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On Some Summer Depressions

By. C. K. M. DOUGLAS, B.A.

The unsettled weather of the present summer has provided a number of interesting features for the meteorologist, and it is proposed to give some details of a few special cases. Figs. 1 and 2 illustrate the development of the depression responsible for the third wet Derby day in succession. Fig. 1 shows the chart on the evening of Monday, May 31st, with the depression in its early stage of development far out on the Atlantic, the dotted line marking the approximate position of the warm and cold fronts. It was known that polar air had penetrated right down to Spain, and that a warm southwest current had prevailed at the Azores for about 12 hours. It was also known that there was another anticyclone to the northwest of the new depression, both from the strong northwest wind observed by the "Montclare," and from a Norwegian ship reporting from further west five hours previously. The presence of this anticyclone meant that there would be a strong polar current striking down behind the advancing depression, a factor very favourable for its development. The essential factor for the development of a depression is that masses of air originating in widely different latitudes should be brought together, but their relative position and movements are also important. The case under discussion was one of the very few when all the factors were known to be favourable before the issue of the forecast, so that the deepening of the system could be predicted with confidence. Another satisfactory feature from

the point of view of the forecaster was the pronounced westerly current over the British Isles, which made it certain that the depression would pass over or near southern England. The

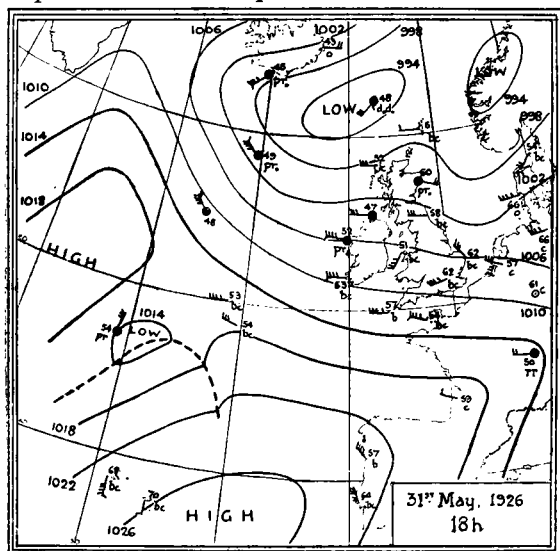


FIG. 1.

Fig. 2 shows the chart for 7h. on June 2nd, and it can be seen that the depression had greatly deepened, pressure at the centre having dropped about 22 mb. There were no ships' reports received from suitable positions to show the intermediate stages, but from the fact that the wind at Valencia remained westerly, veering to north-northwest, on the morning of the 2nd, we may infer that most of the deepening took place during the night of the 1st. The single dotted line on fig. 2 shows the occlusion, or line of intersection of the two cold currents, after the disappearance of the warm sector from the earth's surface. During the next 24 hours the system partly filled up (pressure rising 12 mb. at the centre), and advanced only 300 miles, compared with 1,200 miles during the preceding 36 hours. During the night of the 1st there were nearly two inches of rain in parts of South Devon, but at Pembroke there was none. In the 12 hours commencing 7h. on the 2nd the rain area spread up as far as Harrogate, and in southeast England there was about three-quarters of an inch in places, but no very large falls. From the expansion, but decreased intensity of the rain area we may infer that the angle of inclination of the surface of discontinuity decreased.

Depressions in their early stages, of which an example is seen in fig. 1, are commonly known as "secondaries." Various types of systems, differing entirely in their physical structure, are included under that much overworked term. One of

"further outlook" issued that evening therefore predicted rain for southern England on Wednesday. On the following evening there was a falling barometer and backing wind at the mouth of the English Channel, accompanied by rain, but it was only because of the chart of Monday evening that a definitely rainy day could be forecasted.

these small developing cyclones crossed southeast England on November 3rd, 1925, and a valuable aeroplane ascent was made at Duxford in the warm sector, near the centre, showing a temperature at 15,000 feet about 20° F. warmer than those observed at that level on the preceding or the following days.

Another important depression began to develop south-south-west of Ireland on the morning of June 9th, 1926, and moved north-northeast, at the same time rapidly deepening, with a fall of about 14 mb. in the pressure at the centre in 24 hours. By next morning the polar air had curved round and swept across England from southwest, with very low upper air temperatures,

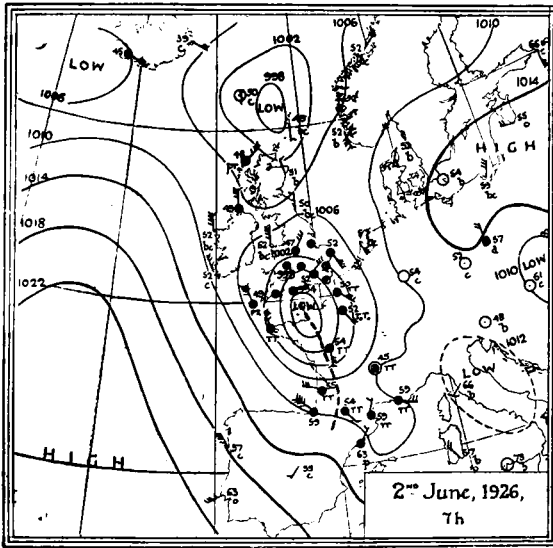


FIG. 2.

and numerous thunderstorms in spite of strong winds, which reached gale force locally, and force 7 Beaufort, even in the southeast. The centre of the cyclone was then occluded, but a secondary formed about 200 miles further east, swung round the main centre and became absorbed into it. In consequence the system became still deeper, the barometer at Malin Head falling to 978.3 mb. at 7h. on the 11th, the lowest sea level reading recorded in the British Isles in June for at least half a century. Subsequently the centre moved a little west and began to fill up. The depression which caused continuous rain at Nottingham on June 14th and 15th, thus finally spoiling the first Test Match, began to develop over the upper Rhine valley on the night of 12th, at a well-marked polar front, the same front which caused a tornado near Geneva and the Jura mountains. This depression moved northwest, bringing with it a new rain area. The original primary, in which the rain had for some days been of the showery type, filled up rapidly and swung southeast as a dying "secondary" to the new system. When complex developments of this type take place out in the Atlantic, with only scattered ships' observations, the details cannot be followed. It may be regarded as certain that all long irregular cyclone tracks represent

complex developments of new centres and not ordinary movements. Between July 3rd and 6th, 1926, another depression moved northwest, in this case from southeast Europe, and brought heavy rain to northeast England, amounting to well over an inch in places. On the 3rd and 4th violent thunderstorms developed in Germany and France in the middle of an easterly to northeasterly current, which in eastern England, and probably also on the continent, extended right up to the cirrus. At Säntis, an Alpine Observatory on a summit at 8,200 feet, the wind was northeast on the 3rd. It is by no means rare to find continental air with enough moisture for thunderstorms, or for prolonged rains if the air should act as a "warm sector." The historic rains early in August, 1917, were supplied by a very warm easterly current over Germany and Denmark. The exceptionally wet period in June, 1903, was started by a depression from the east on the 9th. From the 13th to the 15th there was a 58 hours downpour in London and the surrounding area, with 3.44 inches at Camden Square. During this period there was no supply of Atlantic air, but a vast anticyclone extending from north of Iceland to Madeira. A depression developed over southern England as the result of a cold northerly current cutting into warmer air which originally came from the east, and then only moved slightly and irregularly for 48 hours.

Extremes of Temperature

A type of question which is frequently asked is: What is the highest or lowest temperature which can be anticipated under given conditions, in the sun, in the shade, or on the ground, in England or in the tropics or in any part of the world? The following notes have been collected, mainly by Miss R. E. Smith, from a great variety of sources in order to provide material for a ready answer to many of these questions. They have been classified under the geographical headings, World, Tropics, United Kingdom, England and London.

The highest temperatures are those recorded by the "black bulb in vacuo." These temperatures do not correspond with anything which occurs in a state of nature, and their physical meaning is obscure, while their value is still further decreased by the difficulty of getting two instruments which read alike. They have not been systematically collected, but a brief search has revealed the following maxima: for the world, 184° F. at Coolgardie (West Australia) in January, 1914, and for London, 173° F. at Greenwich on July 2nd and 15th, 1925. For the tropics, the search has not been very complete and the highest

which was found, 169°F. at Lagos (Nigeria) in March, 1908, may have been exceeded in drier localities. If any black-bulb temperatures have been recorded on high mountains, they probably show very much higher values. In the Antarctic a maximum of 154°F. was recorded by the National Antarctic Expedition on December 21st, 1902, the corresponding shade maximum being only 24°F. , and this difference of 130°F. between the shade and "sun" temperatures would be very hard to match.

Of much greater practical importance are the highest temperatures recorded by objects exposed to both sun and air. Dr. Helene Wiszwianski* gives the following surface temperatures in the sun: in the Sahara, recorded by Foureau, 159°F. at Iferouan on May 12th, 1899; in the central Asiatic desert, recorded by Obrutschew, $140\text{--}158^{\circ}\text{F.}$ ($60\text{--}70^{\circ}\text{C.}$). H. G. Cornthwaite† gives the temperatures of iron or steel painted different colours and exposed to the sun's rays at Balbao Heights, Panama. The observations were made in the last half of April with the mid-day sun directly overhead; a half-inch hole was drilled into the centre of each block and filled with mercury, in which a thermometer was inserted. The highest temperature recorded was 133°F. in steel painted black, and it is estimated that under the most favourable conditions possible in the Canal Zone the maximum temperature of exposed steel is not likely to exceed 140°F. With steel painted other colours, lower temperatures were recorded, green being nearly as hot as black, red much cooler, and white slightly cooler than red, but the difference between black and white averaged less than 20°F. at mid-day.

