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The Fogs which ascend from the Dead Sea to the mountains of Jerusalem.

By DR. D. ASHBEL

(Hebrew University, Jerusalem)

A curious and interesting phenomenon, unnoticed up to now, is the heavy fog which reaches Jerusalem from the east. The reason for this lack of attention lies probably in the fact that Jerusalem is situated on the slope of the mountain to the west of Mount Olive, so that when standing in the city one does not see all that happens on the other side of the mountain, in the Judean desert and the Jordan valley. Between November and May, on winter days, appears the fog which originates in the Jordan valley, as it climbs the brooks of the Judean desert at a rate of 5–8 Km./hr. These fogs arrive at Mount Olive and Mount Scopus in the forenoon hours, stay there for a few hours and disappear in the afternoon. It sometimes happens that the fog remains during the whole afternoon and may even grow heavier by an additional stream of new cold air, as was the case on December 27th, 1935. Only on very rare occasions does the fog continue to rise from the Jordan valley all night, as on July 1st, 1936.

The fog does not pass the mountain line to the west, save at exceptional places in the "neck" of the mountain, as between Kfar-Tur and the German Sanatorium, or between the Sanatorium and the University. The mountain line itself is an impassable western boundary for the fog, although its thickness reaches several hundred metres. The fog remains fixed on the eastern slope of the mountain, in proximity to its top, as a wall, forming an angle of

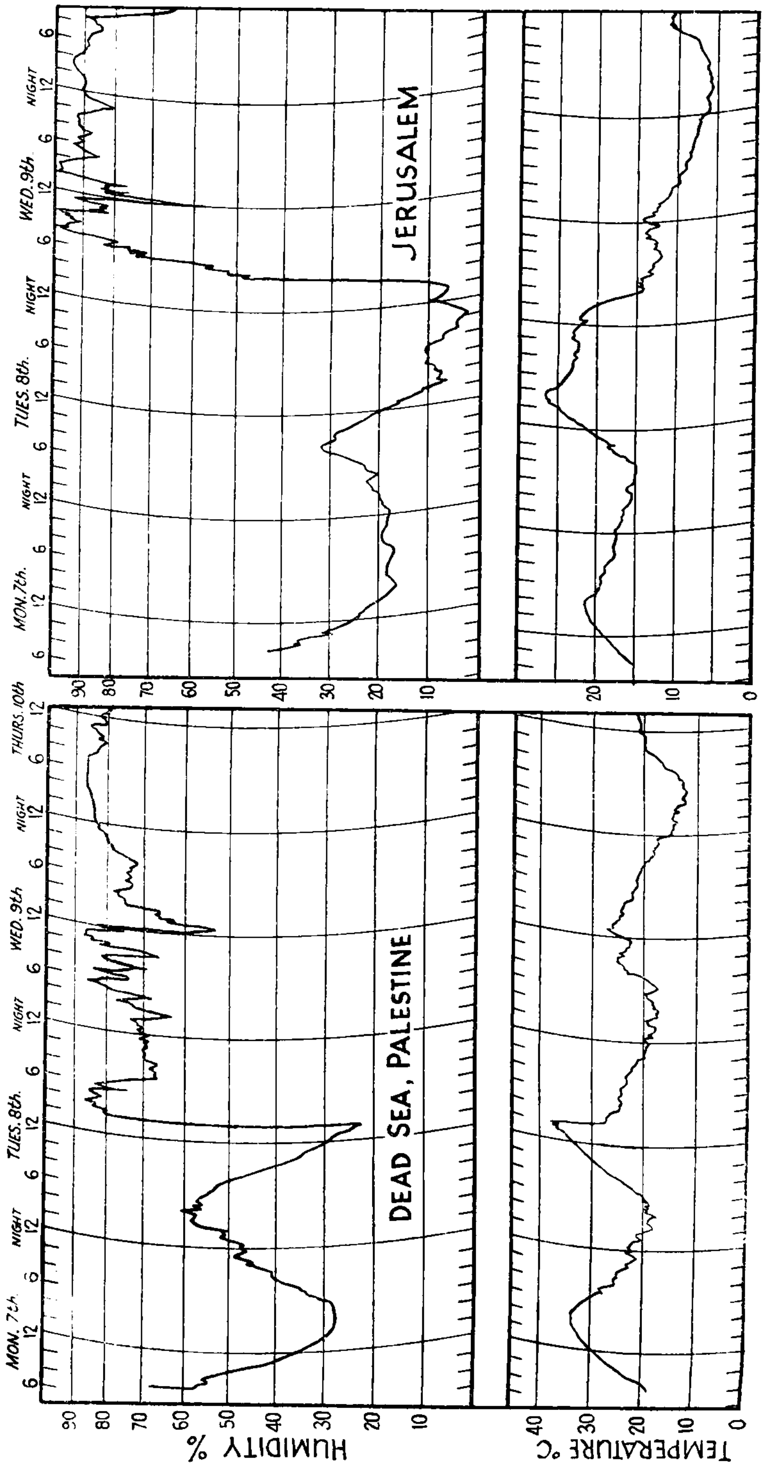


FIG. 3.—COLD AIR ARRIVAL AT THE DEAD SEA AND 12 HOURS LATER AT JERUSALEM

about 60° to the east. Thanks to the smoke rising from the burning garbage at a distance of 5 Km. from Jerusalem to the north, it is possible to determine that a western current rises above the fog and probably by pushing it eastward causes its inclination to the east.

The formation of this fog depends on a cold air stream which descends into the Jordan valley in the rear of a barometric depression. This air pushes the warm local air upwards. As this air rises, condensation of vapours takes place from a certain limit upward at a slow rate. The cold air slowly fills the Jordan valley. The rising air spreads over the western slopes of the mountains (Judean, Ephraim and Galileen mountains) and presumably also over the eastern slopes (Moab mountain). I have seen such a fog not only in Jerusalem and the Ephraim mountains, but also during a journey from Nazareth to Tiberias, on the mountains between Nazareth and Kfar Turan, as it spreads and advances over the ground from the east.

The cold air which fills the Jordan valley does not always come from the west or the south-west. A cold air wave may sometimes come from the north or north-east and fill the Jordan valley before reaching the mountains of western Trans-Jordan. It keeps on filling the valley until it reaches its border, the mountain tops, and then it also spreads above them westward. Such an interesting case happened on March 8th, 1932. The cold air then reached the Dead Sea valley 12 hours before reaching Jerusalem (Fig. 3). At first the air temperature in the Dead Sea depression fell rapidly 11° C. during one hour, immediately after noon, and afterwards continued to fall in the afternoon and night hours about an additional 11° C. Only 12 hours after the fall in the temperature in the Dead Sea depression the cold air reached Jerusalem also, about an hour after midnight, and the relative humidity of the air rose at once to the maximum, whereas the temperature fell 8–9° C.

The conditions prevailing on misty days are not so extreme, but each case was preceded in the Jordan valley by sufficiently warm weather and only upon the arrival of the cold air in the rear of the barometric depression, did the formation of the fog start. The appearance of the fog as it creeps from the Jordan valley along the brooks of the desert towards the mountain tops has become already a sure sign of the end of rainy weather, although this phenomenon may repeat itself.

In recent years, I noted the following cases of Dead Sea fogs which reached Jerusalem: January 20th and 21st, 1932; January 6th, 1933, November 8th and December 11th, 1934, January 9th and 16th, November 26th and December 27th, 1935; January 7th, 8th, 12th, 14th and 15th, 1936. Of these, the case of December 27th, 1935 was the most interesting one. It occurred after a khamsin period of several days' duration which ended on December 26th, accompanied by a front of heavy hailstorms throughout the country. On the same day, at 3 p.m., heavy hailstorms occurred in Jerusalem, Tiberias, Tel Mond (on the shore), Ain Harod, Ayeleth Hashachar and Kfar Giladi; i.e., from the northern part of the country to its southern part. The greatest damage was done in the neighbourhood of Tel Mond on the shore, where the water equivalent of the hail

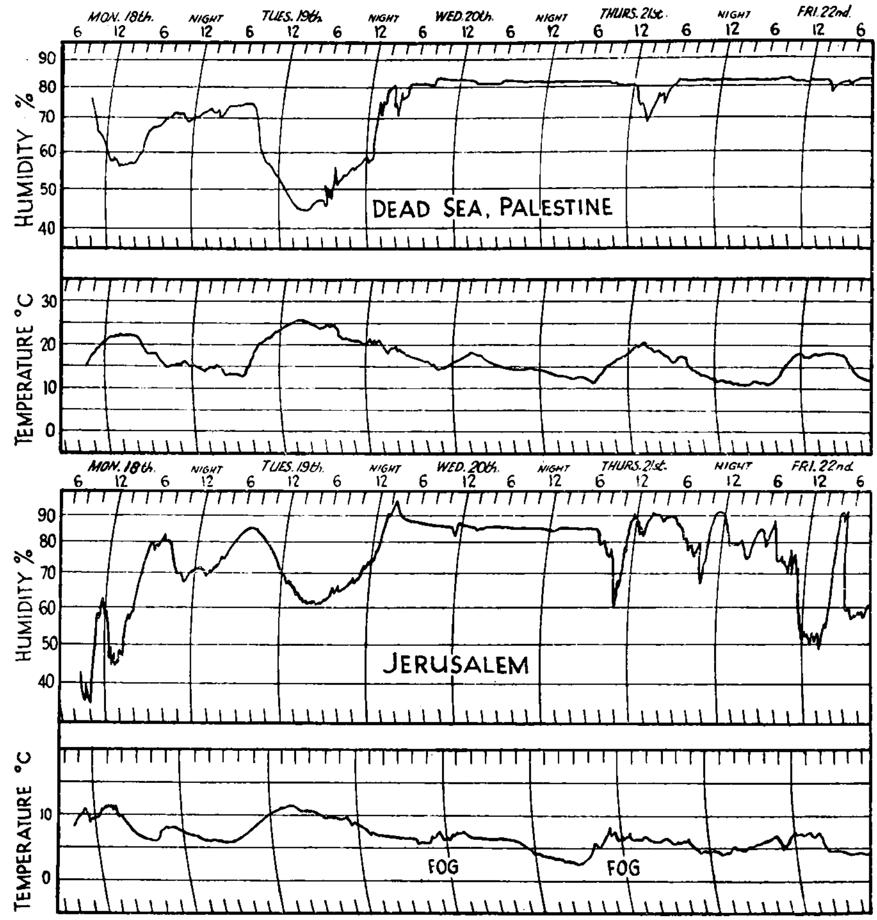


FIG. 4—CONDITIONS AT DEAD SEA AND JERUSALEM DURING EASTERN FOG.

amounted to 45 mm. This hail fell during three-quarters of an hour and devastated the plantations. In Kfar Giladi and Ain Harod the falling hailstones were as large as dove's eggs and also caused considerable damage. On the following day, in the early morning hours, a heavy fog arose from the Jordan valley towards the mountains of Jerusalem and lasted the whole day. It was reinforced in the afternoon hours, seemingly by the addition of new cold air, and also gave up its excess of water as rain (3·75 mm.). Such rain from the east is not at all usual here, but the farmers of the eastern Yesreel valley informed me of several cases of clouds coming from the east and giving rain in their region in small quantities.

