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Temperature of the Surface Water of Loch Maree July, 1932–September, 1934

In 1932 Mr. Malcolm MacLennan, of Letterewe, Ross-shire, offered to take daily readings of the temperature of the water of Loch Maree if a suitable thermometer could be loaned. (Mr. MacLennan also keeps a rainfall record.) A thermometer was issued—an ordinary Mark I mercury thermometer with Sea Protector—and observations commenced in July, 1932. The readings are taken daily at about 9 a.m. G.M.T. at the side of the Loch, near Letterewe, the thermometer, case and all being plunged over a foot under water and kept there for three minutes before a reading is taken. The temperatures are taken 3 feet from the bank in a place where the water is at least 8 feet in depth. Opposite this point, which is roughly midway along the length of the Loch, there is deep water, the 40-fathom line being $\frac{1}{4}$ mile out.

Loch Maree is a long narrow loch $13\frac{1}{2}$ miles long and generally more than $\frac{1}{2}$ mile wide, with a superficial area of 11 square miles, a maximum depth of 367 feet and a mean depth of 125 feet. Its estimated volume of water is 38,539 million cubic feet and it is sixth in volume amongst the fresh-water lochs of Scotland.

There is a considerable amount of information available about the temperature conditions and the temperature changes of Scottish freshwater lochs, both in space and time. Most of this information was collected in the years 1897–1909 by Sir John Murray, Mr. Laurence Pullar, Professor E. M. Wedderburn and their associates;

the physical problems arising were very fully discussed in numerous papers by Professor Wedderburn, whose work on seiches is well known. A summary of the information and many references to papers are to be found in Sir John Murray's " Bathymetrical Survey of the Scottish freshwater Lochs ", issued by the Challenger Office, Edinburgh, in 1910.

TABLE I.—MONTHLY MEAN TEMPERATURES OF THE SURFACE WATER AT LOCH MAREE (NEAR LETTEREWE) AND OF THE AIR AT ACHNASHELLACH

	1932		1933		1934		Means	
	Water	Air	Water	Air	Water	Air	Water	Air
	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.
January	—	—	42·3	35·9	42·8	40·7	42·5	38·3
February ...	—	—	41·5	37·7	42·6	42·1	42·1	39·9
March	—	—	41·5	44·3	42·0	38·6	41·7	41·5
April	—	—	44·0	46·4	43·1	41·0	43·5	43·7
May	—	—	49·4	51·7	45·8	47·6	47·6	49·7
June	—	—	58·3	58·9	54·4	57·0	56·3	57·9
July	58·3	57·7	62·7	60·1	61·5	60·1	60·8	59·3
August	59·0	56·1	60·8	57·1	59·3	56·3	59·7	56·5
September ...	55·6	51·0	58·7	55·8	56·9	54·7	57·1	53·8
October	50·6	45·1	53·9	47·7	—	—	52·3	46·4
November ...	47·6	42·4	46·6	40·3	—	—	47·1	41·3
December ...	44·2	40·9	43·7	37·5	—	—	43·9	39·2
Year	—	—	—	—	—	—	49·5	47·3

In the Loch Maree series, made since 1932, surface observations only have been possible, but they have been made daily for two years and three months. The monthly mean water temperatures are given in Table I together with the mean air temperatures of the same months at Achnashellach, some 14 miles distant. The object has been chiefly to obtain information as to the nature and extent of the temperature changes of the surface of such a sheet of water and the nature of the annual variation. The most nearly comparable series of regular surface observations is that made by the Scottish Lake Survey at Loch Ness* from July, 1903, to April, 1905. The Loch Ness observations, however, were on a much more elaborate scale and included observations at various depths down to 200 feet. For the most part, they were made from a small decked yacht anchored off Fort Augustus in 250 feet of water. The time of

* E. M. WEDDERBURN—*Edinburgh, Trans. R. Soc. XLV, Pt. II, No.* 16, 1907.

observation varied; in cases where more than one series had been taken in one day, the earliest only was used in computing mean temperature. Loch Ness resembles Loch Maree in so far that it is also a long narrow loch, but its length and its superficial area are each approximately twice those of Loch Maree, its maximum depth is 754 feet and its mean depth 433 feet. The volume of water contained is indeed approximately seven times as great as that of Loch Maree.

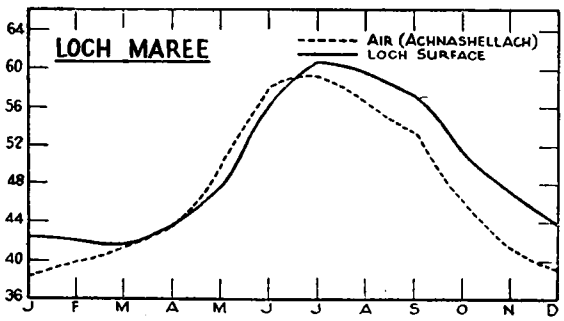


FIG. 1

In Fig. 1 are set out the mean surface water temperatures at Loch Maree as derived from the 27 months' observations in 1932–4 and also the mean air temperatures as derived from the observations of the same months at Achnashellach.

In Fig. 2, for purposes of comparison, are set out the mean temperatures at the surface and at a depth of 200 feet in Loch Ness as derived from 22 months' observations in 1903–5, and also the mean air temperatures as derived from the observations of the same months at Fort Augustus. It is notable in both cases that for the year as a whole the mean surface water temperature exceeds the mean air temperature—by 2·2° F. in the case of Loch Maree and by 0·8° F. in the case of Loch Ness. If instead of Achnashellach air temperatures we take those of Stornoway for comparison with Loch Maree the difference is reduced from 2·2° to 1·5°, but it is still positive.

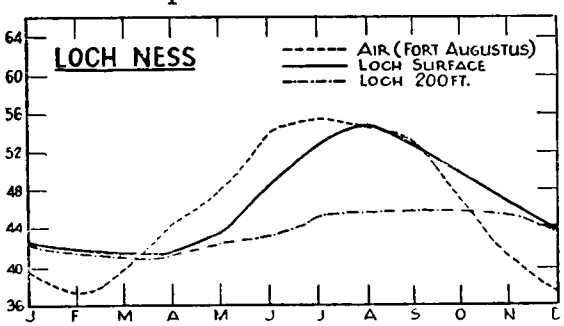


FIG. 2

The curves of annual variation show that the higher mean temperature of the surface water of the lochs comes from the feature that in the winter months the loch temperature is not appreciably depressed but remains sensibly constant as compared with the variation of the air temperature. The Loch Ness observations showed that the temperature at 200 feet was always less than or at most equal to that at the surface, that its annual variation had a range of only 4·8° F., and that it never fell below the temperature of maximum density. Loss of heat from surface water thus tends

always to set up convection (quite apart from any mixing set up by disturbance due to strong winds). In fact, in each month from December to March the mean temperatures obtained in Loch Ness were almost identical from the surface down to 200 feet.

As might be expected in view of the smaller depth of water, especially where the temperatures were taken, Loch Maree observations show a steeper rise of temperature in summer than those at Loch Ness and attain their maximum about a month earlier, i.e., they follow up the air temperature much more closely. The greatest excess of loch temperature over air temperature occurs at Loch Maree in October and November (5·9° and 5·8°) and at Loch Ness in November and December (5·5° and 6·5°). The high difference at Loch Ness in December arises mainly, however, from the unusually low mean air temperature of 35·7° F. at Fort Augustus in December, 1903, when mean air temperature was 8·4° below loch temperature.

The annual range of the surface water temperature at Loch Maree is 91 per cent. of that of the air temperature; at Loch Ness the surface water had an annual range equal to 72 per cent. of that of the air temperature and at 200 feet a range equal to only 26 per cent. of that of the air temperature. The interdiurnal change of temperature at Loch Maree was usually slow. The largest variations found within a calendar month were 9° F. in May and in October, 1933. In the former case between May 15th and May 29th there occurred a rise of 9° F., about half of which may be regarded as the contribution from the normal annual variation. In October, 1933, the fall of 9° was a practically continuous change throughout the month at about twice the rate shown in October, 1932.