The highest shade temperature on record is 136°F. at Azizia (Uzzizia) in Tripoli, on September 13th, 1922, which is 2°F. higher than the maximum of 134°F. recorded at the famous station of Death Valley, California. Temperatures of 130°F. or over have also been recorded at Insalah in the Sahara, at Mammoth Tank in the Colorado Desert, and in the interior of New South Wales. It must be remarked that G. Hellmann‡ queries the maximum at Azizia, as being about 10°C. higher than those of the neighbouring stations in Tripoli. The minima at Azizia are lower than those of surrounding stations, and suggest incomplete protection against radiation, or a position in a hollow. Similarly, Hellmann believes that the American screen in use at Death Valley gives maxima 1°C. or more too high. All these high temperatures occur in the sub-tropical

* WISZWIANSKI H., *Die Faktoren der Wüstenbildung*, Berlin, Veröff. Inst. Meeres. Heft. 9, 1906.

† CORNTHWAITE, H. G. Exposed steel temperatures in the tropics. *Washington, D.C., M. W. Rev.* 48 (1920), p. 403.

‡ HELLMANN, G., *Grenzwerte der Klimatelemente auf der Erde*. Berlin, SitzBer Ak. Wiss. 11 (1925), p. 200.

desert zone. Between the tropics, although the temperature remains steadily at a high level, very high maxima are rare. A brief search gave a maximum of 132° F. at Tokar ($18^{\circ} 25' \text{ N.}$, $37^{\circ} 40' \text{ E.}$) in the Sudan, on June 28th, 1915. This figure is somewhat doubtful, and it would perhaps be better to accept the figure of 129° F. at the same station three days later. In England a temperature of 100.5° F., registered at Tunbridge Wells in 1868, is recorded by Marriott* ; it is closely approached by the well-known Greenwich maximum of 100° F. on August 9th, 1911, recorded in a Glaisher stand. On the same day a temperature of 98° F. was recorded at Raunds (Northamptonshire). A temperature of 101.5° F. at Alton, Hants, on July 15th, 1881, was obtained in a screen which differed from the standard pattern, and this record cannot be accepted.

Death Valley has the distinction of recording the hottest summers, the mean July temperature being 102° F., which is approached by Jacobabad, in north-west India, with 98° F. Within the tropics is the August mean of 96° F. at Suakin. The place with the highest mean annual temperature is apparently Massaua, on the Red Sea, with 86° F. ; this high temperature is due as much to the high minima as to remarkable maxima. Thirteen months' observations at Juba, in Italian Somaliland, gave an annual mean of 87° F. Both of these stations are within the tropics. The places with the highest annual mean temperature in the British Isles are Scilly, Jersey and Guernsey with 52.2° F.

The highest wet bulb temperature on record is 100° F. observed at Kamaran Island, in the Red Sea, on September 23rd, 1923, and also at Berbera, Somaliland, on June 21st, 1924 ; Kamaran also gave the highest dry-bulb temperature with a saturated atmosphere discovered by a brief search, namely 94° F. at 9h. on August 14th, 1924. The highest temperature of the sea surface is not known ; a mean monthly temperature exceeding 90° F. has been found in the Red Sea in September. It may be of interest to note that the chemical composition of some deposits from a Permian lake in central Europe indicates that the temperature in summer rose to 95° F.

The absolute minimum temperature on record at the earth's surface comes from Verkhöiansk, in the well-known " cold pole " of Siberia, and is as low as -94° F., recorded by a spirit thermometer on January 3rd, 1885 (mercury freezes at -38° F.). No polar expedition has recorded temperatures nearly so low as this, the nearest approaches being -76° F. on a sledge journey between Cape Evans and Cape Crozier, in 76° S., on July 5th-6th, 1911, and -74° F. at Floeberg Beach, in Lady Franklin Bay, 82° N. These surface temperatures, however, pale into insignificance compared with that of -133° F. (182 a) found

*MARRIOTT, W. Some facts about the weather. 2nd edition. London, 1909.

at 17 km. over Batavia, Java. In the British Isles a temperature of -98° F. (201 a) occurred at 12.5 km. over Pyrton Hill on October 13th, 1913, but without a thorough scrutiny of all the records it is impossible to say if that is the lowest in this country.

The lowest shade temperature at a low level within the tropics revealed by a brief search is 25° F. at Wellington, Madras, but at high levels much lower temperatures are recorded. Of interest, though it is actually outside the tropics, is the minimum of -24° F. recorded at a height of 21,000 feet on Mount Everest in 1924. In the United Kingdom the record is held by Blackadder with a minimum of -23° F. on December 4th, 1879 (Marriott); in England, -11° F. occurred at Buxton on February 11th, 1895; and at Greenwich, 7° F. on February 8th, 1895. The lowest grass minimum at Greenwich is 2° F. on December 30th, 1908. A grass minimum of -9° F. was recorded at Hodsock Priory, Worksop, in February, 1895, but lower minima would probably be revealed by a systematic search.

Turning to low mean temperatures, we find the January mean at Verkhoiansk to be -59° F. As the July mean at this station is $+60^{\circ}$ F., the mean annual range is as much as 119° F. The lowest mean annual temperature probably occurs in the Antarctic. Observations have not been maintained for a year in the interior, but at Framheim, the winter quarters of Amundsen's expedition, the annual mean was -14.4° F. The interior of Greenland is also very cold, and in 75° N, at a height of about 10,000 feet, A. Wegener supposes the mean temperature to be about -26° F., but this is not based on actual observations. The lowest mean annual temperature for the British Isles given in the *Book of Normals*, is 43.3° F. at Braemar, but the mean temperature at the top of Ben Nevis is 31.4° F.

It may be of interest to close this summary of temperature extremes with three tables compiled from nine annual volumes of the Meteorological Office publication entitled the *Réseau Mondial*. This publication gives data of pressure, mean and extreme temperature, and rainfall, based on land stations, generally two for each ten degree "square" of latitude and longitude. The stations are arranged in ten-degree zones, and Miss F. A. Shields has taken out the absolute maximum and minimum in each zone during each of the nine years, with the results shown in Tables 1 and 2. The absolute extremes of the whole period in each zone, with the station and date, are shown in Table 3. One of the most remarkable points shown by Table 1 is that the highest temperature in the zone 0° — 10° S was actually lower than the highest temperature in the zone 60° — 50° N in seven years out of nine, the same in one year and lower in only one year. The maximum in this equatorial zone was lower than the maximum in the zone 40° — 50° S in four years out of nine.

C. E. P. B.

TABLE I. ABSOLUTE MAXIMUM TEMPERATURES.

Zone	Latitude	1910	1911	1912	1913	1914	1915	1916	1917	1918
		° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.
1	80°—70°N.	74.7	76.6	75.2	83.3	82.6	85.5	77.4	81.5	73.9
2	70°—60°	91.0	95.0	91.4	93.0	93.2	97.0	97.0	91.8	96.1
3	60°—50°	103.5	102.9	100.9	98.8	102.2	98.1	100.0	102.0	102.0
4	50°—40°	107.1	104.4	108.7	109.0	105.8	107.6	109.6	107.1	108.9
5	40°—30°	117.3	117.0	118.4	117.0	120.6	119.1	118.4	122.7	120.6
6	30°—20°	124.9	122.0	123.6	122.0	133.3	125.8	123.8	122.7	124.2
7	20°—10°	119.1	114.8	118.4	120.6	116.2	116.1	118.9	115.7	115.0
8	10°N.—0°	115.0	105.1	107.1	108.0	110.5	110.5	108.7	109.4	108.0
9	0°—10°S.	97.3	100.0	100.4	97.7	101.5	102.9	100.0	98.6	100.4
10	10°—20°	111.6	109.8	111.7	111.0	108.0	111.9	108.5	107.1	109.0
11	20°—30°	115.0	114.6	115.0	116.1	115.0	118.9	115.0	118.6	114.8
12	30°—40°	116.1	109.9	120.7	117.5	115.0	117.0	114.1	115.0	115.0
13	40°—50°	96.1	89.8	105.4	106.2	93.2	92.8	98.1	101.5	101.5
14	50°—60°	73.4	74.1	72.3	79.5	73.0	73.8	92.7	91.4	87.6
15	60°—70°	45.5	47.3	41.4	49.3	47.7	41.0	46.8	48.6	52.3
16	70°—80°S.	...	34.7	39.9	...	...	37.0	...	...	...

TABLE II. ABSOLUTE MINIMUM TEMPERATURES.

Zone	Latitude	1910	1911	1912	1913	1914	1915	1916	1917	1918
		° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.
1	80°—70°N.	-34.2	-38.6	-47.7	-48.6	-42.3	-39.3	-50.3	-56.6	-45.6
2	70°—60°	-68.1	-82.8	-79.6	-76.5	-67.7	-79.1	-78.0	-80.7	-75.8
3	60°—50°	-56.6	-60.3	-61.2	-57.6	-58.4	-70.4	-68.8	-60.0	-60.9
4	50°—40°	-42.0	-45.0	-41.3	-36.9	-39.5	-37.3	-45.0	-47.0	-41.1
5	40°—30°	-18.9	-17.0	-16.1	-20.9	-15.0	-13.0	-24.0	-16.8	-17.0
6	30°—20°	24.1	19.0	19.9	27.0	13.5	3.0	21.2	19.0	16.0
7	20°—10°	27.0	36.0	29.5	36.3	38.3	31.8	34.9	29.8	27.7
8	10°N.—0°	50.0	44.1	44.6	44.6	27.1	33.6	30.4	31.8	27.5
9	0°—10°S.	39.0	37.9	40.8	36.5	42.1	39.0	34.0	39.9	37.9
10	10°—20°	29.8	30.0	28.6	32.0	30.4	29.3	24.8	28.8	25.7
11	20°—30°	25.0	19.0	26.1	23.4	25.0	24.1	19.6	23.0	19.9
12	30°—40°	23.7	12.6	11.7	24.8	25.9	17.1	16.7	21.2	13.5
13	40°—50°	24.1	24.6	22.3	21.2	23.0	22.6	10.4	15.8	2.8
14	50°—60°	14.0	9.3	8.2	9.3	11.8	9.3	9.7	9.3	8.8
15	60°—70°	-25.1	-18.4	-30.1	-32.8	-26.7	-25.4	-24.3	-26.7	-27.8
16	70°—80°S.	...	-73.3	-37.5	...	...	-34.1	...	...	...

