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The Weather of the Past Winter—Some Comparisons

The winter of 1929-30 was characterised by an abrupt change from extraordinarily mild, stormy and rainy weather in December and January to very dry and rather cold weather in February, with persistent northeasterly winds over England. The change in the pressure distribution was equally marked; in December and January pressure was more than 15mb. below normal between Iceland and the Faeroes, in February pressure was more than 10mb. above normal over the Faeroes and Shetlands. The deviations of pressure from normal in each of these three months are shown on the right-hand side of Fig. 1, which brings out very clearly the almost complete reversal between January and February.

Reversals of this nature, associated with a sudden and complete change in the general type of weather over the British Isles, are not infrequent, though they are probably more common in spring than in winter. An interesting example occurred in March and April, 1912, a deficit of 10mb. in March giving place to an excess of 10mb. in April, when rainy stormy weather was replaced by quiet anticyclonic conditions with complete rainlessness.* A detailed study of this case showed that the excess of pressure had travelled slowly northeastward from the Azores, at the same time growing more intense, and it is probable that the

* *London, Q.J.R. Meteor. Soc.*, 52, 1926, *p*. 263.

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change in 1930 was brought about in the same way, for pressure at Horta in January was 6·5mb. above normal.

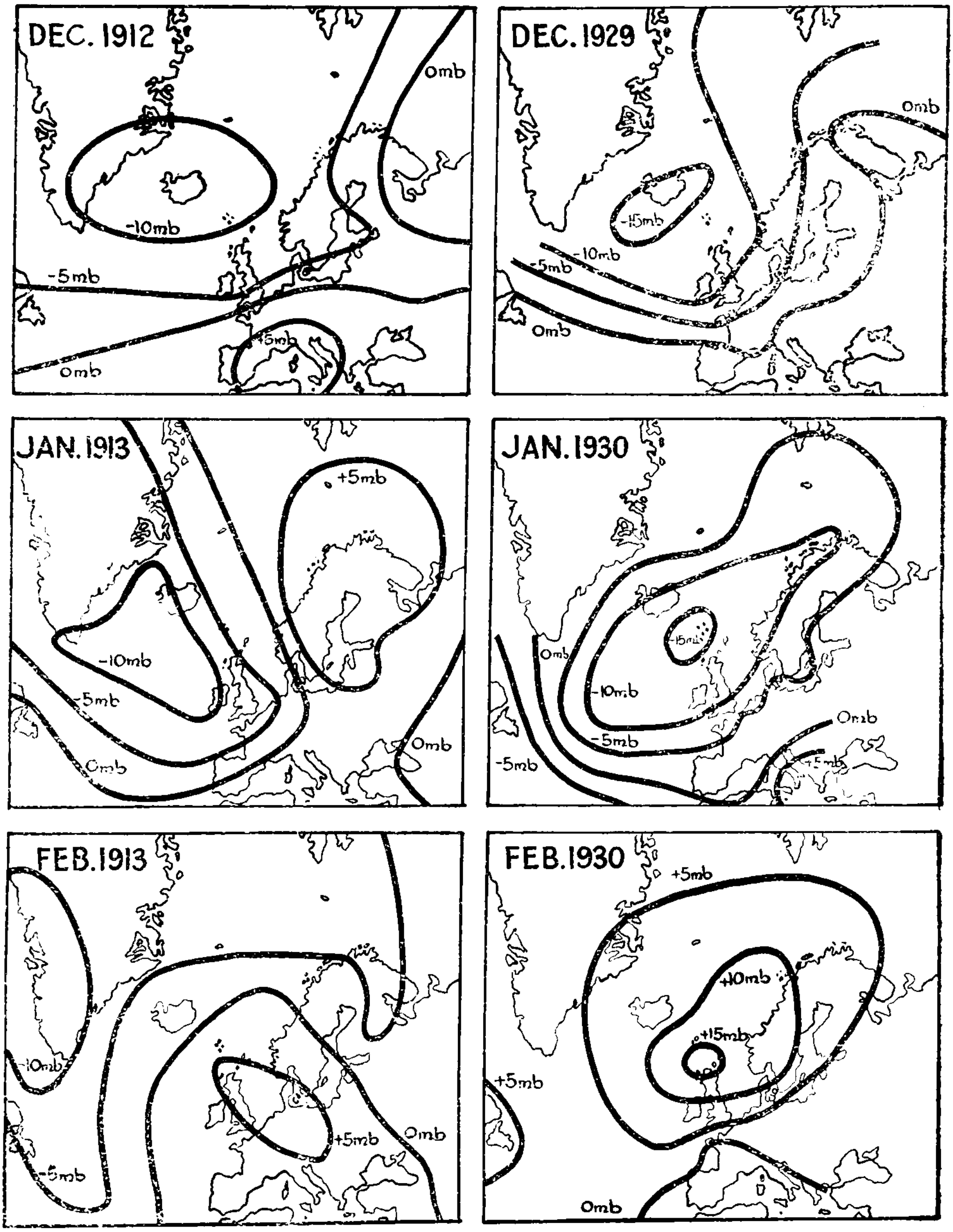
Although February, 1930, was dry, it has not been especially cold, in that respect comparing favourably with February, 1895, which had a distribution of pressure at first sight rather similar. The deviations from normal in the latter month were illustrated in the *Meteorological Magazine* for May, 1924, p. 80. Pressure was more than 15mb. above normal over Iceland, and about normal over the English Channel, giving a month of strong easterly winds. The difference between the two months probably lay in the pressure distribution over Europe, which in 1895, and again in February, 1929, permitted a continuous stream of cold air from eastern Europe and Siberia to reach these islands. A chart showing the actual distribution of pressure in February, 1930, as distinct from a chart of deviations from normal, shows a narrow ridge of high pressure extending from the Azores northeastward across the British Isles to southern Scandinavia, where it exceeded 1,024mb. Over the rest of Europe the pressure gradients were on the average slight and irregular, and there was no continuous current from Siberia. Probably much of the air which formed our northeast winds came as a descending current from higher levels of the atmosphere, the remainder coming partly from the northern North Atlantic, partly from the eastern Mediterranean, and only to a very small extent from Russia. It is interesting to note that the pressure distribution during February, 1930, resembled rather closely that during January, 1929, which was not nearly so cold as the following month.

The most striking parallel, however, lies between the winter of 1929-30 and that of 1912-3. The charts of pressure deviations are shown side by side in Fig. 1, and the similarity is apparent at a glance. The weather sequence also was closely similar, as is shown by the headings from the corresponding issues of the *Monthly Weather Report* :—

	1912-3.	1929-30.
December	Stormy and mild.	Mild, abnormally wet and Stormy, but with frequent sunny periods.
January	Stormy and wet.	Mild and wet. Violent gales on 1st to 3rd and on 12th.
February	Cloudy and dry—one foggy week.	—

The official epigram on February, 1930, has yet to be composed, but the particulars given on p. 51 of this issue show that the weather was cold and dry and cloudy in England, though fortunately we escaped the week of fog.

There is one other point of similarity between 1929-30 and 1912-3, which may or may not be relevant. The spring months of both 1912 and 1929 were remarkable for the enormous numbers of icebergs which were carried by the Labrador Current over the Newfoundland Banks and into the North Atlantic. In this respect these two years stand almost in a class apart, though



PRESSURE ANOMALIES IN TWO WINTERS.

1905 was somewhat similar. It should be noted, however, that the winter of 1905-6 presented no particular resemblance to 1929-30.

Over the continent of Europe, as in Great Britain, the months of December and January were abnormally warm, the temperature from Warsaw to the Rhine averaging about 6°F. above normal in both months. December was rainy in almost all districts, but January was remarkably dry, only small parts of Germany and Austria exceeding the normal rainfall. Such information as is available for February is given on p. 52.

C. E. P. BROOKS.

The Heavy Rain of November 11th, 1929

By J. GLASSPOOLE, Ph.D.

In view of the large rainfall amounts reported from the Rhondda Valley during November and December, 1929, an inspection was authorised by the Director of the Meteorological Office, and on December 19th and 20th I visited Pontypridd and the two valleys immediately to the north.

The largest amounts for November 11th (*i.e.*, for the 24 hours commencing at 9 a.m. on the 11th) are:—

	in.
Rhondda (Lluest Wen Reservoir)	8·31
,, (Lluest Wen Filter)	6·20
Treherbert (Tynywaun)	5·25
Llyn Fawr Reservoir	4·98
Glyncorrwg Colliery	4·93
Rhondda (Castell Nos Reservoir)	4·72

All the stations are in Glamorgan and the actual values are shown on the map. The catchment area of the two streams draining to Porth is indicated, together with the contours of 500, 1,000 and 1,500 feet, and the isohyetal lines showing the probable distribution of the rainfall over the valleys are given.

In the British Isles, falls exceeding 8in. in a single rain-day are very rare and one of the main objects of the inspection was to see if there was any reason to doubt the authenticity of the fall of 8·31in. at Lluest Wen Reservoir. No such reason could be discovered and the reading has therefore been accepted. The rainfall records of this country contain only five previous examples of daily falls (9h. to 9h.) exceeding 8in. They are given in the table below, and it will be seen that three of them

County	Station	Amount	Date
		in.	
Somerset ...	Bruton (Sexey's School) ...	9·56	June 28th, 1917
,, ...	Cannington (Brymore House)	9·40	August 18th, 1924
,, ...	Bruton (King's School) ...	8·48	June 28th, 1917
,, ...	Aisholt (Timbercombe) ...	8·39	June 28th, 1917
Inverness ...	Loch Quoich (Kinlochquoich)	8·20	Oct. 11th, 1916
Cumberland	Borrowdale (Seathwaite) ...	8·03	Nov. 12th, 1897

refer to the same date, June 28th, 1917. The fall of 8·31in.

on November 11th, 1929, has been exceeded, therefore, on only two previous rain-days. Both these occasions were "summer" rains, and the amounts shown in the table were measured at stations whose average annual fall is from 30 to 35in. The average annual fall at Lluest Wen Reservoir is about 88in. The fall of 8·31in. on November 11th, 1929, is therefore a record "winter" rain and also a record for the "wet" stations.