The Weather at Malta

Certain meteorological phenomena common enough in one part of the world, may be rare and of outstanding interest in other parts. The tornado is an example of this. On the other hand, a phenomenon which is universally common may have a significance peculiar to a particular place. For instance, a north-easterly gale at flood tide demands special precautions in the Port of London and a north-easterly gale or strong wind calls for special care in the Grand Harbour at Malta. Accordingly, the following description of the weather at Malta on November 24th, 1936, may be of interest, as phenomena coming under both the above categories were experienced on that day. The sequence was as follows: moderate gregale; heavy thunderstorms; a tornado; strong gregale.

A moderate gregale is a north-easterly wind of force 5 to 7 and a strong gregale is a north-easterly gale; the word "gregale" being derived from the local word for Greece, which country lies to the north-east of Malta. The Grand Harbour is exposed to the north-east and a persistent strong wind from this direction may raise sufficient swell in the harbour to necessitate special precautions being taken lest ships at anchor drag their moorings. With a strong gregale blowing, ships have to raise steam and be prepared to leave port at short notice.

On November 24th, 1936, a moderate gregale occurred in the morning and a strong gregale in the afternoon. Between these two events, however, a thunderstorm with intense rainfall occurred at Valletta and, at about the same time, a tornado caused considerable structural damage at the Royal Air Force Station at Hal Far (8 miles from Valletta) and also at the village of Ghaxak nearby.

To examine the sequence of events in conjunction with the synoptic situation, reference should first be made to the 19h.* chart for the previous day on which were indicated a shallow depression over Algeria and a small anticyclone over Cirenaica. The upper winds at Malta were light easterly and at Tripoli moderate easterly in the lower layers, veering to SW. by 13,000 ft. At 5h. the next morning, a depression was indicated between Malta and Tripoli. Information was meagre, however, as African reports were available only from coastal stations of Tunisia and Tripolitania and there were no reports from Libya or Cirenaica. It was not possible, therefore, to estimate accurately the depth of this depression nor yet to locate any fronts with confidence. At 8h. the depression was indicated with its centre somewhere between Malta and Tripolitania. From Malta to Tripoli, however, is 200 miles and no reports were received from the islands between Malta and the Tunisian coast, so that it was still not possible to gauge the depth of the depression.

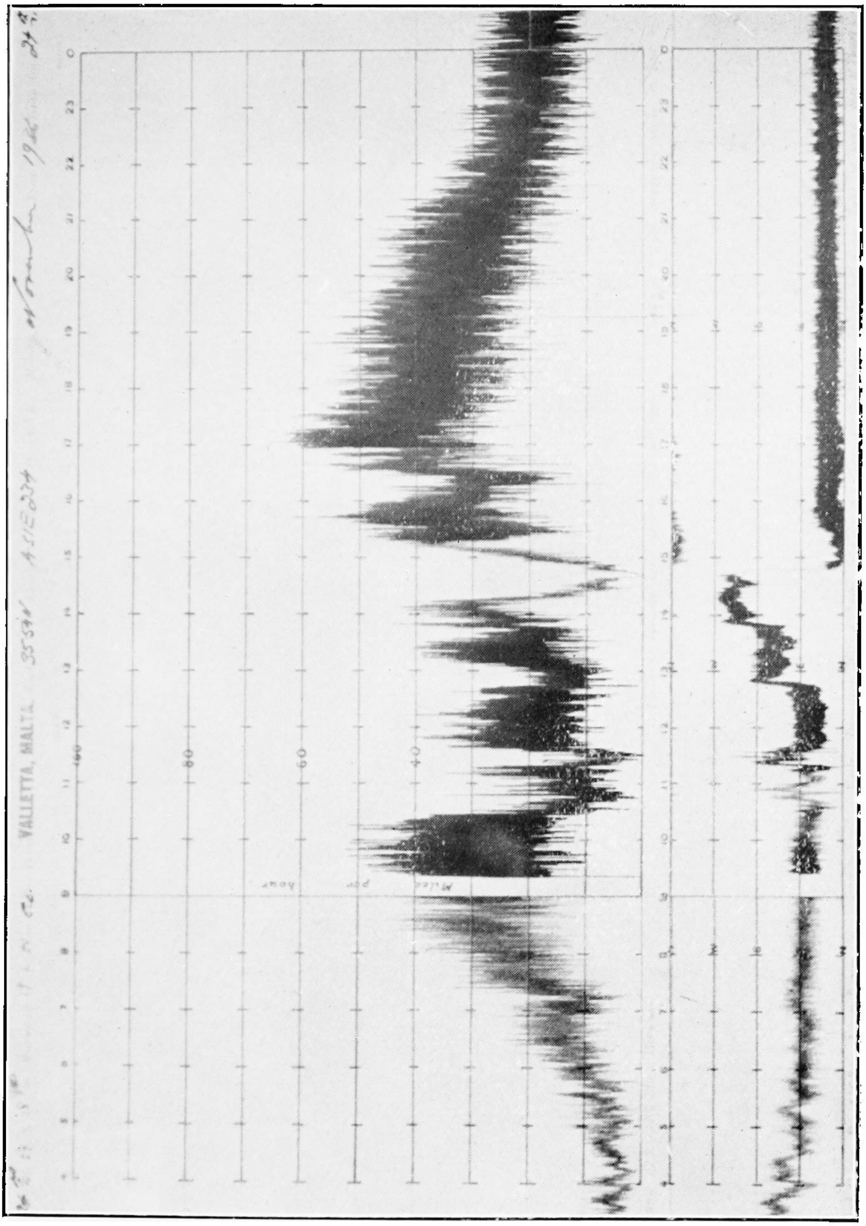
(*All times are Central European Time, 1 hour ahead of G.M.T.)

The upper wind at Tripoli (WSW. 44 m.p.h. at 3,000 ft.) gave a hint that the pressure gradient north of Tripoli was fairly steep, although the upper wind at Malta was only 15 m.p.h. from ESE. at 3,000 ft. The surface wind at Malta was, however, increasing rapidly from ENE. by this time and warning of a moderate gregale was issued to the harbour authorities. It was apparent then, either that the depression was deepening or that it was already deep and moving towards Malta. Undoubtedly a discontinuity passed over Malta between 10h. and 11h. for a thunderstorm with very heavy rainfall (45·7 mm. in 1½ hours) occurred at Valletta and at about 10h. 40m. a small tornado preceded by heavy hail and thunder passed over Hal Far and Ghaxak.

The tornado was small but during its brief life it caused considerable damage. The roofs of two hangars were ripped off, one being carried 200 yards and the other 100 yards. Both hangars were completely destroyed and over twenty aircraft damaged more or less seriously. From the aerodrome the tornado passed northwards and was next reported from the village of Ghaxak 2 miles away where it demolished four stone houses. Nothing more was heard of it after this. The path of the tornado was quite narrow ; a wind sock about 170 yards from the damaged hangars being almost unaffected. There seems but little doubt that the damage was caused primarily by the sudden large reduction in pressure combined with a strong vertical current and not by the horizontal component of the wind. This view is supported in several ways. First, the hangars were closed and therefore destruction could not have been caused by any " umbrella " or " parachute " effect. Secondly, aircraft hands who were at work inside the hangars described the feeling as though their eardrums were being blown out and it was also stated that the wind did not appear to be abnormally strong. Thirdly, a press photograph taken of the damage at Ghaxak gives the impression that the walls of the damaged houses were burst outwards.

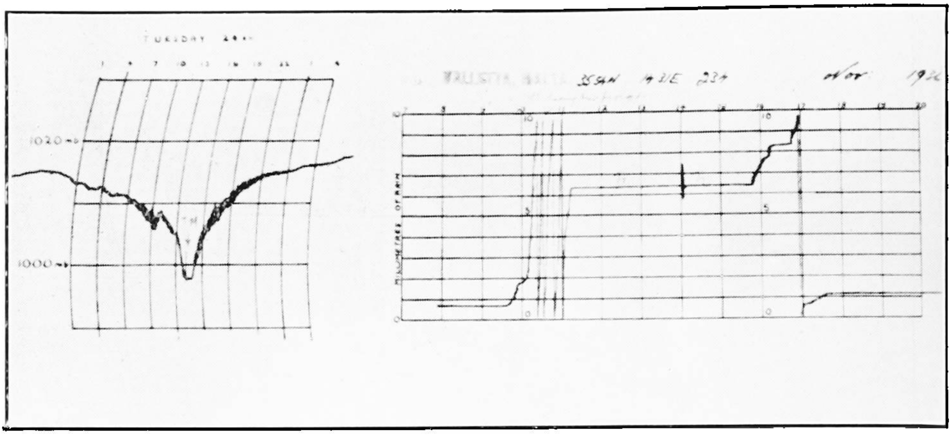
Several waterspouts were also observed from Hal Far and from H.M.S. *Hood* at about this time. From this vessel, which was anchored east of Hal Far, one of these waterspouts was seen to move towards the coast in Hal Far direction so that it seems probable that the tornado originated as a waterspout.

The 11h. chart showed that the depression was more vigorous than previously had been indicated and that the front was a discontinuity between cool air, which had passed over the Balkans and southern Italy and reached Malta from a north-westerly direction, and comparatively warm air coming up from the Gulf of Sidra. This front curved east-north-east and then south-east from Malta and finally down towards Libya. During the early part of the morning the depression apparently deepened and at 11h. it was situated between Malta and the Gulf of Gabes with its centre nearer

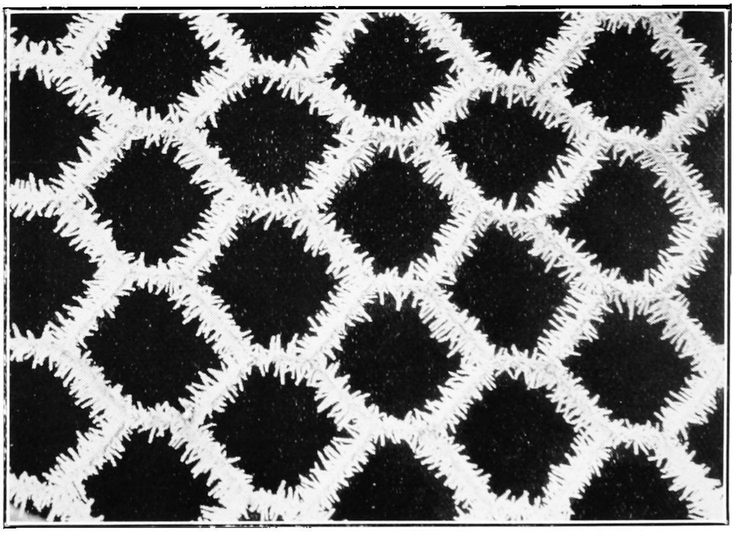


ANEMOGRAM, VALLETTA, MALTA, NOVEMBER 24TH, 1936

facing p. 35]



BAROGRAM AND RAINFALL RECORD, VALLETTA, MALTA, NOVEMBER 24TH, 1936



RIME ON WIRE NETTING AT ESKDALEMUIR OBSERVATORY,
10.50 G.M.T., JANUARY 14TH, 1937 (*see p.* 41)

Malta. At this time its direction of travel was easterly as shewn by the rapidly rising barometer at Lampedusa and by an equally rapid fall of pressure at Malta. The anemogram indicated that at about 12h. 45m. and 13h. 50m. further fronts passed across Malta although the temperature and humidity records do not offer any further evidence on this point.

