

# Symons's Meteorological Magazine.

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## DR. SHAW ON FORECASTING WEATHER.\*

THIS long-expected work brings before the general public the results of the researches carried on by Dr. Shaw and the staff of the Meteorological Office during the last eleven years. The main outlines of these have been recorded in this Magazine from time to time as they were published in official papers or communicated to Societies; but now that they are brought together and focussed upon the art of forecasting weather we are better able to appreciate the value of the work and the unity of the purpose which has animated it. To those of our readers who are familiar with the development of our knowledge of the distribution of heavy rains, as worked out year by year in *British Rainfall*, the volume will appeal with a peculiar force, for the data elaborated by the British Rainfall Organization is, in a considerable degree, complementary to that dealt with in the Meteorological Office, and it is a duty on our part to recognize fully and call attention to the monumental additions to the science of meteorology which Dr. Shaw has made during the past decade.

To most of us the art of forecasting weather is familiar in the form given to it in Abercromby's *Weather* a quarter of a century ago, and Dr. Shaw preserves so much of that work as remains applicable in the light of recently acquired knowledge. The amount is amazingly small. The treatment of cyclones alone can be quoted without alteration, and even here only the empirical as distinct from the theoretical part of the subject. Premising an adequate knowledge of Abercromby's work on the part of the reader, Dr. Shaw proceeds to expand and correct the earlier views until in the end he has suggested, rather than described, a new view of almost every form of weather. *Forecasting Weather* must be studied in detail, even with a magnifying glass for some of the diagrams, and every detail will

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\* *Forecasting Weather*. By W. N. Shaw, F.R.S., Sc.D., Hon. LL.D. (Aberdeen), Hon. Sc.D. (Dublin, Harvard and Manchester), Hon. Fellow of Emmanuel College, Cambridge, Reader in Meteorology in the University of London, Hon. Member of the Austrian Meteorological Society and of the German Meteorological Society, President of the International Meteorological Committee, Director of the Meteorological Office, London. Fully illustrated with Maps, Charts and Diagrams. Constable & Company, Ltd., 10, Orange Street, Leicester Square, W.C. 1911. Size 9×5½. Pp. xxviii + 380. Price, 12s. 6d. nett.

repay study. We are not in agreement with all parts of the plan of the exposition, nor with every point of view occupied, nor with every conclusion reached, but we say nothing of our own opinions here for two reasons, in the first place the points in which we differ from the author are so few compared with those in which we agree that to refer to them would be to give this notice a false balance, and in the second place we have read the book during a voyage in the Atlantic and are writing now, at the end of December in a temperature of  $80^{\circ}$ , to the music of the south-east trade wind and far from the books of reference necessary to justify any controversial attitude.

We believe that the best way to show our appreciation of the merits of *Forecasting Weather* is to refer to the outstanding facts of each chapter, laying stress mainly on those which strike us as introducing the most important modifications of earlier views.

Chapter I., *Synoptic Charts*, starts from the Daily Weather Chart of the Meteorological Office, touches on isobars and expounds the Beaufort scale of wind-force, giving detailed information as to the numerical value in velocities of the arbitrary numbers.

Chapter II., *The Relation of Wind to Barometric Pressure*, gives an admirable discussion of the inclination of wind to the isobars, and here the careful reader will begin to realize that he must lay aside his early belief in a cyclone as a simple region of inward and upward spiral winds, and of an anticyclone as a simple region of downward and outward spiral winds. He will also learn that a steepening of the barometric gradient may not increase the velocity of the wind but merely alter its inclination to the isobars. We have rarely seen a physical fact in meteorology set forth so simply and effectively as this is on pp. 42-45.

Chapter III., *The Relation of Temperature and Weather to Barometric Pressure*, deals with a number of typical weather charts illustrating cyclones, straight isobars, secondaries, V depressions and wedges, with many hints as to physical relationships more fully expounded later. Stress is laid on the want of the perfect accord between isobars and weather, in contrast to the rigid relation between isobars and wind. The distribution of temperature in a cyclone is shown to be "evidence against the common view that the air in any part of a cyclonic area may be regarded as having described a considerable part of a revolution." Twenty-five pages are quoted from Abercromby's *Weather* with reference to forecasting in cyclones.

Chapter IV., *Types of Weather and the Further Outlook in Weather Forecasting*, introduces us to examples of Abercromby's southerly, westerly, northerly and easterly types, illustrated by synoptic charts of the Atlantic, and raised to a very high place as controlling weather. A very brief statement is given of certain conditions in which the weather is steady enough to justify a three days' forecast for the British Isles.

Chapter V., *Local Weather in Relation to Weather Types*, is also a short chapter and consists mainly of extracts from a paper read by

Dr. Shaw to the Scottish Meteorological Society, in which data are considered for groups of stations, during the prevalence of various types of weather, in order to ascertain how far geographical conditions modify the weather of the type in different localities. Here the treatment is detailed rather than generalized, and the whole must be studied in the light of the very elaborate diagrams before the full meaning can be appreciated.

Chapter VI. is one of the most important in the book, though not so much to the forecaster in search of rules for practice as to the meteorologist desirous of understanding what he reads. It is entitled *The Physical Processes of Weather*, and starts with the consideration of the normal condition of the atmosphere being movement, not calm. It goes on to consider the thermo-dynamical conditions of the atmosphere, cooling by expansion and the formation of cloud and rain, and mentions in passing that the condensation of water on an electron, which is theoretically possible, can only occur in the absence of a dust-mote, and in nature it practically cannot occur at all. The latter part of the chapter deals in a most illuminating way with the ascent and convergence of air-streams and with atmospheric instability. In this chapter we reach Dr. Shaw's opinion that an anticyclone or cyclone may be said to be maintained by the air-currents circulating round them, rather than the winds can be said to depend on the isobaric form.

This leads directly to Chapter VII. on *The Life History of Surface Air Currents* in which the actual paths of air-particles are traced out for the circulation associated with different isobaric forms, and the areas of ascending and descending air are tentatively indicated. It is pointed out that the essential condition of a cyclone is the southerly wind which forms the eastern flank, then a cold easterly current of air crossing the southerly about the line of the path, and thirdly a westerly wind. The incidence of rain in cyclones is treated mainly from the period of occurrence as indicated by the small number of stations represented on the daily weather maps. The very important question of the source of vapour supply for a long steady rainfall is touched upon and appears at least as reasonable in Dr. Shaw's view of a cyclone as from the traditional standpoint of an inflowing spiral.

Chapter VIII., *The Minor Fluctuations of Pressure*, introduces the fascinating phenomena of line-squalls, the investigation of which is an important development since the date of Abercromby's book. The "embroidery of the barogram," showing the pressure changes during these squalls, has been studied in detail since the invention of the microbarograph, and the abrupt inflections of the isobars which express these changes in plan, have been mapped on a few special occasions when a large number of observing stations has been used, so also have the isochronous lines giving the direction and rate of travel of the squalls. A line-squall is regarded as due to the rushing over the country of a flood of colder and denser air which takes the place of the warmer current previously in possession and

advances like the bore of a river. Thunderstorms are frequently associated with this phenomenon. No instances of line-squalls in an easterly current are known. Dr. Shaw adopts M. Durand-Gréville's expression, *ruban de grain*, in preference to an English equivalent for the area in which the sudden rise of pressure in a line-squall gives rise to a crowding of the isobars, and he raises the question as to whether a *ruban de grain* or a circular depression "has the better claim to be regarded as the normal type."

Chapter IX., on *Gales and Storm Warnings*, returns from the fertile realms of new investigations to a statement of part of the routine work of the London Meteorological Office, the practical difficulties with which it has to grapple, and the degree of accuracy in prediction which has been attained; but in Chapter X., on *Anticyclones and Land Fog*, we return to the land of discovery. Here the anticyclone is shown to be an inert mass of air which for some reason is not taking part in the circulation of the atmosphere around it, and the attractive antithesis between cyclone and anticyclone, which helped so much in the popular exposition of meteorology, is pointed out to be groundless. The areas of descending air are stated to be not the centres of anticyclones but "(a) the shoulders, or protuberances, of anticyclones, in particular the regions of comparatively high pressure between two consecutive cyclonic depressions, and, therefore, also between two anticyclones, or the extension of an anticyclone, between a depression and its secondary; (b) the trough lines of travelling V-shaped depressions, and parts of the central areas of travelling circular storms." Land fogs are considered in this chapter, and Chapter XI. is devoted to *Coastal Forecasts, Sea-fogs and Thunderstorms*; the thunderstorms being land storms, not those over the sea.