The gauge at Lluest Wen Reservoir was only set up in 1915, but other gauges have been in operation at the works in the upper Rhondda-fach valley since 1888. The previous largest values recorded there in one day are :—

1928 February 5th ...	4·10in.	1913 April 27th ...	4·40in.
1920 November 15th ...	4·12in.	1891 April 30th ...	4·26in.

The general meteorological conditions associated with the storm of November 11th were discussed in the *Meteorological Magazine*, 1929, pp. 249-52. It should be noted, however, that so far as the Rhondda Valleys were concerned the rainfall was steady and persistent, and no comments of abnormal intensities, so typical of the passage of a "cold front," were noted.* There is definite evidence that the rainfall ceased at 3 a.m. on the 12th, so that the whole of the rain can be credited to 18 hours. Comparing the effect of the rain in the area where over 8in. fell, with that noted after the Cannington storm of August 18th, 1924,† there is no doubt that the greatest intensity on November 11th was appreciably less than an inch an hour and probably the intensity hardly exceeded half-an-inch an hour. Recording rain-gauges were in operation at Swansea, 19 miles to the west-south-west of Lluest Wen Reservoir, and at Cray Reservoir, 13 miles to the north-north-west. On the chart for Swansea there is some indication of a slight increase in the intensity of rainfall after 8 p.m. on the 11th, but at Cray Reservoir the rain was practically uniform throughout the whole time. The amounts for successive hours at these two stations are set out below :—

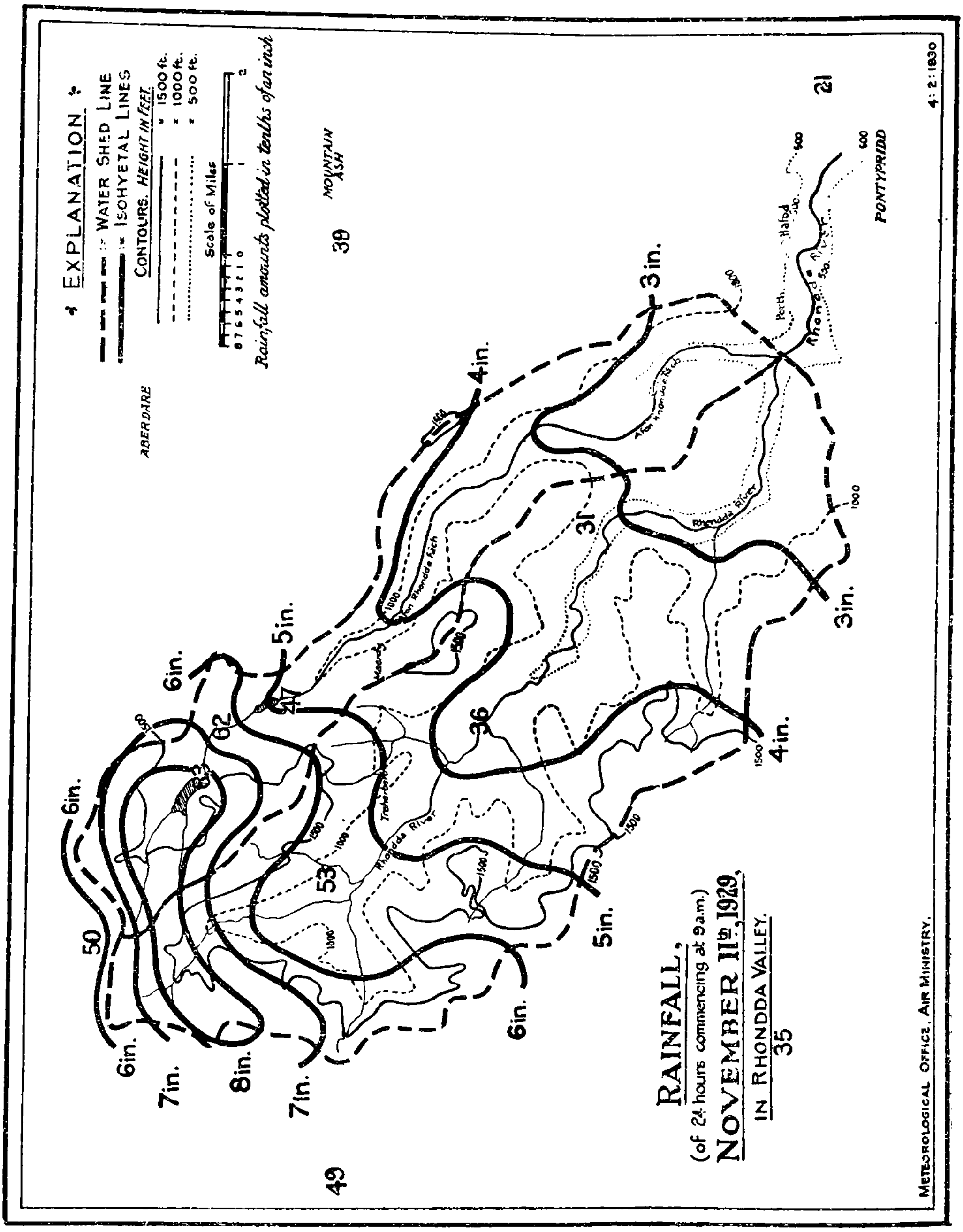
RAINFALL DURING SUCCESSIVE HOURS ON NOVEMBER 11TH, 1929.

For the hour ending	10h.	11h.	12h.	13h.	14h.	15h.	16h.	17h.	18h.	19h.	20h.	21h.	22h.	23h.	24h.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Cray Reservoir	·22	·23	·21	·28	·24	·18	·18	·27	·28	·19	·20	·20	·19	·17	·20
Swansea (Morriston Park)	·08	·25	·24	·20	·19	·10	·11	·11	·07	·05	·03	·19	·25	·22	·08

At Cannington, on August 18th, 1924, 8 inches of rain and hail

* From the Article by Mr. Absalom in the *Meteorological Magazine* for December, 1929, under the title of the Storm of November 11—12th, it is apparent that the "cold front" crossed the Rhondda Valley about 22h. on the 11th. It will be interesting to know whether any autographic records which are not yet available throw any light on the question whether the orographical effect in the Rhondda Valley was sufficient to mask the variation of intensity due to the passage of the cold front. An alternative explanation may be that the rains of the Rhondda Valley were caused by some local disturbance subsidiary to the main depression.

†See the *Meteorological Magazine*, 1924, p. 187 and p. 205.


EXPLANATION
WATER SHED LINE
ISOHYETAL LINES
CONTOURS. HEIGHT IN FEET.
1500 ft.
1000 ft.
500 ft.
Scale of Miles
Rainfall amounts plotted in tenths of an inch
ABERDARE
MOUNTAIN ASH
39
21
PONTYPRIDD
4:2:1930
Porth
Hafod
Rhondda River
Rhondda Fach
Treherbert
31
36
47
53
62
83
50
49
35
3in.
4in.
5in.
6in.
7in.
8in.
RAINFALL,
(of 24 hours commencing at 9 a.m.)
NOVEMBER 11th, 1929,
IN RHONDDA VALLEY.
METEOROLOGICAL OFFICE, AIR MINISTRY.

fell in 5 hours, so that the rainfall was nearly four times as intense as that of November 11th. The former rain was therefore associated with ascending currents of a much greater vertical velocity than prevailed during the cyclonic rain in the later case. At Cray Reservoir, 15 miles to the north-north-west, the water rose 5 feet in 10 hours on the 11th, and this rise in the reservoir corresponds to 2 inches of water over the whole catchment area of 2,600 acres (4 sq. miles) in 10 hours.

The areas in the Rhondda Valleys covered by rainfalls exceeding certain specified amounts are set out below :—

more than 8in.	2 sq. miles	more than 4in.	21 sq. miles
,, 7in.	5 ,,	,, 3in.	32 ,,
,, 6in.	9 ,,	,, 2in.	37·5 ,,
,, 5in.	14 ,,		

These estimates correspond fairly closely to those made in the case of the Cannington storm of August 18th, 1924, when the corresponding values were 3, 5, 7. 10, 13, 27 and 47 sq. miles.* As already mentioned there was an important difference, however, for on August 18th, 1924, the bulk of the rain fell in 5 hours, while on November 11th, 1929, the rain lasted 18 hours.

The general average annual rainfall over the two areas draining to Porth is set out below, together with estimates of the general rainfall over the area for the rainfall days November 11th and November 18th and 19th.

Catchment area	Area	General rainfall		
		Average annual	Nov. 11	Nov. 18 and 19
	sq. miles	in.	in.	in.
Rhondda-fach River ...	12·0	82	4·8	6·6
Rhondda River	25·5	85	4·7	6·8
Rhondda Valley above Porth ...	37·5	84	4·7	6·7

If it be assumed that the only loss from the whole Rhondda Valleys is that due to evaporation, and that the evaporation is 15in. a year, then the mean flow at Porth would be of the order of 103 million gallons per day. The flow would, of course, be greater in winter and less in summer. The total volume of rain over the Rhondda Valleys on November 11th is computed to be 2,570 million gallons, of which the volumes in the two valleys were about 830 and 1,740 million gallons respectively. The bulk of this rain fell in 18 hours. The evaporation at this time of the year is small, and as there was fairly heavy rain on each day from November 5th to 10th, practically the whole of this volume of rain would have to flow past Porth. Following 6 days with very litle rain there was on November 18th and 19th a

*_British Rainfall_, 1924, p. 246.

general rainfall over the Rhondda Valleys above Porth of 6·7in., of which about 60 per cent., or 4·0in., fell during the 24 hours ending at 4 p.m. on the 19th. This corresponds to about 2,200 million gallons of rain in 24 hours.