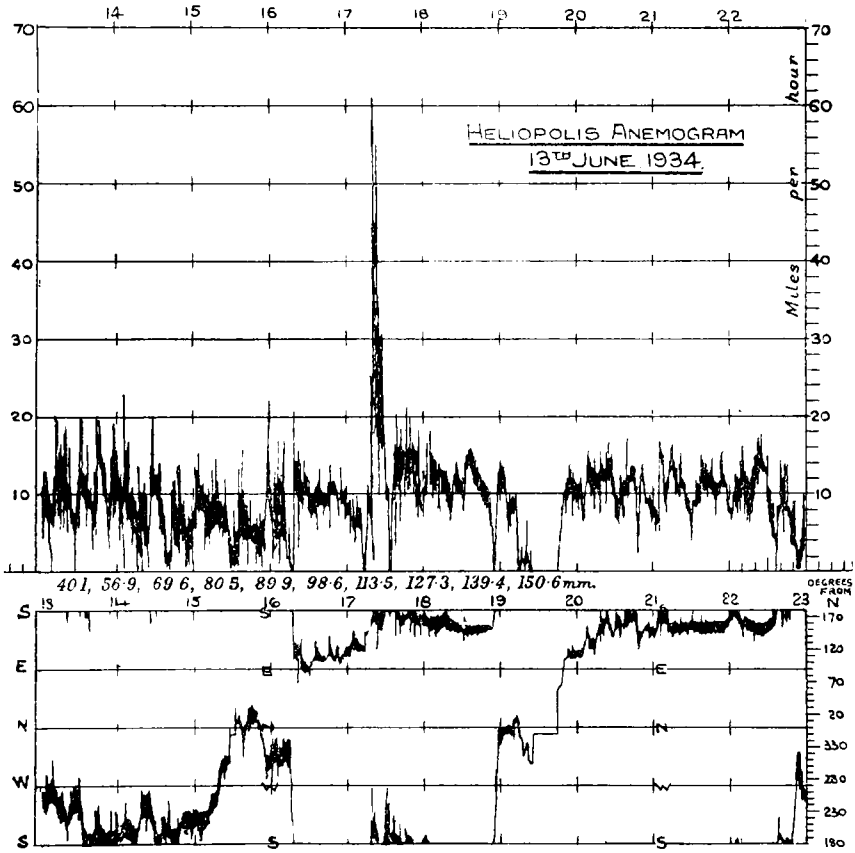
The observations cover the summer period, July to September, of three years. Of these 1933 was the warmest—in the mean 3·1° warmer than 1932, which was the coldest. The highest temperature attained by the loch surface was 65° F. on two days in July, 1933, and two days in July, 1934; the lowest was 39° F. on four days in February, 1933. The loch is said never to freeze.

A. H. R. GOLDIE.

Minor Haboob at Heliopolis, Egypt

A very severe sandstorm (or minor "haboob") was experienced in the Cairo Area on June 13th, 1934. The day had been extremely hot and almost calm throughout. Towards dusk unusually heavy conditions prevailed, and at 17h. 10m. G.M.T. a heavy mass of sand was observed approaching Heliopolis from south-south-west or south-west. The height of rising sand was estimated to be about 1,500 ft. to 2,000 ft., and it did not appear to extend along a long front, but owing to buildings obstructing the view the full extent could not be

gauged. At 17h. 20m. G.M.T. a squall of 61 m.p.h. was recorded at the Meteorological Office, Heliopolis aerodrome (about $\frac{1}{4}$ mile to the south of the town), and immediately afterwards the visibility deteriorated to less than 50 yards. After about 10 minutes the sandstorm had passed, but its effect was felt for a considerable time afterwards as sand particles were held in suspension over Heliopolis up to a very late hour. A member of the staff of this office who lives about 1 mile to the north-west of Heliopolis, reported later that no gust occurred, and even in western Heliopolis itself the wind



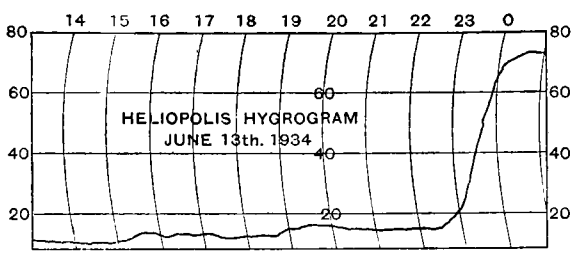
is estimated not to have exceeded 20–25 m.p.h. It appears probable therefore that the storm was of very limited extent and may not have been more than 3 miles wide. Its track after passing Heliopolis seems to have been over the open desert.

According to press reports serious damage was caused by the storm in Cairo. Trees and hoardings were blown down, pleasure boats on the Nile were blown about as if made of paper and some were capsized. Four swimmers in the Nile about a mile south of Cairo lost their lives by being caught in whirlpools set up by the violence of the squall.

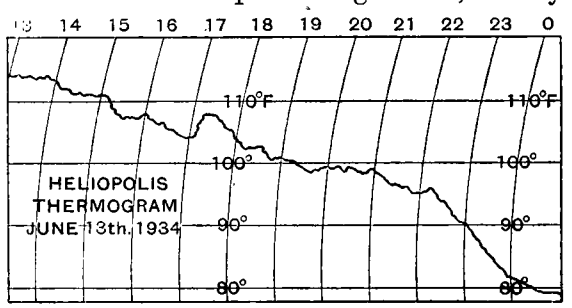
It is worthy of note that the squall of 61 m.p.h. is the highest

recorded at Heliopolis during the past 10 years at least; in fact gusts exceeding 50 m.p.h. have been recorded previously on six occasions only.

Normally in Lower Egypt sandstorms are caused either by the action of a sufficiently strong surface wind, or the actual " scooping up " of sand which occurs with the arrival of a cold front. In the first case the visibility may be reduced to 1,000 to 2,000 yards for hours on end; in the latter, the visibility is often reduced to less than 100 yards temporarily, but conditions improve quickly. The storm of June 13th was more similar in character to the haboobs experienced in the Sudan than to either of the types usually experienced in Egypt.



The synoptic chart for the morning of June 13th showed the existence of a desert depression of only moderate intensity west-south-west of the Nile Delta and the centre moved east-north-east between Cairo and Aboukir during the ensuing 12 hours. In front of the on-coming " low " very high temperatures were reached, the maximum at Heliopolis being 113°F., or only 5° less than the record for this station, which happens to have occurred on exactly the same date in 1933. On June 13th, 1933, however, by 18h. G.M.T. the temperature had fallen to 85°F., whereas in the present case it was still 104°F. at that hour, the cold front not arriving until 22h. 50m. G.M.T. The interesting feature of the storm is the fact that it is impossible to invoke the arrival of any cold air to explain the squall of 61 m.p.h. and it is likely that the phenomenon was of the nature of a dust devil on a very large scale. Sutton, in his investigation of Khartoum haboobs,* found that whilst many are cold front phenomena, " by far the majority of haboobs probably have their origin in the diurnal variation of temperature and pressure in the northern Sudan and adjacent regions." The 12h. G.M.T. temperature at Aboukir was 83°F., whilst at Heliopolis it was 112°F., representing an average horizontal temperature gradient of 29°F. per 100 miles, which is almost certainly equal to or more than gradients



* See *London, Q.J.R. Meteor. Soc.*, **57**, 1931, p. 155.

occurring in the Sudan. It should be remarked, however, that most stations in the Delta recorded temperatures over 105°F., so that the very steep gradient was confined to a relatively narrow strip of country near the coast.

Autographic records of wind, temperature and humidity are shown in the accompanying diagrams. The similarity of the squall with one which occurred at Amman on March 4th, 1934, is noteworthy.

Another minor haboob was experienced in Cairo at 20h. 15m. G.M.T. on June 13th, but did not affect Heliopolis. The Director, Meteorological Service, Physical Department, Cairo, reports that neither of the storms were experienced at Helwan Observatory (20 miles to south of Heliopolis); in fact, autographic records from that place show no gust stronger than 17 m.p.h. until the arrival of the cold front at 0h. 35m. on June 14th.

C. V. OCKENDEN.

Discussions at the Meteorological Office

The subjects for discussion for the next two meetings are :—

January 28th, 1935.—*The branching of lightning and the polarity of thunderclouds.* By J. C. Jensen. (Philadelphia, J. Franklin Inst. 216, 1933, pp. 707–48.) *Opener:* Mr. R. E. Watson, Ph.D.

February 11th, 1935.—*Practical weather analysis.* By G. Schinze. (Hamburg, Aus. d. Arch. dtsch. Seew. 52, No. 1, 1932) (in German). *Opener:* Mr. W. A. Harwood, D.Sc.

Royal Meteorological Society

The monthly meeting of this Society was held on Wednesday, December 19th, at 49, Cromwell Road, South Kensington, Lieut.-Col. E. Gold, D.S.O., F.R.S., President, in the chair.

The following papers were read and discussed :—

C. K. M. Douglas, B. A.—Some Facts and Theories about the Upper Atmosphere.

The first part of the paper consists mainly of detail and the latter part of a discussion of general principles, dealing more especially with the structure of depressions and anticyclones. The paper is in five sections :—

1. It is shown that the changes of temperature of a given moving air mass at fixed levels between 2 and 5 Km. are often slow, but that subsidence of initially cold air may cause a rise of temperature of the order of 10° F. in 24 hours in certain cases.

2. It is shown that the ascending air over a rain area is normally warmer than the adjacent air at the 4 Km. level. Some details are given.

3. The variations of the height of the tropopause are discussed.

It is thought that the air masses just below and above the tropopause move (slowly) up or down together.

4. The rotary aspects of depressions and anticyclones are considered in relation to convergence and divergence in the horizontal motion. The high-level systems appear first behind the low-level centres and are sheared over them. It is thought that a high-level depression is partly advective in character, but also develops over the subsiding cold air, while a high-level anticyclone (or wedge) develops over rising warm air.

5. It is considered that the troposphere is normally the primary theatre of action, but that air movements in the stratosphere play a necessary part in the development of depressions and anticyclones. There is some discussion of surges and of the movements of air from one system to another.

