

The Meteorological Magazine



Air Ministry: Meteorological Office

Vol. 70

July
1935

No. 834

LONDON: PRINTED AND PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE

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The Halo Phenomena of May and June, 1935

The *Meteorological Magazine* for June included a number of letters describing remarkable displays of halo phenomena on several days in March and April, and again on May 3rd and 4th. Halos continued to be frequently observed throughout May and the early part of June. Halo phenomena were reported from some part of the British Isles on no fewer than 21 days in May, including every day from the 2nd to 8th and 11th to 21st inclusive. The most widespread phenomena occurred on the 3rd to 5th and 15th, being reported at 21 stations (out of 47 for which weather diaries are available) on the 3rd, 24 on the 4th and 5th, and 23 on the 15th.

On May 4th the upper arc of contact of the 22° halo was observed at Limpsfield (Surrey), Worthing, Torquay and Paignton, and mock suns at the latter station and at Calshot.

A remarkable display occurred in the north of England and southern Scotland on May 8th. Parts of this display were observed at nine stations out of 47. The most complete record was obtained by Mr. Tom Wilson from Honister Pass; his sketch, representing the phenomena as seen at about 2.30 p.m. B.S.T. is reproduced in Fig. 1, in which coloured arcs or circles are represented by three lines and white arcs or circles by two lines. S is the sun and Z the zenith. The altitude of the sun was approximately 50°. Mr. Wilson made several sketches at the time and afterwards revisited the scene with measuring instruments. He determined the radius

of the large halo C as about 46° . B is evidently the halo of 22° . Inside B was another halo A, showing the colours of the spectrum with the red towards the sun. Unfortunately the radius of this halo cannot be determined exactly, but Mr. Wilson describes it as nearer to B than to the sun. It was probably Rankin's halo of about 17° and has been inserted in Fig. 1 on that assumption. Where it crossed the mock-sun ring D two mock suns HH appeared very distinctly. The mock-sun ring was complete, E appears to be part of a circumzenithal ring tangent to the innermost halo, but F was "rather elusive," and it is not clear whether it represents a circum-

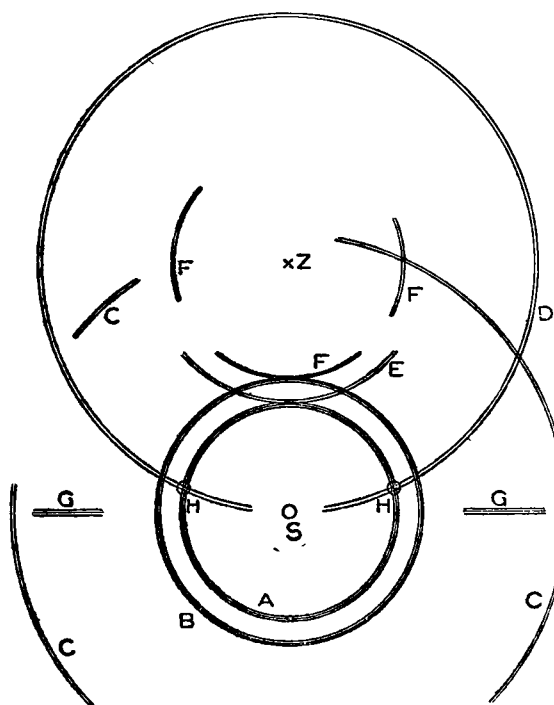


FIG. 1

zenithal ring or parts of the oblique arcs through the anthelion or both. As described below (Fig. 2), the oblique arcs were clearly seen not far off at Ambleside and from a study of three rough sketches made by Mr. Wilson at 1.45, 2.10 and 2.45 p.m., it seems probable that F in Fig. 1 represents parts of these arcs. The identity of the coloured bands G is not clear; it is possible that they represent parts of the oblique arcs descending from the intersection of the mock-sun ring and halo of 46° , which have only been recorded twice before.*

Mr. Wilson adds: "I have been informed that a much larger circle outside C was observed though I could find none from my point of observation. It reached from the sun and circled the whole of the sky, but was not fully observed"; this, however, may have been merely the mock-sun ring seen at a later hour when the sun was lower. The phenomena lasted from 1 p.m. to 3.30 p.m. B.S.T.

Mr. R. K. Pilsbury reported some parts of the same display from Eskdalemuir Observatory: "On May 8th, 1935, a bright halo of 22° was first observed at 9.30 a.m. B.S.T., and this persisted more or less until late afternoon. At 4 p.m. no halo was visible, but at

* See *Meteorological Magazine*, 66, 1931, pp. 289-90.

4.15 p.m. the halo reappeared with a great brilliance, being accompanied by a horizontal circle or mock-sun ring, together with two mock suns, that on the right of the sun from the observer being brighter than the other. The mock-sun ring was incomplete, the portion joining the mock suns through the sun not being visible, while the portion outside the mock suns was broken. . . . The halo itself was complete and its colouring was very strong, being distinctly very red on its inner edge, the usual colour variations following until the outer edge faded away in whiteness. Another noteworthy feature of the display was the presence of iridescent cloud within the halo ; this cloud appeared to vary its position and

gave at time the impression of a band or portion of a ring. The mock suns appeared just outside the white edge of the halo." Can it be that the inner halo observed by Mr. Wilson began to form also at Eskdalemuir ?

On the same day, Miss L. Scowcroft, at Ambleside, Westmorland, observed the display shown in Fig. 2 from 2.10 to 3 p.m. B.S.T. Here neither the 22° nor the 46° halo was seen, but the circumscribing elliptical halo to the 22° halo and the left-

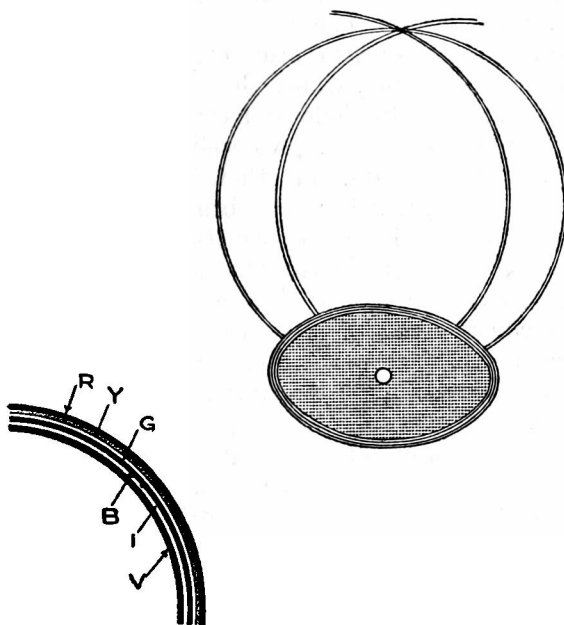


FIG. 2

hand tangent arc to the 46° halo were both visible and brilliantly coloured. The sketch also shows very clearly the mock-sun ring and the oblique arcs through the anthelion. The colour inside the elliptical halo is described as a dark greyish blue contrasting with the deep clear blue of the rest of the sky. Mr. F. Howson at Ambleside also sent a rough sketch showing apparently the halos of 22° and 46° and the mock-sun ring ; the hour is not stated, but it is curious that this observation differs so markedly from Miss Scowcroft's.

On May 8th also, Mr. W. S. Davenport observed near Saltdean, Sussex, from 3.25 to 7 p.m. B.S.T., a halo the radius of which he estimated (by theodolite) as 25° , but which was probably the halo of 22° ; on either side was a mock sun showing prismatic colours,

and elongated away from the sun into white streaks. The colours are described as "ending not unlike osprey feathers". A halo with mock suns and sun pillar was reported at Lympe at 4.15 p.m. B.S.T.

A widespread display, including besides the halo of 22° , the arc of contact and mock suns, occurred on the 13th, being recorded at 12 stations, chiefly in the north and west but as far south as Oxford.

Another remarkable display occurred on the afternoon and evening of June 2nd. At Westcliff-on-Sea, Essex, Mr. E. J. Horrex observed the halo of 22° with parhelia and the 46° halo with part of the circumzenithal arc, from 6.18 to 6.32 p.m. B.S.T., when the mock sun to the right was obscured by passing fractocumulus, reappearing at 6.45 p.m. The mock sun to the left was not seen from 6.22 to 7.24 p.m., though the sky was clear. The 46° halo at the point of contact with the circumzenithal arc was brilliantly coloured, the inner edge was red and the outer blue, whilst the remainder of the halo was white. At 6.40 p.m. the 46° halo and circumzenithal arc suddenly faded and were not seen again. No well-marked arc of contact was visible with the 22° halo, but there was a distinct thickening of the halo at the top, which was as brilliantly coloured as was the point of contact of the 46° halo with its circumzenithal arc. During the display the sky within the 22° halo and outside the 46° halo was a deep blue, while the sky between the halos was a very pale blue; the contrast was reminiscent of Oxford and Cambridge colours. The mock suns were prolonged into tapering shafts of brilliant white light extending horizontally half-way to the inner edge of the 46° halo.

At Steyning, Sussex, for two hours on the afternoon of the same day, Mr. G. D. Pegler observed the 22° halo, part of the mock-sun ring and two mock suns. "The latter, which were situate on the outer rim of the halo, appeared in the form of two bright patches of light tapering away from the sun, finally diminishing to bright narrow beams. The axes of these beams were not horizontal but were both raised above the horizontal diameter of the halo by about 10° . A very faint line of light was observed between the mock suns and the sun itself . . . later in the afternoon I observed that the light from the outside edges of one of the mock suns was stratified, giving the appearance of being produced by a layer in which rifts were developing."