Flooding at Porth and Hafod has occurred repeatedly in earlier years, but never with such severity as in November, 1929. The last occasion on which very severe damage occurred was July, 1911. The hillsides are generally steep and bare, so that the run-off is rapid and the river rises and falls quickly. At Hafod, the river rose 2ft. in 1½ hours, with a total rise of 10ft. on the 11th, and subsided soon after the rain ceased. Severe flooding occurred on the afternoon of the 11th, and on the four successive Mondays, November 18th, 25th, and December 2nd and 9th, when additional heavy rains fell on saturated ground. At Treherbert (Tynywaun) the rainfall from 4 p.m. on November 18th to 4 p.m. on the 19th amounted to 5·71in. In the upper Rhondda Valleys the subsequent heavy rains credited to the rainfall days were:—November 24th and 25th, nearly 4in.; December 1st and 2nd nearly 3in.; December 6th, 7th and 8th nearly 5in. On November 11th some 625 houses were known to be flooded, while during the second flood the water entered over 700 houses. The general level on the second occasion was similar to that on the 11th.

The area has the disadvantage that subsidences over the coal measures are common. Thus bridges which were originally erected clear of the river in flood, now obstruct the flow. At Porth, a bridge which, when built in 1897 was some 8ft. above the normal level of the river, now stands within a couple of feet. Similarly many houses which previously were clear of floods have subsided so that now they are in danger of flooding. Near Hafod, parts of the district have subsided 23ft. through colliery workings since 1875.

I am indebted to Mr. Octavius Thomas and Mr. H. E. Maltby, the Water Engineers at Rhondda and Pontypridd, for the facilities they kindly afforded me to inspect the raingauges under their control, and to the Surveyor and Medical Officer of Health at Rhondda for many of the facts incorporated in this report.

OFFICIAL PUBLICATIONS

The following publications have recently been issued.

GEOPHYSICAL MEMOIRS.

No. 48. *The Meteorological Results of Journeys in the southern Sahara,* 1922 *and* 1927, made by F. R. Rodd. F.R.G.S., discussed by C. E. P. Brooks, D.Sc., and S. T. A. Mirrlees, M.A. (M.O. 307h.)

In 1922 Mr. F. R. Rodd visited the region between Nigeria and Aïr in the southern Sahara; in 1927 the outward journey was made over approximately the same route as before, but the return journey was westward from Aïr to the Niger near Timbuctoo.

Meteorological observations were made regularly during both expeditions and over much of the area these are the first observations available. In addition, between May and September, 1927, several autographic records of pressure and temperature were obtained. The temperature records are especially interesting for the light which they throw on the conditions under which rain falls in a great desert. On fine days the temperature rises steadily to a maximum about 3 p.m., to fall gradually during the late afternoon. On other days the temperature rises until about noon, when it falls suddenly by ten to twenty degrees, while at the same time a "tornado" brings a sudden shift of wind and frequently a storm of rain.

The high day temperatures are sometimes associated with very low humidities, but the daily range of temperature may be so great that dew forms at night, and frost is not unknown.

The winds are discussed in detail, and the structure of the south-west monsoon in the southern Sahara is also analysed by means of observations of cloud motion. Observations of visibility, mirage and other phenomena are discussed, and in an appendix the daily meteorological journal is given in full.

The Dines Balloon Meteorograph and the method of using it. By L. H. G. Dines, M.A. (M.O., 321.)

The pamphlet describes in detail a form of very light meteorograph which has been used by the Meteorological Office for many years in connexion with observations of the upper atmosphere made in Great Britain by means of small free balloons. Full instructions based on the experience gained, are given covering the whole process of making such soundings. Various pieces of auxiliary apparatus are described, which have been developed in connexion with the work.

Royal Meteorological Society

The monthly meeting of this Society was held on Wednesday, February 19th, at 49, Cromwell Road, South Kensington, Mr. R. G. K. Lempfert, M.A., F.Inst.P., President, in the Chair.

Dr. G. C. Simpson, C.B., F.R.S.—The Distribution of Terrestrial Radiation.

(*a*) The geographical distribution of incoming and outgoing radiation during January and July is determined and exhibited on maps.

(*b*) The incoming and outgoing radiations for each 10° zone of latitude are calculated for each month of the year.

(*c*) The result indicates great uniformity in the intensity of the outgoing terrestrial radiation, both in time and space, and that except for small uncertain irregularities the total outgoing radiation from the earth as a whole just balances the incoming solar radiation at all periods of the year.

C. K. M. Douglas, B.A.—The Cyclonic Depressions of November 16th and 23rd, 1928.

Autographic records were reproduced showing the conditions close to the centres of these two intense cyclones. These showed that in both cases the first cold front soon advanced beyond the trough line of the cyclone. This happens with nearly all intense cyclones, owing to the fact that the gradient wind behind the cold front is much greater than the rate of travel of the cyclone itself, even when this is large. It was found that the speed of advance of these cyclones was greater than that of the general current in which they travelled. This "excess velocity" is characteristic of systems with warm sectors.

Correspondence

To the Editor, *The Meteorological Magazine.*

Thunderbolt in southern New Zealand

A single thunderbolt of unusual violence was reported on January 20th at Stewart Island, at the southern extremity of New Zealand. The thunderbolt flashed down the valley on Half Moon Bay and struck a small steamer tied to the wharf.

According to the newspaper account, "the thunderbolt tore three feet from the head of the foremast, the timber reaching the sea astern of the vessel. The ship's lamps were broken, a steel wire cable was burned through, the front of the wheel house was splintered, and twelve feet of heavy timber was shattered along the port bow. The ship's compass was rendered useless, being 33° from true. . . . The damage was not confined to the steamer. In Jensen's store many articles were thrown from the shelves, while a window was broken in a house 200 yards from the water front. At Lee Bay, three miles distant, a telegraph fuse was shattered as by gelignite, the copper being melted into the porcelain, and pieces thrown 7 feet."

The trough of an intense cyclone was passing over southern New Zealand on the afternoon this phenomenal lightning occurred. Although rain fell during the morning there was no rain for some time either before or after the bolt of lightning caused such various forms of damage.

ANDREW THOMSON.

Meteorological Office, Wellington, New Zealand. January 27th, 1930.

Waterspouts in British Waters

In the *Meteorological Magazine* for November, 1929, Mr. J. Crichton gave details of 18 waterspouts observed at various times in the areas around the British Isles during the period 1920-8, both years inclusive. We have examined the synoptic charts relevant to these 18 occurrences and the results of that survey, very briefly stated, may not lack in interest. Of the 18 cases no less than 13 were associated with very slack pressure gradient and the remaining 5 with moderate pressure gradient. No single case, it will be noted, occurred with steep pressure gradient. Again, analysing the maps according to Norwegian "front theory," there were 15 of the 18 cases in which there was no suspicion of a front occurring at or near the place of occurrence of the waterspout, the remaining 3 cases being marked by occlusions. Further, 11 of the 18 cases were accompanied by thunderstorms in the vicinity.

It would appear, therefore, that waterspouts, at least these in British waters, are in the main concomitant with quiet thundery conditions, and that the above does not support the view quoted by Mr. Crichton that "waterspouts occur under conditions present during or simulating those of a line squall."

W. H. Pick.
F. E. Coles.

33, *Brunswick Square, London, W.C.*1. *December* 23*rd*, 1929.

The note on "Frequency of Waterspouts in British Waters" arose directly as a result of the Meteorological Discussion opened by Mr. Giblett* on "Mechanism of Waterspouts and Tornadoes." While refraining in the note from entering into details as to the conditions present during any of the waterspouts mentioned, I should just like to comment here that the view "waterspouts occur under conditions present or simulating those of a line squall" does not necessarily involve that on a synoptic chart representing surface conditions either there should be a steep gradient or a well-marked front. The waterspout requires instability to be present, and this frequently can only be determined by upper air observations. With this in view a re-examination of the charts might reveal such conditions, the past history of the air currents disclosing satisfactory clues. The slack gradients mentioned in the note by W. H. Pick and F. E. Coles perhaps refer to a type of gradient characterised by instability.

J. Crichton.

The Influence of explosive Volcanic Eruptions on the subsequent pressure distribution over western Europe

The article by Dr. Brooks and Miss Hunt on the above subject on page 226 of the *Meteorological Magazine* for November, 1929, raises several questions as to the validity of such a use of statistics for the calculation of how likely such a distribution of figures might arise by chance.

In the first place with so few cases, dividing the standard

*See *Meteorological Magazine*, 64, 1929, p. 63.

deviation by the square root of the number of cases less 1 (which seems to have been used in this paper) is not valid, but "Student's" tables (*Biometrica*, 1908, VI, 1-25; 1917, XI, 414-417) should be used and they would give for the probability of the Stykkisholm pressure for the 3rd quarter odds of 62 : 1 (as against 200 : 1 in the paper) and similarly with the 14 cases in the 3rd and 4th quarters 110 : 1 (as against 200 : 1).

Now these figures were not originally taken by chance (nor I think from *a priori* reasoning), but presumably because it was noticed that some eruptions were followed by certain types of weather and corresponding variations in the atmospheric circulation. Any other changes in pressure distribution whether abnormal types or variations in the magnitude of the normal gradients, or in magnetic or electrical phenomena in any part of the globe, might also have been taken had they coincided with those original eruptions so an allowance should be made for the number of these other possible trials that did not materialize when calculating the odds (which is impossible in practice). As regards time this was done by allowing for the fact that the figures for 10 quarters were considered, and so reducing the odds from 200 down to 20 : 1.

These difficulties are inherent in all similar statistical examinations unless the effect was predicted originally and then compared with the actual result; and, of course, in the present series the three explosions which were not originally employed by Defant are also quite valid, but only if used on Defant's original system and not on another which is now found to bring all into line better.

The fact that the biggest ash eruptions (Krakatoa and St. Vincent—St. Maria) gave the greatest deficits of Stykkisholm pressure in the following December and March quarters supports the hypothesis; on the other hand, had the December quarter for Krakatoa been positive it could equally well have been explained as the immediate rise to be followed afterwards by a fall.

GEOFFREY S. PHILLPOTTS.