Chapter XII. deals with *Forecasts for Agriculturists*, including an interesting discussion of night-frosts in spring, where the influence of the form of the land on such frosts, demonstrated by Dr. Buchan about sixty years ago, receives fuller recognition than has been accorded to it in most recent books. Chapter XIII. consists of memoranda on *Colliery Warnings*, and in Chapter XIV. we have a discussion of *The Approach of Depressions*, consisting mainly of a description of M. Guilbert's rules, to which we called attention in these pages when his book was published (see Vol. 45, p. 55), but Dr. Shaw "confesses" that he does not feel inclined to employ the method in the work of his office. Chapter XV. continues the subject under the title of *Movements of Depressions—Isallobaric Charts*. Here the tracks of cyclonic storms are treated, and their bewildering diversity made clear by the reproduction of a chart of Rykatcheff's showing the tracks across Europe of all the October cyclones between 1872 and 1887. Ekholm's plan of dealing, not with isobars, but with isallobaric lines representing equal amounts of rise or fall of pressure in a given time is then described; this also has been tried at the Meteorological Office, but on account of the extreme westerly position of the British Isles the results have not been of practical utility.

Chapter XVI. treats of *The Upper Air—Forecasts for Aeronauts*, and it is pointed out that for weather forecasts to be of use to aeronauts the general forecasts would have to be interpreted by a local meteorologist who knew the requirements of the aeronaut, and was skilled enough to see whether the general forecast was being fulfilled, or whether it should be modified from time to time.

Chapter XVII., *Statistical Methods for Long Period and Seasonal Forecasting*, touches on the Brückner and Sunspot Cycles, refers to Schuster's Periodogram and to the work of Dr. Walker on the Indian monsoons, and in Chapter XVIII., and last, we have a brief statement of *The Practical Utility of Weather Forecasts*, as issued by the Meteorological Office. The difficulties in the way of expressing in the twelve words available for telegraphic forecasts the varying conditions of British weather, and the difficulty on the part of a public untrained in meteorology in understanding what to look for, are set forth, and Dr. Shaw urges the improvement of education so far as meteorology is concerned. With regard to the value of forecasts, he speaks guardedly; he shows that improvements have been made, and that although it may in the end prove impossible to predict all the changes of to-morrow's weather, it is yet possible that the attempts to do so may result in the establishment of a system of more distant forecasts referring to a season or a month.

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### DISTRIBUTION OF RAIN IN MAURITIUS DURING THE DECADE 1891—1900.

By the late PROF. V. RAULIN.

IN the *Meteorological Magazine* for March, 1885 (Vol. 20, p. 19) there appeared an analysis which I had made of the rainfall of Mauritius during the decade 1871 to 1880 (with a map of the island), and for February, 1893 (Vol. 28, p. 2) during the decade 1881 to 1890. I have now the pleasure of sending a similar analysis for the decade 1891-1900.

For the data used in the analysis I am indebted to Dr. C. Meldrum, F.R.S., and Mr. T. F. Claxton, F.R.A.S., Director of the Royal Alfred Observatory, who published annually the "Results of the Meteorological Observations" made in the colony, and has been kind enough to furnish me with copies.

The yearly totals of the decade are 143·66 in. for the maximum at Mare-aux-Vacoas, and 19·93 in. for the minimum at Solitude, the extremes being 173·02 in. and 19·73 in.

*Seasonal Distribution.*\*—In India, at Calcutta, there is great dryness in winter and spring from December to May, and a heavy rainfall in summer and autumn from June to November; but Mauritius is in the Southern Hemisphere where the seasons are

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\* In consequence of an error in the volume for 1893, pages 3 and 4, the tables of the Regimes V. (page 3), and VII. (page 4), have been transposed.

inverted. The rainy season, therefore, extends from December to May, and the dry season from June to November. The inversion of the maximum of dryness between winter and spring and of the

REGIME V. (as at Limoges).—*Winter and Autumn wet, Spring and Summer rather dry.*

	STATIONS.	Height above Sea.	Years.	Summer.	Autumn.	Winter.	Spring.	YEAR.
				in.	in.	in.	in.	in.
Pamplounses.	St. André ... ..	175	1891-1900 (9)	16·31	16·87	5·96	3·67	36·81
	The Mount ... ..	325	1892-1900 (9)	21·33	23·26	11·21	6·31	61·92
	Botanical Gardens ...	225	1891-1900 (9½)	17·00	18·83	9·63	5·34	50·20
	Mon Rocher ... ..	270	1892-1900 (8½)	21·69	22·75	9·86	5·59	59·89
	Constance ... ..	626	1895-1899 (5)	21·36	27·40	12·91	7·79	69·52
	Beau Plan ... ..	195	1891-1900 (10)	17·45	17·88	7·28	3·59	46·20
	La Grande Rosalve ...	643	1891-1900 (10)	21·99	27·01	12·62	8·57	70·19
	Australia ... ..	430	1894-1899 (6)	22·19	29·77	17·96	8·29	78·21
	California ... ..	850	1893-1900 (8)	26·00	30·24	13·44	7·58	77·26
Riv du Rempart.	St. Antoine... ..	90	1891-1900 (10)	16·14	20·36	8·45	2·79	47·74
	Schœnfeld ... ..	?	1891-1899 (9)	16·45	19·59	8·67	4·95	49·66
	Mon Loiser ... ..	300	1893-1900 (8)	17·87	19·45	9·16	3·70	50·18
	Labourdonnais ... ..	290	1891-1900 (9½)	20·73	23·53	12·05	5·69	62·01
	Antoinette ... ..	640	1891-1900 (7)	21·03	28·10	13·98	7·80	70·91
	Mon Songe ... ..	620	1891-1900 (10)	22·34	27·59	11·93	7·57	69·43
Flacq.	Beau Bois ... ..	500	1894-1900 (7)	19·84	26·21	12·63	7·14	61·82
	Constance ... ..	100	1891-1900 (10)	17·63	22·00	10·51	5·21	55·35
	Rich Fund ... ..	300	1891-1900 (10)	23·74	30·07	14·92	7·52	76·25
	Union ... ..	600	1889-1900 (12)	21·79	28·58	12·61	7·56	70·54
	Bel Etang ... ..	700	1895-1900 (6)	23·25	44·96	20·51	8·55	97·27
	Sans Souci ... ..	910	1891-1900 (10)	35·43	49·50	26·85	14·56	126·34
	Etoile ... ..	400	1891-1900 (10)	29·61	43·43	21·85	11·94	106·83
Gr. Port.	Ferney ... ..	20	1891-1900 (10)	28·73	36·66	14·69	8·87	88·95
	Riche-en-Eau ... ..	1200	1891-1900 (10)	27·13	32·48	15·65	9·25	84·51
	Astræa ... ..	700	1891-1900 (10)	32·61	38·90	19·41	11·18	102·10
	Beau Vallon ... ..	60	1891-1900 (10)	19·29	24·72	10·70	6·02	60·73
	Eau Bleue ... ..	?	1895-1899 (5)	36·09	49·03	23·93	13·59	122·64
Savanne.	Colmar ... ..	400	1891-1900 (10)	29·24	33·54	16·42	9·87	89·07
	St. Avoird ... ..	840	1891-1895 (5)	34·33	34·62	18·64	11·89	99·48
	Benarès, Residence ...	300	1891-1900 (10)	24·50	28·31	13·62	7·87	74·30
	„ Sugar House ... ..	200	1891-1900 (10)	23·54	27·01	11·26	7·09	68·90
	Beau Champ ... ..	60	1891-1900 (10)	22·27	23·11	8·15	5·10	58·63
	St. Aubin ... ..	300	1891-1900 (7½)	22·73	26·58	13·63	7·56	70·50
	Bois Ombre ... ..	50	1891-1900 (10)	23·16	24·74	11·27	5·58	64·75
	Union, Bel Air ... ..	90	1891-1900 (10)	27·11	27·41	13·89	6·73	75·14
	Terracine ... ..	50	1889-1900 (12)	22·16	24·10	9·62	4·57	60·45

maximum of wetness between summer and autumn gives indications of three European rainfall regimes.

