President, in the chair, Major G. I. Taylor, R.F.C., delivered a lecture on "The Formation of Fog and Mist," of which the following is a summary :—

Fogs are due either to precipitation of water in the air or to a condition of the atmosphere which prevents smoke from being dispersed from the air close over the roofs of a town. The two necessary conditions for the formation of a smoke fog are that the wind velocity must be very small, and the air near the ground must be relatively cold compared with the air higher up for a period sufficiently long to collect enough smoke to form a fog.

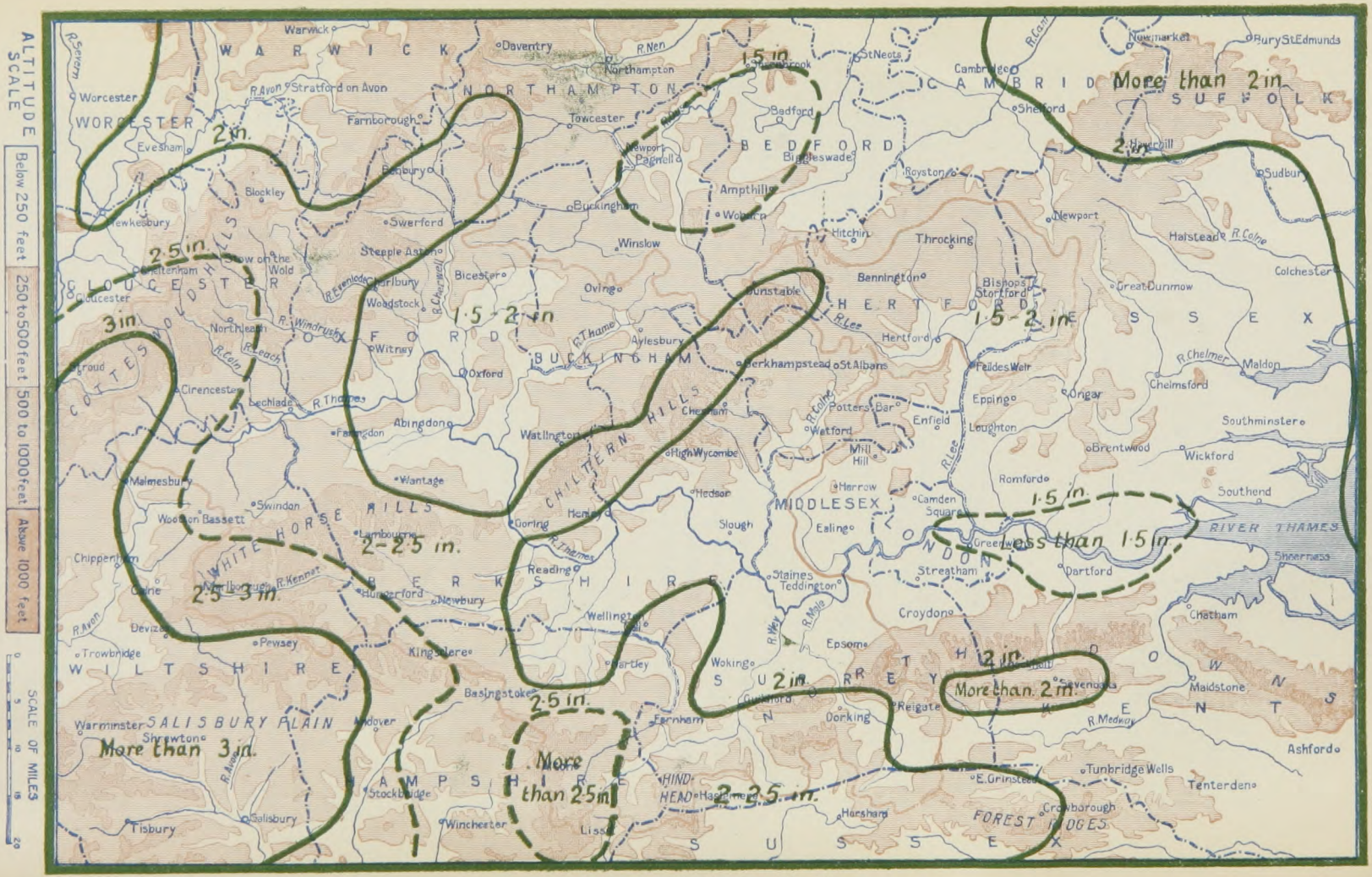
The formation of fog at sea can usually be traced to the cooling of the surface air when it flows from a place where the sea is warm to a place whe e it is cold, but sometimes a fog is caused by air flowing from a cold to a warm part of the sea. In the former case the fogs are usually low-lying and thick, while in the latter they are more frequently light fogs which stretch up to a considerable height.

Fogs consisting of small drops of water are formed on land, too, by the cooling of surface air, but in this case the air usually stays still while the lowering of the temperature of the ground by radiation to the sky at night cools the air near the surface.

Fogs of this type are not formed till the temperature has fallen considerably below the dew-point of the air during the day. This is because the formation of dew dries the air near the ground. Theoretical considerations show that the amount by which the temperature must fall below the dew-point before fog is produced depends on a complicated series of causes, but an empirical method has been devised for estimating whether, on any given night, there is enough water vapour in the air to form a fog if other conditions are suitable. This method can be used for local forecasting.

The following Fellows were elected :—P. Y. Alexander, W. T. Burgess, Capt. V. Campos. G. A. Crawley, L. Davis, Lieut. H. D. Grant, R. F. Grantham, Comm. K. M. Grieve, R.N., H. H. Humphreys, Flt.-Comm. F. Lucas, R.N., M. R. Pryor, H. C. Salmon.

THAMES VALLEY RAINFALL, MARCH, 1917.



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

Isohyetals.

Symons's Meteorological Magazine.

THE WEATHER OF MARCH.

THE outstanding feature of the weather of March was its low mean temperature, the departure from the normal taking the whole country being about three and a half degrees. The departure from the average was greatest (from 4° to 4°·5) in the east of England and the midlands, and least (2° to 2°·5) in the north of Scotland and in Ireland. In London (Camden Square) the mean temperature was 38°·6 or 3°·5 below the 50 years average, the coldest March since 1892, when the mean was 37°·4. The day maxima at this station were 4°·8 under, but the night minima only 2°·6 under the average. March was the fourth month with temperature well under the average, the mean (Camden Square) from December, 1916, to March, 1917, being 36°·7, or 3°·3 under the normal, the only colder period in the sixty years' record occurring in the four months ending March, 1891, when the mean was 35°·8. During the first half of March pressure was in general high over Iceland, Scandinavia, and Spitzbergen, and low over the British Isles, but in the second half of the month conditions were, on the whole, reversed, an anti-cyclone being frequently situated off our western coasts. The shade temperature fell to zero at Balmoral, and to 2° below zero at West Linton on the 9th, but in England the lowest values reported on this day were 8° at Alnwick Castle, and 9° at Hereford. High day temperatures were uncommon, although on the 16th, when the pressure distribution was favourable for strong southerly winds, the shade maximum rose to 61° at Foynes (Co. Limerick). As the southerly current spread eastward on the 17th several readings of 59° were recorded in the south of England including London (Westminster).

Bright sunshine varied from about 4·5 hours a day in the south-west of England, and 4 hours a day in the Channel Islands, to half this amount in the north of Scotland. As compared with the average for March no part of the country showed any pronounced excess, but there was a shortage of an hour per diem in the north of Scotland and the eastern counties of England.

The distribution of rainfall was exceedingly patchy and showed in some cases sharp variations over restricted areas. At only a few stations did the maximum daily fall exceed three quarters of an inch. Over the eastern half of Great Britain the total fall for the month was under two inches. The greatest rainfall, between five and eight inches, was recorded in the normally rainy districts in the west of Ireland and Scotland, and in Wales and the Lake district. Over Ireland a relatively uniform rainfall distribution obtained. Over the kingdom as a whole the general rainfall expressed as a percentage of the average was as follows :—England and Wales, 99 per cent.; Scotland, 73 per cent.; Ireland, 102 per cent.; British Isles, 92 per cent.

In London (Camden Square) the evaporation was ·52 in. Duration of rainfall, 32 hours. Sunshine, 69 hours.

RAINFALL TABLE FOR MARCH, 1917.

STATION.	COUNTY.	RAINFALL.						
		Aver. 1875–1909. in.	1917. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	1·70	1·74	+ ·04	102	·39	11	20
Tenterden	*Kent*	1·95	1·69	+ ·26	87	·25	4	19
Arundel (Patching)	*Sussex*	1·95	1·92	— ·03	98	·40	30	15
Fordingbridge (Oaklands)	*Hampshire*	2·09	3·13	+1·04	150	·45	11	22
Oxford (Magdalen College)	*Oxfordshire*	1·45	1·49	+ ·04	103	·32	6	20
Wellingborough (Swanspool)	*Northampn*	1·72	1·49	— ·23	87	·28	11	17
Bury St. Edmunds (Westley)	*Suffolk*	1·71	2·25	+ ·54	132	·61	11	18
Geldeston [Beccles]	*Norfolk*	1·57	2·58	+1·01	164	·69	11	19
Polapit Tamar [Launceston]	*Devon*	2·74	3·11	+ ·37	114	·42	4	21
Rousdon [Lyme Regis]	,,	2·30	2·96	+ ·66	129	·58	11	19
Stroud (Field Place)	*Gloucester*	2·01	3·43	+1·42	171	·70	6	23
Church Stretton (Wolstaston)	*Shropshire*	2·19	2·13	— ·06	97	·53	10	20
Boston	*Lincoln*	1·47	1·06	— ·41	72	·31	10	18
Worksop (Hodsock Priory)	*Nottingham*	1·70	1·89	+ ·19	111	·67	10	17
Mickleover Manor	*Derbyshire*	1·69	1·99	+ ·30	118	·65	10	17
Buxton	,,	3·99	2·69	—1·30	67	·65	10	23
Southport (Hesketh Park)	*Lancashire*	2·11	3·26	+1·15	155	·89	31	16
Arncliffe Vicarage	*York, W.R.*	5·17	2·69	—2·48	52	·66	28	15
Goldsborough Hall	,, ,,	2·00	2·79	+ ·79	139	·83	10	16
Hull (Pearson Park)	,, *E.R.*	1·84	1·77	— ·07	96	·52	10	17
Newcastle (Town Moor)	*North'land*	2·10	2·08	+ ·08	104	·60	10	15
Borrowdale (Seathwaite)	*Cumberland*	10·63	7·03	—3·60	66	1·70	18	14
Cardiff (Ely)	*Glamorgan*	2·89	3·04	+ ·15	105	·56	10	23
Haverfordwest	*Pembroke*	3·16	3·54	+ ·38	112	1·09	10	18
Aberystwyth (Gogerddan)	*Cardigan*	3·04	2·42	— ·62	80	·60	10	19
Llandudno	*Carnarvon*	2·13	2·13	·00	100	·40	31	18
Cargen [Dumfries]	*Kirkcudbrt.*	3·33	3·10	— ·23	93	·75	19	17
Marchmont House	*Berwick*	2·64	1·40	—1·24	53	·30	10	14
Girvan (Pinmore)	*Ayr*	3·62	2·46	—1·16	68	·48	19	19
Glasgow (Queen's Park)	*Renfrew*	2·61	...	...	...	...	...	...
Islay (Eallabus)	*Argyll*	3·68	3·32	— ·36	92	·68	28	22
Mull (Quinish)	,,	4·28	1·88	—2·40	44	·62	28	20
Balquhidder (Stronvar)	*Perth*	6·02	...	...	...	...	...	..
Dundee (Eastern Necropolis)	*Forfar*	2·06	1·83	— ·23	89	·90	10	17
Braemar	*Aberdeen*	2·87	2·54	— ·33	89	·54	5	15
Aberdeen (Cranford)	,,	2·65	2·08	— ·57	78	·48	10	21
Gordon Castle	*Moray*	2·36	1·41	— ·95	...	...	...	...
Drumnadrochit	*Inverness*	3·09	2·33	— ·76	75	·45	19	16
Fort William	,,	6·39	3·71	—2·68	58	1·00	28	20
Loch Torridon (Bendamph)	*Ross*	7·29	5·48	—1·81	75	·72	28	21
Dunrobin Castle	*Sutherland*	2·64	2·26	— ·38	86	·39	25	16
Killarney (District Asylum)	*Kerry*	4·51	2·86	—1·65	63	·46	3	26
Waterford (Brook Lodge)	*Waterford*	2·64	3·27	+ ·63	124	·65	4	17
Nenagh (Castle Lough)	*Tipperary*	2·99	2·88	— ·11	96	·57	3	23
Ennistymon House	*Clare*	3·24	3·05	— ·19	94	·65	4	21
Gorey (Courtown House)	*Wexford*	2·28	2·60	+ ·32	114	·62	4	15
Abbey Leix (Blandsfort)	*Queen's Co.*	2·59	4·18	+1·59	162	1·33	6	23
Dublin (Fitz William Square)	*Dublin*	1·98	3·00	+1·02	152	1·09	4	23
Mullingar (Belvedere)	*Westmeath*	2·64	2·00	— ·64	76	·54	6	17
Crossmolina (Enniscoe)	*Mayo*	4·36	4·69	+ ·33	108	·51	2	26
Cong (The Glebe)	,,	3·80	3·15	+ ·65	83	·61	6	27
Collooney (Markree Obsy.)	*Sligo*	3·33	3·52	+ ·19	106	·67	4	21
Seaforde	*Down*	2·84	2·53	— ·31	89	·39	28	20
Ballymena (Harryville)	*Antrim*	3·07	2·94	— ·13	96	·41	4	24
Omagh (Edenfel)	*Tyrone*	2·98	3·41	+ ·43	115	·44	28	25

SUPPLEMENTARY RAINFALL, MARCH, 1917.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	1·73	XI.	Lligwy	1·66
,,	Ramsgate	1·49	,,	Douglas, Isle of Man	2·17
,,	Hailsham	1·84	XII.	Stoneykirk, Ardwell House...	1·93
,,	Totland Bay, Aston House...	2·26	,,	Carsphairn, Shiel	4·23
,,	Stockbridge, Ashley..	2·90	,,	Langholm, Drove Road	2·45
,,	Grayshott	2·25	XIII.	Selkirk, The Hangingshaw..	·94
III.	Harrow Weald, Hill House...	1·77	,,	North Berwick Reservoir.....	1·14
,,	Pitsford, Sedgebrook.....	1·26	,,	Edinburgh, Royal Observaty.	1·08
,,	Woburn, Milton Bryant.....	1·51	XIV.	Biggar.....	2·10
,,	Chatteris, The Priory.....	1·60	,,	Maybole, Knockdon Farm ...	2·31
IV.	Elsenham, Gaunts End	1·55	XV.	Buchlyvie, The Manse.....	...
,,	Shoeburyness	1·85	,,	Ballachulish House	4·92
,,	Colchester, Hill Ho., Lexden	1·94	,,	Oban.....	2·19
,,	Ipswich, Rookwood, Copdock	2·56	,,	Campbeltown, Witchburn ..	2·48
,,	Aylsham, Rippon Hall..... ..	2·59	,,	Holy Loch, Ardnadam.....	4·03
,,	Swaffham	1·62	,,	Tiree, Cornaigmore	1·85
V.	Bishops Cannings	2·90	XVI.	Dollar Academy	...
,,	Wimborne, St. John's Hill ...	...	,,	Glenlyon, Meggernie Castle..	3·49
,,	Ashburton, Druid House.. ..	5·10	,,	Blair Atholl	1·52
,,	Cullompton	4·13	,,	Coupar Angus	2·29
,,	Lynmouth, Rock House	2·50	,,	Montrose, Sunnyside Asylum.	...
,,	Okehampton, Oaklands... ...	3·43	XVII.	Alford, Lynturk Manse.....	...
,,	Hartland Abbey.....	3·13	,,	Fyvie Castle	4·69
,,	St. Austell, Trevarna	4·61	,,	KeithStation	2·04
,,	North Cadbury Rectory.	3·12	XVIII.	Rothiemurchus	2·28
VI.	Clifton, Stoke Bishop	3·22	,,	Loch Quoich, Loan	11·10
,,	Ledbury, Underdown..... ...	2·66	,,	Skye, Dunvegan	3·54
,,	Shifnal, Hatton Grange.....	2·24	,,	Lochmaddy, Bayhead	...
,,	Droitwich.....	2·05	,,	Fortrose.....	1·94
,,	Blockley, Upton Wold.....	2·32	,,	Glencarron Lodge	5·50
VII.	Grantham, Saltersford.....	1·18	XIX.	Altnaharra	...
,,	Market Rasen	1·67	,,	Melvich	1·55
,,	Bawtry, Hesley Hall	1·52	,,	Loch More, Achfary	5·46
,,	Whaley Bridge, Mosley Hall	2·87	XX.	Dunmanway, The Rectory ..	3·29
,,	Derby, Midland Railway.....	1·33	,,	Glanmire, Lota Lodge.....	3·88
VIII.	Nantwich, Dorfold Hall	2·34	,,	Mitchelstown Castle.....	4·06
,,	Chatburn, Middlewood	...	,,	Darrynane Abbey.....	3·78
,,	Lancaster, Strathspey	2·06	,,	Clonmel, Bruce Villa	4·90
IX.	Langsett Moor, Up. Midhope	...	,,	Broadford, Hurdlestown.....	2·88
,,	Scarborough, Scalby	2·63	XXI.	Enniscorthy, Ballyhyland...	4·05
,,	Ingleby Greenhow	3·42	,,	Rathnew, Clonmannon	2·72
,,	Mickleton	1·60	,,	Ballycumber, Moorock Lodge	2·49
X.	Bellingham, High Green Manor	1·79	,,	Balbriggan, Ardgillan	2·54
,,	Ilderton, Lilburn Cottage ...	1·31	,,	Castle Forbes Gardens.....	2·83
,,	Keswick, The Bank.....	2·83	XXII.	Ballynahinch Castle.....	4·56
XI.	Llanfrechfa Grange	2·50	,,	Woodlawn	2·39
,,	Treherbert, Tyn-y-waun	5·03	,,	Westport, St. Helens	3·74
,,	Carmarthen, The Friary	3·10	,,	Dugort, Slievemore Hotel ...	3·28
,,	Fishguard, Goodwick Station.	1·85	XXIII.	Enniskillen, Portora.....	2·58
,,	Crickhowell, Tal-y-maes.....	4·00	,,	Dartrey [Cootehill]	3·54
,,	New Radnor, Ednol	3·87	,,	Warrenpoint, Manor House ..	3·10
,,	Birmingham WW., Tyrmynydd	4·40	,,	Belfast, Cave Hill Road	3·84
,,	Lake Vyrnwy	4·35	,,	Glenarm Castle	3·50
,,	Llangynhafal, Plas Drâw.....	3·58	,,	Londonderry, Creggan Res...	2·89
,,	Dolgelly, Bryntirion.....	4·99	,,	Dunfanaghy, Horn Head ...	3·44
,,	Bettws-y-Coed, Tyn-y-bryn...	3·53	,,	Killybegs	3·96

Climatological Table for the British Empire, October, 1916.

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	69·3	5	29·3	22	60·2	47·2	48·0	85	108·6	28·9	3·25	23	7·0
Malta	81·9	27	60·0	27	76·7	65·6	...	75	137·5	...	·53	5	1·7
Lagos	89·0	*30	70·0	1	85·2	73·1	73 3	79	158·5	68·5	6·04	16	7·7
Cape Town	82·5	17	40·9	21	69·9	53·9	52·0	69	....	...	·76	7	4·8
Johannesburg	89·6	14	42·4	6	77·9	54·7	44·6	54	...	41·4	1·94	8	4·2
Mauritius	82·2	29	61·4	18	78·3	64·8	61·7	73	...	52·9	3·79	24	5·8
Bloemfontein	93·4	13	35·6	6	80·4	51·8	44·9	47	.	...	2·62	8	3·7
Calcutta...	90·3	22	73·5	10	86·8	76·6	76·3	87	...	70·5	14·62	17	7·0
Bombay...	89·4	19	74·8	16	86·2	77·3	76·0	83	134·0	69·1	4·79	14	5·7
Madras	98·4	3	72·5	21	89·0	76·3	74·4	82	169·4	70·2	15·30	15	5·8
Colombo, Ceylon ...	85·9	2	73·1	3	84·9	75·8	73·0	82	159·3	68·8	3·25	19	7·6
Hongkong	85·3	10	65·8	31	80·2	72·3	65·8	71	...	...	·73	6	6·1
Sydney	80·4	23	50·0	18	68·4	56·2	54·2	70	141·0	40·7	11·14	17	5·7
Melbourne ...	75·4	8	38·7	1	65·8	48·2	46·6	66	141·5	27·2	3·09	14	6·0
Adelaide ...	79·8	11	38·3	18	68·9	51·2	47·9	62	145·7	31·3	1·92	13	5·5
Perth	82·0	17	44·0	12	68·6	51·2	48·3	64	151·5	37·5	1·90	11	5·0
Coolgardie	91·0	27	41·2	12	73·3	52·4	43·7	45	153·8	35·4	1·84	9	4·0
Hobart, Tasmania ..	76·5	8	35·8	1	61·4	45·8	43·1	65	143·7	26·2	2·46	19	7·0
Wellington ...	68·0	9	36·9	3	59·6	47·8	47·3	79	137·3	27·2	5·23	17	7·0
Auckland ...	...	...	...	...	63·2	52·8	...	..	...	...	6·00	21	...
Jamaica, Kingston ..	91·0	9	70·6	19	86·5	73·1	73·1	89	...	...	8·17	18	6·4
Grenada	90·0	13	70·0	+7	85·0	75·0	...	80	135·0	...	4·57	12	...
Toronto	85·2	8	29·7	18	59·6	39·5	40·7	80	148·8	41·8	3·91	9	4·9
Fredericton	81·0	5	20·0	19	58·0	34·1	39·1	81	...	...	3·58	12	4·8
St. John, N.B. ...	75·0	4	30·2	19	54·6	40·4	41·0	78	128·2	20·5	4·31	10	5·0
Victoria, B.C.	67·3	9	37·7	12	55·4	43·0	42·0	77	117·0	27·0	1·56	12	5·2

* 31, + 8.

Malta.—Crops practically lost through want of rain.

Johannesburg.—Bright sunshine, 263·6 hours.

Mauritius.—Mean. temp. 1°·1 below. Dew point 0°·2 below, and R 2·41 in. above, average.

COLOMBO, CEYLON.—Mean temp. 80°·3, or 0°·2 above, dew point 0° 9 below, and R 11·03 in. below, averages. Mean hourly velocity of wind 6·4 miles.

KONGKONG.—Mean temp. 75°·9; mean hourly velocity of wind 12·9 miles. Bright sunshine 185·5 hours.

Sydney.—Very wet month, only twice exceeded for October.

Melbourne.—Mean temp, 0°·6 below, and R ·51 in. above, averages. TS on 31st, streets flooded.

Adelaide.—Mean temp. 2°·6 below, and R ·51 in. above, averages.

Perth.—Heavy wind storm on 5th and 6th. Maximum 60 miles per hour.

Coolgardie.—Temperature 1°·1 below, and R 1·00 in. above, averages.

Hobart.—Rainfall ·23 in. above average.

Wellington.—Mean temp. 0°·4 below, and R 1·02 in., above, averages. Bright sunshine 139·2 hours. Frost on three days.

JAMAICA.—Rainfall much above average.

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SOME PROBLEMS CONNECTED WITH THE TEMPERATURE ELEMENT IN CLIMATOLOGY.

By L. C. W. Bonacina.

Of the four fundamental meteorological elements—temperature, moisture, wind, and sunshine—with which the climatologist is concerned in devizing schemes for the comparison and classification of the diverse climatic regions of the Earth, temperature is the one which is given usually the foremost place in works on climatology, and it is, therefore, perhaps, specially unfortunate that it should also be the one which in its climatological signification presents more perplexing problems than any of the others. The reason is this : that the temperature element of the atmosphere which imparts to animals and plants sensations and effects of heat and cold, and is responsible for the temperatures assumed by the surface of inanimate bodies, is compounded of two separate factors. Firstly, there is what is commonly known as the temperature of the air, a definite physical condition scientifically measurable in different ways but best, perhaps, by enclosing a thermometer in some sort of shelter from radiation like the familiar Stevenson screen ; secondly, there are the sensations and effects of heat and cold attributable to direct radiation received from the sun or lost from the earth, to which must be added the various local radiations and reflections of heat which take place between body and body ; and this complexus of radiation unfortunately offers a most refractory problem in the thermal investigation of climate for the very good reason that it can not be measured in definite climatological terms, as will shortly be shown. The thermal element of climate comprises, therefore, air temperature plus radiation effects, in as much as the sense of " hotness " experienced by human beings, which is also an index of important consequences in the growth of plants and crops, depends on the conjoint influence of these two factors, and I propose to distinguish this thermal combination from the measurable temperature of the air conveniently by the indeterminate expression " temperature of the atmosphere " (using the term atmosphere in the sense of general climatic environment

without special reference to the air we breathe), meaning thereby simply that temperature which the surface of a body will assume on exposure to the air and radiation, and which will, of course, vary for the same intensity of radiation and the same air temperature with the nature and composition of the body, as well as with the amount of wind blowing over the surface of the body.

First, by way of a geographical illustration, let the climate of London be compared with that of Rome. The Italian capital has a mean annual air temperature very approximately 10° F. higher than the English, the former being almost exactly 60° F., and the latter slightly under 50° F., the latitude difference between the cities being likewise practically 10°. But the 10° difference in air temperature although a most important measure of the thermal difference between London and Rome, does not afford a full picture of the contrast between England and Italy in respect of warmth, because the greater intensity of solar radiation in latitude 41½° N. than in 51½° N., manifests itself directly to sensation as well as indirectly by raising the mean annual air temperature the said 10° F.

One need not, however, travel to observe the necessity of studying the two thermal factors in question, and for a second illustration let a seasonal experience be taken and the climate of April be compared with that of October. Now these two months, situated diametrically opposite one another in the earth's orbit round the sun, have each an average mean air temperature which in temperate climates does not materially differ from the mean annual temperature, so that the periods may be regarded as nodal points separating the five definitely warm months of the year from the five definitely cold months. In continental countries the mean temperatures of April and October are in fact substantially identical, though in maritime countries like England, where the seasonal maxima and minima of temperature lag longer behind the solstices, the advantage of air warmth is with October by some 2° or 3° F. So much greater, nevertheless, is the power of the sun and the length of the day in April than in October that it is the universal practice of meteorologists to place the former month by preference in the "summer half of the year"—thereby giving expression to the paradox that a month which is distinctly colder than another, as judged solely by the temperature of the air, may be indeterminately warmer when radiation influences in conjunction with air temperature are taken into account.

In these illustrations an attempt is made to visualize the two separate factors of our thermal environment, of which everyone is more or less conscious, but of which one has been neglected in meteorological thermometry simply because no satisfactory method has yet been devized for its measurement. But the importance of the question is further emphasized when, instead of confining

our attention to the variations of climate which attend change of latitude or change of season, we consider such as accompany change of altitude. Every mountaineer knows that at great altitudes the heat of the sun feels inordinately great in spite of the low temperature of the air, and in like manner he no doubt finds that the direct chill from rock radiation at night is more noticeable than it is in the denser air of lower levels. It would, perhaps, be true to say that whereas at sea-level where the air is dense the temperature of the air is of greater consequence in the physiological estimation of warmth than radiation, at high levels conditions tend to become reversed. That this is, amd must be so, can, I think, be inferred by contemplating what meaning may be attached to the so-called temperature of planetary space. Whatever the precise trend of recent physical theory may be concerning "ether" as the basis of "matter," I assume that in planetary space there exists no molecular substance possessing temperature, and that consequently the phrase "temperature of space" can mean nothing more than the temperature to which some imaginary body placed beyond the confines of the Earth's atmosphere would be brought by the totality of radiation influences to which it would be subjected—which temperature would be conditioned by the nature of the body. On the surface of the moon, apparently, "temperature" means radiation exclusively, in default of any molecular gaseous envelope. If, however, a very thin atmosphere does exist on the moon, say of about 1 mm. pressure, then it is evident that objects on its surface must be in a definite molecular environment, however thin it may be, possessing a temperature of its own. But a tenuous atmosphere like that will impart its temperature to a small object immersed in it more slowly than a dense gas in as much as according to the kinetic theory the number of molecular bombardments upon unit area of surface of the object is less. Similarly one can not doubt that on the summit of Mont Rosa, 15,000 odd feet above the sea, where half the mass of the atmosphere lies below, the thermal consciousness of the Observatory officials must be governed more decidedly by the various direct radiation influences and less decidedly by the temperature of the air than is the case with ourselves in the dense atmosphere of London near sea-level where not only is solar radiation by day materially softened down, but also terrestrial radiation at night is not in the ordinary way very conspicuous to the senses except indirectly through its effect in chilling the air which surrounds us. It should hardly be necessary to point out that for the same temperate dense air *feels* colder than rare air in the case of ordinary temperatures below that of the blood, and hotter in the case of temperatures above that point, but these latter are only occasionally met with locally in hot countries.

(To be continued.)

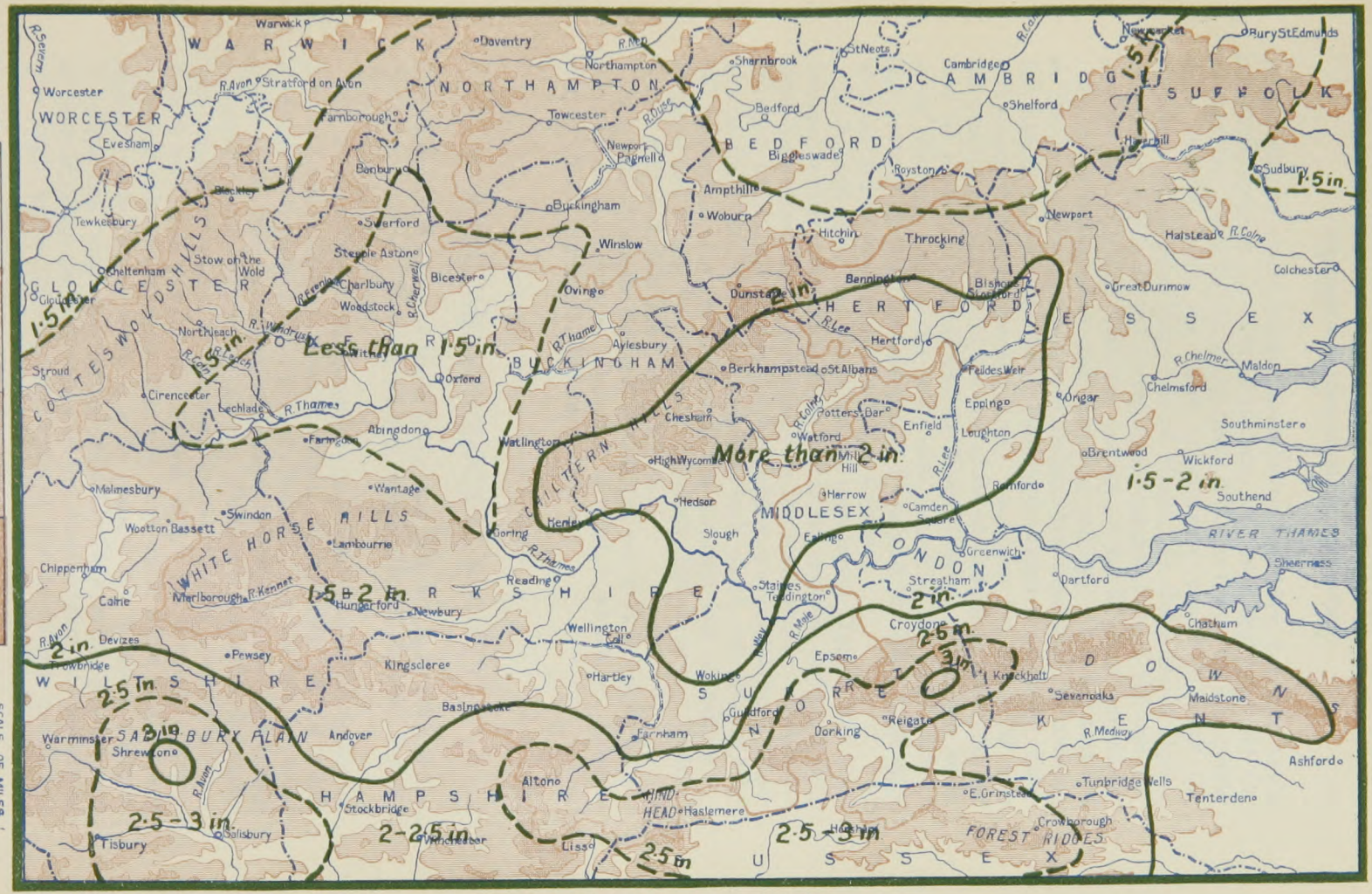
THE WEATHER OF APRIL.

THE outstanding feature of the weather of April was the very low mean temperature which was accompanied by considerable falls of snow in places. During the first eighteen days of the month the low temperatures that had prevailed without interruption since the beginning of the year continued with practically undiminished intensity, but during the last ten days a gradual rise set in which culminated in warm weather at the close.

The month opened with very low temperatures the thermometer falling to 4° in the screen at Eskdalemuir on the night of the 1st-2nd while at Bothalhaugh, Morpeth the Rev and Hon. W. Ellis reports a shade value of 3° on the lawn 90 feet above the river and of —5° lower down near the river. Other stations reporting temperatures under 10° were Rounton (Yorks., N.R.), 7°, Buxton, 8°, and Newton Rigg, 5°. Heavy falls of snow were of frequent occurrence during the first half of the month, when the British Isles were largely under the influence of shallow cyclonic disturbances moving in a northerly or easterly direction. On the 24th an anticyclone, whose centre had some days previously lain to the westward of Ireland, began to spread eastward, and until the end of the month this system was accompanied by relatively warm weather very generally. The only interruption in the spell of fine and dry weather occurred about the 27th, when a depression travelling eastward at some distance to the north produced strong winds and rain in the north of Scotland. At the close of the month some relatively warm days were experienced. The highest values reported on the 30th were 67° at London (Camden Square), and also at Ross-on-Wye, while as far north as Nairn a temperature of 60° was reported.

For the British Isles as a whole the mean temperature was about 4° below the average, the greatest deficit, 5°, being recorded in the eastern and south-eastern parts of Great Britain, and the least, 3° below the average, in the Channel Islands. The mean temperature in London (Camden Square) was 43°·1, being the lowest during the 60 years covered by this record in the Glaisher Stand. The nearest approach was in 1860, when the mean was 43°·9. At Greenwich the mean temperature (mean of daily maximum and minimum) was 42°·7, the month being the coldest April since 1839, when the mean was 42°·1, but 2°·6 warmer than the record cold of 1837 (39°·5), which seems to have been the coldest April in the London district and also at Edinburgh during the last century and a half. From information regarding April, 1917, kindly supplied by Mr. Watt, Secretary of the Scottish Meteorological Society, it appears that in the north-east of Scotland, where Gordon Castle had a mean temperature of 39°·4, April, 1917, was the coldest April since 1812, when the mean was 38°·2, but further south, at Edinburgh, April, 1879, was slightly colder than that of 1917. The

THAMES VALLEY RAINFALL, APRIL, 1917.



temperature of every month, since December, 1916, has been much below the average at Camden Square, the mean deficiency for the five months, December to April, being 3°·6, the lowest for this period since 1890-91, when the mean temperature was 4°·0 below the average. At Totland Bay, Isle of Wight, Mr. John Dover reports an average deficit of 4°·1 in the mean temperature of the last five months, as compared with the normal of the 31 years preceding.

The distribution of rainfall was very patchy. At a few stations in Devon and the south-east of Ireland less than half the average fell, but in the extreme north, both of Scotland and Ireland, there was a considerable excess in places. Less than two inches of rain fell over the greater part of the east of Great Britain and even as far west as parts of Cornwall and the Welsh Border. Relatively small areas reaching four inches were only found in the Lake District and parts of the rainiest portions in Wales and the West Highlands, with one or two spots with as much as 6 inches.

In Ireland there was less than an inch round Dublin, less than two inches over most of the south and in the interior, and more than three inches only in the mountains on the west coast. An absolute drought, which has extended well into May, commenced very generally on the 19th. Over the Kingdom, as a whole, the general rainfall expressed as a percentage of the average was as follows :— England and Wales, 95 per cent ; Scotland, 106 per cent. ; Ireland, 85 per cent ; British Isles, 95 per cent.

In London (Camden Square) the rainfall was 2·19 in., being 26 per cent. above the average. Duration of rainfall, 44 hours. Evaporation, 1·18 in. Sunshine, 149 hours.

ROYAL METEOROLOGICAL SOCIETY.

The Monthly Meeting of the Society was held on April 18th at the Society's Rooms, Victoria Street, Major H. G. Lyons, F.R.S., President, in the Chair.

Mr. E. G. Bilham read a paper on " The Diurnal Variation of Atmospheric Pressure at Benson, Oxon., during 1915," in the course of which he remarked that he had obtained from the hourly values of the Dines' float barograph the mean monthly diurnal inequalities of pressure and analysed them in a Fourier series, with the result that, except in regard to the amplitude of the 24 hour term, they agreed very closely with the normal values for Kew and Oxford. The probable errors show that the first order term is the most susceptible to casual error due to non-periodic pressure changes. A comparison with the normal monthly Kew values showed that at Benson relatively high values of the diurnal range are associated with high values of the amplitude of the 24 hourly oscillation.

The amplitudes of the second and third order are similar at the two stations. The President and Messrs. Whipple, Bryant, Chree, Harding and Brooks took part in the discussion.

A paper by Lieut. C. D. Stewart, R.E., dealing with "Atmospheric Electrical Phenomena during Rain," was also read, in which the values of the potential gradient occurring during rain had been investigated. The maximum is in summer and the minimum in winter, but the maximum "fine weather" values occur in the later season. The form of the diurnal variation of rain potential gradient is uncertain, although it appears to have only one oscillation in 24 hours as compared with the double oscillation in fine weather. In most cases rain depresses the potential gradient and is a function of the rate of fall. The President and Messrs. Chree and Bilham took part in the discussion.

The following new Fellows were admitted, *viz.*, M. A. Giblett, Lieut. M. J. D. Mayall, J. D. North and F. A. Ward.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

WATER DROPS BELOW THE FREEZING-POINT.

Referring to Dr. G. C. Simpson's interesting letter on the above in the March Magazine I may be allowed to record an instance of rain falling at a temperature below the freezing-point. At 8 a.m. on February 16th the air temperature was 30° F., and the ground was covered with dry snow. I was inside a zinc roof building when I heard a loud and sudden sound on the roof like the dropping of hailstones. I immediately went out and to my surprise found that it was a shower of real rain drops of large size, and the water was dripping from the eaves. On surveying the sky I noticed a small dark cloud just overhead with the rest of the sky quite clear. The surface wind at the time was calm or very light, but the cloud moved at a fair rate from the south-west. The base of it was about a mile high. At the time there was no mist on the neighbouring mountains (2,600 feet high), but, towards the afternoon, the temperature rose the mist descended to about 2,300 feet on the hills and a thaw set in. The shower occurred just at the transition from the cold to the mild spell of weather. The rain presumably originated in a layer of relatively warm air, and merely fell through a stratum of air which was below 32° at the time.

J. R. GETHIN JONES.

Blaen-y-Cwm, S. Wales, April 8th, 1917.

THE GREAT SNOWSTORM ON THE 1st APRIL, 1917.

THE people in East Clare will long remember Palm Sunday, 1917. A little snow fell on the night of March 31st, but it was all melted by noon on April 1st. It began to snow again at 2.45 p.m. on that day, and at 5.30 p.m. it was 9 inches deep on all the roads about Broadford. Two motor cars came to Broadford early in the afternoon and had to stay there till the morning of the 4th. The mail car left Broadford at 6.40 p.m. for Limerick, and did not get there till the evening of the 2nd. Thus taking 24 hours to do 12 miles. The direct road from Broadford to Killaloe is only 8 miles over the mountain. The first four miles of which, to the village of Kilbane, is nearly level, Kilbane being 200 feet above the sea. A mile further on the road gets to the top of the pass of Slounagalough, 892 feet above the sea. It then falls 700 feet in half-a-mile, and the last 2½ miles to Killaloe is nearly level. On April 1st a man named James Vaughan (aged 40) and his nephew, Michael Vaughan (aged 12), who both live at Kilbane, drove a trap to Killaloe. On their way home that evening, they were caught in the snow storm . They left their trap at a farm house at the foot of the eastern side of the pass, and started to walk home, leading the horse with them. On the evening of the 2nd some men went to the top of the pass, looking for sheep that had been lost in the snow, and were much surprised to see a horse standing there with harness on him. In a short time they found the two Vaughans lying dead in the snow. There was very severe frost that night. My thermometer here went down to 16°. Only once before (viz., on February 4th) during the past very severe winter, was it so low. No doubt they were killed by the great cold, as there is not a bit of shelter to be found on the " Sap Road " as it is called locally. Very few cars ever go over this road, though I have seen a map for motorists, on which it was marked as the main road to Killaloe. And it is said that one night, some time ago, a strange motor car did actually drive over the " Sap." The driver no doubt driving by the map.

On Monday, April 2nd, Broadford was quite cut off from the outside world. No mail car came or went. All the roads being quite blocked up with snow drifts, several feet deep. The day was very fine, however, with a bright warm sun. The snow on the level ground, where it had not drifted, was 12 inches deep. But just about the rain gauge it was 18 inches deep. That is 6 inches over the rim of the gauge. Never before has the gauge been quite hid by snow, during the thirty-two years it has been here.

On Tuesday, April 3rd, it was snowing nearly all day and very cold. A mail car came from Quin railway station at 2 p.m. The road here from there being fairly level ground was not blocked with snow. But the mail car from Broadford to Scariff, which started at 2.30 p.m.,

ran into a drift two miles from here. The horse fell, and the car was smashed, and the driver had to return to Broadford. In the evening one of the motor cars tried to get to Limerick, but found the road so blocked with snow that it had to return here.

On Wednesday, April 4th, the Broadford-Limerick road was cleared by the road men. A motor bread van came to Broadford to the great pleasure of everyone.

The greatest previous snow storm I can remember here was on February 19th, 1892. Then it was generally only 5 inches deep. But a severe E. gale blew the snow off the fields into the cuttings on the roads, which were quite blocked up with very deep drifts.

Many old men about here have told me they never saw the snow so deep as it was on the morning of April 2nd.

W. A. BENTLEY, Lieut.-Col.

Hurdlestown, Broadford, Co. Clare, 11th April, 1917.

MR. DARKEN'S WEATHER FORECAST.

MR. DARKENS forecast of weather published in your Magazine for March is like most long distance forecasts so vague that it is difficult to test its accuracy. He gives eight periods aggregating 86 days, and varying in length from eight to fifteen days, during which he expected the British Isles to lie in the track of depressions producing strong winds and bitter weather. In two cases these periods were consecutive, in two they were separated by one day in two by two days, and in one case by three days. Thus there were nine days concerning which no prediction was made. From the Weather Reports of the Meteorological Office and other sources it is clear that the whole period was abnormally cold, but the nine days not specified do not seem to have been any warmer than the 86 days included in the prediction. On these nine days the distribution of pressure was essentially of a cyclonic type and gales mostly from the north and east or south-east occurred on six of the days, accompanied in general by snow or rain.

The first cyclonic period, January 1st to 11th, may be taken as a successful forecast, but the second January 15th to 24th was a failure, as the conditions during that time were on the whole anti-cyclonic. The third period, January 26th to February 2nd, included several days with strong winds or gales, but no depressions came near to the British Isles. This forecast was thus indeterminate.

The fourth cyclonic period, February 3rd to 16th, was a total failure, the conditions from the 5th to the 16th being markedly anti-cyclonic, but the fifth cyclonic period, February 19th to March 5th was indeterminate, depressions, mostly in the far north, or to the westward of Ireland, dominating the weather from the

20th to the 27th and from March 2nd to 7th. A marked anti-cyclone occurred from February 27th to March 1st, The sixth cyclonic period from March 8th to 18th,, was, on the whole, a failure, for although there were shallow depressions on several days, they did not produce strong winds, except on the 8th, and the British Isles were largely under the influence of an anti-cyclone from the 16th to the 18th.

The seventh period, March 20th to 27th, may be cast as a success on account of a cyclone which passed well to the north of the British Isles on the 25th and 26th, while the eighth period, March 28th to April 6th, was a success as far as depressions are concerned, though these were not accompanied by strong gales.