Oakfield, Foxrock, Co. Dublin. January 22nd. 1930.

Percolation at Grayshott

Observations of percolation to a depth of 3 feet in natural soil at Grayshott have now ceased owing to the gauge having fallen into disrepair. The record extends from January, 1904, to December, 1929, giving a period of 26 years. The height above sea-level is 661 feet and the soil in the neighbourhood is very light and sandy, the vegetation being chiefly heather, gorse, fir, whortleberry and bracken. The mean annual rainfall for this period is 36·94 inches, and the corresponding run-off 23·84 inches. This gives a percentage percolation of 64·53.

The highest annual percentage was 75·7 in 1923 and the lowest 32·0 in 1921. In this latter year only 5·69 inches percolated to a depth of 3 feet. The longest period in which no water percolated was from May 23rd, 1921, to January 1st, 1922, which is 223 days. By employing annual values of rainfall and run off, a correlation coefficient of + 0·993 was obtained.

Evaporation cannot be determined by using monthly values of rainfall and percolation, as in summer, evaporation exceeds the rainfall and in winter, the percolation is sometimes greater than the rainfall. This latter effect is due to the water already present in the soil being carried through, and sometimes to a large run off being measured at the beginning of a month as the result of heavy rain at the end of the previous month. The greatest evaporation in any one year of the period concerned is 15·96 inches in 1906 and the smallest 9·23 inches in 1923. The mean value for 26 years is 13·10 inches. Unfortunately no evaporimeter observations have been made at Grayshott for comparison.

S. E. ASHMORE.

Windwhistle Cottage, Grayshott, Hindhead, Surrey. January 5th, 1930.

Range of Visibility in a Fog

I had an opportunity this morning of making similar observations to those mentioned by Col. Gold in his letter in your February issue. The city was enveloped in a thick fog, though the light was fairly good, with visibility in the centre of the city between 40 and 120 yards (the fog was very patchy as it usually is here). I made two or three observations of the relative visibility of lights and the standards on which they are hung, and in all cases I found that the light could be seen at least twice as far away as the standard—in one case it was considerably further. My observations were made on electric lights about 9 a.m. Though I have never made detailed observations of this before, from general experience of fogs here I should say that this difference is quite usual here.

H. E. ELLINGER.

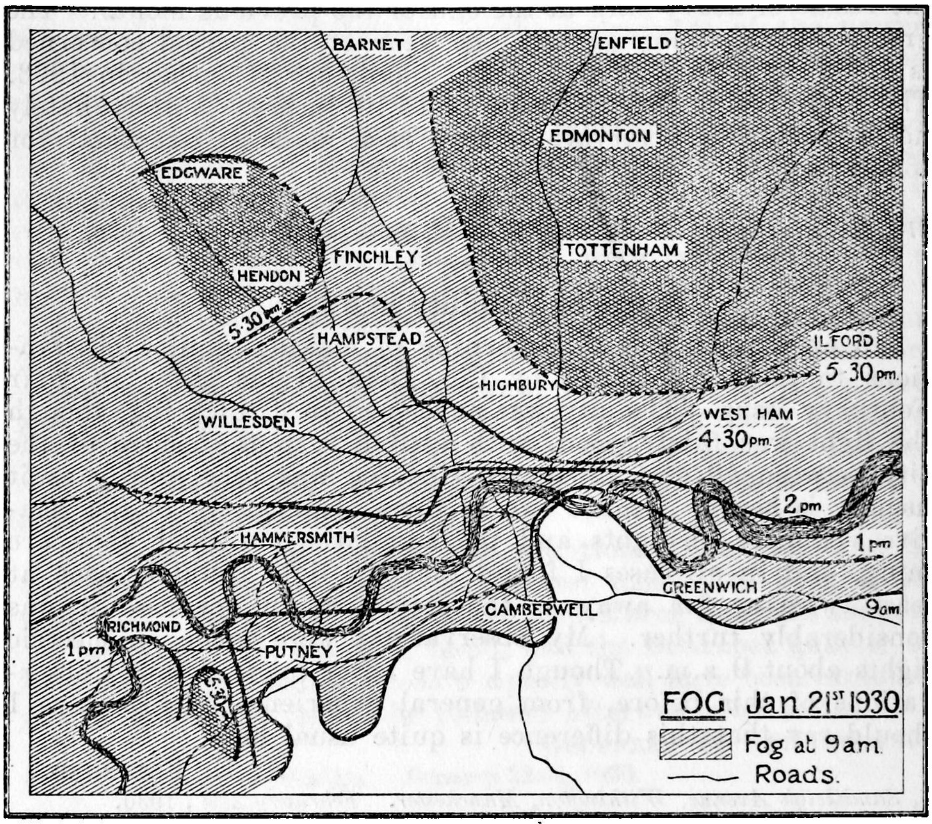
7, *Sandileigh Avenue, Withington, Manchester. February 21st*, 1930.

NOTES AND QUERIES

Fog of January 21st, 1930

On two previous occasions I have investigated the distribution of fog over the London area, and the occurrence of a dense fog on January 21st, 1930, offered a third opportunity to obtain further data. On that date fog conditions were much more widespread than on the other two occasions; the fog which affected the London area was only a small part of a foggy belt whose northern edge lay east and west somewhere north of Luton and whose southern edge seems to have coincided roughly with the Thames.

The results obtained from this investigation are different from the others in that, while little light was thrown on the onset of the fog, the stages of its disappearance were much more clearly shown. Beyond the fact that the fog set in over the eastern part of the London area much earlier than in the western districts, little information has been obtained as to the way in which it spread. In the east it had reached the river by the very early hours of the morning, while in the west it was only between 7.30



and 8 a.m. that mist became fog. The map shows the conditions at 9 a.m. The most noticeable feature is the curious wavy front which has been remarked on previously. These conditions remained almost unchanged till about 12.30 p.m., though it is just possible that before then the fog front retired a little in the neighbourhood of London Bridge, and it had certainly gone from Blackheath and eastwards. After 12.30 p.m. the fog front moved steadily northwards, losing some of its sinuosities as it did so. Its position is shown at 1 p.m., 2 p.m., 4.30 p.m., and 5.30 p.m. In the east the front was clearly defined; in most of the western areas, however, the fog gradually thinned to mist and it is more difficult to mark the front.

One definite result must be pointed out, namely, that in the Lea valley the fog never disappeared at all but continued on into the 22nd. On both the previous occasions the Lea valley was found to be covered with fog. On one of these occasions the fog advanced from the Lea valley over other parts of London. On this occasion the fog retired there. That fog was associated with the Lea valley on two occasions might be only a coincidence, but when this relationship occurs on a third occasion it is more than a coincidence, it appears to be a habit. The Lea valley seems indeed to be the villain of the piece.

J. FAIRGRIEVE.

Floods in Southern France

A series of disastrous floods occurred in southeastern France at the end of February and the early days of March, as a result of which enormous damage was done to property, and several hundred lives were lost. The tragedy reached its greatest intensity in the valley of the Garonne and its tributaries, especially the Tarn, but the area affected extended almost to the Rhône in the east and the Pyrenees in the south.

Few details are available as yet, but from the data given in the French *Bulletin Quotidien d'Etudes* it appears that the floods were caused by heavy rain which began on the night of February 26th-27th. By 6 p.m. on the 27th, 1·4in. had fallen at Nîmes, a short distance inland from the Gulf of Lions. On the 27th-28th heavy falls occurred in the Rhône Valley, which in the 13 hours ending at 7 a.m. amounted to 1·5in. at Marignane, and 2in. at Montelimar. On March 1st the area of the rainstorm extended westward, and nearly 3in. fell at Perpignan. These stations are all on low ground, and it is almost certain that very much heavier totals occurred on the high ground of the southern Auvergne Mountains. These mountains form the gathering ground for a number of streams, such as the rivers Lot, Aveyron and Tarn, which flow westward in deep narrow gorges and eventually find their way into the Garonne. It was in these streams, and especially the Tarn, that the most serious flooding occurred. It is reported that the town of Moissac, on the latter river near its junction with the Garonne, was almost entirely destroyed through the bursting of a dam or embankment.

An examination of the weather maps shows that throughout the period there was a deep and powerful southeasterly current blowing from the Mediterranean towards the Auvergne mountains. On February 27th a barometric depression was centred over Brittany and moved southwards to the Bay of Biscay on the 28th and the eastern Mediterranean on March 1st, while on the 2nd another depression appeared in the Bay of Biscay. At

Marignane the wind at a height of 500 metres was 40 m./sec. from ESE. on February 27th and 54 m./sec. from ESE. on March 2nd. Coming from the Mediterranean, this wind was naturally moist, and its forced ascent over the Auvergne would cause very heavy rain. It was also relatively warm for the season, and the floods were accentuated by melting of the snows.

Hurricane at the Bahamas

An account of the hurricane which passed over the Bahamas on September 25th-26th, 1929, has been received from Mr. E. J. V. Armsden of the Imperial Lighthouse Service, through the courtesy of the Mercantile Marine Department of the Board of Trade. The hurricane was centred about lat. 26° N., long. 75° W. approx. 100 miles northeast of Governors Harbour at noon on Tuesday, September 24th, and was moving west or west-northwest. The barometer in Nassau then stood at 1,018 mb. (30·05 in.), wind WNW., force 5, sky cloudy. At 3 p.m. the wind freshened from the west with overcast sky and falling barometer, and at 7 p.m. news was received that the storm was centred 150 miles northeast of Nassau and was increasing in intensity and moving westnorthwest, so that it did not seem likely then that Nassau would be affected. In the early hours of the 25th however the wind veered to the north of west at Nassau, increasing to a moderate gale with a high sea running in the harbour. This was followed by a slight backing about 1 p.m., when there were fierce gusts of hurricane force and torrential rain. At 9 p.m. the centre approached, the wind dropped to a dead calm, although a heavy confused sea continued in the harbour and the barometer stood at 948mb. (28·00 in., below which the aneroid barometers supplied do not register). "The wind came from the east at 1 a.m. increasing in gusts to full hurricane force and backing to ENE. By 2 a.m. the barometer had risen slightly, though the wind was of violence incredible . . . . The dawn broke shortly after 6 a.m. The barometer then stood at 980 mb. (28·93 in.), with wind of hurricane force from the ENE. During the forenoon the storm began to abate, and by 2 p.m. on the 26th the wind had fallen to a strong gale from the east, which continued throughout the day and following night with steadily rising barometer. By 8 a.m. on the 28th the barometer stood at 1,013 mb. (29·92 in.), and the wind had fallen to a moderate easterly breeze with overcast sky and rain. . .