From 13h. pressure fell rapidly reaching its lowest value between 14h. and 15h. By 14h. 40m. the wind had dropped fairly rapidly to calm to become NE. and rose rapidly to between 30 and 40 m.p.h. a short time afterwards. There seems little doubt that the centre of the depression passed almost directly over Malta and all the phenomena associated with the " eye of the storm " were experienced. At 11h. the sky was completely covered with low cloud ; by 13h. the cloud had decreased to 4 tenths and this partial clearance lasted for about two hours after which the sky clouded over again. After the passage of the centre, the wind increased very rapidly and eventually reached force 9 from about NE., moderating gradually as the centre moved away eastwards.

A full understanding of the causes underlying this sequence of weather is hampered by the paucity of observations from northern Africa, the distance of Malta from the nearest reporting station and by the absence of upper air information between the mornings of November 23rd and 25th.

It seems probable, however, that the sequence of events was as follows. Cool air was drawn round the shallow depression over Algeria and comparatively warm air round the small anticyclone over Cirenaica. These two air masses probably met in the region of Tripolitania and a small depression developed early on the 24th. As it developed the depression drew in cold air which had arrived indirectly from the Balkans. This caused a rapid deepening and gave rise to the discontinuities shewn on the anemogram. As development took place over the sea and the horizontal extent of the depression was small, it was not clearly shewn on the synoptic charts until it was quite close to Malta. During the early part of its life it moved north-west travelling in the circulation round the shallow depression over Algeria, but subsequently its motion was governed by the general westerly current existing at the higher levels. An estimate of the horizontal extent of the depression as it passed Malta may be obtained from a measurement of the barograph trace. The rapid fall and rapid rise occurred within about three hours. The velocity of the depression itself cannot be gauged exactly from the charts owing to the difficulty in placing the centre, but it seems unlikely that it moved at a greater speed than 60 m.p.h. Hence the deep part of the depression was probably not more than 180 miles in diameter.

A. C. BEST
E. L. CLINCH

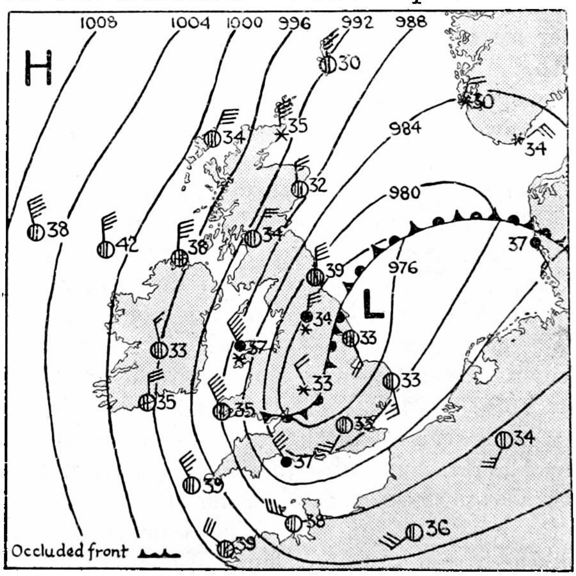
The Blizzard of February 27th—March 1st, 1937

The month of February ended with a blizzard which was the worst experienced in this country since February 1933* and was also comparable with the great storm of January 1881*.

From the meteorological point of view it is interesting to compare the synoptic situations with which these three storms were associated. The depression which was associated with the 1881 storm possessed well-marked warm and cold fronts, the air in the warm sector being tropical air which had been drawn from low latitudes over the Atlantic.

The 1933 storm was due to a depression which developed in the polar air; associated with this depression were two fronts, a warm front and a cold front but the air in the warm sector was definitely of polar origin though slightly warmer than the air outside the sector. The synoptic situation which produced the recent storm was the result of the combination of a polar air depression and a depression which originally possessed a supply of warm air.

On February 25th, 1937, a complex depression, the main centre being a polar air depression, was almost stationary over the Atlantic to the west of Ireland. Another depression with which were associated two occlusions, one being a back-bent occlusion, was situated about 300 miles north of the Azores. The depression north of the Azores had formed on the coast of North Carolina in America and during its passage eastwards had deepened and occluded. This depression continued to travel eastwards and to deepen; it then turned north-east, became associated with the polar air depression, and eventually became the main centre. The polar air depression rotated around the main centre and eventually became a trough. At 1 a.m. on Saturday, February 27th, the depression was centred over west Ireland, it moved east-north-east and at 6 p.m. on Saturday was centred over the North Sea just off the Yorkshire coast. During Saturday, winds



Synoptic Chart, 7h., February 28th, 1937.

Meteorological Magazine 68, 1933, pp. 29–34.

became northerly over most of the country and freshened considerably, increasing to gale force in exposed places. The cold northerly current brought with it snow or sleet to all districts except east and south-east England, the falls being heaviest in Scotland and extreme north England. During Sunday, February 28th, the depression moved south-south-west and then south-east, moving across to Belgium. As a result the wind freshened considerably, the gale being extremely severe in the Irish Sea, and snow spread to east and south-east England. The occluded fronts moved southwards with the depression and gave rise to very heavy falls of snow, particularly in north England and north Wales. This northerly current was essentially unstable and even after the passage of the occlusions instability showers of snow continued.

The great storm of 1881 was most severe in Wales, the Midlands and south England, while the storm of 1933 was very severe in south Wales and south Ireland and maintained a fair degree of severity in the Midlands and north England. The severity of the present blizzard was greatest in north England and north Wales and heavy drifts of snow were also reported from Scotland.

The snow commenced to fall in Scotland early on Saturday, February 27th, 1937, and aided by the strong wind huge drifts of snow rapidly gathered. Early on Saturday afternoon many roads were completely blocked by snowdrifts as deep as 13 ft. and cars and omnibuses were unable to proceed and had to be abandoned. Trains were delayed and the train from Stranraer, which was expected at midnight Saturday in Glasgow, did not arrive until 11 a.m. on Sunday morning. Not only was the traffic on both roads and rail impeded by snowdrifts but an added danger and impediment were obstacles such as trees and telephone poles which were blown down by the gale. The snow continued in Scotland throughout Sunday and some roads were still impassable on Monday, March 1st.

In north England and north Wales sleet or snow commenced to fall on Saturday and snow continued throughout Sunday. On Sunday falls of up to 2 ft. were reported, with drifts as deep as 12 ft. The equivalent rainfalls in the period 9 a.m. Saturday to 5 p.m. Sunday were Harrogate 1·01 in., Ilkley 0·93 in. and Rhyl 0·91 in. On Sunday the gale was extremely severe in north Wales and north England—a gust of 107 m.p.h. being recorded at 4 a.m. at Holyhead, a record for this station. Roads were blocked by snowdrifts and by trees and telephone poles; cars and omnibuses, having to be abandoned, were almost buried in the snow, while considerable difficulty was experienced in keeping the railway lines clear. Most parts of north Wales and many parts of north England were isolated by a general breakdown of the telephone service, while in addition electricity supplies failed in many places. As a result of this electricity failure the B.B.C. relay transmitter in north Wales was closed until Tuesday morning, March 2nd. By Monday the gale had abated and apart from a few scattered showers, no further snow fell. Many roads however were still impassable and villages continued to be isolated from neighbouring towns.

In the Midlands, south Wales and south-west England the blizzard was not quite so severe as it was in the north. Snowdrifts 3 to 4 ft. in depth gathered along many roads, while a large number of trees, some 60 to 80 ft. high, and telephone poles were blown down in many places.

East and south-east England appear to be the districts which suffered least from the storm though some roads in Surrey were closed with snowdrifts 4 ft. 6 in. in depth. As a result of the fall of snow in south-east England, the Thames, which was already at a high level, continued to rise and on Monday at Windsor it was 3 ft. 10 in. above normal, the highest level reached this winter.

Both along the east coasts of England and Scotland and in the Irish Sea shipping was imperilled during the week-end. Many ships in the Irish Sea were damaged by the severe buffeting which they received. Heavy seas were also reported along the east coasts of Scotland and England. At Arbroath in Scotland a schoolboy was swept into the sea, by a wave which burst over the harbour protection wall, and was drowned. According to the Yorkshire coastguards the gale was the worst experienced along the east coast of Yorkshire for the last 10 years. Gorleston lifeboat rescued three men from a vessel which went ashore on the Yarmouth beach, while because of reports of ships in danger, Redcar and Teesmouth lifeboat crews stood by for nearly 12 hours.

J. H. Brazell.

OFFICIAL PUBLICATION

The following publication has recently been issued:—

Monthly normals of percentage frequencies of surface and upper winds over Malta, Egypt, Palestine, Trans-Jordan and Iraq. Mainly between the years 1921 and 1932. (M.O. 405.)

The results of over 30,000 pilot balloon ascents are analysed according to wind direction and velocity; percentage frequencies are shown for the surface and for certain heights above mean sea level, namely, 1,500, 3,000, 6,000 and 10,000 feet. This publication marks a further step in the work of presenting in an accessible form the averages of meteorological elements for which observational data are steadily accumulating in the records of the Meteorological Office. It forms the first of a new series of publications which will deal with the factors of most importance for aviation: wind, cloud and visibility. The form adopted is that recommended by the International Commission for Air Navigation (Appendix G); further publications will deal with the other factors for these stations abroad and also for stations in the British Isles.

Royal Meteorological Society

The monthly meeting of the Society was held on Wednesday, February 17th, at 49, Cromwell Road, South Kensington. Dr. F. J. W. Whipple, F.Inst.P., President, was in the Chair.

Dr. C. E. P. Brooks gave a brief account of the meteorological circumstances of the recent floods in the United States of America.

The following papers were read and discussed :—

R. C. Sutcliffe, Ph.D.—The sea breeze at Felixstowe.

The pilot-balloon ascents for a period of ten years are analysed in order to study the sea breeze effect on upper winds from the surface to 5,500 ft. When sea breezes replace land-breezes during the course of the day, the vector change in speed normal to the coast is in the order of 15 m.p.h. in the layer up to 500 ft., and decreases with height to become negligible above about 2,500 ft. The sea breeze has an average depth of 1,500 ft., but there is no evidence of an increased outflow to form a returning current up to the highest level considered. There is also an added component parallel to the coast of about 5 m.p.h. with the land to the left. When the sea breeze is continuous owing to a general current off the sea there is very little increase in the speed, but the wind definitely backs during the course of the day.

