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INVERSE WEATHER PHENOMENA.

(Continued.)

By L. C. W. Bonacina.

It will be instructive here to quote the mean monthly frequencies for three English stations in Mr. Brodie's list, namely, Oxford, a typical Thames Valley district in the South Midlands, Cambridge, a locality characteristic of the flat Fen Country, in the East Midlands, and Stonyhurst a north country station climatically influenced by the bold relief of the Pennine Chain:—

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Cambridge—	—	0·12	0·32	0·72	*2·32*	*3·32*	*3·40*	*2·56*	1·32	0·52	0·08	—	14·68
Oxford—	0·04	—	0·16	0·60	*1·56*	*2·40*	*2·48*	*1·84*	1·08	0·32	0·04	0·08	10·60
Stonyhurst—	0·24	0·40	0·52	1·12	*2·28*	*2·76*	*3·40*	*3·52*	1·72	1·16	0·52	0·32	17·96

In all three cases the May-August maximum is conspicuously brought out ; and the only anomaly worthy of note is that at Stonyhurst, where winter thunderstorms figure more prominently than in the south and east of England, the frequency shows some disposition to be displaced towards the autumnal side of summer as evidenced by the maximum in August and the slightly higher value for October than for April. The fact that May, with a lower mean temperature of the air than September brings more frequent and severe thunderstorms points indubitably to the importance of direct solar heating in their production. In July the factors of direct sun heat and accumulated warmth apparently combine at most places to cause the highest thunder frequency of the four summer months. It should be remembered, however, that Mr. Brodie's figures do not distinguish different types of thunderstorm, and that many of the passing thunder showers common in the rather wet months of July and August are electrically speaking of a mild character, though the rainfall may be torrential. At all events the writer becomes yearly more convinced that it is the first heat of the summer in May and June that is so prone to breed violent electrical disturbance, and that spells of hot weather later in the summer are on the whole less conducive to sudden local instability, the July and August storms occurring more characteristically in spells of unsettled, broken and relatively cool weather. But such details, though interesting, are incidental, and do not affect the main proposition, namely, that the heat, or land, thunderstorms of the summer season in general are grouped in mean frequency and intensity more or less symmetrically round the high solstice.

Mr. Brodie's figures for gale frequency around the British coasts as a whole, on the basis of 33 years' observations, represent "severe" gales (Beaufort force 10) alone, as well as the total number of gales. The designation of a "gale" is, of course, more or less arbitrary, and such being the case, the seasonal variations of cyclonic storms are, perhaps, as well or better emphasized by studying the figures for the "severe" storms only, which are herewith quoted :—

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Winter Half-Year..	1·2	1·7	2·0	2·2	1·2	1·2
	April	May	June	July	Aug.	Sep.
Summer Half-Year	0·3	0·1	0·1	—	0·2	0·5

The distribution of total number of gales is similar, but the figures are about three times as great for the winter months and about eight times for the summer months. It will be seen that severe gales are virtually relegated to the winter half of the year, with a prominent solstitial maximum, November to January, in exact accordance with ordinary experience. The minimum is diametrically opposite, May to July or August, when thunderstorms are at their maximum. It is, therefore, evident that the equinoxes bound the gale season, and that instead of "equinoctial gales," which, in a seasonal sense, have no existence, we ought correctly to speak of "winter solstitial gales." The minor irregularity which represents February equal to March and October in the number of severe gales instead of greater may possibly be due to the shortness of the month, but even if it is real it does not obscure the broad clear association of gales with the winter six months and very especially with the midwinter or solstitial three months.

Mr. Brodie's figures for the mean fog frequency only refer to London, and consequently hardly have the same significance in this article as those for the gales and thunderstorms. They are based on a 33-year period and are as follows :—

	Oct.	Nov.	Dec.	Jan.	Feb.	March
Winter Half-Year	7·8	8·5	9·5	8·2	6·4	4·8
	April	May	June	July	Aug.	Sept.
Summer Half-Year	2·0	0·8	0·6	0·4	1·2	4·7

Here, again, the winter solstitial maximum, November to January, stands out in company with the gale predominance in the same period, and in opposition likewise to the summer solstitial minimum May to July. A minor anomaly indicates a rather higher frequency in equinoctial October than in February, which is mainly a solstitial month*, but it should be noted that under the term "fog," especially London fog, a variety of dark, misty appearances are liable to be included, and that it is the true land radiation (valley or plain, as distinct from mountain or hill) fogs which are under discussion. Dense surface fog in London as a day phenomenon is practically confined to November, December and January, when the sun is lowest, but by night it is common enough in October and February, and occasionally develops in September and March, or even April. The interesting point, however, to observe is this: that in the London Basin gales and fogs which are irreconcilable phenomena and cannot occur simultaneously, have a seasonal variation which is practically identical, the one or other meteorological event occurring according as the temporary conditions are cyclonic or anticyclonic, etc.