Thus it will be observed that taking the predictions for the specified periods three appear to have been successful, two were indeterminate and three were failures. Thus Mr. Darken's system which he does not describe produced results very similar to what might be expected by mere guessing. No doubt it would be possible for a " partisan " of the system to claim more hits than misses, and for an opponent to assert that there were more misses than hits, but in my opinion if Mr. Darken had confined himself to saying that the whole period from January 1st to April 6th, would be abnormally cold, he would have made a fair case for a further consideration of his methods.

R. C. MOSSMAN.

334, Camden Road, London, N. 7, May 9th, 1917.

DEW AND HOURLY TEMPERATURE.

On page 10 of Vol. 50 you published some figures and remarks of my own regarding dew deposit. I have pursued the investigation of the matter through the two intervening years; but the results have been by no means more lavish. All I got in 1915 amounted to no more the ·3 in.; and last year I secured only ·216 in. Surely somebody in the British Isles gets more dew than I.

In the communication referred to I gave the horary value of fluctuations in temperature during the years 1913 and 1914. I herewith forward the same for two succeeding years.

	1915.	*1916.*
Hours with temperature below 32° ..	310	269
Temperature 32° to 40° ,, ..	1,361	1,338
,, 40 °to 50° ,, ..	2,971·5	2,726·5
,, 50° to 60° ,, ..	2,176·5	2,426
,, 60° to 70° ,, ..	1,281·5	1,452·5
,, 70° to 80° ,, ..	556	453·5
,, 80° to 90° ,, ..	102	118·5
With temperature higher than 90° ..	1·5	·0

WILLIAM GODDEN.

20, Richmond Avenue, Willesden, N.W., 28th January, 1917.

RAINFALL TABLE FOR APRIL, 1917.

STATION.	COUNTY.	RAINFALL.						
		Aver. 1875–1909. in.	1917. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	1·74	2·19	+ ·45	126	·42	2	15
Tenterden	*Kent*	1·77	1·87	+ ·10	106	·27	14	14
Arundel (Patching)	*Sussex*	1·82	1·84	+ ·02	101	·37	11	12
Fordingbridge (Oaklands)	*Hampshire*	1·92	2·36	+ ·44	123	1·05	2	13
Oxford (Magdalen College)	*Oxfordshire*	1·67	1·27	— ·40	76	·23	11	14
Wellingborough (Swanspool)	*Northampn*	1·78	1·44	— ·34	81	·24	11, 16	13
Bury St. Edmunds (Westley)	*Suffolk*	1·62	1·65	+ ·03	102	·35	16	16
Geldeston [Beccles]	*Norfolk*	1·55	1·82	+ ·27	118	·36	2	19
Polapit Tamar [Launceston]	*Devon*	2·34	2·72	+ ·38	116	·55	11	15
Rousdon [Lyme Regis]	,,	2·39	1·17	—1·22	49	·23	1	12
Stroud (Field Place)	*Gloucester*	2·09	1·62	— ·47	78	·39	1	14
Church Stretton (Wolstaston)	*Shropshire*	2·20	1·84	— ·36	84	·35	5	13
Boston	*Lincoln*	1·57	2·01	+ ·44	128	·73	11	16
Worksop (Hodsock Priory)	*Nottingham*	1·62	1·46	— ·16	90	·49	11	12
Mickleover Manor	*Derbyshire*	1·77	1·23	— ·54	69	·24	1	13
Buxton	,,	2·87	3·39	+ ·52	118	·56	8	15
Southport (Hesketh Park)	*Lancashire*	1·84	1·64	— ·20	89	·43	17	13
Arncliffe Vicarage	*York, W.R.*	3·73	...	...	...	...	...	...
Goldsborough Hall	,, ,,	1·89	1·99	+ ·10	105	·28	5	15
Hull (Pearson Park)	,, *E.R.*	1·69	1·71	+ ·02	103	·24	16	16
Newcastle (Town Moor)	*North'land*	1·84	2·28	+ ·44	124	·57	2	14
Borrowdale (Seathwaite)	*Cumberland*	6·91	5·64	—1·27	82	1·95	14	15
Cardiff (Ely)	*Glamorgan*	2·50	2·16	— ·34	86	·54	11	17
Haverfordwest	*Pembroke*	2·82	2·19	— ·63	78	·50	17	16
Aberystwyth (Gogerddan)	*Cardigan*	2·48	2·91	+ ·43	117	·74	17	17
Llandudno	*Carnarvon*	1·79	1·58	— ·21	88	·38	10	16
Cargen [Dumfries]	*Kirkcudbrt.*	2·50	2·76	+ ·26	110	·95	10	13
Marchmont House	*Berwick*	2·28	2·98	+ ·70	131	·81	3	13
Girvan (Pinmore)	*Ayr*	2·81	3·12	+ ·31	111	·53	9	22
Glasgow (Queen's Park)	*Renfrew*	1·86	...	...	...	...	...	...
Islay (Eallabus)	*Argyll*	2·64	2·61	— ·03	99	·51	17	21
Mull (Quinish)	,,	2·98	2·67	— ·31	90	·44	13	22
Balquhidder (Stronvar)	*Perth*	4·15	1·95	—2·20	47	·50	8	10
Dundee (Eastern Necropolis)	*Forfar*	1·93	1·43	— ·50	74	·24	13	13
Braemar	*Aberdeen*	2·30	1·33	— ·97	58	·21	27	15
Aberdeen (Cranford)	,,	2·23	1·65	— ·58	74	·45	1	19
Gordon Castle	*Moray*	1·74	2·76	+1·02	159	...	...	...
Drumnadrochit	*Inverness*	1·85	2·63	+ ·78	142	·35	12	23
Fort William	,,	3·65	2·53	—1·12	69	·47	13	23
Loch Torridon (Bendamph)	*Ross*	4·70	6·45	+1·75	137	·87	27	26
Dunrobin Castle	*Sutherland*	2·02	2·73	+ ·71	135	·90	27	20
Killarney (District Asylum)	*Kerry*	3·46	2·23	—1·23	64	·46	10	18
Waterford (Brook Lodge)	*Waterford*	2·68	1·58	—1·10	59	·62	1	10
Nenagh (Castle Lough)	*Tipperary*	2·54	2·44	— ·10	96	1·05	1	13
Ennistymon House	*Clare*	2·81	1·69	—1·12	60	·40	10	16
Gorey (Courtown House)	*Wexford*	2·37	1·00	—1·37	42	·20	5	10
Abbey Leix (Blandsfort)	*Queen's Co.*	2·54	1·31	—1·23	52	·37	2	12
Dublin (Fitz William Square)	*Dublin*	2·03	·90	—1·13	44	·18	17	12
Mullingar (Belvedere)	*Westmeath*	2·37	1·91	— ·46	81	·30	18	14
Crossmolina (Enniscoe)	*Mayo*	3·13	3·80	+ ·67	122	·67	10	18
Cong (The Glebe)	,,	2·98	2·64	— ·34	89	·90	10	14
Collooney (Markree Obsy.)	*Sligo*	2·52	2·69	+ ·17	107	·53	17	17
Seaforde	*Down*	2·76	2·04	— ·72	74	·57	10	14
Ballymena (Harryville)	*Antrim*	2·57	4·88	+2·31	190	1·50	10	20
Omagh (Edenfel)	*Tyrone*	2·50	2·47	— ·03	99	·49	17	16

SUPPLEMENTARY RAINFALL, APRIL, 1917.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Warlingham, Redvers Road .	2·96	XI.	Lligwy	3·20
,,	Ramsgate.....	1·48	,,	Douglas, Isle of Man	2·13
,,	Hailsham	1·55	XII.	Stoneykirk, Ardwell House...	1·63
,,	Totland Bay, Aston House...	2·70	,,	Carsphairn, Shiel.....	3·18
,,	Stockbridge, Ashley..	2·40	,,	Langholm, Drove Road	3·31
,,	Grayshott.....	2·75	XIII.	Selkirk, The Hangingshaw..	3·46
III.	Harrow Weald, Hill House...	2·28	,,	North Berwick Reservoir... ..	1·56
,,	Pitsford, Sedgebrook....	1·50	,,	Edinburgh, Royal Observaty.	1·20
,,	Woburn, Milton Bryant.....	1·64	XIV.	Biggar.....	2·66
,,	Chatteris, The Priory..... ...	1·13	,,	Maybole, Knockdon Farm ...	1·78
IV.	Elsenham, Gaunts End	2·05	XV.	Buchlyvie, The Manse.....	...
,,	Shoeburyness	1·68	,,	Ballachulish House	3·36
,,	Colchester, Hill Ho., Lexden	1·85	,,	Oban.....	2·28
,,	Ipswich, Rookwood,Copdock	1·51	,,	Campbeltown, Witchburn ..	2·54
,,	Aylsham, Rippon Hall.... ..	2·29	,,	Holy Loch, Ardnadam.....	2·79
,,	Swaffham	1·79	,,	Tiree, Cornaigmore	1·56
V.	Bishops Cannings	1·75	XVI.	Dollar Academy	...
,,	Wimborne, St. John's Hill ...	...	,,	Glenlyon, Meggernie Castle..	1·72
,,	Ashburton, Druid House.. ...	1·80	,,	Blair Atholl	1·09
,,	Cullompton	1·68	,,	Coupar Angus	1·20
,,	Lynmouth, Rock House	2·11	,,	Montrose, Sunnyside Asylum.	·97
,,	Okehampton, Oaklands... ...	3·04	XVII.	Alford , Lynturk Manse[.....	...
,,	Hartland Abbey.....	1·74	,,	Fyvie Castle	2·91
,,	St. Austell, Trevarna	1·62	,,	KeithStation	3·28
,,	North Cadbury Rectory.....	1·85	XVIII.	Rothiemurchus	2·60
VI.	Clifton, Stoke Bishop	1·90	,,	Loch Quoich, Loan	8·40
,,	Ledbury, Underdown..... ..	1·32	,,	Skye, Dunvegan	2·36
,,	Shifnal, Hatton Grange.....	1·56	,,	Lochmaddy, Bayhead	...
,,	Droitwich.....	1·31	,,	Fortrose.....	2·17
,,	Blockley, Upton Wold.....	1·57	,,	Glencarron Lodge	5·35
VII.	Grantham, Saltersford.....	1·37	XIX.	Altnaharra	...
,,	Market Rasen	2·21	,,	Melvich	2·73
,,	Bawtry, Hesley Hall	1·44	,,	Loch More, Achfary	8·62
,,	Whaley Bridge, Mosley Hall	2·78	XX.	Dunmanway, The Rectory ..	1·14
,,	Derby, Midland Railway.....	·95	,,	Glanmire, Lota Lodge.....	1·05
VIII.	Nantwich, Dorfold Hall	1·71	,,	Mitchelstown Castle.....	1·67
,,	Chatburn, Middlewood	...	,,	Darrynane Abbey.....	1·75
,,	Lancaster, Strathspey	1·36	,,	Clonmel, Bruce Villa	1·72
IX.	Langsett Moor, Up. Midhope	1·75	,,	Broadford, Hurdlestown.....	2·50
,,	Scarborough, Scalby	3·08	XXI.	Enniscorthy, Ballyhyland...	1·30
,,	Ingleby Greenhow	2·96	,,	Rathnew, Clonmannon	·76
,,	Mickleton	1·40	,,	Ballycumber, Moorock Lodge	1·55
X.	Bellingham, High Green Manor	2·32	,,	Balbriggan, Ardgillan	1·47
,,	Ilderton, Lilburn Cottage ...	3·03	,,	Castle Forbes Gardens.....	1·94
,,	Keswick, The Bank.....	3·12	XXII.	Ballynahinch Castle.....	2·55
XI.	Llanfrechfa Grange	1·23	,,	Woodlawn	1·62
,,	Treherbert, Tyn-y-waun	4·15	,,	Westport, St. Helens	2·56
,,	Carmarthen, The Friary	2·41	,,	Dugort, Slievemore Hotel ...	4·10
,,	Fishguard, Goodwick Station.	2·11	XXIII.	Enniskillen, Portora.....	2·09
,,	Crickhowell, Tal-y-maes.....	2·00	,,	Dartrey [Cootehill]	2·57
,,	New Radnor, Ednol	1·92	,,	Warrenpoint, Manor House ..	1·36
,,	Birmingham WW., Tyrmynydd	3·42	,,	Belfast, Cave Hill Road	2·77
,,	Lake Vyrnwy	2·48	,,	Glenarm Castle	2·75
,,	Llangynhafal, Plas Drâw.....	2·71	,,	Londonderry, Creggan Res...	4·03
,,	Dolgelly, Bryntirion.....	5·20	,,	Dunfanaghy, Horn Head ...	3·76
,,	Bettws-y-Coed, Tyn-y-bryn...	4·98	,,	Killybegs	3·98

Climatological Table for the British Empire, November, 1916.

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	58·4	11	26·2	28	50·1	39·1	41·1	89	91·5	25·2	4·67	12	7·1
Malta	75·9	21	54·7	24	71·7	59·5	...	75	123·0	...	3·26	10	2·7
Lagos	90·4	19	70·5	24	87·4	74·4	74·3	78	153·0	69·0	5·29	10	6·5
Cape Town	92·4	16	48·4	10	75·3	56·9	53·8	63	...	...	·36	5	3·4
Johannesburg	84·8	15	40·3	12	74·6	52·6	48·4	61	...	39·6	4·23	13	5·0
Mauritius	85·0	29	57·0	1	81·8	66·6	63·3	70	...	51·1	1·33	17	5·4
Bloemfontein	90·8	14	41·8	12	82·2	54·4	51·5	62	..	...	·68	6	3·2
Calcutta...	86·8	1	60·7	22	81·7	66·7	65·4	75	...	51·2	1·07	2	2·3
Bombay...	88·5	15	73·4	22	86·5	75·6	72·5	76	140·3	68·1	·72	1	2·8
Madras	92·8	3	68·8	22	85·5	73·7	72·9	84	164·3	67·2	14·17	18	4·9
Colombo, Ceylon ...	87·4	21	69·1	7	85·3	72·1	71·7	83	159·4	63·4	8·04	17	6·9
Hongkong	82·6	8	47·0	29	73·5	62·4	55·8	63	...	...	·08	1	3·4
Sydney	...	...	...	...	...	...	...	...	...	...	...	...	..
Melbourne	85·5	20	40·1	14	67·3	51·3	48·5	67	147·0	32·7	6·71	20	7·3
Adelaide	88·1	30	44·5	14	69·3	52·3	48·8	63	157·8	39·0	2·84	17	6·6
Perth	95·7	15	50·7	4	77·0	57·3	52·2	58	155·8	41·1	2·78	8	3·9
Coolgardie	97·8	16	47·0	4	81·2	57·3	46·0	39	158·0	40·0	2·04	5	3·0
Hobart, Tasmania ..	72·0	11	42·4	15	61·4	48·5	45·2	68	141·6	32·8	7·07	20	7·7
Wellington ...	73·5	14	41·0	2	64·2	53·5	51·2	76	147·5	27·5	5·98	15	6·8
Auckland	...	...	...	...	67·2	56·3	...	...	...	...	7·74	22	...
Jamaica, Kingston ..	88·5	6	65·8	28	84·1	71·5	71·3	89	...	...	11·27	16	6·5
Grenada	86·0	1	70·0	4	83·0	73·0	...	80	134·0	...	15·19	23	4·5
Toronto	64·0	8	12·0	26	44·5	30·7	30·6	83	104·0	9·0	1·64	14	5·4
Fredericton	66·0	9	—5·0	*15	38·9	20·8	24·5	86	...	...	2·37	7	6·4
St. John, N.B. ...	54·0	24	9·0	17	40·0	27·0	29·8	77	104·0	·0	2·55	8	5·6
Victoria, B.C.	52·0	8	29·0	12	46·4	38·1	37·0	84	108·0	19·0	2·26	17	5·9

* 17,

Malta.—A cyclone passed over the east of the Island, doing some damage to property

Johannesbury.—Bright sunshine, 222·8 hours.

Mauritius.—Mean. temp. 1°·3 and dew point 0°·7 below, average. R ·25 in. under, average.

COLOMBO, CEYLON.—Mean temp. 78°·7, or 0°·8 below, dew point 1°·2 below, and R 3·54 in. below, averages. Mean hourly velocity of wind 3·9 miles. TS on 4 days.

HONGKONG.—Mean temp. 67°·8; mean hourly velocity of wind 10·7 miles. Bright sunshine 231·8 hours.

Melbourne.—Mean temp, 2°·0 below, and R the highest for November for 61 years, and the total for year up-to-date is highest for 61 years. Pressure very low,

Adelaide.—Mean temp. 6°·3 below, and R 1·69 in. above, averages. Coldest November on record for 59 years, and the cloud, highest on record.

Coolgardie.—Rainfall fully 1·00 in. above, averages.

Hobart.—Temp. 2°·3 below, and R 4·57 in. above averages. The wettest year to date on record.

Wellington.—Mean temp. 2°·0 above, and R 2·60 in., above, averages. Bright sunshine 177·5 hours.

JAMAICA.—Rainfall more than twice the average over the Island.

Symons's
Meteorological Magazine.

No. 617. JUNE, 1917. Vol. LII.

Sir Alexander Richardson Binnie.

London, 26 March, 1839—Bere, Devon, 19 May, 1917.

We much regret to record the death of Sir Alexander Binnie, the third Trustee of the British Rainfall Organization who has died in little more than three years. He was a pupil of the famous civil engineer, Mr. J. F. Bateman, and had early experience on railway construction. At the age of thirty he went to India and served for six years in the Public Works Department, where his most important undertaking was the Nagpur Water Works. In India his attention was directed to the vital importance of a knowledge of rainfall in planning water works, and throughout his whole life he continued to study this question on which he was a leading authority. On leaving India Mr. Binnie was for fifteen years the water engineer at Bradford, where he planned the extensive water works in the Nidd Valley, and then came to London as chief engineer to the London County Council. The Blackwall Tunnel under the Thames and the new Highgate Archway are monuments of his official labours, and he was knighted in 1897. In 1902 Sir Alexander retired from official work, but devoted himself as a consulting engineer to the pursuit of his profession in advising on public works in many parts of the world. While at the County Council Sir Alexander Binnie devoted much time and thought to planning a great scheme for the water supply of London from the valleys of south and central Wales. Under his authority an extensive series of rain gauges were set up by Mr. Symons, some in very remote places. After the scheme was abandoned the London County Council presented the rain gauges to the British Rainfall Organization, and several of them are being kept up by the old Observers who were formerly paid but who continue the routine as a labour of love to this day.

In India Sir Alexander turned his attention to the periodicity of rainfall and to the difficult question of the length of time necessary to establish the normal rainfall of a locality. This led him to study long records of rainfall in all parts of the world and resulted in a very important paper "On mean or average annual rainfall and the

fluctuations to which it is subject," read to the Institution of Civil Engineers in 1892. No paper is more frequently referred to in the course of theoretical as well as practical investigations of the problems it tackled.

Sir Alexander was a man of wide sympathies, a pleasant colleague in work and a charming companion in leisure. He took a lofty view of his profession, and his outlook on life was coloured by the philosophical bent of his mind and his cheerful temperament. As the result of failing health he relinquished his professional work and left London for the picturesque seclusion of Bere, in Devon, a few years ago.

Baldwin Latham.

1837—1917.

The death of Mr. Baldwin Latham removes yet another of the past presidents of the Royal Meteorological Society and a life-long meteorological Observer. Mr. Latham was one of the early friends and supporters of the late Mr. Symons in his rainfall work, and to the end he stimulated the municipalities and other local authorities with which he had professional relations as a consulting civil engineer to institute and maintain rainfall observations. For many years he had been one of the leading authorities on Water Supply and Sewage Works and carried out extensive schemes in Calcutta, Bombay and other Indian cities, as well as at home. At his residence, in Croydon, he had the earliest self-recording rain gauge from which records were published, and also one of the earliest evaporation and percolation gauges. With Mr. Campbell Bayard he made the Croydon Natural History Society, in which he took a great interest, the foremost local society in the study of meteorology. Mr. Latham studied the phenomena of the movements of underground water in chalk and other strata with particular attention. He also investigated the use of the wet and dry bulb thermometers for the determination of humidity, and contributed many valuable papers to the *Quarterly Journal* of the Royal Meteorological Society.

To those who knew Mr. Latham as an engineer and man of science only he seemed to be immersed in work of the sternest aspect; but he expanded to a surprising extent in historical studies. He revealed his civic associations to many of his friends by the gift of highly ornate packs of cards one Christmas, and greatly mystified them by the unexpected act until it was noticed that the ace of spades bore his familiar countenance, enshrined there as the Master of the Company of Playing Card Makers.

SOME PROBLEMS CONNECTED WITH THE TEMPERATURE ELEMENT IN CLIMATOLOGY.

By L. C. W. Bonacina.

(*Continued from p. 39.*)

The considerations stated are, I think, sufficient to demonstrate that all pictures of climate derived from the study of air temperature alone must necessarily be incomplete, and to raise the question of the ultimate possibility of investigating radiation influences in a manner that will yield results having climatological significance. In this connection it may be noted that the pair of instruments which commonly form part of the equipment of a meteorological observing station known as the "black and bright bulbs in vacuo," though an excellent index of the diathermancy of the atmosphere from day to day, are not of much use for the purposes of general climatic study, because they eliminate not only air movement or wind, a factor of great importance in deciding to what extent a body will be heated on exposure to a given intensity of radiation, but also, as the name of the thermometers indicates, the air itself whose temperature likewise is a factor in determining the temperature acquired by bodies exposed to radiation and the sense of warmth experienced by animals when exposed to the same. We all know, for example, that in this country given the same altitude of the sun with the same diathermancy, temperature, and humidity of the air the solar rays are less troublesome to us on a windy day than on a calm day, and that a given object exposed to a given radiation will be heated to a higher temperature according as there is less air movement. We know also that on a brilliant summer day, with a moderate air temperature, say 70° F., the sun's rays feel far less oppressive than does the same brilliancy of sunshine on a day with a very high air temperature, say 90° F., or than a considerably feebler radiation might in a like degree of warmth. What is wanted, therefore, for the adequate representation of the thermal aspect of climate is a system of thermometry which will furnish results compounded of radiation and air temperature effects as modified by such a natural agency. It is clear that such a need could be met by the simple expedient of using freely exposed thermometers to supplement—not supplant—the ordinary screened instruments, if only certain practical objections and possibly also certain theoretical misconceptions can be abolished. Exposed instruments have, indeed, already been employed by botanical investigators* to whom is brought home very forcibly the great importance of radiation temperatures to plants and crops. In

* R. H. Yapp—On Stratification in Vegetation of a Marsh. (Annals of Botany, Vol. 23, No. 90. (London), April, 1909).

a paper† written a few years back, moreover, I myself drew attention to the need of freely exposed thermometers, and it was then discovered that a series of observations of this nature had been previously made in this country, at Uckfield, Sussex, by Mr. Prince, as also in Servia, at Belgrade, by P. Vujevïc.‡ Whilst no one has ever disputed the validity of the arguments put forth on behalf of this procedure, there appear to be two outstanding difficulties of a practical nature which have discouraged further systematic attempts in this direction, namely, the difficulty of obtaining sufficient uniformity of exposure to ensure that the readings of the exposed thermometers may be climatically comparable, and the alleged difficulty in constructing a pattern of standard thermometer such as would ensure the elimination of thermal pecularities in the individual instruments. As to the first difficulty this could in many instances probably be surmounted with the exercise of a little experience and judgment in the selection of a site, and as regards the second, which is more serious, if real, one can only hope that it is not beyond the skill of the makers of modern instruments of precision to meet. It is evident, however, that the adoption of a reliable standard would be a *sine qua non* in any such system of observations as is here proposed in as much as different thermometers take up different temperatures on exposure to the same radiation, and it may be as well here to meet a possible misconception that may arise in this regard..

An exposed thermometer might record, say, 90° F. in the sun, whilst another along side of it equally accurate, but of a different "make," might record 85° F., and yet another 95° F.; but transfer all three instruments to the Stevenson Screen and they will all, in so far as they are accurate, show the same reading, let us say 80° F. In the latter case the instruments have merely taken up the temperature of the body of air in which they are immersed; in the former case they are subjected in addition to an amount of radiant energy which, though the same for each, will not effect the same temperature in each unless the material and construction of each is, thermally speaking, identical. Hence it follows that "exposed readings" so far as their actual values are concerned correspond to no external temperature and are not in themselves climatically significant. But if a reliable standard were devized the reative values of the instruments in comparing place with place, and time with time, might be of very great climatological utility, even though the actual values might not be significant. If, for example, on one day in summer the exposed instrument gave in one place a reading of 75° F. and in another place one of 85° F., one could say that in the

† A Plea for the Use of Freely Exposed Thermometers in addition to Sheltered Ones. [Q. J., Roy.Met.Soc., Vols. **35** (1909), p. 281; **36** (1910), p. 235].

‡ See note in *Nature* for March 31st, 1910.

former place it was 10° hotter in the sun than in the latter; but the actual readings 75° and 85° would be discarded as relating only to the instruments. It would be advantageous to construct a form of standard instrument either mercurial or electrical resistance designed to magnify as much as possible the difference between its exposed readings and the ordinary shaded readings, because some thirty years ago it was found in the course of some experiments conducted by John Aitken that thermometers with *very small* bulbs did not show sun readings in excess of those in the shade. But since it is an obvious fact that vegetation and crops, as likewise the human skin, experience much higher temperatures under the influence of solar radiation than they do in the shade, and that bare rock and soil often becomes very hot indeed in full sunshine, the legitimate conclusion is that the thermal aspect of climate will never be fully studied until we are able to take radiation temperatures in conjunction with shade temperatures.

ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on May 16th, at 70, Victoria Street, Westminster, Major H. G. Lyons, F.R.S., President, in the Chair.

The Phenological Report for 1916 by Mr. J. E. Clark and Mr. H. B. Adames was read by Mr. Clark, who pointed out that the peculiar distribution of wet and warm weather combined with a deficiency of sunshine was responsible for the disastrous effect on vegetation revealed by an analysis of the phenological data. The warm winter developed growth which the cold spring checked. June was very cold and even in the first half of July occasional frosts were not uncommon. The cold summer destroyed much of the fruit crop and lowered the quality of the harvest. The potato crop was a failure owing to the heavy rainfall of October and November, the period of the ripening off and lifting. The hazel was remarkably early appearing on January 26th, probably for the first time on record in that month. A very interesting summary was given regarding the areas of equal dates of appearance to which the name "isophainal" zones has been assigned. The earliest before April 29th appears to include South-West Wales, Cornwall, Devon, and a tongue stretching from Hants to Worcester, East Sussex, Surrey and Kent. In Scotland dates later than May 19th prevail, but, owing to the paucity of stations, definite dates cannot be given north of the Tweed. An animated discussion followed, in which the President, Col. Rawson, and Messrs. Hopkinson, Inwards, Mellish and Taylor took part. Maj.-Gen. W. Du G. Grey, C.B., Col. Sir H. McMahon, G.C.V.O. and Mr. E. Wigglesworth were elected fellows of the Society.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE GREAT THUNDERSTORM OF MAY 29th.

I HAVE time and again emphasized that marked climatic tendency which practically every year assures the local development up and down the country of extremely violent heat thunderstorms during the period when May is melting into June.

On May 29th I happened to be at Potters Bar, and, during the heat of the afternoon, observed a growing tendency towards the formation of thundery cumulo-form clouds. About 4.30 p.m. I noticed that the summits of some of the cumulus banks were turning into false cirrus—a sure indication of storminess. A preliminary storm had already broken over London, and catching the 4.55 train to King's Cross I soon noticed that the independent centres of cumulus cloud were coalescing into a dense thunder mass with the precipitation of huge drops of rain. I reached Hampstead about 6 p.m., just in time for the commencement of the main storm, which lasted an hour. During this hour a dense storm sheet of terrible blackness moved stealthily over the high ground of Hampstead Heath from N.W. to S.E., discharging to the ground a series of dangerous but magnificent forked flashes followed in at least three cases by instantaneous crashes of the most alarming, explosion-like character—that impressive brand of thunder which from time to time during the longest days is liable to strike, the hour of the summer solstice. At the same time a surface current from a southerly direction was moving across the storm track, and it appeared to reach nearly up to the cloud level—to judge from the contrary motion of some lower scud. After the storm had ceased, about 7 p.m., the warm moist atmosphere was fraught with the delicious fragance of the May blossoms, and the clearing of the sky revealed, high above the receding thunder clouds, an exceptionally delicate and beautiful structure of cirro-cumulus at first in soft small flakes, afterwards in well-marked ripples having a pearly lustre.

L. C. W. BONACINA.

Hampstead, N. W., 3rd June, 1917.

[We regret that it is impossible to find space for the many letters we have received on the remarkable series of thunderstorms of the last week of May; but hope to utilize the information received in "British Rainfall, 1917."—ED.—S.M.M.]

THE REMARKABLE WINTER OF 1916-17.

In the following table I compare particulars of the snow during the past winter with those of other winters in my record. The columns headed "Products" give the average number of days when snow covered the ground multiplied by the average depth in inches. Other items are also given when these were abnormal. The thermometers have not been kept on screens, but against the house, and the observations are therefore not standard, though comparable year with year. By far the lowest point reached in the winter was on April 2nd.

SNOW.*

1916–17 Month	Days fell	Difference from Average	Days lay	Difference from Average	Days Covered	Difference from Average	Products	Difference from Average
Oct. ..	0	—0·5	0	—0·8	0	—0·2	0	—0·1
Nov. ..	1	—1·3	1	—2·6	0	—1·1	0	—1·8
Dec. ..	5	+0·3	13	+4·6	4	—0·3	3·8	—13·9
Jan. ..	19	+12·9	22	+9·5	8	+3·2	5	—6·7
Feb. ..	4	—2·1	17	+7·5	8	+4·5	8	+1·4
Mar. ..	9	+1·9	14	+5·3	8	+4·3	4·5	—3·4
Apr. ..	12	+9·8	11	+9·2	11	+10·7	33·1	+32·9
May ..	0	—0·5	0	—0·2	0	—0·0	0	—0·0
Total..	50	+20·5	78	+32·5	39	+21·1	54	+9

In April, 1917, the minimum temperature was 16° on the 2nd, the lowest previously recorded in April having been 24° in 1862. The lowest maximum was 32° on the 1st, the previous lowest having been 39° in 1862. In January, 1917, the number of days of easterly or sea wind (*i.e.*, from N. to S.E.) was 17¾, or 12¼ more than the average, the largest number previously noted in January being 11, in 1873. The amount of cloud was ·86, or ·23 above the average for January.

The excessive cloud is evidently connected with the easterly winds. This is shown also in the cloudiest January next to 1917, viz., 1897, when the average was ·81; the days of observation being 23·5, the easterly winds blowing for 10 days. In the whole month, if in the same proportion, there would have been 13 days.

On April 14th, 1917, foliage of trees was about 2 days behind 1881, which was the most backward of any of the 48 years I could compare, beginning with 1861. Those years were not all consecutive, there being gaps in my record.

On May 10th, 1917, foliage was a day or two in advance of 1860, 1879 and 1881, 1879 being probably slightly the most backward of the 52 years I could compare.

T. W. BACKHOUSE.

West Hendon House, Sunderland.

* Not including sleet, but including soft hail.

REVIEWS.

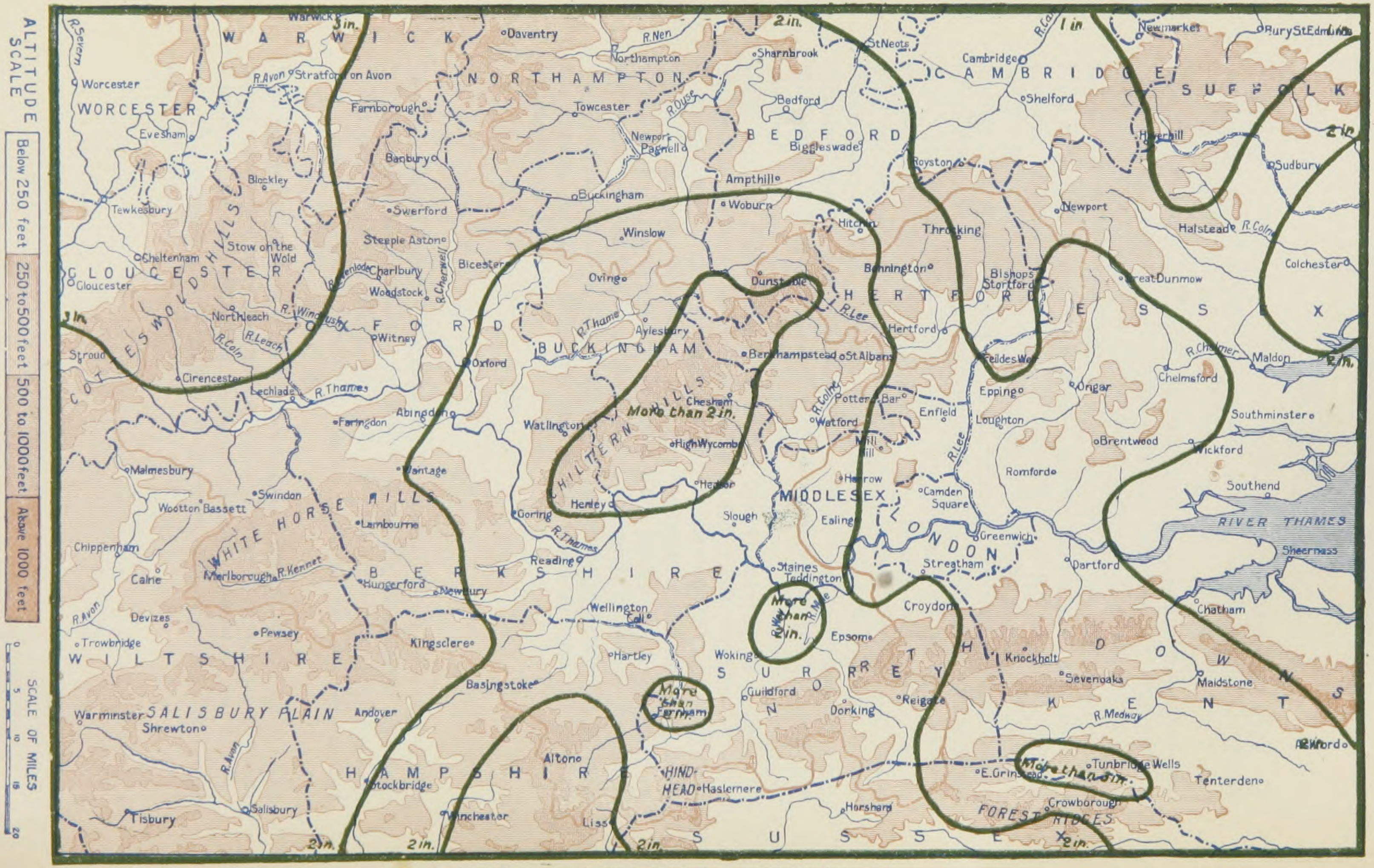
Republica Argentina. Oficina Meteorológica Nacional Jorge O. Wiggin, *Jefe. Boletin Mensual. Ano* 1—*Numeros* I.—V. *Enero à Mayo* 1916. Size, 15 × 12 in. Pp. 41. Plates, 6.

With 1916 the Argentine Meteorological Office commenced the publication of a new monthly Weather Review. A summary is given of the observations made thrice daily at 75 stations, pressure, temperature, and humidity being corrected to the mean of the 24 hours. The tri-daily observations at 23 stations are given *in extenso*. The stations range in latitude from 22° to 55° S., and in height from 8 to 3,447 metres. Some 16 pages in each "boletin" contain the daily rainfall at 1,421 stations, of which more than a third are in the province of Buenos Aires. Magnetic and seismic data are given for Pilar, and the hydrometric section gives a summary of the daily height of the rivers and lakes, along with an analysis of the monthly height of the Parana and other rivers from 1884 to 1915. Six maps show the distribution of the various elements over the country. This Boletin supplies a long-felt want, and constitutes a notable contribution to the monthly weather reviews of the Southern Hemisphere. In the May number there is a very interesting notice by Señor Hessling of a negative correlation between the temperature at the South Orkneys in April to September of one year and the July to December rains in Buenos Aires of the year following. On the strength of the available data a wet period is predicted in Buenos Aires during the second half of this year. In the work involved in the preparation of the "Boletin," under the direction of Mr. Wiggin, we may specially note the labours of Messrs. Rector, Bigelow and Helm Clayton, and of Señors Talamon and Wolff.

Bacon's New Series of Physical Wall Atlases. Scale, 1 : 1,187,000 (18·7 *miles to an inch*). Geology, Contours, Isotherms, Rainfall, Isobars, etc. Productions, etc. Population. Communications. 7 maps, on cloth, folded in case. London, G. W. Bacon and Co., Ltd. [1917]. Price, 21*s*.

The isohyetal lines on the Rainfall map are by Dr. H. R. Mill. The maps are very boldly printed and are striking illustrations of distributions. Our only criticism is that too many features are shown, *e.g.*, the isobars or isotherms for average and extreme conditions tend to confuse.

THAMES VALLEY RAINFALL, MAY, 1917.



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

Isohyetals.

THE WEATHER OF MAY.

THE outstanding feature of the weather of May was its high mean temperature, this being most pronounced in the immediate neighbourhood of London, and least marked at coastal stations. On the average of the whole country the mean excess was about 2° F., being greatest, over 3° in the east and south-east of England and the Midlands. Scotland had a general excess of half a degree, but in the east a practically normal temperature was experienced, whilst in Ireland the excess was 1°·5. Individual stations, especially those in strictly insular situation were much cooler than inland stations in the vicinity. Portland Bill, for example, had a mean temperature 0°·5 below the average, whilst at Shaftesbury the mean was 3° in excess. At Great Yarmouth the mean was about 1°·5 above the average, but at Norwich over 4°, in the vicinity of London, Tottenham, had a mean over 5° in excess of the average, whilst at Dungeness the mean temperature of May was normal. In Scotland and Ireland a considerable number of stations on the coast had a mean from 0·5° F. to 1°·0 F. under the average, although in Scotland, Crieff, an inland station, showed the largest defect, viz., 2°, a similar excess occurring at Colmonell, in Ayr. During the greater part of the month anti-cyclonic conditions prevailed, the general fine weather being interrupted only for a few days, from the 16th to the 23rd, when shallow depressions passed eastward over the south of the British Isles.

During the first half of the month the weather remained in general cold or cool, the lowest screen temperatures recorded being 28° at West Linton on the 3rd, and 22° at the same station on the 7th, other low values on the latter date being 25° at Bawtry, in the Midlands, and 26° at West Witton. Shade temperatures of 32° or below were recorded as late as the 16th and 17th in various parts of Scotland, and the north of England. During the second half of the month very warm weather prevailed, with local cool areas on the coast where the temperature remained normal for the time of year. A considerable number of places experienced maxima of 79° on various dates between the 13th and 28th. On the 28th shade maxima of 79° were recorded at Bawtry, and in London (Regents Park), while at Camden Square the temperature rose to 80° in the Stevenson Screen and to 84° on the Glaisher Stand.

Bright sunshine varied from an average of 5 hours a day in Scotland and the north of Ireland to 7½ hours a day in the east of England. There was an average daily deficit of one hour in Ireland and an excess of about the same amount in the east of the British Isles.

Rainfall showed sharp local variations due to thunderstorms, but little more than half an inch fell on the Kent coast, whilst inland the amount increased to over 3 inches at Tunbridge Wells. Over a considerable area around Worcester from 3 to 4 inches fell, but large parts of the eastern half of England, including the Midland counties as well as the north-east of Scotland, had less than 2 inches. Falls of over 5 inches occurred in the normally wet areas and also at one or two places in the south of Scotland. In Ireland the rainfall varied within relatively small limits. Over the Kingdom as a whole the general rainfall expressed as a percentage of the average was :—England and Wales, 98 per cent.; Scotland, 92 per cent.; Ireland, 120 per cent.; British Isles, 102 per cent.

In London (Camden Square) the rainfall was 1·99 in., being 14 per cent. above the average. An absolute drought lasting 27 days terminated on the 15th, there being only two longer absolute droughts in the 60 years' record, while the mean temperature of 59°·1 was 5°·1 above the average, and the highest in 60 years. May, 1868, was very nearly as warm, and it appears probable that the mean temperature exceeded 60° in London in the years 1833, 1811, 1809, 1808, 1804, 1788 and 1784. It is curious to note that the extremely warm May of 1809 also followed an extremely cold April.

The duration of rainfall was 19 hours; of Sunshine, 209 hours; Evaporation amounted to 3·06 in.

RAINFALL TABLE FOR MAY, 1917.