E. G. Bilham, B.Sc., D.I.C., with the assistance of E. F. Relf, F.R.S.—The dynamics of large hailstones.

The form of the relation between terminal velocity and diameter is deduced from values of the drag coefficient obtained from observations on spheres towed by aeroplanes. Values of the terminal velocity are calculated for various mean specific gravities and it is concluded that an upper limit, about 1·5 lb., is set to the mass attainable by a spherical hailstone, by aerodynamical considerations.

W. P. Digby, M.I.Mech.E., M.I.E.E.—The photometric study of atmospheric pollution.

The author describes a photometric method of comparing the loss of reflecting value through tarnishing of polished metal plates and shows for different metals simultaneously exposed in the same place, the wide daily and seasonal effects of changes in the polluting media in the atmosphere. The different rates of tarnishing of the same metal plates exposed during the same week in rural, London and industrial areas are very marked. Extreme cases in Westminster for polished copper are losses of 38 per cent and 50 per cent in 5 hours in December fogs, whereas on four successive days in February, 1936, the loss in 5 hours varied between 5 per cent and 11 per cent. For a summer day in 1935 a 10 per cent loss in 24 hours seems normal. For short periods of, say, 1 to 2 days in the winter and a week in the summer, copper is a good indicator. For longer periods "fine" silver is better. Aluminium responds slowly, while the useful range of nickel appears to be between those of copper and of silver. In two appendices, the loss of reflection value is correlated with independent measurements of sulphur in the atmosphere. Further lines of research are indicated.

Correspondence

To the Editor, *Meteorological Magazine*

Brilliant Optical Phenomena

There has been for most of the morning a wonderful display of optical phenomena. The halo of 22° was only faintly visible but the two mock suns lying on it have been dazzlingly bright and the mock sun ring has been almost complete although in places rather faint. The halo of 46° has not been visible but the arc of contact (upper) to it has been very brilliant indeed, rivalling the brightest rainbow. The mock suns " occidens " and " oriens " have also been plainly visible at times shining with a greenish white light. Also the mock sun " sepentris " (anthelion) was faintly visible for a brief period at 11.55 a.m. The colouring of the mock suns on the 22° halo was at times very marked showing red, yellow, green and faint blue. The sky was 8 tenths covered with cirrostratus of medium density; wind WNW. force 3.

Another display of optical phenomena was observed on February 10th, between 2.20 and 2.40 p.m., consisting of the 22° halo, the 46° halo, both nearly complete, the mock suns on the 22° halo and the upper arc of contact to the 22° halo. The sky was 9 tenths covered with fairly dense cirrostratus. This set of haloes however was not as bright or as lasting as the set of February 11th.

J. M. Brierley.

Rodwell, South Petherton, Somerset, February 11th, 1937.

Weather Changes on the West African Air Route

The article in the November, 1936 issue of the *Meteorological Magazine*, p. 227, on the above subject was read by me with great interest. It so happened that I viewed the passage of a front across Kano on April 22nd, 1936. As your readers are no doubt aware, the west African mail route (Khartoum to Kano) was opened up at the beginning of February, 1936. Although February is a harmattan month in Northern Nigeria, the pilots were fortunate in that they experienced but little of the dust haze which is normally associated with the dry easterly winds from equatorial Africa. The weather during March and the first half of April was nearly ideal for flying, and it was not expected that any storms would occur until May or June, at the break of the hot season.

There were obvious cloud indications of the approach of a storm on the morning of April 22nd. " Strong tendency for thunderstorm Kano Area " was wirelessed and telegraphed to Maiduguri to reach the pilot before his departure on the last 300 mile lap of his trans-central African flight. In spite of this warning, the pilot decided to risk it and took off at 11h. 45m. G.M.T. from Maiduguri, a lonely outpost of the Empire, about 80 miles south-west of Lake Chad. Hardly had he done so when the sky at Kano became even more ominous. A vain endeavour was made to get in touch with the plane but the atmospherics were too intense and the pilot had doubtless wound in his aerial.

At 13h. 50m. a dust storm broke from the north-east and lasted for about 20 minutes during which period the visibility was less than 200 yards. The wind speed, however, could not have been more than 30 m.p.h. By the time the plane arrived at 14h. 45m. the storm had passed and the pilot made his landing on the aerodrome in comparatively fine weather. At 15h. 30m. a thunderstorm came up from the west against the surface easterly wind and lasted intermittently till 21h.

It will interest Mr. Durward to know that a similar set of meteorological phenomena was experienced at Kano during the preceding evening. A slight dust storm came up from the west at 17h. and at 19h. a thunderstorm broke from the north-east. The morning temperatures at Kano and Zinder (about 130 miles north of Kano) on the 21st, were 86° F. and 91° F. On the 22nd, at the same observation hours the temperatures were 81° F. and 82° F. The corresponding barometric pressures were :—

	21st	22nd
Kano	1007·1 mb.	1008·8 mb.
Zinder	1007·1 ,,	1009·0 ,,

Upper Wind Observations at Kano and Zinder on April 21st and 22nd, 1936

Height.	21st				22nd			
	Kano.		Zinder.		Kano.		Zinder.	
ft.	°	m.p.h.	°	m.p.h.	°	m.p.h.	°	m.p.h.
2,000	..	..	WSW.	37	..	..	W.	29
3,000	SW'W.	16	W.	36	WNW.	23	W'S.	26
5,000	WSW.	19	SW'S.	13	W.	22	..	..
7,000	..	..	S.	7	W'N.	23	..	..
10,000	..	..	SE.	8	W'S.	5	..	..

D. E. Smith.

Survey Dept., Lagos, Nigeria, January, 1937.

NOTES AND QUERIES

Rime on Wire Netting

The photograph, reproduced opposite page 35, of rime on wire netting (1½ in. mesh) was taken at Eskdalemuir Observatory on January 14th, 1937, at 10h. 50m. G.M.T. Mr. Pilsbury writes that the meteorological conditions prevailing there between 10h. and 11h. on that day were:—temperature, 23·2° F. at 10h. rising steadily to 24·3° F. at 11h.; humidity, 100 per cent throughout; pressure, 993·4 mb. (station level) steady; wind, calm; visibility, 220 yds., wet fog throughout.

It is interesting to note that there was no rime on the netting at 7h. when the temperature was 24·0° F., humidity 96 per cent, visibility 550 yds. and the wind calm. The rime began to melt soon after the photograph was taken.

The Persistent Rainfall of January and February, 1937

During the exceptional drought of the 25 months November, 1932 to November, 1934, the total rainfall over the British Isles was 12·4 in. less than the average. Although both 1935 and 1936 were wet, the deficiency was not made up until the persistent rains of January and February, 1937.

The general values for the two months January and February, 1937, are set out below:—

	England and Wales.		Scotland.		Ireland.		British Isles.
	In.	Percentage of average.	In.	Percentage of average.	In.	Percentage of average.	Percentage of average.
January ...	5·5	185	7·9	162	7·2	178	176
February ...	5·6	218	5·7	136	5·5	158	182

Over the British Isles as a whole, January 1937 was only slightly wetter than January 1936, with 154 per cent, but since 1870 there were but three wetter Januaries, viz., 1872, 1877 and 1928 with 181, 192 and 203 per cent respectively.

The totals for January reached twice the average over large areas, e.g. to the south-east of a line drawn roughly from Okehampton to Norwich, the Grampians and adjacent districts, the southern uplands of Scotland and the south of Ireland. At both Balmoral Castle and Braemar the totals of 11·80 in. and 13·41 in. respectively exceeded four times the average. At Braemar it was not only the wettest January but by far the wettest month since records began there in 1866.

The large totals were due mainly to the frequent cyclonic rains during the fourteen days, the 12th to 25th. Over the Thames Valley above Teddington the general rainfall for this period amounted to 3·5 in. out of a total for the month of 4·5 in.; at Princetown Prison it was 9·7 in. out of 14·3 in.; at Watendlath Farm, in the English Lake District, 12·3 in. out of 17·8 in.; on Snowdon 8·0 in. out of 17·6 in. (7·3 in. occurring for the 3rd to 5th); and at Balmoral Castle 9·4 in. out of 11·8 in.

February, 1937, ranks as the wettest February over the British Isles as a whole since 1870, apart from that of 1923, with 204 per cent, although February 1915 was about as wet as February 1937.

The totals for February exceeded the average in all parts of the British Isles, except the north-west of Scotland, and exceeded twice the average over most of southern and central districts of England. Many stations in these regions recorded the wettest February since before 1870, e.g. Camden Square (London), Slough (Bucks.), Oxford, Salisbury and Bidston Observatory.

Over the British Isles as a whole the total rainfall for the two months January to February, 1937, exceeded that for any similar period back to 1870.

The totals for January and February together were most remarkable in parts of Suffolk, Kent, Hampshire, Devon and Aberdeenshire where they exceeded 250 per cent of the average, as much as 306 per cent being recorded at Ovington Rectory, near Winchester. At Camden Square (London) the total was 7·80 in., or 221 per cent, and more than that recorded in any similar period since the record commenced there in 1858, the next largest amount being 7·62 in. in January and February, 1866. The duration of rainfall was 163 hours, the largest amount in the series back to 1881, although 161 hours occurred in January and February, 1919. At Tenterden, in Kent, the total of 10·35 in. exceeded that of any similar period back to 1863, the next largest amount being 8·88 in. in 1900. At Oxford the total of 8·07 in. was the largest since 1815, that of 1915 giving 6·53 in.

Over the Thames Valley above Teddington the general rainfall for January and February was 9·2 in., exceeding that of any similar period since before 1881, the next wettest period being that of 1915 with 8·5 in. This large amount was due mainly to the frequent rains, no one of which was especially remarkable, during the period January 12th to February 28th, when some rain fell on every day but three. The wettest periods were the five days January 20th to 24th with 1·8 in., the six days February 2nd to 7th with 1·8 in. and the seven days February 21st to 27th with 1·9 in.

An outstanding feature of the rainfall of individual Februaries is its variability. Of the four driest calendar months on record, viz., February 1932, March 1929, June 1925 and February 1891 (each with about half an inch), two are Februaries. On the other hand, the Februaries of 1915, 1923 and 1937 (each with about 6 inches) were wetter than any March, April, May, June or July on record. This wide range is due to the fact that in some years the marked frequency of orographical and cyclonic rains, which is typical of winter months and is brought about by an increased intensity in the wind drift from the Atlantic, continues well into February, whereas in other years quieter weather, with light winds, typical of the spring months, sets in earlier than usual.