The storm itself was of extreme severity, and seems to have taken a most unusual course. Instead of travelling to the west-northwest as tropical disturbances generally do in these latitudes, it appears to have travelled southwest, the centre passing over Nassau and Andros Island."

Pilot's Report of Experiences of Landing Through A Sand Devil

Flying Officer Wayte reported the following after having landed through a Sand Devil which existed over Amman aerodrome at some time between 10h. 45m. and 11h. G.M.T. on June 15th, 1929. He was so concerned with the safety of his machine that detailed notes on the devil were not practicable and, unfortunately, it was not seen by anyone else.

The aircraft dropped so violently that both pilot and passenger involuntarily left their seats and were brought up with a snatch against their safety belts. A Vèry pistol, lying in its holder on the floor of the pilot's cockpit, but not fastened down in any way, "rose" out of its place to the level of the pilot's chest and then "fell" back again into some other part of the machine, and was not found until after taxying into the sheds. The pilot is a man of small stature, so it may be assumed that the pistol "rose" about three feet. Several articles carried in a small locker just behind the pilot's head were "thrown out" and "fell" over into the observer's cockpit. Dust and small bits of rubbish lying on the floor of the pilot's cockpit "rose" in a cloud around the pilot's body and head.

The reference to "rising" and "falling" of these various things are in inverted commas since it seems likely that the movements being relative, what actually happened was that the whole aircraft itself fell away from the loose articles leaving them suspended for a fraction of time before either genuinely falling back into the machine, or/and being caught up by the aircraft again when it was lifted slightly by the use of the controls to counteract the effect of the "bump." There is a remote chance that the cockpit dust, &c., was lifted by the devil itself, the engine was throttled for landing, of course.

[The most remarkable point about this account, for which we thank Mr. J. Durward, was that the aircraft not only "fell" but was forced downwards with an acceleration exceeding that due to gravity, otherwise of course the articles referred to could not have left the floor.—Ed., *M.M.*]

Changes in the "Daily Weather Report"

At an International Conference of Directors of Meteorological Services held in Copenhagen during September, 1929, the codes used in the international exchange of meteorological information were drastically revised, and in some particulars, especially in the case of cloud, entirely new codes embodying new information were drawn up. The new codes were to be brought into use by most of the meteorological services of Europe on March 1st, and this necessitated modifying the information published in the *Daily Weather Report*, the columns used in the former *Report* being no longer suitable.

The opportunity afforded by this change has been taken to add a chart of the Northern Hemisphere to the British Section, as it has now become possible through the improvement in international co-operation to prepare such a chart daily. As this new chart contains much of the information shown on the chart of western Europe which was formerly published, it has been found possible to replace the latter by a chart on the same scale but limited to the area of the British Isles. It has, however, been found necessary to omit the three inset maps and one or two of the less important tables. In order to minimise the loss of the isallobar chart, the barometric tendency is being entered on the chart for the British Isles.

It is regretted that the change has necessitated increasing the size of the *Report*, as this may make its exhibition in the frames designed for the old chart difficult. It is felt, however, that by judicious folding of the *Report*, so that the information considered of least importance is not exhibited, the chart can be made to fit the old frames.

Reviews

Climate : A Handbook for Business Men, Students, aud Travellers. By C. E. P. Brooks, D.Sc. Size 8½ × 5½in., pp. 199. *Illus.* London, Ernest Benn Ltd., 1929. 10s. 6d. net.

Having in his previous works fascinated us by his speculations on the character of climate before its elements were as carefully studied as they are by modern meteorologists, and on the way in which it has evolved to its present state, Dr. Brooks now sets out to show us the climate of the world as it exists to-day. His position as Superintendent of the General Climatology Division of the Meteorological Office has given him a unique opportunity for the collection of climatic data from all parts of the globe and in this volume he places much of this material at the disposal of the general reader, together with his own valuable interpretation of the facts given and of the still greater mass of data in his possession.

The arrangement of the book is on the lines of climatic regions subdivided by political or continental boundaries. Thus the seven chapter headings are "The North Temperate Regions," "Mediterranean Climates," "North Tropical Climates," "Equatorial Climates," "Sub-tropical Climates of the Southern Hemisphere," and "The Polar Regions." The use of the term "sub-tropical" can hardly be regarded as satisfactory, for although Dr. Brooks is content to classify the climate of the Azores and the Canary Islands as "north tropical," that of Madagascar is called "sub-tropical." The method of subdivision of the chapters also results in the climate of Arabia being classified as "Mediterranean" while that of the Californian Valley is " north temperate "; and the reader is left the choice of either " sub-tropical " or " temperate " as a description of the climate of central Chile. Some, too, may disagree with the author's endorsement of Köppen's use of the term " Boreal " to describe the climate of central Canada and Siberia.

The separate sections of each chapter are followed by tables clearly setting out climatic data for ten stations in each region considered. For each station are given its latitude, longitude and height above sea level, and also the period over which the observations there have extended. Then follow mean monthly and mean annual values for temperature and precipitation, mean daily range of temperature for January and July, and mean values of relative humidity and cloud amount for the same two months. The highest and lowest temperatures ever recorded at each station are then given, and also the mean annual values of the daily maxima and minima. Finally the average number of days in the year on which rain and snow have fallen, and on which thunder has been heard are recorded. Thus this book provides for over two hundred stations a more complete summary of authentic climatic data than can be obtained in any other published volume.

The tables and accompanying climatic descriptions will give the business men and travellers for whom the book has been written all that they may reasonably expect of such a work, but although the students, who make up the remaining third of the audience to which the author and publishers address themselves, will find the tables of inestimable value, we feel that they will perhaps be a little disappointed in the work as a whole. They might quite reasonably expect a fuller explanatory treatment of some phenomena than is here given, and would certainly welcome a more generous allowance of maps and diagrams. There are only three of the latter, two being the necessary if somewhat familiar isobar maps of the world for January and July, and the third a graphical representation of mean monthly temperature and rainfall at Kew such as is now commonly drawn by lower form pupils in most secondary schools. It is explained in the introduction that these limitations are the result of endeavouring to keep the book small in bulk and low in price, but they certainly detract seriously from its value as a book for students.

It is to be hoped that in the later editions which will certainly be called for, a few of these defects may be remedied. For example, a simple map for each of the chapters showing the location of all the stations referred to would be much better than quoting the latitude and longitude of these often quite unfamiliar places, especially as in a few cases, such as that of Calabozo (p. 141), the misprinting of one of the co-ordinates makes the text difficult to follow. Similarly the several occasions on which the text says east or easterly instead of west or westerly would have been less disturbing to the student if an accompanying map or diagram had made it clear that these were simply terminological inexactitudes.

Many will wish that Dr. Brooks had allowed himself more space to deal with the subject of descending winds and their climatic effects. For example an account is given of the warming effects of the chinook and the föhn, followed some pages later by reference to the chilling effects of the mistral and the bora, without the significant cause of the difference between the two cases being even hinted at. The student will probably find it still more puzzling to understand why the wind which blows from the mountains of Sinai into the Gulf of Akaba has a cooling effect, while a little later on the high temperatures experienced on the south coast of Asia Minor are ascribed to winds descending from the mountains. Finally many will find it very difficult to believe without further explanation that the winds descending from the ice plateau of Greenland which has a mean winter temperature of probably minus 60° (p. 183) sometimes cause the temperature to rise 50° or more in a few hours at places on the coast which have a mean temperature at the same season of about zero.

The effect of cold currents on the climate of west coast regions in middle latitudes might also have been rather more fully treated. For example, it is explained that high relative humidity and abnormal fogginess are experienced regularly where a cold current washes a warm land area, and this is illustrated by references to California, Rio Doro and southwest Africa. But although there is a reference to high humidity in the corresponding region of Peru there is no mention of fogs, while in the case of Western Australia not only does there appear to be no fogs but we are told that humidity is only moderate. We feel that the student will expect some explanation of these seeming anomalies. He will also be anxious to know why it is that in Germany and France hail is associated with thunderstorms (p. 27), while in Britain hail is most frequent where thunderstorms are least common (p. 20), but the book does not enlighten him on this point. We are also given a fairly full and interesting account of the origin of the tornadoes of the American prairies, but the modern theories of the origin of the cyclones of the North Atlantic which mean so much more to most English readers receive no mention.

In conclusion, however, we are sure that students will welcome this handy volume as a notable addition to the existing literature of climatology, which incidentally is admirably summarised in the bibliographies attached to each chapter of the book, but they will also look forward to the time when Dr. Brooks will give us in a much larger work a more comprehensive treatment of the whole subject.

C. B. THURSTON.

Sea-Surface Temperatures on some Steamer Routes in the Malay Archipelago. By Dr. H. P. Berlage, Jr. Koninklijk Magnetisch en Meteorologisch Observatorium te Batavia. Verh. No. 21, 1928.

Investigations based on sea-surface temperatures have been rare up to the present time, the steadily accumulating data having been utilised chiefly for the formation of monthly averages for the main oceanic areas. In the above paper Dr. Berlage, Jr., gives the results of an analysis of the temperatures observed on Dutch steamships on five routes in the South China and East Indian Seas. The observations were organised by Dr. Braak on three of the routes in 1913, the remaining two beginning in 1922 and 1925 respectively. The temperatures were read with tested thermometers, the usual canvas-bucket method for obtaining the sample being employed. The number of observations range from 13,929 on the Singapore to Pontianak (West Borneo) route to 587 on the Menado (North Celebes) to Ternate (Moluccas) route.