STATION.	COUNTY.	RAINFALL. Aver. 1875–1909. in.	1917. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Date.	No. of Days
Camden Square	*London*	1·75	1·99	+ ·24	114	·62	20	8
Tenterden	*Kent*	1·65	2·45	+ ·80	149	·79	20	9
Arundel (Patching)	*Sussex*	1·80	1·08	— ·72	60	·44	20	10
Fordingbridge (Oaklands)	*Hampshire*	2·09	1·46	— ·63	70	·48	27	12
Oxford (Magdalen College)	*Oxfordshire*	1·81	1·94	+ ·13	107	·67	17	11
Wellingborough (Swanspool)	*Northampn*	1·98	2·59	+ ·61	131	·83	20	11
Bury St. Edmunds (Westley)	*Suffolk*	1·93	·75	—1·18	39	·57	17	5
Geldeston [Beccles]	*Norfolk*	1·78	·77	—1·01	43	·40	17	7
Polapit Tamar [Launceston]	*Devon*	2·08	1·68	— ·40	81	·44	20	10
Rousdon [Lyme Regis]	,,	2·02	2·00	— ·02	99	·58	26	9
Stroud (Field Place)	*Gloucester*	2·10	2·61	+ ·51	124	·97	27	10
Church Stretton (Wolstaston)	*Shropshire*	2.64	3·77	+1·13	143	1·34	27	12
Boston	*Lincoln*	1·80	1·38	— ·42	77	·59	17	12
Worksop (Hodsock Priory)	*Nottingham*	2·08	1·86	·22	89	·59	17	10
Mickleover Manor	*Derbyshire*	2·10	2·57	+ ·47	122	·62	10	11
Buxton	,,	3·30	2·10	—1·20	64	·48	12	15
Southport (Hesketh Park)	*Lancashire*	2·13	2·66	+ ·53	125	·62	27	13
Arncliffe Vicarage	*York, W.R.*	3·55	...	...	...	...	...	...
Goldsborough Hall	,, ,,	2·16	1·54	·62	71	·45	17	7
Hull (Pearson Park)	,, *E.R.*	1·98	1·68	— ·30	85	·68	10	8
Newcastle (Town Moor)	*North'land*	2·04	1·63	— ·41	80	·50	17	9
Borrowdale (Seathwaite)	*Cumberland*	7·50	6·77	— ·73	90	3·33	30	15
Cardiff (Ely)	*Glamorgan*	2·56	3·36	+ ·80	131	1·04	12	19
Haverfordwest	*Pembroke*	2·62	3·34	+ ·72	128	1·35	26	14
Aberystwyth (Gogerddan)	*Cardigan*	2·63	2·99	+ ·36	114	·85	12	11
Llandudno	*Carnarvon*	1·86	2·29	+ ·43	123	·99	27	13
Cargen [Dumfries]	*Kirkcudbrt.*	2·87	4·58	+1·71	160	1·04	14	15
Marchmont House	*Berwick*	2·53	2·18	— ·35	86	.60	12	14
Girvan (Pinmore)	*Ayr*	2·98	3·64	+ ·66	122	·85	27	16
Glasgow (Queen's Park)	*Renfrew*	2·40	...	...	...	...	...	...
Islay (Eallabus)	*Argyll*	2·58	4·36	+1·78	169	·93	26	18
Mull (Quinish)	,,	2·99	3·86	+ ·87	129	1·06	26	15
Balquhidder (Stronvar)	*Perth*	4·10	3.20	—5·90	78	.39	28	19
Dundee (Eastern Necropolis)	*Forfar*	2·05	1·99	— 06	97	·57	8	14
Braemar	*Aberdeen*	2·33	2·73	+ ·40	117	·47	29	13
Aberdeen (Cranford)	,,	2·40	1·35	—1·05	56	·21	11	11
Gordon Castle	*Moray*	2·10	1·28	·82	61	...		...
Drumnadrochit	*Inverness*	2·33	1·70	— ·63	73	·42	7	16
Fort William	,,	3·93	1·98	—1·95	50	·88	31	13
Loch Torridon (Bendamph)	*Ross*	4·54	2·10	—2·44	46	·50	26	14
Dunrobin Castle	*Sutherland*	2·19	1·61	— ·58	74	·49	10	10
Killarney (District Asylum)	*Kerry*	3·05	2·62	— ·43	86	·39	22	15
Waterford (Brook Lodge)	*Waterford*	2·33	3·46	+1·13	149	·77	20	11
Nenagh (Castle Lough)	*Tipperary*	2·51	3·10	+ ·59	124	.72	26	13
Ennistymon House	*Clare*	2·70	2·30	— ·40	85	·45	26	13
Gorey (Courtown House)	*Wexford*	2·24	3·62	+1·38	162	·74	12	15
Abbey Leix (Blandsfort)	*Queen's Co.*	2·43	...	...	...	...	...	...
Dublin (Fitz William Square)	*Dublin*	2·07	2·98	+ ·91	144	·85	26	12
Mullingar (Belvedere)	*Westmeath*	2·51	2·14	—5·37	85	·31	13	11
Crossmolina (Enniscoe)	*Mayo*	3·17	3·10	— ·07	98	·71	21	16
Cong (The Glebe)	,,	2·94	2·85	— ·09	97	·59	21	14
Collooney (Markree Obsy.)	*Sligo*	2·80	3·17	+ ·37	113	1·23	26	17
Seaforde	*Down*	2·72	5·08	+2·36	187	2·18	26	16
Ballymena (Harryville)	*Antrim*	2·84	4·47	+1·63	157	1·17	26	19
Omagh (Edenfel)	*Tyrone*	2·66	2·27	— ·39	85	·40	12, 26	16

SUPPLEMENTARY RAINFALL, MAY, 1917.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Warlingham, Redvers Road..	1·96	XI.	Lligwy	2·99
,,	Ramsgate	·58	,,	Douglas, Isle of Man	4·15
,,	Hailsham	2·02	XII.	Stoneykirk, Ardwell House...	3·34
,,	Totland Bay, Aston House...	1·75	,,	Carsphairn, Shiel	5·45
,,	Stockbridge, Ashley..	1·78	,,	Langholm, Drove Road	3·58
,,	Grayshott	1·64	XIII.	Selkirk, The Hangingshaw..	2·23
III.	Harrow Weald, Hill House...	1·60	,,	North Berwick Reservoir.....	1·81
,,	Pitsford, Sedgebrook...	1·87	,,	Edinburgh, Royal Observaty.	1·47
,,	Woburn, Milton Bryant.....	1·73	XIV.	Biggar.....	2·02
,,	Chatteris, The Priory.....	1·11	,,	Maybole, Knockdon Farm ...	3·05
IV.	Elsenham, Gaunts End	2·09	XV.	Buchlyvie, The Manse.....	3·76
,,	Shoeburyness	1·48	,,	Ballachulish House	2·61
,,	Colchester, Hill Ho., Lexden	2·89	,,	Oban.....	4.24
,,	Ipswich, Rookwood,Copdock	1·26	,,	Campbeltown, Witchburn ..	5·36
,,	Aylsham, Rippon Hall.... ..	·62	,,	Holy Loch, Ardnadam.....	5·45
,,	Swaffham	·45	,,	Tiree, Cornaigmore	3·90
V.	Bishops Cannings	2·00	XVI.	Glenquay	2·80
,,	Weymouth.....	1·93	,,	Glenlyon, Meggernie Castle..	1·57
,,	Ashburton, Druid House.. ...	3·09	,,	Blair Atholl	1·97
,,	Cullompton	2·00	,,	Coupar Angus	2·23
,,	Lynmouth, Rock House	2·16	,,	Montrose, Sunnyside Asylum.	1·72
,,	Okehampton, Oaklands.. ...	2·34	XVII.	Balmoral	2.19
,,	Hartland Abbey.....	2·17	,,	Fyvie Castle	1·31
,,	St. Austell, Trevarna	2·95	,,	KeithStation	1·85
,,	North Cadbury Rectory.....	2·48	XVIII.	Rothiemurchus	1·52
VI.	Clifton, Stoke Bishop	2·24	,,	Loch Quoich, Loan	...
,,	Ledbury, Underdown..... ...	3·67	,,	Skye, Dunvegan	3·97
,,	Shifnal, Hatton Grange.....	3·78	,,	Fortrose.....	2·21
,,	Droitwich.....	3·85	,,	Glencarron Lodge	1·08
,,	Blockley, Upton Wold.....	3·40	XIX.	Altnaharra	...
VII.	Grantham, Saltersford.....	1·49	,,	Melvich	·99
,,	Market Rasen	1·08	,,	Loch More, Achfary	1·50
,,	Bawtry, Hesley Hall	1·90	XX.	Dunmanway, The Rectory ..	4·50
,,	Whaley Bridge, Mosley Hall	1·78	,,	Glanmire, Lota Lodge.....	4·63
,,	Derby, Midland Railway.....	2·61	,,	Mitchelstown Castle.....	4·58
VIII.	Nantwich, Dorfold Hall	3·28	,,	Darrynane Abbey.....	2·05
,,	Chatburn, Middlewood	...	,,	Clonmel, Bruce Villa	3·35
,,	Lancaster, Strathspey	2·21	,,	Broadford, Hurdlestown.....	3·61
IX.	Langsett Moor, Up. Midhope	2·06	XXI.	Enniscorthy, Ballyhyland...	3·43
,,	Scarborough, Scalby	1·71	,,	Rathnew, Clonmannon	3·65
,,	Ingleby Greenhow	1·21	,,	Ballycumber, Moorock Lodge	2·54
,,	Mickleton	2·00	,,	Balbriggan, Ardgillan	3·31
X.	Bellingham, High Green Manor	2·99	,,	Castle Forbes Gardens.....	2·93
,,	Ilderton, Lilburn Cottage ...	1·92	XXII.	Ballynahinch Castle.....	3·65
,,	Keswick, The Bank.....	3·17	,,	Woodlawn	3·41
XI.	Llanfrechfa Grange	4·18	,,	Westport, St. Helens	2·52
,,	Treherbert, Tyn-y-waun	4·98	,,	Dugort, Slievemore Hotel ...	3·83
,,	Carmarthen, The Friary	2·93	XXIII.	Enniskillen, Portora.....	2·06
,,	Fishguard, Goodwick Station.	2·81	,,	Dartrey [Cootehill]	2·20
,,	Crickhowell, Tal-y-maes.....	6·50	,,	Warrenpoint, Manor House ..	3·55
,,	New Radnor, Ednol	3·80	,,	Belfast, Cave Hill Road	5·73
,,	Birmingham WW., Tyrmynydd	4·40	,,	Glenarm Castle	5·33
,,	Lake Vyrnwy	3·08	,,	Londonderry, Creggan Res...	3·36
,,	Llangynhafal, Plas Dráw.....	3·24	,,	Dunfanaghy, Horn Head ...	3·85
,,	Dolgelly, Bryntirion.....	3·08	,,	Killybegs	4·52
,,	Bettws-y-Coed, Tyn-y-bryn...	2·53			

Climatological Table for the British Empire, December, 1916.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	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	55·1	29	25·5	17	41·9	32·8	35·2	92	67·7	24·4	2·55	15	8·2
Malta	73·8	12	50·0	9	67·6	58·6	...	82	107·5	...	1·19	4	2·3
Lagos	90·1	13	69·0	28	87·8	74·4	73·4	75	150·0	64·2	·02	1	5·7
Cape Town	98·6	16	48·2	10	79·5	59·8	57·4	65	...	...	·48	7	3·2
Johannesburg	79·0	3	49·1	31	72·9	54·8	55·1	79	...	48·9	9·41	20	5·8
Mauritius	87·4	9	65·0	17	83·5	69·8	66·6	73	...	61·5	2·74	21	6·6
Bloemfontein	91·7	5	53·4	8	83·9	59·0	56·3	60	..	...	2·78	9	4·2
Calcutta...	79·6	18	49·2	31	75·9	56·6	55·0	69	...	36·7	·00	0	1·1
Bombay...	89·2	4	64·5	31	84·0	70·6	65·2	68	138·5	58·5	·00	0	1·0
Madras	85·8	2	64·1	25	83·7	69·7	67·0	76	155·5	60·3	3·91	8	4·1
Colombo, Ceylon ...	91·6	8	66·1	27	86·4	70·1	68·9	78	162·6	58·4	2·03	6	5·4
Hongkong	76·4	8	50·4	1	67·9	57·9	49·0	60	...	...	·05	1	4·5
Sydney	86·0	9	57·6	14	76·0	63·3	62·8	77	147·0	48·7	3·42	18	5·9
Melbourne	96·6	27	48·9	6	75·0	56·8	52·7	62	157·0	41·8	4·38	14	5·5
Adelaide	106·0	27	45·6	4	80·5	57·7	50·8	50	167·1	37·5	1·67	9	3·2
Perth	98·4	14	51·0	1	81·6	60·1	54·2	55	163·3	41·3	·16	2	1·5
Coolgardie	106·4	18	45·4	11	88·0	57·2	46·3	35	168·0	43·0	·17	2	1·7
Hobart, Tasmania ..	82·4	28	43·8	15	67·3	53·2	50·0	69	148·0	36·4	7·72	19	7·9
Wellington ...	79·5	24	44·2	1	70·3	56·4	53·6	71	158·0	33·8	·00	0	5·5
Auckland	...	...	...	...	71·9	60·0	...	...	...	...	8·59	10	...
Jamaica, Kingston ..	88·0	24	61·8	31	84·6	66·5	65·0	78	...	...	·02	1	2·6
Grenada	86·0	8	70·0	sevl	83·0	72·0	...	73	134·0	...	6·04	15	2·5
Toronto	55·0	5	5·0	16	33·1	20·8	21·0	83	97·0	3·0	2·03	20	7·5
Fredericton	52·0	1	—11·0	15	29·1	15·9	19·4	91		...	5·26	17	6·7
St. John, N.B. ...	50·0	1	—1·0	30	31·7	20·1	21·0	80	92·0	—2·0	5·10	19	6·4
Victoria, B.C.	49·0	2	27·0	29	40·4	34·2	35·0	89	89·0	22·0	4·92	23	·1

Malta.—Sunshine average hours per day 5·1.

Johannesbury.—Rainfall record for December since 1904. Bright sunshine, 197·6 hours.

Mauritius.—Mean. temp. 1°·8, dew point 1°·3, and R 1·98 in. below, average.

COLOMBO, CEYLON.—Mean temp. 78°·1 or 0°·9 below, dew point 2°·3 below, and R 2·15 in. below, averages. Mean hourly velocity of wind 5·3 miles. TS on 12th and 13th.

HONGKONG.—Mean temp. 62°·8; mean hourly velocity of wind 10·4 miles. Bright sunshine 209·0 hours.

Melbourne.—Rainfall for the year, 38·04 in., is the highest on record for 61 years, previous 36·61 in. Season exceptionally good and splendid yield of wheat.

Adelaide.—Mean temp 2°·1 below. and R ·72 in. above, averages.

Coolgardie.—Temp 3° 5 below, and R about half an inch below, averages.

Hobart.—Cloudy and wet month.

Wellington.—Mean temp. 3°·0 above, and R 3·33 in., below, averages. Bright sunshine 268·5 hours. A fine summer month.

Symons's
Meteorological Magazine.

No. 618. JULY, 1917. Vol. LII.

GREAT LONDON THUNDERSTORM OF JUNE 16th.

The critics whose watchward is *Cui bono*? not infrequently call our attention to the fact that we are always pressing for more rainfall observations even in places where there are already many Observers at work. To the Prussian type of mind it is as distressing to see a district crowded with observing stations as to see a district without them, for the ideal of that school of thought is rigid uniformity. If you have 6,000 rain gauges, they say, on 120,000 square miles they ought to be planted so that every block of 20 square miles has its gauge. This would involve a distance of about 4½ miles between gauge and gauge. No doubt the mapping of monthly and annual rainfall would gain greatly in precision if this ideal distribution could be realized; but the mapping of daily rainfall would lose the fascination it now presents in the crowded places. The distribution of intense downpours is so local that were it not for the few districts where voluntary Observers crowd together, we could know nothing about it. If 100 square miles of London had only the 5 rain gauges, which is the average for such an area in the United Kingdom, the remarkable rainfall of June 16th, 1917, might have passed unrecorded, and would certainly have escaped unmapped. Fortunately there are rather more than 50 rain gauges on these 100 square miles, and we wish that there were twice as many, for, apart from the interest to residents and the importance to local authorities of knowing how torrential rains fall, we may view an accurate rainfall map as a stencil print made by the rain itself of the atmospheric disturbances which gave rise to it. When a number of such stencillings has been accumulated we shall learn something precise and positive as to the natural history of storms. Hence, as Mr. J. Y. Buchanan pointed out long ago with reference to ocean charts, we learn more by irregularly spaced than by uniformly spaced observations when the total number is limited. The main value of closely adjacent independent rainfall stations is the mutual help they afford in coming to a decision as to the reality of so-called "record falls." When a figure is reported which is larger than was ever reported before it is absolutely

necessary to subject it to such criticism as can be brought to bear on it before accepting the reported result.

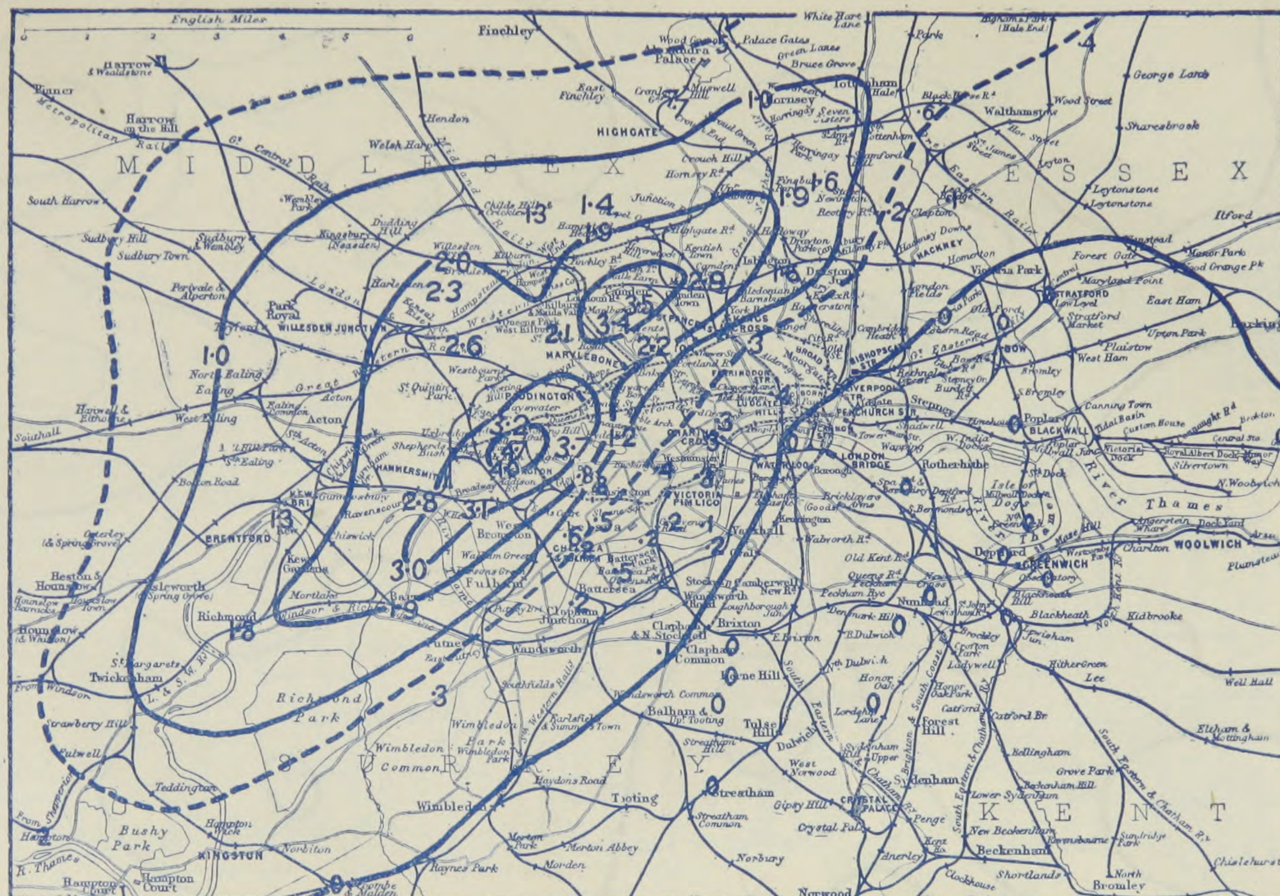
The greatest rainfall in 24 hours hitherto recorded in the county of London, was 3·90 in. at Hampstead on April 10th, 1878. Lord Justice Phillimore reported a fall of 4·65 in. at Cam House, Campden Hill, on June 16th, 1917, and unprecedented though this is it is borne out by a record of more than 4 inches at Holland House (where the gauge after collecting 4 inches overflowed and so did not give a definite figure). The whole rain of the storm fell in scarcely more than 2 hours, from about 5 to 7 p.m. Greenwich Time, so that the intensity of the rain was as remarkable as the quantity. The following list gives a statement of the falls exceeding two inches

	in.		in.
Campden Hill, Cam House..	4·65	Barnes, Castelnau	3·00
Holland House (*gauge overflowed*)	4·00	St. Pancras, Camden Square	2·86
Kensington Gardens ..	3·65	Hammersmith, The Creek ..	2·75
Regents Park, Ormond Terr.	3·50	Harrow Road	2·55
Barrow Hill	3·37	Willesden Reservoir ..	2·34
Campden Hill Water Works	3·20	Regent's Park, Royal Botanic Gardens	2·17
Hammersmith Cemetery ..	3·10		

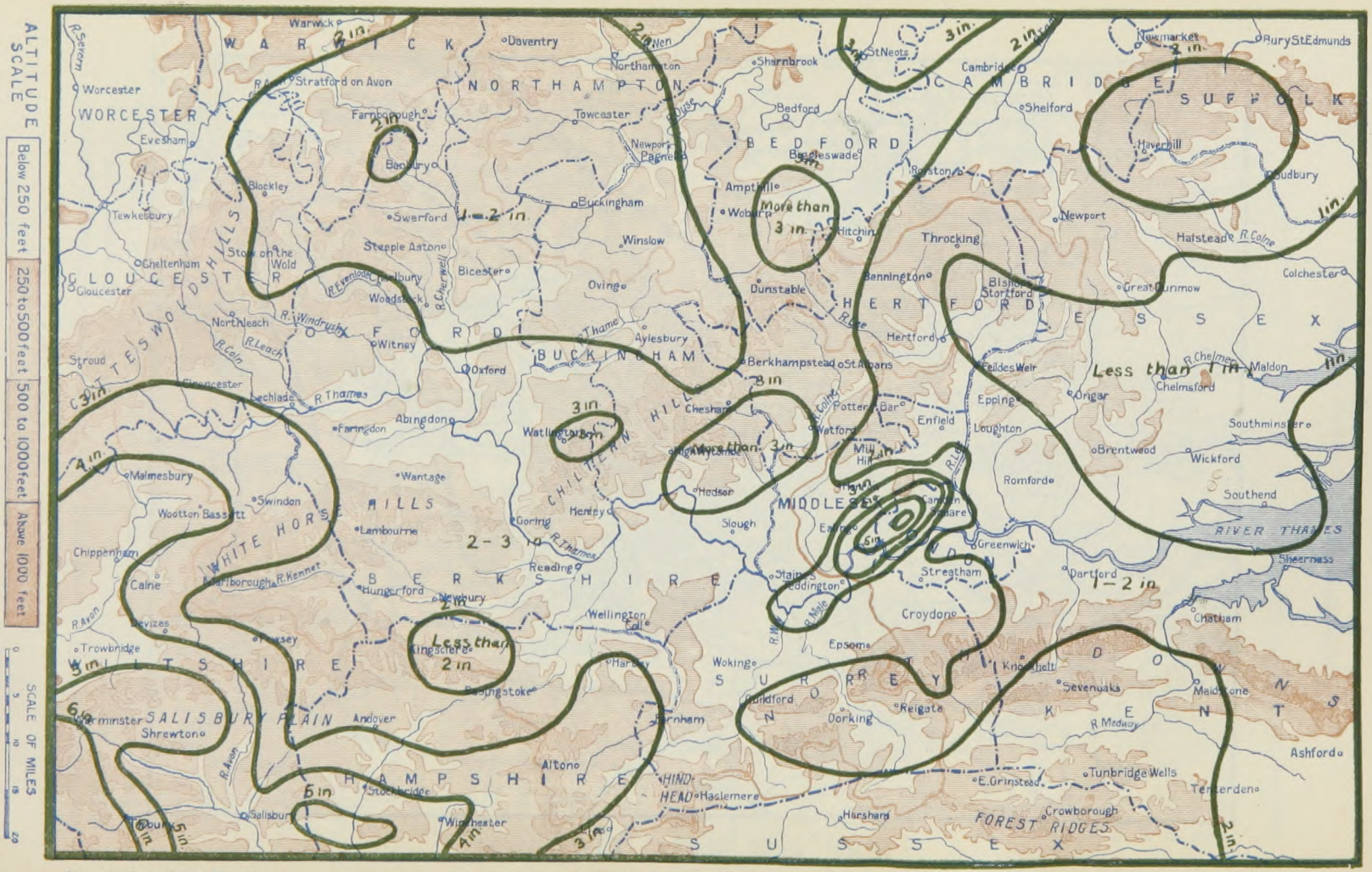
The map shows all the returns that have been received from the area included in it, the figures being given to the nearest tenth of an inch and the decimal point placed on the site of the rain gauge when it was possible to ascertain its exact position.

The first thing that strikes one is that no rain fell to the south and east, almost exactly in the districts which received no rain in the similar but less intense thunderstorm of May 6th, 1915 (see this Magazine, vol. **50**, p. 77, and "British Rainfall, 1915," p. [62] East of Waterloo Station there seems to have been no rain south of the Thames, and very little east of Battersea. The rainfall increased towards the north-west until it amounted to half-an-inch along a line running from Barnes through Charing Cross to Walthamstow. To the north-west of this line the increase was extraordinarily rapid, especially in the neighbourhood of Kensington Gardens, where in the distance of one mile, from the Meteorological Office to Campden Hill, the rainfall increased from rather less than 1 inch to considerably over 4 inches in the two hours of the storm. An irregular oval, extending for 15 miles, from Twickenham in the south-west to Tottenham in the north-east, and 6 miles in its greatest breadth, had more than one inch of rain. Within it and towards the southern edge a similar area with more than 2 inches extended from near Richmond in the south-west for 10 miles to Finsbury Park in the north-east. Within this were two areas with more than 3 inches, the larger extending for about 4 miles from near Barnes to the Edgware Road, and $1\frac{1}{4}$ mile wide at the most, and the smaller centred between Regent's Park and Hampstead Heath, measuring

RAINFALL JUNE 16TH, 1917.



THAMES VALLEY RAINFALL JUNE, 1917.



2 miles, from south-west to north-east, and about 1 mile across. It is possible that these areas should be united, but the data are insufficient to decide the point. The larger 3-inch area as shown, included a patch measuring perhaps one mile by half a mile centred on Campden Hill, with a rainfall exceeding 4 inches, and quite possibly 5 inches might have been measured had there been a rain gauge at the wettest point. The areas with different rainfalls within the 20 by 12 mile rectangle of the accompanying map of the London area were measured and showed 75 square miles without rain, 51 square miles with more than one inch, 20 square miles with more than two inches, and 4 square miles with more than three inches. This yields a general rainfall of 1·93 in, for the portion with more than one inch.

The storm is thus described by Mr. J. G. Wood, who observed it at Sutherland Avenue, Maida Vale, at a point between the 3-inch areas where the fall was probably about 2·20 in.

"I imagine that the area of the storm was small. It began here at 4·45 p.m. Greenwich time, with enormous drops of rain, followed in a few minutes by the first flash, and the first sound of thunder. It continued incessantly till 7.15 p.m., the rain (or rain and ice) being torrential throughout. The sewers could not carry it off, and water backed up from them into the basements and areas—into my own areas for the second time only in 24 years. I am told that Edgware Road, Bishops Road, and Harrow Road, are impassable, the wood pavement having been forced up by the force of the water. I have seen this in Formosa Street, where the pavement is wrecked for 100 yards. Buildings were struck near the junction of the Harrow and Chippenham Roads. The storm came up 'against the wind'—that is the vanes showed throughout N. to N.W.—while the clouds moved or gathered from S.

"Twice during the storm abnormally large pieces of hail fell in great quantities. In the first I picked up three, which when melted together gave ·038 cub. in., or just one-eighth on an average. On the second occasion I gathered twenty-four of varying sizes, but every one much bigger than an ordinary hailstone. These together gave 2·1 cub. in., or ·087 cub. in. on average. All were opaque, some spherical, some ellipsoidal, some nondescript. In each set one exactly reproduced the form of a dried "Normandy Biffin," circular, flattened with depression on each side. In the earlier part of the storm I found a piece of clear ice, about the size and thickness of a shilling, with sharp but irregular edge. It melted too quickly in my hand to be measured."

It is quite impossible to print the whole of the correspondence we have received or to describe the damage done to the roadways and drains and houses.

UNPRECEDENTED RAINFALL IN SOMERSET.

THE London rainfall described in the foregoing article sinks into insignificance when compared with the deluge that flooded the south of England on the night of June 28th, 1917. Within the last five years we have had to chronicle one-day rains unprecedented in their localities for Norfolk, on August 25th, 1912, when the largest amount recorded on a rainfall day was 7·31 in., at Brundall (making with ·78 on the previous day a total of 8·09 in in 24 hours); for the neighbourhood of Doncaster on September 17th, 1913, when 6·06 in. was recorded at the Doncaster Pumping station, and for East Inverness-shire, on September 25th, 1915, where 7·06 in. was measured at Dalcross. But if no mistake has been made (and preliminary investigations lead us to think that there is none), **9·84 in.**, the greatest one day's fall yet recorded in the British Isles, was measured at Sexeys' School, Bruton, on June 28th.

The greatest fall on a rainfall day previously known was 8·20 in. at Kinlochquoich, Invernesshire, on October 11th, 1916, which has not been published until now. Before last year the highest figure was 8·02 in., recorded at Seathwaite, Cumberland, on November 12th, 1897.*

The remarkable thing is that the record rains in the West Highlands and the Lake District occurred in the normally wet winter months at localities where the average rainfall far exceeds 100 inches whereas the Norfolk, Doncaster, and East Inverness rains occurred in summer and in places with an average rainfall under 30 inches, and the Bruton fall was also an incident of the summer season, and in a locality where the average rainfall is very little above 30 inches.

Mr. Symons used to insist that a fall of 4 inches might occur in one day at any place in the United Kingdom, and many Observers still consider such an idea fantastic; but we must in the light of recent experience double Mr. Symons's limit and assert that as much as 8 inches of rain may fall in any part of the British Isles in one day at any time of the year. A practical application is that no rain gauge should be of less capacity than ten inches of rain, and we expect to hear of many cases of overflowing gauges on June 28th.

Mr. W. A. Knight, the headmaster of Sexey's School, Bruton, sends us the following restrained account of the terrific storm :—

"The local effects of the storm of Thursday night are so exceptional that they deserve to be recorded. Our rain-gauge

* Lest any reader should be misled by the report of 8·58 in. at Llyn Llydaw, Snowdon, on 22nd November, 1908, printed in "British Rainfall, 1908," we point out that this figure was a mistake, the reading in question referring to two days' fall, and a correction was duly made in "British Rainfall, 1909."

measured 9·84 in. between 10 a.m., June 28th, and 10 a.m., June 29th (summer time). Other local records are :—

i.	½ mile	S.W. (9 a.m. to 9 a.m.)	..	7·90
ii.	½ „	N.E. „ „	..	8·49
iii.	8 „	N.	..	3·5

" The damage done to roads, walls, hedgebanks, house-property, furniture and gardens is estimated at from £1,000 to £2,000 in this parish alone (population, 1,600). Most of the roads have been quite recently made up and steam-rolled. Some of them now resemble the bed of a mountain-torrent, or a glacier moraine. In some places 2 ft. of debris has been deposited and in others excavations of 2 ft. to 3 ft. deep have been washed out down to the rock. In some places the road is quite uninjured, the tar-sprayed top layer being intact. The playground of the elementary school adjoining the river Brue and surrounded on three sides by masonry, although 10 ft. above the normal river-level, has been scooped out to a depth of 2 or 3 ft. Some cottages were flooded to a depth of more than 6 ft.

" During the storm, the thunder and lightning were quite moderate and the wind N.E. by N."

We have been in correspondence with Mr. Knight on the question of the high reading, and we have had the advantage of seeing the Rev. H. A. Boys, the energetic head of the Mid-Wessex Rainfall Association, who visited Bruton immediately after the storm, and we are satisfied that the record was carefully observed and deserves to be accepted as correct. The following list of stations recording rainfalls over 4¼ inches on June 28th is by no means complete, but it suffices to show that an unprecedentedly high rainfall prevailed over an extensive area in the south of England.

	in.		in.
Bruton (Sexey's School) ..	9·84	Street (Hind Hayes) ..	5·15
„ (King's School) ..	8·49	„ (Millfield)	5·13
„ (Pitscombe Vicarage)	7·90	Fovant	5·04
Taunton (Cothelstone House)	7·05	Williton	5·00
Butleigh	7·00	West Tytherley	4·94
Stourhead	6·50	Bridgewater (Brymore) ..	4·91
Charlton Musgrove	6·20	North Petherton (Shovell) ..	4·80
Tisbury (Pythouse)	6·01	Porton	4·80
Ashcott	6·00	Kilmington	4·60
Street (Leigholt Reservoir)..	5·85	Gillingham	4·48
Tisbury (Fonthill House) ..	5·75	Warminster (Bishopstrow)..	4·42
Butleigh Court	5·75	Shrewton	4·36
Mere	5·69	Glastonbury	4·30
Street (Overleigh House) ..	5·61	Warminster (Rye Hill) ..	4·22
Taunton (Wheddon Cross) ..	5·43		

A preliminary map of the distribution of the great rain has been drawn, and although the data are still too incomplete to justify

publication, we may describe the general character of the rainfall in a few words. The rain was greatest in a narrow strip running across the south of England from the north-west coast of Cornwall to the middle of Kent. It fell off very quickly to the south, reaching about half-an-inch along the south coast of England. To the north it fell off more gradually, the line of half-an-inch running from the mouth of the Bristol Channel to Lowestoft, and no rain fell north or west of a line drawn from Cardigan through Chester to Newcastle. In the west belt more than an inch of rain extended from Cornwall into the west of Kent, between Lymington on the south, and Aylesbury on the north. The area with over 2 inches extended from Devonshire into Sussex, and that over 3 inches from Somerset into Hampshire. The storm was of unprecedented severity in all probability within the area where the fall exceeded 4 inches, which extended for about 110 miles, from the middle of Exmoor to near Winchester, and had a breadth of between 10 and 15 miles.

More than 5 inches fell in two portions of this area, and the rainfall was very little below 5 inches between them. The western extending east for about 23 miles, from the slopes of Exmoor, had a maximum of rather more than 7 inches at Cothelestone House, near Taunton. The eastern ran for 40 miles, from near Bridgwater to near Wilton, with an average breadth of about 7 miles, and in the centre Bruton received the tremendous amount of 9·84 inches. Judging by the eye alone, for the map is still too incomplete for measurement, we are of opinion that the total amount of rain deposited in this storm cannot fall much short of what was measured in the Norfolk flood of August, 1912, and may exceed it. The rainfall of June, 28th seems likely to prove the most remarkable which we have yet investigated. We greatly regret the absence of self-recording rain gauges in the neighbourhood where the rainfall was most intense, and we are sure that many Observers in that district who had often thought of setting up a recording gauge will bitterly regret the procrastination that lost them the opportunity of obtaining a record the like of which may not occur again for hundreds of years.

Our usual rainfall map of the Thames Valley shows in the monthly totals the western, and less remarkable part, of the great fall of June 28th, the axis of which, curiously enough, is in line with that of the great London fall of June 16th. Without these two showers the month would have been a very dry one, with them it has in many places been the wettest June on record.

We have a mass of most interesting letters on the storm from all parts of the area affected and greatly regret the impossibility of printing them here. They will all be utilized in the full discussions which will be undertaken for publication in "British Rainfall, 1917."

METEOROLOGICAL OBSERVATIONS AT LU-KIA-PANG, CHINA, FOR 1916.

By Rev. J. De Moidrey, S.J.

(*Continued from page* 28.)

The Observatory at Lu-kia-Pang is located in 31° 19′ N. long., 121° 3′ E., at an altitude of 3 metres, and is situated in the great fertile plain of the lower Yang-tse river.

VI.—*Rainfall*

(*a.*) INTENSITY. Days with

	mm. 0·1—0·9	1·0—2·9	3·0—4·9	5·0—9·9	10·0—19·9	20·0—39·9	40·0—59·9	60·0 & over	Days with Rain.	Snow.	Total.
Jan...	5	1	0	2	—	—	—	—	6	1	7
Feb...	5	4	0	3	1	1	—	—	13	—	13
Mar...	2	2	0	2	2	1	—	—	9	—	9
Apl...	3	3	1	1	2	3	—	—	13	—	13
May..	6	2	1	2	5	2	—	—	12	—	12
June	3	1	3	3	2	1	2	1	15	—	15
July..	12	2	1	1	2	1	2	—	14	—	14
Aug.	10	5	2	3	0	1	—	—	16	—	16
Sept.	6	4	1	3	3	0	—	—	12	—	12
Oct...	4	3	0	1	3	1	—	—	10	—	10
Nov.	7	2	3	0	1	1	—	—	8	—	8
Dec...	10	1	3	1	—	—	—	—	6	1	7
Year	73	30	15	22	21	12	4	1	134	2	136

VI.—(*con.*)

(*b.*) *Total Rainfall. Millimetres.*

	8 p.m. —8 a.m.	8 a.m. —8 p.m.	Total.
Jan. ..	*9·1*	5·6	*14·7*
Feb. ..	45·3	21·5	66·8
Mar. ..	49·2	19·7	68·9
April ..	54·2	67·8	122·0
May ..	97·8	37·6	135·4
June ..	**130·9**	**156·0**	**286·9**
July ..	65·3	115·3	180·6
Aug. ..	19·7	42·1	61·8
Sept. ..	19·1	59·8	78·9
Oct. ..	30·8	46·1	76·9
Nov. ..	**34·0**	17·1	51·1
Dec. ..	**15·3**	*3·3*	18·6
Year ..	570·7	591·9	1162·6

(*c.*) *Rainless Periods of 10 days or more, excluding dew.*

Began.	Ended.	Lasted.
Jan. 10	Jan. 19	10 days
Sept. 26	Oct. 7	12 ,,
Oct. 13	Oct. 25	13 ,,
Nov. 27	Dec. 12	16 ,,

VIII.

Mean Duration of Bright Sunshine. Hours.

	Fore-noon.	After-noon.	Total.	Per-centage of possible.	Mean amount of Cloud.
Jan. ..	2·0	2·1	4·1	41	0·6
Feb. ..	1·8	1·1	2·9	*26*	0·7
Mar. ..	26	2·7	5·3	44	0·6
April ..	2·8	3·0	5·8	45	0·6
May ..	3·3	2·9	6·2	46	0·6
June ..	2·7	2·1	4 7	34	0·7
July ..	3·4	2·7	6·1	44	0·6
Aug. ..	3·8	3·5	7·3	**54**	0·5
Sept. ..	2·8	2·2	5.0	41	0·6
Oct. ..	2·3	2·0	4·3	38	0·6
Nov. ..	2·2	2·1	4·3	41	0·6
Dec. ..	2·5	2·2	4·7	47	0·5
Year ..	2·7	2·4	5·1	42	0·6

VII.—*Wind* (*a.*)

Mean Velocity at 8 a.m., 2 p.m. and 8 p.m. Metres per second.

	Mean.	Min.	Max.
Jan. ..	3·2	*0·0*	7·3
Feb. ..	3·7	1·0	7·9
Mar. ..	3·1	1·0	5·7
April ..	3·6	0·8	6·9
May ..	3·4	1·1	7·5
June ..	3·0	1·0	7·3
July ..	2·7	0·9	4·7
Aug. ..	3·0	0·5	5·9
Sept. ..	3·2	0·8	8·3
Oct. ..	3·1	1·3	7·0
Nov. ..	**3·8**	0·8	8·6
Dec. ..	3·7	1·4	**8·8**
Year ..	3·3	0·0	8·8

VII.—*Wind.* (*b.*) *Direction Percentage Frequency.*

	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.	Vari-able.
Jan.	17	16	10	4	2	*0*	6	**30**	14	1
Feb.	20	19	18	8	*0*	2	4	**24**	5	0
Mar.	9	**22**	13	18	6	6	*3*	10	12	1
April ..	14	22	6	**26**	9	*3*	4	7	9	0
May	11	9	13	**36**	9	*5*	8	5	4	0
June	7	13	11	**34**	12	8	*2*	4	7	1
July	*3*	13	14	**24**	13	16	8	4	5	0
Aug.	17	20	15	9	*3*	4	8	17	5	1
Sept.	13	**29**	11	14	10	5	*1*	11	2	4
Oct.	22	**31**	17	6	*0*	*0*	3	20	1	0
Nov.	23	15	7	6	*0*	4	2	**36**	6	0
Dec.	22	22	9	6	*2*	4	4	**28**	2	0
Year	22	**19**	12	16	6	5	*4*	16	6	1

EDITORIAL NOTES.

We much regret that two unprecedented rainfalls should occur in the same month at a time when the exigencies of a state of war make it impossible for us to expand the size of this Magazine ; but we beg those contributors whose contributions have been crowded out to be more considerate than the elements have proved on this occasion.

"British Rainfall, 1916," is now in an advanced state ; but there is still time to receive returns for last year which have not yet been sent in. As many records have stopped on account of the effects of the War, we urge our readers to endeavour to secure any returns for 1916 which are complete but have not yet been forwarded, and to send them without delay to 62, Camden Square, London, N.W. 1.

THE WEATHER OF JUNE.

THE characteristic features of the weather of June were the great irregularity in the distribution of rainfall and in the temperature, and the uniformity of the excess of bright sunshine.

The mean temperature taking the British Islands as a whole was about a degree above the average. In the east and south-east of England there was a general excess of from three to four degrees, but in Ireland and Scotland temperature was nearly everywhere under the average fully a degree in the north of Ireland. During the first eighteen days of the month warm and dry weather was experienced practically everywhere, the warmth being specially marked in the eastern half of England, including the Midlands, where the mean for the period was 4°·5 above the average, the excess for the whole country being 3°·5. The highest temperatures were in general recorded from the 15th to the 18th, although in Scotland the 12th was the warmest day, with maximum readings of 81° at Fort William, and 78° at Fort Augustus. On the 16th Little Massingham (Norfolk) and London (Camden Square), recorded maxima of 88°. On the 17th, Little Massingham and Greenwich recorded 93°, while at Norwich, Cambridge, Salisbury and Camden Square, the maximum was 90°. Cool weather prevailed in Scotland and Ireland, the maximum on the 17th being as low as 62° at Poltalloch and Valentia, and 59° at Malin Head.

During the last thirteen days the mean temperature was below the average in all parts of the British Isles, except the east of England, as much as 3°·5 in the east of Scotland and the north of Ireland. At a considerable number of Scottish and Irish stations, especially in coastal situations, the temperature during this period did not exceed 65° with minima of 32° at Ford (Argyll), and 33° at Eskdalemuir and Markree Castle on the 26th, and as low as 29° at Balmoral and 30° at West Linton on the last day of the month. During the last week the mean temperature of the British Isles was 4°·2 below the average, while in the east of Scotland the deficit was 6°·3.

Bright sunshine for the whole month was everywhere above the average, the mean daily excess being about an hour, a value which was appreciably exceeded in the east of Scotland, and the northern half of England, while in the south of Ireland values were but little above the normal.

The rainfall of the month was in general below the average, but showing great variations over the southern parts of England where high local excesses in the areas covered by the great falls of the 16th and 28th (see ante, pp. 61-66), afforded a marked contrast to the deficiency noted at stations outside the zones of these two storms. The great rainfall of the 28th was associated with the passage eastward to Kent of a depression which appeared off the south-west of Ireland on the 27th. In England and Wales north of a line stretching from St. David's Head to Clacton-on-Sea the rainfall distribution was fairly normal, showing the usual pronounced variations between the west and the east.

In Scotland less than an inch fell at one or two spots in the east of Fife and less than two inches over a considerable part of the eastern counties south of Montrose. Insular stations in the west had also a relatively small rainfall. The maxima recorded were 6 inches at Inverary, and a little over 5 inches near Glencoe. In Ireland less than 2 inches fell over a considerable portion of the eastern coasts. Few stations reported more than 3 inches. The maximum fall from 4 to 6 inches occurred over a limited area to the north of Connemara. Over the Kingdom as a whole the general rainfall expressed as a percentage of the average was :—England and Wales, 107 per cent.; Scotland, 99 per cent.; Ireland, 82 per cent.; British Isles, 98 per cent. In London (Camden Square) the mean temperature was 63°·7 or 3°·6 above the average. The duration of rainfall was 14·7 hours; of Sunshine, 185 hours; Evaporation amounted to 3·01 in.

RAINFALL TABLE FOR JUNE, 1917.