J. Glasspoole.

Persistent South-east Gales in the North Sea

Throughout the period from January 11th to February 1st, the pressure distribution controlling the weather of western Europe was dominated by two outstanding features—the persistence of the continental high over western Russia (pressure at Leningrad was 1030 mb. or more during much of this period and in the neighbourhood of 1050 mb. on the 23rd, 24th and 25th) and the intensity of depressions on the North Atlantic. Consequently in north-west Europe there was a high frequency of winds from between south and east. An extremely cold current of continental air which spread across Germany and the eastern part of the North Sea, seemed to be an impregnable barrier to the eastward motion of Atlantic depressions and associated fronts. The effect of any deepening of low pressure systems in the Atlantic west of Ireland therefore resulted in a steepening of the pressure gradient between the deepening centre and Scandinavia. Wind reached gale force quickly in all exposed districts, especially in the North Sea between the mountainous plateaux of Norway and Scotland. During the 26th and 27th the continental high spread north-westwards towards Greenland, while a depression over Newfoundland moved at an unusually high speed (about 60 m.p.h.) east-south-east across the Atlantic to north-west Spain. Easterly winds and continental air invaded the whole of the British Isles, the region of gales being displaced along with the boundary zone of the cold air to the southern North Sea. By February 1st the north-west extension of the anticyclone had already disappeared, and during the 2nd and 3rd the anticyclone itself, attacked simultaneously by deepening Arctic, Atlantic, and Mediterranean disturbances, was displaced quickly south-eastwards. By the morning of the 4th, mild maritime polar air had extended across the whole of the British Isles and spread almost to Norway, associated with relatively light winds.

The anemograms for Kirkwall are of considerable interest during this period, more especially from January 23rd onwards. During the early hours of the 24th the wind increased to gale force from SSE., as a deepening depression moved eastwards towards western Ireland. With a further steady increase of wind during the day, an average velocity of 53 m.p.h. was reached between 16h. and 17h., and a gust of 82 m.p.h. at 17h. 10m. Thereafter the wind force decreased somewhat, but remained above or near gale force till the morning of February 1st, with occasional gusts exceeding 60 m.p.h. How constant in direction such a strong and pronounced stream of cold continental air can be is extremely well illustrated by the Kirkwall records of this period: the direction trace is almost continuously between S. and SE., and without exception between S. and E., from the afternoon of January 23rd to the morning of February 2nd.

The anemograms for Lerwick are of a similar nature. They, likewise, show a remarkable persistence of SE. winds, reflecting the persistence of the continental anticyclone and frequent gales heralding the approach of deepening low pressure systems on the Atlantic. Throughout January 25th, the wind maintained an average velocity of 50 m.p.h., with gusts frequently exceeding 70 m.p.h. The highest gust of 83 m.p.h. was recorded at 15h. on that day.

The observer at Deerness states that such a remarkable series of SE. gales with " tempestuous " seas has not been known in Orkney in living memory and that considerable coast erosion has been caused. During the latter half of January several S.O.S. messages were sent out from shipping disabled by the gales between Norway and Scotland, involving two adventurous rescues. On January 20th, the crew of the Norwegian steamer *Frym* was rescued in the North Sea by the liner *Venus :* a breeches-buoy was effective after both lifeboats had been destroyed by the waves. On the 25th, the *Jupiter* and the *Venus* were standing by the *Veni* off the Norwegian coast, while unsuccessful attempts to rescue the crew were made by other ships. The *Venus* was compelled to leave for Bergen owing to shortage of oil, but later in the day the *Jupiter* was able to take the *Veni* in tow.

It need hardly be stressed that the extreme cold and frequent snow squalls associated with the persistent air mass added greatly to the rigours of existence in these gale-swept regions. In the Shetlands, influenza was rampant, many homes were repeatedly swept by seas, medical stores were depleted, and no mails left the island for a week.

F. E. LUMB.

Meteorological averages for periods with incomplete records

In computing averages of meteorological factors a familiar problem is to determine the best way of dealing with missing observations. This note concerns only a trivial point but the result is interesting.

Certain averages for the period 1927–36 were being prepared, but in some cases the station had closed down during the last few years. It was suggested that for these stations the ten-year period should be made up by including years prior to 1927. The following analysis shows, however, that it is better to give the means for the partial periods, that the introduction of other years is likely to make the average worse rather than better unless more than half the years are missing.

Let the required mean over the full period of N years be M, but suppose that m years only are available and n missing, so that $m + n = N$. Let the known mean for the m years be M_m and the unknown mean for the n years be M_n. From the definition of a mean value

$$NM = m\,M_m + n\,M'_n$$

In order to make up the full number of N years we introduce n years from outside the period, so obtaining a mean M'. If the mean over these n years is M'_n then

$$NM' = mM_m + nM'_n$$

The problem is to decide which of the two means M_m or M' is likely to be the closer approximation to the unknown M.

In general, $M-M_m$ and $M-M'$ are as likely to be positive as negative and $M-M_m$ is probably greater (or less) than $M-M'$ according as the standard deviation of $M-M_m$ is greater (or less) than that of $M-M'$.

The standard deviation of the sum or difference of two independent quantities is the square root of the sum of the squares of their individual standard deviations. The expressions $M-M'$ and $M-M_m$ are not sums of independent quantities but by using the two equations above, the inequality is easily transformed to standard deviation of (M_n-M_m) greater than or less than the standard deviation of $(M_n-M'_n)$ where the means are independent.

The required conditions are therefore

s.d. M_m + s.d. M_n greater than or less than s.d. M'_n + s.d. M_n

i.e., s.d. M_m greater or less than s.d. M'_n

or m less than or greater than n

or $m + n$ equal to N but less than or greater than $2n$

since the standard deviation of the mean of a number of observations decreases as the number increases.

As N is the total number of observations and n the number of missing observations this proves the proposition stated above.

R. C. SUTCLIFFE.

Meteorology in the Royal Astronomical Society of Canada

The Journal of the Royal Astronomical Society of Canada contains frequent papers on Canadian meteorology. In the issue for July to August, 1936, Andrew Thomson discusses " Sunspots and weather forecasting in Canada," and D. A. MacLulich " Sunspots and the abundance of animals," while in the issue for September, W. E. Knowles Middleton and F. Graham Millar write on " Temperature profiles in Toronto."

The upshot of Thomson's paper is that there are no definite relations between sunspot numbers and the weather in Canada, and since also it is not possible to forecast sunspot numbers, long-range weather forecasting by this means is not practicable. This conclusion is doubtless correct, but the analysis is not very critical and only annual means are used. The break-down of the correlation between sunspots and the levels of the central African lakes was not due to the deepening of the Shire River, as stated on the first page, as this river has no connexion with lakes Victoria and Albert.

MacLulich gives a critical examination of the returns of furs of lynx and hare in Canada, and shows convincingly that the cycle in the abundance of these animals has no definite relation to the sunspot cycle, as has often been postulated, and therefore cannot be taken as evidence of a relation between sunspots and climate. The fur cycle is very similar to the sunspot cycle in appearance, but its length is only about ten years instead of eleven.

The paper by Middleton and Millar is an extremely interesting study of the microclimatology of a large city. Toronto is on the north shore of Lake Ontario, and the ground rises fairly steadily northward by about 300 ft. in five miles, except for two shallow valleys. Further north, outside the limits of the city, is a large deep valley. Temperature readings were taken at various times and seasons by means of a nickel resistance thermometer shielded from radiation and mounted 2 ft. in front of a motor car and about 27 in. from the ground. The profile on a bright summer day clearly shows the influence of the lake, but most striking are those of clear calm nights, when every little irregularity in the ground is shown up clearly by the thermograph record. A run at midnight showed an "almost unbelievable" inversion of more than 27° F. between the floor of the large valley and the hillside 100 ft. above, and even a slight dip of about 20 ft. caused a drop of more than 10° F. in the temperature. The effect of buildings and open spaces also appears on the record, and the effect on humidity, shown by readings of a sling psychrometer, also appears to be of interest. Unlike the first two, this paper has no obvious connexion with astronomy, but the Royal Astronomical Society of Canada is to be congratulated on its publication.

REVIEW

Manual of Meteorology, Vol. II. New and Revised Edition. By Sir Napier Shaw, LL.D., Sc.D., F.R.S., with the assistance of Elaine Austin, M.A. 8vo, $10\frac{1}{2}$ in. × $7\frac{1}{2}$ in. pp. XLVIII + 472. *Illus.* Cambridge University Press, 1936. 36*s*. net.

It is a sincere compliment to the value of the "Manual of Meteorology," and a testimony to the confident esteem in which Sir Napier Shaw is held by his fellow workers, that a book of this size, on a subject which can hardly be expected to appeal to a very wide circle, should appear in a second edition within 8 years. It is also a notable proof of the author's energy and enthusiasm that he has revised Volume II so soon after the last volume of his Manual was completed.

The preface points out that a complete revision of the presentation of meteorological data from the point of view of 1935 instead of 1927 is not possible. But there are very copious references to the most recent literature, especially at the end of the book, in Chap. X, which includes a table giving details of the most recent maps of meteorological elements, and a very long and apparently exhaustive bibliography of publications of data of the Upper Air.

We do not notice much alteration in the treatment of the origin and history of the pressure irregularities of the Westerlies. The author still maintains his belief in the importance of the Greenland ice cap in this connexion—" with cold air descending on either side of a ridge some 1,200 miles long and capable of attaining anywhere very high velocities, one cannot lightly set aside its influence for the behaviour of the surface air of the northern hemisphere" (p. 419). This remark is made with reference to the somewhat different conclusions that have been drawn by the British Arctic Air Route Expedition, 1930–1.

There is a superficial but by no means negligible improvement in this new edition in the printing of the numerous full-page charts of isotherms, isobars, etc., by hemispheres (though there is no change in the course of the isopleths). In the previous edition the lines were printed in colour, which at first sight seemed a welcome innovation after the usual black. But in practice some of the colours proved difficult to read, especially in a poor light, so that the new luxury was a disappointment. In the present edition all the isopleths are in black, and the body of the maps is in colour. This gives easy legibility while improving the pleasant colour effect and leads us to hope that publishers may extend the use of colours for maps and diagrams in such books as this.

W. G. KENDREW.

BOOKS RECEIVED

The Climate of Palestine during the year 5694 (1933–34) and Table of Rainfall in the upper Euphrates, Syria, Lebanon, Palestine, the Sinai Peninsula and lower Egypt during the winter 5694 (1933–34). By Dr. D. Ashbel of the Hebrew University, Jerusalem, Tel-Aviv, 1936.

The temperature at Jerusalem, Oct. 1930–*Oct.* 1935. By Dr. D. Ashbel (reprint from the Bulletin of the Jewish Palestine Exploration Society). Jerusalem, 1935.

The Cyclone Season 1931–1932 *and the Cyclone Season* 1932–33 *at Mauritius.* By N. R. McCurdy, B.Sc., Royal Alfred Observatory, Misc. Publ. Nos. 14 and 15, Port Louis, 1933 and 1934.