Since 1921 the observations have been taken every two hours, day and night, the previous interval being four hours. The fixed times of arrival and departure would introduce systematic errors in the mean monthly temperatures if these were uncorrected for diurnal variation. The diurnal variation has therefore been worked out for the middle part of the routes and the mean monthly values corrected accordingly. Data are however insufficient to do this completely except in the case of the route Singapore to Pontianak, but a probable correction is applied where necessary. On the route mentioned the mean daily range for the year amounts to 0.70°C., the mean monthly range being greatest during the changes of the monsoon in April (1·08°C.) and November (0·92°C.), when wind and current speeds are low, and least in August (0·40°C.). On the same route temperature is highest about 13h. and lowest about 3h. Detailed tables of mean monthly temperatures for each year of observation are given for all routes, each half-degree of latitude or longitude being separately computed. Tables of monthly deviations from the average are also given. The mean annual ranges of temperature on the better observed routes in general slightly exceed 2°C. and on all routes temperature maxima occur in the months of the change of the monsoon, with minima during the steady monsoons. The relation between the temperatures of the east and west monsoon periods however varies on different routes.

For the mid-areas of the chief routes the mean deviations are smoothed over consecutive six-monthly periods and are given in graphical form. The curves show variations which it is hoped will be of assistance in connexion with an inquiry which is being made as to the possibility of long-range monsoon forecasting in the East Indies.

E. W. BARLOW.

Anales del Observatorio Nacional de San Bartolome en los Andes Colombianos. Observaciones meteorologicas de 1927. Size 13½ × 9½in., pp. xiii + 78. Bogota, 1929.

The observatory at Bogota was inaugurated in 1922, and its first publication was reviewed in this magazine in 1925.* Since then the lag between year-end and publication of the results has been gradually reduced. The present volume deals mainly with the observations at Bogota, which have been carried on as in previous years, but there are also included summaries of observations at nine secondary stations and a description of geophysical methods in prospecting. We note with pleasure the continued progress of the Colombian meteorological service under the direction of Father Sarasola.

Books Received

Uber den Einfluss meteorologischer Faktoren auf die Potentialgefälle in Davos. By M. Bider (Verh. Schweiz. Natur. Gesellschaft Lausanne, 1928. Part II, pp. 149-52).

Obituary

Dr. Felix M. Exner.—We regret to learn of the death of Hofrat Prof. Dr. Felix M. Exner on February 7th, 1930, at the early age of 54. Dr. Exner was born at Vienna on August 23rd, 1876. After taking the degree of Doctor of Philosophy at Vienna in 1900, he served for ten years as an assistant at the Zentralanstalt. From 1910 to 1916 he was Professor of Cosmical Physics at the University of Innsbruck, and from 1917 until his death Professor of Physics of the Earth at the University of Vienna and Director of the Zentralanstalt für Meteorologie und Geodynamik.

Dr. Exner is perhaps best known to students for his text-book "Dynamische Meteorologie," of which the first edition appeared in 1917 and the second in 1925, and for his association with J. M. Pernter in preparing the second edition of "Meteorologische Optik." He also collected the invaluable series of monthly data for European stations which are included in the volume of "World Weather Records," published in 1927 as Volume 79 of the *Smithsonian Miscellaneous Collections*. His numerous papers deal especially with the dynamics of the atmosphere, including the distribution of pressure anomalies and other problems of the atmospheric circulation, but he wrote at

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one time or another on almost every branch of meteorology, and even went outside the science, as in his studies of dune formation.

We regret to learn of the death on January 7th, 1930, of Prof. Henry J. Cox, Principal Meteorologist, U.S. Weather Bureau and Councillor, American Meteorological Society since 1919.

News in Brief

The Meteorological Office Staff held their eleventh Annual Soirée at the Portman Rooms on February 7th. The function which was well attended by the past and present staff and their friends, consisted of dancing, concert items and community singing. The staff appreciate the services of the artistes who voluntarily helped to make the evening a success.

The Ninth Annual Dinner of the Staff of the Meteorological Office, Shoeburyness, was held at the Queen's Hotel, Westcliff, on Saturday, February 15th. The guest was Mr. D. Brunt, Superintendent of Army Services, and past members of the staff now serving at other stations were present. The customary entertainment consisting of original topical items followed the dinner.

Errata

January, 1930, page 278, line 43, *for* " 77°F. on the 28th," *read* " 77°F. on the 29th."

February, 1930, page 22, last two lines, *for* " *Jahrbuch*, 1926," *read* " *Jahrbuch*, 1927," and *for* " Bremen, 1928," read " Bremen, 1929."

The Weather of February, 1930

The weather of the month was generally dry and cold, the mean temperature being below normal by 1·0°F. at Kew and by 5·6°F. at Valentia, while at several places in Scotland and northern England the rainfall was less than 20 per cent. of the normal. During the first few days depressions passed across the southern part of the country giving unsettled conditions generally and moderate rainfall in south England and Ireland. By the 6th and 7th these depressions had moved further south and east, and the rain area had withdrawn to the eastern districts, while an anticyclone situated to the north of Iceland on the 5th moved slowly southsoutheast and was centred over Scotland on the 8th. Among the larger rain measurements at this time may be mentioned 1·21in. at Swingfield, Kent, on the 6th, and 0·98in. at Hartland, Devon, on the 3rd; snow occurred locally in the eastern districts on the 6th and 7th. In the west the 6th, 7th and 8th were all sunny days, *e.g.*, at Mallarany 8·0hrs. were recorded on the 6th and 8·3hrs. on the 7th. From this time onwards mainly anticylonic conditions persisted, apart from a temporary break on the 14th and 15th, when a trough of low pressure crossed the country. This was immediately followed by another anticyclone. On the 14th temperature rose generally to 50°F., but in the rear of the trough there were cold northerly winds, and snow fell in most parts. Slight snow was also experienced over most of the country on the 16th and 17th. During the anticyclonic periods from the 7th-13th and 16th-24th the minimum temperature readings were low, those in the screen falling below 20°F. on several days, while on the ground, 9°F. was recorded at Rhayader on the 17th, 11°F. at Aspatria on the 10th. The diurnal range was also usually small, day temperatures being frequently below normal. Much cloud occurred during this period in the east, except on occasional days among which the 9th, 16th and 17th may be noted, when between 8 and 9 hrs. bright sunshine occurred over the country generally, 9·2hrs. being registered at Rhayader on the 16th. A depression off southeast Ireland on the 24th moved slowly southeast and slight rain or snow was experienced generally on the 24th, 25th and 26th. In south Ireland the amounts were heavier, 1·13in. being recorded at Waterford on the 25th. On the 27th and 28th the conditions again became anticyclonic and temperature rose above 50°F., reaching 55°F. at Kilmarnock and 54°F. at Dumfries and Plymouth on the 28th and Cambridge on the 27th, and there was much sunshine at many places, *e.g.*, 9·3hrs. at Plymouth, 9·1hrs. at Aspatria on the 28th and 8·9hrs. at Inverness on the 27th. Mist and fog occurred in the mornings and evenings. The distribution of sunshine for the month was as follows:—

	Total (hrs.)	Diff. from normal (hrs.)		Total (hrs.)	Diff. from normal (hrs).
Stornoway	75	+17	Liverpool	41	—27
Aberdeen	82	+ 9	Ross-on-Wye	44	—27
Dublin	84	+11	Falmouth	89	+ 6
Birr Castle	70	+ 3	Gorleston	69	—12
Valentia	112	+43	Kew	47	—13

Pressure was above normal over northwestern Europe and the North Atlantic, the greatest excess being 13·2mb. at Thorshavn (Faeroes) and below normal over southwestern Europe and Spitsbergen, the greatest deficit being 12·8mb. at Spitsbergen. Temperature was above normal at Spitsbergen and over Scandinavia (as much as 15°F. at Spitsbergen and 11°F. in northernmost Sweden), but below normal in southern and central Europe. Rainfall was generally deficient over the whole of western Europe but in excess at Spitsbergen.

High tides caused much damage on the west coast of France, and there were heavy floods in the department of Var on the 2nd. Following the mild weather prevailing in Switzerland snow fell heavily on the 3rd down to the level of Geneva. Heavy snow between Madrid, Barcelona and Seville on the 8th, delayed the trains and caused a railway accident. The hamlet of Villa di Mezzo in the province of Marche (east-central Italy) was overwhelmed by an avalanche from Monte Pettrano on the 22nd; more than 15 people were killed. Snow fell heavily on the mountains of Upper Piedmont, reaching a depth of over 3ft. about the 23rd. At Trieste the Bora was so strong on the 23rd that local railway traffic was interrupted. Landslips and floods were reported from Calabria and serious damage done by a tidal wave at Catanzaro about the same time. Snow fell heavily during the last days of the month in the mountain regions of Corsica and was nearly 10ft. deep in the district of Vizzavona.

Continued heavy rain during the first seven days of the month prevented railway communications between Kilosa and Dodoma (Tanganyika Territory).

Widespread rain fell in the agricultural area of South Australia between the 1st and 3rd, ranging from 1½in. to nearly 6in. Heavy rain in the southeast of Western Australia later in the month caused floods in the desert there, which stopped all railway communications.

A severe storm did much damage at Burges, Newfoundland, on the 21st, where the floods resulting from the storm were followed by severe frosts.

Temperature during the month over the United States was generally high for the time of year. A sudden cold wave accompanied by severe snowstorms swept across the eastern States about the 16th, but this was followed in a few days by a spell of exceptionally warm weather with southerly winds, extending also to Canada. A maximum temperature of 84°F. was reported from Washington, of 74°F. from New York on the 25th and of 55°F. at Toronto on the 23rd. Thunderstorms, however, occurred generally in the east in the evening of the 25th, and temperature fell rapidly. Precipitation in the United States was generally deficient for the mouth. Fog was experienced off the east coast from about the 20th-25th.