STATION.	COUNTY.	RAINFALL.						
		Aver. 1875—1909. in.	1917. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	2·28	5·29	+3·01	232	2·86	16	10
Tenterden	*Kent*	2·03	1·61	— ·42	79	1·00	28	12
Arundel (Patching)	*Sussex*	2·13	4·25	+2·12	200	3·20	28	11
Fordingbridge (Oaklands)	*Hampshire*	1·93	2·72	+ ·79	141	1·56	28	14
Oxford (Magdalen College)	*Oxfordshire*	2·27	2·22	— .05	98	1·60	28	10
Wellingborough (Swanspool)	*Northampn*	2.14	2·03	— ·11	95	·53	28	12
Bury St. Edmunds (Westley)	*Suffolk*	2·21	1·86	— ·35	84	·58	28	9
Geldeston [Beccles]	*Norfolk*	1·77	3·00	+1·23	170	1·12	18	12
Polapit Tamar [Launceston]	*Devon*	2·18	4·17	+1·99	191	1·46	28	17
Rousdon [Lyme Regis]	,,	2·18	1·75	— ·43	80	·52	28	12
Stroud (Field Place)	*Gloucester*	2·43	2·59	+ ·16	107	.66	28	16
Church Stretton (Wolstaston)	*Shropshire*	2·59	2·66	+ ·07	103	·43	1	16
Boston	*Lincoln*	1·95	1·85	— ·10	95	·62	24	9
Worksop (Hodsock Priory)	*Nottingham*	2·06	1·49	— ·57	72	·33	24	13
Mickleover Manor	*Derbyshire*	2·55	2·50	— ·05	98	·52	24	13
Buxton	,,	3·42	2·19	—1·23	64	·42	6	16
Southport (Hesketh Park)	*Lancashire*	2·26	2·03	— ·23	90	·70	6	10
Arncliffe Vicarage	*York, W.R.*	3·63	3·36	— ·27	93	·67	3	14
Goldsborough Hall	,, ,,	2·22	1·21	—1·01	54	·28	20	11
Hull (Pearson Park)	,, *E.R.*	2·09	1·38	— ·71	66	·27	7	13
Newcastle (Town Moor)	*North'land*	2·04	1·35	— ·69	66	·26	7	13
Borrowdale (Seathwaite)	*Cumberland*	6·94	6·75	— ·19	97	2·24	3	13
Cardiff (Ely)	*Glamorgan*	2·55	2·71	+ ·16	106	·51	28	24
Haverfordwest	*Pembroke*	2·74	3·28	+ ·54	120	·97	20	12
Aberystwyth (Gogerddan)	*Cardigan*	2·97	3·37	+ ·40	113	1·09	20	14
Llandudno	*Carnarvon*	1·97	2·14	+ ·17	109	·94	20	10
Cargen [Dumfries]	*Kirkcudbrt.*	2·84	2·94	+ ·10	104	1·17	20	12
Marchmont House	*Berwick*	2·38	1·12	—1·26	47	·45	20	8
Girvan (Pinmore)	*Ayr*	3·04	3·17	+ ·13	104	1·12	21	11
Glasgow (Queen's Park)	*Renfrew*	2·41	...	...	...	...	...	...
Islay (Eallabus)	*Argyll*	2·80	2·96	+ ·16	106	·40	7	18
Mull (Quinish)	,,	3·30	2·79	— ·51	85	·32	20	17
Balquhidder (Stronvar)	*Perth*	4·07	...	...	...	...	...	...
Dundee (Eastern Necropolis)	*Forfar*	2·06	1·48	— ·58	72	·28	13	11
Braemar	*Aberdeen*	2·18	2·09	— ·09	96	1·12	20	9
Aberdeen (Cranford)	,,	2·02	1·39	— ·63	69	·87	20	8
Gordon Castle	*Moray*	2·13	3·17	+1·04	149	...	...	...
Drumnadrochit	*Inverness*	2·26	2·70	+ ·44	120	·72	21	20
Fort William	,,	3·77	4·18	+ ·41	111	.67	20	19
Loch Torridon (Bendamph)	*Ross*	4·07	4·40	+ ·33	108	·62	24	18
Dunrobin Castle	*Sutherland*	2·10	2·15	+ ·05	102	·60	21	8
Killarney (District Asylum)	*Kerry*	2·92	2·77	— ·15	95	·52	19	23
Waterford (Brook Lodge)	*Waterford*	2·79	1·76	—1·03	63	.38	2	15
Nenagh (Castle Lough)	*Tipperary*	2·70	1·69	—1·01	63	·44	14	11
Ennistymon House	*Clare*	3·18	2·84	— ·34	89	·69	15	14
Gorey (Courtown House)	*Wexford*	2·59	2·37	— ·22	92	·49	26	13
Abbey Leix (Blandsfort)	*Queen's Co.*	2·58	1·83	— ·75	71	·40	23	15
Dublin (Fitz William Square)	*Dublin*	2·00	1·60	— ·40	80	·50	25	11
Mullingar (Belvedere)	*Westmeath*	2·72	2·18	— ·54	80	·38	16	13
Crossmolina (Enniscoe)	*Mayo*	3·17	3·59	+ ·42	113	·49	3	19
Cong (The Glebe)	,,	3·18	3·22	+ ·04	101	·85	3	18
Collooney (Markree Obsy.)	*Sligo*	3·11	2·53	— ·58	81	·34	12	22
Seaforde	*Down*	2·88	1·26	—1·62	44	·37	6	10
Ballymena (Harryville)	*Antrim*	2·89	2·50	— ·39	86	·35	3	16
Omagh (Edenfel)	*Tyrone*	2·82	2·58	— ·24	91	·47	3	20

SUPPLEMENTARY RAINFALL, JUNE, 1917.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	1·94	XI.	Lligwy	2·12
,,	Ramsgate	1·79	,,	Douglas, Isle of Man	1·55
,,	Hailsham	3·54	XII.	Stoneykirk, Ardwell House...	1·75
,,	Totland Bay, Aston House...	1·01	,,	Carsphairn, Shiel.....	3·59
,,	Stockbridge, Ashley..	4·86	,,	Langholm, Drove Road	2.19
,,	Grayshott	2·28	XIII.	Selkirk, The Hangingshaw..	1·05
III.	Harrow Weald, Hill House...	1·99	,,	North Berwick Reservoir.....	1·15
,,	Pitsford, Sedgebrook....	1·70	,,	Edinburgh, Royal Observaty.	1·51
,,	Woburn, Milton Bryant.....	2·31	XIV.	Biggar.....	2·76
,,	Chatteris, The Priory..... ...	2·62	,,	Maybole, Knockdon Farm ...	2·93
IV.	Elsenham, Gaunts End	1·57	XV.	Buchlyvie, The Manse.....	3·05
,,	Shoeburyness	·63	,,	Ballachulish House	5·28
,,	Colchester, Hill Ho., Lexden	·63	,,	Oban.....	3·68
,,	Ipswich, Rookwood, Copdock	1·25	,,	Campbeltown, Witchburn ..	2·59
,,	Aylsham, Rippon Hall.... ..	1·13	,,	Holy Loch, Ardnadam.....	3·60
,,	Swaffham	·91	,,	Tiree, Cornaigmore	2·07
V.	Bishops Cannings	2·99	XVI.	Glenquey	4·40
,,	Weymouth.....	1·35	,,	Glenlyon, Meggernie Castle..	4·89
,,	Ashburton, Druid House.. ...	4·21	,,	Blair Atholl	2·06
,,	Cullompton	3·22	,,	Coupar Angus	1·83
,,	Lynmouth, Rock House	5·14	,,	Montrose, Sunnyside Asylum.	1·99
,,	Okehampton, Oaklands.. ...	4·67	XVII.	Balmoral	3·42
,,	Hartland Abbey.....	3·82	,,	Fyvie Castle	2·25
,,	St. Austell, Trevarna	3·85	,,	Keith Station	3·10
,,	North Cadbury Rectory.....	...	XVIII.	Rothiemurchus	3·10
VI.	Clifton, Stoke Bishop	2·78	,,	Loch Quoich, Loan	7·01
,,	Ledbury, Underdown..... ...	2·14	,,	Skye, Dunvegan	3·95
,,	Shifnal, Hatton Grange.....	2·16	,,	Fortrose.....	3·28
,,	Droitwich.....	2·80	,,	Glencarron Lodge	4·39
..	Blockley, Upton Wold.....	2·02	XIX.	Altnaharra	...
VII.	Grantham, Saltersford.....	1·24	,,	Melvich	3·09
,,	Market Rasen	...	,,	Loch More, Achfary	4·08
,,	Bawtry, Hesley Hall	1·47	XX.	Dunmanway, The Rectory ..	2·63
,,	Whaley Bridge, Mosley Hall	2·87	,,	Glanmire, Lota Lodge.....	1·82
,,	Derby, Midland Railway.....	2·91	,,	Mitchelstown Castle.....	1·20
VIII.	Nantwich, Dorfold Hall	2·55	,,	Darrynane Abbey.....	2·91
,,	Chatburn, Middlewood	...	,,	Clonmel, Bruce Villa	1·24
,,	Lancaster, Strathspey	2·91	,,	Broadford, Hurdlestown.....	2.32
IX.	Langsett Moor, Up. Midhope	1·86	XXI.	Enniscorthy, Ballyhyland...	2·36
,,	Scarborough, Scalby	1·84	,,	Rathnew, Clonmannon	1·66
,,	Ingleby Greenhow	1·83	,,	Ballycumber, Moorock Lodge	1·93
,,	Mickleton	·60	,,	Balbriggan, Ardgillan	1·11
X.	Bellingham, High Green Manor	1·17	,,	Castle Forbes Gardens.....	1·99
,,	Ilderton, Lilburn Cottage ...	1·13	XXII.	Ballynahinch Castle.....	4·25
,,	Keswick, The Bank.....	3·13	,,	Woodlawn	1·71
XI.	Llanfrechfa Grange	3·17	,,	Westport, St. Helens	2·53
,,	Treherbert, Tyn-y-waun	3·46	,,	Dugort, Slievemore Hotel ...	4·95
,,	Carmarthen, The Friary	3·09	XXIII.	Enniskillen, Portora.....	2·20
,,	Fishguard, Goodwick Station.	2·14	,,	Dartrey [Cootehill]	2·39
,,	Crickhowell, Tal-y-maes.....	2·50	,,	Warrenpoint, Manor House ..	2·19
,,	New Radnor, Ednol	2·20	,,	Belfast, Cave Hill Road	2·81
,,	Birmingham WW., Tyrmynydd	2·65	,,	Glenarm Castle	2·75
,,	Lake Vyrnwy	2·73	,,	Londonderry, Creggan Res...	2·89
,,	Llangynhafal, Plas Drâw.....	2·33	,,	Dunfanaghy, Horn Head ...	3·02
,,	Dolgelly, Bryntirion.....	5·05	,,	Killybegs	3·99
,,	Bettws-y-Coed, Tyn-y-bryn...	2·26			

Climatological Table for the British Empire, January, 1917.

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	55·0	1	24·8	29	38·3	32·7	32·6	89	73·1	20·4	1·30	18	8·3
Malta	65·7	17	45·5	12	59·4	51·9	...	79	110·8	...	3·35	14	0·4
Lagos	90·2	14*	71·5	26	88·5	75·0	74·5	77	142·0	69·2	·23	3	6·6
Cape Town	93·2	25	52·0	6	80·6	61·1	58·6	65	...	...	·77	2	3·0
Johannesburg	87·8	18	47·3	8	77·4	55·9	55·0	76	...	48·1	4·52	15	5·4
Mauritius	87·8	1	68·7	4	85·1	72·5	69·3	76	...	63·9	9·37	24	6·4
Bloemfontein	94·8	5	41·8	8	85·7	60·1	53·3	52	..	...	4·06	11	4·0
Calcutta...	83·6	28	47·3	6	77·3	54·8	53·8	65	...	35·1	·00	0	1·1
Bombay...	88·3	17	65·3	1	83·9	69·7	65·6	70	136·5	58·1	·00	0	1·3
Madras	85·4	15	63·1	25	83·8	69·2	64·4	69	156·5	59·3	·38	1	3·4
Colombo, Ceylon ...	91·1	3	64·6	4	86·3	70·0	67·8	75	159·1	55·0	4·34	8	5·1
Hongkong	70·1	17	38·8	9	60·7	51·7	44·0	63	...	...	·35	5	5·6
Sydney	96·8	12	61·3	27	81·3	67·2	63·8	69	157·6	55·2	3·09	17	6·0
Melbourne	100·3	19	49·8	13	76·8	57·6	54·1	63	151·7	40·1	1·75	12	5·3
Adelaide	104·2	18	51·9	5	84·3	60·2	52·2	48	158·5	43·5	·44	4	4·1
Perth	101·6	15	54·0	11	83·7	63·1	57·2	58	170·5	47·0	·02	1	2·6
Coolgardie	108·4	18	51·0	12	90·9	62·2	51·0	38	170·0	47·8	·00	0	2·8
Hobart, Tasmania ..	95·8	19	46·2	17	69·6	52·9	47·6	59	149·9	40·1	1·68	14	6·4
Wellington	81·5	31	49·7	19	72·6	57·9	54·5	68	151·0	38·7	1·76	7	5·3
Auckland	...	...	...	...	73·4	61·5	...	...	...	...	3·48	13	...
Jamaica, Kingston ..	89·9	11	60·0	10	84·5	65·9	64·7	77	...	...	·26	3	3·2
Grenada	85·0	30	69·0	var.	81·0	70·0	...	74	135·0	...	3·73	22	3·0
Toronto	40·0	30	—9·0	11	30·0	15·2	16·4	80	102·0	—10·0	2·97	16	6·8
Fredericton	46·0	14	—25·0	29	22·4	1·1	7·3	88	...	...	4·28	12	5·0
St. John, N.B. ...	47·0	14	—10·0	29	26·4	9·8	12·0	77	94·0	—11·0	4·32	14	5·4
Victoria, B.C.	49·0	5	13·0	30	41·0	34·6	33·9	87	104·0	7·0	4·41	21	7·3

* 16.

Johannesburg.—Bright sunshine 237·7 hours.

Mauritius.—R 1·57 in. above average. Mean temp. 0°·5 below average

COLOMBO, CEYLON.—Mean temp. 78°·1 or 0°·7 below, dew point 1°·7 below, and R 1·25 in. above, averages. Mean hourly velocity of wind 6·0 miles. TS on seven days.

HONGKONG.—Mean temp. 55°8·. Bright sunshine 169·9 hours.

Melbourne.—Mean temp. 0°·2 below and R ·11 in. below, averages.

Adelaide.—Mean temp. 1°·8 below, and R ·29 in. below, averages.

Coolgardie.—Temp. 0°·8 below, and R 0°·4 in. below, averages.

Wellington.—Mean temp. 2°·8 above, and R 1·64 in. below, averages. Bright sunshine 267·2 hours. A fine sunny month. TSS on the 8th and 9th.

Symons's
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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 "Boletin 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
Temp. at S. Orkneys, April to November	° −6·9	1903 −0·3	1904 −1·0	1905 +0·2	1906 0·0	1907 −0·6	1908 +2·4	1909 +0·1	1910 +1·9	1911 +1·5	1912 −1·6	1913 −0·2	1914 +0·8	1915 −2·2	1916 −1·1	
Rainfall at Gen Acha, July to December ...	mm. 188	1905 −27	1906 +20	1907 +50	1908 +25	1909 +41	1910 −121	1911 +77	1912 −50	1913 −45	1914 +92	1915 −15	1916 −50			−0·82
Rainfall at B. Aires, October to March ...	538	1906-7 − 92	1907-8 −204	1908-9 − 49	1909-10 −108	1910-11 −253	1911-12 +448	1912-13 + 99	1913-14 +146	1914-15 +173	1915-16 − 88	1916-17 −77				+0·88
July to June	1026	−150	−371	−317	−228	−169	+572	+140	+484	+386	−334					+0·92

Table II.

Temp. at Stykkisholm	° 3·3	1893 −0·1	1894 +0·8	1895 +0·2	1896 −0·1	1897 +0·3	1898 +0·1	1899 −0·7	1900 +0·2	1901 +0·6	1902 −0·6	1903 −0·8	1904 −0·2	1905 +0·2	1906 −0·4	1907 −0·8	1908 +0·9	1909 +0·3	1910 −0·5	1911 +0·1	
Pressure at P. Delgada	mm. 765·02	1894 +0·25	1895 −2·50	1896 +0·94	1897 +0·07	1898 −1·04	1899 −2·02	1900 +0·33	1901 −0·57	1902 −1·44	1903 +0·33	1904 +0·06	1905 +0·61	1906 +1·30	1907 +1·42	1908 +1·46	1909 −0·60	1910 +1·21	1911 +0·42	1912 −0·15	−0·56
Temp. at Stykkisholm	° 3·2	1890 +0·3	1891 +0·7	1892 −1·8	1893 0	1894 +0·9	1895 +0·3	1896 0	1897 +0·4	1898 +0·2	1899 −0·6	1900 +0·3	1901 +0·7	1902 −0·5	1903 −0·7	1904 −0·1	1905 +0·3	1906 −0·3	1907 −0·7	1908 +1·0	−0·52
Temp. at Jacobshavn	° −5·9	1890-91 −1·1	91-92 0	92-93 +1·1	94-95 −1·0	95-96 −0·7	96-97 −0·4	97-98 −1·5	98-99 −1·8	99-1900 −1·3	1900 01 +0·9	01-02 +1·5	02-03 +1·1	03-04 +0·9	04-05 +0·6	05-06 +0·9	06-07 +0·5	07-08 −0·5	08-09 +0·5		
Pressure at P. Delgada	mm. 765·02	1894-5 −1·12	95-96 −0·78	96-97 +0·50	97-98 −0·48	98-99 −1·53	99-00 −0·84	00-01 −0·12	01-02 −1·00	02-03 −0·56	03-04 +0·20	04-05 +0·83	05-06 +0·96	06-07 +1·36	07-08 +1·44	08-09 +0·43	09-10 +0·30	10-11 +0·82	11-12 +0·14		+0·69

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 :—$Th = a_0 + a, \sin (H + A_1) + a_2 \sin (2H + A_2)$. 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."

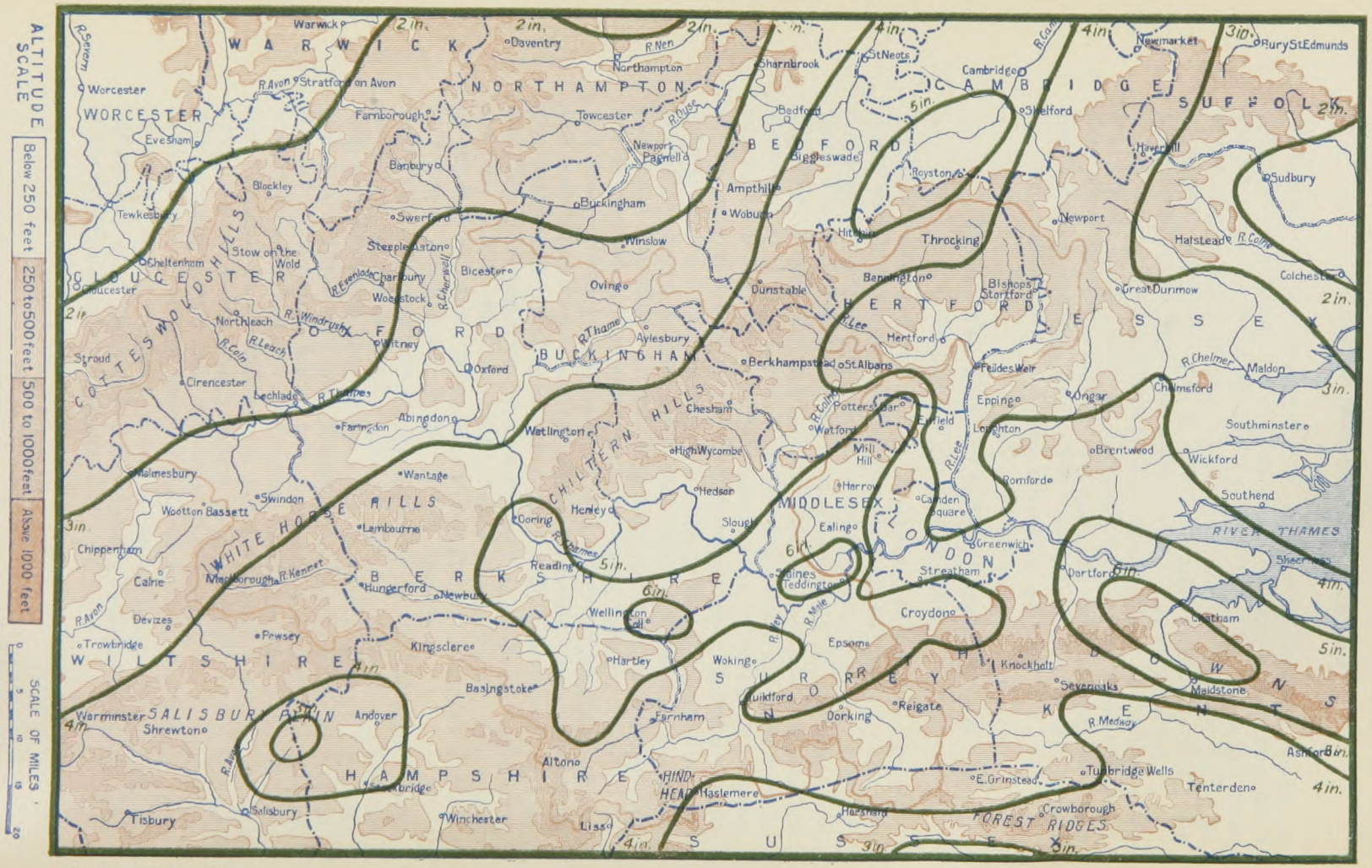
WORK OF THE CONJOINT BOARD OF SCIENTIFIC SOCIETIES.

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.

THAMES VALLEY RAINFALL. JULY, 1917.



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. in.	Date.	No. of Days
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)	*Northampn*	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 (Pinmore)	*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
Balquhidder (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.	Elsenham, 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	,,	Dugort, 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. 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	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	150·9	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.

Symons's
Meteorological Magazine.

No. 620. SEPTEMBER, 1917. Vol. LII.

THE RAINFALL OF AUGUST AND THE SUMMER OF 1917.

The unusual rainfall of the past summer, and more especially of the month that has just closed, are of sufficient interest to justify a much more detailed summary than the exigencies of our space at present allow, so we must ask the consideration of the numerous Observers who have favoured us with ample details, which will be fully utilized later. Since the termination of the long partial drought in the middle of June the south and south-east of England has been the theatre of several rainstorms of the first magnitude varying in duration from about two hours—the period covered by the great London thunderstorm rain of June 16th, to the exceptionally rainy week covering the seven days ending with August 4th. These falls were completely eclipsed by the great Wessex rain of June 28th, so that in whatever direction the "time element" is considered new records have been established which will in all probability remain unchallenged for the districts in question for many years to come. Although not specially noteworthy for any great daily fall August has in many districts, particularly in Ireland, established a new record, which accentuates the unique character of the unstable atmospheric conditions of the past summer. In the present notice we can only summarize briefly the salient features of the periods under consideration.

In August in England and Wales a few isolated areas had less than four inches of rain, these being located in the vicinity of Oxford, Cambridge, Chelmsford and Coventry. A considerable area, near the coast, from Lowestoft to Harwich, had also less than four inches, as also had another coastal area, from Hunstanton to Cromer. Large portions of the country had more than six inches, the rainfall exceeding ten inches over the elevated portions of Devon and Somerset. In the normally rainy portions of Wales, and Cumberland, various stations in Snowdonia, and the Lake District, had more than 20 inches in the month, an amount closely approached in parts of Glamorgan and exceeded in Denbigh. In Ireland the rainfall varied from about five inches in Co. Antrim, to over ten inches in Connemara and Killarney, and

at many places the amount recorded constituted an extreme record for the month over a long series of years. In Dublin, for example, the rainfall amounted to 7·58 in. on 24 days, all after the 6th of the month, against the previous August record in about half a century of 7·02 in. on 22 days in 1905. At other places, and this also applies to some English stations, August established a record as the wettest month ever experienced.

In Scotland the rainfall was much less remarkable, ranging from about 3·5 in. in the outlying western islands—where the precipitation was under the normal—and also in the north-east, at Keith, to over 10 inches near Glencoe and in West Inverness. Mr. A. Watt, Secretary to the Scottish Meteorological Society, has kindly sent us the following notes on the weather in Scotland :—" The mean pressure for the month was the lowest recorded in August for at least 50 years. A striking feature was the very moderate fluctuations of the night temperatures. These were, as a rule, decidedly above the normal ; higher on the average than in any August for at least 50 years ; and, leaving out of account fairly low readings, around 20th, or 31st, showed at many stations a variation of only five or six degrees throughout the month, the mean daily range for the " Eight Large Towns " being the lowest on record. Except in the east little or no rain fell during the first week and Orkney experienced all but rainless weather until the 16th. By the 8th conditions had become unsettled generally and remained more or less so throughout the month, with some heavy falls in most districts, especially from the 8th to the 18th, 22nd to the 24th, and 26th to the 28th. On the last-mentioned day a severe rainstorm was general in east and north, with numerous falls exceeding an inch, and as much as 2·40 in. at Ardross Castle, in Ross-shire. Except in the extreme north and at some western stations aggregates were above the normal, in most eastern districts decidely so, and in Berwickshire the month was the wettest August on record." The general rainfall expressed as a percentage of the average was :— England and Wales, 192 per cent. ; Scotland, 121 per cent. ; Ireland, 192 per cent. : British Isles, 173 per cent. During the very wet August of 1912, the rainfall in England and Wales was 198 per cent., Scotland gave 119 per cent., Ireland, 129 per cent., while the British Isles had 158 per cent. of the average. Thus in England and Wales and also in Scotland the values for the two years under review were much the same, the excess in Ireland in August, 1917, being the most pronounced feature, as shown from the data given in the monthly rainfall table for 55 stations, which appears in this Magazine.

The rainfall of the summer months of June, July, and August, 1917, shows great variations from the average over the British Isles, although the transition from wetness to drought proceeded with considerable regularity over the country. We have taken the 55 stations given in the general table and expressed the results for

the three months as a percentage of the average of the period 1875-1909.

The south of the British Isles was conspicuously the wettest area, more than 20 per cent. above the average falling south of a line drawn from Sligo Bay to the Wash. More than 40 per cent. above the average fell over the greater part of the south of Ireland, south-west Wales, and south-east of England. In the last mentioned area portions of the counties of Middlesex, Surrey, Sussex, and Kent had an excess of more than 80 per cent., rising in patches to double the average. When it is remembered that the first half of June was practically rainless over most of the south-east of England the exceptional character of the eleven weeks in this area is emphasized.

Less than the average fell generally in the north and west of Scotland and as far south as Morecombe Bay. The driest area was the west of Scotland and the English Lake District, with a deficiency of 20 per cent., rising to 40 per cent in Mull. In the North Midlands of England the rainfall was only slightly above the average, and may have fallen under the average in places.

STONYHURST COLLEGE AND CLIMATE.

By L. C. W. Bonacina.

The Stonyhurst Observatory is situated near the Yorkshire border of Lancashire, about 400 feet above sea-level, on a shoulder of ground rising from the steep-cut, picturesque valley of the Hodder, not far from its confluence with the Ribble below Clitheroe ; and is set amid bold outlying spurs of the Pennine chain within easy reach of some of the wildest and most untameable fell-country in the north of England.

Founded by the Jesuit Fathers in 1838, it has taken a prominent place among the astronomical observatories of these isalnds, and has conducted no fewer than seven total solar eclipse expeditions to distant parts of the globe, all except one under Government authority. The first four of these expeditions were led by the Rev. S. J. Perry, S.J., F.R.S., who died in 1889 while on one of these expeditions ; the latter three were led by the Rev. A. L. Cortie, S.J. In addition to the astronomical work Stonyhurst maintains a continuous record of meteorological, magnetic and seismological conditions, and the results of the observations which were, till 1913, sent to the Meteorological Office in connection with the latter's secondary stations, are embodied in an Annual Report compiled by the Rev. W. Sidgreaves, S.J., the Director of the Observatory, in a form which for conciseness and arrangement leaves little to be desired.

The absolute extremes of air temperature during the 69 years ending with 1915 were 89°·0, on July 20th, 1901, and 4°·6 on January,

15th, 1881, and the warmest and coldest months were July, 1901, with a mean temperature of 63°·2, and February, 1855, with a mean of 28°·6. The warmest year was 1868, with a mean of 49°·1, and the coldest 1879, with 44°·1. The greatest rainfall in any one day was 3·7 in., on November 16th, 1866, in any one month, 13·437, in October, 1870, and in any one year, 62·09, in 1866. The driest month was May, 1859, with ·25 in., and the driest year, 1887, with 31·25.

The following table shows the average mean monthly temperature and rainfall for the last 69 years, and of sunshine for the last thirty-six years :—

	Temperature in degs. F. (adopted mean).	Rainfall in inches.	Sunshine in hours.	
			hours.	per cent. of possible.
Jan.	37·5	4·230	32·8	13·2
Feb.....	38·3	3·535	59·0	21·5
March	40 0	3·398	103·4	28·3
April	44·5	2·568	150·0	35·8
May	49·5	2·684	186·0	37·7
June	55·1	3·409	184 0	36·2
July.....	57·8	3·998	174·2	34·2
Aug.	57·4	4·998	151·2	33·1
Sept.	53·8	4·217	125·7	33·2
Oct.	47·6	4·962	83·4	25·6
Nov.	41·8	4·424	46·7	18·3
Dec.....	38·8	4·627	25·2	10·9
Year	47·0	47·050	321·6	29·6

The mean annual temperature is about 2½° below that of Greenwich at the opposite end of England, and the annual rainfall —under the influence of orographic features—nearly double. It will be seen that Stonyhurst shows the well-marked April-May minimum of rainfall characteristic of northern England and southern Scotland ; but that the maximum is less definite, indicating that the different seasonal factors which produce isolated maxima in many parts of the country are all more or less prominent at Stonyhurst. Thus the August figure, which is actually the highest in the year, betrays the thunderstorms for which the locality is rather noted ; the October figure is in keeping with the generally high rainfall of that month, reaching a maximum over a large part of the country ; and finally the December figure exhibits the heavy cyclonic rainfalls which in the west of Scotland and Ireland make the depth of winter the wettest period of the year. The sunshine columns show that both meteorologically, with 37·7 per cent. of the possible amount, and climatically, with 186·0 hours, the sunniest month in the year at Stonyhurst is May—a month which astronomically, of course, only ranks third in possible sunniness everywhere in the Northern Hemisphere. The "climatic" sunniness is the most significant, since it depends both on the time of the year and the state of the weather, *i.e.*, on the astronomical and meteorological estimates of sunniness.

The general character of the climate of north-east Lancashire is cold and bracing, and, though distinctly harder than that of south-country places, is highly salubrious. The January temperature at Stonyhurst is only about a degree lower than that of Greenwich, but the general character of the winter weather is more severe. A long sequence of heavy cyclonic gales and pitiless, sweeping rain-storms is a common feature in the depth of winter; but the wet weather is broken at intervals by spells of hard and invigorating frost, and now and again the district is visited by snowstorms of true Pennine severity. It is probable, however, that the district, as a rule, suffers less from snow than places on the eastern side of the Pennine Range. The cool July temperature of barely 58° results from the combination of Northern and Atlantic influences. But though a great deal of chilly broken weather marks the summer, spells of brilliantly hot weather occur here as in all parts of England, and when these accompany the very long days which the north-country enjoys, the midsummer effects are magnificent. Moreover, character is given to the summer climate of the Ribble Valley and the Pendle and Bowland Forest uplands by the tendency to thunder-storms of a somewhat violent type which occur with greater frequency than in most parts of England. Although the Stonyhurst Reports do not give the mean frequency of thunderstorms in the locality, it is interesting to note that statistics compiled elsewhere have shown a very high frequency of thunderstorms at Stonyhurst, in fact, one of the highest in England and higher than that of the London district with its distinctly hotter summers.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE WET AUGUST.

On Tuesday, August 28th, at 7.20 a.m., G.M.T., the barometer here fell to 28·557 ins. corrected and reduced to sea level. This is by far the lowest I have registered in August, and has only once been approached in the summer half of the year, *viz.*, on September 2nd, 1883, when the pressure fell to 28·686 ins. at 7 p.m. Only twice in 38 years has the rainfall (6·52 in.) been exceeded, and only once has the number of rain-days (28) been surpassed in any month, *viz.*, in October, 1903 (29 days).

The barometric mean, 29·655 in., is also the lowest in my record for August, and probably the lowest since 1860.

CHARLES LEWIS BROOK.

Harewood Lodge, Meltham, Yorks, September 1, 1917.

My rainfall figures for the month of August, 1917, are so remarkable that I send them to you in detail. The total of 8·54 in. for the month exceeds by over an inch any single month's record in this part of the country that I have ever heard of. ROGER P. SING.

Eastham, Birkenhead, 1st September, 1917

The rainfall here during August was notable, no less than 6·39 in. being registered. Not only was it the wettest August since 1900, but the rainfall was the greatest recorded at Blundellsands in any one month since October, 1903. The excess was principally due to the very heavy rain on the 17th, when 1·93 in. fell.

The average rainfall for August at Blundellsands for the past forty-one years is 3·27 in., so that this amount was exceeded by 3·12 in. or over 95 per cent.

HUGH MONTGOMERY, F.R.Met.Soc.

"Myra," Blundellsands, 1st September, 1917.

The rainfall for the past month recorded at Bothalhaugh was 6·74 in. The highest recorded for August was 6·83 in. in 1877. In that year, 1877, there were two days without rain. In this August there were three days; but the heavy rain which fell on September 1st began just before the time for taking the record. A few minutes more and there would have been enough to register, and to make it equal to the rainfall of 1877. I give the records of the heaviest monthly falls since 1877 :—

In 1903 (October), 9·42 in; 1878 (November), 7·37 in.; 1877 (August), 6·83 in.; 1917 (August), 6·74 in.; 1896 (October), 6·34 in.; 1900 (October), 6·11 in.

The average of August for 41 years is 3·24 in.

WILLIAM ELLIS.

Bothalhaugh, Morpeth, September 3rd, 1917.

HEAVY RAINFALL IN THE SOUTH-EAST OF ENGLAND.

In the article under this heading in your August issue, after giving the amounts of rainfall at the end of July, and beginning of August, you say, "many of these amounts are doubtless unprecedented .. the Observer . . . 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." Also in this note you

mention a heavy fall in Essex and as a contrast the comparative dryness of other parts, particularly the north-east coast.

This appears to the writer to strongly support his theory, that the abnormal disturbance of the atmosphere over France and Flanders must cause a larger rainfall than usual within a limited area, of which the south-east and east of England form one of the borders. Apparently no meteorologist has been sufficiently enthusiastic to fix up a raingauge in the actual war area, but should such a thing be possible the writer feels certain the amounts recorded would be out of all proportion to those of normal times. It is only reasonable to assume that, apart from the concussions of the explosions, the enormous amount of chemical matter discharged into the atmosphere must effect it in the same manner as a volcanic eruption, which nearly always causes a disturbance of an electrical nature over the crater, known as a volcanic thunderstorm.

Thunderstorms have been remarkably frequent at the seat of war, which also seems to bear out this theory; also nearly all the rains have been caused by secondary or thunderstorm depressions which generally have their origin locally. All this would seem to point to the fact that meteorologists should approach the matter of gunfire and rainfall with a more open mind than they have hitherto.

D. W. HORNER, F.R.Met.Soc.

Tower Park, Moreton Hampstead

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

AFTER reading Mr. Boys' letter in your August issue, I feel I should like to send you the results of some personal experiments touching these matters.

In regard to the question of the "demerits of rain gauges" raised in Mr. Boys' letter in the August number, I have experimented with three gauges, two Snowdon and one shallow-rimmed pattern. When placed together these gauges registered alike in what may be called ordinary rain, but in extremes, such as heavy rain, or in light drizzle, differences arose. The Snowdons invariably registering more in heavy rain, and slightly less in light drizzle. The former resulting from no out-splashing, and the latter from a greater surface to be covered before delivery into funnel, whilst in snow and hail the Snowdons were always considerably more, especially so if a wind of more than force 4 was blowing, so much so, that I decided the shallow gauge useless for anything approaching a correct estimate of the real "rainfall."

Then I experimented further with the two Snowdons, always keeping my standard in its own position, with rim 1 foot above

the surface, placing the other a distance of 3 feet away, with the rim moved to various heights above the surface. At 6 inches it registered slightly more, viz., 0.25 in. against 0.245 in. at 12 inches. At 2 feet serious differences arose, increasing according as the height was increased, to such an extent, that I thought it unneccesary to experiment further. When gauge was placed on hard bare soil in-splashing became very evident at anything below 12 inches, but when placed on a short grass surface I could trace no in-splashing at 12 inches, either during very heavy rain, or hail. What seems to be a greater obstacle to accuracy is the measuring glass. There are so many shapes and forms in use, some old patterns being quite inaccurate, especially in the smaller readings. And again, all Observers should read the meniscus alike, whereas some read the "top," and some read "midway," whilst others read the "bottom," these differences make serious totals. Surely the bottom line of meniscus is the true reading.

From these few experiments I feel sure that for accurate and comparable results, the height of 12 inches should be maintained, all gauges should be alike in form, *i.e.*, Snowdon, or deep rimmed. Measuring glasses should be true and read to ·005 in., and the gauge placed on short grass plot, free from all low-growing vegetables or flowers, for at least a space of 3 feet on either side.

FREDERICK LOWE, F.R.Met.Soc.

S. Michael's, Tenbury, 28th August, 1917.

UNUSUAL RAINBOW.

On August 15th, at 6.40 p.m. (summer time), a very unusual rainbow was seen here. It took the form of an arc (80° at most) with the prismatic colours arranged as in an ordinary primary bow, *i.e.*, with the red on the outside of the curve; but what was so remarkable was that it lay *between the sun and the zenith.* So far as I can judge it centred on the zenith, at a distance of about 20° from it, and it seemed to be part of a circle. The cloud in which it lay was nimbus, and not specially high; but as it did not extend further east, there was no opportunity of observing the completion of the circle, if, indeed, any such completion were possible.

I am familiar with the general theory of primary and secondary bows, which alone are mentioned in such books on the subject as I possess; but I am unable to understand this bow, the position of which is quite new to me.

HENRY BURY.

Mayfield House, Farnham, Surrey, August 16th, 1917.

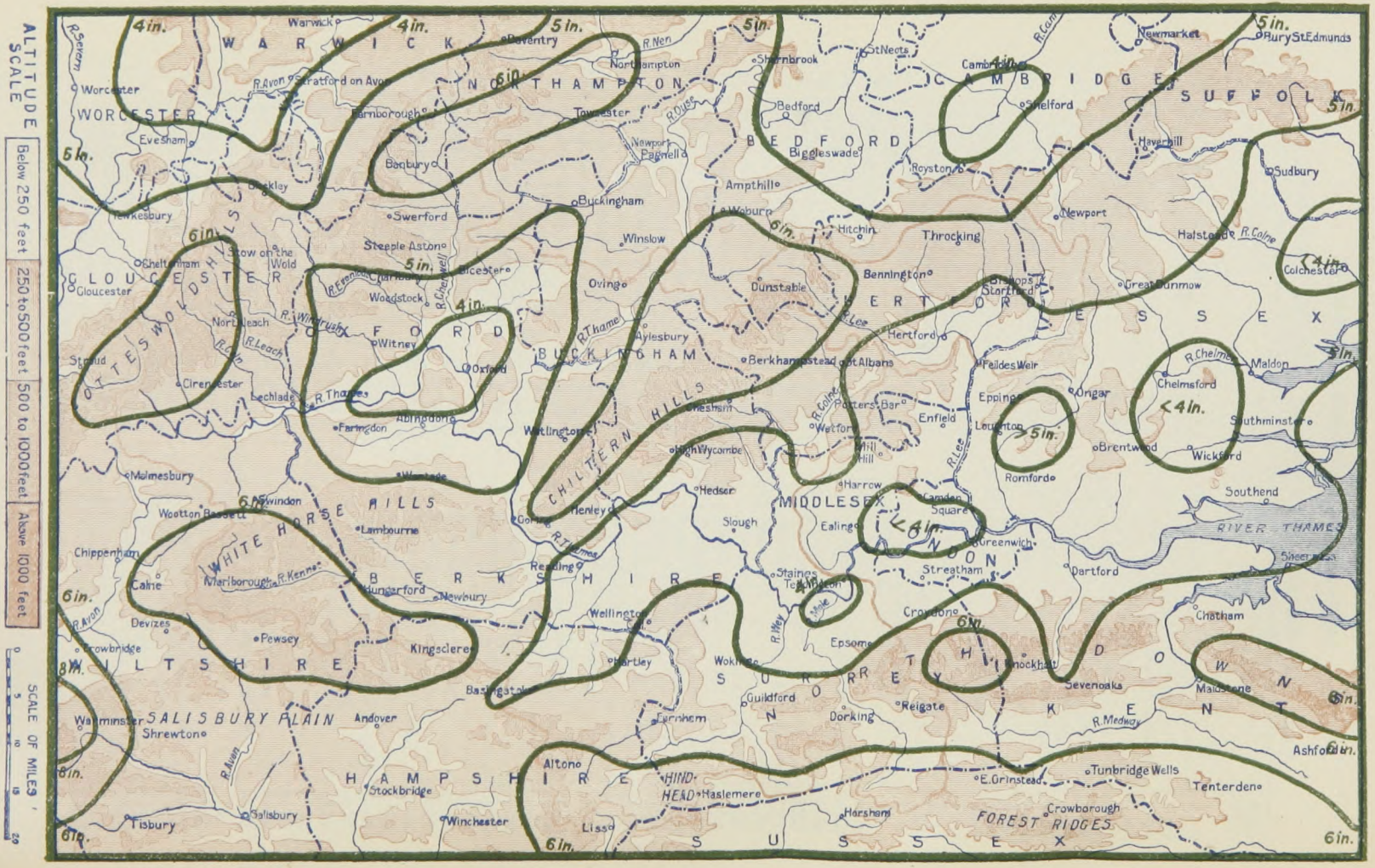
RAINFALL TABLE FOR AUGUST, 1917.

STATION.	COUNTY.	RAINFALL.						
		Aver. 1875—1909. in.	1917. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	2·39	3·99	+1·60	167	1·05	27	23
Tenterden	*Kent*	2·42	6·40	+3·98	265	1·66	27	22
Arundel (Patching)	*Sussex*	2·52	5·78	+3·26	229	1·22	1	20
Fordingbridge (Oaklands)	*Hampshire*	2·76	5·04	+2·28	183	1·05	1	29
Oxford (Magdalen College)	*Oxfordshire*	2·44	3·46	+1·02	142	·95	1	21
Wellingborough (Swanspool)	*Northampn*	2·36	6·64	+4·28	281	1·14	1	23
Bury St. Edmunds (Westley)	*Suffolk*	2·52	5·02	+2·50	199	1·65	1	22
Geldeston [Beccles]	*Norfolk*	2·22	3·74	+1·52	169	·93	3	19
Polapit Tamar [Launceston]	*Devon*	3·17	5·88	+2·71	186	1·20	27	23
Rousdon [Lyme Regis]	,,	2·84	5·21	+2·37	183	·83	27	24
Stroud (Field Place)	*Gloucester*	2·90	5·99	+3·09	207	·82	1	25
Church Stretton (Wolstaston)	*Shropshire*	3·43	6·62	+3·19	193	1·17	27	29
Boston	*Lincoln*	2·39	4·47	+2·08	187	·84	1	21
Worksop (Hodsock Priory)	*Nottingham*	2·55	4·75	+2·20	186	1·31	8	25
Mickleover Manor	*Derbyshire*	2·80	4·37	+1·57	156	·72	27	27
Buxton	,,	4·52	8·77	+4·25	194	1·06	28	27
Southport (Hesketh Park)	*Lancashire*	3·73	6·12	+2·41	164	1·56	17	23
Arncliffe Vicarage	*York, W.R.*	5·62	9·49	+3·87	169	1·22	8	28
Goldsborough Hall	,, ,,	2·80	...	...	...	...	...	...
Hull (Pearson Park)	,, *E.R.*	3·05	5·76	+2·71	189	·99	8	25
Newcastle (Town Moor)	*North'land*	3·20	7·58	+4·38	237	1·06	27	29
Borrowdale (Seathwaite)	*Cumberland*	11·47	19·83	+8·36	173	2·52	16	22
Cardiff (Ely)	*Glamorgan*	4·54	7·90	+3·36	174	·91	27	28
Haverfordwest	*Pembroke*	4·21	8·73	+4·52	207	1·55	17	19
Aberystwyth (Gogerddan)	*Cardigan*	4·88	11·52	+6·64	236	2·65	17	22
Llandudno	*Carnarvon*	3·16	5·68	+2·52	180	·88	26	22
Cargen [Dumfries]	*Kirkcudbrt.*	4·23	5·94	+1·71	140	·90	23	24
Marchmont House	*Berwick*	3·54	8·35	+4·81	236	1·15	27	27
Girvan (Pinmore)	*Ayr*	4·54	4·78	+ ·24	105	1·37	23	21
Glasgow (Queen's Park)	*Renfrew*	3·62	...	...	...	...	...	...
Islay (Eallabus)	*Argyll*	4·49	3·60	— ·89	80	·51	11	22
Mull (Quinish)	,,	5·00	3·49	+1·51	70	·85	23	21
Balquhidder (Stronvar)	*Perth*	6·22	8·08	+1·86	130	·92	24	21
Dundee (Eastern Necropolis)	*Forfar*	3·34	5·56	+2·22	167	1·00	14	29
Braemar	*Aberdeen*	3·63	5·44	+1·81	150	1.53	28	22
Aberdeen (Cranford)	,,	3·07	4·50	+1·45	147	1·09	14	25
Gordon Castle	*Moray*	3·29	3·07	— ·22	93	...	...	...
Drumnadrochit	*Inverness*	3·11	4·97	+1·86	160	2·63	28	18
Fort William	,,	6·15	6·11	— ·04	99	1·46	23	21
Loch Torridon (Bendamph)	*Ross*	6·61	6·21	— ·40	94	1·04	28	23
Dunrobin Castle	*Sutherland*	2·71	4·09	+1·38	151	1·30	28	21
Killarney (District Asylum)	*Kerry*	4·57	11·36	+6·79	249	1·70	28	29
Waterford (Brook Lodge)	*Waterford*	3·73	6·95	+3·22	186	1·72	27	23
Nenagh (Castle Lough)	*Tipperary*	4·04	8·81	+4·77	218	1·80	10	25
Ennistymon House	*Clare*	5·01	8·28	+3·27	165	1·13	10	26
Gorey (Courtown House)	*Wexford*	3·31	8·87	+5·56	268	2·12	27	24
Abbey Leix (Blandsfort)	*Queen's Co.*	3·94	9·33	+5·39	237	1·72	10	26
Dublin (Fitz William Square)	*Dublin*	3·08	7·58	+4·50	246	1·21	27	24
Mullingar (Belvedere)	*Westmeath*	4·00	7·17	+3·17	179	1·10	10	25
Crossmolina (Enniscoe)	*Mayo*	4·68	7·57	+2·89	167	1·36	10	29
Cong (The Glebe)	,,	4·70	9·33	+4·63	199	1·58	7	24
Collooney (Markree Obsy.)	*Sligo*	4·30	6·97	+2·67	162	.87	23	26
Seaforde	*Down*	3·64	7·28	+3·64	200	·85	13, 15	25
Ballymena (Harryville)	*Antrim*	4·18	5·08	+ ·90	122	·70	21	24
Omagh (Edenfel)	*Tyrone*	4·22	5·60	+1·38	133	·93	7	24

SUPPLEMENTARY RAINFALL, AUGUST, 1917.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	6·53	XI.	Lligwy	8·13
,,	Ramsgate	6·47	,,	Douglas, Isle of Man	6·92
,,	Hailsham	6·52	XII.	Stoneykirk, Ardwell House...	2·78
,,	Totland Bay, Aston House...	4·30	,,	Carsphairn, Shiel	7·65
,,	Stockbridge, Ashley..	5·64	,,	Langholm, Drove Road	8·62
,,	Grayshott	7·25	XIII.	Selkirk, The Hangingshaw..	6·66
III.	Harrow Weald, Hill House...	5·48	,,	North Berwick Reservoir.....	4·63
,,	Pitsford, Sedgebrook...	5·55	,,	Edinburgh, Royal Observaty.	4·77
,,	Woburn, Milton Bryant.....	6·45	XIV.	Biggar.....	5·78
,,	Chatteris, The Priory..... ...	3·89	,,	Maybole, Knockdon Farm ...	3·93
IV.	Elsenham, Gaunts End	5·57	XV.	Buchlyvie, The Manse	5·11
,,	Shoeburyness	4·20	,,	Ballachulish House	10·22
,,	Colchester, Hill Ho., Lexden	3·68	,,	Oban.....	4·18
,,	Ipswich, Rookwood,Copdock	4·14	,,	Campbeltown, Witchburn ..	5·20
,,	Aylsham, Rippon Hall.... ..	4·59	,,	Holy Loch, Ardnadam.....	7·77
,,	Swaffham	4·07	,,	Tiree, Cornaigmore	...
V.	Bishops Cannings	5·95	XVI.	Glenquey	7·20
,,	Weymouth.....	4·09	,,	Glenlyon, Meggernie Castle..	6·39
,,	Ashburton, Druid House.....	7·95	,,	Blair Atholl	4·48
,,	Cullompton	5·65	,,	Coupar Angus	5·03
,,	Lynmouth, Rock House	7·32	,,	Montrose, Sunnyside Asylum.	3·96
,,	Okehampton, Oaklands... ...	9·00	XVII.	Balmoral	4·98
,,	Hartland Abbey.....	5·51	,,	Fyvie Castle	4·98
,,	St. Austell, Trevarna	6·50	,,	Keith Station	3·24
,,	North Cadbury Rectory.....	6·63	XVIII.	Rothiemurchus	4·71
VI.	Clifton, Stoke Bishop	7·30	,,	Loch Quoich, Loan	12·33
,,	Ledbury, Underdown..... ..	6·01	,,	Skye, Dunvegan	5·54
,,	Shifnal, Hatton Grange.....	5·32	,,	Fortrose.....	5·69
,,	Droitwich.....	4·87	,,	Glencarron Lodge	7·85
,,	Blockley, Upton Wold.....	5·73	XIX.	Altnaharra	...
VII.	Grantham, Saltersford.....	6·55	,,	Melvich	...
,,	Market Rasen	5·12	,,	Loch More, Achfary	7·31
,,	Bawtry, Hesley Hall	3·79	XX.	Dunmanway, The Rectory ..	9·15
,,	Whaley Bridge, Mosley Hall	6·44	,,	Glanmire, Lota Lodge.....	7·52
,,	Derby, Midland Railway.....	4·64	,,	Mitchelstown Castle.....	7·82
VIII.	Nantwich, Dorfold Hall	6·34	,,	Darrynane Abbey.....	7·36
,,	Chatburn, Middlewood	...	,,	Clonmel, Bruce Villa	7·34
,,	Lancaster, Strathspey	7·96	,,	Broadford, Hurdlestown.....	9·02
IX.	Langsett Moor, Up. Midhope	5·47	XXI.	Enniscorthy, Ballyhyland...	8·52
,,	Scarborough, Scalby	8·17	,,	Rathnew, Clonmannon	7·52
,,	Ingleby Greenhow	7·37	,,	Ballycumber, Moorock Lodge	7·86
,,	Mickleton	6·50	,,	Balbriggan, Ardgillan	6·78
X.	Bellingham, High Green Manor	6·96	,,	Castle Forbes Gardens.....	7·23
,,	Ilderton, Lilburn Cottage ...	7·53	XXII.	Ballynahinch Castle.....	9·92
,,	Keswick, The Bank.....	9·51	,,	Woodlawn	8·72
XI.	Llanfrechfa Grange	8·87	,,	Westport, St. Helens	6·84
,,	Treherbert, Tyn-y-waun	17·69	,,	Dugort, Slievemore Hotel ...	8·63
,,	Carmarthen, The Friary	10·78	XXIII.	Enniskillen, Portora.....	..
,,	Fishguard, Goodwick Station.	6·67	,,	Dartrey [Cootehill]	6·92
,,	Crickhowell, Tal-y-maes.....	8·50	,,	Warrenpoint, Manor House ..	6·32
,,	New Radnor, Ednol	4·65	,,	Belfast, Cave Hill Road	5·41
,,	Birmingham WW., Tyrmynydd	13·62	,,	Glenarm Castle	5·04
,,	Lake Vyrnwy	8·77	,,	Londonderry, Creggan Res...	8·47
,,	Llangynhafal, Plas Drâw.....	6·34	,,	Dunfanaghy, Horn Head ...	5·72
,,	Dolgelly, Bryntirion.....	11·09	..	Killybegs	8·60
,,	Bettws-y-Coed, Tyn-y-bryn...	9·00			

THAMES VALLEY RAINFALL. AUGUST, 1917.