TABLE III. EXTREME TEMPERATURES.

Zone	Latitude	Abs. Max.	Station	Date	Abs. Min.	Station	Date
		° F.			° F.		
1	80°—70°N.	85.5	Gjesvaer ...	July 28, 1915	—56.6	Spitsbergen ...	Mar. 28, 1917
2	70°—60°	97.0	Rampart {	July 21, 1915 June 26, 1916	—82.8	Verkhoiansk ...	Jan. 28, 1911
3	60°—50°	103.5	Minnedosa ...	July 14, 1910	—70.4	Eniseisk ...	Jan. 10, 1915
4	50°—40°	109.6	Krasnovodsk	July 20, 1916	—47.0	Macleod ...	Jan. 31, 1917
5	40°—30°	122.7	Baghdad ...	July 21, 1917	—24.0	Modena ...	Dec. 27, 1916
6	30°—20°	133.3	Insalah ...	July 19, 1914	3.0	Cañadas del Teide	Feb. 2, 1915
7	20°—10°	120.6	Timboubtoo...	June 13, 1913	27.0	Mexico ...	Jan. 22, 1910
8	10°N.—0°	115.0	Wau ...	April 16, 1910	27.1	Nuwara Eliya ...	Feb. 8, 1914
9	0°—10°S.	102.9	Barra do Corda	Oct. 8, 1915	34.0	Nairobi ...	July 23, 1916
10	10°—20°	111.9	Daly Waters	Jan. 4, 1915	24.8	Sucre ...	July 1, 1916
11	20°—30°	118.9	Boulia ...	Feb. 7, 1915	19.0	Mitchell...	June 23, 1911
12	30°—40°	120.7	Eucla ...	Dec. 17, 1912	11.7	Heidelberg ...	June 26, 1912
13	40°—50°	106.2	Bahia Blanca	Jan. 13, 1913	2.8	Sarmiento ...	July 7, 1918
14	50°—60°	92.7	Santa Cruz ...	Feb. 17, 1916	8.2	South Georgia ...	Aug. 13, 1912
15	60°—70°	52.3	South Orkneys	Jan. 25, 1918	—32.8	South Orkneys ...	June, 1913
16	70°—80°S.	39.9	Cape Evans (McMurdo Sd.)	Jan., 1912	—73.3	Framheim ...	Aug. 13, 1911

Correspondence

To the Editor, *The Meteorological Magazine*

The Relative Sunniness of the south-western and south-eastern Counties

In the recent discussion in *Nature* and the June number of the *Meteorological Magazine*, on the claims of England, south-west or south-east, to the most sunshine, it strikes one that there is some danger of haggling about insignificant differences, and thus of losing sight of the real climatic picture, viz., that there is sensible equality between the two districts. The quarterly differences made much of, both by Mr. Harding and Mr. Phillips, are in most cases of a trivial order, and, even supposing they are real, as based on a limited number of stations in a period of thirty-five years, an excess of 2 minutes per day on the average of the year (4.53-4.49 hours, according to figures quoted in the June *Meteorological Magazine*) cannot surely be credited with any medical or other practical importance. The fact which makes Mr. Phillips object to the inclusion of south Wales in the south-west district, on the ground that it lowers the sunshine values for that district, tells, in my opinion, rather in favour of

the south-east district, since it is an expression of the fact that, as may be verified by the sunshine maps in Section III. of the *Book of Normals*, the characteristic sunniness of the south coast of England as a whole extends considerably further up the east coast than the west. This means that the south-east lies more centrally in the sunny belt than the south-west, which may at least have some significance.

L. C. W. BONACINA.

27, Tanza Road, London, N.W. 3. June 26th, 1926.

Waterspouts observed at Paull

I saw two water spouts or whirls or vortices of cloud on Monday, June 28th, at about 12 noon from Paull Pt., Paull, near Hedon, near Hull. They were both to eastward. The first one was at a great distance and in the duration of 5 or 10 minutes extended downwards from a dark cumulus cloud which might have been over Spurn or east of Sunk Island. The view was in each case across land. The first extended downwards until its lower part looked like a thin thread. The whole swayed gently from side to side.

When it had gone a long finger of white cloud was seen comparatively close, perhaps $\frac{1}{2}$ mile away, subtending about 2° , in which the spin and upward spiral in a clockwise direction could be observed, but whether water or cloud or dust I could not say, it was quite white. Where I was, the water was still.

M. R. C. NANSON.

Rosemarkie, Goxhill, Barrow on Humber, Lincs. July 1st, 1926.

NOTES AND QUERIES

The Thunderstorms of July 18th, 1926

For the fourth year in succession July has provided a notable day of thunderstorms. The storms which began on Saturday night, July 17th, and continued on the Sunday, were the most widespread for many years past, affecting practically the whole of the British Isles, and in some western districts they were very severe and prolonged. There was a little local thunder in the southwest on the 17th, but the first really severe storm appears to have reached the south coast about the borders of Devon and Dorset shortly before midnight, after much lightning over the English Channel. At Seaton the storm broke at 10.30 p.m. (probably summer time) and lasted for 1.12 hours, with 1.78 in. of rain (*Times*, June 19th). Mr. B. D. Kilburne, writing in the *Times* of June 23rd, reports that at Sidmouth 2.66 in. fell.

in about 5 hours, commencing 2 a.m. Several houses were struck by lightning in Lyme Regis and the vicinity, and there was some flooding.

Thunderstorms also commenced during Saturday night in Wales and Ireland, and in the Channel Islands, and throughout Sunday they were very general in western England, Wales, Ireland, and parts of Scotland, continuing far into the night in places. At Birr Castle, in Central Ireland, thunderstorms recurred at intervals for over 24 hours, and the total rainfall was 2.52 in., of which 1.65 in. fell during the Sunday night. Mr. Hansford, the observer at Woolacombe climatological station (Devonshire), reports a severe hailstorm at 1.30 p.m. on Sunday afternoon, with hailstones 4 to 5 inches in circumference and weighing 2 to 3 ozs., much glass being broken. Hailstones $3\frac{1}{4}$ inches in circumference were observed at Braunton (N. Devon), at 2.20 p.m., by Mr. Longfield (*Times*, June 23rd).

During the Sunday night thunderstorms extended over eastern England, but they were neither so severe nor so prolonged as they had been in the west. Mr. Henry Newby sends in an account of the storm at Hove, where it broke at about 8.30 p.m., preceded by distant thunder, and by a dark sky over the sea since 6 p.m. It was probably the same storm which crossed the southeast suburbs of London a little over an hour later, doing some damage by lightning. A more general but less severe storm crossed the London area soon after midnight, at the passage of a "cold front."

A study of the synoptic charts shows that on the 17th there was an anticyclone over the North Sea, covering most of the British Isles, but off our western coasts there was an indefinite trough of low pressure, which had only just developed, and which extended down to an old "dying" depression between the Azores and Spain. During the 18th a rather deep depression developed quickly near Brittany and moved north, causing an unusual combination of severe thunderstorms and persistently strong winds later in the day. On the following night a "cold front" or "squall line," swept quickly across the southeast half of England, but the severe storms in the west were certainly not due to a cold front. Like many of our severe storms, they drifted from the south over surface winds mainly between east and southeast, and the upper southerly current probably brought abundant warmth and moisture from low latitudes at the level of the cloud base.

For the ordinary observer, one of the most valuable of all cloud signs is the turret cloud, or alto-cumulus castellatus, which is usually followed by thunder, especially if the wind is easterly and the clouds are moving from south or southwest.

Good examples of this cloud were visible in southeast England on the afternoon of 17th, and also on the 18th.

C.K.M.D.

Lieut.-Col. W. A. Bentley, of Broadford, Co. Clare, reports that during the storm 1·24 in. of rain fell on July 17th and 1·50 in. on the 18th, the total of 2·74 in. in 48 hours not having been exceeded since 2·77 in. fell on 2nd and 3rd April, 1909. The storm came from the southeast; two cows and some goats were killed and a small cock of hay burned by the lightning. The rivers rose rapidly but soon subsided.

Abnormal Audibility of Gunfire. The Time of Passage of the Sound

The study of the "abnormal" audibility of the sounds from explosions suffers from the drawback that as large explosions are usually unforeseen, persons who happen to hear them are not prepared to time with any precision the arrival of the sound. On the other hand, the deliberate detonation of large quantities of explosive can only be arranged on the rare occasions when superfluous stores have to be disposed of. It occurred to me recently that it might be possible to utilise the comparatively small air disturbances produced by gunfire, and, to give the method a trial, I ascertained when heavy guns were likely to be tested at Shoeburyness. For my listening post, I selected Grantham, in Lincolnshire, as being at an appropriate distance for abnormal audibility and in a likely direction. It may be recalled that the Silvertown explosion was audible in Lincolnshire, and also that during the war, firing on the western front was heard in London in the summer months, the bearing being about the same in each case.

On Monday, June 28th, 1926, I was at Grantham and received a telegram to say that firing would commence at about 2 o'clock (13h. G.M.T.) and last for an hour. The spot I selected for listening was on the hill about a mile east of Grantham and half a mile northwest by north from Spittlegate Aerodrome. I sat under a hedge with a clump of trees behind it. The view to the south and southeast from this position was quite open.