The seasonal opposition between gales and thunderstorms on the one hand and between fogs and thunderstorms on the other, being demonstrated, the question arises whether the facts can be interpreted to a certain extent in the light of physical inversion.

The fog-thunderstorm case had better be considered first as it is the easier to explain, having, indeed, already been discussed by Sir Napier Shaw.† It is a question of stability or instability. Solar radiation at the summer solstice effects a great amount of surface heating, which is conducive at intervals to a condition of atmospheric instability favourable to those convective disturbances of which thunderstorms are the meteorological exponent. Terrestrial radiation at the winter solstice, on the contrary, promotes shallow surface cooling which induces a stable condition of the air strata, one of the essential predisposing causes of dense and occasionally prolonged surface fog. Sir Napier Shaw says: "Hence to a certain extent fogs and thunderstorms may be regarded as inverse phenomena and for a good physical reason. The surface fog is characteristic of stability in the stratification of the atmosphere; the thunderstorm on the contrary of marked instability." This, of course, refers to winter land fogs as opposed to summer land thunderstorms. It may be observed, moreover, that certain physical divisions of the country, *e.g.*, the Thames Valley, which have a somewhat evil notoriety for their fog-breeding capacity in the depth of winter have also a rather sinister reputation for electrical disturbance in the height of summer.

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* The solstitial periods roughly comprise eight months out of the twelve.

† "Forecasting Weather," p. 292.

The cyclonic gale-thunderstorm case is more difficult to expound, and is little understood at the present time. It is not a simple question of stability *versus* instability, but depends upon another relation, namely the dynamical opposition between two essentially different types of circulation. This subject was investigated for the first time by the writer in a paper* on, "The Re-adjustment of Pressure Differences: Two Species of Atmospheric Circulation and their Connection." Cyclonic gales, as has been demonstrated, occur primarily around midwinter, thunderstorms around midsummer, a fact which may be interpreted in the following manner, the physical explanation being sought in the paper above quoted. At the low solstice storm energy takes the form of a fairly uniform diffuse system of horizontal air motion round areas of deep barometric depression. At the high solstice, on the other hand, storm energy is concentrated in local patches of vertical (convective) air motion in such a manner that although the individual thunderstorms so engendered are only local, the total area of disturbed electrical conditions is as great as that which in winter would form the central core of a cyclonic depression commanding a system of wind energy. It is attempted to show elsewhere that the two species of circulation are, as regards a given disturbing force, dynamically inconsistent with one another; and that whilst cyclonic wind energy greatly accentuates in accordance with the effect of the earth's rotation the original difference of pressure which generates it in the first place, the vertical circulation of thunderstorm commotion neutralizes any such disturbing variation of pressure, thus preventing the development of barometric-gradient winds with respect to a cyclonic minimum. It is shown why at the high solstice dynamical conditions do not permit of so much horizontal motion as at the low solstice, and that *ipso facto* instability ensues at the former season with consequent vertical motion instead of the prohibited horizontal. Thunderstorm circulation may, of course, occur locally superimposed upon cyclonic circulation, and such instances are best exemplified in the case of quick-travelling winter thunderstorms which are invariably of the line-squall type, and are more common along the Atlantic seaboard of Scotland and Ireland than elsewhere.

It should be noted, furthermore, that winter gales and fogs, being both in different senses inverse to summer thunderstorms are in one very patent sense inverse to one another in that valley or plain fogs are conditioned by a calm atmosphere. Since both these meteorological events occur at the same time of year, in this case there is no seasonal opposition to hint at their inverse character which, however, is obvious to the senses.

(*To be continued.*)

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* Q.J.R. Met. Soc., Vol. 42, 1916.

ROYAL METEOROLOGICAL SOCIETY.

A MEETING of this Society was held on April 17th at 70, Victoria Street, S.W., Col. H. Mellish, C.B., Vice-President, in the Chair.

Mr. E. G. Bilham, B.Sc., read a paper entitled, "The Variations of Underground Water Level near a Tidal River." The paper was chiefly devoted to a comparison of records from the Kew Observatory water-level recorder and the Richmond Lock tide-gauge for a period of two years from May, 1914. The seasonal variations, determined from lunar monthly means, are found to be similar, as was to be anticipated on general grounds. A better method of determining the extent to which the variations of sub-soil water-level are directly controlled by the river Thames consists in the analysis of the well records to find tidal oscillations analogous to those which are well marked in the river. The well responds but slightly to the lunar semi-diurnal tide, but the lunar-fortnightly oscillation is well reproduced with a lag of five days and a reduction of amplitude in the ratio of approximately one to fourteen. After allowing for the direct action of the river, the well is found to be very sensitive to local rainfall during winter months. The effects of rainfall upon river-level and underground water-level appear to be in many respects closely similar.