Miss Cicely M. Botley observed similar phenomena at Hastings at 5.45 p.m. B.S.T. The 22° halo was fairly bright, while the two mock suns were very brilliant, and the mock-sun ring could be traced in the black mirror up to the sun on both sides and to a considerable distance outside the halo. The parts nearest to the mock suns were bright and of a silvery appearance. The presence of the summit of the 46° halo was at one time suspected.

The display was also seen at West Wickham and, according to

correspondence in *The Times*, at Sevenoaks, Woking, Canterbury and Dover. At Dover Mr. H. L. Baker recorded also about sunset a white sun-pillar extending from the sun to the summit of the 22° halo.

The many rare features of the halo complex of May 8th point to the presence of ice crystals of a variety of forms. The commoner phenomena are caused through the refraction or reflection of light by small hexagonal prisms of ice with flat ends, the length of the prisms being great in proportion to their diameter (ice crystals). The halo of 22° with its mock suns and tangent arcs results from refraction through two alternate faces of a prism which make an angle of 60°; when the directions of the axes are irregular the 22° halo is formed, but refraction through prisms falling with axis vertical gives the mock suns. The prisms may fall like this on account of included bubbles. If the crystals float or fall with their axes horizontal, they give the tangent arcs or, if the sun is at a sufficient elevation, the circumscribed elliptical halo. The mock sun ring is explained very simply as the reflection of the sun's rays from the vertical faces of the prisms, or of their vertical ends if they are floating with their axes horizontal.

The 46° halo is caused by the refraction of light through one side and the base of hexagonal prisms, the refracting angle being 90°. Associated with the 46° halo are the infra-lateral arcs. These are explained as due to the refraction of light through crystals floating with their axes horizontal, that is to say the same crystals as produce the arcs of contact of the 22° halo. The explanation of the oblique arcs through the anthelion is very uncertain so the type of crystal indicated by these arcs cannot be stated.

All the phenomena hitherto described arise from reflection, or from refraction through crystal faces inclined at angles of 60° or 90°, which are the only refracting angles possible in a hexagonal prism with flat ends. The small halo seen by Mr. Wilson inside the 22° halo is in a different category. A halo of 16° to 17° requires a refracting angle of 48° to 50°. It is likely that the crystals producing such a halo are prisms with pyramidal ends. Apparently there are no good observations of well formed crystals of this type, but the general theory of crystallography has been called upon to prove that the crystals ought to exist. The rarity of the halos with small radii indicates that these specialised crystals are seldom in great profusion. The circumstances of May 8th were most exceptional when the small halo observed by Mr. Wilson was so brilliantly coloured. I believe that mock suns on such a halo are hitherto unknown. It would seem that not only was there a remarkable profusion of ice crystals in the air above Cumberland on May 8th, but that these crystals had taken on a still more remarkable variety of form.

Lake Deposits in the Crimea and the Rainfall of Europe since 2000 B.C.

A recent publication by W. B. Schostakowitch* contains a table of measurements of annual layers of the mud deposit in Lake Saki. The Map Curator of the Royal Geographical Society informs me that Saki is a salt lake on the west coast of the Crimea in $45^{\circ} 7' N.$, $33^{\circ} 33' E.$, separated from the sea by a strip of sandy beach; from *The Times* atlas, the neighbouring country seems to be flat. The total thickness of the deposit is several metres, most of the individual layers measuring only a few millimetres. The measurements, in tenths of a millimetre, were made partly on photographs and partly on the original sections; the earliest layer is dated 2294 B.C., but in some parts of the sections it was difficult to distinguish the lines separating the annual layers and there may have been some errors in calculating the age of parts of the sections.

This series would form a valuable climatic record, comparable in importance with the tree-rings of western America, if we can decide what causes the variations in thickness of the layers. The most obvious agency is rainfall, and in particular heavy rainstorms which would cause rapid run-off. The measurements show a number of isolated years with very thick layers five or ten times as thick as neighbouring layers, which is consistent with this suggestion. A possible connexion with rainfall was further examined by comparing overlapping five year means with the variations in level of the Caspian Sea. E. Brückner† has calculated annual means of the level from 1851 to 1878, and has also given a few additional data from which the curve can be extended back to about 1822 and on to 1882. The results are shown in Fig. 1, in which the five year Saki means are each entered to the middle year of the five. Although the curves show many differences of detail, there can be no doubt that their general course, from maximum to minimum and back to a second maximum, is similar. Since rainfall is presumably an important factor in determining the fluctuations of the Caspian, it seems probable that the deposits of Lake Saki are also to some extent a measure of rainfall.

The measurements of the Saki deposit were next summed to give a series of ten-year means and these in turn were combined to form overlapping series of fifty years. These overlapping fifty-year means are shown in curve I of Fig. 2. The oscillation shown in Fig. 1 is represented here only by the last small hook of the curve. This curve presents several points of interest. Beginning at a

* Bodenaablagerungen der Seen und periodische Schwankungen der Naturerscheinungen. Reprinted from *Leningrad Mem. Hydr. Inst.* (in Russian, with a German summary).

† Klimaschwankungen seit 1700, Vienna, 1890.

very high level, it drops rapidly from 2140 B.C. to 2060 B.C., then more slowly and very irregularly to 1400 B.C. From that point it oscillates about a mean of some 2.8 mm. until about 900 B.C. when there appears to be a rise to a new mean of about 3.1 or 3.2 mm. From 900 B.C. the general trend of the curve is slightly downwards to a minimum of slightly below 3.0 mm. between 300 A.D. and 700 A.D. followed by a steady rise to 4.0 mm. at 1890 A.D., interrupted, however, by two marked maxima at 800 and 1130 A.D.

If the layer attributed to 2294 B.C. is really the beginning of the deposit, we should expect the first layers to be abnormally thick, like the first rings of a tree, but even so the drop after 2160 B.C. seems to be abnormally steep. Recently a good deal of evidence has been found in the dry regions of Mekran and north-west India that the rainfall was appreciably greater than now for some time

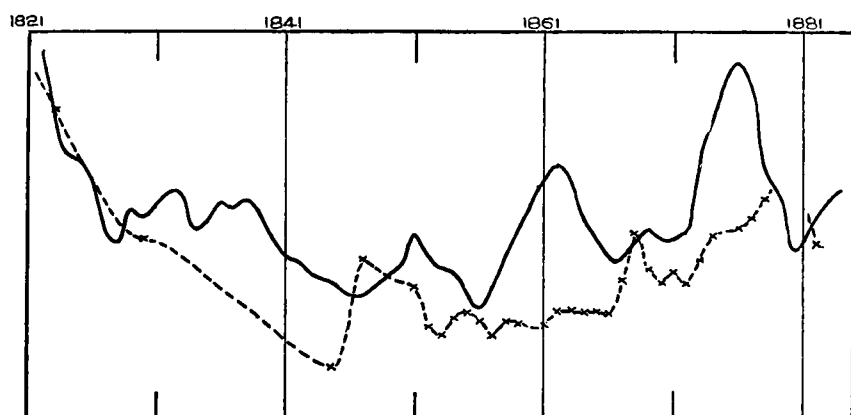


FIG. 1.—THICKNESS OF DEPOSITS OF LAKE SAKI (FULL LINE) AND LEVEL OF CASPIAN SEA (BROKEN LINE)

after 3000 B.C., while according to H. J. E. Peake,* settlements in south-west Asia were abandoned about 2200 B.C., probably owing to intense drought, and were not re-occupied until Persian times.

On the other hand in any deposit of this nature the weight of the upper layers tends to compress the lower layers, giving a gradual increase in thickness of the layers towards the top of the section, which would account for the gradual rise in the average level of the curve. There is sufficient evidence to show that about the beginning of the Christian era conditions in the Near East were not greatly different from those prevailing at present, which confirms such a steady rise of the base line. Small variations of sea-level and changes in the vegetative covering of the shores of the lake may also have had some effect on the thickness of the deposit.

The clearly marked maxima at 800 and 1130 A.D. offer an opportunity of checking the dating. From the data collected and critically examined by Brückner, it appears that the Caspian was

* The Bronze Age and the Celtic World, London, 1922.