OBITUARY

Oliver Lanard Fassig, Ph.D.—We regret to learn of the death of Dr. O. L. Fassig on December 6th, 1936, at Washington, D.C., owing to a motor accident. Dr. Fassig was born at Columbus, Ohio, on April 5th, 1860, and graduated at Ohio State University in 1882. After taking special courses at Yale and Berlin Universities he was awarded the Ph.D. degree by the John Hopkins University in 1899. In 1883 he entered the Signal Corps at Washington, D.C., and from June, 1888, to February, 1896, he was bibliographer and librarian at the Central Office during which time he compiled the notable "Bibliography of Meteorology" published by the Signal Service. From 1900–19, with the exception of three years (1909–12) at Puerto Rico and two years (1905–7) as Director of upper air research at Mt. Weather, he was in charge of the station at Baltimore. While there he wrote an exhaustive report on the climate and weather of Baltimore and devised a recorder for the time of beginning of rainfall. In 1919 Dr. Fassig returned to Puerto Rico and organised successfully the West Indies and Caribbean climate and forecasting service of the United States Weather Bureau, including the hurricane warning service. He wrote many valuable papers on hurricanes and also nearly completed a comprehensive study of the climate of Puerto Rico, which is to be published shortly. In 1930 he was appointed chief of the climatological division of the Weather Bureau and had introduced new efficiencies and enlarged the usefulness of the climatic data before his retirement in 1932. From then until his death he was research associate at the Blue Hill Observatory, Harvard.

ERRATA

FEBRUARY, 1937, p. 17, 10th line from bottom, *for* "in 1883" *read* "in 1884."

FEBRUARY, 1937, p. 20, 2nd line, *for* "Canon William Frederick Archibald Ellison" *read* "Canon William Frederick Archdall Ellison."

The Weather of February, 1937

The broadcast climatological data for February cover, for the first time, the whole northern hemisphere north of 50°. Pressure was lowest over the North Atlantic, an area below 995 mb. extending westwards from the Shetland Isles, while a secondary centre of low pressure, about 1001 mb., lay to the north-west of Nova Zemlya, and another centre, about 1004 mb., over the Aleutian Islands. Pressure was highest (1031 mb.) near Semipalatinsk in south-western Siberia; other anticyclonic centres were south of Lisbon (1022 mb.), eastern Greenland (1015 mb.) and northern Canada (1018 mb.). Winds were mainly westerly over the British Isles and France, south-westerly or southerly over eastern Europe and westerly over northern Asia. Pressure was above normal over Labrador, most of Greenland, Morocco and south-western Siberia, and below normal over most of Europe, the North Atlantic, Arctic and Canada, the deficit exceeding 15 mb. in the north of Germany.

The coldest area was in northern Canada, where the mean temperature was just below −40° F., about 30° below normal, while at Verkhoïansk in Siberia the mean was −33° F., which is 15° above normal. The isotherm of 0° F. passed north of Spitsbergen but included the greater part of Siberia and Canada. In Europe temperatures increased westwards from about 10° F. in the east of Russia to 20° F. at Moscow and Leningrad, 25° F. over most of Norway, 36° F. at Berlin and Vienna, 45–50° F. in France and 54° F. at Lisbon. In the British Isles the mean was about 38° F. in Scotland, 41–47° F. in England and 42–45° F. in Ireland. In North America the isotherm of 32° F. extended south of 40° N. west of the Great Lakes, temperature rising southwards to 54° at San Diego and 56° at New Orleans. The greater part of Europe was a few degrees above normal, but Scandinavia and northern Scotland were below normal.

Precipitation was generally heavy in the west of Europe, exceeding 4 in. over most of the British Isles, western and northern France, Belgium and Holland, but decreased steadily eastwards to about 2 in. in Russia and was negligible over most of Siberia. Precipitation was generally above normal in Europe, except northern Norway and the east of Russia.

The weather of the British Isles during February was unsettled, with frequent gales and rainfall much in excess of the normal in most parts of the country.* Temperature was above normal in the south but below normal in the north, while sunshine was generally deficient in the south but in excess in the north. From the 1st–5th a complex area of low pressure lay to the west and north of the British Isles while secondaries passed across the country giving generally mild unsettled rainy weather with longer bright periods in the north and heavy rain in the south, 3·25 in. on the 2nd and 1·71 in. on the 4th at Holne, Devon, 2·04 in. at Ystalyfera, Glamorgan on the 2nd, and in the south-east, 1·31 in. at Compton, Sussex, on the 4th. Gales occurred in the north on the 1st, in the south-west on the 3rd and in the north-west on the 4th–5th, while slight fog or mist was experienced locally. The 6th, and in Scotland, the 7th also, were dry sunny days as a ridge of high pressure passed across the country, 8·3 hrs. bright sunshine were recorded at Clacton on the 6th and 7·6 hrs. at Tiree on the 7th. On the 7th–9th a complex depression passed across the country giving dull rainy weather generally with gales in the south-west at times and snow in Scotland, east Ireland, north England and the Midlands. Flooding occurred in the Thames Valley, eastern counties and Kent. In the rear of the depression the 9th, 10th and 11th were sunny days with cold W–NW. winds becoming NW–N., and showers of rain, hail, sleet or snow. Sharp frost was experienced on the night of the 11th–12th when 15° F. was recorded at Penrith and Ross-on-Wye, and thunderstorms occurred locally on the 9th and 10th in the north and Midlands. An unusually brilliant display of the aurora borealis was observed from Waringstown, Co. Down on the 9th. From the 12th–19th pressure was again low to the north-west with mainly SW. winds becoming NW. for a brief spell on the 17th.

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* *See* p. 42.

Temperature was rather low at first but rose above normal from the 14th onwards, 57° F. was the maximum at Sealand on the 14th and at Greenwich on the 15th. Mist or fog occurred generally in England, south Scotland and east Ireland on the 14th and 15th and thunderstorms in north-west Ireland on the 15th and in east England, the Midlands and west Ireland on the 16th, while gales were experienced in the north-west and west on the 13th–17th. Rain fell on most days with some sleet or snow in the north and west. From the 20th–23rd cold, moderate to strong NW. winds prevailed with wintry precipitation at times—especially in the south on the 21st—but considerable sunshine each day; Ilkley and Catterick had 9·2 hrs. on the 23rd. On the 24th there was a change to milder weather and SE. winds in the south as a complex depression remained centred off south-west Ireland from the 24th–26th but conditions continued cold in the north. Temperature in the south rose above 50° F. generally on the 25th and 26th and rain occurred in most parts especially the south-west—snow in the north. Gales were again experienced at exposed places and floods were reported on the 26th from many parts of the south and Midlands. Thunderstorms occurred locally in south England, the Midlands and south-west Ireland on the 25th–27th. On the 27th and 28th this depression passed across the country and heavy snow occurred generally over the whole country on the evening of the 27th and on the 28th even as far south as Guernsey. Accompanied by strong northerly gales the drifts exceeded several feet in depth in places.† The distribution of bright sunshine for the month was as follows :—

	Total (hrs.)	Diff. from normal (hrs.)		Total (hrs.)	Diff. from normal (hrs.)
Stornoway ...	71	+16	Chester ...	63	+1
Aberdeen ...	101	+31	Ross-on-Wye ...	58	−11
Dublin	85	+10	Falmouth ...	63	−17
Birr Castle ...	69	+3	Gorleston ...	78	+3
Valentia... ...	50	−16	Kew	63	−2

Kew, Temperature, Mean 43·9° F., Diff. from normal + 2·8° F.

Miscellaneous notes on weather abroad culled from various sources.

Severe storms were experienced in the North Sea on the 1st and ice conditions off the north-east coast of Denmark were severer than usual at the beginning of the month. For about the first ten days, the weather was generally mild with intermittent snow in Switzerland ; a landslip cut the main road and railway near Oberried on Lake Brienz about the 7th ; about the 12th, snow fell again generally and conditions were good for skiing the following week, although temperatures were rather high. In France, continued heavy rain early in the month resulted in floods between Dunkirk and Hazebrouck, along the Lys Valley and in eastern Brittany on the 8th and 9th ; the Seine also had risen and many of the lower

† *See* p. 36.

Paris quays were under water. Owing to strong northerly winds 65 fishermen and 9 horses from Finland were stranded on ice-floes in the Baltic about the 8th, and with difficulty brought to land. Dense fog was reported from Tarifa (Spain) on the 13th and Boulogne on the 14th. Six skiers were killed on the 14th by an avalanche which fell from a slope in the Monte Rosa owing to the comparatively mild weather. After heavy snow and a sudden rise of temperature an immense avalanche occurred about the 17th near St. Jean de Maurienne carrying uprooted trees with it and wrecking a power station. Persistent rain during the previous few days caused floods in several places near Brussels about the 23rd through the overflowing of two rivers. Rain and snowfalls between the 21st and 23rd caused several landslips and some unusually large avalanches in the Alps. Navigation was opened at Sulina (Roumania) on the 25th. Bitterly cold weather with heavy falls of snow occurred generally in Switzerland and France on the 27th and 28th and snow fell along the south coast of the Bay of Biscay, an unusual occurrence at this time of year; in western France north-westerly gales were experienced. (*The Times, February 3rd*–March 2nd.)

Unusually severe floods in the eastern Transvaal and Mozambique which have damaged railways and roads were reported on the 13th—100 natives and 2,000 cattle were stated to have been drowned in Mozambique. By the 18th railway communications between Johannesberg and Lourenço Marques had been re-established but the flood position was still serious. (*The Times*, February 15th–19th.)

Heavy rain—unusual at this season—fell in Bombay on the 11th. (*The Times*, February 12th).

Extensive rains occurred on the 14th–16th in the pastoral and agricultural areas of South Australia and floods in the far north caused washaways. The total rainfall for the month in Australia was generally below normal except in South Australia, and parts of Tasmania and of Queensland. (*The Times*, February 18th and Cable).

Five people died as the result of a severe snowstorm in Washington State about the 2nd and an ice blockade which is unusual in February extended in all directions seawards from St. John's Newfoundland on the 5th. Floods occurred in southern California on the 7th as the result of torrential rains and melting snow—3 people were drowned. A thunderstorm was experienced in the Ottawa Valley on the 8th. The first duststorm of the year blew over parts of Texas, Oklahama and Kansas on the 7th and another severe duststorm occurred throughout Kansas, Colorado, Oklahama and Texas on about the 15th–19th. During the month the flood-water which did so much damage to the Ohio Valley in January passed down the 800 miles of the Mississippi from Cairo (Illinois) to the Gulf of Mexico without causing any serious breaches in the defences. Sudden floods in Illinois and Wisconsin on the 21st due to extremely heavy rains caused the deaths of 5 people; by the 22nd the water was receding fast. Considerable damage was done in New York by gales on the night of the 21st. Owing to heavy rain and the rapid melting of the snow, floods throughout Ontario on the 22nd did much damage. In the United States temperature was above normal in the Lake Region, mainly above normal in the eastern and middle States but below normal along the Pacific coasts, while precipitation was variable in distribution. (*The Times*, February 2nd–26th and *Washington, D.C., U.S. Dept. Agric., Weekly Weather and Crop Bulletin*).