1. The maximum of dryness in winter and of rain in summer indicates the first regime, which appears in some stations from the district of Black River in the south-west of the Island.

2. The maximum of dryness in spring and of rain in summer indicates regime VII., which advances from the western coast far into the interior everywhere in Moka and Plaines Wilhelms.

REGIME VII. (*as at Bar-le-Duc*).—*Winter and Summer wet.*

	STATIONS.	Height above Sea.	Years.	Summer.	Autumn.	Winter.	Spring.	YEAR.
		feet.		in.	in.	in.	in.	in.
Pampl	Solitude ... ..	90	1891-1900 (9½)	13·88	13·70	4·17	2·28	34·03
	Alfred Observatory ...	179	1891-1900 (10)	18·17	17·84	7·27	4·07	47·35
	Solitude, Mont. Longue ...	430	1896-1900 (5)	21·74	16·60	7·71	4·70	50·75
Moka.	Port Louis, George Street	18	1895-1900 (6)	15·23	12·72	4·04	2·51	34·50
	The Bower ... ..	1080	1891-1900 (9½)	28·32	23·03	9·41	7·03	67·79
	Gentilly ... ..	1150	1891-1900 (10)	31·43	25·23	10·59	7·84	75·09
	Lynnwood ... ..	1100	1891-1898 (8)	32·24	25·49	10·04	7·15	74·92
	Alma ... ..	1500	1891-1900 (10)	43·50	40·94	24·14	13·93	122·51
	Bon Air ... ..	1050	1891-1900 (10)	28·96	23·33	9·32	6·44	68·05
	Le Réduit ... ..	1000	1891-1900 (10)	24·53	18·59	6·41	5·21	54·74
	Minessy ... ..	1150	1891-1900 (9½)	28·22	25·29	10·37	6·89	70·77
Plaines Wilhelms.	Bagatelle ... ..	1300	1891-1899 (8)	27·69	22·64	9·95	6·39	66·67
	Trianon ... ..	950	1891-1900 (10)	27·12	21·77	8·54	6·48	63·91
	Phoenix, Estate ... ..	1300	1891-1900 (10)	35·09	27·39	13·59	9·47	85·54
	„ Railway Station	1315	1891-1899 (7½)	36·90	29·34	14·81	10·37	91·42
	Mare-aux-Vacoas ... ..	1850	1891-1900 (10)	47·12	46·98	32·08	17·46	143·64
	Highlands ... ..	1400	1891-1895 (5)	28·08	25·01	13·39	8·65	75·13
	Réunion ... ..	1420	1891-1900 (10)	36·17	29·18	17·35	10·73	93·43
	Marton, Vacoas ... ..	1400	1891-1900 (10)	34·29	27·34	15·50	9·80	86·93
	Curepipe ... ..	1840	1891-1900 (10)	45·92	40·90	25·61	15·39	127·82
	Villa-le-Bain ... ..	1840	1891-1900 (10)	43·21	42·00	27·16	14·25	126·62
G. P. & Sav.	Henrietta ... ..	1549	1891-1899 (9)	36·56	29·33	15·93	8·83	90·65
	The Glen ... ..	1580	1891-1899 (9)	38·95	27·96	16·20	10·02	93·14
	La Marie ... ..	1715	1891-1899 (9)	40·27	32·47	20·92	10·08	103·74
	Tamarind Falls ... ..	1629	1891-1899 (9)	34·18	26·48	16·21	8·78	85·63
	St. Marie ... ..	100	1896-1900 (5)	26·27	31·75	13·29	6·01	77·68
Black River.	Cluny ... ..	1000	1891-1900 (10)	46·97	46·80	28·10	15·79	137·66
	Gros Bois ... ..	500	1891-1900 (10)	28·99	32·44	17·45	9·92	88·80
	Chamarel Yard ... ..	850	1891-1897 (6)	31·09	23·93	14·08	8·78	77·88
	REGIME I. ( <i>as at Moulins</i> ).— <i>Dry Winter and wet Summer.</i>							
	Wolmar, Clarens ... ..	200	1891-1900 (9)	18·25	16·97	1·98	3·07	40·27
	Casela ... ..	250	1891-1897 (6½)	23·43	17·12	2·74	3·77	47·06
	Tamaria ... ..	150	1891-1900 (10)	19·07	13·42	2·07	2·49	37·95

The following observations were also made on islands near Mauritius:—

Seychelles, Mahé (Reg. I.)	...	1891-1899 (9)	43·39	23·42	11·43	20·75	98·99
Ile Rodrigues (Reg. VII.)	...	1891-1899 (9)	15·91	15·02	8·77	4·54	44·24

3. The maximum of dryness in spring and of rain in autumn indicates regime V., which occupies the north-east and south quarters, Pamplemousses, Rivière du Rempart, Flacq, Grand-port and Savanne.

## Correspondence.

*To the Editor of Symons's Meteorological Magazine.*

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### THE DISTRIBUTION OF RAIN IN CYCLONIC STORMS.

I HAVE been considering the distribution of rain in heavy cyclonic storms. My old idea had been that the heaviest rain fell pretty evenly along the centre of the track of the depression, thinning off on each side, and it has been a revelation to me to find that the heaviest downpours are usually far away from this central line, in a broken band parallel to or gradually diverging from the central track on its left side. Since becoming aware of these peculiarities I have very carefully observed the changes of wind, both in force and direction, in such heavy rain storms as have visited this place, and I have come to the following conclusion: that when a cyclonic depression crosses this country, the bulk of the rain falls in subsidiary eddies, too shallow to be evidenced on the meteorological charts, but perceptible to a local observer by a careful observation of the variation of the wind. These eddies I suspect of having an orbital movement round their primary, at the same time sharing its forward movement. Let us consider what the effect of this condition of things would be in case of a cyclonic system crossing this country from west to east. Let us consider in the first place a subsidiary eddy to the south of the central track. Such an eddy would have its revolving movement round its primary added to the general velocity of the system; it would, therefore, pass rapidly over an observer, giving him a comparatively brief rain storm, with a slight shift of the westerly wind towards south at the beginning, and towards north at the end, if it passed centrally over him, and an acceleration of the west wind if he were near its southern edge, and a diminution if he were near its northern edge. This is what I have noticed repeatedly in rain storms which have passed over me when I have been to the right of the central track.

Next let us consider the case of an eddy some distance on the northern side of the central track. It will have its orbital velocity subtracted from the general forward movement, and it will consequently pass very slowly over any given point, and in some cases might remain nearly stationary, giving a prolonged heavy rain as is noticed in such places. An observer on the north side of the eddy would have the east wind of the general storm accelerated, one on its southern edge would have it diminished, while an observer over whom it passed centrally would find the east wind deflected a little to the south at the commencement, and to the north at the end of the rain. I have had less opportunities of studying rain storms on the left of the track, but the observations of others would be interesting.



To account for the patchiness of the band of high rainfall, I might suggest that a number of such eddies are formed at intervals revolving round the primary, and that these successively arrive at the position where they become almost stationary, geographically speaking, thus forming a succession of patches of heavy rainfall along a band nearly parallel to the central track. If I am right, however, the patches should, I think, be somewhat crescent shaped, with the concavity towards the central track. A gradual divergence of the band of patches from the line of the central track would seem to require that the eddies should be developed further and further from the centre of the depression as the latter advances over the country, but I cannot suggest any reason why this should be so.

F. J. WARDALE.

*Shrewton, Wilts, Dec. 9th, 1911.*

### SEA SPRAY CARRIED FAR INLAND.\*

THE occurrence of a film of salt on glass windows, foliage of plants, &c., has often been observed after severe gales in localities far removed from the sea, but we do not appear to have many data recorded as to the exact amount deposited. The following may, therefore, be of interest.

This morning, November 6th, after a severe westerly gale of over 24 hours' duration, I noticed on the windows of my house a considerable incrustation, which tasted strongly of salt, so I decided to examine the water in the rain gauge. The amount of rain for the previous 24 hours, registered at 9 a.m., was .19 inch. This water which was clear and colourless—proving the absence of any accidental organic contamination—gave on analysis 13.18 grains per gallon of combined chlorine, which is equivalent to 21.72 grains of sea salt, calculated as sodium chloride.