H. L. Wright, M.A.— Visibility and Atmospheric Suspensoids at Kew Observatory.

At Kew Observatory, in the afternoon, the distance of vision if above 2 Km. depends so little on nuclei and humidity that their effect may be neglected. The distance of vision varies inversely as the number of particles raised to a power apparently a little greater than unity. It also depends on some other quantity which is subject to annual variation and it is suggested that this quantity may be the size of the particles.

Conditions of mist and fog in the afternoon are associated with high humidity and with high concentrations of particles and nuclei. As each one of these quantities increases so does the density of the fog. The order of importance of these three quantities cannot be assigned at present with any certainty.

C. S. Durst, B.A.—Dust in the Atmosphere.

A picture is formed of a dusty atmosphere in which each particle of dust is surrounded by a pocket of air of different temperature and humidity to those of the general air mass. This picture is shown to be corroborated by the rising of haze tops, the air temperature over the Arabian Sea during the south-west monsoon and the diurnal variation of wind in that region. Some consequences are pointed out, one of which is that there may be a layer of dust high up in the atmosphere.

Correspondence

To the Editor, *Meteorological Magazine*

Frostless December Weather

Possibly the number of days this December with maxima over 50° F. has hardly been equalled here since at least 1870; nor only one rainless day. But even more striking is the entire absence of even a ground frost. So far this winter, I have only recorded three frosts off the ground and one other on, namely, 30°, October 30th;

27½°, November 1st; 31°, November 20th; the ground frost, November 13th. In a cottage garden plot near by scarlet geraniums are quite gay and many other summer flowers have lingered.

J. EDMUND CLARK.

Portway, Street, Somerset, January 1st, 1935.

Heavy Rain on December 26th at Waltham Cross

A remarkable shower was experienced at Waltham Cross, Herts, on the evening of December 26th.

The day had been dull, overcast and rainless, with a feeble S. wind which, slowly veering SW., occasionally fell to a dead calm. At 19h. 35m. G.M.T., without any indication of its approach, a very heavy shower of rain commenced. The air at the time was quite calm, but the rainfall was of the intensity usually associated with a line-squall or summer thunderstorm, the splashing on the tarmacadam roadway appearing as a level stratum of mist. At 19h. 41m. the rain ceased almost as suddenly as it had commenced and was followed by a light wind from SSW. force 2. The 5-inch rain-gauge registered a fall of 0·12 in. in the six minutes. This is the heaviest fall I have experienced in so short a period without any appreciable wind or other squall phenomena, there being no apparent change in temperature or wind direction and force associated with the shower. It would be interesting to know what forces were acting to produce so sharp a shower in what was otherwise dull, inactive weather.

Further moderate rain set in at 20h. 30m., which lasted until about 21h. 10m., after which the sky cleared, to be followed by a night of bright moonlight and ground fog.

DONALD L. CHAMPION.

7, *Robinson Avenue, Goff's Oak, Waltham Cross, Herts., December 28th*, 1934.

December Thunderstorms in Southern England

Thunderstorms have developed on at least four days during the present month in the southern counties of England from Essex to Dorset, and on the evening of December 27th a heavy squall accompanied by vivid lightning and a few loud peals of thunder broke over the northern and north-western suburbs of London. As always happens when the metropolis experiences anything a little out of the ordinary in the way of weather phenomena, this visitation attracted a disproportionate amount of attention in the Press. "An Air Ministry official" was cited as authority for the following statements:—"Most unusual, but not impossible" (*Daily Mirror*); "A thunderstorm at this time of year is a very unusual occurrence . . . . I personally cannot recall a thunderstorm in December" (*Daily Mail*). Such notions, like short memories, are misleading and should be combated.

So far from being rare, thunder during a wet, rough and mild December is quite typical in southern England. The month now ending has produced several instances. In the very rainy and boisterous December of 1929 a large number of the stations contributing returns to the *Monthly Weather Report* had two or three days with thunderstorms or thunder alone (Kew and Kensington two each); at Ascot and Grayshott there were four such days, while in north-west Devon, Arlington, near Barnstaple, reported seven and Woolacombe eight. Observers' remarks published on page 199 of Vol. 3 of this magazine reveal the incidence of thunder in the southern counties on no fewer than eleven dates from the 7th to the 28th in the excessively wet and mild December of 1868; Selborne noted the occurrence on four days. Corresponding records in Vol. I, page 107, show that the somewhat similar December of 1866 gave Calne (Wilts) an actual thunderstorm on three successive days, and thunder or lightning in southern England on seven dates from the 6th to the 17th. Again, in December, 1886, another blustering and rainy month, the *Meteorological Record*, Vol. 6, No. 24, of the Royal Meteorological Society lists the 8th, 9th, 14th, 15th, 20th and 28th, as having brought thunderstorms or one of the associated manifestations to places in the same part of Great Britain. Finally, in the *Book of Normals* (Section 4) it is recorded that Dungeness had four days of December thunder in 1909, and Kew two in 1919 (as in 1929). Such a month as this December of 1934 would probably have greater claims to distinction if it were to pass without distributing its quota of thunderstorms south of a line from Harwich to Haverfordwest.

E. L. HAWKE.

Caenwood, Rickmansworth, Herts, December 30th, 1934.

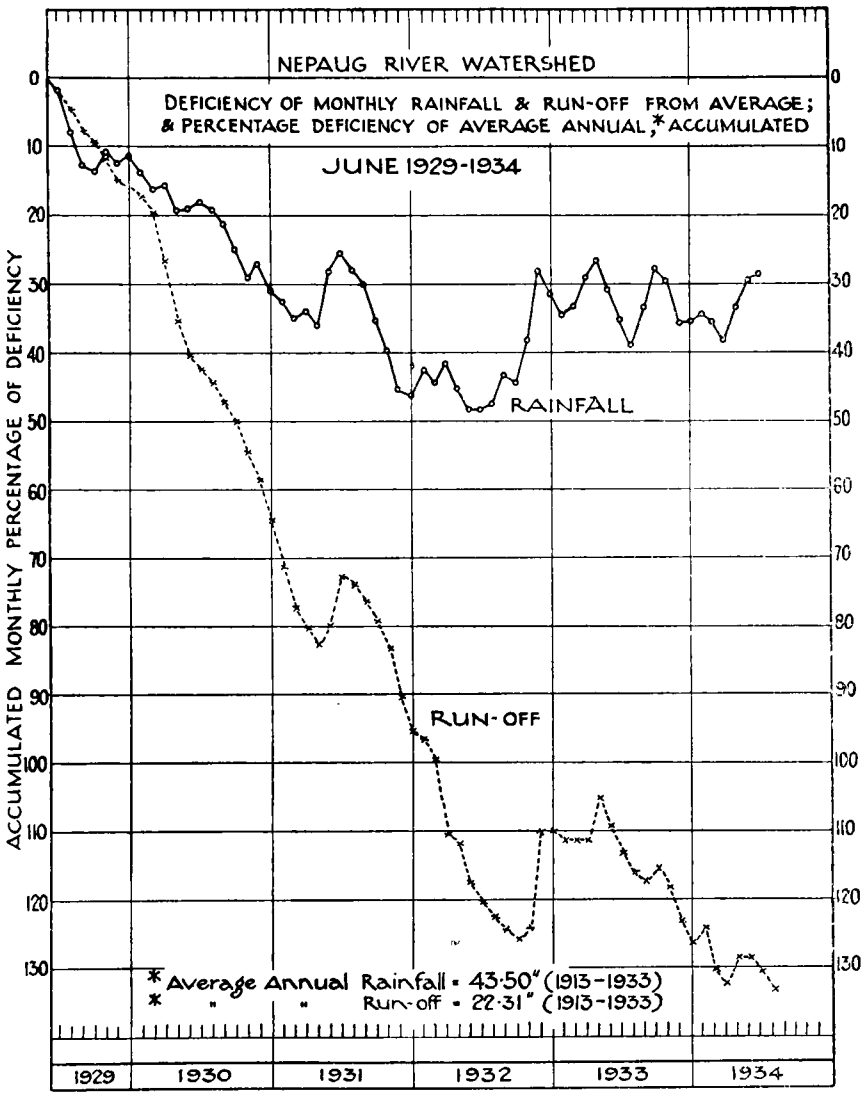
The Deficiency of Rainfall at Hartford, Connecticut

Following out the method of portraying the deficiency of monthly rainfall which appeared in the July issue of the *Meteorological Magazine*, perhaps you will be interested in a plot which we made here after having read that article.

We have added, also, run-off from the Nepaug River watershed for the same period. This has, as you will note, produced most interesting results; that is to say, for the five years, 1929–34, while the deficiency in rainfall has been about 28 or 29 per cent., that for run-off has been about 133 per cent., i.e., while we are short during this period about four months of average rainfall, during the same period, we are short about one year and four months in run-off. This, I presume, means that of the three principal dispositions of rainfall, vegetation demands, ground water reserve and surface run-off, surface run-off, which is the residual, has fared rather badly, being a bad third to the requirements of the other two, indicating

that Nature will see that her requirements are met, regardless of human needs.