It was not until 13h. 48m. that I heard any noise which could be identified with gunfire. After that I heard six more booms at intervals. The noises were all so faint that they would have been unnoticed by anyone who was not on the alert. There were considerable differences between the noises, and it is

therefore worth while to copy my notes. The times have been corrected to G.M.T.

13h 48m 25s Definite boom, short. 13h 55m 48s Boo oo m.
 14h 9m 6s Ahaa haa. 14h 15m 56s Ahaa ha.
 14h 22m 31s Up up. 14h 28m 23s Doubtful (Ad-
 14h 34m 45s Single boom, faint. ventitious noises).
 The meteorological conditions were the same throughout ; little wind, overcast sky (small cumulus below stratus), poor visibility.*

On receipt of information from Shoeburyness, I was gratified to find that exactly seven rounds had been fired, so that I had heard all of them. The times are shewn in the following table :—

JUNE, 28th, 1926.						
Round.	Fired.			Heard.	Time of Passage.	Apparent Speed.
	h. m. s.			h. m. s.	m. s. s.	km/s.
1	..	13	37 37	13 48 25	10 48 = 648	·285
2	..		44 56	55 48	10 52 = 652	·283
3	..		58 2	14 9 6	11 4 = 664	·278
4	..	14	4 44	15 56	11 12 = 672	·275
5	..		11 14	22 31	11 17 = 677	·273
6	..		17 8	28 23	11 15 = 675	·274
7	..		23 44	34 45	11 1 = 661	·280

It will be seen that there were considerable differences in the time of passage of the sound over the range, which is 115 miles or 185 kilometres. For the first round, it was 10 minutes 48 seconds, for the fifth, 11 minutes 17 seconds. If the sound had travelled near the ground at the speed 341 metres per second appropriate for the temperature, the time of passage would have been just 9 minutes. The single booms were observed when the time of passage was short, the double ones when it was longer. The interpretation may be that in the former case, my station was almost on the inner boundary of the zone of abnormal audibility, in the latter case the station was well beyond the boundary. According to theory, the fore and aft section of the wave front as it approaches the ground is γ -shaped. The arrival of the cusp might be heard as a single crack, whereas the arrival of the two branches of the γ would be heard as two booms in quick succession. However, I do not attach much importance to this aspect of the observations. It is recognised that even at short distances from a gun, the quality of the sound differs from round to round. In the present instance, Mr. Britton reports that at Shoeburyness 8,500 yards from the gun, rounds 3, 6 and 7, were clearly less sharp than the remainder,

* The *Daily Weather Report* shews that pressure was high, 1,029 mb., and temperature moderate (64° F, at Cranwell at 13h.). An aeroplane flight at S. Farnboro' at 9h 30m the same morning gave a regular temperature gradient up to 8·6 km. above sea level, where temperature was -38° F.

and that another observer about 9,200 yards from the gun, but much nearer the trajectory, found that rounds 1, 2, 3 and 5, were accompanied by more reverberation than rounds 4, 6 and 7. The firing conditions for the seven rounds were identical, the charge being the same every time.

That the time of passage of the sound should change so much in the course of half-an-hour implies rapid variation in the upper air conditions.

If we accept the theory that abnormal audibility depends on the fact that at heights from 30 kilometres upwards the atmosphere is comparatively warm, and at 50 kilometres at least as warm as at ground level, variations in the time of passage of the sound imply variations in the temperature and height of this warm layer. These may be casual; on the other hand it is possible that they are systematic, with a large daily range. It is even within the bounds of possibility that it is the daily fluctuation in the density of the air in these high regions that is responsible for the familiar regular oscillation of barometric pressure.

My thanks are due to Lt.-Col. J. V. Hope, Superintendent of Experiments, Shoeburyness, and to Mr. C. Britton, the Meteorological Officer, without whose assistance the investigation could not have been undertaken.

F. J. W. WHIPPLE.

The Breathing of the Continents

Herr Otto Myrbach has developed some ideas on the succession of weather types in temperate regions which are of exceptional interest.* His theory depends on the fact that land has a smaller specific heat than water and therefore warms or cools more rapidly. Starting from a winter period with slight barometric and thermal gradients, he sets out the theoretical succession of events as follows:—

(A) Over the continents the temperature falls more rapidly than over the sea. The air over the land is cooled by conduction and radiation and contracts, drawing in air from the oceans; "*the continents breathe in.*" The vertical contraction causes a lack of air at great heights, producing a barometric depression in the upper air.

(B) To fill this high depression over the land air streams in from the sea. Pressure rises over the land and falls over the sea; this land-sea gradient prevents the further influx of air at low levels. The temperature over the land reaches its minimum.

(C) The cold air in the anticyclones over the continents breaks out as cold waves over the sea, especially in low latitudes.

* O. MYRBACH, *Das Atmen der Atmosphäre unter kosmischen Einflüssen.* Ann. Hydrogr., Berlin 54 (1926) pp. 94-105 and pp. 145-168.

Over the land air descends, warming adiabatically and bringing about a rise of temperature and fall of pressure. "*The continents breathe out.*"

(D) The cold waves spread further over the sea and displace the warm air (stage of winter sea rainfall). Pressure rises over the sea and the original stage of uniformity of pressure and temperature is re-established.

The author investigates these winter stages by examining the charts of the northern hemisphere for the first half of 1914, published by the United States Weather Bureau. An analogous succession during the summer months could not be investigated directly because of the lack of suitable charts. In order to eliminate the "small weather changes" due to the passage of depressions he forms overlapping ten-day charts and also forms the "isallobar" charts from one ten-day period to the next. He considers that the charts confirm his theoretical succession and reproduces a number of them showing typical stages. His starting point is January 10th, when there were small pressure gradients over the whole northern hemisphere and relatively high pressure over the polar basin. Stage (B) is reached by February 1st, when a depression over the Arctic Ocean is surrounded by a ring of very high pressure. Stage (C) is reached by February 11th, and (D) by February 21st. The outbreak of cold air from the Arctic basin is very clearly pictured by the isallobar chart representing the change of pressure from February 21st to March 9th, which shows three tongues in which pressure was rising over the oceans, separated by areas of falling pressure over the continents. On March 9th the original stage of uniform distribution has been reproduced and the cycle begins again.

The average interval between the corresponding stages of the two cycles is 58 days. The obvious course would be to regard this as the natural length of the cycle under the existing conditions of solar constant, size of continents, etc., and if he had been able to leave it at that, the author would have presented us with a clear-cut theory of the sequence of pressure types, requiring only to be proved or disproved by the examination of further series of weather charts for different years. But in addition to this simple succession, he finds on his charts evidence of various series of pressure waves, both progressive waves moving from west to east, and stationary meridional waves, and in his investigation of these waves he become rather involved. He finally postulates a very complex series of "rhythms" depending on the rotation of the sun, the conjunctions of the planets, the moon, all fitting neatly into a grand period of 432 days in which the position of the pole oscillates about its mean. The

term "rhythms" is used instead of "periods" because they are of variable length, being shortened in years of many sunspots, and lengthened in years of few sunspots. Altogether we have about 22 "rhythms" ranging in length from 45 to 432 days, few of which are likely to prove worthy of serious consideration.

The conception of the "breathing of the continents" is simpler and may explain some examples of the succession of weather types which have emerged from the study of monthly charts of pressure. For example in the spring of many years there is an occasion when a large anticyclone moves north-eastward from the Azores across the British Isles.* Good examples occurred in April, 1912, and March, 1926. It was supposed that these are "warm" anticyclones composed of equatorial air with a high cold stratosphere; Myrbach's charts show that in 1914 a similar phenomenon occurred between March 9th and April 15th, and he attributes the anticyclone to a mass of cold polar air, breaking out from the Arctic Ocean southwards across the western North Atlantic and curving round the Icelandic minimum. Aeroplane ascents in the middle of March, 1926, showed a very marked inversion at a height of 5,000-6,000 feet, above which the air was abnormally warm for the season, so that it was presumably equatorial air. On the other hand, in the anticyclone of April, 1912, the average height of the tropopause was only a little over 10 km., and the temperature from 5 to 9 km. was abnormally low, presumably indicating polar air, so that neither view is definitely excluded.

Chinese Boy Scouts as Observers

The Hankow Weather Guide, by Stanley V. Boxer, which has recently been published by the Griffith John College, Hankow, forms a welcome addition to our knowledge of the meteorology of Central China. The well-known compilations of the Zi Ka Wei Observatory, *La pluie en Chine*, and *La temperature en Chine*, deal with the regional distribution of special elements; here we have a comprehensive account of the variations of all elements of climate at one station over a period of ten years, 1916 to 1925. The observations were commenced by Mr. Boxer as a result of the enthusiasm of the late Mr. W. W. Lindsay, of Kuling, and by far the greater number of the observations have been taken by the 1st Hankow Troop of the Chinese Boy Scouts, assisted by the staff of the Griffith John College. Every effort has been made to preserve continuity and accuracy. The analysis of the data is very complete, including numerous frequency tables, and there are many excellent diagrams. There is, in fact, something to record at this station: "From the hot breathless nights of August (would that we had a Recording Katathermo-

* See *Meteorological Magazine*, 61, (1926), p. 59.

meter for these), through the delightful clear days of autumn to shrivelling, dry northerly winds of January . . . we undergo an annual oscillation between Goa and Gobi ! ”

Radiation from the Sky

RADIATION MEASURED AT BENSON, OXON, 1926.

Unit : one gramme calorie per square centimetre per day.