Mr. J. Fairgrieve, M.A., read a paper entitled "Suggestions as to the Conditions precedent to the occurrence of Summer Thunderstorms, with special reference to that of June 14th, 1914." The meteorological phenomena accompanying the rainfall were put on record and the cloud distribution, the barometric pressure, the wind movements and the temperature were specially dealt with. It is evident that the clouds and the rain-fields lie in parallel belts and that the former appear some hours before the rain begins to fall. It was suggested that this belting of wind and rain must be due to rippling on a large scale, the rippling being brought about by the interaction of two currents of different temperatures. If the conditions are unstable and especially if relief also induces disturbance, thunderstorms will develop along lines of rippling and will drift with the wind. Thunderstorms have apparently three movements, a development along a belt, a sideways movement to leeward, and a spread to windward. The first may be due to rippling ; the second is a drift ; the third may be explained if it is granted that a local ridge of high pressure develops along the axis of the thunderstorm. The storm then breaks up into two belts of which that to leeward soon dies out, owing to the lack of a supply of rising air.

The following gentlemen were balloted for and elected Fellows of the Society:—Mr. H. Aldous, Lieut. D. Brunt, R.E., Lieut. H. Cotton, R.E., Lieut. L. B. Cundall, R.E., and Lieut.-Col. C. E. Dupuis, R.E.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE LATE Mr. D. S. SALTER.

MAY I be permitted to express my gratitude to your numerous readers who have written to me on hearing of the death of my brother, since it has been impossible for me to reply to each personally. Their sympathy has made me feel that my own sense of loss is widely shared in that the war has taken toll of another of those promising young lives on which the future of meteorology depended

CARLE SALTER.

62, Camden Square, London, N.W. 1, 4th May. 1918.

BLACK RAIN.

A BLACK RAIN is recorded in the minutes of the Philosophical Club of the Royal Society which I have recently been editing. It was described by Mr. James Rust, Minister of Slains, in Aberdeenshire, and Colonel Sykes, who made the communication, had satisfied himself of his trustworthiness. The rain fell not only at that place but also along the whole eastern coast of the county on January 14th, 1862. The morning, about 8.30 a.m., was clear, then the sky darkened, threatening rain. About an hour later, a "large, dense, black, smoky-looking cloud came driving over the sea from the S.S.E. and discharged a shower of rain, with drops like ink, which blackened all the water collected in cisterns from the roofs of houses and dirtied clothes put out to bleach, so effectively that warm water was needed to wash out the spots." Mr. Rust suggested that a recent eruption of Vesuvius might be the cause ; Sir R. Murchison thought this origin impossible, because of the distance, and that it must be smoke, while Professor Tyndall stated that his own experiments made him doubtful whether a sufficient quantity of soot could have been distributed through the atmosphere to produce the blackness described.

T. G. BONNEY.

9, Scroope Terrace, Cambridge, 25th April, 1918.

VARIATIONS IN SPRING TEMPERATURE.

THE following readings afford another instance of the great and irregular changes to which our climate is subject :—

1918.	Max. temp.	Min. temp.	Range °	Mean °	Difference from average.
March 24 ..	71	36	35	53·5	+11·0
April 16 ..	39	36	3	37·5	— 9·7

Bristol, April 18th, 1918.

W. F. DENNING.

USUAL TEMPERATURE RANGE.

THE temperature range of 36°F. recorded by Mr. G. Weston, near Godalming on March 24th, was certainly remarkable, but reference to the Daily Weather Report shows that it was exceeded at both Benson and South Farnborough, as at each of these stations the range amounted to more than 40°. The figures in the Report for March 24th are :—Benson, max. 67°, min. 26° ; South Farnborough, max., 70°, min., 28°. The Benson thermograph record for the week ending on the 25th was of great interest, the regular diurnal wave growing steadily larger in amplitude as the week advanced, culminating in the range of 41° noted above. If the "meteorological day," 7 a.m. to 7 a.m. is disregarded, the range between the min. early on the 24th and the max. on the afternoon of the same day was 1° larger still, *i.e.*, 42° at Benson, and 43° at South Farnborough, and this in a period of about 12 hours, a very unusual phenomenon in this country. J. S. DINES.

66, Sydney Street, S.W. 3, April 23rd, 1918.

METEOROLOGICAL NEWS AND NOTES.

DR. H. R. MILL is steadily improving in health, after his recent accident, and is now at his home in Surrey. It may still be some time before he is able to resume his work at Camden Square.

CORPORAL H. E. CARTER, Chief Computer to the British Rainfall Organization, who had been for some time employed in the Meteorological Section of the Royal Engineers, felt it to be his duty to take a more active part in the war, and recently obtained a transfer to an infantry regiment, with which he took part in opposing the great German offensive movement of March last. We regret to learn that he was taken prisoner and sent to Germany. All those who know his enthusiastic temperament will have much sympathy with him in the misfortune that has befallen him.