You will note that we started the beginning of our plot about the middle of 1929, which antedates your drought by a few years. Our



period was taken at this time because the effect of our drought was first felt then in our big storage reservoir. It is interesting also to note that, with the beginning of your drought in 1932, our rainfall began to increase.

CALEB MILLS SAVILLE.

The Water Bureau, Hartford, Connecticut, U.S.A. August 14th, 1934.

Cloudiness and the State of the Sky

I am much obliged to Dr. Brooks for the very interesting remarks following my note on the above in the December issue of this magazine.

It is true that, in estimating nebulosity, the simple method of ignoring high cloud gives a measure of " effective " nebulosity with regard to bright sunshine, but since cirriform cloud at times does occur in considerable quantities, it certainly has effect on the " state " of the sky, apart from its meteorological significance.

This being so, it appears that it should be considered in the mean state of the sky but not treated as being heavy cloud as it is in mean cloudiness. The fact that it is ineffective in reducing the duration of bright sunshine will be apparent in maps showing the distribution of that element expressed as a percentage of the " possible ".

The point I wished to stress was not the effect of high cloud on bright sunshine, but the fact that the terms " Cloudiness " and " State of the Sky " are not always synonymous, because the latter is often considerably fairer in appearance than is denoted by the former; hence, my suggestion of an alternative method of summarising the latter.

DONALD L. CHAMPION.

7, *Robinson Avenue, Goff's Oak, Herts, December 27th*, 1934.

NOTES AND QUERIES

Atmospheric Refraction and the Moon's Globularity

Under this heading Mr. Bonacina contributes an interesting note in the November number of the *Meteorological Magazine*. I think, however, that the problem he sets is capable of an explanation which has no reference to atmospheric refraction.

The full moon appears flat because it is evenly illuminated and also because such markings as are visible are irregular. Furthermore, these dark markings are, broadly speaking, grouped about the centre of the disc, leaving a very luminous bright external ring round the limb. If the conditions were reversed, with a bright central region and a darkening towards the limb, the full moon would tend to appear as a globe. This is shown by low-power observation of the sun in the telescope or by a good photograph of the whole sun. The absorption of light from regions near the limb of the sun by the solar atmosphere causes a gradual slight darkening towards the limb and the effect is definitely globular. It is not within ordinary experience to see spheres so illuminated that the central part of the visible side is darkest and hence any psychological tendency to see the moon as a globe would be neutralised by its presentation of the external bright ring.

The full moon cannot be seen in daylight, except perhaps at the

moment of sunset. At any phase, not very near the full, the terminator mainly passes through the darker areas of the surface. To the eye, therefore, one of the apparent edges of the moon is relatively dark, while the light increases towards the bright ring of the opposite limb. Conditions for assuming globularity are thus favourable, but the globular effect will not usually be seen at night since the intensity of moonlight, even at the quarter phase, is too great to allow the eye to discriminate fully between the illumination of the limb and that of the terminator region. Under conditions of lesser general intensity of illumination, when the moon is seen in daylight, and perhaps even in early twilight, the difference will be very noticeable and hence the globular effect will be observed. It follows that such conditions are also the best for seeing detail on the lunar surface without instrumental aid and by actual observation I have found this to be true.

Since the above remarks were written two letters on this subject have been received. Mr. J. C. M. Kruisinga, of Vriezenveen, Overyssel, Holland, is of the opinion that a globe representing the full moon with its irregular markings, if hung against a black background, would not appear as a globe even if it were illuminated somewhat from the side. Mr. Kruisinga also notes the fact, stated above, that the moon as seen in daylight has " a sharp edge on one side and an elliptical shadow-line on the other " and he considers that the capability of ascribing some definite shape to such an object is assisted by the fact that it is seen in association with familiar daylit objects such as clouds, hills, etc. With regard to this, he says :—" By mitigation of the nocturnal contrast between black and white it (the moon) has ceased to be ' extra-terrestrial,' and we now see, or subconsciously note, that it is lit by the same sunlight as the distant cumulus or mountain-side. We are able to guess its real shape because it now fits nicely into our general scheme of deducting the shape of things from their terrestrial appearance in sunlight. The human eye has probably not been developed to discern shapes on the astronomical level, but to see corners, edges, points and curves within the distance considered vitally important to the observer. Apart from scientific interest, no human being has until now had any use for speculations concerning the real shape of heavenly bodies, and therefore the moon has to be drawn down, as it were, to a practical level, and to be looked at amidst terrestrial surroundings during the daytime, when it will be found to look like a globe—simply by conforming to the impressions we associate with sunlit curvatures of familiar objects."

Miss Cicely M. Botley points out that the moon has been seen as a black globe just before the total phase of a solar eclipse. At this stage there would still be a very narrow but bright solar crescent on one side of the moon. I find it difficult to suggest an explanation here. Perhaps the complete blackness of the moon allows fuller

play to the psychological element, which may also be enhanced by the fact that the movement of the moon across the sun in an eclipse is rapid enough to be visible after a short time-interval.

E. W. BARLOW.

Snow cover and Ski-ing in the Black Forest

The latest issue of the Baden meteorological yearbook* contains under the above title a detailed analysis by Dr. A. Peppler of snow records in the Black Forest with special reference to ski-ing. He writes not only as a meteorologist but as an experienced skier, the founder and president of the ski-club in Giessen. He is thus well aware of the insufficiency from the skier's point of view of snow data as normally included in official meteorological publications.

In this paper he deals with records mostly covering over thirty winters from 35 stations in the Black Forest including the Königstuhl and adds by way of comparison a briefer treatment of conditions at 25 stations in other mountainous parts of Germany. Tables are given showing the average number of days each winter month with snow lying to depths of or exceeding 10, 20, 30 and 40 cm. which he describes respectively as possible, good, very good and excellent for ski-ing. Many skiers would doubtless disagree with this classification but as Dr. Peppler points out, the requisite depth depends largely upon contours, etc. and is in consequence considerably less in the Black Forest than on steeper, more rugged ranges. In any case the numerical values are clearly stated in the tables and diagrams so that the qualitative equivalents are more or less immaterial.

The western, windward side with its plentiful precipitation naturally receives larger amounts of snow in winter than the drier, eastern slopes and to show the relation between height and snow conditions the author found it necessary to exclude stations on the leeward side unless they were sufficiently near the crests to have high precipitation figures. The snow reliability diagrams and tables (which thus apply only to the windward sides and crests) indicate that in the four months December to March on an average 10 cm. at least of snow is measured on 50 per cent. of the days at a height of about 780 m., on 75 per cent. at 950 m. and on over 90 per cent. above 1,200 m. In the average season 40 cm. is to be obtained on 50 per cent. of the days somewhat above 1,000 m., whereas on the Feldberg it may be expected on over 80 per cent. February is the best month while March is rather better than January at the higher levels and on the Feldberg itself even the April average is 20 days with 40 cm.

In the latter part of the paper the snow conditions in the Black

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* *Karlsruhe, Deutsches Meteorologisches Jahrbuch für* 1933, *Baden*, **65**, pp. 92—108.

Forest are shown to compare favourably with those on the Brocken, Schneekoppe and Fichtelberg while even in a poor snow season such as 1911–2 it is stated that 30 cm. were measured on over 90 per cent. of the days at about 1,300 m.

There is something more the potential visitor might like to know. How frequent and prolonged are the intervals when the snow (or rain) is actually falling? An average of 622 mm. in the four months December to March somehow suggests that the weather might often detract from the pleasure of sport on the Feldberg.

The Rainfall of 1934

Although 1934 will be remembered for the acute and prolonged lack of adequate water supplies in many localities, the total rainfall for the year, over the British Isles as a whole, actually exceeded the average. The difficulties experienced were mainly due to the deficiency inherited from 1933, since November and December of that year together gave less rain than that of any similar period since before 1870, but they were aggravated by the incidence of the rainfall during the year. December was by far the wettest month of the year, so that while 1934 opened with the ground drier than usual and many reservoirs short of capacity, it ended with rivers in spate and underground storage in some measure replenished.

Provisional estimates of the general rainfall for 1934 are given below, both in actual inches and as percentages of the average, together with similar values for 1933 and the average rainfall in inches.

	1934.		1933.		Average.
	in.	%	in.	%	*in.*
England and Wales...	33·7	96	28·6	81	35·2
Scotland	55·0	109	40·3	80	50·3
Ireland	45·9	106	33·5	77	43·3
British Isles	42·0	102	33·3	80	41·4

Over each country 1934 was therefore appreciably wetter than 1933. The year 1934 gave more than the average rainfall in both Scotland and Ireland, as well as over the British Isles as a whole. Over England and Wales the deficiency was small, being only 1·5 in. Owing to the recent run of wet years the rainfall over England and Wales during 1934 was less than that of any year back to 1911, with the exceptions only of 1921 and 1933. Over Scotland, 1934 was wetter than any of the three preceding years and over Ireland than either 1933 or 1932.

General values for each month are set out in the table below, both as percentages of the average for the period 1881 to 1915 and in actual inches of rainfall.