Daily Readings at Kew Observatory, February, 1937

Date	Pressure, M.S.L. 13h.	Wind, Dir., Force 13h.	Temp. Min.	Temp. Max.	Rel. Hum. 13h.	Rain.	Sun.	REMARKS. (see vol. 69, 1934, p. 1).
	mb.		°F.	°F.	%	in.	hrs.	
1	997·0	SW.5	45	51	71	0·02	5·8	r–r_0 5h.–6h.
2	1007·3	SSW.4	40	51	81	0·07	0·3	d_0–r 17h.–21h.
3	1004·1	SW.5	49	54	74	0·08	0·0	r–r_0 4h.–11h.
4	999·8	SSW.5	49	53	76	0·30	1·1	r 1h–9h., 20h.–24h.
5	987·5	NNW.4	47	49	88	0·36	0·0	r–r_0 0h.–13h.
6	1010·9	W.4	37	48	58	—	6·9	x early.
7	996·6	E.3	36	42	94	0·61	0·0	r–r_0 9h.–23h.
8	984·6	SW.4	41	52	81	0·04	1·4	r_0 6h.–7h., 18h.–21h.
9	1003·7	W.4	37	45	55	0·06	5·8	p R hq 10h.
10	1006·2	WNW.4	36	46	54	—	6·5	
11	1007·1	NW.4	37	44	60	—	3·6	r_0s_0 14h.
12	1013·3	WSW.2	31	43	69	0·20	2·8	x f early, r 19h.–24h.
13	1009·3	NW.2	36	45	86	0·09	0·0	r_0 0h.–10h.
14	1017·7	SSW.3	41	53	92	0·06	0·0	r_0 0h.–7h., 21h.–22h.
15	1020·1	SW.3	49	55	83	0·03	1·0	r_0 0h.–3h., 23h.–24h.
16	1005·4	W.6	49	51	90	0·24	2·9	r 0h.–3h., rkq 13h.
17	1003·6	WNW.4	36	49	62	—	1·9	r_0 4h., 13h.
18	1015·5	SSW.3	34	49	94	0·03	0·0	r_0–d_0 10h.–15h.
19	1001·4	SSW.3	46	54	92	0·09	0·0	r_0–r 9h.–14h.
20	1009·7	W.4	40	48	56	—	5·5	pr_0 13h.
21	1010·5	WSW.4	39	47	59	0·02	5·0	pr_0 3h., r_0 18h.–24h.
22	994·3	NW.3	42	44	67	0·68	2·3	r 0h.–10h., pr 13h.
23	1006·3	WNW.4	32	45	56	—	7·2	x early and late.
24	999·9	SE.4	34	44	78	0·40	0·0	r 7h.–9h., 15h.–24h.
25	996·2	SSE.3	41	52	90	0·30	0·2	r 0h.–9h., 14h.–17h.
26	991·4	S.5	39	50	94	0·20	0·2	r_0 9h.–16h., pRh 17h.
27	981·0	S.W5	41	48	81	0·10	2·1	pr during day.
28	977·1	NNW.4	32	36	88	0·08	0·0	s–s_0 9h.–11h., 15h.
*	1002·1	—	40	48	76	4·05	2·2	* Means or Totals.

General Rainfall for February, 1937

England and Wales ...	218	per cent of the average 1881–1915.
Scotland	136	
Ireland	158	
British Isles	182	

Rainfall : February, 1937 : England and Wales

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av.
Lond	Camden Square	4·33	260	*War*	Birminghm, Edgbaston	3·89	230
Sur	Reigate, Wray Pk. Rd.	4·79	219	*Leics*	Thornton Reservoir	3·49	209
Kent	Tenterden, Ashenden	4·79	243	„	Belvoir Castle	2·85	171
„	Folkestone, Boro. San.	5·10	...	*Rut*	Ridlington	3·39	207
„	Margate, Cliftonville	3·68	266	*Lincs*	Boston, Skirbeck	2·60	178
„	Eden'bdg., Falconhurst	5·55	251	„	Cranwell Aerodrome	2·59	173
Sus	Compton, Compton Ho.	6·43	244	„	Skegness, Marine Gdns.	2·28	149
„	Patching Farm	5·47	248	„	Louth, Westgate	2·28	119
„	Eastbourne, Wil. Sq.	5·73	258	„	Brigg, Wrawby St.	1·83	...
Hants	Ventnor, Roy.Nat.Hos.	5·37	255	*Notts*	Worksop, Hodsock	2·50	162
„	Fordingbridge, Oaklnds	6·13	246	*Derby*	Derby, L. M. & S. Rly.	3·80	235
„	Ovington Rectory	6·84	263	„	Buxton, Terr. Slopes	8·93	238
„	Sherborne St. John	5·24	239	*Ches*	Bidston Obsy	4·46	266
Herts	Royston, Therfield Rec.	3·05	198	*Lancs*	Manchester, Whit. Pk.	4·72	246
Bucks	Slough, Upton	4·64	273	„	Stonyhurst College	6·16	184
„	H. Wycombe, Flackwell	4·48	232	„	Southport, Bedford Pk.	4·55	217
Oxf	Oxford, Radcliffe	4·73	289	„	Ulverston, Poaka Beck	6·79	184
N'hant	Wellingboro, Swanspool	3·18	198	„	Lancaster, Greg Obsy.	5·73	199
„	Oundle	2·49	...	„	Blackpool	5·02	224
Beds	Woburn, Exptl. Farm	4·16	281	*Yorks*	Wath-upon-Dearne	3·39	207
Cam	Cambridge, Bot. Gdns.	2·60	203	„	Wakefield, Clarence Pk.	4·32	252
„	March	2·30	178	„	Oughtershaw Hall	8·20	...
Essex	Chelmsford, County Gdns	3·83	259	„	Wetherby, Ribston H.	4·53	262
„	Lexden Hill House	3·59	...	„	Hull, Pearson Park	2·49	150
Suff	Haughley House	2·80	...	„	Holme-on-Spalding	3·34	199
„	Rendlesham Hall	3·78	270	„	West Witton, Ivy Ho.	6·13	214
„	Lowestoft Sec. School	2·67	190	„	Felixkirk, Mt. St. John.	3·92	232
„	Bury St. Ed., WestleyH.	3·17	212	„	York, Museum Gdns.	2·98	197
Norf.	Wells, Holkham Hall	2·26	153	„	Pickering, Hungate	4·01	231
Wilts	Porton, W.D. Exp'l. Stn	4·80	242	„	Scarborough	3·25	194
„	Bishops Cannings	6·33	298	„	Middlesbrough	2·26	174
Dor	Weymouth, Westham.	5·59	258	„	Baldersdale, Hury Res.	4·82	160
„	Beaminster, East St.	6·87	227	*Durh*	Ushaw College	3·47	218
„	Shaftesbury, Abbey Ho.	4·18	182	*Nor*	Newcastle, Leazes Pk.	3·68	240
Devon	Plymouth, The Hoe	7·26	245	„	Bellingham, Highgreen	4·33	171
„	Holne, Church Pk. Cott.	14·98	272	„	Lilburn Tower Gdns.	3·58	180
„	Teignmouth, Den Gdns.	5·88	221	*Cumb*	Carlisle, Scaleby Hall	3·85	173
„	Cullompton	6·69	240	„	Borrowdale, Seathwaite	19·00	170
„	Sidmouth, U.D.C.	5·73	...	„	Thirlmere, Dale Head H.	11·04	145
„	Barnstaple, N. Dev.Ath	6·44	237	„	Keswick, High Hill	6·49	131
„	Dartm'r, Cranmere Pool	17·20	...	*West*	Appleby, Castle Bank	4·03	136
„	Okehampton, Uplands.	9·76	224	*Mon*	Abergavenny, Larchf'd	6·43	202
Corn	Redruth, Trewirgie	7·67	203	*Glam*	Ystalyfera, Wern Ho.	10·76	210
„	Penzance, Morrab Gdns.	7·39	221	„	Treherbert, Tynywaun.	14·76	...
„	St. Austell, Trevarna	9·25	241	„	Cardiff, Penylan	6·39	217
Soms	Chewton Mendip	7·60	226	*Carm*	Carmarthen, Model&P.S.	7·40	193
„	Long Ashton	5·16	220	*Pemb*	St. Ann's Hd, C. Gd. Stn.	4·50	169
„	Street, Millfield	4·73	...	*Card*	Aberystwyth	6·14	...
Glos	Blockley	4·59	...	*Rad*	BirmW.W.Tyrmynydd	10·10	192
„	Cirencester, Gwynfa	5·01	222	*Mont*	Lake Vyrnwy	10·53	232
Here	Ross-on-Wye	3·51	174	*Flint*	Sealand Aerodrome	4·89	...
Salop	Church Stretton	5·56	253	*Mer*	Blaenau Festiniog	13·93	187
„	Shifnal, Hatton Grange	4·44	274	„	Dolgelley, Bontddu	8·83	199
Staffs	Market Drayt'n, Old Sp.	4·57	264	*Carn*	Llandudno	4·22	216
Worc	Malvern, Free Library	4·52	251	„	Snowdon, L. Llydaw 9.	19·28	...
„	Ombersley, Holt Lock.	3·95	241	*Ang*	Holyhead, Salt Island	4·57	187
War	Alcester, Ragley Hall	3·57	216	„	Lligwy	6·71	...