THE WEATHER OF AUGUST.

THE characteristic features of the weather of August were the heavy rainfall, the unseasonal strength of the prevailing southerly and south-westerly winds, and the absence of any pronounced spell of warm settled weather throughout the month. The month opened with the western and south-eastern counties of England under cyclonic influence, while the weather over the United Kingdom as a whole was dominated by anti-cyclonic conditions. The mean temperature of the month, taking the country as a whole, was 0°·6 F. above the average, the excess being considerable (slightly over 2°) in the north and west of Scotland. On the other hand, temperature in the south-east of England was 0°·5 below the average, and in the English Channel, 1°·1 below. In most other parts of the country there was a slight excess, due largely to the relative warmth of the nights, the day temperatures in general being below the average, except in parts of Scotland. On the 5th the screen maximum was 81°, at Kilmarnock, and on the 6th, at Nairn, the maximum was 84°. Temperature over England, and also in the south-east of Scotland remained low, there being many maximum values below 70°, as low as 66°, at St. Anne's Head, on the 5th, and at Edinburgh, on the 6th. No very low temperatures were noted during the month, the lowest reported being 38°, at Balmoral, on the 19th, and at Kilkenny, on the 27th. A large number of shallow depressions passed over the country, pressure being in general high to the south and south-west of the British Isles. A deep depression passed over the country from the 26th to the 28th, causing gales and very heavy rains over a wide area. At southern coastal stations a whole gale with squalls of hurricane force were experienced principally from south-westerly points. In some places thunderstorms were reported.

Bright sunshine was below the average in most parts of Great Britain, but in Ireland and the north of Scotland there was an average daily excess of about half an hour. In the east of Scotland, on the other hand, there was a daily deficiency of nearly two hours, while the Midland counties, and the south-east of England, had a deficit of an hour and a half. The actual amounts recorded varied from three hours a day, in the east of Scotland, and about four hours a day in the more northern parts of England, including the Midlands, to over 6 hours in the English Channel and over 5 hours in Ireland and England south-west.

Rainfall was nearly everywhere much in excess of the average (*see* special article, ante. p. 85).

In London (Camden Square) the mean temperature was 63°·2, being the average. Duration of rainfall, 54·1 hours, of sunshine, 160 hours. Evaporation, 1·95 in.

Climatological Table for the British Empire, March, 1917.

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	57·0	17	20·2	9	45·2	32·8	34·0	88	101·6	20·1	1·74	20	7·6
Malta	68·0	24	48·0	2, 3	61·7	53·0	...	80	121·9	...	·86	4	2·6
Lagos	94·0	26	73·0	6	90·1	76·4	75·2	72	152·0	69·0	3·22	4	6·6
Cape Town	89·4	7	52·7	7	77·7	59·0	57·7	72	...	...	·48	8	3·5
Johannesburg	80·7	6	49·0	5	74·8	53·8	51·9	71	...	47·2	1·55	7	4·7
Mauritius	86·2	var.	64·8	29	84·0	70·4	68·7	77	...	57·0	6·34	22	6·1
Bloemfontein	83·3	23	47·8	17	77·3	55·7	60·4	67	...	...	2·29	12	3·8
Calcutta...	100·0	31	58·1	1	90·7	68·5	64·4	64	...	47·3	1·42	2	1·9
Bombay...	92·4	31	67·7	8	86·1	73·2	69·3	71	141·7	61·0	·00	0	1·5
Madras	91·4	18	64·5	3	89·3	71·8	69·2	71	158·5	61·1	·00	0	2·4
Colombo, Ceylon ...	90·0	3	70·2	3	86·4	73·3	72·3	82	158·2	64·6	10·03	21	6·3
Hongkong	77·2	19	48·4	1	65·9	58·4	55·0	78	...	...	2·67	9	7·8
Sydney	89·2	30	52·4	24	77·1	62·0	58·8	70	140·0	42·0	·98	10	4·8
Melbourne	85·0	13	39·3	24	71·7	55·1	51·9	66	140·7	35·8	1·41	10	6·1
Adelaide	94·5	4	52·4	31	79·3	59·7	53·0	54	149·2	40·8	2·50	11	5·3
Perth	89·0	5	47·6	13	76·1	59·2	56·6	69	152·4	41·0	·54	8	5·5
Coolgardie	102·4	1	45·0	30	79·0	59·3	52·2	71	160·0	43·0	3·68	10	5·4
Hobart, Tasmania ..	76·0	13	39·0	24	65·3	51·3	49·6	73	141·0	31·4	2·06	19	7·3
Wellington ...	74·6	19	43·6	28	68·5	55·7	52·8	72	136·0	32·3	1·47	4	5·4
Auckland	...	...	...	...	70·4	57·8	...	...	...	...	2·72	11	...
Jamaica, Kingston ..	89·0	19	63·3	6	86·2	66·6	65·0	75	...	...	·07	4	3·2
Grenada	85·0	7	67·0	3	81·8	70·8	...	71	137·0	...	2·95	14	3·7
Toronto	62·6	26	6·8	6	39·0	25·3	24·0	76	118·2	—1·0	2·32	12	4·7
Fredericton	56·0	26	—5·0	3	36·7	15·7	20·6	81	...	...	2·66	12	4·7
St. John, N.B. ...	46·6	27	4·5	20	35·7	21·6	22·8	72	118·5	3·8	3·93	12	5·1
Victoria, B.C.	50·2	16	29·6	2	45·7	35·0	35·0	78	119·0	18·8	2·63	19	6·2

Malta.—Poor crops for want of rain.

Johannesburg.—Bright sunshine 272·2 hours.

COLOMBO, CEYLON.—Mean temp. 79°·9 or 1°·5 below, dew point 0°·4 below, and R 10·03 in. or 5·59 in. above, averages. Mean hourly velocity of wind 3·8 miles. T8 on 6 days. Rain storm on 28th when 1·18 in. fell.

HONGKONG.—Mean temp. 61°·6. Bright sunshine 116·9 hours. Mean hourly velocity of wind 14·2 miles.

Sydney.—Rainfall 4·23 in. below, average.

Melbourne.—Mean temp. 1°·2 below, and R ·76 in. below, averages

Adelaide.—Mean temp. 0°·4 below, and R 1·45 in. above, averages.

Coolgardie.—Temp. 2° 5 below, and R 3 to 3·50 in. above, averages.

Wellington.—Mean temp. 1°·7 above, and R 1·87 in. below, averages. Bright sunshine 216·5 hours. Bright and sunny.

Symons's
Meteorological Magazine.

No. 621. OCTOBER, 1917. Vol. LII.

METEOROLOGY AT THE SOUTH ORKNEYS, IN 1916.

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

We have been favoured by Mr. George O. Wiggin, Director of the Argentine Meteorological Service, by the following summary of the meteorological observations made at Laurie Island, South Orkneys (Lat. 60° 44′ S., Long. 44° 39′ W.) during 1916. The observations are taken hourly by night as well as by day, so that the values given in the tables require no correction to bring them to the "true" daily mean. Although not so cold as in 1915, the mean temperature was 22°·1, or 1°·9 under the average. May was abnormally the coldest month of the year, with a mean of 9°·4, or 10°·7 below the average, the lowest for the month during the period 1903-16 covered by the observations. September was also characterized by the lowest mean temperature, 9°·3 under the average and April was also rather cold, but the other months of the year did not depart much from their respective normals. An unusual feature was the frequency of Föhn, the absolute maxima, except in May and September, being all on the high side. The absolute minima, on the other hand, except in April and May, were not specially noteworthy. Except in January and December barometric pressure was above the average, the absolute maximum being 30·31 ins., in June, and the minimum 28·17, in April, showing an extreme range of 2·14 ins. The wind velocity during the year was remarkably light, although slightly higher than in 1915, which was the calmest year yet recorded in this region. Precipitation, nearly all in the form of snow, was scanty, being 36 per cent. below the average. Sunshine was, on the whole, deficient, but August September and October were remarkably sunny, the record for the three months showing a third of the total possible, rising to 41 per cent, in September, which was the sunniest month yet experienced both absolutely and relatively.

It is of interest to note that the South Orkney observations thoroughly support the reports of the Shackleton Expedition, which, it will be remembered, was stranded on Elephant Island, to the west of the South Orkneys, from the middle of April until their rescue on August 30th, and thus experienced under exceptionally unfavourable conditions the extreme rigours of an unprecedentedly early winter.

Laurie Island, South Orkneys, 1916.

Lat., 60° 44′ S., Long., 44° 39′ W. Height, 20 feet.
Pressure at 32° Sea Level, and Lat. 45°.

	Barometric Pressure.		Temperature in Shade.				
	Mean. in.	Diff. from Aver. in.	Mean. °	Diff. from Aver. °	Highest. °	Lowest. °	Wind vel. mile per hour.
Jan.....	29·19	—·09	32·2	+0·2	46·8	25·9	7·3
Feb.....	·36	+·12	32·0	—0·7	44·1	18·5	8·0
Mar. ..	·37	+·14	29·6	—1·5	40·1	12·2	9·1
April. ..	·36	+·11	22·4	—4·0	40·8	— 6·0	8·5
May....	·32	+·03	9·4	—10·7	32·5	—16·8	10·0
June ..	·47	+·07	13·0	—1·4	39·6	—15·2	10·1
July ..	·56	+·19	11·9	+0·8	42·3	—24·3	10·6
Aug. ..	·64	+·25	18·3	+2·3	37·4	—11·2	11·8
Sept. ..	·34	+·03	11·8	—9·3	35·1	—15·9	9·0
Oct.....	·42	+·13	24·2	—0·4	41·5	—10·3	11·5
Nov. ..	·22	+·04	29·6	+1·8	40·8	18·5	9·7
Dec.....	·22	—·15	31·0	+0·4	39·6	24·3	5·5
Year ..	29·37	+·07	22·1	—1·9	46·8	—24·3	9·3
Average	29·30		24·0		46·4	—28·8	12·3

	Relative Hum. Sat. = 100.	Precipitation. in.	Cloud. 0— 10	Bright Sunshine. Hours.	Bright Sunshine. °/₀ of possible.
Jan.....	88·8	1·57	9·4	31·9	6
Feb.....	90·1	·91	9·0	59·2	15
Mar. ..	88·1	1·46	9·5	25·5	7
April ..	88·3	1·33	9·0	33·8	14
May....	89·4	·77	7·5	29·0	19
June ..	93·6	·71	8·2	2·6	5
July....	91·2	·82	7·7	11·1	8
Aug. ..	93·9	·83	7·9	54·3	28
Sept. ..	91·0	·79	6·4	124·8	41
Oct.....	88·3	·57	8·4	107·4	27
Nov. ..	90·9	·57	9·5	51·7	11
Dec.....	88·3	·95	9·7	49·6	10
Year ..	90·2	11·28	8·5	579·9	16
Average	90·4	17·52	8·5	542·0	14

Correspondence.

To the Editor of Symons's Meteorological Magazine.

HEAVY RAINFALL IN S.E. ENGLAND.

QUITE in accordance with anticipation the nebulous fancy that rain is produced by noise is once more trotted out, but why does Mr. Horner claim it as "his theory"? He does not adduce a single fact to show that "abnormal disturbance of the atmosphere . . . must cause a larger rainfall than usual." Indeed, he takes us no further on the way than to say that "It is only reasonable to assume," and then appeals to us to approach the matter with a more open mind than heretofore. Half a century ago my old tutor used to advise us "appeal to facts to prove your case; by adopting assumptions you can prove that the moon is made of green cheese!"

We all agree that there was heavy firing on the Flanders front and heavy rain in the south-east of England at the beginning of August, but the coincidence does not prove that the guns caused the rain any more than it proves that the rain fired the guns. Prior to this particular instance the cannonading during the spring offensive had been far more violent and sustained, and included the explosion, in one vast mine under the Messines Ridge, of 450 tons of Mr. Horner's "chemical matter." More recently, in the second half of September, the violence of the artillery duel is said to have been greater than ever. According to Mr. Horner "his theory" we ought to have been perpetually flooded from the middle of April until the close of September—but we were *not*!

Space is so strictly limited, it is not possible to pursue the subject to show that "a larger rainfall than usual" is a very common experience when peace reigns over all the Earth, and no 17-inch guns are roaring.

I will only add that the general public love to have a "scientific" explanation of all occurrences—they are mightily pleased with a string of phrases which are quite beyond their comprehension. It was magnificent on the part of the weather "expert" of a London newspaper to account for some freak of the elements by the presence of *Sirius, the Dog Star, in the Zenith*! Even more popular than Mr. Horner's theory was the widespread belief that the excessively wet August of 1912 was brought about by the greatly increased activity of wireless telegraphy—and, rightly or wrongly, the honoured name of Camille Flammarion was given as the authority for the discovery. But since then wireless telegraphy has increased tenfold, and our rainfall goes on much the same as before guns and wireless were invented—in alternations of floods, droughts, and gentle showers.

HY. HARRIES.

October, 1st, 1917.

THE GREEN FLASH AT SUNSET.

If the phenomena, seen by me at Clevedon on September 14th, which I am about to describe were merely a repetition of those described by Dr. Rambaut and others in your magazine for 1905 and 1906, I should not have offered this note. But the differences appear so marked that it may be worth while to record them for future comparison and consideration.

Several of the former Observers said that the green flash occurs with a yellow, and not with a red, sunset. They all use the term "flash"; though what they described was rather a gradual change, during an appreciable interval of time, of the apparent colour of the upper limb or segment of the sun's disc from yellow, through other colours, to a bluish green; or, as many preferred to describe it, a blue. None described a momentary or instantaneous coruscation or ray of light exterior to the sun's disc.

The morning of September 14th was cloudy and hazy, with a very fine drizzle till 10 a.m. (G.T.). It then gradually cleared; but the distance continued hazy until well into the afternoon. Under a strong W. wind the opposite coast began to show about 4 p.m. By 5, on the S. side of the channel, the outlines of Dunkery Beacon and all the Exmoor and Devon hills as far as the Hangman were sharply defined against a low bank of cumulus; above which a broad dark band stretched across the sky towards the sun. On the other side all the details of the coasts of Glamorgan (east of Scilly Island) and Monmouth, and for 10 miles beyond the Wye mouth, were perfectly clear, except where blurred by the smoke of the factories of Cardiff and Newport.

This clearness continued. At 6.15 white "mackerel" clouds formed overhead. The line of the sunset was directly through Cardiff, beyond which a level range of low hills S. of Llanharan, forming the horizon, were perfectly sharp and clear against the sky; a few degrees above them and above the sun was a band of golden cloud. The sun's rays passed through the smoke of the Guest's works at Cardiff, which made the disc a deep (almost "Krakatoa Nc. 6") red; and so capable of being observed without any distress or eye fatigue.

The disc remained quite sharp and showed no appearance of flattening, or change of colour, as it touched and passed down behind the hill line. Then, at the instant of disappearance of the last fragment of the upper segment, a bright emerald green flash shot out horizontally right and left at what would have been a tangent to the disc had it remained visible. The flash was absolutely momentary.

JAMES G. WOOD.

116, Sutherland Avenue, W., September 22nd, 1917.

THE GREAT SEPTEMBER THUNDERSTORM.

DURING the summer of 1917 the London district experienced three thunderstorms of the first magnitude—on May 29th, June 16th, and September 5th. Each of these was of approximately three hours' duration, and of similar violence as regards the thunder and lightning; but the June storm, which occurred during a spell of great heat, was the most sudden, and occasioned the heaviest rainfall. The weather on September 4th had been brilliant and fairly hot, but during the ensuing night the sky became thinly veiled with patches of cirrus and the barometer slowly fell. On the afternoon of the 5th a peculiar yellowish mottled sky was moving slowly from the south, and a thunder-wise person might have taken a hint from a sultry surface draught of air from the east—a frequent precursor of thunder in the south-east of England. About 8 p.m. the storm was advancing slowly from the southward, and in this respect differed markedly from the afternoon storm of June 16th, which developed *in situ* with astonishing suddenness from one or two nuclei of orange-coloured cumulus heads. The earlier part of the September storm, though characterized by brilliant and almost continuous lightning, was of moderate intensity; but after a brief interval about 9.30 p.m., a second storm came over of extreme violence, discharging about 10.30 p.m. a veritable "thunderbolt," which did no little damage in different parts of London and sounded at Hampstead as though houses in the vicinity might have been shattered. There was no local wind disturbance, and as in nearly all such storms there was hardly any *general* wind. It is this stagnant type of summer storm which is electrically so violent. Occurring as it did after dark the lightning display was magnificent.

There is normally a marked decline in thunderstorm frequency in England during the month of September, nothwithstanding the continued warm character of the month. The reason is that under equinoctial radiation there are not so many sets of conditions liable to set up convective instability as there are in May, June, July or August, when the solar rays are more intense.

L. C. W. BONACINA.

September 15th, 1917.

REVIEWS.

A Pocket Book for Chemists, etc. By Thomas Bayley, Eighth edition, edited by Robert Ensol. London. E. and F. N. Spon, 1917. Size, 7 × 4. Pp. xvi + 426. Price 7s. 6d. *net.*

AMONGST the physical data in this singularly comprehensive book of reference are sections on the barometer and on hygrometry, the value of which is vouched for by the name of "Mr. Curtis of the Meteorological Office."

Météorologie de Brésil [Meteorology of Brazil] par C. M. Delgado de Carvalho. Preface de Sir W. Napier Shaw, ScD., F.R.S., Londres, John Bale, Sons, and Danielsson, Ltd., 1917. Size, $9\frac{1}{2} \times 6\frac{1}{2}$. Pp. xx + 528. Price, 25s. net.

THIS is a work of quite exceptional importance not only because it brings together facts and statistics which have hitherto been difficult of access,but in particular because we find a Brazilian professor seriously grappling with a very complicated problem and coming to this country for guidance in his task. Professor Delgado de Carvalho is a Fellow of the Royal Meteorological Society, and he has been working in close association with the Meteorological Office, the Director of which contributes a preface dealing with the inportance of the meteorology of Brazil from the point of view of the meteorology of the globe.

We greatly regret that want of space prevents us from publishing a notice worthy of the work. The book is divided into three parts. Part I. deals with General Considerations including the climatic elements of the Southern Hemisphere, the climates of Brazil in relation to the people, with special reference to immigration, acclimatization and public health, concluding with an account of the meteorological services of the country. Part II., the Distribution of Climatological factors, deals in turn with cosmic or geographical influences such as latitude, altitude, and the effect of distance from the ocean, and then in turn with the system of prevailing winds, the distribution of rainfall, and the climatic zones of the country. Part III, Climatography, forms the bulk of the volume. It is sub-divided into eight chapters, each dealing with a different type of climate, with details for each of the States of the Brazilian Union which lies in the particular climatic division. The divisions arrived at are as follows :—*Equatorial,* including the Super-Humid or Amazonian and the Semi-Arid of North-east Brazil; *Tropical and Sub-Tropical Semi-Humid,* including the Maritime, the Plateau, and the Continental; and the *Temperate Semi-Humid,* including the Maritime, the Rio-Grande Plain and the High Plateau.

In all sections Senhor Carvalho quotes the observations on which he bases his classifications and gives a very comprehensive bibliography containing references to unpublished records as well as to published data.

Much valuable information has been gathered together, and the additional service has been done of calling attention to the vast importance of the meteorology of Brazil (one of the great centres of solar activity in the atmosphere) in the circulation of the atmosphere which sways the climate of the whole world.

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The Aviator and the Weather Bureau. By Ford A. Carpenter, LL.D. Meteorologist. Published by the San Diego Chamber of Commerce, 1917. Size, 7 × 5. Pp. 54.

THE scope of this well-illustrated little book cannot be given more tersely than by the author in his preface :—"This is a brief but general account of the history of aviation as it is associated with southern California, a description of the War Department school of aviation at San Diego, a syllabus of the course of lectures delivered there on the subject of practical meteorology as applied to aviation a narrative of weather-study from an air plane, and a recital of subsequent active co-operation between the aviators and the U.S. Weather Bureau."

AN OLD WEATHER NOTE.

SERGEANT A. E. AMIES, of the Kent County Constabulary, has kindly forwarded to us the following notes from the diary of his wife's great grandfather, Mr. James Budd, a farmer of Clifton, near Rugby, who was born about 1730 :—

In 1739 there were 103 days of frost.
,, 1763 ,, ,, 94 ,, ,,
,, 1779 ,, ,, 84 ,, ,,
,, 1783 ,, ,, 89 ,, ,,
,, 1784 ,, ,, 130 ,, ,,

Sharp frost, June 14th, 1791. Thick ice.

Not a bit of grain carried in Clifton Lordship at Rugby Fair, August 21st, 1805.

In the year 1801, wheat was 1 guinea a strike, barley, 6 guineas a quarter, oats, 3 guineas a quarter, malt, 17s. a strike.

In 1805, great snow on April 28th and 29th; three nights severe frost.

In 1807, May 2nd, a great hailstorm.

Frost and snow began at Rugby St. Thomas Fair, 1794, lasted till Lady Day Fair, 1795. A sudden thaw made a great flood, the ice broke many bridges.

In 1798, frost and snow began about Martinmas. A very severe frost and snow about Christmas. A very severe time till Lady Day, some of the snow laid till after Lutterworth April Fair, 1799.

On November 18th, 1793, hogs were 7s. 6d. score, cheese was 40s. a cwt.

In 1807, frost and snow and very cold weather before Martinmas.

A deal of snow fell on April 19th and 21st, 1808. Very cold to May Day. A very cold winter.

BRITISH RAINFALL, 1916.

ALTHOUGH the MS. of this volume was completed on August 15th, practically the same date as last year, much delay has occurred in the completion of the maps by the engravers and in the setting and printing of the sheets. A few weeks must still elapse before the volume can be issued, but the delay is inevitable on account of the dearth of labour in all branches of the trades concerned in the mechanical production of books. The volume is but little smaller than last year's, and the price remains unaltered. Any reader requiring a copy who has not already ordered it is requested to apply without delay to the Editor, 62, Camden Square, London, N.W. 1, as the number being printed is smaller than usual.

METEOROLOGICAL NEWS AND NOTES.

A COMMITTEE FOR THE DISCUSSION OF GEOPHYSICS was recently appointed by the British Association and we learn from the *Meteorological Office Circular* that two meetings have been arranged to take place in the rooms of the Royal Astronomical Society, Burlington House. The first meeting with the Astronomer Royal in the chair, will be held on November 7th, at 5 p.m., when Dr. S. Chapman and Dr. W. G. Walker will deal with the subject of magnetic surveys. The second meeting is provisionally arranged for December 5th, when Professor Arthur Schuster will preside and Sir Napier Shaw will introduce the subject of "The general constitution and condition of the atmosphere."

THE GREAT RAIN OF JUNE 28th in the west of England appears to have had two foci of intensity, one at Bruton, where the fall in 24 hours exceeded 9 inches, the other to the north of Taunton, where we have just heard of the measurement on that day of **8·39** in., at Timbercombe, near Aisholt. Were it not for the falls at Bruton and South Brewham on the same day this would be the greatest authentic fall in one day ever recorded in the British Isles.

EXCUSES FOR DEFECTIVE RAINFALL RETURNS are rarely so ingenuous as that conveyed in the following letter communicated to us by the Acting Superintendent of a colonial meteorological service :—"Sir, I beg to send herewith the rainfall return for May till 25th May. After that I did not attend to it because on May 25th the Rest House keeper of —— abused me and told me not to enter the Rest House compound. If I enter into the gate he said that he will break all the Rest House things and make me to 3, 4 years imprison. So I informed the headman and my superior. Owing to this matter it was delayed. I, etc. . . "

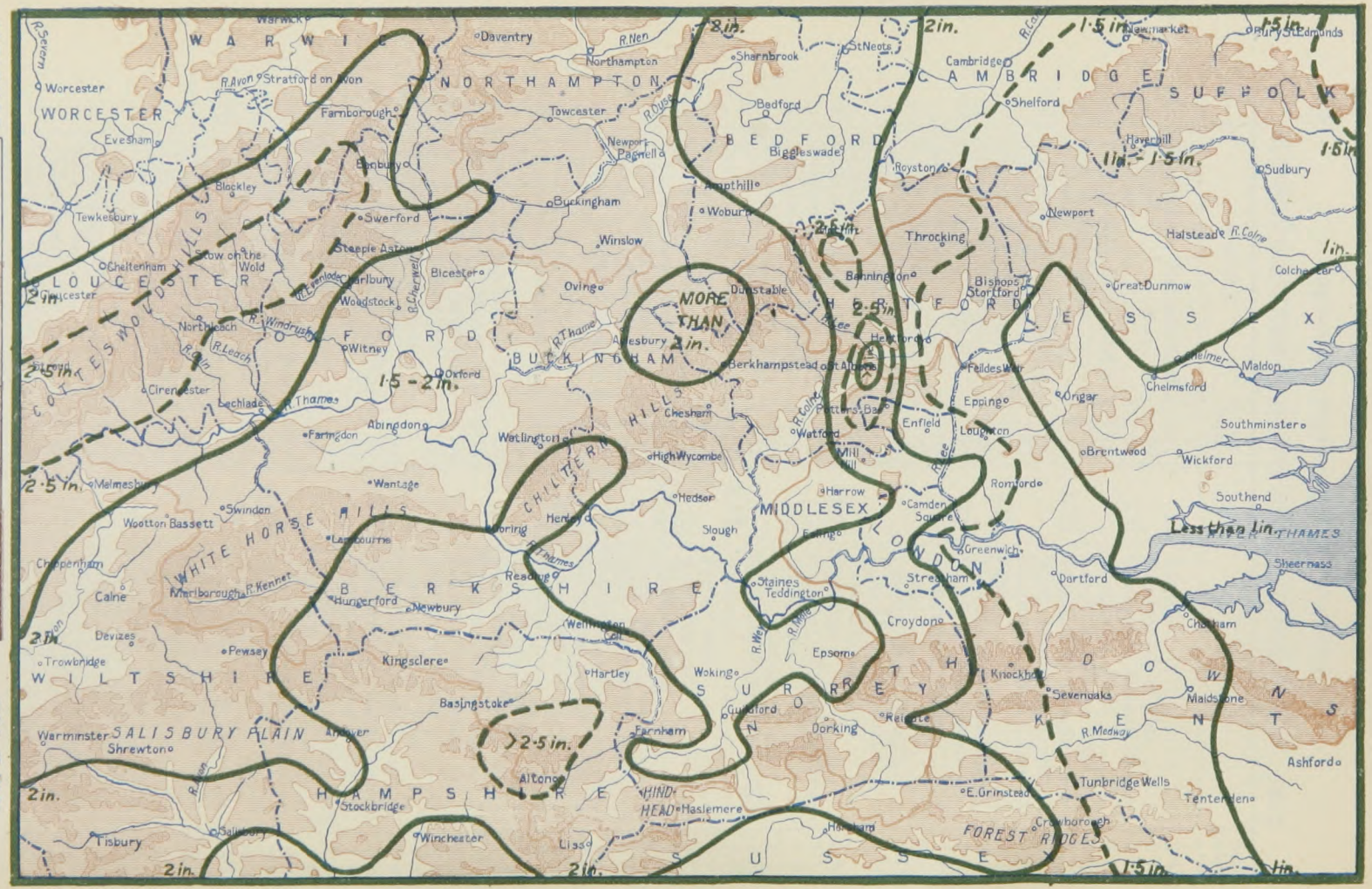
RAINFALL TABLE FOR SEPTEMBER, 1917.

STATION.	COUNTY.	RAINFALL.						
		Aver. 1875—1909. in.	1917. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	2·00	2·31	+ ·31	115	1·09	5	11
Tenterden	*Kent*	2·25	0·87	—1·38	39	·19	17	11
Arundel (Patching)	*Sussex*	2·58	1·63	— ·95	63	·58	17	8
Fordingbridge (Oaklands)	*Hampshire*	2·39	1·88	— ·51	79	·59	17	15
Oxford (Magdalen College)	*Oxfordshire*	1·98	1·61	— ·37	81	·65	18	11
Wellingborough (Swanspool)	*Northampn*	2·13	1·80	— ·33	84	·77	18	13
Bury St. Edmunds (Westley)	*Suffolk*	2·18	1·44	— ·74	66	·43	17	10
Geldeston [Beccles]	*Norfolk*	2·13	1·79	— ·34	84	·46	19	12
Polapit Tamar [Launceston]	*Devon*	3·11	1·78	—1·33	57	·73	18	13
Rousdon [Lyme Regis]	,,	2·69	2·15	— ·54	80	·74	17	13
Stroud (Field Place)	*Gloucester*	2·39	2·90	+ ·51	121	1·25	18	12
Church Stretton (Wolstaston)	*Shropshire*	2·40	1·72	— ·70	72	...	...	...
Boston	*Lincoln*	2·07	1·04	—1·03	50	·44	18	10
Worksop (Hodsock Priory)	*Nottingham*	1·84	0·57	—1·27	31	·35	18	9
Mickleover Manor	*Derbyshire*	2·11	1·46	— ·65	69	·62	18	11
Buxton	,,	3·84	2·38	—1·46	62	·50	26	20
Southport (Hesketh Park)	*Lancashire*	3·09	2·34	— ·75	76	·55	13	15
Arncliffe Vicarage	*York, W.R.*	4·55	...	...	..	...	...	...
Goldsborough Hall	,, ,,	2·17	...	...	...	...	...	...
Hull (Pearson Park)	,, *E.R.*	2·05	0·83	—1·23	40	·25	18	9
Newcastle (Town Moor)	*North'land*	2·00	2·03	+ ·03	101	·82	1	17
Borrowdale (Seathwaite)	*Cumberland*	11·28	18·04	+6·76	160	3·18	13	24
Cardiff (Ely)	*Glamorgan*	3·61	2·77	— ·84	77	1·30	18	23
Haverfordwest	*Pembroke*	3·91	2·82	—1·09	72	·75	18	16
Aberystwyth (Gogerddan)	*Cardigan*	3·89	4·57	+ ·68	117	·96	13	17
Llandudno	*Carnarvon*	2·50	0·98	—1·52	39	·25	26	12
Cargen [Dumfries]	*Kirkcudbrt.*	3·34	3·84	+ ·50	115	·87	1	22
Marchmont House	*Berwick*	2·67	1·46	—1·21	55	·51	1	11
Girvan (Pinmore)	*Ayr*	4·30	2·99	—1·31	70	·67	14	27
Glasgow (Queen's Park)	*Renfrew*	2·99	2·42	— ·57	81	·56	20	23
Islay (Eallabus)	*Argyll*	4·49	3·81	— ·68	85	·67	13	25
Mull (Quinish)	,,	5·20	5·24	+ ·04	101	·87	13	25
Balquhidder (Stronvar)	*Perth*	5·81	...	...	...	...	...	...
Dundee (Eastern Necropolis)	*Forfar*	2·34	1·43	— ·91	61	·44	13	15
Braemar	*Aberdeen*	2·73	1·59	—1·14	58	.41	13	15
Aberdeen (Cranford)	,,	2·69	2·01	— ·68	75	·75	16	14
Gordon Castle	*Moray*	2·58	1·77	— ·81	69	...	...	...
Drumnadrochit	*Inverness*	2·94	2·90	— ·04	99	·78	13	18
Fort William	,,	6·66	9·06	+2·40	136	1·26	27	27
Loch Torridon (Bendamph)	*Ross*	7·28	8·78	+1·50	121	1·02	27	26
Dunrobin Castle	*Sutherland*	2·51	2·80	+ ·29	112	·62	13	17
Killarney (District Asylum)	*Kerry*	3·79	2·29	—1·50	60	·77	1	21
Waterford (Brook Lodge)	*Waterford*	3·19	1·81	—1·38	59	·34	25	13
Nenagh (Castle Lough)	*Tipperary*	3·16	1·39	—1·77	44	·35	25	10
Ennistymon House	*Clare*	4·22	3·24	— ·98	77	·45	22	22
Gorey (Courtown House)	*Wexford*	2·78	1·51	—1·27	54	·39	17	16
Abbey Leix (Blandsfort)	*Queen's Co.*	2·93	...	...	...	..	...	...
Dublin (Fitz William Square)	*Dublin*	2·06	1·58	— ·48	77	·36	17	15
Mullingar (Belvedere)	*Westmeath*	3·02	2·95	— ·07	98	·62	16	17
Crossmolina (Enniscoe)	*Mayo*	4·42	3·68	— ·74	83	·43	12	24
Cong (The Glebe)	,,	4·05	3·92	— ·13	97	·57	21	20
Collooney (Markree Obsy.)	*Sligo*	3·65	3·59	— ·06	98	.53	19	24
Seaforde	*Down*	3·25	1·98	—1·27	61	·79	12	16
Ballymena (Harryville)	*Antrim*	3·43	2·36	—1·07	69	·50	13	22
Omagh (Edenfel)	*Tyrone*	3·39	3·83	+ ·44	113	·87	19	22

SUPPLEMENTARY RAINFALL, SEPTEMBER, 1917.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	2·49	XI.	Lligwy	2·41
,,	Ramsgate	·66	,,	Douglas, Isle of Man	2·74
,,	Hailsham	2·36	XII.	Stoneykirk, Ardwell House...	3·19
,,	Totland Bay, Aston House...	1·70	,,	Carsphairn, Shiel.....	4.56
,,	Stockbridge, Ashley.	2·28	,,	Langholm, Drove Road	5·52
,,	Grayshott.....	2·11	XIII.	Selkirk, The Hangingshaw..	1·77
III.	Harrow Weald, Hill House...	1·57	,,	North Berwick Reservoir.....	1·42
,,	Pitsford, Sedgebrook....	1·63	,,	Edinburgh, Royal Observaty.	1·01
,,	Woburn, Milton Bryant.....	1·81	XIV.	Biggar.....	2·79
,,	Chatteris, The Priory..... ...	2·06	,,	Maybole, Knockdon Farm ...	2·34
IV.	Elsenham, Gaunts End	·93	XV.	Buchlyvie, The Manse.....	2·75
,,	Shoeburyness	·64	,,	Ballachulish House	7·57
,,	Colchester, Hill Ho., Lexden	·95	,,	Oban.....	5·49
,,	Ipswich, Rookwood, Copdock	1·18	,,	Campbeltown, Witchburn ..	2·10
,,	Aylsham, Rippon Hall..... ..	1·80	,,	Holy Loch, Ardnadam.....	6·06
,,	Swaffham	2·59	,,	Tiree, Cornaigmore	..
V.	Bishops Cannings	1·88	XVI.	Glenquey	4·50
,,	Weymouth..... ...	1·62	,,	Glenlyon, Meggernie Castle..	4·11
,,	Ashburton, Druid House.. ...	3·01	,,	Blair Atholl	1·92
,,	Cullompton	1·91	,,	Coupar Angus	1·16
,,	Lynmouth, Rock House	3·38	,,	Montrose, Sunnyside Asylum.	1·43
,,	Okehampton, Oaklands... ...	2·36	XVII.	Balmoral	1·48
,,	Hartland Abbey.....	2·73	,,	Fyvie Castle	1·69
,,	St. Austell, Trevarna	2·03	,,	Keith Station	1·66
,,	North Cadbury Rectory.....	1·77	XVIII.	Rothiemurchus	2·50
VI.	Clifton, Stoke Bishop	2·80	,,	Loch Quoich, Loan	24·10
,,	Ledbury, Underdown..... ...	1·95	,,	Skye, Dunvegan	9·31
,,	Shifnal, Hatton Grange.....	1·40	,,	Fortrose.....	...
,,	Droitwich.....	1·76	,,	Glencarron Lodge	8·93
,,	Blockley, Upton Wold.....	2·40	XIX.	Altnaharra	6·62
VII.	Grantham, Saltersford.....	1·27	,,	Melvich	4·30
,,	Market Rasen	·80	,,	Loch More, Achfary	11·89
,,	Bawtry, Hesley Hall	·63	XX.	Dunmanway, The Rectory ..	2·15
,,	Whaley Bridge, Mosley Hall	2·13	,,	Glanmire, Lota Lodge.....	1·06
,,	Derby, Midland Railway.....	1·56	,,	Mitchelstown Castle.....	1·71
VIII.	Nantwich, Dorfold Hall	1·18	,,	Darrynane Abbey.....	1·88
,,	Chatburn, Middlewood	...	,,	Clonmel, Bruce Villa	1·37
,,	Lancaster, Strathspey	4·12	,,	Broadford, Hurdlestown.....	1·97
IX.	Langsett Moor, Up. Midhope	1·37	XXI.	Enniscorthy, Ballyhyland...	1·94
,,	Scarborough, Scalby	·64	,,	Rathnew, Clonmannon	1·70
,,	Ingleby Greenhow	·81	,,	Ballycumber, Moorock Lodge	2·27
,,	Mickleton	2·00	,,	Balbriggan, Ardgillan	1·26
X.	Bellingham, High Green Manor	2·56	,,	Castle Forbes Gardens.....	2·86
,,	Ilderton, Lilburn Cottage ...	1·12	XXII.	Ballynahinch Castle.....	5·07
,,	Keswick, The Bank.....	6·03	,,	Woodlawn	3·29
XI.	Llanfrechfa Grange	3·38	,,	Westport, St. Helens	3·73
,,	Treherbert, Tyn-y-waun	4·62	,,	Dugort, Slievemore Hotel ...	6·58
,,	Carmarthen, The Friary	2·94	XXIII.	Enniskillen, Portora.....	2·57
,,	Fishguard, Goodwick Station.	2·42	,,	Dartrey [Cootehill]	2·22
,,	Crickhowell, Tal-y-maes.....	2·50	,,	Warrenpoint, Manor House ..	1.56
,,	New Radnor, Ednol	2·25	,,	Belfast, Cave Hill Road	2·32
,,	Birmingham WW., Tyrmynydd	2·94	,,	Glenarm Castle	2·03
,,	Lake Vyrnwy	3·02	,,	Londonderry, Creggan Res...	2·59
,,	Llangynhafal, Plas Drâw.....	1·00	,,	Dunfanaghy, Horn Head ...	3·02
,,	Dolgelly, Bryntirion.....	7·06	,,	Killybegs	5·57
,,	Bettws-y-Coed, Tyn-y-bryn...	2·44			

THAMES VALLEY RAINFALL. SEPTEMBER, 1917.



Symons's Meteorological Magazine

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

Isohyetals

THE WEATHER OF SEPTEMBER.

THE outstanding features of the weather of September were a mean temperature well above the average in most parts of the United Kingdom, a deficiency of bright sunshine, except in some favoured eastern districts, and in general a deficiency of rainfall. During the first five days of the month an irregular type of pressure distribution obtained, with relatively high readings in Iceland and Northern Scandinavia, and shallow depressions in the south. After the 5th until the close of the month the British Isles lay as a rule between a high pressure system in general central about the Azores, and a low pressure system over Iceland. Gradients were, on the whole, slight, so that the wind, usually from some westerly quarter, seldom exceeded the force of a moderate to strong breeze. A depression which skirted the north of Scotland on the 20th gave gales over a considerable area, extending as far south as the Midlands, and towards the end of the month the prevailing southerly and westerly winds reached gale force in the north accompanied by heavy rains in the west.

The mean temperature of the month was a degree and a half above the average taking the kingdom as a whole; the excess varying from over 2°F. in the northern half of England to less than a degree in the north and east of Scotland. In the English Channel the excess was only 0°·3 F.

Owing to the persistence of weather of a westerly type the range of temperature was very moderate. The warmest weather was experienced between the 5th and 8th, when maximum shade values exceeding 70° were recorded in all parts except the northern portions of Ireland and Scotland. A number of stations as far north as Kilmarnock had maximum readings of 75°, and at Hereford, on the 7th, a value of 77° was attained. The coldest weather of the month was recorded about the 10th, when the shade minima were as low as 29° at Balmoral, 32° at West Linton, and 34° at Markree Castle. Another warm period centred round about the 25th, when the thermometer rose to 74° at Geldeston, and to 73° at a number of other stations in the east and south-east of England. In Ireland and Scotland relatively cool weather prevailed, and on the 25th the Irish maxima ranged from 71° to 59°.