It will be seen that over the country generally the rainfall of December appreciably exceeded that of the three months May, June and July, and was as much as ten times that of February. Over England and Wales only one of the seven months May to

November gave more than the average amount. Over Scotland there were four consecutive months July to October and over Ireland three months August to October with more than the average. Over the British Isles as a whole only two Februaries since before 1870 were drier than that of 1934, *viz.*, those of 1891 and 1932. The rainfall of December, 1934, was exceeded only by those of 1876, 1914 and 1929 with 189, 183 and 180 per cent. respectively. Over England and Wales only the Decembers of 1914 and 1876 were wetter and over Ireland only those of 1876, 1914 and 1872. At Chilgrove near Chichester, where the record commenced in 1834, the total of 11·90 in. for December, 1934, was more than an inch in excess of that of any other month and as much as 33 per cent. of the total for the whole year.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	%	%	%	%	%	%	%	%	%	%	%	%
England and Wales ..	105	22	110	137	71	71	56	95	109	79	75	190
Scotland	117	42	97	182	120	79	108	122	134	155	49	122
Ireland	124	11	114	107	103	72	68	113	208	127	46	164
British Isles	112	24	108	142	89	74	70	106	134	107	62	170
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
England and Wales ..	3·1	0·6	2·9	2·9	1·7	1·7	1·6	3·2	2·8	3·1	2·6	7·5
Scotland	5·7	1·8	3·9	5·4	3·6	2·2	4·1	5·5	5·4	7·6	2·6	7·2
Ireland	5·0	0·4	3·8	2·9	2·8	2·0	2·3	4·8	6·5	5·2	2·0	8·2
British Isles	4·2	0·8	3·5	3·6	2·3	1·9	2·3	4·1	4·1	4·6	2·6	8·0

The incidence of the rainfall during 1934 can be considered in four periods :—(1) January to April gave only ·7 in. short of the average, over the British Isles as a whole, in spite of a very dry February, (2) May, June and July were each moderately dry, giving an accumulated deficiency of 2·0 in., (3) the period August to November gave precisely the average amount and (4) December was unusually wet with an excess amounting to 3·3 in.

The totals for practically every station for 1934 were between 70 and 120 per cent. of the respective averages for the standard period 1881 to 1915. There was less than 90 per cent. over most of England lying between London to Bristol in the south and Liverpool to Hull in the north, with less than 80 per cent. between Cambridge and Great Yarmouth and also in the neighbourhood of Barnsley. In both the extreme south and north of England many stations recorded more than 110 per cent., with as much as 120 per cent. in parts of Dartmoor and in the Cheviots. Over Wales the rainfall closely approximated to the average. In Scotland there was less than the average amount only over a small area around Lossiemouth and in the Outer Hebrides. In the Southern Uplands and to the north of the Central Plain falls exceeding 110 per cent. were widespread, while as much as 120 per cent. occurred at Balmoral and in parts of Ross and Cromarty. In Ireland the range was from rather less than 90 per cent. near Dublin to over 110 per cent. in certain localities in the west.

J. GLASSPOOLE.

An Unusual Honour to Professor W. Köppen

We learn from the *Annalen der Hydrographie und Maritimen Meteorologie* that the Senate of Hamburg, at the request of the Deutsche Seewarte, has renamed "Violastrasse" the "Köppenstrasse". Professor W. Köppen lived from 1903 to 1924 at 7, Violastrasse, near the Kite station of the Deutsche Seewarte, which he established in Grossborstel, and which developed into the meteorological research station at Fuhlsbüttel. The new street sign contains the inscription "Köppenstrasse. Professor Wladimir Köppen von 1875–1919 Meteorologe und Abteilungsleiter der Deutschen Seewarte in Hamburg deren Drachenstation er 1903 in Gross Borstel errichtet hat".

Official Course of Training for Meteorological Observers

A course of training for meteorological observers was held at the Meteorological Office, South Kensington, on November 27th and 28th, 1934. Among the 22 observers who attended were two from Scotland and one from Ireland. As in previous years, the greater part of the course was occupied with a description of the instruments in general use at climatological stations and their management where this presents any difficulty, and with those points in the observation of weather and visibility that experience has shown are often a source of trouble to inexperienced observers.

BOOKS RECEIVED

Royal Alfred Observatory, Mauritius. Results of magnetical and meteorological observations for September to December and year 1932; and January to September, 1933. Port Louis, 1933.

Report on rainfall registration in Mysore for 1932 and 1933. By C. Seshachar, M.A., Bangalore, 1933 and 1934.

Meteorology in Mysore for 1932 and 1933, being the results of observations at Bangalore, Mysore, Hassan, Chitaldrug, Balehonnur and Jogimatti. Fortieth Annual Report, Bangalore, 1933 and 1934.

OBITUARY

R. P. Berloty.—We regret to learn of the death of R. P. Berloty on October 10th, 1934. M. Berloty was born at Lyons on March 25th, 1856. He entered the order of the Jesuits and devoted his life to science, becoming Docteur dès Sciences de la Faculté de Paris in 1886, and Professor aux Facultés libres d'Angers et de Lyon. After working for some years on solar phenomena and seismology at Stonyhurst, England, and at Tortosa, Spain, he was sent to Syria in 1907, where he founded the Astronomical and Geophysical Observatory of Ksara. This observatory gradually developed into a first order meteorological station and work was also done on magnetism and seismology. During the war, however, it was totally

destroyed when the Jesuits were expelled from Syria. In 1920 Berloty returned to Syria, re-established the Observatory of Ksara, and founded secondary meteorological stations in the Levant.

Adrien de Gerlache de Gomery.—We regret to learn of the death of Baron de Gerlache in his 69th year on December 4th, 1934. While still a young lieutenant in the Belgian Navy he started to organise an expedition to explore the Antarctic regions, but it was not until August, 1897, that he set sail for Graham Land in the *Belgica* with Professor H. Arctowski as geologist, Dr. F. A. Cook as surgeon, and Roald Amundsen as first officer. During that summer he explored and charted the coasts near Graham Land, but in endeavouring to reach a high latitude early in March the ship was frozen in and Gerlache was committed to the first wintering in the Antarctic regions, the *Belgica* drifting in all directions with the pack. Before this drift nothing was known of winter conditions in the Antarctic and the meteorological observations were thus very important. It was largely due to the courage and tenacity of Gerlache that the party emerged with all its collections in good condition. Gerlache commanded the *Belgica* in the Duke of Orlean's scientific expedition to the East Greenland Sea in 1905 and he promoted the building of an ice-protected ship which he transferred to Sir Ernest Shackleton in 1914 as the *Endurance*.

NEWS IN BRIEF

Dr. Paul Raethjen of Königsberg has been appointed Professor of Meteorology at the University of Hamburg in place of the late Professor A. Wigand.*

Professor R. Samoilowitsch and Professor W. Wiese have been appointed to the newly established Chair of Polar Science of the University of Leningrad.

Erratum

December, 1934, photographs facing p. 253. The dates given under the two photographs should be interchanged.

The Weather of December, 1934

Pressure was below normal over the whole of the North Atlantic, western, central and southern Europe, Iceland, south Greenland and the east coast of North America and also in north Alaska, the greatest deficit being 17·4 mb. at 50° N., 30° W. Pressure was above normal over Spitsbergen, northern and eastern Europe and most of North America, the greatest excess being 9·2 mb. at Moscow and 7·1 mb. at 50° N., 120° W. Temperature was above normal over the whole of the western half of Europe, being as much as 16·6° F.

* See *Meteorological Magazine* 67, 1932–3, p. 294.

above normal at Spitsbergen, 12·5° F. at Särna (Svealand) and 9·3° F. at Zürich. Precipitation was deficient at Spitsbergen, Northern Scandinavia and central Europe, but in excess in central Scandinavia.