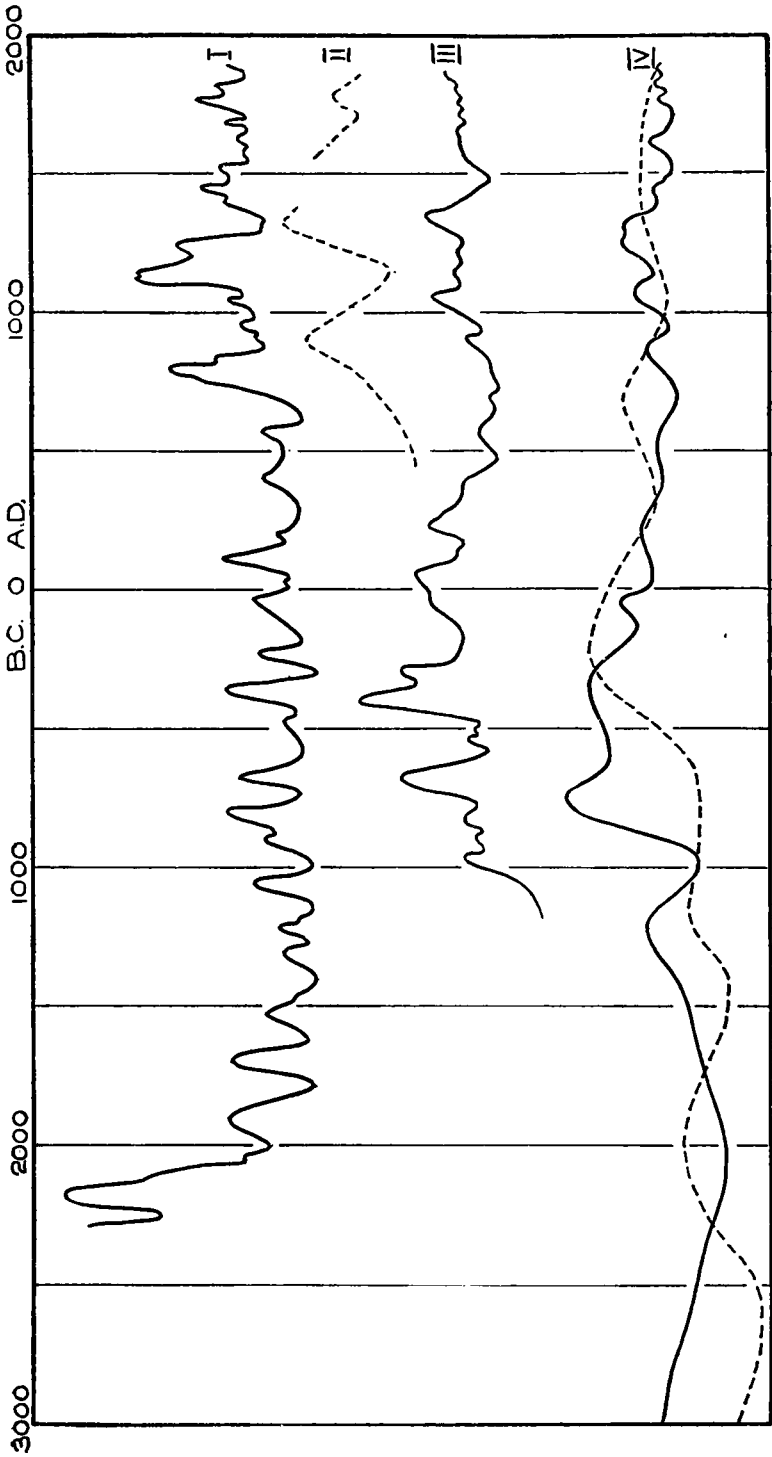


Fig. 2.—I. DEPOSITS OF LAKE SAKI. II. LEVEL OF CASPIAN SEA. III. TREE GROWTH IN WESTERN U.S.A.
IV. ESTIMATED RAINFALL IN CENTRAL EUROPE AND SWEDEN.

very high from 915 to 921 A.D., very low in the 12th century, still higher about 1306-7, after which it fell steadily to about 1715-20, followed by a further rise about 1730. These data are indicated by the broken line in curve II of Fig. 2. It is evident that while the last maximum fits curve I sufficiently closely, the first two maxima are completely discordant. They would, however, fit if this part of curve I were displaced about 100 years to the right, and it is possible that we have here one of the errors of dating the Saki deposits, the possibility of which was referred to earlier. An obvious possibility is that many of the layers are double, because of seasonal irregularities. It must be remembered, however, that the hydrographic conditions of the Caspian basin have changed from time to time, thus about 1306 A.D. the Oxus River entered the Caspian instead of the Sea of Aral as at present, and the Caspian curve may not be a fair representation of the rainfall.

Curve III shows the variations of tree growth in western North America,* standardised by data as to variations of level of inland lakes. The first maximum, about 700 B.C., agrees with a fairly well-marked double maximum on the Lake Saki curve. The second maximum in 400 B.C. also agrees and in general the courses of curves I and III are similar until about 600 A.D., but the two maxima at 800 and 1100 A.D. on curve I are displaced to 1050 and 1350 on curve III, agreeing more closely with the Caspian curve II than with the Saki curve.

The full curve in IV is also transcribed from "Climate through the Ages"; it represents variations in Europe derived from a variety of sources, chiefly variations of lake levels, and may be taken as representing central Europe. The main maximum at about 800 B.C. is probably placed too early. The broken curve in IV is that derived by E. Granlund† from a detailed study of peat bogs in Sweden. The great increase in rainfall in the Early Iron Age is displaced to about 500 B.C., a subsidiary maximum is shown about 2000 B.C. in good agreement with the Saki curve.

In spite of the doubts as to the timing, the data from Lake Saki have several useful lessons. Apart from the very earliest figures, the fluctuations are of the same order of magnitude throughout, except for the two maxima in the Middle Ages. All the other curves show an increasing amplitude with increasing age. In the tree curve III this is due in part to the decrease in the number of trees available as we go back in time. With the other records it may well be due to an exaggeration of the importance of ancient events for which the evidence is naturally somewhat less clear than for more recent changes. An increase in the average thickness of the Saki deposits during the Early Iron Age is fairly clear; moreover,

* BROOKS, C.E.P., *Climate through the Ages*, London, 1926.

† De Svenska hogmossarnas geologi. *Stockholm, Sverig. geol. Unders. Afh.*, C, 26, 1932, No. 1.

both the maxima and the minima lie at a higher level, but the maxima of the "dry" period are well above the minima of the "wet" period. This is in accord with the trend of recent investigations into the history of vegetation in Europe, and it seems that we must be on our guard against too ready generalisations on the "climate" of long stretches of time.

C. E. P. BROOKS.

OFFICIAL PUBLICATION

The following publication has recently been issued:—

GEOPHYSICAL MEMOIRS.

No. 66. *The three components of microseismic disturbance at Kew Observatory.* A discussion of the records for 1932. By A. W. Lee, M.Sc., A.R.C.S., D.I.C.

The microseisms recorded during 1932, by the N-S, E-W and Z components of the Galitzin seismograph at Kew Observatory have been tabulated for four hours daily. The mean amplitudes and periods of the three components for the whole year are approximately equal (0.9 μ and 5.6 sec.). The amplitudes of the two horizontal components are nearly equal for all periods, but the ratio of horizontal to vertical amplitudes diminishes from about 1.2 for microseisms of period 4½ sec. to 0.85 for periods of 9 sec.; this variation is consistent with the hypothesis that the microseisms may be regarded as Rayleigh waves through granite covered by a superficial layer. The yearly mean amplitudes of the simple Rayleigh waves with energy equal to that of the microseisms are 0.5 μ in the horizontal and 0.8 μ in the vertical components.

The vertical is more reliable than either of the horizontal components for tabulations of the microseisms, since there are no uncertainties due to changes in the direction of travel of the waves, and effects of the local geological structure are smaller.

Royal Meteorological Society

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

The following papers were read and discussed:—

W. E. Knowles Middleton.—*Unusually great visual range over Ontario.*

The author gives details of exceptional visibility on the morning of January 30th, 1935, during an aeroplane ascent from Toronto, when the hills of Manitoulin Island in Lake Huron, 280 Km. away, were visible at a height of 2,623 metres. The light path is calculated by means of the meteorological data recorded on the flight. These data disclosed a temperature inversion, and it is shown that the existence of the inversion over the entire region was necessary for

the geometrical possibility of the observation, and that the air at the time must have been exceptionally clean and dry for the contrast between the distant hills and the sky behind them to be perceived.

Major H. C. Gunton, F.R.Ent.Soc.—Phenological Records of British Lepidoptera.

The author explains a graphical method of analysing records of the first appearance dates of fifty common species of indigenous British lepidoptera in relation to meteorological conditions and draws conclusions with reference to the causes and extent of early and late appearance. It is considered that the next stage of these investigations must include the adjustment of the lists of species to suit the local requirements of the different districts, the comparison of results obtained from different districts, and the differences in the response of individual insects according to their life-histories and to the extent of their protection in the pupa state. To do this effectively there must be an increase in the number of observers.

Capt. W. N. McClean, A.M.Inst.C.E., gave an account of rainfall and run-off records from the River Dee catchment area, Aberdeenshire, January to May, 1935.

Mr. K. Chandra described instruments used in India for the purpose of making upper air observations.

The Summer Meeting of the Royal Meteorological Society was held at Kew Observatory, Richmond, on the afternoon of June 27th, by kind invitation of the Director of the Meteorological Office and Dr. F. J. W. Whipple, Superintendent of the Observatory. More than a hundred fellows and guests were shown the activities of the Observatory, including the normal work of a station of the first order as well as a seismographic observatory, and a number of experimental investigations of great interest. The latter included several recently designed instruments for the detailed study of rainfall—the Jardi Rate of Rainfall Recorder, Rainfall Chronograph, and four rain-gauges exposed on short grass, gravel, and cement respectively, to determine whether the splashing of rain affects the catch of a gauge appreciably.* The various investigations of atmospheric electricity also excited great interest, especially the ingenious experimental apparatus for determining the sign of the charge in different parts of a cloud directly by means of an electrograph carried up through a thunderstorm cloud by a balloon.

Balloons in general formed the most attractive part of the programme. Throughout the afternoon a series of small pilot balloons were liberated and followed by theodolites to determine the upper winds and height of the clouds; postcards were attached, to be returned to the Society by the finders. At 5.30 p.m. a sounding balloon was liberated, carrying a Dines meteorograph. The meeting

* See *Meteorological Magazine*, 70, 1935, pp. 32-4.

as a whole was an unqualified social success, aided by ideal weather, the heat being tempered by a pleasant breeze.