Bright sunshine, except in some eastern and south-eastern districts, was deficient, the mean daily duration varying from 3 hours in the north of Scotland and north of Ireland, to nearly double this amount in the east and south-east.

The rainfall of the month, expressed as a percentage of the average, varied greatly, even within limited areas, this being largely due to the incidence of thunderstorms, while in the west and north-western normally rainy districts the area affected by the cyclonic rains associated with the depressions passing north-eastward was of limited extent. At a number of stations less than half the average fell, and at some stations in the Midland counties of England less than a third of the normal was recorded. More than the average fell at a large number of stations in the extreme west and north-west, and also at some places where thunder-storms were experienced. The general rainfall, expressed as a percentage of the average, was England and Wales, 88 per cent.; Scotland, 95 per cent.; Ireland, 77 per cent.: British Isles, 87 per cent.

In England a large area, extending well inland from south of Morpeth to Nottingham, including all coastal stations from Whitby to Grimsby, and from Clacton-on-Sea to Brighton, had less than an inch, falling to about half an inch near Scarborough and Northallerton. In most other districts from one and a half to three inches fell, and in the rainy districts of Wales in general from four to six inches, rising to double this amount in exposed places. In Cumberland and Westmorland, where the rainfall was fully 50 per cent. above the average, several stations had as much as 20 to 25 inches. In Scotland less than an inch fell in the vicinity of Edinburgh, and less than two inches over most of the eastern districts, the amount rising to over 10 inches in parts of Skye and West Inverness. In London (Camden Square), the mean temperature was 59°·5, being 1°·8 above the average. Duration of rainfall, 24·3 hours, of Sunshine, 136 hours. Evaporation, 1·16 in.

Climatological Table for the British Empire, April, 1917.

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	67·4	30	26·5	2	52·6	34·6	34·6	...	116·7	20·5	2·19	15	6·5
Malta	71·6	4	48·8	1	63·8	54·2	...	79	125·0	...	·99	2	2·1
Lagos	92·0	21	72·1	5	88·9	76·1	74·8	72	155·0	70·0	6·18	8	6·7
Cape Town	98·2	11	43·3	28	74·7	55·3	53·9	68	...	...	1·10	9	4·3
Johannesburg	81·3	2	34·0	29	67·8	47·8	46·0	75	...	30·8	2·58	9	4·4
Mauritius	84·4	2	62·0	24	81·5	68·7	67·4	79	...	56·8	6·96	18	5·1
Bloemfontein	83·7	2	31·2	29	70·9	44·8	45·1	65	...	...	1·26	4	2·6
Calcutta...	103·1	27	70·4	23	96·9	75·5	69·6	63	..	61·1	2·00	3	3·1
Bombay...	91·6	1	75·6	12	88·6	77·3	73·0	73	136·2	70·5	·00	0	3·1
Madras	101·5	16	73·1	29	93·1	77·7	73·9	74	161·4	70·5	·00	0	1·7
Colombo, Ceylon ...	90·0	19	72·1	25	88·5	75·9	74·9	82	156·2	68·6	4·78	12	6·8
Hongkong	80·6	23	59·4	30	73·5	66·4	65·3	86	...	...	5·23	16	8·7
Sydney	78·1	5	48·1	29	68·3	54·8	52·0	73	131·3	35·0	12·28	15	5·0
Melbourne	...	...	...	...	...	...	...	...	...	...	...	...	...
Adelaide	...	...	...	...	...	...	...	...	...	...	...	...	...
Perth	...	...	...	...	...	...	...	...	...	...	...	...	...
Coolgardie	83·0	20	44·4	28	72·7	52·3	48·8	60	138·6	40·0	1·50	3	3·7
Hobart, Tasmania ..	...	...	...	...	...	...	...	...	...	...	...	...	...
Wellington ...	72·2	8	43·6	22	65·0	54·4	52·6	77	141·0	31·0	4·86	16	7·9
Auckland	...	...	...	...	66·9	58·2	...	...	...	...	9·31	24	...
Jamaica, Kingston ..	90·8	24	66·4	1	86·9	69·5	67·2	75	...	...	·97	13	3·5
Grenada	88·0	27	71·0	4,5,6	84·3	73·0	...	76	138·0	...	·17	4	3·5
Toronto	65·3	18	20·4	9	48·8	33·4	31·6	71	119·0	17·2	3·36	14	5·9
Fredericton	65·0	22	15·0	1	46·6	29·4	31·4	77	...	...	4·30	11	6·4
St. John, N.B. ...	55·2	20	21·5	1·10	44·4	30·9	31·4	77	126·9	17·0	4·02	12	7·0
Victoria, B.C.	64·8	27	35·1	22	51·9	41·1	41·0	84	124·8	27·5	2·41	22	7·5

Johannesburg.—Bright sunshine 262·9 hours.

COLOMBO, CEYLON.—Mean temp. 82°·2 or 0°·5 below, dew point 0°·1 above, R 4·78 in. or 2·66 in. below, averages. Mean hourly velocity 3·8 miles. TS on 11 days. Rain storm on the 30th when ·44 in. fell.

HONGKONG.—Mean temp. 69°·4. Bright sunshine 76·9 hours. Mean hourly velocity of wind 135 miles.

Coolgardie.—Temp. 2°·9 below, and R about ¾ in. above, average.

Wellington.—Mean temp. 2°·3 above, and R ·84 in above, averages. Cloudy, showery month. Bright sunshine 114·7 hours. Frost on 3 days.

GRENADA.—The lowest rainfall for any month during the past 26 years.

Symons's
Meteorological Magazine.

No. 622. NOVEMBER, 1917. Vol. LII.

BRITISH RAINFALL, 1916.

The fifty-sixth annual volume of *British Rainfall** has just been published. Its late appearance is due to no slackness on the part of the Observers, for the 5,192 annual records it contains were sent in with the usual punctuality in the early part of the year. Nor, we may be allowed to say, has it been brought about by any remissness on the part of the depleted staff in the office of the British Rainfall Organization, the whole of the MS. having been completed on August 16th. The delay is solely due to the difficulties experienced by the block makers and printers in obtaining the necessary supply of skilled labour on account of the accumulated pressure of the long-continued war.

An interesting feature of the great national war museum now forming will probably be a collection of annual publications of all kinds for the last year of peace and for each year of the war. The thinning of the volumes of *British Rainfall* in the effort to keep the rising cost within the limits of the shrinking income is noticeable, the total number of pages in the issues for 1914, 1915 and the newly published 1916, being respectively 448, 338, 306. The reduction has been brought about by the successive elimination of the less essential features, the Notes of Observers on the weather, the index maps of the river-divisions, and the detailed analysis of the losses and gains having been sacrificed in order to allow of the unabridged publication of the total annual rainfall at all stations, the monthly and annual rainfall maps, with descriptive letterpress, and the treatment of the distribution of rainfall in time. These are all as full as they ever were, and preserve unbroken continuity with the past in the treatment of statistics. The description of heavy rains on rainfall days has been a little restricted, and the number of wet days selected for mapping is smaller than usual. However, all the most interesting days are treated, and we may be allowed to call special attention to this section in the new volume.

* *British Rainfall, 1916.*—On the Distribution of Rain in Space and Time over the British Isles during the year 1916. Compiled by Hugh Robert Mill and Carle Salter. London, 1917. Price, 10s.

We believe that the exact mapping of the rainfall of individual days, not necessarily the wettest days, will supply data of very great value in theoretical meteorology. For this purpose it is important to deal with the whole rainfall of a natural period and no more. In the case of a single continuous shower, which began and ended between 9 a.m. on one day and 9 a.m. on the next, the daily rainfall as measured meets this requirement, whether the fall lasted for one hour or for twenty-four. When a continuous shower is in progress at 9 a.m. part of the rain is measured for one day and part for the next; but if no rain fell in the first rainfall day before the shower began, or in the latter part of the second rainfall day after the shower ceased, the total for the two days supplies the natural amount to be mapped, while the mapping of the two days' fall separately dissects the shower into an earlier and a later portion often showing features of great interest. When portions of two separate showers, which may belong to different meteorological types, occur in one rainfall day, the total figure when mapped does not represent an individual phenomenon, but the combined parts of two separate phenomena, and is thus of less value as a means of investigation into the nature and cause of rainfall, and the unsuspected occurrence of this kind of rain day is apt to confuse the study of individual rains. It must be remembered that the mapping of rainfall in this section is work of very high precision, the position of the isohyetal lines is as rigidly determined as the position of the coast lines or the county boundaries on the maps as printed. The rains selected for mapping in this volume include two very striking instances of unprecedentedly heavy and widespread falls in Scotland, on the east side of the country, on July 7th-8th, and on the west side, on October 11th. The last-named occasion produced the highest daily rainfall ever recorded in the British Isles up to that date, viz., 8·20 in., at Kinlochquoich, in Inverness-shire. Two other instances are the heavy rainfall over the whole south of England on August 29th, and a violent little storm in the west of Ireland, on October 21st. In all cases where the track of a depression could be shown the heavy rainfall lay far to the left of the track.

There is a diminution noted of 220 records as compared with 1915, the total number appearing being 5,192, as compared with 5,412. This amounts to a reduction of 4 per cent. owing to the war. There is reason for believing that the real reduction is much less than this as it was found impossible to get many records which are known to be going on, on account of the Observers having no leisure to copy out the figures. It is remarkable how small the shrinkage in the number of Observers is, but this is explained by the fact that before the war very few Observers were men of military age.

In his Report to the Trustees the Director says: "I am thoroughly persuaded that work of this kind is most efficiently carried on by a

voluntary agency absolutely free from red tape; but to ensure this efficiency the generous help of the well-to-do Observers is as necessary as the devoted services of the staff." No public appeal for funds is made by the British Rainfall Organization, economy in cutting the annual coat being secured by the Director providing himself the extra cloth required after that provided by the other Observers has been used up. This may prove a very difficult operation next year.

LOCAL RAINFALL ORGANIZATIONS.

We learn with great interest of the recent inauguration, under Mr. A. A. Barnes, C.E., of Stockport, of a new local Rainfall Organization designed to deal with an area of approximately 3,000 square miles surrounding Manchester and Stockport. Arrangements have been made for the monthly rainfall totals to be published in the *Stockport Advertiser*, and it is intended to supplement this with an annual report, illustrated by maps, for private circulation.

We need hardly say that we heartily welcome this latest addition to the small group of local associations who are rendering special assistance to the British Rainfall Organization by stimulating local interest in rainfall observing, in a systematic manner. Among other special services we believe that every opportunity is taken to encourage the use of standard instruments and uniform methods of observing.

The local organizations now in existence include, besides the newly formed Manchester and Stockport, the Croydon Natural History Society (dealing with parts of London, Surrey and Kent), the Hertfordshire Natural History Society, the Northamptonshire Natural History Society, the Norfolk Rainfall Organization, the Mid-Wessex Rainfall Association (parts of Somerset, Wiltshire and Dorset), the Dorset Field Club, the Cardiff Naturalists' Society, and Miss Marshall's Lake District system. Among less formal collections of records published at intervals we may mention those of Sir John Moore (parts of Ireland), Mr. A. Collenette (Guernsey), and Mr. C. V. Hawksford (Jersey).

In the case of institutions which have funds at their disposal for defraying the cost of printing the war has fortunately not interfered materially with this very useful work, but local newspapers have, in some instances, found it necessary either to discontinue printing tables or to print them only in an abbreviated form, thereby considerably reducing their value. We trust that Mr. Barnes's scheme will overcome temporary difficulties of this kind, and shortly find opportunities for developing itself under more favourable conditions. We wish it the success which it undoubtedly merits.

RAINFALL IN RELATION TO CYCLONIC CENTRES—A REVIEW.*

BY CARLE SALTER.

SINCE Dr. H. R. Mill first drew attention in 1904 to the unsymmetrical distribution of rainfall about the paths of moving cyclonic systems, this problem has been studied by a number of leading meteorologists both in Europe and America. The conclusions arrived at have been decidedly conflicting, in some cases even directly contradictory, and three Japanese investigators have, in consequence, been led to make an investigation on somewhat different lines. The method followed consisted in dividing the area covered by Japan and the surrounding seas into numbered squares, regarded as geographical units, and classified primarily in three main groups, referring respectively to the Pacific coast, the coast of the Japan Sea, and the interior of Japan. In each of these squares the number of instances was tabulated when rain was observed to have occurred on any occasion when a single and well defined depression centre could be located in any part of the whole area of the map. The rainfall appears to have been considered solely in point of its occurrence and not in respect of its amount, and the cyclone in point of its position at a given time and not in respect of its direction of travel. In these respects the data differ from those considered by Dr. Mill and Mr. W. G. Reed. The tabulated records provided material for calculating the probability of rain falling in any individual square for a large number of depression centre-points, and the percentages of probability when plotted on maps yielded isopleths of great interest. We are inclined to deprecate the use of the word "isohyet" as applicable to such lines of equal probability, not because it is intrinsically inaccurate, but because it has passed into the currency of meteorological terminology as a term for lines of equal rainfall amount.

These maps are studied in relation to the configuration of the land. It is shown that in the front of a distant cyclone the Pacific coast has a greater expectation of rain than the Japan Sea coast, whereas in the rear the reverse is the case. In the immediate vicinity of the centre of the depression the difference between the east and west coasts is not so conspicuous. In the inner region of a cyclone the effect of land configuration appears to be less pronounced than on the outskirts. When the centre is situated in the Japan Sea the expectation of rain is greater on both coasts of Japan than in the interior of the islands. These generalizations refer to the mean distribution: with individual cases, discrepancies sometimes arise.

* On the Distribution of Cyclonic Precipitation in Japan. By T. Terada, T. Yokota and S. Otuki. (Journal of the College of Science, Imp. Univ., Tokyo.) Tokio, 1916. Size 10 by 7½. Pp. 32.

A second set of maps show the loci of centres of depressions bringing equal expectation of rain to any one spot. These "centre-locus" maps indicate clearly that the normal position of the area of greatest rainfall expectation lies mostly on the east, north-east or north side of the cyclone, but there are characteristic differences between the Pacific coast, the interior and the Japan Sea coast, in this respect. With depressions moving northwards this gives the maximum precipitation expectation to the forward right-hand quadrant. In this case, therefore, the results tend to confirm Abercrombie's hypothesis.

An attempt is made to reconcile the conclusions of Professor Hann and Dr. Mill by consideration of orographical and other external circumstances, but a complete explanation is impossible owing to lack of data. It should be borne in mind that whilst the authors deal with occurrence of actual rain at the moment of observation, the method used by Dr. Mill, which, following Mr. W. G. Reed, they dub the "smear" method, takes account of the precipitation during the whole period of the passage of the centre of the depression between given points. Thus whilst it does not distinguish the limits of the rain-fields at any individual epoch, it has the advantage of locating clearly the regions of heaviest rainfall. The authors appear to be under a slight misapprehension on this point. The "smears" referred to are enclosed by the outline of the area over which, during the passage of the cyclone, one inch of rain or more fell. Since the publication of these maps most instances of heavy daily rainfall in the British Isles have been mapped in relation to the movements of the accompanying cyclonic centres in *British Rainfall*. These subsequent maps include isohyets for other values than 1 inch and where practicable give the zero line or outside limit of the rain field. Taken together they present a great weight of evidence in favour of the hypothesis that in the British Isles the heaviest rainfall occurs on the left-hand side of the track, and that it appears commonly to occur principally in advance of the centre, or in the forward left-hand quadrant. The whole rain-field, though almost always extending across the track is nearly always wider on the left than on the right. These generalizations appear to hold good in whatever direction the depression is travelling, though it must be admitted that instances of east-west movement are rare. An interesting suggestion as to the phenomenon of intensified rainfall on the left, from the pen of Mr. R. Corless, appeared in this magazine (vol. **46**, 1911, p. 85), and offered a well reasoned explanation which would appear to hold good for other parts of the world, but there are so many complicated orographical and convectional influences which may operate to interfere with the normal circulation in individual cases that it is probable that the contradictory conclusions arrived at by Hann and Reed may be explained by local circumstances.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE READING OF THE MENISCUS—ALSO GUNFIRE.

I HAVE read with interest the letter of Mr. Lowe in your September number, the more so as I have myself been experimenting for a short time with two Snowdon rain-gauges, and a Glaisher pattern (Negretti and Zambra, 1868) with very much the same results.

Absolute accuracy of measurement is, of course, unattainable; but in view of the loss by evaporation, which, I think, is greater with the Snowdon pattern, and the loss in the actual pouring from the receiver into the measuring glass, for it is a wet receiver, not a dry one, that one puts back into place, do we not rather require some counterbalancing error, such as we should get by reading the meniscus midway, or at the top, rather than at the bottom? This error would be none too much in warm weather.

I did not in my last letter raise the question of comparison between the rainfall of England, and that of the Continent, and the rest of the world. But twenty years' experience on the shores of the Mediterranean showed me that "a six-foot circle of short grass round the gauge" was generally an impossibility outside England; and unfortunately the more one proves that 3 or 4 feet is too high for the gauge mouth in England, the more one is proving also that our figures and those of Europe and Asia, etc., are not properly comparable. I believe that $1\frac{1}{2}$ metres is the standard height in some countries. A standard height for rain gauge mouths the whole world over is a desideratum—not to be obtained while the war goes on.

Touching the connection between the Heavy Firing and the Torrential Rains, I welcome Mr. Horner's letter. An ignorant amateur like myself, who perceives that the three years of war have been also years of very large rainfall and of torrential downpours, may be allowed to wonder whether or not here is a case of cause and effect. He sees that the parts of England nearer to the explosions have experienced very heavy rains; and he does not know that these explosions can have no effect further afield, say, on the moisture-laden air coming up from the Atlantic, causing that rain to fall heavily in a smaller area which should have been distributed over a larger one. It is surely a case for the open mind.

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

North Cadbury Rectory, Oct. 3rd, 1917.

HEAVY RAINFALL IN SOUTH-EAST ENGLAND.

MAY I ask for a little space to reply to Mr. Harries (p. 99)?

He seems to confuse my *theory* with the popular belief that anything that makes a noise will bring down rain! In this he is mistaken, as I will show by a quotation from "Star and Weather Gossip," by Mr. Joseph H. Elgie, F.R.A.S., published in 1915, where that gentleman kindly printed a note by me on the subject as follows:—"Mr. D. W. Horner, F.R.Met.Soc., has been good enough to send me an expression of opinion on the subject (of gunfire and rain). He believes that with a dry and rainless atmosphere, such, for instance, as was experienced at the beginning of the war, *no amount of cannonading, however violent, will cause a drop of rain to fall.* If, however, the atmosphere be thick with rain-bearing clouds, as during the phenomenally wet December of 1914, he thinks that the rainfall, which would have been in any case heavy, would be made heavier *'by the concussion setting free the extra moisture usually held in suspension.'* I also mentioned this matter in a letter to your magazine, September, 1916, p. 120, so my theory is by no means new, and it is curious that it should have gone so long unchallenged.

D. W. HORNER, F.R.Met.Soc.

Moretonhampstead, Devon, Nov. 5th, 1917.

THE GREEN FLASH AT SUNRISE.

HAVING read with keen interest the account of a "green flash" by Mr. J. G. Wood in the October magazine, I think that an extract from my meteorological note-book would be of interest, although I have witnessed many sunrises and sunsets, but never another like that which I now describe :—

"July 7th, 1916. Watched sunrise and noticed a peculiar blue light on top of sun, immediately before sun rose, the colour was similar to that caused by an electric light burning mercury, a greyish blue, and very bright. It only lasted a moment, and then disappeared as suddenly as it appeared. I have many times watched sunrise but do not remember seeing the same thing before. The clouds were only broken sufficiently for the sun to shine through for about ten minutes after sunrise, the sky being overcast."

GEO. E. DANES.

Alderney Lighthouse, Channel Islands, Oct. 21st, 1917.

REPORT ON ATMOSPHERIC POLLUTION.

In our last volume we gave a detailed summary of the First Report of the Committee appointed in 1912 at the International Exhibition and Conference held in London to investigate the question of atmospheric pollution. The second report has just been issued in a special supplement to *The Lancet* of October 27th, 1917, dealing with the work carried on during the year 1915-6. A curious informality in connection with this Report is that it is not signed, nor is the name of Chairman, Secretary or any member of the Committee given. The Report is headed "Meteorological Office, Advisory Committee on Atmospheric Pollution," and it is no doubt by accident that the names have been omitted. The present position of the investigation may be gathered from the following extracts from the Introduction to the Second Report, which after pointing out that the work of the Committee consisted (1) of the organization of the scheme and the carrying on of the work; (2) of the establishment and operating of the collecting stations, goes on to say :—

"In view of the above considerations, application was made to the Department of Scientific and Industrial Research for a Government grant in aid of the work included under No. 2, and the Committee have now gratefully to acknowledge the generous help given to them by the Department.

"Not only have their financial difficulties been met by a substantial grant, but the work has been given official approval and status by placing it under the control of the Meteorological Office. The Committee has been constituted an "Advisory Committee on Atmospheric Pollution" to the Meteorological Office, and its original title has been altered accordingly. At the same time little change in the personnel has been made, with the exception that the Department of Scientific and Industrial Research have power to appoint a representative, and it has also been decided to ask each co-operating authority to appoint a representative. It will thus be seen that a new impetus has been given to the work, and although, strictly speaking, the changes which are above indicated took place during 1917, yet as their effect is retrospective as above indicated, it appeared best to set them forth here."

The Report deals in great detail with the impurities collected from the air in various places, and attention is drawn to the fact that an increase in the amount of solid impurities which was observed in summer was probably due to blown dust rather than to matter suspended in the air. The value of the researches is practical rather than scientific, the bearings on the health of towns being obviously the most important. A valuable sidelight is thrown on the waste of fuel by the figures which are obtained of the actual weight of carbon thrown off unburned in smoke. It is not impossible that some relation to meteorological phenomena may ultimately emerge; but so far no stress has been laid on this aspect.

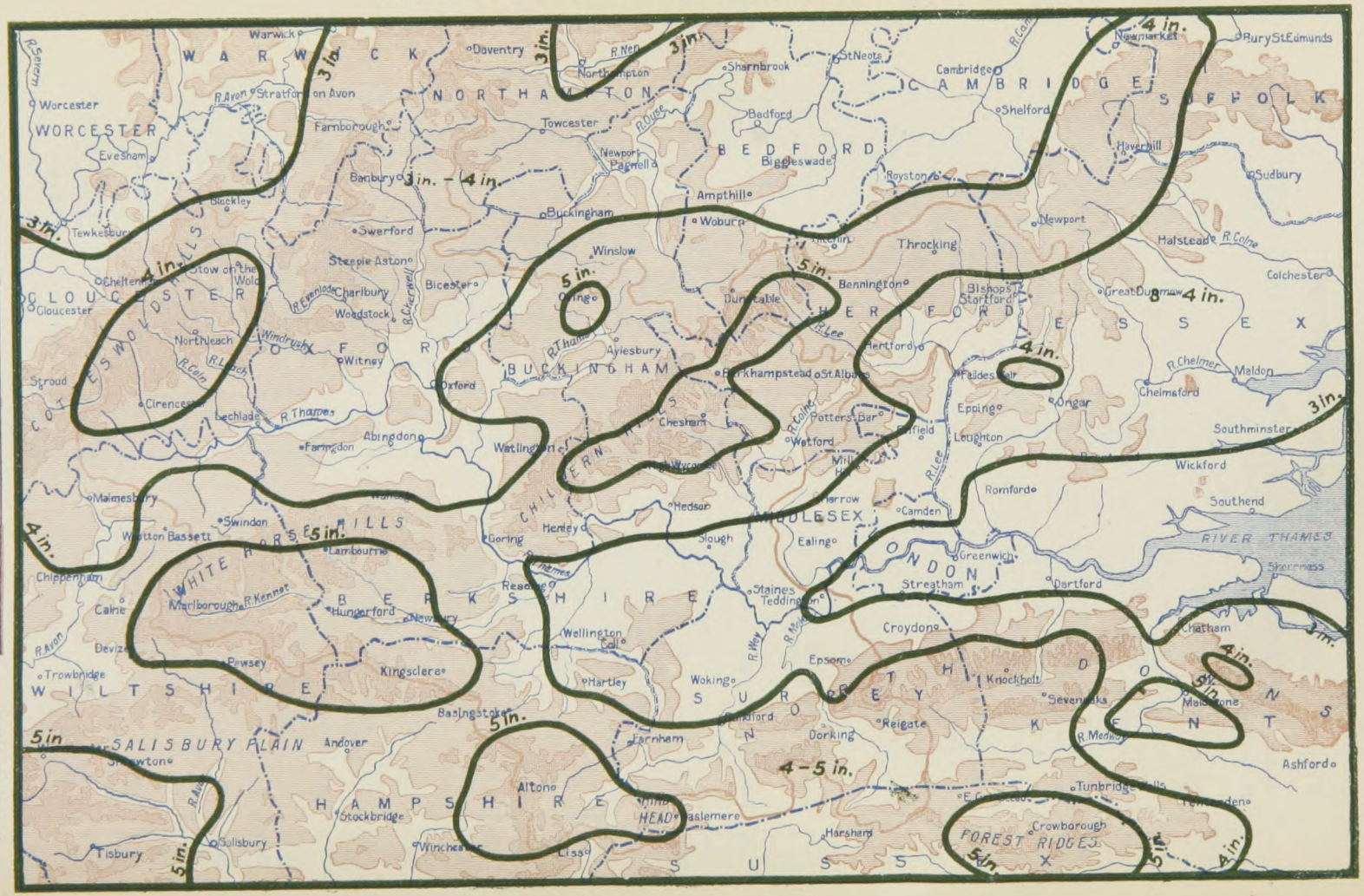
RAINFALL TABLE FOR OCTOBER, 1917.

STATION.	COUNTY.	RAINFALL.						
		Aver. 1875—1909. in.	1917. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	2·72	3·25	+ ·53	120	·42	12	19
Tenterden	*Kent*	3·48	3·88	+ ·40	112	·64	7	21
Arundel (Patching)	*Sussex*	4·01	4·41	+ ·40	110	·59	11	17
Fordingbridge (Oaklands)	*Hampshire*	3·97	5·08	+1·11	128	1·39	16	26
Oxford (Magdalen College)	*Oxfordshire*	2·82	3·99	+1·17	142	·69	16	20
Wellingborough (Swanspool)	*Northampn*	2·60	2·88	+ ·28	111	·40	4	18
Bury St. Edmunds (Westley)	*Suffolk*	2·72	3·98	+1·26	146	·80	4	16
Geldeston [Beccles]	*Norfolk*	2·84	3·06	+ ·22	108	·77	4	21
Polapit Tamar [Launceston]	*Devon*	4·84	7·82	+2·98	162	·97	12	27
Rousdon [Lyme Regis]	,,	3·81	3·25	— ·56	85	·41	8	19
Stroud (Field Place)	*Gloucester*	3·21	3·45	+ ·24	107	·67	3	24
Church Stretton (Wolstaston)	*Shropshire*	3·77	3·93	+ ·16	104	...	...	...
Boston	*Lincoln*	2·75	3·12	+ ·37	114	·56	4	18
Worksop (Hodsock Priory)	*Nottingham*	2·77	2·28	— ·49	82	·43	8	20
Mickleover Manor	*Derbyshire*	2·81	4·24	+1·43	151	·52	7	21
Buxton	,,	5·23	7·45	+2·22	142	·99	8	26
Southport (Hesketh Park)	*Lancashire*	3·74	6·73	+2·99	180	·66	3	24
Arncliffe Vicarage	*York, W.R.*	6·48	...	...	..	...	...	...
Wetherby (Ribston Hall)	,, ,,	3·18	3·47	+ ·29	109	·49	12	27
Hull (Pearson Park)	,, *E.R.*	3·19	2·68	— ·51	84	·45	7	18
Newcastle (Town Moor)	*North'land*	3·20	2·36	— ·84	74	·57	8	20
Borrowdale (Seathwaite)	*Cumberland*	12·71	21·86	+9·15	173	3·32	22	25
Cardiff (Ely)	*Glamorgan*	4·87	7·06	+2·19	145	1·55	3	29
Haverfordwest	*Pembroke*	5·51	5·51	·00	100	·67	29	24
Aberystwyth (Gogerddan)	*Cardigan*	5·38	7·79	+2·41	145	·77	8	28
Llandudno	*Carnarvon*	3·78	5·16	+1·38	137	·85	12	26
Cargen [Dumfries]	*Kirkcudbrt.*	4·45	7·05	+2·60	158	·91	24	25
Marchmont House	*Berwick*	3·83	4·18	+ ·31	109	·64	24	21
Girvan (Pinmore)	*Ayr*	5·38	10·54	+5·16	196	1·30	30	27
Glasgow (Queen's Park)	*Renfrew*	3·36	5·95	+2·59	177	·81	23	25
Islay (Eallabus)	*Argyll*	4·95	12·13	+7·18	245	1·52	20	31
Mull (Quinish)	,,	5·87	12·52	+6·65	213	1·90	29	29
Balquhidder (Stronvar)	*Perth*	7·29	11·83	+4·54	162	1·97	20	25
Dundee (Eastern Necropolis)	*Forfar*	2·81	2·43	— ·38	87	·38	24	20
Braemar	*Aberdeen*	3·88	4·38	+ ·50	113	·71	24	26
Aberdeen (Cranford)	,,	3·23	3·50	+ ·27	108	·51	7	24
Gordon Castle	*Moray*	3·38	4·40	+1·02	130	...	...	...
Drumnadrochit	*Inverness*	3·49	5·69	+2·20	163	·72	24	28
Fort William	,,	7·32	12·97	+5·65	177	1·65	22	28
Loch Torridon (Bendamph)	*Ross*	8·38	17·29	+8·91	206	1·81	27	29
Dunrobin Castle	*Sutherland*	3·15	6·84	+3·69	217	1·42	27	24
Killarney (District Asylum)	*Kerry*	5·59	7·60	+2·01	137	·69	30	30
Waterford (Brook Lodge)	*Waterford*	4·00	2·82	—1·18	70	·55	20	22
Nenagh (Castle Lough)	*Tipperary*	3·48	5·34	+1·86	153	·59	3	28
Ennistymon House	*Clare*	4·40	7·11	+2·71	162	·94	11	29
Gorey (Courtown House)	*Wexford*	3·75	2·57	—1·18	69	·36	3, 29	23
Abbey Leix (Blandsfort)	*Queen's Co.*	3·53	3·15	— ·38	89	.49	8	23
Dublin (Fitz William Square)	*Dublin*	2·88	2·60	— ·28	90	·57	3	24
Mullingar (Belvedere)	*Westmeath*	3·19	6·02	+2·83	189	1·00	3	22
Crossmolina (Enniscoe)	*Mayo*	5·27	8·70	+3·43	165	·76	20	30
Cong (The Glebe)	,,	4·60	8·16	+3·56	177	·76	8	29
Collooney (Markree Obsy.)	*Sligo*	4·21	9·26	+5·05	220	·71	20	29
Seaforde	*Down*	3·65	4·48	+ ·83	123	·62	24	22
Ballymena (Harryville)	*Antrim*	3·78	6·27	+2·49	166	.56	20, 29	28
Omagh (Edenfel)	*Tyrone*	3·76	8·36	+4·60	222	·76	24	30

SUPPLEMENTARY RAINFALL, OCTOBER, 1917.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	4·82	XI.	Lligwy	7·53
,,	Ramsgate	2·79	,,	Douglas, Isle of Man	7·37
,,	Hailsham	4·60	XII.	Stoneykirk, Ardwell House...	6·66
,,	Totland Bay, Aston House...	3·95	,,	Carsphairn, Shiel	15·78
,,	Stockbridge, Ashley..	4·32	,,	Langholm, Drove Road	8·50
,,	Grayshott	5.13	XIII.	Selkirk, The Hangingshaw..	4·33
III.	Harrow Weald, Hill House...	4·31	,,	North Berwick Reservoir.....	2·55
,,	Pitsford, Sedgebrook.....	2·87	,,	Edinburgh, Royal Observaty.	2·62
,,	Woburn, Milton Bryant.....	3·79	XIV.	Biggar.....	5·12
,,	Chatteris, The Priory.....	3·53	,,	Maybole, Knockdon Farm ...	6·71
IV.	Elsenham, Gaunts End	4·06	XV.	Buchlyvie, The Manse.....	7·75
,,	Shoeburyness	1·97	,,	Ardgour House	16·62
,,	Colchester, Hill Ho., Lexden	3·48	,,	Oban.....	10·06
,,	Ipswich, Rookwood,Copdock	3·69	,,	Campbeltown, Witchburn ..	11·51
,,	Aylsham, Rippon Hall.... ..	3·56	,,	Holy Loch, Ardnadam.....	14·75
,,	Swaffham	3·75	,,	Tiree, Cornaigmore	10·11
V.	Bishops Cannings	5·60	XVI.	Glenquey	7·80
,,	Weymouth.....	3·71	,,	Glenlyon, Meggernie Castle..	9·76
,,	Ashburton, Druid House.. ...	8·04	,,	Blair Atholl	4·16
,,	Cullompton	5·42	,,	Coupar Angus	2·65
,,	Lynmouth, Rock House	8·48	,,	Montrose, Sunnyside Asylum.	2·83
,,	Okehampton, Oaklands.....	10·10	XVII.	Balmoral	3·85
,,	Hartland Abbey.....	6·10	,,	Fyvie Castle	5·27
,,	St. Austell, Trevarna	7·65	,,	Keith Station	6·28
,,	North Cadbury Rectory.....	3·59	XVIII.	Rothiemurchus	4·13
VI.	Clifton, Stoke Bishop	5·92	,,	Loch Quoich, Loan	29·25
,,	Ledbury, Underdown..... ...	2·49	,,	Skye, Dunvegan	15·72
,,	Shifnal, Hatton Grange.....	3·18	,,	Fortrose.....	4·41
,,	Droitwich.....	2·74	,,	Glencarron Lodge	13·81
,,	Blockley, Upton Wold.....	3·44	XIX.	Tongue Manse	7·75
VII.	Grantham, Saltersford.....	2·96	,,	Melvich	6·90
,,	Market Rasen	2·92	,,	Loch More, Achfary	14·65
,,	Bawtry, Hesley Hall	2·68	XX.	Dunmanway, The Rectory ..	6·99
,,	Whaley Bridge, Mosley Hall	6·44	,,	Glanmire, Lota Lodge.....	3·88
,,	Derby, Midland Railway.....	3·60	,,	Mitchelstown Castle.....	4·21
VIII.	Nantwich, Dorfold Hall	5·17	,,	Darrynane Abbey.....	7·75
,,	Bolton, Queen's Park	8·86	,,	Clonmel, Bruce Villa	2·90
,,	Lancaster, Strathspey	5·87	,,	Broadford, Hurdlestown.....	7·34
IX.	Langsett Moor, Up. Midhope	4·65	XXI.	Enniscorthy, Ballyhyland...	3·58
,,	Scarborough, Scalby	3·70	,,	Rathnew, Clonmannon	2·46
,,	Ingleby Greenhow	3·74	,,	Ballycumber, Moorock Lodge	4·66
,,	Mickleton	4·00	,,	Balbriggan, Ardgillan	3·21
X.	Bellingham, High Green Manor	3·86	,,	Castle Forbes Gardens.....	4·63
,,	Ilderton, Lilburn Cottage ...	3·26	XXII.	Ballynahinch Castle.....	10·85
,,	Keswick, The Bank.....	9·93	,,	Woodlawn	5·84
XI.	Llanfrechfa Grange	5·17	,,	Westport, St. Helens	8·93
,,	Treherbert, Tyn-y-waun	12·78	,,	Dugort, Slievemore Hotel ...	13·40
,,	Carmarthen, The Friary	6·82	XXIII.	Enniskillen, Portora.....	7·71
,,	Fishguard, Goodwick Station.	5·37	,,	Dartrey [Cootehill]	5·25
,,	Crickhowell, Tal-y-maes.....	7·00	,,	Warrenpoint, Manor House ..	4·48
,,	New Radnor, Ednol	6·53	,,	Belfast, Cave Hill Road	6·59
,,	Birmingham WW., Tyrmynydd	9·26	,,	Glenarm Castle	7·73
,,	Lake Vyrnwy	8·54	,,	Londonderry, Creggan Res...	7·92
,,	Llangynhafal, Plas Drâw.....	5·98	,,	Dunfanaghy, Horn Head ...	
,,	Dolgelly, Bryntirion.....	10·55	,,	Killybegs	11·27
,,	Bettws-y-Coed, Tyn-y-bryn...	9·60			

THAMES VALLEY RAINFALL. OCTOBER. 1917.



Symons's Meteorological Magazine

THE WEATHER OF OCTOBER.

THE outstanding features of the weather of October were a low mean temperature, and a general excess of rainfall, with frequent and unseasonable snow storms in northern districts.

The month opened with a high pressure system over southern Europe and a low pressure area near Iceland, the accompanying southerly and south-westerly winds bringing a high temperature, especially over south ern and eastern England, where shade maxima exceeding 70° were recorded at several places on the first three days of the month. The highest values were recorded on the 2nd, Geldeston, in Norfolk, 74°, Greenwich, 73°, and Tunbridge Wells, Raunds and York, 72°. In Scotland and Ireland the temperature at the same time was low.

During the month there was an almost complete absence of anti-cyclonic conditions, except round about the 20th, when the continental high pressure area was transferred to the east and south-east of England. In general the greater part of the month was very unsettled, with frequent snow, hail, and gales, especially in the north and west, where conditions were dominated by the passage of frequent cyclonic systems between the north of Scotland and Iceland, the rough weather extending to the Midlands of England and the south generally on several occasions, with thunderstorms in places. The lowest temperature of the month was recorded as early as the 7th, when Balmoral and West Linton recorded a shade value of 22°, the frost being general over the country except at stations on or near the coast. Owing to the absence of any pronounced spell of warm weather the mean temperature of the month was everywhere considerably below the average, as much as 4° F. in the north-east of England, and over 3° in the north and west of Scotland. For the whole country the temperature was nearly 3° below the average, and only in the English Channel was the deficiency less than 2°.

The average daily amount of bright sunshine varied from 5 hours, in the east of England, to less than 2 hours, in the north of Scotland. The excess as compared with the average, was most pronounced in the Midlands and eastern and south-eastern districts, where it amounted to rather more than an hour per day. More than a third of the total possible was recorded in most districts, and nearly half the possible in the Midlands.

Rainfall was above the average nearly everwhere. In some parts of the west of Scotland and the northern central parts of Ireland, the amounts recorded were unprecedented for October over a long series of years. Thus the observer at Omagh remarks: "The wettest October since the records here commenced 54 years ago and probably the highest fall for one month." About double the average fell in the north and west, and the only areas showing a slight deficiency were portions of the north-east of England, the east of Scotland, and east and south-east of Ireland, where at some stations the rainfall was under 2·50 in.

On the other hand as much as from 15 to 30 inches fell in parts of west Inverness, while spots in the Lake District and north-west Wales had over 20 inches. In parts of Kerry and Galway over 15 inches fell. Over the greater part of the country the rainfall varied between 3·5 and 7·0 in. A noteworthy feature was the large number of rainy days in the north and west, rain falling on every day of the month at some places, while a great many stations had only two or at most three days without rain.

The general rainfall, expressed as a percentage of the average, was :— England and Wales, 129 per cent.; Scotland, 158 per cent.; Ireland, 147 per cent.: British Isles, 142 per cent.

In London (Camden Square), the mean temperature was 47·°1, being 3°·0 under the average. Duration of rainfall, 57·1 hours, of sunshine, 116 hours. Evaporation, ·75 in.

Climatological Table for the British Empire, May, 1917.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	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	83·9	27	35·2	7	71·4	48·5	48·0	...	128·5	33·7	1·99	8	5·2
Malta	78·4	11	58·0	1	70·8	61·3	...	81	133·5	...	·16	3	2·4
Lagos	...	...	...	...	...	...	...	...	...	...	...	...	...
Cape Town	77·8	2	43·1	29	64·9	50·7	49·6	75	...	...	4·28	10	5·1
Johannesburg	69·9	24	35·8	27	63·3	45·2	36·7	61	...	33·0	·75	6	3·3
Mauritius	81·9	9	57·0	18	79·2	64·4	64·2	79	...	49·3	·94	16	4·5
Bloemfontein ...	72·3	25	23·1	31	65·9	34·3	34·3	61	...	...	·12	1	1·4
Calcutta...	...	...	...	...	...	..	...	...	..	...	...	...	...
Bombay...	92·0	31	75·1	5	90·1	79·2	74·4	72	135·6	69·3	·88	9	3·1
Madras	105·3	25	74·5	29	97·0	79·6	71·6	65	158·6	72·0	·62	4	2·5
Colombo, Ceylon ...	90·7	17	71·3	1	87·8	76·2	74·0	80	156·5	67·2	5·59	14	5·9
Hongkong	89·6	31	59·7	1	79·4	70·9	69·5	82	...	...	9·69	14	7·3
Sydney	73·2	6	43·0	27	63·4	49·9	46·2	70	119·8	29·3	3·52	6	3·2
Melbourne	...	...	...	...	...	...	...	...	...	...	...	...	...
Adelaide	71·3	30	44·6	13	63·1	50·8	48·0	72	127·6	33·1	5·19	20	7·1
Perth	...	...	...	...	...	...	...	...	...	...	...	...	...
Coolgardie	72·5	2	35·5	17	64·3	44·9	42·0	59	128·5	30·0	1·27	8	4·6
Hobart, Tasmania ..	64·9	17	30·9	28	55·2	42·8	39·9	69	115·8	27·6	2·31	17	6·2
Wellington ...	68·2	10	40·9	3	60·1	50·1	50·0	83	129·0	26·2	5·31	21	6·1
Auckland	...	...	...	...	64·0	53·1	...	...	...	...	8·01	26	...
Jamaica, Kingston ..	92·7	25	69·6	1	88·3	72·5	70·4	77	...	...	1·99	9	3·3
Grenada	89·0	18	71·0	26	85·6	74·1	...	72	139·0	...	2·12	11	3·2
Toronto	77·8	18	34·0	8	57·9	40·7	36·9	64	133·4	28·9	2·36	14	5·7
Fredericton	65·0	19*	25·0	1	53·6	34·6	37·0	76	...	...	4·50	14	7·3
St. John, N.B. ...	63·3	16	26·0	1	49·5	36·6	37·1	78	131·1	23·6	4·08	15	7·4
Victoria, B.C.	62·0	6	39·7	17	55·9	43·9	44·0	83	130·0	31·0	·56	7	5·1

* And 31.

Johannesburg.—Bright sunshine 271·9 hours.

COLOMBO, CEYLON.—Mean temp. 82°·0 or 0°·6 below, dew point 1°·6 below and R 6·96 in. below averages. Mean hourly wind velocity 4·6 miles. Rain storm 29th when ·42 in. fell. TS on 3 days.

HONGKONG.—Mean temp. 74°·8. Bright sunshine 168·6. Mean hourly velocity of wind 9·9 miles.

Adelaide.—Mean temp. 0°·7 below and R 2·51 in. above averages. A very wet and cloudy month.

Coolgardie.—Temp. 3°·2 below, and R about ¼ in. below averages.

Wellington.—Mean temp. 2°·3 above, and R ·43 in above, averages. Bright sunshine 120·9 hours. Cloudy unsettled and wet month.