MR. R. C. MOSSMAN, F.R.S.E., has been awarded the Keith Prize (which is a gold medal and a sum of money) by the Royal Society of Edinburgh, "for his work on the Meteorology of the Antarctic Regions, which originated with the important series of observations made by him during the voyage of the *Scotia* (1902-1904), and has continued to the present time. Mr. Mossman's paper 'On a See-Saw of Barometric Pressure, Temperature, and Wind Velocity between the Weddell Sea and the Ross Sea,' published in the *Proceedings* of the Society, falls within the period."

REVIEWS.

Weather Forecasting in the United States. By a Board composed of Alfred J. Henry, *Chairman,* Edward H. Bowie, Henry J. Cox, Harry C. Frankenfield. U.S. Weather Bureau (Charles F. Marvin, Chief). Washington, 1916. Size, $10\frac{1}{4} \times 7$. Pp., 370, many plates.

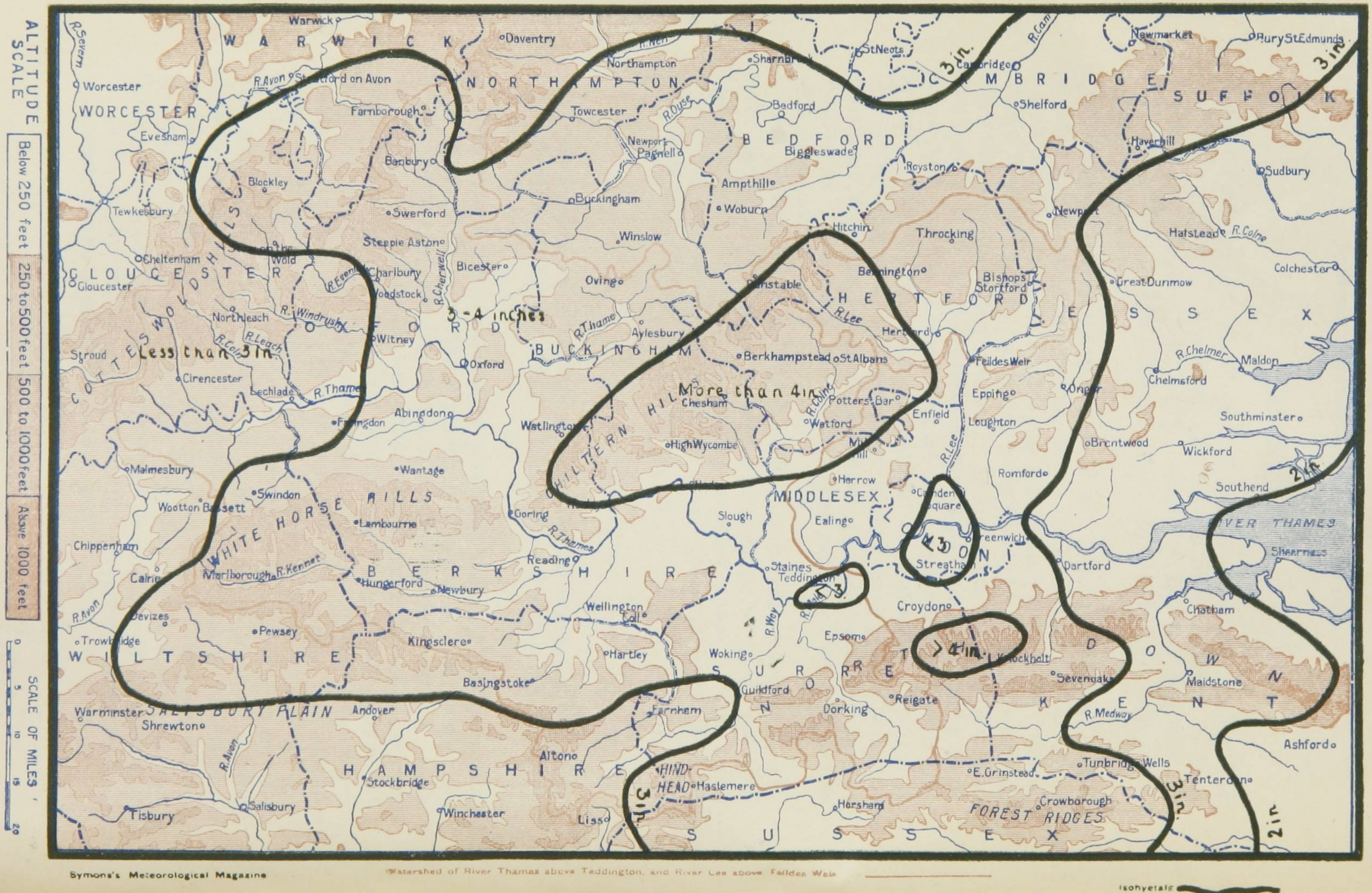
PROF. MARVIN, struck by the want of any formal statement of the principles of weather forecasting which could serve as a text book for students of the art, invited the forecasting staff of the United States Weather Bureau, of which he is Chief, to set out in writing the rules on which they worked. As there are six separate forecast regions in the United States each with its own expert and experienced staff, the Board which was set up to examine the essays sent in had a considerable mass of material to deal with. The result is a dozen chapters, the three first dealing with generalities, the remainder with the practical problems of forecasting as practised in America. The work is copiously illustrated by weather charts and diagrams.