The programme of the meeting included a historical note of the Kew Observatory, which is of sufficient interest to be reprinted here :

“ The Kew Observatory, which was originally known as the King's Observatory at Richmond, was built in time for observations of the transit of Venus in 1769. It is believed that the architect was Sir William Chambers. During the reigns of George III, George IV and William IV, there were in succession two ‘ King's Observers,’ Dr. S. C. T. Demainbray and his son the Rev. S. G. F. T. Demainbray. In 1842, after the accession of Queen Victoria and the dedication of Kew Gardens to the public use, the British Association became tenants of the Observatory. Subsequently, from 1871, the Observatory was under the control of the Royal Society. In 1900 the nucleus of the National Physical Laboratory was established at the Observatory, but the work of the Laboratory was soon transferred to Teddington, and in 1911 the Observatory passed to the administration of the Meteorological Office.”

The Council of the Royal Meteorological Society has awarded the Howard Prize for 1935 to Robert Arthur Neville Cox of H.M.S. *Worcester*. The subject of the competition was an essay on “ Forecasting of weather at sea from observations in his own ship alone.”

Correspondence

To the Editor, *Meteorological Magazine*

Partial Cloud Dispersal by an Aeroplane

On the evening of May 29th, 1935, I noticed a remarkable dispersal of a portion of a cloud by an aeroplane flying through it. Next day I was able to discover the pilot and obtained a few details from him.

The aircraft was flying on a level keel over Otmoor to the north of Oxford at a height of 10,500 feet. At this height an oval patch of altocumulus cloud, calculated to be 1,200 feet long and 600 feet wide, was just beginning to form. The aircraft flew in a straight line through the cloud sheet leaving a clear-cut track in its wake, throughout the breadth of the cloud, which was cut completely in two. The track, which was slightly wider than the span of the wings of the aeroplane, 40 feet, persisted for about seven minutes before closing up again owing to the reformation of the cloud.

The incident was observed independently by quite a large number of people. The pilot stated that the cloud was just forming and was about 10–12 feet thick. It was quite thin and he could see through it from above. The temperature he noticed was -5°C . (23°F .), while the ground temperature at the time was 64°F . and the relative humidity 60 per cent.

The point arises as to how the cloud was dispersed in such a clear-cut path. Was it due to the turbulence of the slip-stream in the rear of the aeroplane, or the temperature of the slip-stream being sufficiently above the dew point to warm up and disperse the cloud, or a combination of both effects?

R. E. WATSON.

Meteorological Station, R.A.F., Abingdon, Berks, May 31st, 1935.

While taking my observations at 13h., G.M.T., on June 26th, a curious phenomenon was witnessed. An Imperial Airways liner which was flying from south-east to north-west entered a patch of relatively low alto-cloud (altostratocumulus) which was moving up from south-west by south. The machine and its shadow on the cloud could be distinctly seen and soon after its passage a perfectly straight lane appeared, which, as the cloud advanced, became clear and widened, giving the appearance that the cloud was cut in two. When at the same altitude as the sun the cloud quickly dissolved. Other cloud forms at the time consisted of large high level cumuli with bases at about the same altitude as the altostratocumulus.

A. E. MOON.

39, Clive Avenue, Clive Vale, Hastings, June 27th, 1935.

[This cloud "divided into two halves by a lane of clear sky" was also observed by Miss C. M. Botley of 17, Holmesdale Gardens, Hastings. Ed. M.M.]

Thunderstorms of June 15th, 1935

Saturday, June 15th, 1935, produced the remarkable phenomenon of five distinct thunderstorms in the nine hours from 10h. 30m. to 19h. 30m. G.M.T. All the storms, which were of a light or moderate intensity, passed over or near Goff's Oak, Herts, from between south and west. The thunder of the first storm was first heard at 10h. 40m. and was last heard at 10h. 53m. in the east, and produced slight rain between 10h. 40m. and 10h. 44m. The second storm followed between 12h. 16m. and 12h. 30m. and produced but one clap of thunder with a trace of light rain. The third storm commenced at 13h. 58m. and was the most intense of all, giving moderate rain for 17 minutes with a heavy fall of rain and hail between 14h. 14m. and 14h. 25m. The wind backed from WSW., force 2 at 14h. 0m. to SE., force 2 at 14h. 3m. and in a gust of force 3 veered again to WSW. at 14h. 8m. The wind then slowly backed again in feeble gusts to ENE., force 1 at 14h. 30m. falling to calm at 14h. 37m.

The sun shone again at 15h. 5m. but the fourth storm was already approaching from WSW. and for 15 minutes there was the curious combination of thunder and lightning in the east from the third storm, bright sunshine, and thunder in the west from the fourth storm. These two storms produced considerable changes in wind direction, etc., which are shown in Fig. 1, the claps of thunder being

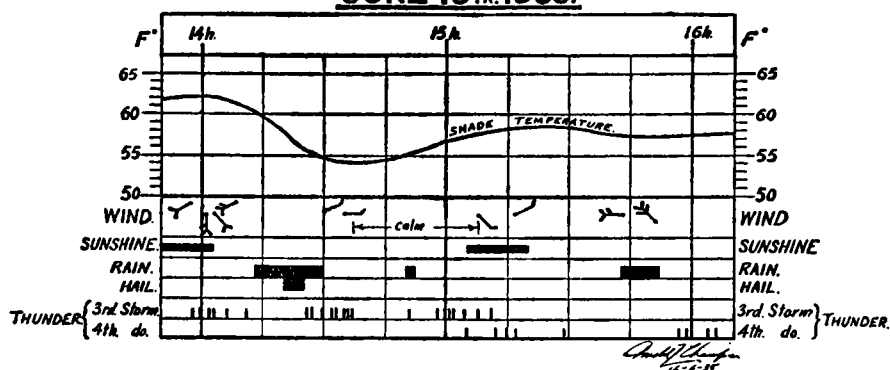
JUNE 15TH 1935.

FIG. 1

indicated by vertical strokes at the time of occurrence. The fourth storm followed the third so closely that for a time both cloud masses were reflected in the nephometer mirror, the appearance of the sky reflected therein at 15h. 10m. being as shown in Fig. 2. At 15h. 8m. the period of calm was replaced by a wind from SE., force 1 which backed ENE. at 15h. 17m. At 15h. 43m. the wind suddenly veered to W., force 3 and rain commenced, the wind veering to NW., force 4 and rain ceasing at 15h. 49m. Thunder continued intermittently until 16h. 35m., with wind slowly backing WSW.

The fifth, and final storm commenced at 18h. 30m. and passed away to the east at 19h. 17m.

Total rainfall from these storms, measured at 6h. 0m. on the morning of the 16th, was 0.22 in.

DONALD L. CHAMPION.

7, Robinson Avenue, Goff's Oak, Waltham Cross, Herts, June 17th, 1935.

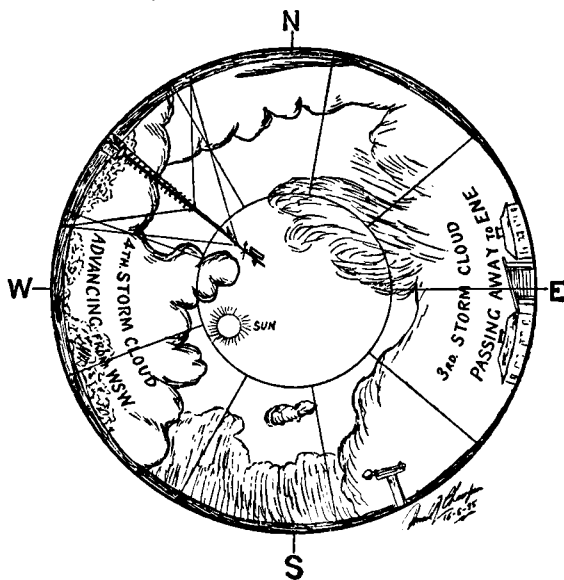


FIG. 2

Mr. J. E. Clark reports that three distinct thunderstorms were experienced at Street, Somerset, the same day, Saturday, June 15th.

The first one lasted from 9h. 20m. to 10h. 14m. and passed from north-west to east; only 0.06 in. of rain was measured during this storm. By 10h. 30m. it was fine overhead but there were signs of a new storm approaching from the west. This second storm lasted 20 minutes from 12h. 15m. to 12h. 35m. and was heavy to the south-east and south. The storm cloud had a ragged fringe to the east at about 8° and Mr. Clark remarks that "incipient waterspouts were forming and retracting but one fully 1° or more long, straight funnel widening at base where cloudlet formed and in two minutes extended 3° or 4° as funnel slowly vanished." 0.15 in. were measured during this storm. The third storm began at 12h. 55m. and was accompanied by heavy rain and hail at intervals which made the ground white. The total rain measured at 16h. amounted to 1.14 in.

At Castle Cary, 11 miles to east-south-east of Street, a cloudburst was experienced shortly after 12h. during a severe thunderstorm accompanied by hail which lasted some 10 to 20 minutes. Torrents of rain fell "over not many acres" in the south of the town and rushed like a waterfall over a high wall bounding several acres of allotments and carried a lot of soil and plants with it into the roadway and down South Street to the centre of the town where the water became some feet deep. A good many houses were flooded.

Mr. Clark adds that little or no rain fell more than some four or five miles off to the north-east and north-west.