ATMOSPHERIC RADIATION only (dark heat rays)				
Averages for Readings				
		April	May	June
Cloudless days :—				
Number of readings ...	n	5	4	10
Radiation from sky in zenith ...	πI	468	504	532
Total radiation from sky ...	J	502	536	568
Total radiation from horizontal black surface on earth ...	X	749	758	769
Net radiation from earth ...	$X-J$	247	222	201
DIFFUSE SOLAR RADIATION (luminous rays).				
Averages for Readings between 9 h. and 15 h. G.M.T.				
Cloudless days :—				
Number of readings ...	n_0	2	1	2
Radiation from sky in zenith ...	πI_0	67	85	60
Total radiation from sky ...	J_0	69	108	73
Cloudy days :—				
Number of readings ...	n_1	1	3	5
Radiation from sky in zenith ...	πI_1	*20	190	173
Total radiation from sky ...	J_1	*17	172	154

* The low values were caused by an usually dense cloud stratum.

Unit for I = gramme calorie per day per steradian per square centimetre.

Unit for J and X = gramme calorie per day per square centimetre.

For description of instrument and methods of observation, see *The Meteorological Magazine*, October, 1920, and May, 1921.

Modern Sunlight

WE have received a copy of Vol. I., No. 3 of *Modern Sunlight*, published monthly by the Sunlight Bureau, price 2s. The health-giving power of sunlight is believed to be largely, if not mainly due to the ultra-violet radiation, and for curative purposes such radiation can be provided with great steadiness and reliability by artificial means. Instead of the patient often

having to make an expensive journey in quest of the sun, the curative essence of sunlight is brought to the patient.

Man and Weather*

“ ‘The time has come,’ the walrus said,
‘To talk of many things.’ ”

The impression which this little book makes on the reader may be summed up in these lines. There are six chapters, representing a series of popular lectures on “aerography” (meteorology), and the author jumps from subject to subject in a delightfully chatty and informal way. “The Strategy of Weather in War” recalls some occasions on which a gale or fog has perhaps changed the course of history. Many of the instances are drawn from the late war, and it appears that, but for south-west gales in the Mediterranean in February, 1915, the war would have been shortened by three years. “Weather in peace” ranges over many topics, from weather forecasts, long and short, to Professor McAdie’s own units and nomenclature. It seems that the forecaster in America plays many parts, and may on occasion be called in to restore the health of a crèche after the doctors have confessed themselves baffled.

“The Structure of the Atmosphere” is a lively account of the six floors of the atmospheric skyscraper—troposphere, stratosphere, the region of meteors, the Kennelly-Heaviside layer, the auroral layer and the Empyrean, from 500 to 1,000 kilometres. The Fahrenheit scale is regarded as obsolete, and readings are given in kilograds. The chapter is marred by a few examples of loose writing, as in the reference to density on page 43. The same applies to the next chapter, where we read (page 62) that it would seem that “the total rainfall for the globe is much less than the evaporation,” a meaningless statement as it stands. The definition of entropy on page 65 as “the running-down of heat” might perhaps be improved upon.

The truth about Franklin forms the main theme of the chapter on “Lightning”: apparently the usual story of the famous kite-flying experiment is inaccurate; in fact, “if Franklin had really flown his kite during a lively thunder-storm, there might have been a coroner’s jury next day holding an inquest on the remains.” The last part of this chapter, dealing with the auroral spectrum, is rather technical, and is out of keeping with the remainder of the book. The final chapter deals with “Droughts, floods and forecasts,” and we read that in order to produce the Noachian flood which submerged Mount Ararat in forty days and forty nights, it must have rained steadily at the

* MCADIE, A. *Man and Weather*, 8vo, 7½ × 5. pp 99, *illus.* published by Humphrey Milford, at the Harvard University Press, Cambridge, Massachusetts, U.S.A. and the Oxford University Press, London. Price 8s. 6d. net.

rate of 100 mm. a minute. The author might have made this figure even more impressive if he had adopted the Indian version of the tradition, in which the ark lands on the top of Mount Everest.

The book is excellently printed, and contains a number of fine plates, mostly of cloud forms. It is well calculated to appeal to the layman, for whom it would while away the idle hour or so of a train journey with great interest and some profit. The price seems rather high for the size, but this is probably accounted for by the illustrations. There is a misprint on page 39, and on page 67 Luke Howard's domicile is given as "Tottingham," this may be the archaic form, but the modern spelling would be preferable.

Reviews

Gerland's "*Beiträge zur Geophysik*." Edited by V. Conrad, Vienna. Band XV., Heft I., Leipzig, Akademische Verlagsgesellschaft M.B.H., 1926.

The first part of a new volume (Volume XV.) of Gerland's "*Beiträge zur Geophysik*" has been published recently. According to the preface to this volume, the last previous issue appeared in 1918. The magazine, which began in 1887 with the publication of theses by Gerland's students at Strassburg, had attained before the war an international character. Angot, Darwin, Galitzin, Helmert and Trabert were numbered amongst the contributors. It is hoped that the international character will be preserved in the revived magazine. The editor might have thought that there was hardly room for his paper as well as for the *Zeitschrift für Geophysik*, but he contends that whilst that journal meets the need for rapid publication of new ideas his will contain more detailed developments.

For this first number the editor has been successful in securing the co-operation of experts from several countries and in covering many branches of geophysics—magnetism, atmospheric electricity, seismology, gravitation, meteorology and geochemistry. The paper on geochemistry is by V. M. Goldschmidt, of Oslo. He sets out the aims and methods of this new subject. It is concerned with such questions as the frequency of the elements: how much oxygen is there on the earth and how much iron? what rules govern their distribution?

Of the two meteorological papers, one by A. Ångström is of outstanding importance. It deals with the flux of heat to and from the earth and with the distribution of temperature. One valuable generalisation is that the outflow of heat by radiation through the top of the atmosphere is the same in all latitudes; the greater radiation from the earth's surface in the hotter regions is balanced by the greater absorption in the moister air.

Within 35° of the equator, the heat received from the sun more than compensates for the loss by radiation; the polar zones on the other hand do not receive from beyond the atmosphere as much as they lose. Reconciliation is effected by atmospheric and oceanic currents; the flow of heat parallel to the earth's surface is analogous to conduction but eddy conductivity on this scale is very large compared with the conductivity of metals; Ångström finds that it is greater in the ratio 10,000,000 : 1. The paper is in harmony with earlier work by Defant and Exner but the subject gains by treatment by a writer who is *the* authority on terrestrial radiation.

The other meteorological paper is by J. W. Sandstrom on what he calls a peculiar ambiguity in the meteorological influence of the Gulf Stream. He demonstrates that winter temperature in northern Europe is associated closely with the direction of the local wind as observed in the Lofoten Islands. His view is that for long range forecasting it will prove profitable to study the winds at the Lofoten Islands rather than the difference between the pressure at the Azores and Iceland, hitherto the favourite criterion of the strength of the Gulf Stream influence.

Jahresberichte (28-33) des *Sonnblick-Vereines für die Jahre* 1919 bis 1924. *Sonnblick-Vereines* XIX, Hohe Warte 38, Vienna 1924 and 1925.

The *Sonnblick* (lat. $47^{\circ} 1' N$, long. $12^{\circ} 6' E$, height 10,190 ft.) is a peak in the Austrian Central Alps, well known to all alpinists as a neighbour of Grossglockner. In 1886 a meteorological observatory was built on its summit by Simon Rojacher, the native owner of a neighbouring gold mine. Due to the initiative of this experienced man, the house may be called a model piece of architecture for mountain regions. It has braved the inclemencies of alpine climate for 40 years, enabling the observers to keep meteorological records running throughout the year, in the region of everlasting snows.

The observations, combined with those taken at base-stations, have been of great importance for the advancement of meteorology. The Alps are, so to say, a laboratory for the meteorologist where he can study the phenomena in and above the cloud-region and the dynamic effects in air flowing up or down the slopes. The Austrian meteorologists, under the leadership of the late Hann and Trabert, have used the data for many investigations, throwing new light on the vertical distribution of temperature in cyclones and anticyclones, the relations between the daily variations of pressure, wind and temperature in the free atmosphere, the amount of water in clouds, etc. The work of Elster and Geitel on atmospheric electricity must also be mentioned.

It has often been thought that modern aerological research

work by means of kites, sounding balloons and aeroplanes has reduced the comparative value of mountain observations. These show indeed local influences causing small differences in the conditions of the air on the summit compared with that in the free atmosphere; but this slight drawback is more than compensated by the high advantage of continuous records for investigational and prognostic work.

The costs for running the observatory have been defrayed by private people united in the Sonnblick-Verein. The bad financial conditions in post-war time nearly crushed the institution, but since 1924 several scientific societies in Austria and Germany have lent support. The present reports deal with this reorganization. They also contain obituaries for Hann and Trabert, several papers of meteorological and alpinistic interest, abstracts of the observations and two splendid photographs of the Sonnblick crowned with snow. During the six years 1919-1924 the highest temperature recorded was $+11.9^{\circ}\text{C}$ (53°F), the lowest -31.6°C (-25°F). The coldest month was February, 1924, with a mean of -15.3°C (4°F), the mildest month was July, 1921, $+2.6^{\circ}\text{C}$ (37°F). The number of days with snowfall per year varies between 119 (1921) and 229 (1919), while the annual precipitation lies between 1,046 and 1,558 mm. The frequency of stormy days (31 % in the year, 41 % in winter) is characteristic for the climate of the peak.

J. BARTELS.

Obituary

Colonel Francisco S. Chaves. It is with much regret that we learn of the death, on July 23rd, of Colonel Chaves, the Director of the Meteorological Service of the Azores. Col. Chaves entered the observatory at Ponta Delgada in 1893, and his association with International meteorology began in 1900 when he was invited to attend a meeting of the Meteorological Committee held in Paris. He was shortly afterwards elected a member of that Committee in place of Admiral de Brito Capello. Realising the importance of meteorological observations in the Azores for the meteorology of Europe and America, Col. Chaves had put forward proposals at Paris for the establishment of an International Meteorological Service in the Azores and had secured the patronage and support of the Prince of Monaco for his project. Subsequently the King of Portugal decided to establish the service at the sole expense of Portugal, and Col. Chaves was charged with the duty of organising the service. This was begun in October, 1901, and the King and Queen of Portugal went to the Azores to lay the first stone of the Meteorological Observatory at Horta. Observatories were established in four of

the islands—St. Michael (Ponta Delgada); Fayal (Horta); Terceira (Angra); and Flores (Santa Cruz). Col. Chaves secured a concession from the Eastern Telegraph Company, under which the meteorological telegrams reporting the observations at these stations were transmitted free of all cable charges up to 40 words per day. The first report from the new observatory at Horta was published in the *Daily Weather Report* for December 6th, 1902.