Now a rainfall of .19 in. represents 19.19 tons, or rather over 4298 gallons of water per acre, so that on every acre there had fallen 13 lbs. 5 ozs. of salt, or on a square mile  $3\frac{3}{4}$  tons (more exactly 3 tons. 16 cwt. 8 lbs.).

The distance from Ilkley to the nearest sea coast, at the mouth of the Lune, is 43 miles, the direction being west, but the wind during the gale blew from a slightly more southerly point, or say from Blackpool, a distance of 50 miles.

ALBERT WILSON.

*28, St. James' Road, Ilkley.*

### FROZEN RAIN.

ON the evening and night of January 17th-18th there occurred here a somewhat remarkable instance of frozen rain. Both days were overcast, thick, with bad light. The wind on 17th moderate to

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\* For further particulars with regard to this subject, see *Meteorological Magazine*, Vol. 29, pp. 178-9.

rough or fresh from S.E., backing to E. and N.E. Barometer (at 365 ft.), 29·50-29·46. Temperatures :—

	Dry.	Wet.	Max.	Min.	Grass.	Rain.
17th .....	34°·0	33°·0	35°·2	32°·8	32°·0	·30 in.
18th .....	32°·1	31°·0	41°·2	29°·8	27°·0	·30 in.

The weather before and since was wet and mild ; at no time did mud on the road freeze. It rained steadily and gently most of 17th, and froze as it fell, so that trees, shrubs, grass, &c., were literally coated on the east side with frozen rain to a considerable thickness, heavy enough to break or tear off big limbs of trees, elms, firs, birches, limes, etc., owing to the great weight ; small twigs were entirely coated, larger branches (say, over  $\frac{3}{4}$  in. in diameter) were coated mostly on E. side, and over  $1\frac{1}{4}$  in. in diameter not on W. side. In coarse grass each blade was so coated as to have the appearance of glass quills, quite clear and transparent. Here it is very open to the wind, so I visited woodlands on 18th, and noticed it was mostly along the outsides excepting the west sides, on the east, north-east, and south-east. I could find no place over one mile from Wrotham Church where it was so thick and heavy as within that radius, and learn that it was unobserved at places a few miles distant : this may be accounted for by reason of Wrotham being on a prominent feature or spur projecting southwards from the North Downs. Another curious example was that of a cyclist who went from Wrotham to Tunbridge Wells on the afternoon of 17th, 3 to 5 o'clock, whose cap got frozen, not otherwise, but on returning between 7 and 9 p.m. the front part of his coat was frozen fully  $\frac{1}{2}$  in. thick, and cap likewise. It was some time before he could unbutton the coat, and he complained of the *heat* to his body (due to lack of air through the clothing). The road was very muddy, but not frozen or slushy.

I hear that the phenomenon was remarkable in a similar degree at Sutton Valence, about 15 miles S.E. by E. from here, but not nearly so severe at Headcorn and Hollingborne.

A. F. BOWKER.

*Wrotham, Kent, 24th January, 1912.*

## THE WEATHER OF JANUARY.

By FRED. J. BRODIE.

JANUARY received a small legacy from the old year in the shape of a brief spell of quiet anticyclonic weather. The British Islands lay, however, on the northern edge of the continental high-pressure system, and the resulting winds, which blew from south or south-west, were accompanied by a temperature in excess of the average. On the opening day of the year the thermometer rose above 50° in nearly all districts, and reached 55° in many parts of Ireland and North Britain, and 56° at Leith and Hawarden Bridge. The anticyclone soon receded to the southward, and on the 5th, when a depression swiftly skirted our northern coasts on its way from Iceland



# THAMES VALLEY RAINFALL JANUARY, 1912.



ALTITUDE  
SCALE

Below 250 feet    250 to 500 feet    500 to 1000 feet    Above 1000 feet

SCALE OF MILES

0 5 10 15 20

to Denmark and North Germany, the wind veered temporarily to W. and N.W., with cool, changeable weather and heavy rain in some of the western districts. Next day a new cyclonic system advanced in a more southerly track across Ireland and England, easterly winds and snow setting in over the northern half of the country, and heavy rain in many places further south. In the rear of the disturbance a cold current of air from the northward spread temporarily over the entire kingdom, and on the night of the 7th a sharp frost was experienced, the sheltered thermometer falling below  $25^{\circ}$  in all parts excepting the south east, and below  $20^{\circ}$  in many northern districts. The brief touch of wintry weather was soon followed by a return of southerly winds, lasting from about the 8th to the 20th, the conditions at the time being influenced by large cyclonic disturbances moving in a north-easterly direction over the northern part of the Atlantic. Gales were experienced rather frequently, especially on our western and northern coasts, and between the 15th and 17th heavy falls of snow occurred over North Britain, and exceeding heavy rain in some of the central and southern districts. Temperature was, as a rule, a little above the average, but at various times between the 17th and 20th sharp frost occurred in most parts of Great Britain, the sheltered thermometer falling at least  $10^{\circ}$  below the freezing point in many places, and touching  $18^{\circ}$  on the 20th at Balmoral. On the surface of the grass the minimum readings were as low as  $15^{\circ}$  at Balmoral,  $19^{\circ}$  at Harrogate and  $20^{\circ}$  at Marlborough. After the 20th a radical alteration in the weather took place, the chief factor in the situation being supplied by an anticyclonic area which appeared over the Icelandic region. Pressure at the same time became low over France and the Bay of Biscay, and as a result of the combined movements, a cold wind from N. and N.E. set in over the whole of the United Kingdom. Sharp nights were now experienced very generally, and towards the close of the month, when the Icelandic high-pressure system advanced southwards over the United Kingdom, a frost of considerable severity set in, the wintry weather lasting throughout the early days of February. The lowest January temperatures occurred mainly on the 29th or 30th, the sheltered thermometer falling below  $15^{\circ}$  over a large portion of the United Kingdom, and reaching  $7^{\circ}$  at Balmoral,  $11^{\circ}$  at Raunds and Aldershot, and  $12^{\circ}$  at Wokingham. On the grass a reading of  $3^{\circ}$  was registered at Balmoral, and a reading of  $8^{\circ}$  at Raunds.

The spells of mild weather in the early part of the month and of cold weather at its close fairly counterbalanced each other, and the mean temperature for the entire period differed, therefore, but little from the average, most of the individual values showing a slight excess. In many western districts the amount of bright sunshine was above the normal, but elsewhere there was a deficiency, and in the east and south-east of England a large deficiency. In London (at Westminster), the total duration, only  $9\frac{1}{2}$  hours, did not amount to more than one-half the average, and was smaller than in any January since that of 1897.



## ROYAL METEOROLOGICAL SOCIETY.

THE Annual General Meeting of this Society was held on Wednesday evening, January 17th, at the Institution of Civil Engineers, Great George Street, Westminster, Dr. H. N. Dickson, President, in the chair.

The Council, in their Report, stated that they had decided to discontinue the collection of observations and the publication of "The Meteorological Record," as from December 31st, 1911, an arrangement having been made with the Meteorological Office for the continuation of the publication of the observations in the "Monthly Weather Report." The Council propose in the place of this work to prepare a series of normal values of climatological elements of the British Isles. Reference was made to the balloon observations and experiments which had been carried out during the year at Blackpool, Sellack, Limerick and Barbados, under the auspices of the Joint Committee appointed by the Society and the British Association.

The Report was adopted, and votes of thanks were given to the Council for their services during the past year, and also to the President and Council of the Institution of Civil Engineers for permitting the Society to hold its meetings in the rooms of the Institution.

The President then presented to Professor Cleveland Abbe the Symons' Gold Medal for 1912. Professor Abbe joined the Weather Service of the United States in 1871, and it is in connection with that organisation that his great life-work has been performed. Apart from a large amount of official work, he is notable mainly for (1) his collection of papers on the "Mechanics of the Earth's Atmosphere," (2) his "Treatise on Meteorological Apparatus and Methods," issued in 1888, (3) his "Preparatory Studies for Deductive Methods in Storm and Weather Predictions," issued in 1890, and (4) his articles on "Meteorology" in the "Encyclopædia Britannica." He was one of the first to realise the importance of experimental investigations of atmospheric radiation, and it was largely due to his enterprise that the well-known researches of Hutchins and Pearson were undertaken. The importance of this work has recently been emphasised by its application to the explanation of the isothermal condition of the upper atmosphere. He has contributed, therefore, to instrumental, statistical, dynamical and thermodynamical meteorology, and also to forecasting.