NOTES AND QUERIES

Thunderstorm Rains of June 25th, 1935

The thunderstorm rains of Tuesday afternoon, June 25th, call for special comment, not only because of the large amounts recorded, but also because of the widely different localities affected. The storms were also remarkable for the frequency of the thunder and lightning over a prolonged period. Reports of heavy and intense rains have been received from Co. Tipperary, in central Wales, near Bath, the south-east Midlands, and the London District. The rain recorded in the neighbourhood of Bath was especially remarkable, recalling that experienced at Bruton on June 28th, 1917, and at Cannington on August 18th, 1924, the centre of the Bath storm being only 20 miles from Bruton and 35 miles from Cannington.

Co. Tipperary.—Mr. E. W. M. Murphy reports one of the worst thunderstorms he has ever experienced at Ballinamona (1½ miles west of Cashel). He measured 1.42 in. of rain and hail in about 1½ hours after 15h. 30m.

Central Wales.—Two stations to the east of Aberystwyth, maintained by the University at the Plant Breeding Station and at Lletty-evan-hen, recorded 2.76 in. and 3.25 in. respectively, within five hours from 15h. to 20h. At Abergorlech to the north of Llandilo in Carmarthenshire 2.95 in. fell between 15h. 30m. and 17h. 30m.

and is referred to as the heaviest rainfall there within living memory.

Near Bath.—Over an area of about 10 sq. miles to the north-east of Bath more than 2 in. fell during $3\frac{1}{2}$ hours. At the climatological station at Bath (Henrietta Park) 1·90 in. occurred between 13h. and 16h. 30m. It is reported that more than 2·7 in. occurred at Lambridge House and more than 4·0 in. at Bathford (both to the east of Bath) but the gauges then overflowed. The Bath Waterworks gauges gave the following readings : Batheaston Reservoir, 4·83 in. ; Monkswood Reservoir, 3·69 in. ; Lansdown, 3·68 in. ; and Charlcombe, 3·11 in. At Ashwicke Park, 5 miles to the north-east of Bath, 3·05 in. was recorded at the Hall and 4·50 in. at the Home Farm. The height of the storm is reported as from 13h. 30m. to 16h. 15m. At Swainswick, two miles to the north of Bath, the gauge, which is usually read once a month only, contained 6 in. more after the storm than before. At Oriel Lodge, Lower Swainswick 3·79 in. was recorded for the 3 hours from 13h. 15m. to 16h. 15m.

The damage done by the flood water was extensive and due to the sudden swelling of the usually small streams draining these narrow valleys. The village of Swainswick occupies one side of the valley, which lies between the Lansdown and Charmy Down spurs of the Cotswolds and drains an area some three miles long to the River Avon. All down the valley, fences adjoining the stream were washed away, low-lying gardens and cottages damaged, numerous landslides occurred and in some cases bridges were entirely swept away. Mr. J. S. Shackell of the Manor House, Swainswick reports the most severe downpour in the valley at any rate during the last 65 years. The River Avon at Bath is reported to have risen as much as 4 ft. in less than two hours and 6 ft. in $4\frac{1}{4}$ hours. The flooding which occurred in the east of Bath, was so severe that the Mayor asked for contributions for the relief of the sufferers. The tram service was held up at Lambridge to the east of Bath, the bus services were delayed between Bath, Chippenham and Melksham, while trains were delayed both at Melksham Station and Box tunnel owing to the depth of water on the lines.

Other areas of intense rain occurred further to the east of Bath. At Beanacre, 10 miles to the east of Bath, 3·00 in. fell between 13h. 30m. and 15h. 30m., no less than 2·5 in. occurring between 14h. 30m. and 15h. 30m. Lt.-Col. Sir Reginald Blake also writes "As regards local damage, this was far greater than within living memory. The River Avon, which flows about half-a-mile from here did not overflow its banks, but the small streams and ditches did. The fact that a great deal of hay was lying in the fields is believed to have contributed largely to the flooding, as it was washed against hedges and gateways and filled culverts. One farmer had ten tons of hay washed from a field. The notable feature of the storm was that certain places, never previously known to be flooded were under water". At Chippenham, 12 miles to the east-north-east of Bath, 4 in. of rain is

reported to have fallen within three hours. From further east, at Devizes, we have the following report: "In 1 hr. 20 mins. between 14h. 50m. and 16h. 10m. I measured 1·87 in. Two storms appeared to meet almost immediately over this place and thunder and lightning were almost simultaneous, although nothing in the immediate neighbourhood was struck."

The south-east Midlands.—At Blisworth as much as 2·50 in. was recorded within 3½ hours from 14h. to 17h. 30m. in a thunderstorm said to have been the heaviest for 50 years, only one larger amount (and then in a much longer period) having been recorded for any day there. Lightning struck a number of houses in Northampton and also a thatched cottage at Blisworth. At Market Harborough 1·21 in. was measured in 1 hr. 20 mins. from 15h. 55m. to 17h. 15m.

London Area.—Over the County of London few stations recorded as much as half an inch, but in certain localities the intensity exceeded two inches an hour for periods up to 15 minutes. Some of the more striking measurements are set out below:—

			Amount in.	Duration min.	Rate inches per hour.
Brockwell Park	...	...	0·22	5	2·64
Deptford Pumping Station	...	...	0·40	9	2·66
Camberwell (Myatts Fields)	...	...	0·45	10	2·70
Forest Hill	...	...	0·74	15	2·96
North Woolwich	...	...	0·38	15	1·52
Putney Heath	...	...	0·44	20	1·32

Much larger amounts were recorded to the south-west of London and amongst these reference may be made to the following:—

			inches.
Ewell (Stoneleigh Park)	...	...	3·25
Sutton (Sewage Works)	...	...	2·10
Banstead (Burgh Heath)	...	...	2·18
Reigate (Alvington)	...	...	1·43
Frimley Green (Ridgemount)	...	...	1·78

The rain at Ewell is said to have fallen in two hours between 12h. 30m. and 14h. 30m. (when "jagged shaped pieces of ice some of them an inch long" were found); at Sutton in 40 minutes from 13h. 20m. to 14h.; at Reigate 1·36 inches fell in two hours from 11h. 30m. to 13h. 30m., the bulk between 12h. and 13h.; at Frimley Green 1·76 in. fell in 2¼ hours.

J. GLASSPOOLE.

OBITUARY

We regret to learn of the death, at Rome, on May 21st, 1935, of Prof. G. Magrini, Editor of the *Bibliographia Oceanographica*.

BOOKS RECEIVED

Functions and Organisation of the India Meteorological Department, 1934 and 1935. Government of India, Dept. of Industries and Labour, Simla, 1934 and 1935.

Deutsches Meteorologisches Jahrbuch, 1933. Freie Hansestadt Bremen. Edited by Dr. A. Mey, Jahrgang 44, Bremen, 1934.

NEWS IN BRIEF

Miss I. L. Coryton, The Manor House, Greatham, Liss, Hants, has for disposal a series of *British Rainfall* for the years 1866 to 1891. Anyone wishing to purchase these should communicate directly with Miss Coryton.

Mr. R. J. Watson, of Foxhole, Calfstock Lane, Farningham, near Dartford, Kent, informs us that he has a Stevenson thermometer screen built to Meteorological Office specifications and a galvanised (brass-rimmed) 5-in. rain-gauge and glass measure by Short and Mason which he desires to sell. Anyone interested should communicate direct with Mr. Watson.

The Weather of June, 1935

Pressure was below normal over Alaska, most of the United States, southern Canada, Bermuda, the area extending from south Greenland to north Russia and Finland, Denmark, western France and Madeira, and over the extreme eastern Mediterranean the greatest deficits being 8·6 mb. at Valentia, 4·3 mb. at Point Barrow and 3·0 mb. near Salt Lake City and at Helwan. Pressure was above normal over the rest of Europe and most of the western North Atlantic, the greatest excesses being 4·6 mb. near St. Johns, Newfoundland, and 4·2 mb. at Lemberg. Temperature was above normal in central Europe and Sweden generally but below normal at Spitsbergen, Lapland and the Iberian Peninsula. Rainfall was deficient in central Europe, eastern Svealand (Sweden), north Norway and Spitsbergen, but about 50 per cent. above normal elsewhere in Sweden.

The weather of June over the British Isles was generally dull, cool and rainy until the 20th but warm and sunny for the last ten days. There were many days of thundery conditions and two very warm spells from the 22nd-25th and 29th-30th. Rainfall was mainly above normal, at Valentia the previous highest rainfall total on record, viz. 7·76 in. in June 1912, was exceeded by 0·39 in. Sunshine was generally below normal except in east and south-east England. From the 1st to 8th, the British Isles was under the influence of a complex low pressure system extending from the Azores to north Russia with mainly dull unsettled cool weather. In this period thunderstorms occurred locally from the 2nd-7th mainly in Scotland and northern England and rain was frequently heavy,