A severe and sudden storm was experienced at Nassau, Bahamas, on the 17th, and severe gales occurred on the North Atlantic early in the month.

The special message from Brazil states that seven anticyclones passed across the country, and that the crops are generally affected by the small and irregular rainfall during the last two months. At Rio de Janeiro pressure was 0·6mb. below normal and temperature 0·4°F. above normal.

Rainfall, February, 1930.—General Distribution

England and Wales	46	per cent of the average 1881-1915.
Scotland	32	
Ireland	28	
British Isles	39	

Rainfall: February, 1930: England and Wales

Co.	Station	In.	Per cent of Av.	Co.	Station	In.	Per cent of Av.
Lond .	Camden Square	1·01	60	*Leics* .	Belvoir Castle	·50	30
Sur .	Reigate, Alvington	·94	43	*Rut* .	Ridlington	·73	...
Kent .	Tenterden, Ashenden	1·75	89	*Linc* .	Boston, Skirbeck	·70	48
,, .	Folkestone, Boro. San.	1·80	...	,, .	Lincoln	...	...
,, .	Margate, Cliftonville	1·01	73	,, .	Skegness, Marine Gdns	1·04	68
,, .	Sevenoaks, Speldhurst	1·43	...	,, .	Louth, Westgate	·94	49
Sus .	Patching Farm	1·38	62	,, .	Brigg, Wrawby St.	·28	...
,, .	Brighton, Old Steyne	1·30	64	*Notts* .	Worksop, Hodsock	·71	46
,, .	Heathfield, Barklye	1·54	65	*Derby* .	Derby, L. M. & S. Rly.	...	...
Hants .	Ventnor, Roy. Nat. Hos.	1·29	61	,, .	Buxton, Devon Hos.	·76	20
,, .	Fordingbridge, Oaklnds	·81	33	*Ches* .	Runcorn, Weston Pt.	·26	14
,, .	Ovington Rectory	·95	37	,, .	Nantwich, Dorfold Hall	·39	...
,, .	Sherborne St. John	·81	37	*Lancs* .	Manchester, Whit. Pk.	·28	15
Berks .	Wellington College	·60	32	,, .	Stonyhurst College	·41	12
,, .	Newbury, Greenham	·68	31	,, .	Southport, Hesketh Pk	·33	16
Herts .	Welwyn Garden City	·54	...	,, .	Lancaster, Strathspey	·26	...
Bucks .	High Wycombe	·91	49	*Yorks* .	Wath-upon-Dearne	·59	36
Oxf . .	Oxford, Mag. College	·53	34	,, .	Bradford, Lister Pk	1·18	50
Nor .	Pitsford, Sedgebrook	·68	41	,, .	Oughtershaw Hall	1·32	...
,, .	Oundle	·76	...	,, .	Wetherby, Ribston H.	·78	45
Beds .	Woburn, Crawley Mill	·62	42	,, .	Hull, Pearson Park	·63	38
Cam .	Cambridge, Bot. Gdns.	·53	41	,, .	Holme-on-Spalding	·45	...
Essex .	Chelmsford, CountyLab	·56	38	,, .	West Witton, Ivy Ho.	1·19	...
,, .	Lexden Hill House	·61	...	,, .	Felixkirk, Mt. St. John	1·32	78
Suff .	Hawkedon Rectory	·72	47	,, .	Pickering, Hungate	1·67	...
,, .	Haughley House	·44	...	,, .	Scarborough	1·53	91
Norf .	Norwich, Eaton	1·05	64	,, .	Middlesbrough	1·25	96
,, .	Wells, Holkham Hall	1·10	74	,, .	Baldersdale, Hury Res.	...	...
,, .	Little Dunham	1·47	91	*Durh* .	Ushaw College	1·79	113
Wilts .	Devizes, Highclere	·79	40	*Nor* .	Newcastle, Town Moor	1·69	106
,, .	Bishops Cannings	·82	39	,, .	Bellingham. Highgreen	2·03	...
Dor .	Evershot, Melbury Ho.	1·12	36	,, .	Lilburn Tower Gdns.	2·02	...
,, .	Creech Grange	·82	...	*Cumb* .	Geltsdale	·52	...
,, .	Shaftesbury, Abbey Ho.	1·18	51	,, .	Carlisle, Scaleby Hall	·35	16
Devon .	Plymouth, The Hoe	2·45	82	,, .	Borrowdale, Seathwaite	1·75	15
,, .	Polapit Tamar	1·70	53	,, .	Borrowdale, Rosthwaite	·68	...
,, .	Ashburton, Druid Ho.	...	...	,, .	Keswick, High Hill	·52	...
,, .	Cullompton	1·24	44	*Glam* .	Cardiff, Ely P. Stn.	·74	25
,, .	Sidmouth, Sidmount	1·08	43	,, .	Treherbert, Tynywaun	1·21	...
,, .	Filleigh, Castle Hill	1·51	...	*Carm* .	Carmarthen Friary	·53	14
,, .	Barnstaple, N. Dev. Ath.	1·30	48	,, .	Llanwrda	·55	13
Corn .	Redruth, Trewirgie	3·35	89	*Pemb* .	Haverfordwest, School	·59	17
,, .	Penzance, Morrab Gdn.	3·36	101	*Card* .	Aberystwyth	·36	...
,, .	St. Austell, Trevarna	1·90	49	,, .	Cardigan, County Sch.	·38	...
Soms .	Chewton Mendip	·75	22	*Brec* .	Crickhowell, Talymaes	1·00	...
,, .	Long Ashton	·55	...	*Rad* .	Birm W. W. Tyrmynydd	·88	17
,, .	Street, Millfield	..	...	*Mont* .	Lake Vyrnwy	·87	19
Glos. .	Cirencester, Gwynfa	·53	23	*Denb* .	Llangynhafal	·85	...
Here .	Ross, Birchlea	·89	44	*Mer* .	Dolgelly, Bryntirion	·79	18
,, .	Ledbury, Underdown	·68	37	*Carn* .	Llandudno	·33	16
Salop .	Church Stretton	1·04	47	,, .	Snowdon, L. Llydaw 9	1·75	...
,, .	Shifnal, Hatton Grange	·55	34	*Ang* .	Holyhead, Salt Island	·46	19
Worc .	Ombersley, Holt Lock	·41	25	,, .	Lligwy	·28	...
,, .	Blockley	·54	...	*Isle of Man*			
War .	Farnborough	·80	39		Douglas, Boro' Cem.	·70	22
,, .	Birminghm, Edgbaston	·90	53	*Guernsey*			
Leics .	Thornton Reservoir	·96	57		St. PeterP't. GrangeRd.	1·67	68

Rainfall: February, 1930: Scotland and Ireland

Co.	Station	In.	Per-cent of Av.	Co.	Station	In.	Per-cent of Av.
Wigt .	Stoneykirk, Ardwell Ho	...	...	*Suth* .	Loch More, Achfary...	1·91	29
,, .	Pt. William, Monreith	·36	...	*Caith* .	Wick......................	1·22	54
Kirk .	Carsphairn, Shiel.......	·57	...	*Ork* .	Pomona, Deerness......	·85	28
,, .	Dumfries, Cargen......	·35	9	*Shet* .	Lerwick	1·57	50
Dumf.	Eskdalemuir Obs.......	·78	...	*Cork* .	Caheragh Rectory......	1·21	...
Roxb .	Branxholm	·70	27	,, .	Dunmanway Rectory...	1·11	19
Selk .	Ettrick Manse..........	·56	...	,, .	Ballinacurra.............	1·36	36
Peeb .	West Linton............	·44	...	,, .	Glanmire, Lota Lo......	1·07	27
Berk .	Marchmont House......	1·57	75	*Kerry*.	Valentia Obsy..........	1·17	23
Hadd.	North Berwick Res.....	1·35	87	,, .	Gearahameen............	·80	...
Midl .	Edinburgh, Roy. Obs.	·46	29	,, .	Killarney Asylum......	...	...
Ayr .	Kilmarnock, Agric. C.	·21	7	,, .	Darrynane Abbey.......	1·59	34
,, .	Girvan, Pinmore..	·30	7	*Wat* .	Waterford, Brook Lo...	1·76	54
Renf .	Glasgow, Queen's Pk. .	·25	8	*Tip* .	Nenagh, Cas. Lough...	·83	27
,, .	Greenock, Prospect H.	·69	12	,, .	Roscrea, Timoney Park	·73	...
Bute .	Rothesay, Ardencraig.	·28	7	,, .	Cashel, Ballinamona...	·99	31
,, .	Dougarie Lodge.........	·40	...	*Lim* .	Foynes, Coolnanes......	·61	19
Arg .	Ardgour House	·56	...	,, .	Castleconnel Rec.......	·63	...
,, .	Manse of Glenorchy...	·57	...	*Clare* .	Inagh, Mount Callan...	...	...
,, .	Oban......................	·48	...	,, .	Broadford, Hurdlest'n.	·96	...
,, .	Poltalloch	·38	9	*Wexf*.	Newtownbarry	...	...
,, .	Inveraray Castle...	·60	9	,, .	Gorey, Courtown Ho...	1·17	42
,, .	Islay, Eallabus.........	·36	9	*Kilk* .	Kilkenny Castle.........	·63	25
,, .	Mull, Benmore.........	...	...	*Wic* .	Rathnew, Clonmannon	1·86	...
,, .	Tiree	·46	...	*Carl* .	Hacketstown Rectory..	1·00	33
Kinr .	Loch Leven Sluice......	...	...	*Leix* .	Blandsfort House......	·95	35
Perth .	Loch Dhu...............	·70	9	,, .	Mountmellick...........	·87	...
,, .	Balquhidder, Stronvar	·86	...	*Off'ly* .	Birr Castle..............	·55	24
,, .	Crieff, Strathearn Hyd.	·81	23	*Dubl* .	Dublin, FitzWm. Sq...	·96	51
,, .	Blair Castle Gardens...	·55	20	,, .	Balbriggan, Ardgillan.	1·12	57
,, .	Dalnaspidal Lodge.....	...	...	*Me'th* .	Beauparc, St. Cloud...	·94	...
Angus.	Kettins School.	1·63	77	,, .	Kells, Headfort.........	·64	21
,, .	Dundee, E. Necropolis	1·50	80	*W.M* .	Moate, Coolatore......	·57	...
,, .	Pearsie House...........	2·35	...	,, .	Mullingar, Belvedere..	·57	20
,, .	Montrose, Sunnyside...	1·02	55	*Long* .	Castle Forbes Gdns......	·33	12
Aber .	Braemar, Bank...	1·36	48	*Gal* .	Ballynahinch Castle...	·93	18
,, .	Logie Coldstone Sch....	2·05	99	,, .	Galway, Grammar Sch.	·49	...
,, .	Aberdeen, King's Coll.	1·12	55	*Mayo* .	Mallaranny..............	1·25	...
,, .	Fyvie Castle.............	2·27	...	,, .	Westport House.........	·68	17
Moray.	Gordon Castle...........	·78	41	,, .	Delphi Lodge...........	·81	...
,, .	Grantown-on-Spey......	·77	36	*Sligo* .	Markree Obsy...........	·72	20
Nairn.	Nairn, Delnies	·61	34	*Cav'n* .	Belturbet, Cloverhill...	·37	14
Inv .	Kingussie, The Birches	·59	...	*Ferm* .	Enniskillen, Portora...	·78	...
,, .	Loch Quoich, Loan.....	1·65	...	*Arm* .	Armagh Obsy...........	·86	39
,, .	Glenquoich..............	·96	9	*Down* .	Fofanny Reservoir......	1·43	...
,, .	Inverness, Culduthel R.	·63	...	,, .	Seaforde..................	·75	25
,, .	Arisaig, Faire-na-Squir	·63	...	,, .	Donaghadee, C. Stn...	·42	18
,, .	Fort William...........	·65	...	,, .	Banbridge, Milltown...	1·30	...
,, .	Skye, Dunvegan........	1·01	...	*Antr* .	Belfast, Cavehill Rd...	·94	...
R & C.	Alness, Ardross Cas ...	1·21	37	,, .	Glenarm Castle........	1·36	...
,, .	Ullapool	·87	...	,, .	Ballymena, Harryville	·97	30
,, .	Torridon, Bendamph...	1·14	14	*Lon* .	Londonderry, Creggan	1·15	36
,, .	Achnashellach..........	1·48	...	*Tyr* .	Donaghmore............	1·13	...
,, .	Stornoway...............	·74	...	,, .	Omagh, Edenfel.........	·58	19
Suth .	Lairg.....................	1·58	...	*Don* .	Malin Head..............	1·21	...
,, .	Tongue	1·43	41	,, .	Dunfanaghy.............	·80	...
,, .	Melvich..................	2·20	...	,, .	Killybegs, Rockmount.	·87	17