Prof. Marvin sums up thus :—" The consensus of opinion seems to be that the only road to successful forecasting lies in the practical and consistent study of the daily weather maps." The value of the book he considers is that it gives the experience of those who have gone before as a guide.

The Combination of Observations. By David Brunt, M.A., B.Sc. Cambridge, University Press. 1917. Size, $9 \times 5\frac{1}{4}$. Pp. x. + 220. Price, 8s. net.

A DIFFICULTY which frequently perplexes students of the actual phenomena of Nature is the apparent indifference of mathematicians to the quality of the Observations on which they exercise their methods. There has grown up a semi-superstitious feeling that mathematical processes have a magical purifying power which can build firm conclusions from shaky data. A useful corrective of this feeling is supplied by Mr. Brunt's valuable little book. The author keeps the limitations of his methods steadily in mind while developing the value of them by carefully worked out practical examples. The aim of the book is to give an account of the method of least squares in applying the law of errors to the treatment of observational data. Special interest attaches to the short chapters on the Weighting of Observations, the Rejection of Observations, and Correlation. An extremely important feature to the student is the bibliography which directs attention to special works dealing with each of the aspects of the subject.

THAMES VALLEY RAINFALL. APRIL, 1918.



THE WEATHER OF APRIL.

IN an average April the mean barometric pressure over the United Kingdom is highest over Central and Southern England, and lowest in the north and west of Scotland. In the past month the normal atmospheric conditions were entirely reversed, and, as a result, the arrangement of weather in the various districts was altogether exceptional.

With the existing pressure distribution the predominant winds were naturally from some point between north and east, and over England, where the weather was influenced not infrequently by cyclonic systems which were developed over neighbouring parts of the Continent, they occasionally blew with considerable strength. The polar current would in itself have been sufficient to produce a low mean temperature, but, owing to the disturbing causes just mentioned, it was unfortunately accompanied by much cloud, and, in the eastern and south-eastern districts, by frequent rains, often of great intensity. At nearly all the English stations the total duration of sunshine for the month was below the average, and at Kew it was the smallest registered in April since the record commenced in 1881. The worst weather occurred during the third week, when the aggregate rainfall in England S.E. was equal to nearly four times, and in England E. to nearly eight times, the average. At many places in the same districts the heavy downpours of the 15th-16th, and the 19th-21st, were mingled with snow.

Over Ireland and north Britain the weather was cold and rather changeable in the earlier part of the month, with sharp frost in many places on the nights of the 2nd, 4th, 7th, and the 11th and 12th. Early on the 3rd the sheltered thermometer fell to 26°, at Markree Castle, on the 5th to 24°, at West Linton, and on the 8th to 22°, at Balmoral, and 27° at Gordon Castle. Towards the middle of the month the weather improved, and later on, when the eastern and southern districts were experiencing the worst possible conditions, the west and the north enjoyed more than a fair amount of bright sunshine. For the month as a whole Glasgow recorded a total duration of 170 hours, or 43 more than the average, and Birr Castle 193 hours, or 40 more than the average, and considerably more than twice as much as Kew.

In the closing week, when an anticyclone extended from the northward, fair weather became more general, and, under the influence of genial sunshine, the temperature reached its highest level for the month. In many parts of the United Kingdom the thermometer between the 26th and 28th rose to between 65° and 70°, and at Killarney it touched 73°.

Auroræ were observed in Scotland on the 3rd, 5th, 6th and 11th; on the last mentioned date it was also seen in the north of Ireland.

The rainfall of the month exceeded the average only in the south-east of England, where a well-marked area extending from Salisbury Plain to Norwich had more than 3 inches. More than 4 inches fell over part of the Thames Valley, where about twice the average fell in places. This renders the map of the distribution of rainfall facing this page more than usually interesting. The total fall in other parts of England and over a large part of Scotland hardly anywhere reached 2 inches. Over the greater part of Wales, and even in the wet districts of the West Highlands, not much more than 2 inches fell. In Ireland the rainfall was very uniform at between 1 and 2 inches. The general rainfall of the countries, expressed as a percentage of the average, was :— England and Wales, 106; Scotland, 49; Ireland, 56; British Isles, 74.

In London (Camden Square), the mean temperature was 45°·2, or 2°·9 below the average of 50 years. The duration of bright sunshine was, 75·3 hours, and the duration of rainfall, 72·1 hours. Evaporation, ·89 in.

RAINFALL TABLE FOR APRIL, 1918.