Professor Abbe said that it gave him the greatest pleasure to have his name associated with that of his dear friend and colleague, George James Symons. He thanked the Society for the honour they had conferred on him in awarding him the medal.

The President delivered an address on "Some Meteorological Observations." He said that meteorology had at the present time reached an important and critical phase in its history. This was due, in the main, to the operation of three principal factors. (1) By the

effluxion of time a mass of observational material had been accumulated which urgently required examination and discussion, with the object of ascertaining the precise meaning and value of the records, and of improving routine methods for the future. (2) The rapid increase of knowledge of the conditions obtaining in the upper atmosphere had modified, and was modifying, current views as to atmospheric phenomena generally, and new interpretations must be placed upon the distributions observed at the surface of the Earth. (3) The importance of applied meteorology in relation to agriculture and other activities of everyday life was becoming more generally recognised. It followed that there was in many directions urgent need for the extended prosecution of research work. Increase of popular interest and public support was necessary, and the active assistance of research workers must be enlisted. It was to be noted that the investigations required were of many different qualifications; they included the criticism and improvement of methods of routine observation, participation in organised exploration of the upper air, investigation of statistical and analytical methods of dealing with data already collected, investigation of mathematical or physical problems, stated as the result of observation, and the examination or re-statement of geographical or other questions affecting the relation of meteorology to the problems of botany and other applied sciences.

A vote of thanks was passed to Dr. Dickson for his services as President during the past year, and also for his address.

The following gentlemen were elected on the Council:—*President*: Dr. H. N. Dickson. *Vice-Presidents*: Mr R. H. Hooker, M.A., Mr. R. G. K. Lempfert, M.A., Mr. H. Mellish, Colonel H. E. Rawson, C.B. *Treasurer*: Dr. C. Theodore Williams. *Secretaries*: Mr. F. Campbell Bayard, LL.M., Commander W. F. Caborne, C.B. *Foreign Secretary*: Mr. R. H. Scott, D.Sc., F.R.S. *Councillors*: Mr. W. W. Bryant, Mr. C. J. P. Cave, M.A., Dr. C. Chree, F.R.S., Mr. F. Druce, M.A., Mr. F. W. Dyson, F.R.S., Mr. E. Gold, M.A., Commander M. W. C. Hepworth, C.B., Mr. R. Inwards, Capt. H. G. Lyons, F.R.S., Mr. Carle Salter, Capt. A. Simpson, and Sir J. W. Towse.

The following new Fellows were elected: Mr. J. G. Cherry, Mr. W. M. Christy, Mr. W. P. James, Mr. W. Tattersall, and Sir Robert Walton.

## SCOTTISH METEOROLOGICAL SOCIETY.

THE Annual Business Meeting of the Society was held at 5, St. Andrew's Square, Edinburgh, on 12th December, 1911, Professor A. Crum Brown, F.R.S., President, in the chair.

The Report from the Council was adopted. As usual it dealt largely with matters of routine, but an important paragraph referred to the financial position of the Society, which was a source of considerable concern. During the past year losses through the

death of old supporters had been unusually numerous, whilst very few new members had been added to the roll. If the annual income from members' subscriptions was not maintained it would be necessary to draw upon the principal of the reserve fund, which the generosity of a number of members' had recently provided, and that the Council would be very reluctant to do. Profound regret was recorded at the death of Professor Chrystal: he had been a director of the Ben Nevis Observatory throughout the whole course of its existence, and had rendered great service in helping to secure funds for the publication of the Observations in complete form.

The following were appointed office-bearers and Council for the ensuing twelve months:—

*President*: Professor A. Crum Brown, M.D., LL.D., F.R.S., F.R.S.E.

*Vice-Presidents*: Ralph Richardson, W.S., C. G. Knott, D.Sc.

*Council*: Sir David Paulin, Gilbert Thomson, H. M. Cadell, Sir A. Buchan-Hepburn, G. G. Chisholm, M. McCallum Fairgrieve, J. Mackay Bernard, J. R. Milne, T. S. Muir. *Hon. Secretaries*: R. T. Omond, E. M. Wedderburn, W.S. *Hon. Treasurer*: W. B. Wilson, W.S.

Thereafter, Mr. Ralph Richardson read a paper, with a strong literary flavour, on "The Climates of Edinburgh and Bournemouth." The personal equation, of course, affected largely the impressions of any individual as to the merits or demerits of the climate of any particular place. R. L. Stevenson, for example—(he was a member of the Society and had read a paper before it)—wrote in bitter terms about the Edinburgh climate, but found that of Bournemouth hardly more favourable for his health. The fact was that he was too confirmed an invalid to suit British weather; his splendid literary career was fitly closed amid the sunshine of Polynesia.

Mr. A. Watt, Secretary, communicated a note supplementary to his paper on "The Mean Annual Rainfall of Scotland, 1871-1910," which had just been published in the Society's Journal, with a coloured map showing the distribution of the rainfall.

## METEOROLOGICAL NEWS AND NOTES.

"No subject would appear to be too gruesome to be treated of in a modern book. A volume entitled *Our Weather* has just appeared."  
—*Punch*.

MESSRS H. SOTHERAN & Co., of 43, Piccadilly, W., send us a well arranged catalogue of second-hand books on Meteorology, Terrestrial Magnetism and Airmanship, in which we notice a number of volumes offered which are not frequently met with. Meteorologists wishing to acquire early works on the subject will do well to consult the list which is peculiarly rich in them.

FLOODS of an extensive and serious nature took place in the Thames Valley as a result of the continued heavy rainfall during



January, following on the downpours of December in the south of England. It is understood to be largely due to increased vigilance and improved lock management by the Thames Conservancy that the water in the lower valley was got away so expeditiously, and gave rise to far less inconvenience than occurred in the memorable floods of 1894.

## INTERNATIONAL BALLOON ASCENTS.

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

*August 5th, 1909.*

Starting Point.	Country.	A miles.	B ° F.	C miles.	D ° F.	E miles.	F
Manchester....	England ....	8·1	—66	10·6	—59	56	E.N.E.
Petersfield ....	" ....	8·1	—65	11·3	—58	12	W.S.W.
Lindenberg....	Germany....	6·9	—61	15·5	?	11	N. by W.
Paris.....	France.....	8·8	—66	10·0	—67	98	S. by W.
Strassburg ....	Germany....	6·6	—66	9·9	—63	41	S.S.W.
Pavia.....	Italy.....	?	?	6·5	—60	72	W. by S.
Pavlovsk .....	Russia .....	8·0	—68	12·2	—51	51	S.E.

A Height in miles of commencement of isothermal column.

B Temperature, F°, at bottom of column.

C Greatest height of reliable record in miles.

D Temperature, F°, at greatest height.

E Distance in miles of point where balloon fell.

F Bearing of falling point from starting point.

On August 4th a high pressure area lay over West France, and a deep cyclone to the North of Iceland, with several ill-defined minima in the South-East of Europe. On the 5th both cyclone and anti-cyclone had moved somewhat to the eastward.

A very remarkable uniformity of temperature is shown. The weakening of the temperature gradient was so gradual that in many cases no definite height could be assigned to the commencement of the isothermal, and this accounts for the large variation of height.

*September 2nd, 1909.*

Starting Point.	Country.	A miles.	B ° F.	C miles.	D ° F.	E miles.	F
Pyrton Hill....	England ....	?	?	8·2	—63	44	S.
Hamburg.....	Germany....	5·9	—53	7·2	—42	55	E.S.E.
Lindenberg....	" ....	6·1	—54	11·0	—56	47	E.N.E.
Strassburg ....	" ....	6·7	—54	15·5	—51	33	E.S.E.
Munich.....	" ....	6·3	—56	7·5	—54	62	N.E. by E.
Vienna.....	Austria ....	6·6	—63	8·0	—61	62	N.E.
Pavia.....	Italy.....	6·3	—56	10·1	—49	34	E.N.E.
Nizhni Oltchedaëff	Russia....	?	?	7·8	—58	39	N.E. by E.

On September 1st depressions lay over Scandinavia and Northern Italy. On September 2nd an anticyclone had advanced over Central Europe, and by September 3rd the whole of Mid- and South Europe was under the influence of an anticyclone.