1·90 in. fell at Aberdeen and 1·75 in. at Pickering (Yorkshire) on the 5th, and 1·20 in. at Southampton on the 6th, while hail was experienced locally. Strong winds between S. and W. occurred in south and east England on the 6th and 7th, reaching gale force in places, mainly on the east coast. On the 8th the anticyclone over central and southern Europe extended northwards over this country and caused a temporary change to sunny conditions; 14·9 hrs. bright sunshine occurred at Ilfracombe on the 8th and 14·5 hrs. at Auchincruive (Ayr) on the 9th. On the 9th however the depression centred south of Iceland was moving south and extending over Ireland and from then to the 20th the country was under the influence of depressions moving from the Atlantic in an easterly or north-easterly direction. Generally cloudy unsettled cool weather prevailed with thunderstorms locally each day from the 9th to 18th, rain occurred on most days but was usually only slight to moderate, though 1·30 in. fell at Lympne on the morning of the 10th during a thunderstorm. There was much thick fog in the English and Irish Channels on the 19th to 22nd. On the 21st pressure rose generally over central and north Europe and anticyclonic conditions spread westwards over the British Isles giving very warm sunny weather in most of England and Wales and south-west Scotland from then to the 25th. Temperature rose above 80° F. in many parts, 88° F. was recorded at Brighton on the 25th and 86° F. at Jersey, Huddersfield and Manchester on the 22nd, at Chester and Manchester on the 23rd, at Tottenham on the 24th and at Cambridge on the 25th. Minimum temperatures were also high on the nights of the 23rd to 24th and 24th to 25th, 66° F. at Kew on the latter night being the highest value experienced there in June since records began. In Ireland and Scotland however rain occurred locally on the 22nd and 24th and temperature remained only slightly above normal in Scotland (except the south-west), Ireland and the north-east coast of England. Thunderstorms were experienced in north Wales on the 23rd, when 2·70 in. of rain fell at Waenfawr (Carnarvon) and also in Scotland and north-west England on the 24th. On the 25th the depression over the Bay of Biscay moved northwards and severe thunderstorms accompanied by heavy rain occurred over a wide area in south England and the Midlands* bringing the very warm spell to a close. The weather, however, continued warm and sunny except in Scotland and Ireland on the 26th and 27th when slight rain fell there. On the 29th and 30th there was a return to high temperatures and 80° F. was again exceeded locally. From the 20th onwards much sun was registered on most days all over the country, among the largest amounts being 15·6 hrs. at Valentia on the 23rd and Torquay on the 28th, 15·5 hrs. at Nottingham and Norwich on the 24th and 15·4 hrs. at Norwich on the 23rd, at Mablethorpe on the 24th and Nairn on the 29th. The distribution of bright sunshine for the month was as follows :—

* See p. 143.

Diff. from			Diff. from		
	Total	normal		Total	normal
	(hrs.)	(hrs.)		(hrs.)	(hrs.)
Stornoway ...	175	+ 7	Liverpool ...	178	-26
Aberdeen ...	136	-45	Ross-on-Wye ...	181	-29
Dublin ...	172	-14	Falmouth ...	179	-43
Birr Castle ...	148	-13	Gorleston ...	235	+27
Valentia... ..	166	-10	Kew	207	+ 8

Miscellaneous notes on weather abroad culled from various sources.

Four people were killed by lightning during a thunderstorm in which hail destroyed crops over a wide area around Ruschuk (Bulgaria) on the 7th. A violent hailstorm broke over Paris on the evening of the 14th, some of the hailstones being the size of shrapnel bullets. Two men were killed in a storm which broke over Milan and the surrounding country on the 15th, when much damage was done at Stresa and Pallanza. During the last week a heat wave was experienced over central and southern Europe, 99° F. was recorded at Munich and Breslau on the 27th. Many people, mostly field labourers, died of the heat in northern Italy. Forest fires occurred in the forests of Fonlade (south France) on the 29th and 30th. The rapid melting of the snows and glaciers in the heat caused serious flooding in the Rhone Valley, where the dykes burst in two places (*The Times*, June 8th-July 2nd, and the *British Daily Weather Report*).

Heavy floods occurred round Durban on the 13th almost isolating the city and the harbour was closed (*The Times*, June 14th).

At the beginning of the month the monsoon was affecting Burma and Assam only, but on the 14th it broke on Bombay with a severe thunderstorm, some parts of the city having over 3 in. of rain. Torrential rain amounting to 10 in. fell in Bombay on the 18th and 19th. During the rest of the month the monsoon continued active and heavy rain fell in Bombay, Deccan and Malabar, and general rain in central India, the Central Provinces and Berars. Very heavy rain occurred in south-west Japan on the 28th and 29th; at Kyoto nearly 15 in. of rain is said to have fallen between 11 p.m. on the 28th and 2 p.m. on the 29th, the rivers became torrents and 515 bridges were washed away, 90 people were drowned, and 190,000 houses flooded (*The Times*, June 7th-July 2nd).

Much damage to telegraph wires was done by heavy snow in New Zealand early in the month; later, moderate to heavy rain was general. Excessive rain occurred in Victoria about the middle of the month and light and scattered showers generally in Western and South Australia, but dry conditions continued in New South Wales. Useful rains of from 1 to 2 in. fell in the pastoral districts of South Australia at the end of the month (*The Times*, June 11th-July 2nd).

In central Canada the month was generally wet but rain was needed in parts of Alberta and Saskatchewan late in the month; elsewhere in these two provinces slight damage from hailstones occurred. The floods in Nebraska were subsiding by the 3rd, but

the floods in Kansas and Missouri were still spreading on the 5th. Renewed floods due to heavy rain occurred in Kansas and Arkansas about the 23rd; four people were drowned and several bridges washed away. Fog was experienced locally off the east coast of North America. In the United States two warm spells passed across the eastern United States during the month but temperature in the Mountain Region and on the Pacific Coasts was mainly above normal throughout. Rainfall was variable in distribution (*The Times*, June 5th-27th, and *Washington, D.C., U.S. Dept. Agric., Weekly Weather and Crop Bulletin*).

Daily Readings at Kew Observatory, June, 1935

Date	Pressure, M.S.L. 13h.	Wind, Dir., Force 13h.	Temp.		Rel. Hum. 13h.	Rain.	Sun.	REMARKS. (see vol. 69, 1934, p. 1).
			Min.	Max.				
	mb.		°F	°F	%	in.	hrs.	
1	1013.8	S.2	51	65	71	0.04	1.9	
2	1006.9	SSW.4	53	65	69	0.10	5.0	r ₀ -r 0h.-3h.
3	1007.0	WSW.4	50	62	68	0.10	7.4	t 12h: 15m., prh 15h.
4	1005.2	SSW.4	51	61	65	0.02	1.1	r-r ₀ 5h.-6h.
5	999.3	SSW.3	50	64	69	0.39	2.5	r 6h.-9h., t 14h. &
6	1001.1	SW.4	51	62	63	0.13	2.1	ir ₀ -r 15h.-24h. [20h.
7	1003.4	SW.6	55	63	60	0.16	4.7	r ₀ -r 0h.-10h.
8	1015.7	W.4	53	63	54	—	10.7	
9	1019.2	S.3	42	68	50	—	9.7	
10	1007.4	SW.3	55	69	73	0.56	2.0	TLR 2h.-6h.
11	1005.7	SW.5	54	63	59	0.06	5.2	pr 9h., r ₀ 16h.-18h.
12	1011.1	SW.4	51	65	76	Trace	7.3	pr ₀ 9h. & 13h.
13	1012.8	SW.4	53	66	52	0.08	9.1	ir-r ₀ 1h.-7h.
14	1009.9	SW.4	53	66	55	0.11	3.5	pr early, r 17h.-20h.
15	1006.1	SW.1	49	63	77	0.19	3.9	prht 10h.-14h.
16	1007.4	W.3	50	63	69	0.31	10.0	r ₀ early, TLRh 13h.
17	1013.5	SW.3	51	66	58	0.15	5.0	ir ₀ -r 19h.-24h.
18	1010.0	SW.4	53	67	76	0.05	3.1	r ₀ early, pr 12h.
19	1021.0	SW.2	54	68	69	0.02	1.0	r ₀ early, r ₀ 22h.-24h.
20	1016.5	SSW.3	58	62	87	0.10	0.0	r ₀ 3h.-6h., 12h. & 16h
21	1019.1	SE.3	59	77	74	—	6.4	
22	1018.7	SE.3	57	84	52	—	13.6	
23	1019.7	E.3	63	81	36	—	13.9	
24	1013.9	E.4	64	84	43	—	14.4	
25	1009.7	S.4	66	82	84	0.79	6.1	TLRh 13h.-15h.
26	1015.6	SW.4	62	74	61	—	13.5	
27	1020.9	SW.4	61	70	75	—	2.0	
28	1030.1	WNW.2	53	78	61	—	14.4	
29	1026.4	E.2	57	80	45	—	13.7	
30	1019.6	E.3	60	78	42	—	13.3	
*	1012.9		55	69	63	3.37	6.9	* Means or totals.

General Rainfall for June, 1935.