STATION.	COUNTY.	RAINFALL. Aver. 1875—1909. in.	1918. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Date.	No. of Days
Camden Square	*London*	1·74	3·24	+1·50	148	·89	15	20
Tenterden	*Kent*	1·77	1·23	— ·54	70	·20	20	15
Arundel (Patching)	*Sussex*	1·82	2·64	+ ·82	146	·66	20	16
Fordingbridge (Oaklands)	*Hampshire*	1·92	2·29	+ ·37	119	·52	15	14
Oxford (Magdalen College)	*Oxfordshire*	1·67	3·27	+1·66	196	·95	15	18
Wellingborough (Swanspool)	*Northampn*	1·78	2·82	+1·04	159	·56	20	17
Bury St. Edmunds (Westley)	*Suffolk*	1·62	3·70	+2·08	129	1·71	15	17
Geldeston [Beccles]	*Norfolk*	1·55	3·48	+1·93	124	1·85	15	12
Polapit Tamar [Launceston]	*Devon*	2·34	2·53	+ ·19	108	·51	16	15
Rousdon [Lyme Regis]	,,	2·39	1·82	— ·57	76	·33	10	17
Stroud (Field Place)	*Gloucester*	2·09	2·30	+ ·21	111	·60	16	15
Church Stretton (Wolstaston)	*Shropshire*	2·20	1·56	— ·64	71	·30	21	12
Boston	*Lincoln*	1·57	1·74	+ ·17	111	·56	15	21
Worksop (Hodsock Priory)	*Nottingham*	1·62	1·49	— ·13	92	·45	6	16
Mickleover Manor	*Derbyshire*	1·77	1·20	— ·57	68	·26	6	13
Buxton	,,	2·87	2·15	— ·72	75	·59	7	12
Southport (Hesketh Park)	*Lancashire*	1·84	1·04	— ·80	57	·24	6	13
Arncliffe Vicarage	*York, W.R.*	3·73	...	...	...	...	...	...
Wetherby (Ribston Hall)	,, ,,	1·85	1·35	— ·50	73	·35	6	9
Hull (Pearson Park)	,, *E.R.*	1·69	1·44	— ·25	35	·36	6	20
Newcastle (Town Moor)	*North'land*	1·84	1·44	— ·40	78	·35	20	15
Borrowdale (Seathwaite)	*Cumberland*	6·91	...	...	...	...	...	...
Cardiff (Ely)	*Glamorgan*	2·50	2·17	— ·33	87	·50	9	18
Haverfordwest	*Pembroke*	2·82	2·09	— ·73	75	·63	25	13
Aberystwyth (Gogerddan)	*Cardigan*	2·48	1·28	—1·20	52	·44	5	9
Llandudno	*Carnarvon*	1·79	1·06	— ·73	60	·29	6	10
Cargen [Dumfries]	*Kirkcudbrt.*	2·50	·69	—1·81	28	·24	25	4
Marchmont House	*Berwick*	2·28	·93	—1·35	41	·15	2	14
Girvan (Pinmore)	*Ayr*	2·81	·80	—2·01	29	·23	9	10
Glasgow (Queen's Park)	*Renfrew*	1·86	·44	—1·42	24	·15	6	9
Islay (Eallabus)	*Argyll*	2·64	2·27	— ·37	86	·87	8	11
Mull (Quinish)	,,	2·98	2·26	— ·72	76	·84	8	12
Balquhidder (Stronvar)	*Perth*	4·15	...	—	...	...	...	...
Dundee (Eastern Necropolis)	*Forfar*	1·93	·88	—1·05	46	·27	19	8
Braemar	*Aberdeen*	2·30	1·03	—1·27	45	·31	1	8
Aberdeen (Cranford)	,,	2·23	·36	—1·87	16	·14	19	10
Gordon Castle	*Moray*	1·74	1·71	— ·03	99	·59	19	12
Drumnadrochit	*Inverness*	1·85	1·41	— ·44	77	·52	19	11
Fort William	,,	3·65	1·34	—2·31	37	·59	5	9
Loch Torridon (Bendamph)	*Ross*	4·70	2·26	—2·44	48	·55	5	10
Dunrobin Castle	*Sutherland*	2·02	1·04	— ·98	52	·45	8	4
Killarney (District Asylum)	*Kerry*	3·46	1·45	—2·01	42	·27	7, 9	17
Waterford (Brook Lodge)	*Waterford*	2·68	1·70	— ·98	64	·65	8	10
Nenagh (Castle Lough)	*Tipperary*	2·54	·79	—1·75	31	·21	8	8
Ennistymon House	*Clare*	2·81	1·23	—1·58	44	·47	8	11
Gorey (Courtown House)	*Wexford*	2·37	1·83	— ·54	77	·37	9	12
Abbey Leix (Blandsfort)	*Queen's Co.*	2·54	1·52	—1·02	60	·52	8	10
Dublin (FitzWilliam Square)	*Dublin*	2·03	1·87	— ·16	94	·49	9	11
Mullingar (Belvedere)	*Westmeath*	2·37	1·76	— ·61	75	·58	8	9
Crossmolina (Enniscoe)	*Mayo*	3·13	1·47	—1·66	47	·29	8	11
Cong (The Glebe)	,,	2·98	1·01	—1·97	34	·21	5	10
Collooney (Markree Obsy.)	*Sligo*	2·52	1·18	—1·34	47	·33	8	10
Seaforde	*Down*	2·76	1·21	—1·55	44	·47	8	9
Ballymena (Harryville)	*Antrim*	2·57	1·89	— ·68	76	·68	8	10
Omagh (Edenfel)	*Tyrone*	2·50	1·40	—1·10	56	·43	8	9