The figures for Pyrton Hill seem doubtful; apart from Pyrton Hill there is great uniformity in the temperatures, the height of the isothermal and the direction of drift of the balloons.

## RAINFALL TABLE FOR JANUARY, 1912.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	RAINFALL OF MONTH.	
					Aver. 1875— 1909. in.	1912. in.
Camden Square.....	London.....	51 32	0 8	111	1'83	4'08
Tenterden.....	Kent.....	51 4	*0 41	190	2'14	2'76
Arundel (Patching).....	Sussex.....	50 51	0 27	130	2'59	3'70
Southampton (Cadland) ...	Hampshire.....	50 50	1 22	52	2'75	4'64
Oxford (Magdalen College)...	Oxfordshire.....	51 45	1 15	186	1'78	4'35
Wellingborough (Croyland Abbey)...	Northampton....	52 18	0 41	174	1'89	3'15
Shoeburyness.....	Essex.....	51 31	*0 48	13	1'33	2'93
Bury St. Edmunds (Westley) ..	Suffolk.....	52 15	*0 40	226	1'70	2'60
Geldeston [Beccles].....	Norfolk.....	52 27	*1 31	38	1'53	2'12
Polapit Tamar [Launceston] ..	Devon.....	50 40	4 22	315	3'59	4'77
Rousdon [Lyme Regis].....	„.....	50 41	3 0	516	2'94	4'46
Stroud (Upfield).....	Gloucestershire..	51 44	2 13	226	2'33	4'36
Church Stretton (Wolstaston)..	Shropshire.....	52 35	2 48	800	2'51	3'80
Coventry (Kingswood).....	Warwickshire ...	52 24	1 30	340	2'22	4'97
Boston.....	Lincolnshire.....	52 58	0 1	25	1'54	2'71
Worksoy (Hodsock Priory).....	Nottinghamshire ..	53 22	1 5	56	1'70	3'51
Macclesfield.....	Cheshire.....	53 15	2 7	501	2'66	2'62?
Southport (Hesketh Park)..	Lancashire.....	53 38	2 59	38	2'55	3'52
Arncliffe Vicarage.....	Yorkshire, W.R. ..	54 8	2 6	732	6'26	5'37
Wetherby (Ribston Hall) ...	„.....	53 59	1 24	130	1'89	4'48
Hull (Pearson Park).....	„ E.R. ....	53 45	0 20	6	1'70	2'84
Newcastle (Town Moor) ...	Northumberland ..	54 59	1 38	201	1'90	3'28
Borrowdale (Seathwaite) ...	Cumberland.....	54 30	3 10	423	13'44	11'58
Cardiff (Ely).....	Glamorgan.....	51 29	3 13	53	3'65	5'45
Haverfordwest.....	Pembroke.....	51 48	4 58	95	4'69	6'47
Aberystwyth (Gogerddan)..	Cardigan.....	52 26	4 1	83	3'91	2'83
Llandudno.....	Carnarvon.....	53 20	3 50	72	2'51	2'29
Cargen [Dumfries].....	Kirkcudbright... ..	55 2	3 37	80	4'10	4'80
Marchmont House.....	Berwick.....	55 44	2 24	498	2'40	2'53
Girvan (Pinmore).....	Ayr.....	55 10	4 49	207	4'78	6'88
Glasgow (Queen's Park) ...	Renfrew.....	55 53	4 18	144	3'53	2'53
Inveraray (Newtown).....	Argyll.....	56 14	5 4	17	7'34	5'94
Mull (Quinish).....	„.....	56 34	6 13	35	5'55	4'16
Dundee (Eastern Necropolis) ..	Forfar .. ..	56 28	2 57	199	2'01	2'85
Braemar.....	Aberdeen.....	57 0	3 24	1114	2'92	6'44
Aberdeen (Cranford).....	„.....	57 8	2 7	120	2'36	3'43
Cawdor.....	Nairn.....	57 31	3 57	250	2'28	1'14
Fort Augustus (S. Benedict's) ..	E. Inverness .. ..	57 9	4 41	68	5'58	2'47
Loch Torridon (Bendamph) ..	W. Ross.....	57 32	5 32	20	9'42	5'84
Dunrobin Castle.....	Sutherland.....	57 59	3 56	14	2'75	1'73
Wick.....	Caithness.....	58 26	3 6	77	2'48	1'59
Killarney (District Asylum) ..	Kerry.....	52 4	9 31	178	5'94	5'36
Waterford (Brook Lodge).....	Waterford.....	52 15	7 7	104	3'78	5'32
Nenagh (Castle Lough).....	Tipperary.....	52 54	8 24	120	3'88	3'38
Miltoyn Malbay.....	Clare.....	52 52	9 26	400	4'01	3'27
Gorey (Courtown House) ...	Wexford.....	52 40	6 13	80	3'19	5'57
Abbey Leix (Blandsfort)....	Queen's County..	52 56	7 17	532	3'15	3'62
Dublin (Fitz William Square) ..	Dublin.....	53 21	6 14	54	2'14	3'51
Mullingar (Belvedere).....	Westmeath.....	53 29	7 22	367	3'10	4'33
Cong (The Glebe).....	Mayo.....	53 33	9 16	112	4'79	3'24
Crossmolina (Enniscoe).....	Mayo.....	54 4	9 16	74	5'35	4'10
Collooney (Markree Obsy.).....	Sligo.....	54 11	8 27	127	3'87	3'03
Seaforde.....	Down.....	54 19	5 50	180	3'41	5'02
Bushmills (Dundarave).....	Antrim.....	55 12	6 30	162	3'19	3'66
Omagh (Edenfel).....	Tyrone.....	54 26	7 18	280	2'46	3'31

### RAINFALL TABLE FOR JANUARY, 1912—continued.

RAINFALL OF MONTH (con.)					RAINFALL FROM JAN. 1.				Mean Annual 1875- 1909.	STATION.
Diff. from Av. in.	% of Av.	Max. in 24 hours.		No. of Days	Aver. 1875- 1909. in.	1912. in.	Diff. from Aver. in.	% of Av.		
		in.	Date.						in.	
+2.25	223	.67	6	17	...	...	...	...	25.11	Camden Square
+ .62	129	.56	17	20	...	...	...	...	27.64	Tenterden
+1.11	143	.70	8	17	...	...	...	...	30.48	Patching
+1.89	169	.76	17	18	...	...	...	...	31.87	Cadland
+2.57	244	1.06	17	19	...	...	...	...	24.58	Oxford
+1.26	167	.50	17	18	...	...	...	...	25.17	Croyland Abbey
+1.60	197	.54	17	20	...	...	...	...	19.28	Shoeburyness
+ .90	153	.52	23	19	...	...	...	...	25.40	Westley
+ .59	138	.78	6	20	...	...	...	...	23.73	Geldeston
+1.18	133	.84	6	19	...	...	...	...	38.27	Polapit Tamar
+1.52	152	.60	5	19	...	...	...	...	33.54	Rousdon
+2.03	187	.92	17	23	...	...	...	...	29.81	Stroud
+1.29	151	.74	17	21	...	...	...	...	32.41	Wolstaston
+2.75	224	1.24	16	17	...	...	...	...	28.98	Coventry
+1.17	176	.65	6	24	...	...	...	...	23.35	Boston
+1.81	206	.74	6	21	...	...	...	...	24.46	Hodsock Priory
— .04	98	.39	5	15	...	...	...	...	34.73	Macclesfield
+ .97	138	.65	17	17	...	...	...	...	32.70	Southport
— .89	86	.77	8	20	...	...	...	...	61.49	Arncliffe
+2.59	237	.97	16	20	...	...	...	...	26.87	Ribston Hall
+1.14	167	.78	6	19	...	...	...	...	26.42	Hull
+1.38	173	.48	24	20	...	...	...	...	27.94	Newcastle
—1.86	86	2.35	16	19	...	...	...	...	129.48	Seathwaite
+1.80	149	.75	8	22	...	...	...	...	42.28	Cardiff
+1.78	138	.98	5	18	...	...	...	...	46.81	Haverfordwest
—1.08	72	.65	4	17	...	...	...	...	45.46	Gogerddan
— .22	91	.47	6	14	...	...	...	...	30.36	Llandudno
+ .70	117	1.80	16	17	...	...	...	...	43.47	Cargen
+ .13	105	.37	24	22	...	...	...	...	33.76	Marchmont
+2.10	144	1.03	17	23	...	...	...	...	49.77	Girvan
—1.00	72	.38	16	18	...	...	...	...	35.97	Glasgow
—1.40	81	1.32	15	21	...	...	...	...	68.67	Inveraray
—1.39	75	.93	12	16	...	...	...	...	56.57	Quinish
+ .84	142	1.14	8	16	...	...	...	...	28.64	Dundee
+3.52	220	...	...	...	...	...	...	...	34.93	Braemar
+1.07	145	1.00	8	21	...	...	...	...	32.73	Aberdeen
—1.14	50	.33	26	5	...	...	...	...	29.33	Cawdor
—3.11	44	.72	2	19	...	...	...	...	44.53	Fort Augustus
—3.58	62	1.21	2	15	...	...	...	...	83.93	Bendamph
—1.02	63	.37	5	8	...	...	...	...	31.90	Dunrobin Castle
— .89	64	.26	5	22	...	...	...	...	29.88	Wick
— .58	90	.76	15	20	...	...	...	...	54.81	Killarney
+1.54	141	.76	15	18	...	...	...	...	39.57	Waterford
— .50	87	.77	5	16	...	...	...	...	39.43	Castle Lough
— .74	82	.51	6	20	...	...	...	...	45.11	Miltown Malbay
+2.38	175	1.56	15	19	...	...	...	...	34.99	Courtown Ho.
+ .47	115	.57	10	17	...	...	...	...	35.92	Abbey Leix
+1.37	164	.77	6	19	...	...	...	...	27.68	Dublin
+1.23	140	.62	5	20	...	...	...	...	36.15	Mullingar
—1.55	68	.65	5	16	...	...	...	...	48.90	Cong
—1.25	77	.70	12	20	...	...	...	...	52.87	Enniscoe
— .84	78	.50	8	15	...	...	...	...	42.71	Markree
+1.61	147	1.23	8	20	...	...	...	...	38.91	Seaforde
+ .47	115	1.05	15	18	...	...	...	...	37.56	Dundarave
					...	...	...	...	39.38	Omagh