Col. Chaves' achievement was a notable one, but perhaps even more noteworthy than the achievement was the spirit in which it was effected. It is not unusual in International meetings for members either to seek for something which is of value to their own country or to offer services in exchange for services rendered or in anticipation of services to be rendered. Colonel Chaves, when he offered reports from the Azores, attached no conditions to his offer nor did he seek for anything in return. This same spirit in which he began, continued throughout his life, and at all the meetings of the Meteorological Committee or Commissions his sole endeavour was to make the service which he had inaugurated at the Azores more completely useful for European (and American) meteorology.

In 1923 and 1924 he was unable to come to International meetings or to Europe on account of illness, and although he had recovered appreciably early in 1925 he was still not well enough to attend the meeting of the Upper Air Commission in London, in April, 1925. Later, however, he recovered sufficiently to pay another visit to Europe.

He was very desirous that European meteorologists should see the service of the Azores and he had a guest room for them in the Observatory. I remember vividly our last conversation when he was describing the view of an island mountain 7,000 feet high, which I should see from the guest chamber window when I went to see him at the Azores, and how the cloud motion over the top of the mountain was one of the local weather prognostics.

To those who knew the earnestness of this desire of Col. Chaves, the sorrowful news of his death is made the more poignant by the fact that he passed away while Sir Napier Shaw was on his way to the Azores to pay just such a visit to his old friend.

E.G.

The Rev. Herbert Arnold Boys, F.R. Met. Soc. The death of the Rev. H. A. Boys, which took place at St. Mary Bourne, Hants, on July 31st, removes another of the band of voluntary observers who have been associated with the British Rainfall Association almost from its foundation. Mr. Boys was born at Wing Rectory, Rutland, in 1844, and educated at Uppingham and Emmanuel

College, Cambridge, where he was Johnson and Thorpe scholar. He took honours in mathematics, classics and theology, and was ordained in 1869. It was in 1868 that he first came into touch with the late G. J. Symons' Rainfall Association, and at Wing that year he set up a Negretti and Zambra rain gauge, which he still had in use at St. Mary Bourne at the time of his death. In 1870 weakness of the lungs forced him to leave England and he became the first English chaplain at Patras, Greece. Here he took regular observations of pressure, temperature and rainfall, and an account of these observations formed his first contribution to *Symons Meteorological Magazine*. This was published in July, 1871, and thereafter for over 50 years he continued a frequent and valued contributor. As late as 1924 he entered with keenness into the discussion on "The Reform of the Calendar," and less than a month before his death he wrote a description of the storms of July 5th, 1926. From 1870 onwards throughout his life he took accurate meteorological observations wherever he was. He wrote a summary of the climate of Algiers, where he was chaplain from 1875 to 1889, and at North Cadbury, Somerset, where he held the living from 1896 to 1921, he started the Mid-Wessex Rainfall Association in 1906 on the lines of the one he had helped Major C. A. Markham with, when he was at Easton Mauduit (1890-1896). He had a fine library and he was an ardent cyclist, continuing to ride until past his 80th birthday. At Cadbury he restored the tower of the magnificent Perpendicular Church at his own expense, and acted for some time as secretary of the Wells and Glastonbury branch of the English Church Union. He married twice.

News in Brief

The Council of the Royal Meteorological Society has awarded the Howard Prize for 1926 to Cadet B. W. Harman, of H.M.S. "Worcester," for the best essay on "The Causes and Distribution of Fog in the North Atlantic."

The Weather of July, 1926

The weather was mainly fair and warm with many thunderstorms during the first part of the month, and unsettled, but with many fine periods during the later part. The first three or four days were fine with high night temperatures especially on the night of the 2nd to 3rd when minima of 55° to 60° were recorded at most stations. On the 4th, low pressure systems began to spread over southern England and Ireland causing unsettled mainly cooler weather with much rain at times and local thunderstorms in the south, while warm cloudy weather continued in Scotland. Rainfall measurements exceeded 30 mm. in several southern places, e.g., 42 mm. (1.67 in.) were recorded at Haughley, Suffolk, on the 5th. On the 8th a general improvement took

place and maximum temperatures of over 80° F. occurred in many parts, but on the 9th thunderstorms accompanied in some instances by heavy rain occurred over a wide area. About the 10th an anticyclone passed across France towards Denmark and was associated with a short spell of hot weather in our islands. Each day the temperature rose higher, until on the 14th 89° F. was registered at London (Camden Square) and at Calshot. Meanwhile pressure was rising on the Atlantic, south of Iceland, bringing a supply of air from a more northerly source to Great Britain. This caused cloudier skies and a marked drop in temperature on the 15th, the maximum readings in some cases being more than 20° F. lower than on the 14th, *e.g.*, at West Witton the maximum temperature on the 14th was 85° F., on the 15th, 63° F. Temperature rose again, however, during the next few days as the anticyclone moved south-east to the continent, but at the same time a depression was spreading up from the Bay of Biscay. This caused numerous thunderstorms and torrential rain and hail in many places as well as high winds and gales locally. 97 mm. (3.80 in.) fell at Ballycumber (King's Co.), and 91 mm. (3.58 in.) at Lyme Regis (Dorset) on the night of the 17th to 18th, 103 mm. (4.06 in.) at Rhayader on the 18th, and 57 mm. (2.26 in.) at Ilderton (Northumberland) on the 19th. Serious floods occurred in several places as a result of this heavy precipitation. A report from Ross-on-Wye states that the river rose rapidly to 11 feet above its normal. Somewhat unsettled rather cool weather with, however, many fair periods when day temperatures reached 80° F. locally, then prevailed until about the 27th when an anticyclone passed northeastwards to Scotland giving fine warm weather over the whole kingdom. In districts visited by heavy thunderstorms the total rainfall was much above the average, but in others the month was dry, *e.g.*, at Braemar only 28 per cent. of the normal occurred.

Pressure was slightly above normal over the British Isles and western Europe, the excess reaching 3.1 mb. at Wick. Pressure was below normal over the Arctic Ocean, Iceland and the greater part of the North Atlantic and also over central Europe, but the deficit nowhere reached 5 mb. Temperature did not depart greatly from its normal value but the month was generally dry in the centre and west of Europe, the deficit amounting to about 40 per cent. of the normal in parts of Sweden. Heavy rain and the melting of the snow in the mountains caused floods throughout Yugoslavia early in the month. On the 4th and 5th, after a respite of about a week, severe thunderstorms again broke over Germany, northern France and Switzerland. Floods occurred in several parts and several lives were lost. On the 16th a

hailstorm devastated the village of Rugovo (Montenegro) and 40 people were killed. During the following days fresh floods occurred in Yugoslavia, and also in Rumania on the 29th.

Heavy rain was experienced in Calcutta on the 21st and 22nd when nearly 12 in. are reported to have fallen in two days. Large areas of the city were flooded. Part of a large building in Bombay collapsed on the 27th as a result of the heavy rain. The monsoon was reported as generally active towards the end of the month. Heavy storms followed by landslides caused much destruction and loss of life in southern Japan about the 7th. On the 25th floods occurred in northern Korea and on the 26th a landslide in southern Korea, 53 people being killed. Nearly 200 people were reported to have been drowned during the severe floods near Tokyo on the 29th.

The total rainfall for the month in Australia was generally slightly below normal, except in the central parts of Western Australia where it was nearly twice the normal and caused floods of unusual magnitude about the 22nd. On the 22nd a tornado passed across Melbourne doing much damage.

The long spell of cool weather which the eastern states of America enjoyed during the spring and early summer was broken on July 9th by a heat wave, lasting two days. This ended in a terrific thunderstorm when the naval ammunition depot at Dover was struck by lightning and many lives were lost. Between the 15th and 20th the Middle West was suffering from a heat wave which passed to the eastern States about the 20th. Temperatures of over 100° F. were registered in many places. At Washington 104° F. was recorded on the 21st, 1° F. higher than the record for July. Windstorms on the 23rd brought an end to the heat wave. A hurricane from the Caribbean Sea swept across the Leeward Islands on the 24th and then over the Bahamas and the east coast of Florida on the 26th. Nassau, Porto Rico and San Domingo suffered the most, and 150 people are believed to be missing from Nassau. Great damage was done to shipping.

The special message from Brazil states that the rainfall in the northern and central regions was scanty, being 70 mm. and 20 mm. below normal respectively, and that the distribution in the southern region was irregular with an average 74 mm. above normal. The atmospheric circulation was normal. The coffee, cane and tobacco crops were suffering from lack of rain. At Rio de Janeiro pressure was 1.1 mb. above normal and temperature 0.7° F. below normal.