England and Wales	...	149	} per cent. of the average 1881-1915.
Scotland	...	146	
Ireland	...	196	
British Isles	...	158	

Rainfall : June, 1935 : England and Wales

Co.	STATION.	In.	Per cent of Av.	Co.	STATION.	In.	Per cent of Av.
<i>London</i>	Camden Square.....	2.81	139	<i>Leics</i>	Thornton Reservoir ...	3.31	153
<i>Sur</i>	Reigate, Wray Pk. Rd..	4.90	235	"	Belvoir Castle.....	2.57	135
<i>Kent</i>	Tenterden, Ashenden...	2.08	109	<i>Rut</i>	Ridlington	2.96	154
"	Folkestone, Boro. San.	2.39	...	<i>Lincs</i>	Boston, Skirbeck.....	2.12	116
"	Eden'bdg., Falconhurst	2.92	133	"	Cranwell Aerodrome...	1.76	105
"	Sevenoaks, Speldhurst.	2.36	...	"	Skegness, Marine Gdns.	1.87	104
<i>Sus</i>	Compton, Compton Ho.	3.96	159	"	Louth, Westgate.....	2.02	93
"	Patching Farm.....	2.69	133	"	Brigg, Wrawby St.....	2.64	...
"	Eastbourne, Wil. Sq....	1.88	102	<i>Notts</i>	Worksop, Hodsock.....	3.42	173
"	Heathfield, Barklye....	2.44	116	<i>Derby</i>	Derby, L. M. & S. Rly.	2.83	126
<i>Hants</i>	Ventnor, Roy.Nat.Hos.	2.34	128	"	Buxton, Terr. Slopes...	5.17	161
"	Fordingbridge, Oaklands	5.34	289	<i>Ches</i>	Runcorn, Weston Pt....	4.41	171
"	Ovington Rectory.....	4.50	194	<i>Lancs</i>	Manchester, Whit. Pk.	3.21	121
"	Sherborne St. John.....	4.84	227	"	Stonyhurst College.....	3.73	121
<i>Herts</i>	Royston, Therfield Rec.	2.61	116	"	Southport, Bedford Pk.	3.55	163
<i>Bucks</i>	Slough, Upton.....	3.90	189	"	Lancaster, Greg Obsy.	4.13	161
"	H. Wycombe, Flackwell	4.16	207	<i>Yorks</i>	Wath-upon-Deane.....	2.08	94
<i>Oxf</i>	Oxford, Mag. College...	4.11	193	"	Wakefield, Clarence Pk.	2.09	97
<i>Nor</i>	Wellingboro, Swanspool	3.02	144	"	Oughtershaw Hall.....	4.58	...
"	Oundle	3.20	...	"	Wetherby, Ribston H..	...	...
<i>Beds</i>	Woburn, Exptl. Farm...	1.95	100	"	Hull, Pearson Park.....	2.14	104
<i>Cam</i>	Cambridge, Bot. Gdns.	2.10	100	"	Holme-on-Spalding.....	2.57	117
<i>Essex</i>	Chelmsford, County Lab	3.49	184	"	West Witton, Ivy Ho.	3.20	157
"	Lexden Hill House.....	3.32	...	"	Felixkirk, Mt. St. John.	3.37	154
<i>Suff</i>	Haughley House.....	2.82	...	"	York, Museum Gdns....	2.38	115
"	Campsea Ashe.....	2.64	140	"	Pickering, Hungate.....	4.05	191
"	Lowestoft Sec. School...	2.01	111	"	Scarborough.....	2.04	111
"	Bury St. Ed., Westley H.	3.09	147	"	Middlesbrough.....	2.69	142
<i>Norf.</i>	Wells, Holkham Hall...	2.65	135	"	Baldersdale, Hury Res.	...	...
<i>Wilts</i>	Calne, Castle Walk.....	4.36	...	<i>Durh</i>	Ushaw College.....	3.00	72
"	Porton, W.D. Exp'l. Stn	4.12	213	<i>Nor</i>	Newcastle, Town Moor.	2.52	116
<i>Dor</i>	Evershot, Melbury Ho.	5.04	221	"	Bellingham, Highgreen	4.01	174
"	Weymouth, Westham.	3.39	190	"	Lilburn Tower Gdns....	3.61	174
"	Shaftesbury, Abbey Ho.	2.54	109	<i>Cumb</i>	Carlisle, Scaleby Hall...	4.17	165
<i>Devon</i>	Plymouth, The Hoe....	4.10	190	"	Borrowdale, Seathwaite	9.00	148
"	Holne, Church Pk. Cott.	7.12	248	"	Borrowdale, Moraine...	6.57	135
"	Teignmouth, Den Gdns.	3.95	201	"	Keswick, High Hill.....	4.54	156
"	Cullompton	3.66	173	<i>West</i>	Appleby, Castle Bank...	3.22	141
"	Sidmouth, U.D.C.....	3.60	...	<i>Mon</i>	Abergavenny, Larchf'd	4.61	189
"	Barnstaple, N. Dev. Ath	2.63	117	<i>Glam</i>	Ystalyfera, Wern Ho....	7.74	205
"	Dartm'r, Cranmere Pool	7.00	...	"	Cardiff, Ely P. Stn.....	3.68	148
"	Okehampton, Uplands.	5.28	191	"	Treherbert, Tynywaun.	9.82	...
<i>Corn</i>	Redruth, Trewrigie.....	3.33	134	<i>Carm</i>	Carmarthen, The Friary	5.26	183
"	Penzance, Morrab Gdn.	3.09	139	<i>Pemb</i>	Haverfordwest, Portfld.	...	...
"	St. Austell, Trevarna...	3.79	146	<i>Card</i>	Aberystwyth	7.37	...
<i>Soms</i>	Chewton Mendip.....	4.17	141	<i>Rad</i>	Birm W.W. Tyrmynydd	5.91	180
"	Long Ashton.....	4.20	166	<i>Mont</i>	Lake Vyrnwy	5.58	177
"	Street, Millfield.....	3.95	185	<i>Flint</i>	Sealand Aerodrome.....	2.76	130
<i>Glos</i>	Blockley	3.33	...	<i>Mer</i>	Dolgelley, Bontddu.....	8.32	239
"	Cirencester, Gwynfa....	3.93	164	<i>Carn</i>	Llandudno	2.57	135
<i>Here</i>	Ross, Birchlea.....	3.35	154	"	Snowdon, L. Llydaw 9..	17.11	...
<i>Salop</i>	Churoh Stretton.....	3.34	138	<i>Ang</i>	Holyhead, Salt Island...	3.30	153
"	Shifnal, Hatton Grange	2.45	110	"	Lligwy	4.93	...
<i>Staffs</i>	Market Drayt'n, Old Sp.	2.71	111	<i>Isle of Man</i>			
<i>Worc</i>	Ombersley, Holt Lock.	2.20	97		Douglas, Boro' Cem....	3.96	160
<i>War</i>	Alcester, Ragley Hall...	3.77	165	<i>Guernsey</i>			
"	Birmingham, Edgbaston	2.35	101		St. Peter P't. Grange Rd.	3.64	197

Rainfall : June, 1935 : Scotland and Ireland

Co.	STATION.	In.	Per cent of Av.	Co.	STATION.	In.	Per cent of Av.
<i>Wig</i>	Pt. William, Monreith.	3·18	135	<i>Suth</i>	Melvich.....	2·32	120
"	New Luce School.....	3·74	129	"	Loch More, Achfary....	2·95	80
<i>Kirk</i>	Dalry, Glendarroch.....	...	...	<i>Caith</i>	Wick.....	·92	51
"	Carsphairn, Shiel.....	7·14	179	<i>Ork</i>	Deerness.....	1·53	83
<i>Dumf.</i>	Dumfries, Crichton, R.I.	4·45	186	<i>Shet</i>	Lerwick.....	1·78	100
"	Eskdalemuir Obs.....	5·29	168	<i>Cork</i>	Caheragh Rectory.....	6·61	...
<i>Roab</i>	Bransholm.....	...	...	"	Dunmanway Rectory...	7·33	209
<i>Selk</i>	Ettrick Manse.....	4·56	126	"	Cork, University Coll...	5·31	210
<i>Peeb</i>	West Linton.....	3·12	...	"	Ballinacurra.....	5·34	204
<i>Berw</i>	Marchmont House.....	4·11	178	"	Mallow, Longueville....	...	...
<i>E.Lot.</i>	North Berwick Res....	2·95	178	<i>Kerry</i>	Valentia Obsy.....	8·16	255
<i>Midl</i>	Edinburgh, Roy. Obs.	2·15	107	"	Gearhameen.....	9·90	198
<i>Lan</i>	Auchtyfardle.....	3·89	...	"	Darrynane Abbey.....	7·50	238
<i>Ayr</i>	Kilmarnock, Kay Pk....	3·95	...	<i>Wat</i>	Waterford, Gortmore...	4·81	184
"	Girvan, Pinmore.....	3·49	121	<i>Tip</i>	Nenagh, Cas. Lough....	5·15	210
<i>Renf</i>	Glasgow, Queen's Pk....	5·56	240	"	Roscrea, Timoney Park	7·73	...
"	Greenock, Prospect H.	3·42	104	"	Cashel, Ballinamona....	7·24	134
<i>Bute</i>	Rothsay, Ardenraig...	3·96	...	<i>Lim</i>	Foynes, Coolnanes.....	4·51	175
"	Dougarie Lodge.....	3·63	...	"	Castleconnel Rec.....	5·50	...
<i>Arg</i>	Ardgour House.....	6·86	...	<i>Clare</i>	Inagh, Mount Callan....	6·01	...
"	Glen Etive.....	7·05	150	"	Broadford, Hurdlest'n.	5·49	...
"	Oban.....	3·32	...	<i>Wezf</i>	Gorey, Courtown Ho....	5·34	220
"	Poltalloch.....	4·33	145	<i>Wick</i>	Rathnew, Clonmannon.	3·94	...
"	Inveraray Castle.....	6·85	173	<i>Carl</i>	Hacketstown Rectory...	4·62	165
"	Islay, Eallabus.....	...	...	<i>Leiz</i>	Blandsfort House.....	5·60	216
"	Mull, Benmore.....	4·20	53	"	Mountmellick.....	5·68	...
"	Tiree.....	2·12	83	<i>Offaly</i>	Birr Castle.....	4·78	207
<i>Kinr</i>	Loch Leven Sluice.....	2·89	132	<i>Dublin</i>	Dublin, FitzWm. Sq....	2·27	116
<i>Perth</i>	Loch Dhu.....	...	...	"	Balbriggan, Ardgillan...	3·58	178
"	Balquhider, Stronvar.	5·26	...	<i>Meath</i>	Beauparc, St. Cloud....	4·24	...
"	Crieff, Strathearn Hyd.	6·85	259	"	Kells, Headfort.....	3·98	150
"	Blair Castle Gardens...	5·98	302	<i>W.M.</i>	Moate, Coolatore.....	4·85	...
<i>Angus</i>	Kettins School.....	3·43	165	"	Mullingar, Belvedere...	6·34	244
"	Pearsie House.....	3·44	...	<i>Long</i>	Castle Forbes Gdns.....	4·39	170
"	Montrose, Sunnyside...	3·89	234	<i>Gal</i>	Galway, Grammar Sch.	5·35	...
<i>Aber</i>	Braemar, Bank.....	2·91	148	"	Ballynahinch Castle....	10·54	298
"	Logie Coldstone Sch....	3·05	156	"	Ahascragh, Clonbrock.	5·48	196
"	Aberdeen, King's Coll.	4·23	247	<i>Mayo</i>	Blacksod Point.....	5·64	202
"	Fyvie Castle.....	2·21	105	"	Mallaranny.....	6·99	...
<i>Moray</i>	Gordon Castle.....	1·54	75	"	Westport House.....	5·80	215
"	Grantown-on-Spey.....	2·70	120	"	Delphi Lodge.....	10·78	187
<i>Nairn</i>	Nairn.....	2·78	158	<i>Sligo</i>	Markree Obsy.....	4·89	166
<i>Inw's</i>	Ben Alder Lodge.....	3·43	...	<i>Cavan</i>	Crossdoney, Kevit Cas..	3·83	...
"	Kingussie, The Birches.	4·69	...	<i>Ferm</i>	Enniskillen, Portora....	4·64	...
"	Inverness, Culduthel R.	3·37	...	<i>Arm</i>	Armagh Obsy.....	4·09	162
"	Loch Quoich, Loan.....	2·67	...	<i>Down</i>	Fofanny Reservoir.....	7·93	...
"	Glenquoich.....	5·93	121	"	Seaforde.....	4·73	172
"	Arisaig, Faire-na-Sguir	3·03	...	"	Donaghadee, C. Stn....	3·50	150
"	Fort William, Glasdrum	...	...	"	Banbridge, Milltown....	3·13	122
"	Skye, Dunvegan.....	4·67	...	<i>Antr</i>	Belfast, Cavehill Rd....	5·59	...
"	Barra, Skallary.....	2·78	...	"	Aldergrove Aerodrome.	3·75	156
<i>R&C</i>	Alness, Ardrross Castle.	4·80	212	"	Ballymena, Harryville.	4·20	144
"	Ullapool.....	2·66	113	<i>Lon</i>	Garvagh, Moneydig....	5·19	...
"	Achnashellach.....	2·72	69	"	Londonderry, Creggan.	5·12	182
"	Stornoway.....	2·66	115	<i>Tyr</i>	Omagh, Edenfel.....	4·45	158
<i>Suth</i>	Lairg.....	2·94	141	<i>Don</i>	Malin Head.....	3·19	...
"	Tongue.....	2·95	144	"	Killybegs, Rockmount.	4·97	...