The outstanding features of the weather of December over the British Isles were, the general deficiency of sunshine, the abnormally high temperatures, the mean pressure readings markedly below normal and the large excess of rainfall except in the extreme north-west; the amounts of rain measured at Holyhead and Valentia were the highest ever recorded during December at these stations since records began in 1871 and 1870 respectively. Throughout the month deep depressions with associated secondaries approaching or crossing the country, maintained mild, rainy, cloudy conditions generally, though from the 4th to 5th the north of Scotland came under the influence of a high pressure area over Iceland, on the 17th the south of England was influenced by a wedge of high pressure and from the 20th–21st a wedge of high pressure passed across Ireland and England. Winds were generally between S. and W. becoming fresh or strong frequently, with gales locally in the south-west or north-west on the 1st, 2nd, 5th, 8th–12th and then from the 23rd to 28th there was a stormy period in the north with frequent gales at exposed places. Gales were again reported from Pembroke on the 30th. A gust of 90 m.p.h. was recorded at the Lizard on the 9th and of 75 m.p.h. at Kirkwall (Orkneys) on the 26th. Mist and fog were experienced locally early in the month becoming denser in the Midlands on the 6th and in south-east England on the 10th, and again between the 17th and 23rd being most severe in the same districts on the 22nd and 23rd. Christmas rail traffic was dislocated. Rain occurred on most days and at times was heavy locally; 3·74 in. were measured at Maesteg (Glamorgan) on the 1st, ~~3·26~~ in., 2·36 in. and ~~2·33~~ in. at Fofanny (Co. Down) on the 4th, 14th and 25th respectively and 2·32 in. at Brechfa (Carmarthen) on the 1st. At Holne (Devon) 10·23 in., at Maesteg (Glamorgan) 10·48 in. and at Tynywaun (Glamorgan) 10·77 in. were measured between the 1st and 8th inclusive. Mr. H. L. Davies, of 40, Salisbury Road, Maesteg, Glamorganshire, sends word that for the eight days ending at 17h. on the 9th, he measured 10·65 in. Snow occurred on the hills in Scotland on the 26th. Thunderstorms were experienced at Rothesay on the 8th, locally in Ireland on the 8th, 10th, 14th and 17th and in south England and south Ireland on the 27th. Temperature was above normal most of the month the minimum temperatures being especially high so that frequently the diurnal range was very small amounting only to 1° F. on some days. In the south maximum temperatures were mostly 50° F. or above. Sunshine values were generally very poor, almost the whole country being sunless on some days. The 31st was the day of most general sunshine, all parts of the country having some and Birmingham 5·3 hrs. Among isolated good records were 6·4 hrs. at Falmouth

on the 29th, 6·1 hrs. at Cullompton on the 12th and Worthing on the 21st and 6·0 hrs. at Phoenix Park, Dublin and Bournemouth on the 20th. The distribution of bright sunshine for the month was as follows :—

	Total (hrs.)	Diff. from normal (hrs.)		Total (hrs.)	Diff. from normal (hrs.)
Stornoway ...	18	− 4	Liverpool ...	25	−18
Aberdeen ...	15	−22	Ross-on-Wye ...	38	−10
Dublin	54	+ 8	Falmouth ...	39	−17
Birr Castle ...	39	− 4	Gorleston ...	20	−23
Valentia... ...	21	−17	Kew	26	−11

Miscellaneous notes on weather abroad culled from various sources.

The weather in Switzerland was so fine and mild during the first fortnight that the snow disappeared generally from the mountains up to a level of 5,500 ft., but heavy falls of snow were reported by the 18th and by the 21st a general drop of temperature had brought the snowline down to the 3,000 ft. level making ski-ing conditions good. Owing to heavy rains the Tiber overflowed its banks near Rome about the 16th, but no lives were lost though some families were driven from their homes. Floods occurred in Cyprus about the 20th and storms prevented the mails from being despatched : heavy rain continued until the 27th, when two of the largest reservoirs burst and flooded the neighbourhood. Torrential rain fell in Coimbra (Portugal) during Christmas night and many parts of the town were flooded. Five persons were drowned and much damage done by a storm followed by torrential rain in the district of Canea in Crete on the 26th. The first snow of the winter fell on the 26th in Vienna and the surrounding district. (*The Times*, December 13th–29th.)

Heavy rain occurred in the eastern Transvaal and many other parts of the Union during the first 10 days of the month and part of Ladysmith was flooded on the 10th when the Klip River burst its banks. (*The Times*, December 11th.)

A cold wave swept across Burma early in the month ending in a snowstorm at Tavoy which is a rare event. (*The Times*, December 12th.)

In the north-western district of Western Australia, in western Queensland, Carpentaria and north-west New South Wales the weather conditions were generally good during the month but in north-east New South Wales dry conditions prevailed. (*The Times*, December 27th.)

Temperature was above normal in the eastern United States at the beginning of the month, but the cold spell in the Mountain Region spread across the whole country to be followed by a warm spell which began in the west about the 11th–18th. This was followed by another cold spell from the north-west at the close of the month. Temperature on the Pacific coast was however above

normal generally. Rainfall was mainly above normal at the beginning of the month becoming below normal later. The first severe blizzard of the winter swept across central Canada on the 19th. Twenty-two in. of rain in 24 hrs. about the 18th caused landslides between Sao Paulo and Santos in Brazil. (*The Times*, December 19th–21st and *Washington, D.C., U.S. Dept. Agric., Weekly Weather and Crop Bulletin.*)

Severe gales were experienced frequently on the North Atlantic and several lives were lost. (*The Times*, December 11th–28th.)

Daily Readings at Kew Observatory, December, 1934

Date	Pressure, M.S.L. 13h.	Wind, Dir., Force 13h.	Temp. Min.	Temp. Max.	Rel. Hum. 13h.	Rain.	Sun.	Remarks. (see p. 1).
	mb.		°F.	°F.	%	in.	hrs.	
1	1024·8	S.3	44	48	83	0·15	0·0	r 20h.–24h.
2	1003·3	SSW.4	47	55	94	0·46	0·0	rir_0 0h.–14h.
3	1006·8	SW.3	54	56	87	trace	0·0	pr_0 19h.
4	1003·3	SSW.3	54	54	94	0·31	0·0	r 9h.–13h., 20h.–24h.
5	990·0	SW.4	51	53	70	0·19	1·0	r 0h.–3h., 14h.–17h.
6	1006·4	SSW.3	45	54	96	0·59	0·0	irr_0 all day.
7	1009·0	SW.3	51	54	78	trace	3·1	ir_0 0h.–3h.
8	1008·4	SSW.4	49	57	82	0·13	1·0	r_0r 1h.–7h.
9	992·1	S.4	54	55	89	0·27	0·0	r_0r 9h.–17h.
10	1002·6	W.1	43	50	91	0·01	1·3	F–m all day.
11	999·5	S.3	42	50	82	0·05	0·1	r_0 3h., 18h., 19h.–20h.
12	987·1	SW.4	47	52	75	0·05	2·1	r_0r 7h.–9h.
13	989·0	S.4	45	51	76	0·11	1·9	pr_0pr all day.
14	984·4	SE.3	45	48	89	0·31	0·0	r_0r 10h.–24h.
15	974·3	SSW.4	48	51	88	0·41	0·0	irr_0 all day.
16	989·9	WNW.2	47	49	89	0·09	0·0	irr_0 0h.–9h.
17	1001·3	SW.2	40	47	89	0·01	2·4	f 1h.–11h., r_0 22h.
18	989·7	SW.5	45	53	82	0·19	1·0	r_0r 1h.–7h., 19h.–21h
19	988·8	S.3	48	51	90	0·13	0·8	r_0r 15h.–23h.
20	1005·4	NW.4	47	51	76	0·02	1·5	rr_0 10h.–11h.
21	1014·6	W.1	37	45	88	—	3·2	fF 8h.–24h.
22	1010·6	E.3	34	43	87	—	0·0	f 0h.–17h.
23	1006·7	SE.3	41	49	89	0·11	1·4	rr_0 7h.–11h., f 21h.
24	1012·6	E.3	37	43	86	0·01	0·0	r_0 3h., r 5h.–6h.
25	1014·4	ESE.2	36	41	92	0·01	0·0	rr_0 23h.–24h., f 10h.
26	1003·9	SSW.3	41	51	90	0·29	0·0	rr_0 0h.–4h., pr_0 20h.
27	1008·4	S.3	40	50	92	0·07	0·0	ir_0 12h.–15h.
28	1003·9	S.3	47	51	84	0·31	0·0	irr_0 7h.–22h.
29	1007·6	W.4	47	51	73	trace	1·3	r_0 9h. & 11h.
30	1019·5	SW.4	41	53	87	0·02	0·0	r_0 10h., 16h., 23h.
31	1015·9	WSW.3	52	53	74	0·14	3·8	r 1h.–2h., 6h.–8h.
*	1002·4	—	45	51	85	4·42	0·8	*Means or totals.

Rainfall 1934—General Distribution

	Dec.	Yr.	
England and Wales	190	96	per cent. of the average 1881–1915.
Scotland	122	109	
Ireland	164	106	
British Isles ...	170	102	