Rainfall, July, 1926—General Distribution

England and Wales	..	96	} per cent. of the average 1881-1915.
Scotland	.. ..	90
Ireland	.. ..	102
British Isles	.. ..	96

Rainfall: July, 1926: England and Wales

CO.	STATION.	In.	mm.	Per- cent. of Av.	CO.	STATION.	In.	mm.	Per- cent. of Av.
<i>London.</i>	Camden Square	2.08	53	87	<i>War.</i>	Birmingham, Edgbaston	1.82	46	78
<i>Sur.</i>	Reigate, Hartswood . . .	1.64	42	78	<i>Leics</i>	Thornton Reservoir . .	2.54	65	102
<i>Kent.</i>	Tenterden, Ashenden . .	1.93	49	92	"	Belvoir Castle	2.13	54	88
"	Folkestone, Boro. San.	1.43	36	...	<i>Rut.</i>	Ridlington	2.20	56	...
"	Margate, Cliftonville . .	1.33	34	67	<i>Linc.</i>	Boston, Skirbeck	1.37	35	62
"	Sevenoaks, Speldhurst . .	1.91	49	...	"	Lincoln, Sessions House	1.45	37	63
<i>Sus.</i>	Patching Farm	2.31	59	96	"	Skegness, Marine Gdns.	1.37	35	63
"	Brighton, Old Steyne . .	1.81	46	83	"	Louth, Westgate	1.95	50	78
"	Tottingworth Park	2.60	66	104	"	Brigg	1.99	51	85
<i>Hants</i>	Ventnor, Roy. Nat. Hos.	1.69	43	84	<i>Notts.</i>	Worksop, Hodsock . . .	1.50	38	66
"	Fordingbridge, Oaklands	1.32	34	66	<i>Derby</i>	Mickleover, Clyde Ho. .	1.59	40	65
"	Ovington Rectory	2.27	58	88	"	Buxton, Devon. Hos. . .	3.20	81	81
"	Sherborne St. John Rec. . .	...	...	...	<i>Ches.</i>	Runcorn, Weston Pt. . .	3.97	101	144
<i>Berks</i>	Wellington College	1.99	51	96	"	Nantwich, Dorfold Hall	3.49	89	...
"	Newbury, Greenham . . .	2.36	60	106	<i>Lancs</i>	Manchester, Whit. Pk. .	3.13	79	95
<i>Heris.</i>	Benington House	2.76	70	113	"	Stonyhurst College . . .	3.34	85	86
<i>Bucks</i>	High Wycombe	2.45	62	124	"	Southport, Hesketh Pk .	3.32	84	116
<i>Oxf.</i>	Oxford, Mag. College . .	2.64	67	116	"	Lancaster, Strathspey .	4.01	102	...
<i>Nor.</i>	Pitsford, Sedgebrook . .	2.00	51	85	<i>Yorks</i>	Sedburgh, Akay	4.92	125	109
"	Eye, Northolm	2.14	54	...	"	Wath-upon-Deane . . .	1.61	41	64
<i>Beds.</i>	Woburn, Crawley Mill . .	1.99	51	89	"	Bradford, Lister Pk. . .	2.13	54	77
<i>Cam.</i>	Cambridge, Bot. Gdns. . .	2.28	58	106	"	Wetherby, Ribston H. . .	2.01	51	80
<i>Essex</i>	Chelmsford, County Lab .	2.19	56	103	"	Hull, Pearson Park . . .	1.89	48	81
"	Lexden, Hill House	2.12	54	...	"	Holme-on-Spalding . . .	2.02	51	...
<i>Suff.</i>	Hawkedon Rectory	3.30	84	135	"	West Witton, Ivy Ho. . .	2.62	67	...
"	Haughley House	2.94	75	...	"	Felixkirk, Mt. St. John .	1.90	48	70
<i>Norfol.</i>	Beccles, Geldeston	1.93	49	83	"	Pickering, Hungate . . .	2.43	62	...
"	Norwich, Eaton	1.67	42	65	"	Scarborough	2.67	68	110
"	Blakeney	2.13	54	94	"	Middlesbrough	4.70	119	184
"	Swaffham	1.38	35	54	"	Baldersdale, Hury Res. .	3.29	84	106
<i>Wilts.</i>	Devizes, Highclere	2.25	57	97	<i>Durh.</i>	Ushaw College . . . . .	...	...	...
"	Bishops Cannings	2.28	58	92	<i>Nor.</i>	Newcastle, Town Moor .	3.75	95	142
<i>Dor.</i>	Evershot, Melbury Ho. . .	1.82	46	72	"	Bellingham, Highgreen .	3.59	91	...
"	Creech Grange	1.66	42	...	"	Lilburn Tower Gdns. . .	5.25	133	...
"	Shaftesbury, Abbey Ho. . .	1.77	45	69	<i>Cumb.</i>	Geltsdale	3.08	78	...
<i>Devon</i>	Plymouth, The Hoe . . . .	...	...	...	"	Carlisle, Scaleby Hall . .	3.54	90	108
"	Polapit Tamar	2.76	70	103	"	Seathwaite M.	11.08	281	131
"	Ashburton, Druid Ho. . . .	1.15	29	38	<i>Glam.</i>	Cardiff, Ely P. Stn. . . .	2.27	58	73
"	Cullompton	1.21	31	45	"	Treherbert, Tynywaun .	4.73	120	...
"	Sidmouth, Sidmount . . .	3.65	93	145	<i>Carm.</i>	Carmarthen Friary . . .	3.23	82	92
"	Filleigh, Castle Hill . . .	2.36	60	...	"	Llanwrda, Dolaucothy .	6.81	173	157
"	Barnstaple, N. Dev. Ath. .	2.63	67	97	<i>Pemb.</i>	Haverfordwest, School .	5.61	142	175
<i>Corn.</i>	Redruth, Trewirgie	1.62	41	53	<i>Card.</i>	Gogerddan	6.04	153	156
"	Penzance, Morrab Gdn. . .	1.40	35	51	"	Cardigan, County Sch. .	3.08	78	...
"	St. Austell, Trevarna . . .	1.04	26	31	<i>Brec.</i>	Crickhowell, Talymaes .	3.20	81	...
<i>Soms.</i>	Chewton Mendip	6.24	158	179	<i>Rad.</i>	Birm. W. W. Tyrmynydd .	6.96	177	169
"	Street, Hind Hayes	4.36	111	...	<i>Mont.</i>	Lake Vyrnwy	6.36	162	185
<i>Glos.</i>	Clifton College	2.48	63	88	<i>Denb.</i>	Langynhafal	6.24	158	...
"	Cirencester, Gwynfa . . .	2.08	53	79	<i>Mer.</i>	Dolgelly, Bryntirion . .	7.24	184	170
<i>Here.</i>	Ross, Birchlea	2.29	58	101	<i>Carn.</i>	Llandudno	3.49	89	146
"	Ledbury, Underdown . . .	2.25	57	100	"	Snowdon, L. Llydaw 9 .	14.55	370	...
<i>Salop.</i>	Church Stretton	2.65	67	108	<i>Ang.</i>	Holyhead, Salt Island .	2.56	65	98
"	Shifnal, Hatton Grange . .	...	...	...	"	Lligwy	2.35	60	...
<i>Staff.</i>	Team, The Heath Ho. . . .	2.16	55	75	<i>Isle of Man</i>				
<i>Worc.</i>	Ombersley, Holt Lock . . .	2.08	53	97	"	Douglas, Boro' Cem. . .	2.98	76	97
"	Blockley, Upton Wold . . .	2.25	57	93	<i>Guernsey</i>				
<i>War.</i>	Farnborough	2.38	60	93	"	St. Peter P't, Grange Rd	1.20	31	59