Rainfall: February, 1937: Scotland and Ireland

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av.
I. Man	Douglas, Boro' Cem.	7·61	239	*R&C*	Achnashellach	8·07	111
Guern.	St. PeterP't.Grange Rd	6·47	263	,,	Stornoway, C.GuardStn.	4·16	...
Wig	Pt. William, Monreith.	6·04	196	*Suth*	Lairg	5·35	173
,,	New Luce School	7·85	205	,,	Tongue	4·70	135
Kirk	Dalry, Glendarroch	6·63	131	,,	Melvich	4·35	145
Dumf.	Dumfries, Crichton R.I.	4·45	144	,,	Loch More, Achfary	7·34	111
,,	Eskdalemuir Obs	6·48	131	*Caith*	Wick	3·47	153
Roxb	Hawick, Wolfelee	4·90	150	*Ork*	Deerness	4·78	159
Peeb	Stobo Castle	4·69	170	*Shet*	Lerwick	3·21	102
Berw	Marchmont House	3·73	179	*Cork*	Dunmanway Rectory	7·40	126
E.Lot	North Berwick Res	2·61	167	,,	Cork, University Coll.	4·30	115
Midl	Edinburgh, Blackfd. H.	3·02	182	,,	Mallow, Longueville	4·99	147
Lan	Auchtyfardle	4·09	...	*Kerry*	Valentia Obsy	7·19	138
Ayr	Kilmarnock, Kay Pk	4·76	...	,,	Gearhameen	12·50	140
,,	Girvan, Pinmore	6·10	143	,,	Bally McElligott Rec.	5·84	...
,,	Glen Afton, Ayr San.	7·03	160	,,	Darrynane Abbey	6·75	148
Renf	Glasgow, Queen's Pk	4·57	155	*Wat*	Waterford, Gortmore	4·96	154
,,	Greenock, Prospect H.	5·86	104	*Tip*	Nenagh, Cas. Lough	5·33	171
Bute	Rothesay, Ardencraig	5·56	139	,,	Roscrea, Timoney Park	4·79	...
,,	Dougarie Lodge	6·04	160	,,	Cashel, Ballinamona	4·69	148
Arg	Lock Sunart, G'dale	4·74	79	*Lim*	Foynes, Coolnanes	5·16	162
,,	Ardgour House	8·42	...	*Clare*	Inagh, Mount Callan	9·87	...
,,	Glen Etive	...	...	*Wexf*	Gorey, Courtown Ho.	5·17	184
,,	Oban	4·47	...	*Wick*	Rathnew, Clonmannon.	5·11	...
,,	Poltalloch	5·70	132	*Carl*	Bagnalstown, Fanagh H.	3·76	148
,,	Inveraray Castle	8·60	127	,,	Hacketstown Rectory	4·64	155
,,	Islay, Eallabus	5·63	134	*Leix*	Blandsfort House	5·04	188
,,	Mull, Benmore	...	...	*Offaly*	Birr Castle	4·15	181
,,	Tiree	2·94	85	*Kild*	Straffan House	4·22	194
Kinr	Loch Leven Sluice	3·95	140	*Dublin*	Dublin, Phoenix Park	3·27	183
Fife	Leuchars Aerodrome	2·89	165	*Meath*	Kells, Headfort	5·16	190
Perth	Loch Dhu	8·50	114	*W.M*	Moate, Coolatore	4·31	...
,,	Crieff, Strathearn Hyd.	3·52	100	,,	Mullingar, Belvedere	4·76	171
,,	Blair Castle Gardens	3·05	109	*Long*	Castle Forbes Gdns	5·15	181
Angus	Kettins School	3·35	143	*Gal*	Galway, Grammar Sch.	4·46	147
,,	Pearsie House	3·40	...	,,	Ballynahinch Castle	8·28	162
,,	Montrose, Sunnyside	2·57	140	,,	Ahascragh, Clonbrock.	4·49	145
Aber	Balmoral Castle Gdns.	3·01	116	*Rosc*	Strokestown, C'node	4·26	161
,,	Logie Coldstone Sch	2·31	111	*Mayo*	Blacksod Point	4·61	114
,,	Aberdeen, Observatory.	2·32	113	,,	Mallaranny	7·64	...
,,	New Deer School House	3·67	172	,,	Westport House	4·76	121
Moray	Gordon Castle	3·28	171	,,	Delphi Lodge	10·31	122
,,	Grantown-on-Spey	...	...	*Sligo*	Markree Castle	5·47	159
Nairn	Nairn	1·83	102	*Cavan*	Crossdoney, Kevit Cas.	4·88	...
Inv's	Ben Alder Lodge	4·14	...	*Ferm*	Newtwnbtlr, Crom Cas.	4·13	141
,,	Kingussie, The Birches.	2·84	...	*Arm*	Armagh Obsy	3·44	155
,,	Loch Ness, Foyers	...	...	*Down*	Fofanny Reservoir	9·33	...
,,	Inverness, Culduthel R.	2·34	104	,,	Seaforde	6·04	198
,,	Loch Quoich, Loan	7·29	...	,,	Donaghadee, C. G. Stn.	4·59	199
,,	Glenquoich	9·49	92	*Antr*	Belfast, Cavehill Rd	...	...
,,	Arisaig House	4·01	81	,,	Aldergrove Aerodrome.	4·15	172
,,	Glenleven, Corrour	...	...	,,	Ballymena, Harryville.	5·72	176
,,	Fort William, Glasdrum	...	...	*Lon*	Garvagh, Moneydig	4·72	...
,,	Skye, Dunvegan	4·35	...	,,	Londonderry, Creggan.	4·59	144
,,	Barra, Skallary	4·62	...	*Tyr*	Omagh, Edenfel	4·46	150
R&C	Alness, Ardross Castle.	3·57	108	*Don*	Malin Head	3·85	...
,,	Ullapool	4·23	99	,,	Killybegs, Rockmount.	3·24	...

Climatological Table for the British Empire, September, 1936

STATIONS.	PRESSURE. Mean of Day M.S.L. mb.	PRESSURE. Diff. from Normal. mb.	TEMPERATURE. Absolute. Max. °F.	TEMPERATURE. Absolute. Min. °F.	TEMPERATURE. Mean Values. Max. °F.	TEMPERATURE. Mean Values. Min. °F.	TEMPERATURE. Mean Values. ½ Max. and Min. °F.	TEMPERATURE. Mean Values. Diff. from Normal °F.	TEMPERATURE. Mean. Wet Bulb. °F.	Relative Humidity. %	Mean Cloud Am'nt 0–10	PRECIPITATION. Am'nt. in.	PRECIPITATION. Diff. from Normal. in.	PRECIPITATION. Days.	BRIGHT SUNSHINE. Hours per day.	BRIGHT SUNSHINE. Percentage of possible.
London, Kew Obsy....	1016·5	− 0·9	74	42	65·7	53·6	59·7	+ 2·4	54·9	90	8·3	2·81	+ 0·94	16	3·0	24
Gibraltar	1017·4	+ 0·2	85	60	77·7	67·5	72·6	...	66·0	83	5·2	0·11	...	2	...	...
Malta	1018·1	+ 1·8	88	65	80·2	70·7	75·5	− 0·5	68·4	72	2·9	0·20	− 1·07	4	10·1	81
St. Helena	1015·7	− 0·3	63	53	60·9	54·0	57·5	+ 0·1	54·4	92	9·7	0·85	− 1·33	10	...	...
Freetown, Sierra Leone	1012·9	+ 2·4	87	70	82·8	73·3	78·1	...	74·8	89	8·0	26·43	− 2·05	27	...	...
Lagos, Nigeria	1013·3	+ 1·1	86	71	82·9	74·0	78·5	− 0·2	73·7	86	9·0	1·77	− 3·82	12	3·1	26
Kaduna, Nigeria	1014·0	...	95	65	86·5	68·0	77·3	+ 2·0	70·7	89	8·1	12·65	+ 1·15	21	5·5	45
Zomba, Nyasaland	1014·5	+ 0·9	88	50	78·5	58·1	68·3	− 1·2	61·9	65	4·5	0·03	− 0·31	2	...	...
Salisbury, Rhodesia...	1018·0	+ 1·4	86	38	77·6	48·4	63·0	− 3·4	51·7	39	1·0	0·00	− 0·28	0	10·1	84
Cape Town	1020·9	+ 1·8	84	43	68·3	52·3	60·3	+ 2·4	53·0	80	6·0	2·52	+ 0·28	10	...	...
Johannesburg	1018·7	+ 1·0	81	30	69·2	44·4	56·8	− 2·6	45·8	48	2·0	0·28	− 0·68	2	9·9	83
Mauritius	1019·6	− 0·6	82	56	77·4	63·0	70·2	+ 0·1	64·2	64	5·1	1·09	− 0·21	19	8·4	70
Calcutta, Alipore Obsy.	1005·2	+ 0·7	92	75	89·0	78·3	83·7	+ 0·5	79·5	90	7·0	19·83	+ 9·82	17*	...	...
Bombay	1006·8	− 1·2	89	75	86·4	76·9	81·7	+ 0·8	77·3	87	7·1	5·72	− 4·96	13*	...	...
Madras	1006·2	− 0·3	99	73	92·9	77·8	85·3	+ 0·1	77·2	75	6·4	1·93	− 2·92	6*	...	...
Colombo, Ceylon	1009·5	− 0·4	88	73	85·3	75·8	80·5	− 0·7	76·7	77	7·4	8·09	+ 3·33	18	6·1	50
Singapore	1009·3	− 0·5	89	73	85·8	76·0	80·9	− 0·2	77·6	81	6·1	5·85	− 0·94	15	6·7	55
Hongkong	1008·2	− 0·1	90	70	86·3	76·9	81·6	+ 0·6	75·5	74	5·8	12·38	+ 2·69	10	7·5	61
Sandakan	1008·6	...	91	72	88·7	75·1	81·9	+ 0·2	76·9	82	7·4	16·73	+ 7·40	14	...	...
Sydney, N.S.W.........	1019·0	+ 2·9	85	43	67·1	48·9	58·0	− 1·2	52·5	60	3·2	1·29	− 1·57	10	9·3	78
Melbourne	1019·1	+ 3·3	74	33	60·5	43·1	51·8	− 2·3	48·1	70	7·5	1·03	− 1·41	17	4·7	40
Adelaide	1021·3	+ 3·8	86	37	66·2	46·5	56·3	− 0·8	50·1	56	6·3	0·67	− 1·38	13	6·1	52
Perth, W. Australia ...	1019·1	+ 1·1	80	40	70·4	52·8	61·6	+ 3·4	53·9	58	5·5	1·75	− 1·67	9	8·3	70
Coolgardie	1019·2	+ 2·0	92	32	72·9	46·4	59·7	+ 1·0	50·5	49	2·3	0·10	− 0·57	1	...	...
Brisbane	1019·7	+ 2·1	87	49	76·0	54·1	65·1	− 0·1	58·1	60	3·0	0·84	− 1·16	5	9·3	78
Hobart, Tasmania......	1012·4	+ 1·4	66	36	57·7	42·1	49·9	− 1·1	44·5	59	6·0	1·27	− 0·80	18	6·5	55
Wellington, N.Z.	1010·0	− 4·6	66	35	56·6	43·6	50·1	− 1·5	47·1	69	6·4	2·44	− 1·53	16	6·4	54
Suva, Fiji	1015·3	+ 1·0	86	64	78·8	69·1	73·9	− 0·6	69·2	80	7·7	7·03	− 0·66	16	4·1	34
Apia, Samoa	1012·0	− 0·2	86	68	84·2	72·5	78·3	+ 0·1	75·0	74	4·2	4·72	− 0·39	12	8·1	68
Kingston, Jamaica	1012·1	− 0·1	91	69	88·8	72·4	80·6	− 0·9	71·6	84	3·7	0·57	− 3·46	4	7·1	58
Grenada, W.I.	1011·8	0·0	88	70	86	73	79·5	− 0·8	73	74	5	10·86	+ 2·87	19	...	...
Toronto	1017·9	+ 0·1	87	37	71·5	53·8	62·7	+ 2·4	56·0	85	4·4	2·90	+ 0·23	11	7·0	56
Winnipeg	1012·9	− 0·9	90	24	67·6	45·5	56·5	+ 2·8	46·7	87	5·4	2·05	− 0·17	5	5·6	44
St. John, N.B.	1017·6	+ 0·2	72	34	61·5	48·5	55·0	− 0·9	51·8	88	6·9	5·59	+ 1·85	17	4·8	38
Victoria, B.C.	1018·1	+ 1·7	73	43	62·1	47·7	54·9	− 1·2	52·7	84	5·3	1·39	− 0·42	8	7·7	61

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