SUPPLEMENTARY RAINFALL, APRIL, 1918.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road .	4·84	XI.	Lligwy	1·16
,,	Ramsgate	1·32	,,	Douglas, Isle of Man	1·77
,,	Hailsham	3·31	XII.	Stoneykirk, Ardwell House...	1·08
,,	Totland Bay, Aston House...	1·74	,,	Carsphairn, Shiel	1·88
,,	Stockbridge, Ashley..	3·04	,,	Langholm, Drove Road	1·00
,,	Grayshott	3·36	XIII.	Selkirk, The Hangingshaw..	·65
III.	Harrow Weald, Hill House...	3·89	,,	North Berwick Reservoir	·62
,,	Pitsford, Sedgebrook	2·38	,,	Edinburgh, Royal Observaty.	·62
,,	Woburn, Milton Bryant	3·60	XIV.	Biggar	·55
,,	Chatteris, The Priory	2·43	,,	Maybole, Knockdon Farm ...	·48
IV.	Elsenham, Gaunts End	3·03	XV.	Buchlyvie, The Manse	·98
,,	Shoeburyness	1·84	,,	Ardgour House	1·62
,,	Colchester, Hill Ho., Lexden	2·08	,,	Oban	1·52
,,	Ipswich, Rookwood, Copdock	2·47	,,	Campbeltown, Witchburn ..	1·17
,,	Aylsham, Rippon Hall	2·95	,,	Holy Loch, Ardnadam	1·79
,,	Swaffham	2·12	,,	Tiree, Cornaigmore	...
V.	Bishops Cannings	3·76	XVI.	Glenquey	1·60
,,	Weymouth	1·35	,,	Glenlyon, Meggernie Castle..	...
,,	Ashburton, Druid House	2·92	,,	Blair Atholl	·74
,,	Cullompton	2·10	,,	Coupar Angus	·87
,,	Lynmouth, Rock House	2·59	,,	Montrose, Sunnyside Asylum.	·40
,,	Okehampton, Oaklands	2·86	XVII.	Balmoral	·86
,,	Hartland Abbey	1·82	,,	Fyvie Castle	1·00
,,	St. Austell, Trevarna	2·63	,,	Keith Station	2·28
,,	North Cadbury Rectory	1·88	XVIII.	Rothiemurchus	1·63
VI.	Clifton, Stoke Bishop	2·38	,,	Loch Quoich, Loan	4·20
,,	Ledbury, Underdown	2·71	,,	Skye, Dunvegan	2·69
,,	Shifnal, Hatton Grange	2·33	,,	Fortrose	·81
,,	Droitwich	2·56	,,	Glencarron Lodge	2·47
,,	Blockley, Upton Wold	3·68	XIX.	Tongue Manse	2·26
VII.	Grantham, Saltersford	2·05	,,	Melvich	1·30
,,	Market Rasen	...	,,	Loch More, Achfary	3·03
,,	Bawtry, Hesley Hall	1·36	XX.	Dunmanway, The Rectory ..	1·96
,,	Whaley Bridge, Mosley Hall	1·70	,,	Glanmire, Lota Lodge	1·57
,,	Derby, Midland Railway	1·33	,,	Mitchelstown Castle	1·57
VIII.	Nantwich, Dorfold Hall	1·22	,,	Darrynane Abbey	2·37
,,	Bolton, Queen's Park	1·06	,,	Clonmel, Bruce Villa	1·51
,,	Lancaster, Strathspey	1·11	,,	Broadford, Hurdlestown	1·19
IX.	Langsett Moor, Up. Midhope	1·33	XXI.	Enniscorthy, Ballyhyland...	1·87
,,	Scarborough, Scalby	2·06	,,	Rathnew, Clonmannon	1·77
,,	Ingleby Greenhow	1·84	,,	Ballycumber, Moorock Lodge	1·00
,,	Mickleton	·70	,,	Balbriggan, Ardgillan	1·56
X.	Bellingham, High Green Manor	·96	,,	Castle Forbes Gardens	1·22
,,	Ilderton, Lilburn Cottage ...	1·17	XXII.	Ballynahinch Castle	1·28
,,	Keswick, The Bank	1·39	,,	Woodlawn	·98
XI.	Llanfrechfa Grange	2·50	,,	Westport, St. Helens	1·36
,,	Treherbert, Tyn-y-waun	3·27	,,	Dugort, Slievemore Hotel ...	1·12
,,	Carmarthen, The Friary	2·38	XXIII.	Enniskillen, Portora	1·35
,,	Fishguard, Goodwick Station.	1·27	,,	Dartrey [Cootehill]	1·48
,,	Crickhowell, Tal-y-maes	6·50	,,	Warrenpoint, Manor House ..	1·26
,,	New Radnor, Ednol	2·62	,,	Belfast, Cave Hill Road	1·56
,,	Birmingham W.W., Tyrmynydd	2·02	,,	Glenarm Castle	1·25
,,	Lake Vyrnwy	2·24	,,	Londonderry, Creggan Res...	2·15
,,	Llangynhafal, Plas Drâw	2·18	,,	Dunfanaghy, Horn Head ...	...
,,	Rhwibryfdir	3·44	,,	Killybegs	1·50
,,	Dolgelly, Bryntirion	2·24			