## SUPPLEMENTARY RAINFALL, JANUARY, 1912.

Div.	STATION.	Rain inches	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road.	3·18	XI.	Lligwy .....	1·73
„	Ramsgate .....	2·40	„	Douglas .....	...
„	Hailsham .....	3·22	XII.	Stoneykirk, Ardwell House...	4·94
„	Totland Bay, Aston House...	4·12	„	Dalry, The Old Garroch.....	8·87
„	Stockbridge, Ashley.. .....	4·34	„	Langholm, Drove Road .....	4·01
„	Grayshott .....	3·51	„	Beattock, Kinnelhead .....	3·61
„	Reading, Caversham Lock ...	3·58	XIII.	St. Mary's Loch, Cramilt Ldge	4·08
III.	Harrow Weald, Hill House...	3·27	„	North Berwick Reservoir.....	1·39
„	Pitsford, Sedgebrook.....	3·45	„	Edinburgh, Royal Observaty.	1·14
„	Woburn, Milton Bryant.....	4·00	XIV.	Maybole, Knockdon Farm ...	2·86
„	Chatteris, The Priory.....	3·18	XV.	Campbeltown, Witchburn ..	4·44
IV.	Colchester, Lexden .....	2·47	„	Glenreasdell Mains .....	4·83
„	Newport.....	3·32	„	Holy Loch, Ardnadam .....	6·80
„	Ipswich, Copdock .....	2·31	„	Ballachulish House .....	8·25
„	Blakeney.....	2·38	„	Islay, Eallabus .....	4·25
„	Swaffham .....	2·64	XVI.	Dollar Academy .....	4·11
V.	Bishops Cannings .....	(4·28)	„	Balquhidder, Stronvar.....	8·89
„	Winterbourne Steepleton.....	7·58	„	Coupar Angus .....	3·97
„	Ashburton, Druid House.....	7·45	„	Glenlyon, Meggernie Castle..	8·66
„	Cullompton .....	4·95	„	Blair Athol .....	6·29
„	Lynmouth, Rock House .....	4·89	„	Montrose, Sunnyside Asylum.	2·96
„	Okehampton, Oaklands.....	3·83	XVII.	Alford, Lynturk Manse .....	5·12
„	Hartland Abbey.....	3·17	„	Fyvie Castle .....	4·83
„	Probus, Lamellyn.....	4·46	„	Keith Station .. ..	3·54
„	North Cadbury Rectory.....	4·67	XVIII.	Skye, Dunvegan .....	5·97
VI.	Clifton, Pembroke Road.....	3·92	„	N. Uist, Lochmaddy .....	2·87
„	Ross, The Graig .....	4·03	„	Glenquoich, Loan.....	11·70
„	Shifnal, Hatton Grange.....	3·84	„	Alvey Manse.....	1·32
„	Droitwich .....	3·79	„	Loch Ness, Drumadrochit...	·96
„	Blockley, Upton Wold.....	5·17	„	Glencarron Lodge .....	6·05
VII.	Market Overton.....	3·52	XIX.	Invershin .....	2·36
„	Market Rasen.....	2·58	„	Loch Stack, Ardochullin .....	4·42
„	Bawtry, Hesley Hall .....	3·20	„	Melvich .....	2·80
„	Derby, Midland Railway.....	3·98	XX.	Skibbereen Rectory .....	5·80
„	Buxton .....	5·40	„	Dunmanway, The Rectory ..	7·26
VIII.	Nantwich, Dorfold Hall .....	3·57	„	Cork .....	...
„	Chatburn, Middlewood .....	4·03	„	Mitchelstown Castle.....	3·92
„	Cartmel, Flookburgh .....	3·63	„	Darrynane Abbey.....	5·12
IX.	Langsett Moor, Up. Midhope	4·99	„	Clonmel, Bruce Villa .....	4·66
„	Scarborough, Scalby .....	3·86	„	Newmarket-on-Fergus,Fenloe	2·99
„	Ingleby Greenhow .....	3·29	XXI.	Laragh, Glendalough .....	9·22
„	Mickleton .....	2·38	„	Ballycumber, Moorrock Lodge	2·56
X.	Bellingham, High Green Manor	2·77	„	Balbriggan, Ardgillan .....	3·55
„	Ilderton, Lilburn Cottage ...	2·83	XXII.	Woodlawn .....	3·52
„	Keswick, The Bank.....	4·46	„	Westport, St. Helens ...	3·72
XI.	Llanfrehfa Grange .....	6·63	„	Achill Island, Dugort .....	5·27
„	Treherbert, Tyn-y-waun .....	11·14	„	Mohill, The Rectory .....	3·91
„	Carmarthen, The Friary .....	4·61	XXIII.	Enniskillen, Portora.....	4·23
„	Castle Malgwyn [Llechryd]...	4·49	„	Dartrey [Cootehill] .....	4·04
„	Crickhowell, Tal-y-maes .....	5·50	„	Warrenpoint, Manor House ...	5·46
„	New Radnor, Ednol .....	4·50	„	Banbridge, Milltown .....	2·61
„	Rhayade, Tyrmynydd .....	6·62	„	Belfast, Cave Hill Road .....	3·32
„	Lake Vyrnwy .....	5·16	„	Glenarm Castle.....	5·76
„	Llangyhanfal, Plâs Draw.....	2·97	„	Londonderry, Creggan Res...	2·90
„	Dolgelly, Bryntirion.....	5·33	„	Killybegs .....	3·71
„	Bettws-y-Coed, Tyn-y-bryn...	3·37	„	Horn Head .....	3·20

## METEOROLOGICAL NOTES ON JANUARY, 1912.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow; F for number of days Frost in Screen; f on Grass.

LONDON, CAMDEN SQUARE.—The dull wet weather of December continued throughout January, and until the last week it was unusually mild. The duration of R, 88·8 hours, was the greatest recorded in January in the past 32 years. The duration of sunshine was only 19·7\* hours, and none at all was recorded from 10th to 26th inclusive. Mean temp. 40°·2, or 1°·7 above the average, and the ninth successive month with temp. above the average. Evaporation 24 in. Shade max. 51°·7 on 6th; min. 17°·7 on 29th. F 8, f 10.