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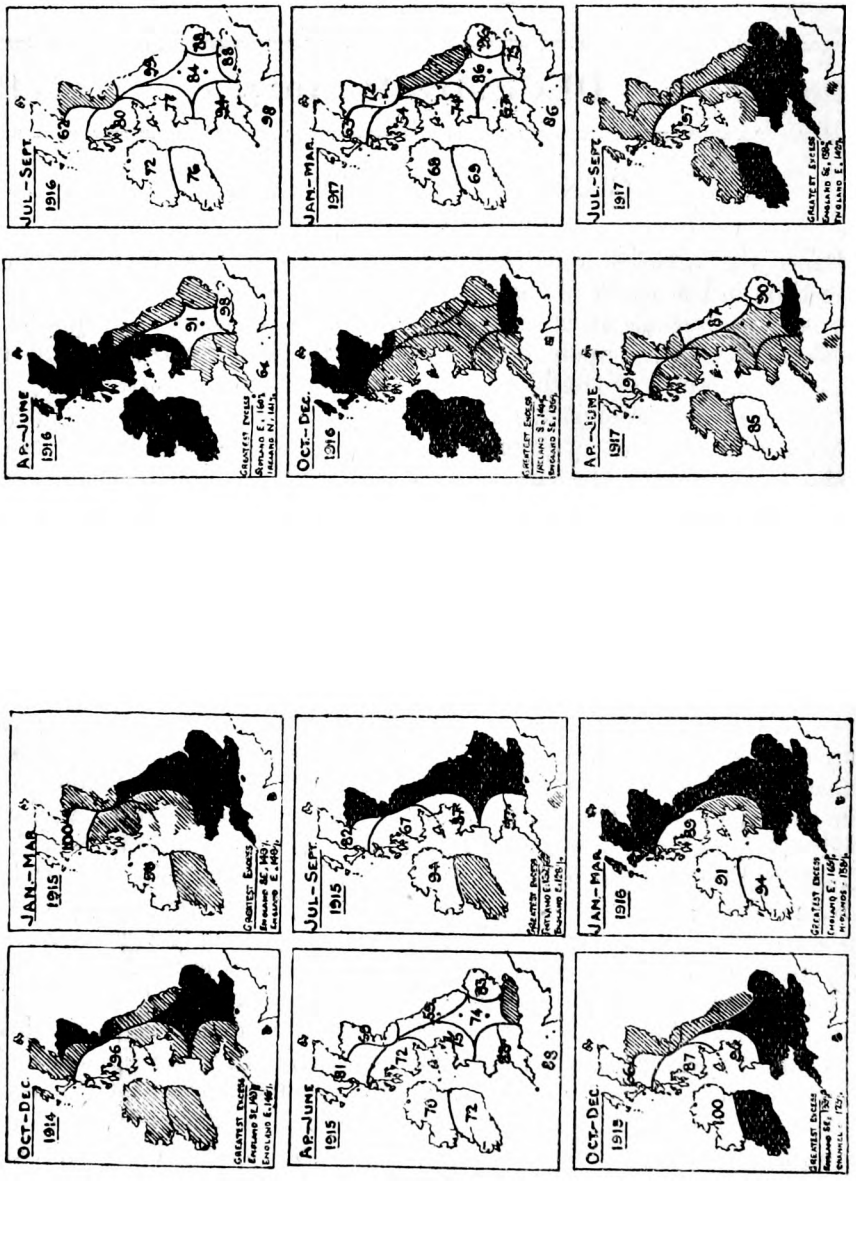
GUNFIRE AND RAINFALL.

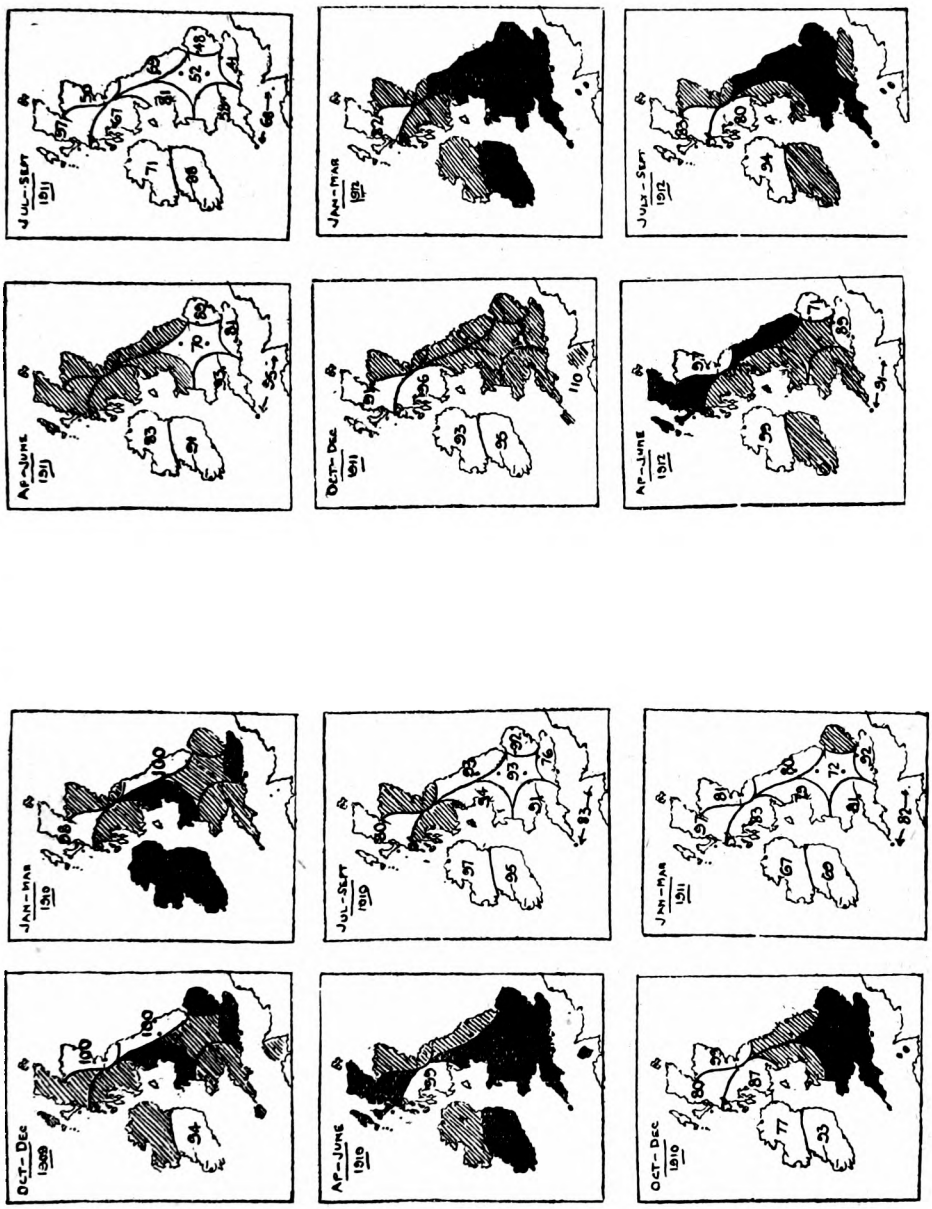
By Fredk. J. Brodie.

From the articles and correspondence which appear from time to time in the pages of *Symons's Meteorological Magazine* and other scientific journals it is clear that the question as to the possible effect of Gunfire upon Rainfall still retains a certain amount of vigour, in spite of the blows it has received from most of our professional meteorologists. To those of us who happen to have acquired some sort of reputation, however slender, in the ranks of the weather-wise the subject has occasionally proved a source of embarrassment. Over and over again during the prevalence of a rainy spell have we been bombarded with the question "Do you think this atrocious weather is due in any measure to the heavy gunfire in Flanders?" As a refuge from such attacks most of us have, I suppose, been glad to shelter behind the great authorities. We have told our inquisitive friends that in the opinion of those best qualified to judge the heavy explosions and the huge air waves which have originated a few miles from our shores have been quite insufficient to generate in the surrounding atmosphere the effect necessary to produce any heavy or widespread deposition of moisture in these islands. The reply has, for the moment, satisfied the anxious enquirer, but whether it has in all cases quieted the doubts which may have arisen in the mind of the teacher is not quite so certain. Some of us may, perhaps, have experienced, as we repeated our lesson, faint qualms of suspicion, and may even have begun to wonder whether the question admitted of as simple a solution as the one we have so boldly offered. Quite recently, when this iconoclastic spirit was upon me, I thought it might be of interest to investigate somewhat carefully the rainfall conditions which have existed in this country since the commencement of the war. The material employed for the purpose was derived from the quarterly summaries issued periodically as appendices to the Weekly Weather Report of the Meteorological Office. These summaries give, *inter alia*, the total rainfall experienced during the quarter in each of the twelve meteorological districts into which the United Kingdom is divided, and also a comparison with the average rainfall for thirty-five years, expressed in the form of percentages. In its tabular

Excess or Defect of Rainfall during twelve Calendar Quarters.



Excess or Defect of Rainfall during twelve Calendar Quarters.



form the information did not appeal much to the eye, but when plotted on maps it acquired a more striking interest. In the twelve quarterly maps reproduced on pp. 122-3, no account has been taken of the actual quantity of rain which fell in the various districts, simply the difference from the normal as shown by the percentages. Districts in which the rainfall was equal to or below the average have been left blank, but the actual percentage has been inserted. Districts in which the rainfall exceeded the average by 19 per cent. or less have been shaded, while those in which the excess amounted to 20 per cent or more have been blackened in.

The maps show :—

(*a*.) That over a large portion of the United Kingdom an excess of rain was reported in 9 quarters out of the 12. The only quarters with anything like a general deficiency were April-June, 1915, July-September, 1916, and January-March, 1917.

(*b*.) That in 7 out of the 9 wet quarters the excess of rain was greatest in districts situated in the eastern or southern half of the country, or in both. Further that in 2 of the 3 dry quarters the only districts which failed to report any deficiency were again situated either in the eastern or in the southern section.

The following table gives for each district the number of quarters in the past 3 years in which an excess of rainfall was reported :—

	Eastern Half of United Kingdom.			Western Half of United Kingdom.	
District.	No. of Quarters.		District.	No. of Quarters.	
	Above Aver.	At least 20 per cent above Aver.		Above Aver.	At least 20 per cent. above Aver.
Scotland, E. ...	10	5	Scotland. W. ...	4	1
England, N.E. ...	9	3	England, N.W.	7	1
England, E. ...	8	6	England, S.W....	8	4
Midland Counties	8	6	Ireland, N. ...	5	2
England, S.E. ...	9	8	Ireland, S. ...	7	4
Extreme Southern and Northern Districts.					
English Channel...	8	5	Scotland, N. ...	5	3

It will be seen that over the eastern half of Great Britain the number of quarters with an excess of rain varied between 8 and 10; in Ireland, N., and Scotland, N., there were only 5 such occasions, and in Scotland, W., only 4. The number of very wet quarters, *i.e.*, quarters with an excess amounting to at least 20 per cent., ranged from 8 in England, S.E., 6 in England, E., and the Midland counties, and 5 in Scotland, E. and the English Channel, to only 2 in Ireland, N., and to only 1 in Scotland, W., and England, N.W.

For any single quarter the greatest excess was 65 per cent., in

England, E. (January-March, 1916), 60 per cent., in Scotland, E. (April-June, 1916), and 58 per cent, in the Midland counties (January-March, 1916), and in England, S.E. (July-September, 1917). In 5 quarters out of the 12 the greatest excess of rain occurred in England, S.E.

The results for the entire three years, October, 1914, to September, 1917, are shown in the maps facing p. 126, from which it will be seen that in England, E., there was an excess of rainfall amounting to 20 per cent., and in England, S.E., to as much as 26 per cent. Westward and northward of those unfortunate regions the excess diminished in extent, and finally disappeared altogether. In the English Channel the excess was only 11 per cent., in England, N.E., 10, and in England, S.W., only 9. England, N.W., had just the average quantity of rain, and Ireland, N., 1 per cent., less than the average. In Scotland, N., there was a deficiency of 5 per cent., and in Scotland, W., a deficiency of 10 per cent.

Here, then, are the facts, and what is one to say about them? It may be, after all, a mere coincidence that the repeated discharge on a wholly unprecedented scale of vast quantities of the most violent explosives ever known to mankind should have been accompanied in this country by an excess of rain which was far more pronounced in districts lying contiguous to the seat of war than in any other part of the United Kingdom. It may be, also, that some diligent investigator may be able to discover among the records of the past, and at a time of profound peace, a three years' period of rainfall showing similar characteristics to those which have been recently noted. But the matter appears to me to be one of curious interest, and if the somewhat striking facts indicated by the maps, admit, as they may, of an explanation entirely differing from the one so timidly foreshadowed, I shall not regret the slight expenditure of time and labour involved in the preparation of this modest memoir.

At the suggestion of the Editor I have examined the rainfall of the three years 1910-12. To make the results strictly comparable with those for 1914-17 I have adopted the period ended September, 1912. It matters, however, very little which period we select. The final three months of 1909 and of 1912 were both wet quarters, and the results for the three years ended either with September or December do not show in any district a variation of more than 3 per cent; in most districts the difference between the two does not exceed 1 per cent.

The maps have been compiled, as in the former case, from the quarterly summaries of the Weekly Weather Report. It will be seen that over the country generally the period 1909-12 was not nearly so wet as 1914-17, and that the eastern and southern districts were not affected to anything like so serious an extent. In one respect the results show, most certainly, a rather striking similarity,

the rainfall being above the average over the country generally and more especially in the east of England, but deficient in most of the districts lying within what may be described as the north-western section of the United Kingdom. In 1909-12 the excess in the east and south was, however, not nearly so large as in 1914-17. England, E., was, in comparison with the average, the wettest district, but even there the excess amounted to only 12 per cent., as against 20 per cent., in 1914-17 A more striking difference was reported in England, S.E., and also in Scotland, E. In 1914-17, England, S.E., stands out boldly as the wettest part of the country, with an excess of rainfall amounting to no less than 26 per cent. In 1909-12 the excess was only 8 per cent., and, in comparison with the average, the district was not quite so wet as England, S.W., practically the same as the Midland counties, and very little wetter than England, N.E. and England, N.W.

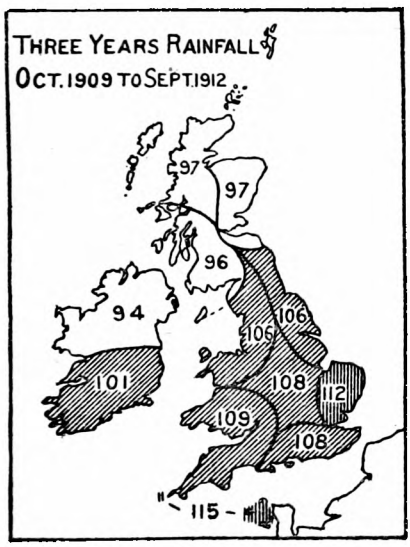
There can be no question that for so extended a period as three years an excess of rainfall amounting to as much as 26 per cent. is extremely large, and it seems to me very doubtful whether it would be possible to find its equal in the records for any consecutive period of thirty-six months. At Greenwich the greatest excess in any three-year period (calendar years) was apparently 24 per cent., in 1879-80. For England, S.E., as a whole, the quarterly summary of the Weekly Weather Report shows for these years an excess of only 15 per cent., but in early times the number of stations from which district values were computed was small, and their geographical distribution was less satisfactory than in later years.

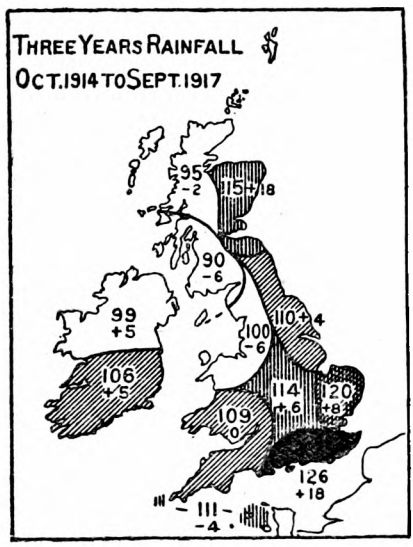
METEOROLOGICAL NEWS AND NOTES.

The Study of Winter Thunderstorms is being continued by Capt. C. J. P. Cave, R.E., and our readers are reminded that any information on storms up to the end of March, 1918, will be of value. The most important items are date and time, especially the time when the storm is overhead, the intensity and duration of the storm, and its direction of travel. the direction of lightning, changes of wind and temperature, and occurrence of hail. Reports should be sent direct to The Meteorologist in Charge, Meteorological Office, South Farnborough, Hants.

The Royal Society has awarded a Royal Medal to Dr. John Aitken, F.R.S., for his work on Cloudy Condensation.

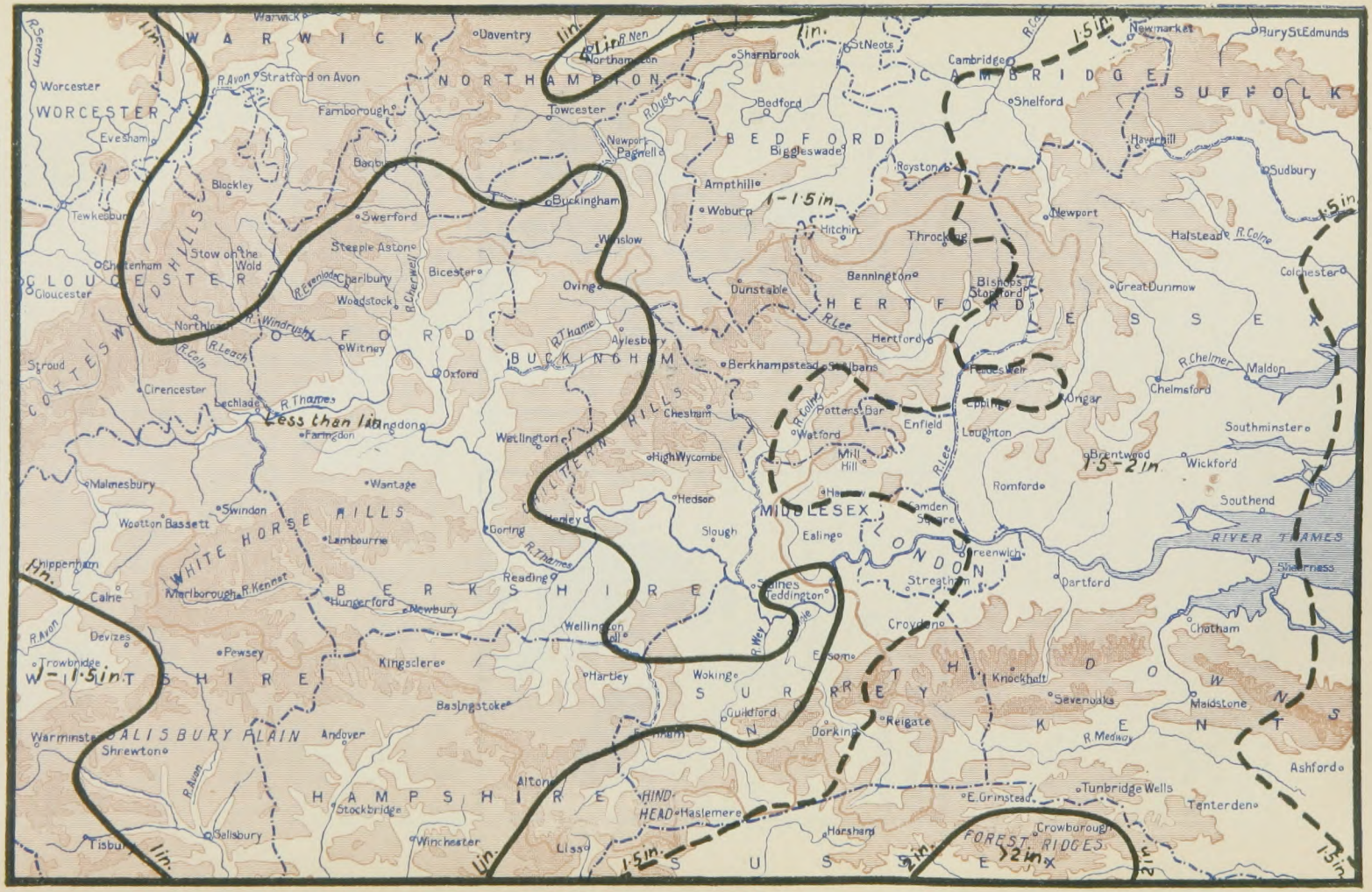
The Royal Meteorological Society has awarded the Symons' Gold Medal for 1918 to Dr. H. R. Mill, for his work in connection with Meteorological Science.


THREE YEARS RAINFALL
OCT. 1909 TO SEPT. 1912
97
97
96
94
106
105
101
108
112
109
108
115


THREE YEARS RAINFALL
OCT. 1914 TO SEPT. 1917
95
-2
115
+18
90
-6
99
+5
100
-6
110
+4
106
+5
114
+6
120
+8
109
0
126
+18
111
-4

Face p. 126

THAMES VALLEY RAINFALL. NOVEMBER, 1917.



Symons's Meteorological Magazine

ROYAL METEOROLOGICAL SOCIETY.

THE first monthly meeting of this Society for the present Session was held on Wednesday, the 21st November, at the Society's Rooms, 70, Victoria Street, Westminster, Lt.-Col. Henry Mellish, C.B., Vice-President, in the Chair.

A paper by Dr. G. C. Simpson, F.R.S., entitled, "The Twelve-hourly Barometer Oscillation," was communicated by Mr. F. J. W. Whipple. The existence of the twelve-hourly atmospheric vibrations, first suggested by Lord Kelvin, in 1882, and developed by Schmidt, in 1890, and further investigated by E. Alt, in 1909, has been proved. These twelve-hourly atmospheric vibrations—one parallel to the circles of latitude and the other parallel to the meridians—have been stated mathematically by Dr. Simpson by an expression containing the geographical position as the only variable, for the amplitude and phase of each vibration. The observed variations in amplitude and phase of the twelve-hourly barometer oscillations caused by the interference of these two waves accounted very completly for the observed diurnal range especially in high northern latitudes. Between the equator and 50 degrees north and south it was shown that the maxima of the waves passed over every station on the same circle of latitude at the same local time. Near the poles the relationship is not so simple, as the maxima do not occur even approximately at the same local time at the different stations. These apparent anomalies had been cleared up by taking the oscillation along the meridians as well as those parallel to the circles of latitude into consideration. A long discussion followed, in which Messrs. Mellish, Chree, Chapman, Tripp, Barton, Dines and Bryant took part, and Mr. Whipple replied.

Mr. W. W. Bryant gave the results of an investigation dealing with "Abnormal Temperature, with special reference to the daily Maximum Air Temperature at Greenwich." The author advocated that for specific meteorological elements the term "abnormal" should be given to a value which departs from a well established normal by twice at least the average departure. This method has been applied to the mean maximum temperature of the air on each day of the year at Greenwich, and is based on the average of the 65 years 1841-1905, the comparisons with the normal being carried down to the end of 1916. The results show that the limits defining abnormal days depart from the average by from 8° to 12·°5 F., so that no fixed limit can be applied. From the analysis one day in ten is found to be abnormal, the proportion being higher in the months from May to October and much lower in December and January. Spells or alternations of heat and cold and the distribution of abnormal days were also dealt with, and the principal extended to monthly and annual values. The relatively hottest month in

the period was June, 1846, and the coldest, December, 1890, the hottest year 1868, and the coldest, 1879. The longest period without a "warm day" was one of 353 days, terminating on 5th March, 1880, and in this period were included 44 "cold" days. The longest period without a "cold" day was the 401 days ending 28th October, 1846, in which period 39 were "warm" days.

In the discussion which followed Mr. W. H. Dines, F.R.S., said he thought it very desirable that some definite standard should be adopted. The standard deviation was not difficult to calculate as sufficient accuracy could be obtained by taking it as equal to four-fifths of the mean of the numerical deviation.

Messrs. Mellish, Harding, and Whipple also took part in the discussion and Mr. Bryant replied.

REVIEW.

The Weather Calendar, or a Record of the Weather for every day in the year, being a series of passages collected from letters and diaries and arranged by Mrs. Henry Head. Oxford, Clarendon Press, 1917. Size, 6 × 4. Pp. iv. + 160. Price, 1s. 6d. (paper), or 2s. (cloth).

THE weather motto prefixed, *Plus ça change, plus c'est la même chose*, aptly expresses the value of this little book in clarifying popular thought on the weather. The choiceness and delicate literary quality of the quotations by which the thesis is supported are a tribute to the fine taste and selective instinct of the compiler.

One or two, or rarely three, short extracts are given for every day in the year, for the most part from writers of over a hundred years ago, but all bear witness to the unchanging changeableness of our weather. Pepys, of course, comes first as a representative of the seventeenth century, Walpole and Swift supply much pleasant reading from the eighteenth and Dorothy Wordsworth and Fitzgerald from the nineteenth, but about thirty other authors are drawn upon. As examples of the "seasonable" and "unseasonable" Pepys recorded 2nd January, 1667, as "mighty cold but dry," while 15th January, 1662, had been "a fast day ordered by the Parliament to pray for more seasonable weather, it having hitherto been summer weather that is, both as to warmth and every other thing just as if it were the middle of May or June, which do threaten a plague (as all men think) to follow." Walpole, on 12th July, 1757, complained of "the heat of this magnificent weather," but on 3rd July, 1790, he says, "To-night I am writing to you comfortably by the fireside for we are forced to raise an English July in a hothouse, like grapes."

THE WEATHER OF NOVEMBER.

THE outstanding features of the weather of November were the high mean temperature and the contrast between the very dry conditions over the southern half of England, and the extreme wetness of the west of Scotland and Ireland.

Pressure throughout most of the month was high at the Azores and low between the north of Scotland and Iceland. Only for a few days after the 15th, when the high pressure area advanced to the south of England and the south-west of Ireland, were anticyclonic conditions in evidence. On the 25th when a large depression covered the Baltic, a gale from the north-west accompanied in many districts by snow was experienced.

Owing to the persistence of westerly and south-westerly winds high temperatures for the season were recorded, especially after the middle of the month. On the 21st the shade maximum rose to 60° at Crieff, while readings of 59° were reached over a large portion of England, North Wales and the south of Ireland. On the 28th shade maxima exceeding 55° occurred nearly everywhere and as far north as Aberdeen 60° was recorded, while on the following day 59° was noted at various places in the English Midlands and at Kilkenny.

The lowest shade temperatures in England were experienced on the 15th or 16th; 26° at Rhayader, and Marlborough, while in Scotland the 26th showed the lowest values, 25° at Marchment and West Linton, and 23° at Eskdalemuir. The mean temperature of the month over the whole country was 3° F. above the average, and, except in the English Channel where the excess was only 1°, was unusually uniform, varying from 3°·8 in the north-east of England to 2°·4 in the southern districts.

It is worthy of mention that the mean temperature of the month was very slightly under that of October.

The duration of bright sunshine did not depart much from the average. The mean daily amount varied from about 2 hours in the eastern half of England to an hour in the north of Ireland.

More than a quarter of the total possible was recorded in the east of England and only 9 per cent. in the north of Scotland. The rainfall expressed as a percentage of the average varied widely. In England many places in Hampshire, Oxfordshire and Yorkshire had less than a third of the average, while at Stroud barely one-fifth of the average fell. Comparatively few stations had an excess, the greatest being 31 per cent. at Arncliffe and 22 per cent. at Seathwaite. Wales was in general well under the average. Except for a deficiency in Berwickshire, Scotland showed a general excess, being nearly double the average in the west and also in Morayshire. In Ireland, Markree Observatory had more than double the average, while Killarney had under half the average. The general rainfall expressed as a percentage of the average was, England and Wales 78 per cent., Scotland 151 per cent., Ireland 107 per cent., British Isles 107 per cent.

The smallest amount of rain—in general less than one inch, and falling in places to about half-an-inch—was recorded over the greater part of the counties of Wilts, Hampshire and Oxford; thus lying within the limits of our map of the Thames Valley. In Scotland and Ireland the driest areas were centred round Berwick and Dublin respectively with about two inches.

The wettest areas were as usual located in the west, where in isolated spots in Connemara and Sligo, in Ireland, the Lake District, and west of Scotland, from 15 to 30 inches fell. In London (Camden Square) the mean temperature was 46°7° being 3°2° above the average. Duration of rainfall 34 hours, of sunshine 37 hours. Evaporation ·31 in.

RAINFALL TABLE FOR NOVEMBER, 1917.

STATION.	COUNTY.	RAINFALL. Aver. 1875—1909. in.	1917. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Date.	No. of Days
Camden Square	*London*	2·34	1·82	— ·52	78	·54	26	15
Tenterden	*Kent*	3·07	1·64	—1·43	54	·83	26	13
Arundel (Patching)	*Sussex*	3·54	1·37	—2·17	39	·62	26	8
Fordingbridge (Oaklands)	*Hampshire*	3·41	1·09	—2·32	32	·28	9	16
Oxford (Magdalen College)	*Oxfordshire*	2·25	·64	—1·61	28	·14	5	12
Wellingborough (Swanspool)	*Northampn*	2·22	1·01	—1·21	46	·18	26	14
Bury St. Edmunds (Westley)	*Suffolk*	2·40	1·65	— ·75	69	·62	26	14
Geldeston [Beccles]	*Norfolk*	2·49	1·83	— ·66	74	·45	26	17
Polapit Tamar [Launceston]	*Devon*	4·07	3·13	— ·94	77	·60	3	21
Rousdon [Lyme Regis]	,,	3·51	1·64	—1·87	47	1·11	3	11
Stroud (Field Place)	*Gloucester*	2·77	·60	—2·17	22	·17	6	13
Church Stretton (Wolstaston)	*Shropshire*	2·94	1·40	—1·54	48	...	...	...
Boston	*Lincoln*	2·05	1·36	— ·69	66	·48	26	16
Worksop (Hodsock Priory)	*Nottingham*	1·98	·97	—1·01	46	·22	9	15
Mickleover Manor	*Derbyshire*	2·21	1·75	— ·46	79	·42	26	17
Buxton	,,	4·83	4·92	+ ·09	102	·63	9	23
Southport (Hesketh Park)	*Lancashire*	3·16	3·33	+ ·17	105	·72	26	21
Arncliffe Vicarage	*York, W.R.*	6·12	8·00	+1·88	131	...	...	...
Wetherby (Ribston Hall)	,, ,,	2·34	1·98	— ·36	85	·40	24	10
Hull (Pearson Park)	,, *E.R.*	2·34	1·40	— ·94	60	·34	26	18
Newcastle (Town Moor)	*North'land*	2·63	1·31	—1·32	50	·39	24	17
Borrowdale (Seathwaite)	*Cumberland*	13·59	16·52	+2·93	122	3·47	26	20
Cardiff (Ely)	*Glamorgan*	4·08	2·55	—1·53	62	·42	8	26
Haverfordwest	*Pembroke*	5·16	3·70	—1·46	72	·73	3	19
Aberystwyth (Gogerddan)	*Cardigan*	4·50	4·73	+ ·23	105	·82	26	23
Llandudno	*Carnarvon*	3·19	2·43	— ·76	76	·59	26	20
Cargen [Dumfries]	*Kirkcudbrt.*	4·35	4·38	+ ·03	101	1·04	5	23
Marchmont House	*Berwick*	3·21	2·32	— ·89	72	·64	5	16
Girvan (Pinmore)	*Ayr*	5·24	6·86	+1·62	131	1·40	26	26
Glasgow (Queen's Park)	*Renfrew*	3·63	6·37	+2·74	176	1·64	6	18
Islay (Eallabus)	*Argyll*	5·33	9·70	+4·37	182	1·57	26	28
Mull (Quinish)	,,	6·24	7·62	+1·38	122	1·09	26	27
Balquhidder (Stronvar)	*Perth*	7·87	...	...	...	...	...	...
Dundee (Eastern Necropolis)	*Forfar*	2·62	3·09	+ ·47	118	1·15	29	17
Braemar	*Aberdeen*	3·76	4·51	+ ·75	120	1·07	29	15
Aberdeen (Cranford)	,,	3·29	3·75	+ ·46	114	1·14	5	19
Gordon Castle	*Moray*	2·85	5·68	+2·83	199	...	...	...
Drumnadrochit	*Inverness*	3·41	4·99	+1·58	146	·73	23	23
Fort William	,,	7·55	14·51	+6·96	192	1·88	29	27
Loch Torridon (Bendamph)	*Ross*	8·90	16·16	+7·26	182	1·58	20	29
Dunrobin Castle	*Sutherland*	3·25	6·04	+2·79	186	·82	23	19
Killarney (District Asylum)	*Kerry*	5·54	2·17	—3·37	39	·45	7	25
Waterford (Brook Lodge)	*Waterford*	3·80	2·20	—1·60	58	·84	2	16
Nenagh (Castle Lough)	*Tipperary*	3·88	3·25	— ·63	84	·48	5	23
Ennistymon House	*Clare*	4·62	4·60	— ·02	100	·54	5	26
Gorey (Courtown House)	*Wexford*	3·41	2·12	—1·29	62	·68	2	15
Abbey Leix (Blandsfort)	*Queen's Co.*	3·28	2·43	— ·85	74	·77	11	22
Dublin (Fitz William Square)	*Dublin*	2·64	1·71	— ·93	65	·41	11	20
Mullingar (Belvedere)	*Westmeath*	3·38	4·38	+1·00	130	·81	11	23
Crossmolina (Enniscoe)	*Mayo*	5·75	6·72	+ ·97	117	1·52	5	24
Cong (The Glebe)	,,	5·00	5·44	+ ·44	109	·94	2	24
Collooney (Markree Obsy.)	*Sligo*	4·02	8·60	+4·58	214	1·95	5	25
Seaforde	*Down*	3·86	3·56	— ·30	92	1·02	2	20
Ballymena (Harryville)	*Antrim*	3·95	5·76	+1·81	146	1.38	5	28
Omagh (Edenfel)	*Tyrone*	3·66	7·17	+3·51	196	1·69	5	27

SUPPLEMENTARY RAINFALL, NOVEMBER, 1917.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	1·93	XI.	Lligwy	3·25
,,	Ramsgate.....	1·37	,,	Douglas, Isle of Man	.
,,	Hailsham	1·71	XII.	Stoneykirk, Ardwell House...	4·35
,,	Totland Bay, Aston House...	·80	,,	Carsphairn, Shiel.....	11·94
,,	Stockbridge, Ashley..	·88	,,	Langholm, Drove Road	5·75
,,	Grayshott.....	1·18	XIII.	Selkirk, The Hangingshaw..	2·99
III.	Harrow Weald, Hill House...	1·61	,,	North Berwick Reservoir.....	1·39
,,	Pitsford, Sedgebrook.....	1·16	,,	Edinburgh, Royal Observaty.	2·00
,,	Woburn, Milton Bryant.....	1·27	XIV.	Biggar.....	3·71
,,	Chatteris, The Priory..... ...	1·06	,,	Maybole, Knockdon Farm ...	7·42
IV.	Elsenham, Gaunts End	1·63	XV.	Buchlyvie, The Manse.....	8·27
,,	Shoeburyness	1·51	,,	Ardgour House	22·60
,,	Colchester, Hill Ho., Lexden	1·36	,,	Oban.....	9·22
,,	Ipswich, Rookwood;Copdock	1·62	,,	Campbeltown, Witchburn ..	8·35
,,	Aylsham, Rippon Hall..... ..	2·23	,,	Holy Loch, Ardnadam.....	14·21
,,	Swaffham	1·95	,,	Tiree, Cornaigmore	5·24
V.	Bishops Cannings	1·01	XVI.	Glenquey	5·30
,,	Weymouth.....	1·40	,,	Glenlyon, Meggernie Castle..	8·50
,,	Ashburton, Druid House.. ...	2·55	,,	Blair Atholl	4·15
,,	Cullompton	2·49	,,	Coupar Angus	2·63
,,	Lynmouth, Rock House	2·43	,,	Montrose, Sunnyside Asylum.	2·65
,,	Okehampton, Oaklands.. ...	3·73	XVII.	Balmoral	3·70
,,	Hartland Abbey.....	3·00	,,	Fyvie Castle	5·52
,,	St. Austell, Trevarna	2·88	,,	Keith Station	6·44
,,	North Cadbury Rectory.....	·82	XVIII.	Rothiemurchus	4·46
VI.	Clifton, Stoke Bishop	·98	,,	Loch Quoich, Loan	31·15
,,	Ledbury, Underdown..... ...	·91	,,	Skye, Dunvegan	11·16
,,	Shifnal, Hatton Grange.....	1·92	,,	Fortrose.....	4·97
,,	Droitwich.....	·96	,,	Glencarron Lodge	19·13
,,	Blockley, Upton Wold.....	1·34	XIX.	Tongue Manse	7·42
VII.	Grantham, Saltersford.....	·92	,,	Melvich	7·66
,,	Market Rasen	1·58	,,	Loch More, Achfary	16·32
,,	Bawtry, Hesley Hall	·82	XX.	Dunmanway, The Rectory ..	2·16
,,	Whaley Bridge, Mosley Hall	4·74	,,	Glanmire, Lota Lodge.....	1·38
,,	Derby, Midland Railway.....	1·47	,,	Mitchelstown Castle.....	2·30
VIII.	Nantwich, Dorfold Hall	2·90	,,	Darrynane Abbey.....	3·57
,,	Bolton, Queen's Park	6·02	,,	Clonmel, Bruce Villa	1·60
,,	Lancaster, Strathspey	3·67	,,	Broadford, Hurdlestown.....	3·93
IX.	Langsett Moor, Up. Midhope	3·19	XXI.	Enniscorthy, Ballyhyland...	3·14
,,	Scarborough, Scalby	2·41	,,	Rathnew, Clonmannon	1·86
,,	Ingleby Greenhow	2·44	,,	Ballycumber, Moorock Lodge	3·01
,,	Mickleton	3·10	,,	Balbriggan, Ardgillan	2·23
X.	Bellingham, High Green Manor	2·65	,,	Castle Forbes Gardens.....	4·02
,,	Ilderton, Lilburn Cottage ...	2·11	XXII.	Ballynahinch Castle.....	7·22
,,	Keswick, The Bank.....	6·18	,,	Woodlawn	3·30
XI.	Llanfrechfa Grange	2·15	,,	Westport, St. Helens	5·17
,,	Treherbert, Tyn-y-waun	6·40	,,	Dugort, Slievemore Hotel ...	8·86
,,	Carmarthen, The Friary	3·51	XXIII.	Enniskillen, Portora.....	5·83
,,	Fishguard, Goodwick Station.	3·26	,,	Dartrey [Cootehill]	5·10
,,	Crickhowell, Tal-y-maes.....	2·30	,,	Warrenpoint, Manor House ..	3·84
,,	New Radnor, Ednol	1·45	,,	Belfast, Cave Hill Road	4·67
,,	Birmingham WW., Tyrmynydd	5·95	,,	Glenarm Castle	7·20
,,	Lake Vyrnwy	4·67	,,	Londonderry, Creggan Res...	6·47
,,	Llangynhafal, Plas Drâw.....	2·88	,,	Dunfanaghy, Horn Head ...	...
,,	Dolgelly, Bryntirion.....	7·89	,,	Killybegs	11 78
,,	Bettws-y-Coed, Tyn-y-bryn...	...			

Climatological Table for the British Empire, June, 1917.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain Depth.	Total Rain Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	89·9	17	46·1	23	76·0	54·2	54·2	...	134·1	44·6	5·29	10	5·8
Malta	88·3	24	64·0	1	77·6	68·8	...	81	141·0	...	·43	2	1·6
Lagos	89·4	1, 2	70·0	25	86·6	74·1	73·8	79	155·5	67·5	19·34	19	7·5
Cape Town	70 3	20	37·9	14	61·6	49·1	48·6	81	...	...	3·84	18	6·2
Johannesburg	69·5	3	32·5	18	58·1	41·6	32·9	63	...	30·0	·67	7	3·4
Mauritius	79·5	9	55·2	16	76·6	63·1	62·2	78	...	46·6	3·16	19	5·2
Bloemfontein	67·8	4	19·6	26	60·4	31·1	32·5	72	..	...	·32	3	3·3
Calcutta...	96·6	1	75·0	4	90·1	78·4	78·1	85	...	73·1	11·66	20	8·5
Bombay...	92·5	3	75·8	12	86·6	79·1	77·3	84	136·0	72·1	15·33	25	8·2
Madras	100·3	2,21	75·2	14	94·5	78·5	73·1	72	159·3	69·8	5·53	10	6·7
Colombo, Ceylon ...	87·2	1	72·2	14	85·2	76·7	74·2	83	153·6	69·7	5·41	20	7·4
Hongkong	89·1	29	74·9	30	86·6	78·4	76·0	83	...	...	11·54	28	8·0
Sydney	...	...	...	...	...	...	...	...	...	...	...	...	...
Melbourne	67·0	4	31·4	22	56·2	44·1	42·6	74	106·8	23·3	3·63	16	6·8
Adelaide	73·0	3	36·7	21	60·5	46·5	45·4	74	124·4	29·5	2·61	15	6·6
Perth	70·0	1	40·3	4	63·0	49·6	49·9	79	126·2	32·0	10·25	23	6·8
Coolgardie	73·0	2	33·5	6	60·9	43·4	41·6	65	129·0	29·0	1·52	12	4·8
Hobart, Tasmania ..	65·2	4	34·5	10	52·8	41·5	39·9	75	107·9	28·1	3·35	24	6·8
Wellington	62·0	10	34·9	2	55·7	46·6	45·4	81	110·0	24·0	6·44	15	6·9
Auckland	...	...	...	...	60·3	49·8	...	...	...	...	6·41	18	...
Jamaica, Kingston ...	94·2	12	70·6	3	88·6	72·8	70·4	77	...	...	3·24	7	6·4
Grenada	88·0	5	72·0	24	85·0	75·0	...	74	137·0	...	5·83	20	3·5
Toronto	83·2	19	40·7	15	70·7	51·0	51·9	76	135·9	36·6	5·39	15	5·4
Fredericton	80·5	14*	37·5	1	69·6	48·6	53·8	81	...	...	6·93	17	6·3
St. John, N.B. ...	73·1	28	40·0	1, 2	61·5	47·4	51·1	88	141·8	35·4	5·41	20	7·1
Victoria, B.C.	78·2	13	43·2	11	61·9	47·5	46·0	74	143·0	37·5	·93	12	5·6

* And 21.

Johannesburg.—Bright sunshine 244·8 hours.

Bloemfontein.—Temperature on 26th the lowest yet recorded here.

COLOMBO, CEYLON.—Mean temp. 81°·0 or 0°·6 below, dew point 0°·6 below and R 5·41 in., or 2·50 in. above, average. Mean hourly velocity of wind 5·9 miles. Rain storm on 24th when 1·56 in. fell.

HONGKONG.—Mean temp. 81°·8. Bright sunshine 167·8 hours. Mean hourly velocity of wind 8·4 miles.

Melbourne.—Mean temp. 0°·2 below, and R 1·55 in. above, averages.

Adelaide.—Mean temp. 0°·1 above and R ·50 in. below averages.

Perth.—Rainfall 3·64 in. above average, exceeded only on three previous occasions in June during 41 years.

Coolgardie.—Rainfall about 25 per cent. above average.

Hobart.—Rainfall 1·18 in. above average.

Wellington.—Mean temp. 3°·7 above, and rainfall 1·47 in above, averages. Bright sunshine 102·5 hours. Frost on five days.

Symons's
Meteorological Magazine.

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THE RAINFALL OF 1917.

A PRELIMINARY examination of the rainfall returns for 1917, of which some 3,000 have been received at the moment of writing, gives a fairly clear indication of the main features of the distribution in relation to the average. Speaking broadly the year was one of average rainfall, but large and continuous areas of deficient rainfall occurred in parts of all the great divisions of the country. Of these the most important in point of extent occupied the centre, and part of the north and the south-west of England, deficiencies of more than 10 per cent. occurring in all these areas and reaching 20 per cent along a narrow strip of the south-west coast. The east, and particularly the east Midlands, of Scotland, were also extremely dry, the deficiency exceeding 20 per cent. over a considerable area extending from the Firth of Forth to the Grampians. The whole of the southern half of Ireland had less than the average rainfall, as was also the case in the extreme north and the south of Wales, but nowhere in these districts did the deficiency exceed 20 per cent. The largest wet area lay in the west and north of Scotland, but as far as the records available indicate the excess reached as much as 10 per cent. only in the extreme south-west. There was a more marked excess of rainfall in the north of Ireland, where a large district had more than 10 per cent. above the average, and a smaller patch, extending from Sligo Bay to Lough Foyle, more than 20 per cent. above the average. The last mentioned area was relatively the wettest portion of the British Isles. The wet areas in England and Wales were more broken, occupying approximately two interrupted belts, stretching respectively from Cardigan Bay to Berwick and from Exmoor to Yarmouth. On the shores of Cardigan Bay and over part of the Yorkshire Wolds the rainfall was more than 10 per cent. above the average, and a similar excess occurred in the London district. The appearance of a wet area in the south-west of England was undoubtedly due to the remarkable rainstorm of June 28th, when over a small area round Bruton as much as 9 inches of rain fell in 24 hours. London, probably as a result of the unprecedented thunderstorm of June 16th, was relatively the wettest spot in Great Britain, the excess just reaching 20 per cent.

The general rainfall of the greater divisions of the British Isles, expressed as a percentage of the average, for the year was as follows :—

England	97	per cent.	of the average.
Wales	99	,,	,, ,,
Scotland	97	,,	,, ,,
Ireland	99	,,	,, ,,
British Isles	98	,,	,, ,,

The only months in the year in which an appreciable excess of rainfall occurred in general over the country were August, October and November. May was rather wet in Ireland and June in England, especially locally. Of the remaining months only February, with 55 per cent. less than the average, was remarkably dry, December following with 40 per cent. defect. There was however, a widespread general deficiency in the first seven months of the year, and a return to dry conditions at the end, especially in England.

TEMPERATURE OF 1917 IN LONDON.