Rainfall : December, 1934 : England and Wales

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av.
Lond .	Camden Square.....	4·80	200	*Leics* .	Thornton Reservoir ...	4·54	169
Sur .	Reigate, Wray Pk. Rd..	8·08	254	,, .	Belvoir Castle.....	3·98	162
Kent .	Tenterden, Ashenden...	7·58	243	*Rut* .	Ridlington	4·92	196
,, .	Folkestone, Boro. San.	6·12	...	*Lincs* .	Boston, Skirbeck.....	3·42	159
,, .	Eden'bdg., Falconhurst	7·44	225	,, .	Cranwell Aerodrome...	3·37	152
,, .	Sevenoaks, Speldhurst.	4·40	...	,, .	Skegness, Marine Gdns.	3·26	148
Sus .	Compton, Compton Ho.	11·72	280	,, .	Louth, Westgate.....	3·96	142
,, .	Patching Farm.....	9·42	280	,, .	Brigg, Wrawby St.....	3·64	...
,, .	Eastbourne, Wil. Sq....	8·55	245	*Notts* .	Worksop, Hodsock.....	3·82	162
,, .	Heathfield, Barklye....	10·98	296	*Derby*.	Derby, L. M. & S. Rly.	4·35	167
Hants.	Ventnor, Roy.Nat.Hos.	9·27	281	,, .	Buxton, Terr. Slopes...	7·94	140
,, .	Fordingbridge, Oaklnds	11·02	280	*Ches* .	Runcorn, Weston Pt....	4·64	147
,, .	Ovington Rectory.....	12·14	306	*Lancs*.	Manchester, Whit. Pk.	4·83	149
,, .	Sherborne St. John.....	8·56	260	,, .	Stonyhurst College.....	5·97	123
Herts .	Welwyn Garden City ...	4·40	180	,, .	Southport, Bedford Pk.	4·32	134
Bucks.	Slough, Upton.....	5·56	221	,, .	Lancaster, Greg Obsy.	5·15	118
,, .	H. Wycombe, Flackwell	6·91	228	*Yorks*.	Wath-upon-Dearne.....	3·43	145
Oxf .	Oxford, Mag. College...	5·26	227	,, .	Wakefield,Clarence Pk.	4·10	169
Nor .	Pitsford, Sedgebrook...	4·47	185	,, .	Oughtershaw Hall.....	10·26	...
,, .	Oundle	2·96	...	,, .	Wetherby, Ribston H..	5·00	204
Beds .	Woburn, Exptl. Farm...	4·56	195	,, .	Hull, Pearson Park.....	3·51	146
Cam .	Cambridge, Bot. Gdns.	3·31	172	,, .	Holme-on-Spalding.....	4·13	168
Essex.	Chelmsford, County Lab	3·96	178	,, .	West Witton, Ivy Ho.	5·38	148
,, .	Lexden Hill House.....	4·19	...	,, .	Felixkirk, Mt. St. John.	5·31	220
Suff .	Haughley House.....	3·35	...	,, .	York, Museum Gdns....	4·60	205
,, .	Campsea Ashe.....	3·57	155	,, .	Pickering, Hungate.....	3·69	146
,, .	Lowestoft Sec. School...	3·01	129	,, .	Scarborough.....	3·92	165
,, .	Bury St. Ed., WestleyH.	3·70	153	,, .	Middlesbrough.....	3·27	169
Norf. .	Wells, Holkham Hall...	3·35	163	,, .	Baldersdale, Hury Res.	...	...
Wilts .	Calne, Castleway.....	7·10	228	*Durh* .	Ushaw College.....	4·89	195
,, .	Porton, W.D. Exp'l. Stn	8·37	266	*Nor* .	Newcastle, Town Moor.	3·44	143
Dor .	Evershot, Melbury Ho.	13·87	268	,, .	Bellingham, Highgreen	4·47	123
,, .	Weymouth, Westham.	9·22	265	,, .	Lilburn Tower Gdns....	4·84	184
,, .	Shaftesbury,Abbey Ho.	5·83	181	*Cumb*.	Carlisle, Scaleby Hall...	4·32	134
Devon.	Plymouth, The Hoe....	12·55	255	,, .	Borrowdale, Seathwaite	21·50	140
,, .	Holne, Church Pk. Cott.	25·03	296	,, .	Borrowdale, Moraine...	18·52	151
,, .	Teignmouth, Den Gdns.	10·92	271	,, .	Keswick, High Hill.....	9·26	138
,, .	Cullompton	12·47	284	*West* .	Appleby, Castle Bank...	5·44	137
,, .	Sidmouth, U.D.C.....	9·85	...	*Mon* .	Abergavenny, Larchf'd	10·28	230
,, .	Barnstaple, N. Dev.Ath	8·37	189	*Glam* .	Ystalyfera, Wern Ho....	18·23	218
,, .	Dartm'r,Cranmere Pool	22·90	...	,, .	Cardiff, Ely P. Stn.....	11·16	218
,, .	Okehampton, Uplands.	15·87	225	,, .	Treherbert, Tynywaun.	23·36	...
Corn .	Redruth, Trewirgie.....	12·60	201	*Carm* .	Carmarthen, Priory St..	12·75	222
,, .	Penzance, Morrab Gdn.	10·68	188	*Pemb* .	Haverfordwest, School.	...	...
,, .	St. Austell, Trevarna...	13·03	214	*Card* .	Aberystwyth	7·27	...
Soms .	Chewton Mendip.....	9·71	180	*Rad* .	BirmW.W.Tyrmynydd	14·69	179
,, .	Long Ashton.....	7·13	185	*Mont* .	Lake Vyrnwy	10·76	157
,, .	Street, Millfield.....	5·73	168	*Flint* .	Sealand Aerodrome.....	4·35	174
Glos .	Blockley	6·00	...	*Mer* .	Dolgelley, Bontddu.....	9·36	137
,, .	Cirencester, Gwynfa....	6·61	197	*Carn* .	Llandudno	4·19	144
Here .	Ross, Birchlea.....	6·07	204	,, .	Snowdon, L. Llydaw 9..	30·80	...
Salop.	Church Stretton.....	5·39	160	*Ang* .	Holyhead, Salt Island...	9·47	227
,, .	Shifnal, Hatton Grange	4·22	164	,, .	Lligwy	8·76	...
Staffs.	Market Drayt'n, Old Sp.	4·35	156	*Isle of Man*			
Worc .	Ombersley, Holt Lock.	4·25	162		Douglas, Boro' Cem....	11·31	226
War .	Alcester, Ragley Hall...	4·72	192	*Guernsey*			
,,	Birmingham, Edgbaston	4·59	170		St. PeterP't.Grange Rd.	9·91	243

Rainfall: December, 1934: Scotland and Ireland

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av.
Wig .	Pt. William, Monreith.	9·60	211	*Suth* .	Melvich	3·16	74
,, .	New Luce School	10·27	185	,, .	Loch More, Achfary	3·48	34
Kirk .	Dalry, Glendarroch	11·28	159	*Caith* .	Wick	2·50	81
,, .	Carsphairn, Shiel	15·27	164	*Ork* .	Deerness	3·26	78
Dumf.	Dumfries, Crichton, R.I.	6·40	159	*Shet* .	Lerwick	3·54	74
,, .	Eskdalemuir Obs.	8·65	124	*Cork* .	Caheragh Rectory	10·31	...
Roxb .	Branxholm	4·46	122	,, .	Dunmanway Rectory	12·02	149
Selk .	Ettrick Manse	9·15	148	,, .	Cork, University Coll.	8·92	174
Peeb .	West Linton	4·12	...	,, .	Ballinacurra	8·42	164
Berw .	Marchmont House	4·08	145	,, .	Mallow, Longueville	8·33	170
E.Lot.	North Berwick Res.	3·28	153	*Kerry.*	Valentia Obsy.	13·60	205
Midl .	Edinburgh, Roy. Obs.	2·50	107	,, .	Gearhameen	18·80	150
Lan .	Auchtyfardle	4·23	...	,, .	Darrynane Abbey	9·38	159
Ayr .	Kilmarnock, Kay Pk.	5·18	...	*Wat* .	Waterford, Gortmore	8·59	187
,, .	Girvan, Pinmore	9·74	163	*Tip* .	Nenagh, Cas. Lough	7·04	152
Renf .	Glasgow, Queen's Pk.	4·59	108	,, .	Roscrea, Timoney Park	6·53	...
,, .	Greenock, Prospect H.	9·68	123	,, .	Cashel, Ballinamona	5·87	135
Bute .	Rothesay, Ardencraig	8·95	...	*Lim* .	Foynes, Coolnanes	5·86	124
,, .	Dougarie Lodge	9·57	...	,, .	Castleconnel Rec.	5·66	...
Arg .	Ardgour House	10·40	...	*Clare* .	Inagh, Mount Callan	9·55	...
,, .	Glen Etive	...	...	,, .	Broadford, Hurdlest'n.	5·15	...
,, .	Oban	6·13	...	*Wexf* .	Gorey, Courtown Ho.	9·18	240
,, .	Poltalloch	8·21	130	*Wick* .	Rathnew, Clonmannon.	8·54	...
,, .	Inveraray Castle	11·30	114	*Carl* .	Hacketstown Rectory	7·80	190
,, .	Islay, Eallabus	6·76	114	*Leix* .	Blandsfort House	7·40	201
,, .	Mull, Benmore	11·60	69	,, .	Mountmellick	6·89	...
,, .	Tiree	...	...	*Offaly.*	Birr Castle	5·14	156
Kinr .	Loch Leven Sluice	4·69	119	*Dublin*	Dublin, FitzWm. Sq.	4·50	181
Perth .	Loch Dhu	14·30	144	,, .	Balbriggan, Ardgillan	5·86	203
,, .	Balquhidder, Stronvar.	11·24	...	*Meath.*	Beauparc, St. Cloud	5·63	...
,, .	Crieff, Strathearn Hyd.	7·65	171	,, .	Kells, Headfort	5·75	151
,, .	Blair Castle Gardens	6·42	168	*W.M* .	Moate, Coolatore	4·51	...
Angus.	Kettins School	6·13	186	,, .	Mullingar, Belvedere	6·84	186
,, .	Pearsie House	8·28	...	*Long* .	Castle Forbes Gdns.	5·48	138
,, .	Montrose, Sunnyside	4·27	154	*Gal* .	Galway, Grammar Sch.	...	...
Aber .	Braemar, Bank	7·23	203	,, .	Ballynahinch Castle	9·94	133
,, .	Logie Coldstone Sch.	4·90	175	,, .	Ahascragh, Clonbrock.	6·48	138
,, .	Aberdeen, King's Coll.	4·18	130	*Mayo.*	Blacksod Point	8·82	144
,, .	Fyvie Castle	5·48	160	,, .	Mallaranny	8·51	...
Moray	Gordon Castle	2·10	78	,, .	Westport House	7·93	138
,, .	Grantown-on-Spey	...	...	,, .	Delphi Lodge	17·36	137
Nairn.	Nairn	2·01	91	*Sligo* .	Markree Obsy.	5·53	115
Inv's .	Ben Alder Lodge	...	...	*Cavan.*	Crossdoney, Kevit Cas.	6·32	...
,, .	Kingussie, The Birches.	2·94	...	*Ferm* .	Enniskillen, Portora	4·13	...
,, .	Inverness, Culduthel R.	2·69	...	*Arm* .	Armagh Obsy.	4·80	153
,, .	Loch Quoich, Loan	13·95	...	*Down.*	Fofanny Reservoir	22·18	...
,, .	Glenquoich	11·48	78	,, .	Seaforde	8·50	206
,, .	Arisaig, Faire-na-Sguir.	6·10	...	,, .	Donaghadee, C. Stn.	7·36	231
,, .	Fort William, Glasdrum	8·59	...	,, .	Banbridge, Milltown	4·31	149
,, .	Skye, Dunvegan	6·42	...	*Antr* .	Belfast, Cavehill Rd.	7·35	...
,, .	Barra, Skallary	4·89	...	,, .	Aldergrove Aerodrome.	5·19	151
R&C .	Alness, Ardross Castle.	3·56	86	,, .	Ballymena, Harryville.	5·80	131
,, .	Ullapool	3·17	50	*Lon* .	Garvagh, Moneydig	4·70	...
,, .	Achnashellach	7·80	78	,, .	Londonderry, Creggan.	3·95	90
,, .	Stornoway	3·49	56	*Tyr* .	Omagh, Edenfel.	5·31	126
Suth .	Lairg	3·45	86	*Don* .	Malin Head	4·64	...
,, .	Tongue	2·95	60	,, .	Killybegs, Rockmount.	3·95	...