TENTERDEN.—Warm, dull month, with a good deal of fog. Duration of sunshine, 29·0† hours. Shade max. 52°·0 on 9th; min. 23°·0 on 29th. F 6, f 14.

TOTLAND BAY.—Duration of sunshine, 39·1\* hours, the lowest ever registered in January. Shade max. 51°·4 on 8th; min. 25°·9 on 29th. F 5, f 9.

PITSFORD.—Mean temp. 35°·1. Shade max. 50°·3 on 1st; min. 16°·6 on 29th. F 16.

WINTERBOURNE STEEPLTON.—R more than double the average of 20 years. Shade max. 52°·1 on 1st; min. 20°·0 on 29th. F 11, f 14.

ROSS.—Shade max. 52°·8 on 6th; min. 11°·9 on 21st. F 11.

HODSOCK PRIORY.—The R has only been exceeded once in January during the previous 36 years, viz., in 1895, when 3·54 in. was recorded. Shade max. 55°·5 on 1st; min. 14°·5 on 29th. F 15, f 26.

SOUTHPORT.—Duration of sunshine 38·5\* hours, and of R 105·0 hours. Mean temp 38°·2. Shade max. 53°·0 on 1st; min. 19°·0 on 29th. F 14, f 22.

HULL.—Shade max. 52°·0 on 1st; min. 19°·0 on 29th. F 11, f 17.

HAVERFORDWEST.—Mild, stormy and wet till 16th; fine and cold generally after. Duration of sunshine 55·5\* hours. Shade max. 58°·5 on 16th; min. 17°·0 on 30th. F 15.

LLANDUDNO.—Shade max. 54°·0 on 1st and 13th; min. 25°·0 on 28th and 29th.

CARGEN.—Vegetation, which had been too forward of late, received a seasonable check. Shade max. 50°·5 on 1st; min. 22°·0 on 8th. F 15.

EDINBURGH.—Shade max. 53°·7 on 1st; min. 21°·9 on 29th. F 16, f 19.

COUPAR ANGUS.—The precipitation was persistent until the 25th, with a heavy fall of soft S on 8th. Temp. was above mean to 27th, but the closing days were cold. Shade max. 51°·5 on 1st; min. 17°·0 on 8th. F 1.

DRUMNADROCHIT.—R 2·81 in. below the average of 26 years, and the lowest ever recorded in January.

LOCH STACK.—Duration of sunshine, 31·2 hours.

MITCHELSTOWN.—The early part was wet and mild, and the latter part cold and frosty. Shade max. 51°·0 on 5th; min. 16°·0 on 31st. F 14.

DUBLIN.—Mild, rainy month until 21st, afterwards cold and drier to the close. Mean temp. 42°·2. Shade max. 53°·2 on 13th; min. 27°·1 on 30th. F 4, f 11.

MARKREE.—The first part was very rainy, but heavy on some days. Frosty from the 21st. Shade max. 53°·4 on 1st; min. 17°·0 on 30th. F 14, f 17.

WARRENPOINT.—Shade max. 52°·0 on 2nd; min. 31°·0 on 29th. F 2, f 11.

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\* Campbell-Stokes.

† Jordan.

## Climatological Table for the British Empire, August, 1911.

STATIONS  (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain		Aver. Cloud.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
London, Camden Square	97°1	9	48°4	31	57°9	53°0	57°8	73	135°3	44°1	·49	7	4·5
Malta ... ..	94°0	1	73°4	20	86°8	75°7	70°6	73	148°8	...	·00	0	1·9
Lagos ... ..	87°2	4	69°0	18†	84°8	71°8	69°2	77	149°0	66°0	·30	7	...
Cape Town ... ..	78°6	31	39°1	27	62°2	47°3	47°2	77	...	...	2·31	13	5·6
Durban, Natal ... ..	79°9	15*	48°4	26	73°7	54°9	53°1	...	137°2	...	1·07	6	2·9
Johannesburg ... ..	73°0	23	28°5	31	63°7	41°9	38°2	68	124°7	27°1	·00	0	1·9
Calcutta ... ..	92°6	3	76°9	11	88°8	79°1	78°0	86	...	74°5	8·49	19	8·5
Bombay ... ..	86°3	10	74°4	5	83°9	77°2	75°4	85	128°0	72°8	16°90	30	8·7
Madras ... ..	103°7	15	73°9	11	97°1	78°9	72°4	69	148°0	71°7	2·16	16	5·9
Kodaikanal ... ..	68°4	25	47°4	15	64°6	50°9	47°2	72	148°3	36°2	2·08	10	5·5
Colombo, Ceylon ... ..	87°7	19	73°5	21	86°0	76°2	73°5	78	150°8	70°1	1°30	5	6·4
Hongkong ... ..	93°1	26	74°3	6	86°2	78°4	75°8	82	141°6	...	30°06	16	6·9
Sydney ... ..	71°3	31	43°1	1	62°5	48°2	45°2	76	119°9	32°9	7·49	23	4·3
Melbourne ... ..	72°2	31	38°2	27	61°0	47°4	44°1	69	125°3	31°0	1°37	9	6°5
Adelaide ... ..	65°0	31	37°9	21	65°1	47°9	45°5	68	138°9	28°6	°76	12	5°4
Perth ... ..	76°2	24	36°0	9	62°6	46°2	46°5	77	127°2	27°9	3°35	12	4°8
Coolgardie ... ..	76°4	29	34°4	20	63°0	42°1	40°2	64	140°0	30°0	°53	12	4°8
Hobart, Tasmania ... ..	67°0	7	34°2	27	56°5	41°9	41°3	70	116°0	30°5	1°30	14	5·9
Wellington ... ..	61°2	17	36°6	11	54°4	43°9	37°4	64	99°0	29°0	1°36	14	5°6
Auckland ... ..	62°0	3, 4	40°0	10	58°6	46°3	46°0	73	98°0	37°0	3°23	20	5°4
Jamaica, Kingston ..	95°0	15	69°9	29	91°7	73°9	70°8	74	...	...	1°48	7	4°0
Grenada ... ..	90°0	21	74°0	sev.	84°4	75°1	...	77	141°0	...	7°93	27	5°0
Toronto ... ..	89°8	8	47°2	30	79°4	59°2	...	...	105°7	42°5	2°42	12	4°7
Fredericton ... ..	87°8	10	40°0	24	75°5	52°8	...	76	...	...	4°03	5	4°9
St. John, N.B. ... ..	80°3	5, 6	50°0	31	69°5	56°4	...	...	...	...	3°15	9	5°1
Victoria, B.C. ... ..	79°5	23	46°2	16	69°3	51°0	...	71	...	...	°68	3	4°0
Dawson ... ..	81°0	2	31°0	19	67°7	39°0	...	...	...	...	1°39	9	5°0

\* and 16.

† and 28.

MALTA.—Mean temp. of air 80°·6. Average bright sunshine 11·9 hours.

Johannesburg.—Bright sunshine, 298·5 hours.

KODAIKANAL.—Bright sunshine, 214 hours.

COLOMBO.—Mean temp. of air 81°·1, or 0°·5 above, of dew point 0°·2 above, and R 2·20 in. below, averages. Mean hourly velocity of wind 7·0 miles. TS on 20th.

HONGKONG.—Mean temp. of air 81°·9. R 15·80 in. above the average. Bright sunshine 190·5 hours. Mean hourly velocity of wind 11·9 miles. Strong gales 4th to 5th.

Sydney.—Mean temp. of air 0°·5 above, and R 3·20 in. above, averages.

Melbourne.—Mean temp. of air 3°·3 above, and R ·45 in. below, averages.

Adelaide.—Mean temp. of air 56°·5, or 2°·7 above, R 1·62 in. below, averages.

Only one drier August in 54 years, in 1860.

Perth.—Mean temp of air 1°·6 below, and R 2·35 in. below, records.

Coolgardie.—Mean temp. of air 0°·8 below, and R ·44 in. below, averages.

Hobart.—Mean temp of air 1°·2 above, and R ·51 in. below, averages.

Wellington.—Mean temp. of air 0°·8 above, and R 3·39 in. below, averages. Bright sunshine 170·4 hours.

Auckland.—Mean temp. exactly the average. Rainfall an inch below average of last 44 years.