THE most interesting features of the temperature results shown in the annexed table were the unusually prolonged cold spell from January to April, in which the mean defect was 4°, the unusual warmth of May, June, September, and November, with an average excess of 3°·5, and the coldness of October and December. The mean temperature of the year was 49°·3, or 0°·7 below the average. So persistent has been the run of warm years during the last quarter of a century, that only one year, *viz.*, 1909, with a mean of 49°·2, had a lower temperature than 1917. For a year with as many warm and cold months the extremes of temperature were quite moderate if we except the two warm days June 16th and 17th, with maxima of 88° and 90° on the Glaisher stand. The lowest temperature occurred on February 7th, *viz.*, 19°·1. The mean temperature of April was 43°·1, and of May, 59°·1, showing the very large increase of 16°, there being practically no spring. October was 12°·4 colder than September.

Temperature at Camden Square in 1917.

	Mean.		Mean Maximum.		Mean Minimum.	
1917.	1917.	Difference from aver.	1917.	Difference from aver.	1917.	Difference from aver.
January	35·5	—3·0	38·3	—5·0	32·7	—1·1
February ..	35·4	—4·2	40·7	—4·8	30·7	—4·0
March	38·6	—3·5	45·2	—4·8	32·8	—2·6
April	43·1	—5·3	52·6	—5·3	34·6	—5·1
May.....	59·1	+5·1	71·4	+6·8	48·5	+3·9
June	63·8	+3·7	76·0	+5·2	54·2	+3·5
July	63·9	+0·4	75·2	+0·9	54·7	+0·5
August	62·3	0·0	71·4	—1·3	55·6	+2·2
September ..	59·5	+1·8	69·8	+2·4	51·9	+3·2
October ...	47·1	—3·0	55·9	—1·8	40·3	—3·4
November ..	46·8	+3·3	52·1	+3·0	41·8	+3·6
December ..	36·0	—3·7	41·1	—3·2	31·3	—3·7
Year	49·3	—0·7	57·5	—0·6	42·4	—0·3

REVIEWS.

Réseau Mondial, 1911. Monthly and Annual Summaries of Pressure, Temperature and Precipitation at Land Stations, generally two for each ten-degree square of latitude and longitude. (British Meteorological and Magnetic Year Book, 1911, Part V.). Also charts showing monthly difference of Temperature and Pressure from normal values. The same for 1912. London, Meteorological Office. Size, $12\frac{1}{2} \times 10$. Pp. xvi.+112.

THE new departure of the Meteorological Office in publishing systematic records of world-wide meteorology deserves a particularly warm welcome in these pages, and we heartily congratulate Sir Napier Shaw on the appearance after very exceptional difficulties of these two issues. As long ago as 1873 Mr. G. J. Symons undertook to prepare monthly meteorological tables of the British Empire for publication in *The Colonies*, and when, in 1882, that journal ceased to print them, he introduced the Climatological Table into this Magazine, in which it has appeared ever since, and has expanded from eighteen to twenty-six stations. Thus, for forty-five years, a regular publication of data was kept up by which the general character of the climate of the Empire was recorded within six months. Such prompt publication in terms familiar to the public is sufficient justification for continuing these humble records on our last page; but we gladly recognize that they are superseded for scientific purposes in which the retardation of date is no objection by the splendid compilation of the Meteorological Office.

The basis of the selection of stations is that for every reticulation of the network of lines of latitude and longitude drawn on the globe at intervals of 10 degrees (loosely designated as "squares," though two tiers of them are triangles and only two tiers are anything approaching squares) there shall be two or sometimes three stations. It is probably this method of distribution which gives rise to the quaint and almost poetic title which may be translated "World Network." This idea of naming a meteorological work by the method of classifying the stations is attractive and capable of expansion. We might even dally with the thought of re-christening "British Rainfall" after the mosaic of river-divisions in which the stations are grouped, veiling the crudity of English in some such guise as *Mosäique Albionale*.

The compilation of world data is so fine a thing that it well deserves to be made the first exponent of the new nomenclature, as it is, we believe, the first instance of the use of the new meteorological units for the presentation of the work of many nations. In all about 400 stations are dealt with, all lying within the sixteen tiers of "squares" between 80° N. and 80° S., and the working up of the temperature, pressure and rainfall data for all these must have been a formidable piece of work, the credit for which is given in

the preface to Mr. C. E. P. Brooks, assisted by Mr. H. W. Braby. The extraction and conversion of the actual monthly data was a comparatively simple task, the real difficulty arose in the calculation of normal values with which to compare them. This is, indeed, a weak mesh in the network, the weakness arising from the fact that the periods for which averages can be computed vary for different places. It is well known that spells of several years may occur in which annual values are all on one side of the long period average so that any comparatively short period may yield an average so distorted from the normal value as to afford very misleading results by comparison. Again, in rainfall at any rate, the monthly totals have a far greater variability than the annual so that a period of years sufficient to yield satisfactory annual normals might be far too short to supply sound normals for the months. The compilers must assuredly have had this aspect of the case borne in upon them while handling the data, but the unwarned reader may not realize the greater certainty of the monthly figures than of the normals.

One can only view these issues of the Réseau Mondial as approximations to perfection; indeed, no scientific production, save, perhaps, the *Nautical Almanac*, can hope to be more, and as the years succeed each other the normals will improve, and the student of world meteorology will get firmer and firmer ground on which to base his generalizations.

The maps show deviations from normal pressure by lines termed "isanomalies" and those of temperature by red figures for positive values and blue for negative. The maps are rather bewildering to one accustomed to ordinary geographical presentations; but if the five-lobed figure is pasted on stiff paper and cut out it can be fitted together into a sort of "globe" on which all the features join up and become extremely suggestive.

Etudes sur le Climat de la France. Régime des Pluies. Première Partie. : Considérations générales : Région du nord-ouest. Par [Studies of the Climate of France. Rainfall, Part I., General considerations : the North-Western Region. By Alfred Angot. Size, 13 + 10. Pp., 128. Plates.

THIS is an extract from the *Memoirs* of the French Central Meteorological Office for 1911. The first part deals with the preparation of statistics for use in compiling maps of average rainfall supplementary to a memoir on the Rainfall of Europe in the *Annales* of the Central Office for 1895. The present work, of which a portion only is yet completed, makes use of all the rainfall data accumulated since 1851. For this purpose the figures given in the annual rainfall volumes (commencing in 1877) have been revised, and many errors detected and rectified, and the earlier records have been compiled from documents preserved in various places. The data have been calculated to a fifty years' average by comparing short records

with the nearest long records, though in many cases the distance of the standard stations is considerable.

A discussion on the variability of rainfall and the value of monthly and annual means is based on 50 years' records (1851-1900) at sixteen stations in France and neighbouring countries. Two English stations are included, *viz.*, Greenwich Observatory and the Royal Institution, Truro, the latter an unsatisfactory choice as the rain gauge was on a roof 40 feet above the ground. The discussion resulted in proof that the deviations of individual years from the mean value accorded well with the theory of probabilities.

This demonstrates that rainfall averages have a true physical significance and are not to be valued simply as the mean of fortuitous numbers. The probable error of the monthly and annual means is discussed in some detail and the conclusion drawn that tenths of a millimetre are of no significance in monthly values, while the nearest centimetre more than suffices for annual values.

The whole data for France are to be discussed in four parts, those for the North-West, South-West, North-East and South-East. Of these the first is before us. Tables of data are given by departments and are preceded by a numbered list of stations giving the altitude, the date and duration of the observations, arranged in river basins from the highest downwards. The rain gauge in practically all cases was fixed with its receiving surface between 1·50 and 1·80 metres (say 5 and 6 feet) above the ground; this means that to compare with British statistics, collected mainly at 1 foot, the values given in the memoir should be increased by 4 or 5 per cent. The total area of the 22 departments of north-west France is 144,260 square kilometres, or 55,685 square miles, the number of rainfall stations 785, or ·54 per square myriametre, *i.e.*, 1·4 per 100 square miles.

Very little is said as to the process of mapping employed; but the maps were originally drawn on the scale of 1 : 1,500,000 or 22 miles to an inch, and then reduced for publication to 1 : 2,500,000, or 39 miles to an inch. Rivers are shown but no indication of departments, towns, railways, roads, relief or watersheds. Nothing is said as to how the isohyetal lines are drawn in their places; but the maps appear to have been drawn without reference to the configuration of the land. The monthly isohyetals are at intervals of 10 mm. (·49 in.) up to 100 mm., then only 120 and 150 m.m; on the annual maps at intervals of 100 mm. (4 inches).

Discovery; or The Spirit and Service of Science. By R. A. Gregory. London, Macmillan and Co., Limited, 1917. 7½ × 5. Pp.,viii + 340. 5s. net.

THIS thoughtful and inspiring book was designed by the author to combat the too common misconceptions as to the real meaning of

science to the scientific student. Professor Gregory approaches his subject with praiseworthy detachment and impartiality, conceding that certain minds may pursue science unworthily but making it clear by an amazing wealth of instances that this is an exceptional and abnormal effect. He say in his preface :—

"When scientific work is instituted solely with the object of securing commercial gain, its correlative is selfishness; when it is confined to the path of narrow specialisation, it leads to arrogance; and when its purpose is materialistic domination, without regard for the spiritual needs of humanity, it is a social danger and may become an excuse for learned barbarity. But scientific research is rarely inspired by these motives, and devotion to it does not necessarily inhibit response to other notes with which a well-balanced mind should be in symphony. Moreover, direct contact with Nature and inquiry into her laws produce a habit of mind which cannot be acquired in literary fields, and they are associated with a wide outlook on life more often than is usually supposed."

Twelve chapters are devoted to as many aspects of the subject, the general principles being illustrated by examples drawn from the work of more than 400 investigators and thinkers whose names are set out in a biographical index. All branches of science are referred to, and we are particularly interested in noting how frequently the facts of meteorology are made use of as illustrations. We may call special attention to the remarks on gunfire and rainfall and on the influence of the moon on the weather in the chapter entitled, "Belief and Evidence." Professor Gregory is probably the only man in this country possessed of a wide enough knowledge of the facts of all the sciences to succeed in producing a work of this kind free from technical error and presented in a readable and convincing form.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

GUNFIRE AND RAINFALL.

REFERRING to the discussion in your pages upon rainfall and gunfire, just after reading p. 115, came a letter from my sister-in-law, Prof. Elizabeth Kendall, reporting extraordinary travel difficulties in Japan from excessive rainfall. The cables of unprecedented South Australian floods belong to a subsequent date. Rather earlier came cables of destruction to life and property through equally abnormal floods in Natal. Earlier in the summer the basin of the Yellow River, in China, was the scene of devastation on an appalling scale. Does Mr. D. W. Horner associate these also with the gunfire on the western front? For myself I am more inclined to take refuge in Dr. Lockyer's astro-physical forecast, early in the century, of exceptional rainfalls from, if I remember right, about 1910 to 1925.

J. EDMUND CLARK.

REFERRING to the article in your December number on Gunfire and Rainfall, another and equally reliable method of examining the data is to note the number of quarters, both during the war and during peace, when an excess of rain occurred in the S.E. districts. We may consider the number of quarters in which the rainfall was above, or below, the average in the S.E. districts, and these figures are given in Table I. below. As these figures will be affected by abnormally wet or dry seasons extending over a wide area, a more reliable test is to consider the number of quarters in which the rainfall, expressed as a percentage of the average for each district, was greater in the S.E. or N.W. districts. These figures are given in Table II.

I.—*Number of Quarters with excess Rainfall in S.E. districts.*

	Oct. 1914 Mar. 1916	Ap. 1916 Sept. 1917	Total (War)	Oct. 1909 Mar. 1911	Ap. 1911 Sept. 1912	Total (Peace)
Excess in S.E.	5	3	8	4	3	7
Deficit in S.E.	1	2	3	2	2	4
Uncertain	0	1	1	0	1	1

II.—*Number of Quarters with more rain in S.E. or N.W. districts.*

Excess in S.E.	5	1	6	3	3	6
Excess in N.W.	0	3	3	2	1	3
Uncertain	1	2	3	1	2	3

These figures appear to show (1) that the excess of rain in the S.E. districts during the war is almost entirely confined to the first half of the war, in spite of the very much greater quantity of explosive detonated during the latter half. (2) Almost identical results are found for the years of peace as for those of war.

This is but another example of the difficulty of reaching trustworthy conclusions without the application of strict statistical methods.

GORDON DOBSON.

R. A. F., Farnborough,
Dec. 12,-17.

MY remarks on p. 99 dealt with Mr. Horner's "theory," as explained at p. 91, which certainly differs from his "expression of opinion" to Mr. Elgie. It is not for me to reconcile these mere hypotheses. Has it not occurred to Mr. Horner that in Nature's laboratory rain (whether an insignificant shower of drizzle, the Somerset 9-inch fall of June 28th, or the 40-inch a day deluges in the tropics) is produced in absolute silence? Is his "theory" of the slightest use in explaining why, with the Ordnance Testing ground along the foreshore between Southend and the Maplin Sand, where big guns have been roaring for many years, rain is less frequent and less heavy in that locality of Essex than in any other part of the kingdom? Speaking generally, the further away from the noise of the guns and the chemical matter they discharge, the more frequent and heavy the downpours!

From the remarks of Mr. Horner and the Rev. H. A. Boys, both writing from the far west country, the inference is that they have been misled into supposing that south-east England has had large rainfalls during the war years only. Briefly, we can regard September, 1909, as the commencement of the present period in the district. Since then we have had numerous wet months, with no artillery violence to explain the excessive rainfalls, 5 inches to more than 9 inches at various stations in this quarter, in nearly every October, November and December before the war.

If readers will consult the Meteorological Office Monthly Weather Reports for August, 1912, and August and October, 1917, they will learn that the great rains of these months were to a very large extent due to the atmospheric conditions over Greenland !—a more reasonable explanation than wireless telegraphy and guns. The September, 1917, report should be consulted for an explanation of the comparative dryness of that month. HY. HARRIES.

Dec. 3, 1917.

In "King Henry the Fourth" the following lines occur :—

GLENDOWER.—I cannot blame him, at my nativity,
The front of heaven was full of fiery shapes,
Of burning cressets ; and, at my birth
The frame and huge foundation of the earth
Shak'd like a coward.

HOTSPUR : Why so it would have done at the same season if your mother's cat had but kitten'd though yourself had never been born.

I think this quotation is most appropriate to the controversy about the connection between gunfire and the excessive rainfall which has undoubtedly occurred in the South-east of England, and I must confess that my sympathies are entirely and whole-heartedly on the side of Hotspur in the matter. W. H. DINES.

I CANNOT bring to bear on this subject the copious statistics employed by Mr. F. J. Brodie, but I should like to make two comparisons :—

Camden Square, 1878-80 .. Mean Excess, 30 per cent.
Seathwaite, 1878-80 .. Mean Defect, 12 per cent.

Again, Seathwaite shows for the whole decade 1860-9 a mean excess of 19 per cent., Camden Square, for the same years, a mean excess of only 2 per cent.

Yet there was no heavy gunfire in Flanders in 1878-80, nor in the neighbourhood of the north of Ireland in 1860-9. Depressions seem

to have a tendency, sometimes lasting for several years, to take at one period a more southerly track, bringing much rain to the south of England, and at another period a more northerly track, bringing heavy and frequent rains in the north and west. We are still in the dark as to the causes of this variation, but I have yet to be convinced that gunfire has anything to do with it. F. J. WARDALE.

Shrewton, Wilts, December 31st, 1917.

THE SQUALL OF 25th NOVEMBER, 1917.

DURING the night of the 24th November, a warm S.W. gale associated with an intense cyclonic system, shifted to the N.W. with clearing sky, marked decrease of temperature and rapidly rising barometer. In London the outlook on the morning of the 25th was scarcely for anything more eventful than a gradual subsidence of the bitter N.W. gale and an ensuing night frost. But about 11 a.m. a terrific squall, accompanied by blinding snow, suddenly swooped down and lasted for the best part of an hour. I happened to be on the Hampstead ridge at the time, and watched the squall advancing from Mill Hill in clouds of white powder and encroaching on the nearer trees and landmarks in icy spirals. The wintry fury of this storm furnished a spectacle certainly more suited to the wild uplands of Dartmoor than the gentle undulating landscape of Middlesex.

The barographic trace during the disturbance became horizontal —a characteristic feature—indicating that the rapid recovery of pressure in rear of the cyclone was checked by a local irregularity. Evidence points to the passage of a line-squall of a simple type occurring in the homogeneous cold current in the rear of the cyclone. When a squall occurs along the line of separation between two currents of different temperature, as on 8th February, 1906, the whole phenomenon is much intensified; but the case of 25th November emphasises what I have suggested elsewhere, that the vertical displacement motion which is a feature of squall action may take place in a single current of uniform temperature, the slight pressure reduction in front of the squall being transmitted from some upper region of the atmosphere.

L. C. W. BONACINA.

December 4, 1917.

BIRD'S NEST IN A RECORDING ANEMOMETER.

THE frontispiece to this volume shows the recording part of an anemograph at the Colombo Observatory, (Ceylon) in which a bird had built its nest so cleverly that the working of the instrument was not affected.

The anemometer is one of a pattern designed by Mr. A. J. Bamford

and constructed locally. It consists of a chain hanging vertically in calm weather with a metal cone attached to it some distance below the point of suspension. As the wind blows on this "sail" (not shown in the photograph) a metal rod attached to the lower part of the chain is raised vertically through guides and lifts a series of cones one within the other, finally in the strongest gusts lifting the outer cone which is shown in the photograph. The record is made on a drum, shown in the upper part of the picture, by means of a pen carried by the vertically moving rod. The instrument is thus a pressure anemometer controlled by a series of weights (the cones) which come into action successively as the strength of the wind increases.

Mr. J. E. Evans, Acting Superintendent of the Colombo Observatory, in sending us the photograph, says :—

"I enclose a photograph of the nest of the magpie robin in one of the anemometers designed by Mr. Bamford. The principle upon which this instrument works is that successive cones are lifted according to the strength of the gusts and the lift recorded upon the drum by means of a pen. Inspection of instruments usually takes place at least once a week, but at the time had been deferred. The anemograph, with other observatory records, is submitted daily, but as at the time no heavy winds were experienced the top cone on which the nest rests would not have been lifted, so nothing unusual was suspected. As calm weather was likely to continue the nest was left undisturbed. Despite that the box was uncovered twice daily by the Observer, to change the forms and fill the pen, the eggs were duly hatched and the chicks successfully reared."

EARLY RECORD OF RAINFALL DURATION.

The late Mr. George Pile, of Hartley, Cranbrook, Kent, who died in 1916, bequeathed to the Trustees of the British Rainfall Organization his manuscript meteorological records and weather memoranda kept with remarkable regularity during the fifty years, 1867-1916. Among the earlier registers, which it has now been possible to examine, we note with great interest a series of records of the duration of rainfall covering a period of two years, 1866 and 1867. It is not stated how these records were obtained, and it seems probable that they were non-instrumental estimates made from day to day. Whether this is the case or not they are, so far as we know, the earliest systematic observations of this element of weather obtained in the British Isles and possibly in other parts of the world also, preceding those of Mr. F. E. Sawyer published in *British Rainfall* 1869, 1870 and 1871, by two and a half years.

The following tables give the monthly totals and the mean rate of fall per hour as deduced by Mr. Pile :—

Duration of Rainfall at Cranbrook, Kent.

	1866			1867		
	Rainfall in.	Duration hrs.	per hour in.	Rainfall in	Duration hrs.	per hour in.
January	4·90	116	·042	4·12	161	·026
February ...	4·66	158	·030	1·93	83	·023
March	1·87	65	·029	3·24	96	·034
April	2·15	59	·036	1·94	66	·029
May.....	·86	31	·028	3·09	61	·051
June	3·46	44	·079	1·23	25	·049
July	2·52	43	·058	4·51	73	·062
August	3·43	58	·059	1·88	33	·057
September ..	5·68	137	·041	1·84	24	·077
October ...	1·74	78	·022	3·10	78	·040
November ..	2·34	55	·043	1·65	48	·034
December ..	2·16	104	·021	2·62	80	·033
Year	35·77	948	·038	31·15	828	·038

The duration values are rather high, and the intensity values consequently rather low, as compared with the amounts recorded in recent years in Kent, but the differences are not larger than might easily occur from year to year.

We should be much interested if any readers know of earlier records of rainfall duration, and, if so, we should be glad to have copies for preservation.

ROYAL METEOROLOGICAL SOCIETY.

THE second meeting of this Society for the present session was held on December 19th at the Society's Rooms, Westminster, Major H. G. Lyons, F.R.S., President, in the Chair.

A paper on "The Computation of Wind Velocity from Pilot Balloon Observations," was read by Mr. P. Bolton, in which a graphic method of ascertaining the required wind velocity was described. Mr. E. G. Bilham, B.Sc., read a paper on, "The Use of Monthly Mean Values in Climatological Analysis," in which the corrections to be applied to the original monthly means and to the Fourier amplitudes had been determined.

The following gentlemen were elected Fellows of the Society on November 21st :—Lieut. F. W. Barlow, A. A. Barnes, E. A. Beale, W. J. E. Binnie, P. H. Budgen, Prof. E. J. Garwood, F.R.S., Lieut. J. L. Gray, A. Mortimer Gunnell, Flt.-Lieut. T. E. Barham Howe, D. B. Mackenzie Hume, Mian Iltaf Hussain, H. F. Jackson, H. Jeffreys, A. J. L. Knapton, Lt.-Col. G. C. Lambton, D.S.O., Lieut. G. D. Lane, Lieut. A. H. Low, Lieut. C. L. J. Nicoll, Lt.Comm. J. W. Scudamore, D.S.C., A. Smith, Rev. D. Holland Stubbs, L. A. Wells.

At the meeting on December 19th, the following candidates were elected:—Lieut. J. H. Grills, Capt. S. M. Holmden, Lieut. J. Logie, T. D. Parkin, Miss A. F. Poole, Miss L. D. Sawyer.

SCOTTISH METEOROLOGICAL SOCIETY.

The Annual Business and General Meeting of the Society was held on December 20th, 1917, in the Lecture Hall of the Royal Society of Edinburgh, Professor R. A. Sampson, F.R.S., in the Chair.

A report from the Council was adopted and the following Council and Office-bearers were elected for the ensuing twelve months :—*President* :—Prof. R. A. Sampson, F.R.S.; *Vice-Presidents* : Mr. M. M'Callum Fairgrieve, and Dr. C. G. Knott; *Council* : Prof. T. Hudson Beare, Dr. J. D. Falconer, Mr. J. Mackay Bernard, Mr. D. A. Stevenson, Mr. R. Cross, Mr. S. B. Hog, Mr. G. Thomson, Dr. A. Crichton Mitchell, Mr. G. A. Mitchell; *Honorary Secretary* : Capatin E. M. Wedderburn, R.E.; *Honorary Treasurer* : Mr. W. B. Wilson.

The Secretary, Mr. A. Watt, M.A., communicated an interesting paper, entitled "Some cases of Ground Ice," a summary of which, owing to exigences of space, is unavoidably held over till our next issue.

METEOROLOGICAL NEWS AND NOTE.

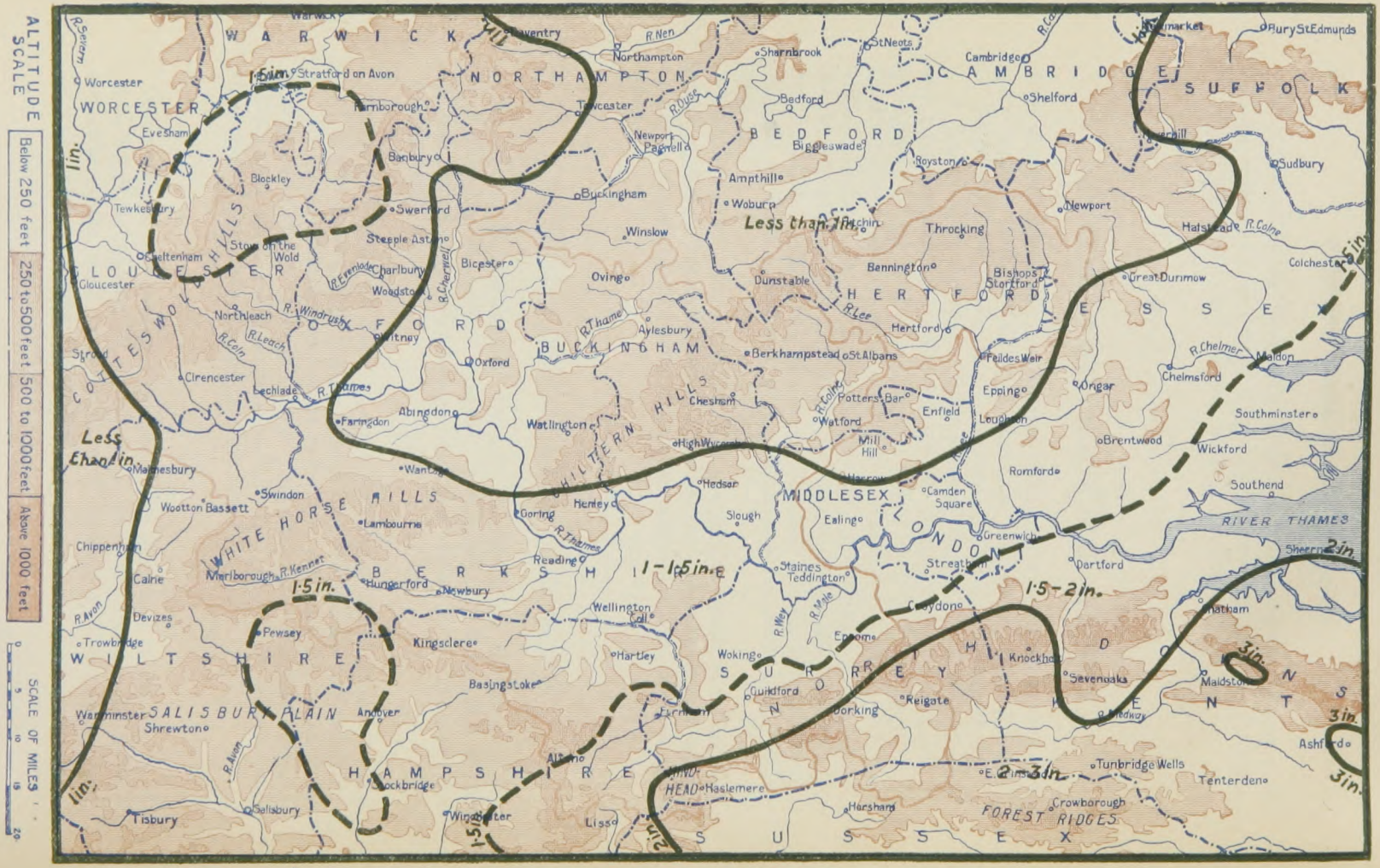
Mr. R. G. K. Lempfert, head of the Forecast Division of the Meteorological Office has received the Order of Commander of the British Empire in connection with the New Year Honours for National Service.

Angelic Origin of Rain is apparently one of the graceful fairy tales of the East. The *Daily Express* has printed the following :—

"Mr. Ernest Young, who went to Siam to organise the educational system, said at the Aldwych Club yesterday that Siamese children believe that when many angels get into the same bath at the same time water runs over the side and it rains."

Erratum.—In the December number of the Magazine, p. 128, Mr. W. H. Dines, F.R.S., is reported as having stated that the standard deviation is four-fifths of the mean of the numerical departures. This is a misprint, the value is approximately five-fourths.

THAMES VALLEY RAINFALL. DECEMBER, 1917.



THE WEATHER OF DECEMBER.

THE outstanding features of the weather of December were the low mean temperature, and the deficient rainfall. At the beginning of the month a low pressure area passed to the north of Scotland, with much snow in places. During the first half the weather was dominated by Atlantic depressions and anti-cyclones alternately, but during the second half of the month a high pressure area covered the British Isles. The mean temperature of the month was 3° F. under the normal, the deficit being greatest, 4°·5 or more, in the south-east and south-west of England, and least, about 1°·5, in the north of Scotland and north of Ireland. The cold weather was far more pronounced in the second than in the first half of the month, although during the last ten days or so the north of Ireland enjoyed a temperature slightly in excess of the normal. The highest temperatures of the month were recorded round about the 7th and 13th, when shade maxima well over 50° occurred nearly everywhere. The maximum values recorded were 56°, at Cahir, and 55°, at Gordon Castle, Valentia, and Killarney, on the 6th, and 55°, at Kilkenny, on the 13th. The lowest temperature was recorded quite early in the month, Balmoral having a reading of 8° on the 4th. Other low temperatures occurred between the 17th and 22nd, the lowest being 11°, at Marlborough, and 13°, at Raunds, on the 19th, and 12° at Balmoral, on the 22nd. In the north of Scotland the 16th or 17th were the coldest days, but the minima were unimportant.

Sunshine was in general in excess of the average, the greatest excess observed—over three-quarters of an hour per day—being in the south-east and south-west of England. In Ireland and the north of Scotland average conditions obtained. The actual mean daily amount exceeded two hours in the eastern counties of England, and the English Channel.

The month was dry nearly everywhere, especially in a large area to the north of London, where less than an inch fell. The southern part of this area is shown on our map of the Thames Valley. In Scotland less than an inch fell only in the vicinity of Montrose, although the greater portion of the eastern half of the country had less than 2 inches. In Ireland the rainfall was unusually uniform, ranging from rather under 2 inches in King's County to between 4 and 5 inches in the north-east and south-west. The wettest areas in the Kingdom were located in West Inverness and the English Lake District respectively, where from 9 to 18 inches fell. Rainfall hardly exceeded the average anywhere, the general fall expressed as a percentage of the average, was :—England and Wales, 50 per cent. ; Scotland, 65 per cent ; Ireland, 69 per cent ; British Isles, 60 per cent.

In London (Camden Square), the mean temperature was 36°·0, or 3°·7 below the average, the month being the coldest December since 1890. The duration of bright sunshine was 39·0 hours, and the duration of rainfall 34·9 hours. Evaporation, ·12 in.

RAINFALL TABLE FOR DECEMBER, 1917.

STATION.	COUNTY.	RAINFALL. Aver. 1875—1909. in.	1917. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	2·13	1·10	—1·03	52	·28	8	14
Tenterden	*Kent*	2·77	2·74	— ·03	99	1·03	9	18
Arundel (Patching)	*Sussex*	2·91	2·26	— ·65	78	1·10	16	9
Fordingbridge (Oaklands)	*Hampshire*	3·35	1·27	—2·08	38	·68	16	15
Oxford (Magdalen College)	*Oxfordshire*	2·06	·88	—1·18	43	·35	16	11
Wellingborough (Swanspool)	*Northampn*	2·13	·67	—1·46	31	·22	29	16
Bury St. Edmunds (Westley)	*Suffolk*	2·14	1·22	— ·92	57	·34	25	16
Geldeston [Beccles]	*Norfolk*	2·07	1·49	— ·58	72	·35	16	18
Polapit Tamar [Launceston]	*Devon*	4·46	1·47	—2·99	33	·43	8	16
Rousdon [Lyme Regis]	,,	3·68	1·08	—2·60	29	·39	16	8
Stroud (Field Place)	*Gloucester*	2·71	·93	—1·78	34	·22	16	12
Church Stretton (Wolstaston)	*Shropshire*	2·99	1·05	—1·94	55	...	...	...
Boston	*Lincoln*	1·88	·89	— ·99	47	·18	16	14
Worksop (Hodsock Priory)	*Nottingham*	2·17	·97	—1·20	45	·32	16	10
Mickleover Manor	*Derbyshire*	2·38	1·03	—1·35	43	·21	30	13
Buxton	,,	5·38	2·56	—2·82	48	·39	23	23
Southport (Hesketh Park)	*Lancashire*	3·10	1·63	—1·47	53	·33	15	15
Arncliffe Vicarage	*York, W.R.*	6·75	...	...	...	...	...	...
Wetherby (Ribston Hall)	,, ,,	2·27	1·30	— ·97	57	·50	23	6
Hull (Pearson Park)	,, *E.R.*	2·32	1·68	— ·64	72	·36	16	16
Newcastle (Town Moor)	*North'land*	2·46	2·57	+ ·11	104	·64	16	19
Borrowdale (Seathwaite)	*Cumberland*	15·14	8·55	—6·59	57	1·82	20	15
Cardiff (Ely)	*Glamorgan*	4·70	1·28	—3·42	27	·36	15	15
Haverfordwest	*Pembroke*	5·18	1·16	—4·02	22	·44	16	8
Aberystwyth (Gogerddan)	*Cardigan*	4·66	2·51	—2·15	54	·55	15	15
Llandudno	*Carnarvon*	2·84	1·72	—1·12	61	·45	16	16
Cargen [Dumfries]	*Kirkcudbrt.*	4·84	2·85	—1·99	59	·45	15	18
Marchmont House	*Berwick*	2·83	2·02	— ·81	71	·38	9	15
Girvan (Pinmore)	*Ayr*	5·48	4·22	—1·26	37	·83	16	22
Glasgow (Queen's Park)	*Renfrew*	3·95	2·85	—1·10	72	1·08	20	15
Islay (Eallabus)	*Argyll*	5·73	7·28	+1·55	127	·80	1, 3	23
Mull (Quinish)	,,	6·59	3·97	—2·62	60	·54	19	23
Balquhidder (Stronvar)	*Perth*	8·83	3·68	—5·15	42	·62	5	15
Dundee (Eastern Necropolis)	*Forfar*	2·67	1·19	—1·48	45	·67	19	11
Braemar	*Aberdeen*	3·13	1·22	—1·91	39	...	...	...
Aberdeen (Cranford)	,,	3·43	1·38	—2·05	40	·29	1	15
Gordon Castle	*Moray*	2·72	1·55	—1·17	57	...	...	...
Drumnadrochit	*Inverness*	3·76	2·55	—1·21	68	·39	1	20
Fort William	,,	9·41	5·45	—3·96	58	·82	6	20
Loch Torridon (Bendamph)	*Ross*	9·86	7·10	—2·76	72	·71	7	25
Dunrobin Castle	*Sutherland*	3·09	2·19	— ·90	71	·70	13	11
Killarney (District Asylum)	*Kerry*	6·92	4·22	—2·70	61	1·17	21	24
Waterford (Brook Lodge)	*Waterford*	4·32	2·39	—1·93	55	·51	4	16
Nenagh (Castle Lough)	*Tipperary*	4·34	1·89	—2·45	44	·51	14	15
Ennistymon House	*Clare*	5·03	2·69	—2·34	54	·49	6	20
Gorey (Courtown House)	*Wexford*	3·42	2·77	— ·65	81	·89	16	17
Abbey Leix (Blandsfort)	*Queen's Co.*	3·41	2·05	—1·36	60	·60	20	20
Dublin (FitzWilliam Square)	*Dublin*	2·27	2·26	— ·01	100	·57	16, 20	17
Mullingar (Belvedere)	*Westmeath*	3·39	2·45	— ·94	72	·39	13	14
Crossmolina (Enniscoe)	*Mayo*	6·11	3·63	—2·48	59	1·14	19	20
Cong (The Glebe)	,,	5·42	3·81	—1·61	70	1·01	19	20
Collooney (Markree Obsy.)	*Sligo*	4·34	3·02	—1·32	70	·64	19	21
Seaforde	*Down*	3·77	2·96	— ·81	79	·47	15, 20	21
Ballymena (Harryville)	*Antrim*	3·97	4·49	+ ·52	113	1·50	15	21
Omagh (Edenfel)	*Tyrone*	3·91	3·23	— ·68	83	·56	15	23

SUPPLEMENTARY RAINFALL, DECEMBER, 1917.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road .	2·62	XI.	Lligwy	2·50
,,	Ramsgate	2·10	,,	Douglas, Isle of Man	.
,,	Hailsham	2·53	XII.	Stoneykirk, Ardwell House...	3·77
,,	Totland Bay, Aston House...	1·17	,,	Carsphairn, Shiel	4·71
,,	Stockbridge, Ashley..	1·48	,,	Langholm, Drove Road	3·40
,,	Grayshott	1·98	XIII.	Selkirk, The Hangingshaw..	2·34
III.	Harrow Weald, Hill House...	1·02	,,	North Berwick Reservoir... ..	1·69
,,	Pitsford, Sedgebrook....	·73	,,	Edinburgh, Royal Observaty.	1·71
,,	Woburn, Milton Bryant.....	·66	XIV.	Biggar	2·00
,,	Chatteris, The Priory..... ...	·57	,,	Maybole, Knockdon Farm ...	2·35
IV.	Elsenham, Gaunts End	·88	XV.	Buchlyvie, The Manse	3·04
,,	Shoeburyness	1·72	,,	Ardgour House	7·85
,,	Colchester, Hill Ho., Lexden	1·36	,,	Oban	3·74
,,	Ipswich, Rookwood, Copdock	1·56	,,	Campbeltown, Witchburn ..	4·56
,,	Aylsham, Rippon Hall.... ..	1·19	,,	Holy Loch, Ardnadam	5·16
,,	Swaffham	·83	,,	Tiree, Cornaigmore	2·45
V.	Bishops Cannings	1·18	XVI.	Glenquey	2·70
,,	Weymouth	1·03	,,	Glenlyon, Meggernie Castle..	...
,,	Ashburton, Druid House.. ...	1·34	,,	Blair Atholl	1·28
,,	Cullompton	1·11	,,	Coupar Angus	1·15
,,	Lynmouth, Rock House	1·53	,,	Montrose, Sunnyside Asylum.	·76
,,	Okehampton, Oaklands.....	1·97	XVII.	Balmoral	1·65
,,	Hartland Abbey	1·26	,,	Fyvie Castle	2·24
,,	St. Austell, Trevarna	1·63	,,	Keith Station ..	1·44
,,	North Cadbury Rectory.....	·81	XVIII.	Rothiemurchus	1·55
VI.	Clifton, Stoke Bishop	·68	,,	Loch Quoich, Loan	18·70
,,	Ledbury, Underdown..... ...	·75	,,	Skye, Dunvegan	4·80
,,	Shifnal, Hatton Grange.....	·93	,,	Fortrose	1·90
,,	Droitwich	1·10	,,	Glencarron Lodge	7·10
,,	Blockley, Upton Wold.....	2·00	XIX.	Tongue Manse	3·07
VII.	Grantham, Saltersford.....	·73	,,	Melvich	3·26
,,	Market Rasen	1·23	,,	Loch More, Achfary	5·93
,,	Bawtry, Hesley Hall	...	XX.	Dunmanway, The Rectory ..	4·00
,,	Whaley Bridge, Mosley Hall	2·28	,,	Glanmire, Lota Lodge	3·01
,,	Derby, Midland Railway.....	1·04	,,	Mitchelstown Castle	2·49
VIII.	Nantwich, Dorfold Hall	1·22	,,	Darrynane Abbey	4·30
,,	Bolton, Queen's Park	2·66	,,	Clonmel, Bruce Villa	2·16
,,	Lancaster, Strathspey	2·10	,,	Broadford, Hurdlestown.....	2·85
IX.	Langsett Moor, Up. Midhope	2·31	XXI.	Enniscorthy, Ballyhyland...	2·71
,,	Scarborough, Scalby	1·89	,,	Rathnew, Clonmannon	2·69
,,	Ingleby Greenhow	2·05	,,	Ballycumber, Moorock Lodge	1·82
,,	Mickleton	1·20	,,	Balbriggan, Ardgillan	2·33
X.	Bellingham, High Green Manor	2·46	,,	Castle Forbes Gardens.....	2·00
,,	Ilderton, Lilburn Cottage ...	1·76	XXII.	Ballynahinch Castle	5·06
,,	Keswick, The Bank	2·57	,,	Woodlawn	1·96
XI.	Llanfrechfa Grange	·89	,,	Westport, St. Helens	2·67
,,	Treherbert, Tyn-y-waun	2·36	,,	Dugort, Slievemore Hotel ...	4·12
,,	Carmarthen, The Friary	1·70	XXIII.	Enniskillen, Portora	2·38
,,	Fishguard, Goodwick Station.	·86	,,	Dartrey [Cootehill]	2·15
,,	Crickhowell, Tal-y-maes.....	1·50	,,	Warrenpoint, Manor House ..	2·44
,,	New Radnor, Ednol	2·60	,,	Belfast, Cave Hill Road	2·77
,,	Birmingham WW., Tyrmynydd	2·09	,,	Glenarm Castle	3·87
,,	Lake Vyrnwy	2·53	,,	Londonderry, Creggan Res...	4·43
,,	Llangynhafal, Plas Drâw.....	1·84	,,	Dunfanaghy, Horn Head ...	...
,,	Dolgelly, Bryntirion.....	3·31	,,	Killybegs	5·31
,,	Bettws-y-Coed, Tyn-y-bryn...	...			

Climatological Table for the British Empire, July, 1917.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	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	83·2	14	46·6	11	75·2	54·7	54·3	..	133·6	44·7	4·13	11	6·2
Malta	88·2	23	69·9	16	82·8	72·5	...	76	141·0	...	·00	0	0·5
Lagos	87·4	9	69·1	4, 16	84·6	72·9	73·7	84	148·3	67·0	29·36	26	8·5
Cape Town	74.5	7	41·2	27	62·4	49·8	48·3	76	...	...	8·61	13	6·1
Johannesburg	64·2	11	29·2	3	56·6	37·5	29·5	62	...	25·5	·83	5	3·3
Mauritius	...	...	...	...	...	...	...	...	...	...	...	...	...
Bloemfontein	68·8	12	16·4	3	58·4	29·6	29·4	68	..	...	·24	3	3·2
Calcutta...	91·5	12	76·1	2,*	88·2	79·2	78·3	88	...	74·1	12·16	22	9·3
Bombay...	87·9	12	76·2	22	85·6	78·9	77·1	84	132·0	71·1	12·91	27	8·4
Madras	101·0	8	73·7	5	95·1	78·7	72·8	71	155·2	73·2	4·21	15	6·8
Colombo, Ceylon ...	87·7	3	74·1	7	86·3	77·4	73·8	80	152·6	70·0	1·71	14	6·7
Hongkong	90·8	13	73·7	24	85·4	77·7	75·5	83	...	...	30·08	15	7·3
Sydney	69·1	9	41·8	6	60·2	47·7	41·4	65	110·8	30·4	·42	7	4·2
Melbourne	63·0	1, 25	35·5	31	56·3	44·6	41·4	79	105·8	26·1	1·41	21	7·4
Adelaide	68·0	24	39·8	13	59·7	47·6	47·1	80	118·0	33·5	4·10	21	6·3
Perth	67·5	22	35·9	28	62·0	49·5	48·6	78	130·4	29·1	11·29	25	6·8
Coolgardie	71·4	22	33·4	18	60·4	43·1	41·1	64	122·2	29·0	·76	9	4·8
Hobart, Tasmania ..	61·8	24	32·8	6	52·7	41·5	38·8	71	109·3	25·0	2·74	25	6·8
Wellington	59·2	16	35·2	13	55·2	46·3	46·9	90	117·0	26·3	6·66	25	7·5
Auckland	...	...	...	...	58·4	49·5	...	...	...	...	9·59	27	...
Jamaica, Kingston ..	93·4	19	71·4	6	89·8	73·3	70·2	76	...	...	·66	8	5·0
Grenada	86·0	22	70·0	Sev.	83·0	73·0	...	81	137·0	...	17·85	26	6·0
Toronto	98·0	30	49·0	4	80·1	60·7	62·5	80	147·4	46·7	3·58	17	4·9
Fredericton	92·0	26	45·0	29	77·9	56·5	61·3	81	...	...	2·54	15	6·0
St. John, N.B. ...	80·0	31	48·0	1	67·3	53·3	55·9	87	138·5	44·2	1·31	14	6·7
Victoria, B.C.	81·0	14	49·0	11,†	67·0	50·5	49·0	73	138·3	39·0	·16	6	2·4

* And 5, 6. † And 13.

LAGOS.—Heavy rains, 4·77 in. fell on the 9th.

Johannesburg.—Bright sunshine 268·7 hours.

Bloemfontein.—On the 3rd the coldest night on record.

COLOMBO, CEYLON.—Mean temp. 81°·8 or 0°·8 above, dew point 0°·3 below and R 4·89 in. below averages. Mean hourly velocity of wind 6·3 miles.

HONGKONG.—Mean temp. 81°·1. Bright sunshine 189·5 hours. Mean hourly velocity of wind 8·8 miles.

Melbourne.—Mean temp. 1°·9 above and R ·43 in. below averages.

Adelaide.—Mean temp. 2°·0 above and R 1·47 in. above averages.

Perth.—Rainfall the heaviest on record for July, 4·82 in. above the average. Severe gale on the 1st.

Coolgardie.—Temp. 0°·8 above and rainfall slightly below averages.

Wellington.—Mean temp. 3°·3 above and rainfall ·82 in. above averages. Bright sunshine 70·5 hours. Frost on 6 days.