Climatological Table for the British Empire, November, 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	58·8	21	30·9	26	52·1	41·8	43·0	88	89·7	26·9	1·82	15	7·5
Malta	72·1	11	52·7	17	64·8	58·0	...	81	119·0	45·0	3·44	16	0·4
Lagos	95.0	18	70·0	15	88·2	84·0	74·8	77	154·4	69·0	2·63	7	7·3
Cape Town	89·4	21	45·1	26	72·6	55·6	52·8	67	...	...	·78	9	4·2
Johannesburg	84·4	1	39·0	20	70·8	51·3	52·1	77	..	37·0	17·76	20	6·1
Mauritius	80·2	17	61·2	1	78·6	66·6	63·1	74	...	57·7	2·97	20	6·2
Bloemfontein	90·2	2	45·3	18	79·8	51·7	49·3	53	..	...	2·82	9	4·2
Calcutta...	86·6	12	58·0	20	82·0	66·4	65·1	75	...	49·0	·40	1	2·2
Bombay...	87·3	29	69·5	12	85·4	72·0	68·0	71	139·5	61·0	·00	0	1·4
Madras	89·5	4	70·2	30	85·0	74·3	72·2	82	159·5	66·6	6·03	17	6·2
Colombo, Ceylon ...	87·9	7	69·6	2, 4	84·8	73·6	71·7	82	158·2	62·0	11·04	19	7·4
Hongkong	82·9	2	57·1	21	72·7	64·7	54·8	60	...	...	·10	1	5·6
Sydney	82·8	15	52·0	19	71·7	58·9	56·1	68	145·7	46·0	8·35	18	7·0
Melbourne	84·5	29	43·3	6	69·6	52·8	50·3	67	147·0	35·4	4·18	16	6·4
Adelaide	89·0	2	43·9	13	75·2	54·1	47·9	55	157·0	35·1	1·15	11	5·1
Perth	96·0	26	48·4	4	75·3	56·6	51·3	58	156·4	38·0	·02	1	2·9
Coolgardie	98·2	2	45·0	6, 16	81·8	54·2	43·3	35	155·0	41·0	1·40	2	2·0
Hobart, Tasmania ...	84·0	4	40·0	6	66·4	49·3	47·5	67	148·3	33·1	2·50	20	6·4
Wellington	70·9	30	45·5	25	64·7	52·0	51·1	77	150·0	30·0	1·79	4	5·3
Jamaica, Kingston ...	89·7	29	68·0	3	85·0	71·2	69·6	82	...	...	·66	9	6·7
Grenada	88·0	9	70·0	1,3,4	84·0	73·1	...	76	139·0	...	6·54	12	4·0
Toronto	54·5	10	10·1	25	41·8	27·1	27·5	80	104·8	6·6	1·27	10	...
Fredericton	50·8	5	—5·0	28	36·3	20·8	23·7	82	...	...	2·33	7	5·8
St. John, N.B. ...	51·3	6	5·5	28	37·0	25·8	25·2	74	111·5	4·2	3·36	11	5·7
Victoria, B.C.	61·2	10	36·6	25	52·3	36·6	44·0	89	117·0	30·8	2·28	19	7·4

Johannesburg.—Bright sunshine 233·°7 hours. Rainfall a record for November.

COLOMBO, CEYLON.—Mean temp. 79°·2, or 0°·3 below, dew point 1°·1 below, and R ·49 in. below, averages. Mean hourly velocity of wind 4·5 miles.

HONGKONG.—Mean temp. 68°·2. Bright sunshine 189·2 hours. Mean hourly velocity of wind 12·5 miles.

Sydney.—A very wet month, R 5·53 in. above average and not surpassed since November, 1873, when 9·45 in. was recorded.

Melbourne.—Mean temp. 0°·1 above, and R 1·94 in. above, averages.

Adelaide.—Mean temp. 2°·3 below, and R ·02 in. below, averages.

Coolgardie.—Mean temp. 2°·9 below, average, and R ·75 above, averages.

Hobart.—Mean temp. slightly above, average, and rainfall normal.

Wellington.—Bright sunshine, 244·4 hours. Mean temp. 1°·4 below.