Rainfall: July, 1926: Scotland and Ireland

CO.	STATION	In.	mm.	Per- cent. of Av.	CO.	STATION.	In.	mm.	Per- cent. of Av.
Wigt.	Stoneykirk, Ardwell Ho	3.16	80	109	Suth.	Loch More, Achfary ...	3.00	76	56
"	Pt. William, Monreith.	3.03	77	...	Caith	Wick	1.56	40	59
Kirk.	Carsphairn, Shiel.	4.44	113	...	Ork.	Pomona, Deerness	1.63	41	63
"	Dumfries, Cargen .....	...	...	...	Shet.	Lerwick	1.12	28	49
Roxb	Braxholme	2.84	72	94					
Selk.	Ettrick Manse	4.73	120	...	Cork.	Caheragh Rectory	2.42	61	...
Berk.	Marchmont House	3.50	89	115	"	Dunmanway Rectory.	3.75	95	96
Hadd	North Berwick Res.	3.61	92	140	"	Ballinacurra	3.23	82	116
Midl	Edinburgh, Roy. Obs. .	2.76	70	105	"	Glanmire, Lota Lo.	1.94	49	67
Lan.	Biggar	3.45	88	119	Kerry	Valencia Obsy. ....	...	...	...
"	Leadhills	5.59	142	...	"	Gearahameen	3.00	76	...
Ayr.	Kilmarnock, Agric. C. .	3.90	99	125	"	Killarney Asylum	2.57	65	77
Renf.	Girvan, Pinnmore	4.17	106	114	"	Darrynane Abbey	2.24	57	59
"	Glasgow, Queen's Pk. .	3.35	85	115	Wat.	Waterford, Brook Lo. .	3.60	91	111
"	Greenock, Prospect H. .	3.21	82	82	Tip.	Nenagh, Cas. Lough. .	4.91	125	156
Bute.	Rothsay, Ardenraig .	3.50	89	88	"	Tipperary	3.68	93	...
"	Dougarie Lodge	3.45	88	...	"	Cashel, Ballinamona .	2.11	54	73
Arg.	Ardgour House	7.61	193	...	Lim.	Foynes, Coolnanes	2.65	67	86
"	Manse of Glenorchy. .	6.40	163	...	"	Castleconnell Rec.	3.90	99	...
"	Oban	3.73	95	...	Clare	Inagh, Mount Callan .	3.64	92	...
"	Poltalloch	4.10	104	99	"	Broadford, Hurdlest'n .	5.05	128	...
"	Inveraray Castle	6.29	160	126	Wexf	Newtownbarry .....	...	...	...
"	Islay, Eallabus	3.65	93	107	"	Gorey, Courtown Ho. .	3.84	98	131
"	Mull, Benmore	11.60	295	...	Kilk.	Kilkenny Castle	2.97	75	105
Kinr.	Loch Leven Sluice	4.77	121	166	Wic.	Rathnew, Clonmannon .	1.96	50	...
Perth	Loch Dhu	3.70	94	77	Carl.	Hacketstown Rectory .	2.80	71	81
"	Balquhidder, Stronvar .	2.64	67	61	QCo.	Blandsfort House	3.05	77	97
"	Crieff, Strathearn Hyd .	2.49	63	84	"	Mountmellick	2.55	65	...
"	Blair Castle Gardens .	2.10	53	82	KCo.	Birr Castle	5.00	127	169
"	Coupar Angus School. .	2.79	71	118	Dubl.	Dublin, FitzWm. Sq. .	2.30	58	90
Forf.	Dundee, E. Necropolis .	3.18	81	116	"	Balbriggan, Ardgillan .	2.86	73	106
"	Pearsie House	2.18	55	...	Me'th	Drogheda, Mornington .	...	...	...
"	Montrose, Sunnyside .	2.23	57	85	"	Kells, Headfort.	4.07	103	128
Aber.	Braemar, Bank .....	.72	18	28	W.M	Mullingar, Belvedere .	4.68	119	147
"	Logie Coldstone Sch. .	1.80	46	61	Long	Castle Forbes Gdns. .	2.58	65	83
"	Aberdeen, King's Coll. .	2.40	61	85	Gal.	Ballynahinch Castle .	3.04	77	73
"	Fyvie Castle	2.18	55	...	"	Galway, Grammar Sch. .	2.39	61	...
Mor.	Gordon Castle	1.74	44	54	Mayo	Mallaranny	4.01	102	...
"	Grantown-on-Spey	2.63	67	86	"	Westport House	2.31	59	75
Na.	Nairn, Delnies	1.70	43	63	"	Delphi Lodge	4.82	122	...
Inv.	Ben Alder Lodge	3.37	86	...	Sligo	Markree Obsy.	2.59	66	75
"	Kingussie, The Birches .	2.11	54	...	Cav'n	Belturbet, Cloverhill. .	4.02	102	129
"	Loch Quoich, Loan	7.40	188	...	Ferm	Enniskillen, Portora .	...	...	...
"	Glenquoich .....	...	...	...	Arm.	Armagh Obsy.	3.13	79	108
"	Inverness, Culduthel R. .	1.67	43	...	Down	Warrenpoint	2.82	72	...
"	Arisaig, Faire-na-Squir .	3.63	92	...	"	Seaforde	2.81	71	88
"	Fort William	5.12	130	106	"	Donaghadee, C. Stn. .	2.65	67	95
"	Skye, Dunvegan	3.07	78	...	"	Banbridge, Milltown .	3.72	94	114
"	Barra, Castlebay	1.86	47	...	Antr.	Belfast, Cavehill Rd. .	4.22	107	...
R&C	Alness, Ardross Cas. .	1.92	49	63	"	Glenarm Castle	3.77	96	...
"	Ullapool	2.83	72	...	"	Ballymena, Harryville .	4.94	125	144
"	Torridon, Bendamph. .	5.87	149	108	Lon.	Londonderry, Creggan .	3.31	84	90
"	Achnashellach	3.46	88	...	Tyr.	Donaghmore	5.58	142	...
"	Stornoway	1.86	47	61	"	Omagh, Edenfel	3.49	89	103
Suth.	Laig	2.06	52	...	Don.	Malin Head	3.17	81	112
"	Tongue Manse	2.32	59	76	"	Dunfanaghy	2.47	63	72
"	Melvich School	1.65	42	59	"	Killybegs, Rockmount .	5.26	134	120

Climatological Table for the British Empire, February, 1926

STATIONS	PRESSURE		TEMPERATURE							Rela- tive Humi- dity	Mean Cloud Am't	PRECIPITATION			BRIGHT SUNSHINE	
	Mean of Day M.S.L.	Diff. from Normal	Absolute		Mean Values							Mean mm.	Diff. from Normal	Days	Hours per day	Per- cent- age of possi- ble
			Max.	Min.	Max.	Min.	1 and 2 min.	Diff. from Normal	Mean Bulb.							
	mb.	mb.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	%	0-10	mm.	mm.			
London, Kew Obsy.	1011.4	- 4.6	57	27	50.4	40.9	45.7	+ 5.6	42.6	91	8.3	+ 19	18	1.6	17	
Gibraltar	1020.3	+ 0.3	68	50	62.8	54.3	58.5	+ 2.6	53.2	81	7.1	- 12	8	...	...
Malta	1018.0	+ 1.3	66	52	60.5	54.0	57.3	+ 2.0	54.1	88	6.6	- 33	7	5.3	49	
St. Helena	1012.0	+ 2.7	73	60	71.6	61.7	66.7	+ 0.3	63.4	91	4.6	- 15	18	...	...
Sierra Leone	1011.4	+ 0.6	93	71	89.3	74.0	81.7	- 0.6	73.3	76	2.3	- 8	0	...	...
Lagos, Nigeria	1008.4	- 1.7	93	72	90.7	78.0	84.3	+ 2.1	78.7	85	7.9	+ 23	5	...	...
Kaduna, Nigeria	1013.2	+ 1.2	95	54	91.0	61.9	76.5	+ 0.4	54.0	14	3.5	+ 4	1	...	...
Zomba, Nyasaland	1014.4	+ 0.4	88	61	82.0	66.1	74.1	+ 2.2	...	88	8.6	+ 57	24	...	...
Salisbury, Rhodesia	1008.0	- 0.5	84	56	79.6	61.9	70.7	+ 1.9	65.2	77	7.8	+ 47	22	6.0	47	
Cape Town	1014.6	+ 1.3	86	49	78.5	58.5	68.5	- 2.0	60.6	74	4.4	+ 8	5	...	...
Johannesburg	1010.5	+ 0.2	86	54	80.0	58.1	69.1	+ 3.7	60.4	71	3.6	- 61	11	8.8	68	
Mauritius	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bloemfontein	...	...	97	49	82.8	58.9	70.9	- 1.0	61.7	53	2.3	- 83	6	...	...
Calcutta, Alipore Obsy.	1013.7	+ 0.4	92	56	84.7	62.7	73.7	+ 2.7	63.9	85	3.6	- 20	2*	...	...
Bombay	1012.8	+ 0.1	89	68	84.3	71.4	77.9	+ 2.3	68.2	74	2.0	- 1	0*	...	...
Madras	1013.9	+ 1.0	93	64	87.3	68.3	77.8	+ 0.1	73.0	87	1.2	- 8	0*	...	...
Colombo, Ceylon	1011.3	+ 0.2	93	68	89.2	71.9	80.5	+ 0.8	74.5	69	3.5	- 4	2	9.5	80	
Hong Kong	1019.8	+ 1.1	74	49	63.9	57.3	60.6	+ 1.5	56.9	81	9.3	+ 20	6	2.4	21	
Sandakan	...	...	89	73	86.1	74.7	80.4	+ 0.3	76.4	81	...	+ 35	5	...	...
Sydney	1012.9	- 1.2	108	61	83.7	68.0	75.9	+ 4.6	69.2	62	4.5	- 27	6	7.8	58	
Melbourne	1013.0	- 1.5	104	46	82.3	57.5	69.9	+ 2.5	59.3	49	4.5	- 1	1	8.4	62	
Adelaide	1013.5	- 0.8	104	51	88.0	61.8	74.9	+ 0.8	60.0	35	4.5	+ 26	4	9.3	70	
Perth, W. Australia	1015.2	+ 2.2	101	54	79.7	61.2	70.5	- 3.6	63.2	58	4.2	+ 15	5	9.3	70	
Coalgardie	1012.3	- 0.2	110	50	92.5	63.4	77.9	+ 1.9	61.9	42	1.9	+ 41	2	...	...
Brisbane	1014.7	+ 2.2	94	67	87.3	71.0	79.1	+ 2.6	72.1	67	4.4	- 30	3	...	70	
Hobart, Tasmania	1007.7	- 5.8	91	45	73.2	53.5	63.3	+ 0.9	53.9	54	6.3	- 1	11	8.4	61	
Wellington, N.Z.	1008.8	- 7.0	72	46	66.9	53.6	60.3	- 2.2	55.9	71	6.4	- 13	9	7.2	53	
Suva, Fiji	1008.0	+ 0.3	85	70	80.0	73.8	76.9	- 3.6	75.0	93	9.5	+ 429	26	1.3	10	
Apia, Samoa	1007.4	- 1.0	89	75	86.0	77.1	81.5	+ 2.5	79.0	81	6.8	+ 10	19	4.6	37	
Kingston, Jamaica	1015.1	- 0.2	90	65	85.4	68.7	77.1	+ 0.6	66.8	84	4.3	+ 25	7	1.8	16	
Grenada, W.I.	1014.8	+ 1.5	86	70	83.7	72.4	78.1	+ 1.0	72.3	76	3.9	+ 35	15	...	...
Toronto	1013.5	- 4.5	40	1	27.7	14.3	21.0	- 0.7	17.3	72	7.7	- 9	18	3.0	29	
Winnipeg	1015.6	- 6.2	39	-20	21.1	4.5	12.8	+ 13.4	...	...	7.0	- 15	12	3.6	36	
St. John, N.B.	1006.8	- 7.3	39	- 3	25.0	10.8	17.9	- 2.0	13.7	...	6.0	+ 29	14	4.6	45	
St. John, B.C.	1013.4	- 2.5	57	37	50.4	41.5	45.9	+ 5.6	42.2	88	8.0	- 61	19	2.6	26	

small station a rain device a day on which 0.1 in. (0.5 mm.) or more rain has fallen.

Mean values stations a rain gauge is day on which 0.1 in. (2.5 mm.) or more rain has fallen.