Climatological Table for the British Empire, July, 1934

STATIONS.	PRESSURE.		TEMPERATURE.							Relative Humidity.	Mean Cloud Am'nt	PRECIPITATION.			BRIGHT SUNSHINE.	
			Absolute.		Mean Values.				Mean.							
	Mean of Day M.S.L.	Diff. from Normal.	Max.	Min.	Max.	Min.	½ Max. and Min.	Diff. from Normal.	Wet Bulb.			Am'nt.	Diff. from Normal.	Days.	Hours per day.	Percentage of possible.
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	%	0–10	in.	in.			
London, Kew Obsy....	1016·9	+ 1·1	83	53	76·8	57·7	67·3	+ 4·6	58·2	74	4·8	3·19	+ 1·02	8	9·1	56
Gibraltar.....	1015·2	— 1·6	89	63	83·5	68·0	75·7	+ 0·9	65·4	78	3·0	0·00	— 0·03	0	...	...
Malta.....	1015·0	+ 0·3	97	67	86·2	72·3	79·3	+ 1·0	70·0	67	1·4	0·00	— 0·05	0	12·7	89
St. Helena	1015·2	— 0·4	72	54	63·3	56·3	59·8	+ 1·3	57·4	92	7·8	4·12	...	21	...	...
Freetown, Sierra Leone	1013·7	+ 1·0	88	68	83·8	72·8	78·3	— 0·3	75·4	91	8·7	53·38	+ 17·80	27	...	...
Lagos, Nigeria	1013·5	+ 0·3	89	71	83·9	74·8	79·3	+ 1·3	75·4	90	9·1	14·49	+ 3·99	20	3·9	31
Kaduna, Nigeria	1009·2	...	89	66	84·3	68·2	76·3	+ 2·7	71·7	88	8·6	5·70	— 4·92	21	5·5	44
Zomba, Nyasaland	1018·2	— 0·3	78	47	74·3	54·4	64·3	+ 2·3	59·7	77	5·2	0·43	+ 0·08	5	...	...
Salisbury, Rhodesia...	1020·1	— 1·2	78	37	71·2	45·8	58·5	+ 2·4	50·8	55	2·4	0·02	— 0·01	1	8·0	71
Cape Town	1022·5	+ 1·2	74	37	61·7	47·8	54·7	0·0	47·2	84	4·5	2·99	— 0·63	9	...	...
Johannesburg	1021·5	— 1·5	72	26	60·4	40·8	50·6	+ 0·2	40·3	52	2·3	0·84	+ 0·51	4	8·8	82
Mauritius	1020·3	— 0·1	76	57	74·3	61·9	68·1	— 0·2	65·1	74	5·5	1·25	— 1·24	28	7·2	66
Calcutta, Alipore Obsy.	998·7	— 0·5	93	76	90·1	79·5	84·8	+ 1·1	80·2	90	8·7	8·91	— 3·79	18*	...	...
Bombay	1003·9	0·0	89	73	85·6	77·0	81·3	— 0·1	77·5	87	9·2	21·37	— 2·90	24*	...	...
Madras	1003·8	— 0·7	101	73	95·2	78·9	87·1	— 0·5	75·9	69	8·4	2·07	— 1·77	6*	...	...
Colombo, Ceylon	1009·1	0·0	86	73	84·5	77·4	80·9	— 0·3	77·1	79	7·4	0·85	— 3·58	11	6·8	54
Singapore.....	1008·5	— 0·4	90	71	86·4	76·5	81·5	+ 0·2	78·0	82	8·2	10·19	+ 3·40	15	6·2	51
Hongkong.....	1005·5	+ 0·8	93	73	87·0	78·7	82·9	+ 0·4	79·1	85	8·1	19·43	+ 5·01	25	5·9	44
Sandakan	1009·1	...	92	72	88·2	75·2	81·7	— 0·1	76·4	83	6·6	14·01	+ 7·29	14	...	...
Sydney, N.S.W.....	1018·4	+ 0·1	73	40	62·6	47·8	55·2	+ 2·5	50·0	79	4·7	9·04	+ 4·24	17	5·5	54
Melbourne	1018·8	— 0·1	69	34	58·0	44·3	51·1	+ 2·4	46·5	83	6·6	1·64	— 0·22	17	3·5	36
Adelaide	1019·3	— 1·0	74	38	63·0	47·1	55·1	+ 3·3	48·4	66	6·7	1·04	— 1·60	15	4·5	45
Perth, W. Australia ...	1019·9	+ 0·9	69	37	63·0	46·9	54·9	— 0·3	48·9	76	4·2	5·88	— 0·68	13	6·0	59
Coolgardie	1019·9	+ 0·1	73	35	60·3	39·9	50·1	— 1·1	47·2	73	4·8	0·92	+ 0·05	6	...	...
Brisbane.....	1019·0	+ 0·6	78	41	67·8	51·6	59·7	+ 1·2	53·1	71	5·8	5·11	+ 2·91	9	5·4	52
Hobart, Tasmania.....	1016·4	+ 2·7	66	34	53·4	40·5	46·9	+ 1·2	42·8	81	6·1	2·11	— 0·07	17	4·5	48
Wellington, N.Z.	1014·3	+ 0·4	60	33	51·1	40·2	45·7	— 2·3	43·4	79	6·8	6·10	+ 0·47	20	3·6	38
Suva, Fiji	1014·0	0·0	82	63	78·1	69·1	73·6	+ 0·2	69·8	84	7.2	9·74	+ 4·81	22	3·9	35
Apia, Samoa	1011·1	— 0·8	87	70	84·3	73·6	78·9	+ 1·7	75·5	81	5·0	7·74	+ 4·76	18	...	...
Kingston, Jamaica	1014·5	— 0·2	93	70	89·2	73·0	81·1	— 0·6	72·2	77	3·1	0·85	— 0·77	8	5·6	43
Grenada, W.I.	1010·1	— 3·2	89	71	86	73	79·5	+ 0·3	73·0	74	6	8·59	— 0·84	25	...	...
Toronto.....	1014·0	— 0·4	93	54	81·5	61·4	71·5	+ 2·4	63·2	65	4·3	1·58	— 1·26	11	10·6	70
Winnipeg	1013·6	+ 1·3	92	40	78·9	53·2	66·1	— 0·3	55·4	81	3·8	1·77	— 1·33	10	11·2	70
St. John, N.B.	1012·9	— 0·7	80	41	71·1	53·8	62·5	+ 2·1	58·3	80	6·1	2·09	— 1·54	13	8·0	52
Victoria, B.C.....	1017·2	— 0·1	81	49	67·0	51·7	59·3	— 0·8	56·2	87	6·2	0·25	— 0·17	5	10·0	64

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

(24083) Wt. 25/32 1000 1/35 Hw. G.377.6