Climatological Table for the British Empire, January, 1935

STATIONS.	PRESSURE.		TEMPERATURE.							Mean Cloud Am't	PRECIPITATION.			BRIGHT SUNSHINE.			
	Mean of Day M.S.L.	Diff. from Normal.	Absolute.		Mean Values.			Mean.	Wet Bulb.		Rela- tive Hum- idity.	Am't.	Diff. from Normal.	Days.	Hours per day.	Per- cent- age of possi- ble.	
			Max.	Min.	Max.	Min.	1 Max. and 2 Min.										Diff. from Normal
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	%	in.	in.					
London, Kew Obey...	1024.9	+ 7.3	54	27	44.8	37.4	41.1	+ 2.2	38.7	87	0.89	0.87	13	1.5	17		
Gibraltar.....	1020.2	+ 1.3	66	35	59.8	46.9	53.3	- 1.6	46.6	76	2.36	2.28	8	...	...
Malta.....	1013.6	- 3.4	60	42	54.7	46.3	50.5	- 4.8	46.0	72	5.20	1.99	26	4.6	47		
St. Helena.....	1011.2	- 0.4	74	58	69.4	61.0	65.2	+ 1.2	62.4	93	1.76	...	13	...	...
Freetown, Sierra Leone.....	1013.3	+ 2.5	90	67	86.2	72.9	79.5	- 1.8	73.6	79	0.80	0.39	4	...	...
Lagos, Nigeria.....	1010.1	+ 0.5	93	67	87.5	74.2	80.9	+ 0.6	73.8	87	0.00	1.04	0	6.5	56		
Kaduna, Nigeria.....	1009.2	...	104	48	91.1	56.9	74.0	+ 0.6	55.1	43	0.00	0.00	0	9.1	79		
Zomba, Nyasaland.....	1008.8	+ 1.4	86	58	78.2	64.2	71.2	- 1.6	67.9	82	8.5	7.39	23	...	...
Salisbury, Rhodesia.....	1009.7	+ 1.0	84	53	77.7	59.2	68.5	- 1.2	62.8	73	6.8	4.54	15	5.8	44		
Cape Town.....	1013.5	+ 0.1	98	50	81.3	62.1	71.7	+ 1.8	62.6	63	0.35	0.33	5	...	...
Johannesburg.....	1009.0	+ 0.1	88	51	80.7	56.5	68.6	+ 1.9	58.5	61	4.0	3.45	10	9.0	66		
Mauritius.....	1011.3	+ 0.6	92	68	86.2	72.7	79.4	+ 0.1	75.0	70	5.7	3.52	21	8.2	62		
Calcutta, Alipore Obsy.....	1016.4	+ 1.2	85	48	76.6	55.7	66.1	- 0.5	56.2	86	1.8	0.12	1*	...	...
Bombay.....	1014.0	+ 0.4	91	53	82.0	65.0	73.5	- 2.0	62.2	67	2.4	0.00	0*	...	...
Madras.....	1014.2	+ 0.1	85	63	83.1	69.1	76.1	- 0.1	70.6	83	5.6	0.57	2*	...	...
Colombo, Ceylon.....	1011.6	+ 0.8	90	67	86.8	72.1	79.5	- 0.0	74.0	73	5.2	2.56	5	8.0	68		
Singapore.....	1010.9	+ 0.5	89	70	86.0	73.4	79.7	- 0.0	75.2	80	8.0	6.17	9	6.2	52		
Hongkong.....	1019.6	- 0.1	76	47	64.3	56.8	60.5	+ 0.3	56.1	78	8.2	0.23	8	3.4	31		
Sandakan.....	1011.3	...	89	70	85.8	74.3	80.1	+ 0.3	76.2	83	7.5	4.16	19	...	...
Sydney, N.S.W.....	1009.3	- 3.1	102	56	77.8	64.3	71.1	- 0.5	66.2	68	7.1	0.61	10	6.4	45		
Melbourne.....	1010.9	- 2.0	104	51	75.8	56.4	66.1	- 1.3	58.1	60	6.4	3.91	11	8.1	56		
Adelaide.....	1012.8	- 0.2	108	52	82.5	58.0	70.3	- 3.6	58.8	39	4.8	0.78	5	9.3	66		
Perth, W. Australia.....	1011.9	- 0.6	106	55	85.7	63.7	74.7	+ 0.9	62.3	51	4.4	0.18	4	10.4	75		
Coolgardie.....	1010.7	- 0.8	111	51	91.4	61.3	76.3	- 1.1	65.6	59	2.7	0.66	3	...	...
Brisbane.....	1009.3	- 2.0	95	61	86.6	68.5	77.5	+ 0.3	71.1	65	5.5	0.70	10	9.5	70		
Hobart, Tasmania.....	1006.6	- 3.7	79	47	69.0	53.8	61.4	- 0.6	54.3	59	7.0	1.05	15	6.9	46		
Wellington, N.Z.....	1010.5	- 2.8	81	50	73.5	59.6	66.5	+ 4.0	61.2	69	6.5	1.46	9	8.6	58		
Suva, Fiji.....	1006.8	- 0.7	88	71	84.4	74.5	79.5	- 0.4	75.3	86	7.8	10.94	25	5.7	44		
Apia, Samoa.....	1007.1	- 0.8	87	72	83.1	74.3	78.7	- 0.3	75.8	85	9.2	23.83	27	2.7	21		
Kingston, Jamaica.....	1014.4	- 0.7	89	61	84.1	66.6	75.3	- 1.5	64.5	81	3.3	0.95	3	4.5	40		
Grenada, W.I.....	...	...	85	71	83	72	77.5	+ 0.4	73	74	4	3.11	16	...	...
Toronto.....	1021.6	+ 3.7	46	-11	28.2	13.3	20.7	- 1.5	17.9	70	6.8	0.17	18	2.3	25		
Winnipeg.....	1024.0	+ 3.1	28	-43	1.6	-16.9	-7.7	- 3.8	...	...	5.9	0.70	15	2.3	27	
St. John, N.B.....	1017.4	+ 1.9	45	-18	23.6	6.5	15.1	- 4.1	10.9	79	5.8	1.96	8	3.8	41		
Victoria, B.C.....	1012.3	- 3.7	56	10	42.5	35.0	38.7	- 0.3	36.5	91	7.9	7.75	20	1.7	19		

* For Indian stations a rain day is a day on which 0.1 in. or more rain has fallen.



FLOODS IN JORDAN VALLEY NEAR ALLENBY BRIDGE,
FEBRUARY 6TH, 1935.

R.A.F.