Climatological Table for the British Empire, September, 1929.

STATIONS	PRESSURE: Mean of Day M.S.L. (mb.)	PRESSURE: Diff. from Normal (mb.)	TEMPERATURE: Absolute Max. (° F.)	Absolute Min. (° F.)	Mean Values Max. (° F.)	Mean Values Min. (° F.)	Mean Values ½ max. and min. (° F.)	Mean Values Diff. from Normal (° F.)	Mean Wet Bulb (° F.)	Relative Humidity (%)	Mean Cloud Am'nt (0—10)	PRECIPITATION: Am'nt (in.)	Diff. from Normal (in.)	Days	BRIGHT SUNSHINE: Hours per day	Percentage of possible
London, Kew Obsy.	1020·1	+ 2·7	85	40	73·0	53·8	63·4	+ 6·3	54·4	89	5·6	0·16	− 1·71	2	6·5	52
Gibraltar	1016·4	− 0·9	86	62	79·8	67·3	73·5	+ 1·0	65·9	85	5·0	1·02	− 0·37	2	..	..
Malta	1016·9	0·0	87	59	78·5	69·5	74·0	− 2·0	68·9	77	4·7	1·55	+ 0·28	6	8·6	70
St. Helena	1015·7	+ 2·2	..	52	..	52·9	..	..	53·4	93	9·8	2·01	− 1·01	19	..	..
Sierra Leone	1013·6	+ 1·4	88	70	83·0	72·3	77·7	− 1·4	74·6	90	6·0	27·23	− 1·25	26	..	..
Lagos, Nigeria	1012·3	− 0·5	88	70	83·9	73·5	78·7	+ 0·3	74·4	83	9·2	3·11	− 2·15	17	..	..
Kaduna, Nigeria	1015·4	+ 2·6	88	..	84·8	..	..	..	70·6	84	..	13·81	+ 2·32	30	..	..
Zomba, Nyasaland	1012·2	− 1·5	88	56	82·6	62·0	72·3	+ 2·8	..	52	1·3	0·00	− 0·34	0	..	..
Salisbury, Rhodesia	1011·8	− 0·4	87	48	81·4	55·1	68·3	+ 1·9	54·6	35	0·9	0·00	− 0·26	0	10·6	88
Cape Town	1019·5	+ 0·4	79	39	65·7	52·4	59·1	+ 1·2	53·7	85	4·6	1·82	− 0·42	10	..	..
Johannesburg	1016·9	− 0·3	78	38	70·6	50·9	60·7	+ 1·3	50·7	63	4·1	3·05	+ 2·09	9	8·1	68
Mauritius	1020·3	+ 0·1	79	57	75·7	63·3	69·5	− 0·6	64·8	66	5·7	1·00	− 0·30	22	8·1	67
Bloemfontein	..	..	..	..	..	..	..	..	..	..	..	3·53	+ 2·63	..	..	..
Calcutta, Alipore Obsy.	1006·0	+ 1·5	92	72	89·7	78·4	84·1	+ 1·1	79·4	89	6·5	10·69	+ 0·82	10*	..	..
Bombay	1007·9	− 0·1	95	73	87·1	76·4	81·7	+ 0·9	76·5	86	5·5	5·58	− 5·10	8*	..	..
Madras	1006·3	− 0·2	101	73	92·8	77·7	85·3	+ 0·2	76·0	73	6·2	7·36	+ 2·37	10*	..	..
Colombo, Ceylon	1009·8	− 0·2	87	73	85·8	76·3	81·1	+ 0·2	76·9	76	7·1	10·02	+ 3·80	23	6·8	56
Hongkong	1009·8	+ 1·4	90	75	85·4	77·8	81·6	+ 0·6	76·3	77	6·7	10·79	+ 0·80	16	7·0	58
Sandakan	..	..	91	73	89·2	74·8	82·0	+ 0·3	77·6	82	..	6·53	− 2·86	10	..	..
Sydney, N.S.W.	1019·0	+ 3·0	79	43	65·6	49·6	57·6	− 1·6	52·6	64	4·5	1·56	− 1·33	7	7·6	64
Melbourne	1020·5	+ 4·7	73	35	62·0	44·4	53·2	− 0·9	48·2	69	5·9	1·67	− 0·74	13	5·7	48
Adelaide	1021·7	+ 4·4	78	39	66·8	47·2	57·0	− 0·1	50·1	52	6·2	2·13	+ 0·09	12	7·0	59
Perth, W. Australia	1021·5	+ 3·6	83	43	67·3	48·5	57·9	− 0·4	51·7	61	4·0	2·80	− 0·60	13	8·8	75
Coolgardie	1020·0	+ 2·9	90	36	73·2	45·0	59·1	+ 0·5	49·1	43	2·1	0·00	− 0·61	0	..	..
Brisbane	1019·6	+ 2·3	86	48	74·2	54·4	64·3	− 1·0	57·4	58	4·1	0·48	− 1·57	8	7·5	63
Hobart, Tasmania	1014·7	+ 4·0	65	34	58·0	43·2	50·6	− 0·2	44·6	63	6·9	1·64	− 0·49	19	5·6	47
Wellington, N.Z.	1014·9	+ 0·3	61	34	54·5	42·3	48·4	− 3·2	46·0	72	6·0	3·29	− 0·68	13	6·8	58
Suva, Fiji	1014·0	− 0·3	86	60	78·7	68·0	73·3	− 1·2	69·2	76	6·3	6·31	− 0·67	16	5·4	45
Apia, Samoa	1011·5	− 0·6	88	69	83·9	73·2	78·5	+ 0·3	75·1	73	4·1	2·29	− 2·83	12	7·4	62
Kingston, Jamaica	1011·8	− 0·4	89	68	87·1	72·7	79·9	− 1·6	72·3	89	6·4	2·42	− 1·61	9	6·3	51
Grenada, W.I.	1009·1	− 2·6	89	71	86·7	73·4	80·1	− 0·1	74·9	79	6·8	14·10	+ 5·84	18	..	..
Toronto	1018·5	+ 0·7	94	37	71·0	53·4	62·2	+ 3·0	54·0	77	4·4	0·78	− 2·40	6	6·2	50
Winnipeg	1016·0	+ 1·2	99	27	62·1	42·2	52·1	− 1·3	42·9	90	6·4	2·39	+ 0·11	5	5·2	41
St. John, N.B.	1019·7	+ 2·2	74	37	64·8	49·7	57·3	+ 1·4	53·5	81	5·6	4·35	+ 0·61	14	5·4	43
Victoria, B.C.	1016·8	+ 0·3	82	45	69·2	51·0	60·1	+ 4·5	53·8	69	2·6	0·10	− 1·91	3	8·2	65

CORRIGENDA.—The Observations for Lagos, Nigeria, for June and July 1929 *should read*:—

June	1012·9	0·0	85	70	83·6	73·2	78·4	−0·9	74·7	88	9·1	24·79	+6·14	22	..	..
July	1013·0	−0·8	83	70	81·1	73·9	77·5	−0·5	74·6	88	9·3	19·93	+9·25	21	..	..

* For Indian stations a rain day is a day on which 0·1 in. or more rain has fallen.