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The Weather of April, 1936

After the fine mild weather of the early part of April, Easter, 1936 was a great disappointment to holiday-makers. Apart from a small depression which crossed England on the 1st and 2nd, the first eleven days gave anticyclonic conditions over the whole country. It is true that the centre of the anticyclone during most of this period lay to the north or west of England, but the barometric gradient was slight, and the coolness of the northerly or north-easterly winds was more than counterbalanced by the absence of rain, and towards the end of the fine spell by a sufficiency of sunshine. On the 9th and 10th, conditions over this country were definitely anticyclonic. April 10th, Good Friday, gave very pleasant weather over most of the country. The average pressure distribution for April 1st-11th shows pressure above 1,015 mb. over the whole of the British Isles except Cornwall and the Scilly Isles, and exceeding 1,020 mb. over northern Ireland and most of Scotland.

After the 10th the anticyclone retreated steadily northwards, and two depressions which had lain over the Atlantic south-west of Ireland and over eastern Europe united to form a trough of low pressure over the southern half of England. Weather deteriorated rapidly, and Easter Sunday and Monday were characterised by cold showery conditions, with snow in many places, including London. As early as Saturday afternoon fairly heavy snow fell in parts of Kent, Surrey and Sussex, and impeded motor traffic. Monday was

English Channel. On the 24th a more normal distribution of pressure returned, and a depression south-west of Iceland brought south-westerly winds and milder weather to the British Isles. During the last few days of the month the Azores anticyclone spread north-eastwards over England and brought a welcome period of fine, warm and sunny days.

For the month as a whole the distribution of pressure was not very abnormal. Pressure was slightly above the average over the whole of the British Isles, the excess increasing north-westwards towards Iceland, where it reached 4.3 mb. at Reykjavik. On the other hand the Baltic showed a negative departure reaching 4.6 mb. at Skagen, and the chart for the whole month shows the tendency for northerly winds. Over the greater part of the North Atlantic pressure was almost normal.

The wintry weather of the middle part of the month extended over a large part of central Europe, and on the 17th, a party of 27 London schoolboys were caught in a heavy snowstorm and fog in the Black Forest, and five of them lost their lives. At the time, the Black Forest lay in an unstable and disturbed current of air from the north and north-west on the western side of a deep depression centred near Prague, but the storm appears to have come up suddenly and to have been unusually severe.

The Investigation of Fog and Mist in Winter

With the growth of aviation and the consequent demand for aerodromes in many parts of the country, it is a matter of great moment that sufficient data should be available on which to found opinions as to the suitability of aerodrome sites. These opinions moreover must, among other factors, take into account local variations in fog, which is the worst obstacle to the regular working of aircraft.

It is common experience that the incidence of fog is very variable from place to place. There are, of course, some days on which fog is widespread and envelops whole districts of the country in its pall, but on other occasions a motorist, for example, may encounter a patch where visibility is appreciably worse than it is 5 or 10 miles further on. That these patches of poor visibility do not occur haphazard is well known, often they lie over a valley with better visibility on the higher ground, sometimes they may be ascribed to the smoke of industrial areas. From the lie of the land and its relation to centres of smoke production it is possible from our present knowledge to give a rough estimate of whether any particular place is more liable to fogs than its general surroundings, but in consideration of the complexity of the problem the data available are scanty.

To rectify this lack of data an appeal was made to rainfall observers, and as a result about 950 offers to co-operate in a special investigation

have been received. The form that the observations for this investigation take is as follows:—Each observer records at about 9 a.m. every day during the winter months which is the furthest of three objects that he can see; the three objects are at distances of about 220 yards, 1,100 yards and 2,200 yards—distances which correspond to the definitions of thick fog, fog and mist respectively. Each observer is also asked to fill in a questionnaire giving particulars of the topography of the observation point in relation to rivers, towns and also soil.

These observations are asked for at 9 a.m., because that is the time at which visibility is usually worst in the winter months, as is seen from Fig. 1 which shows the variation in frequency with which

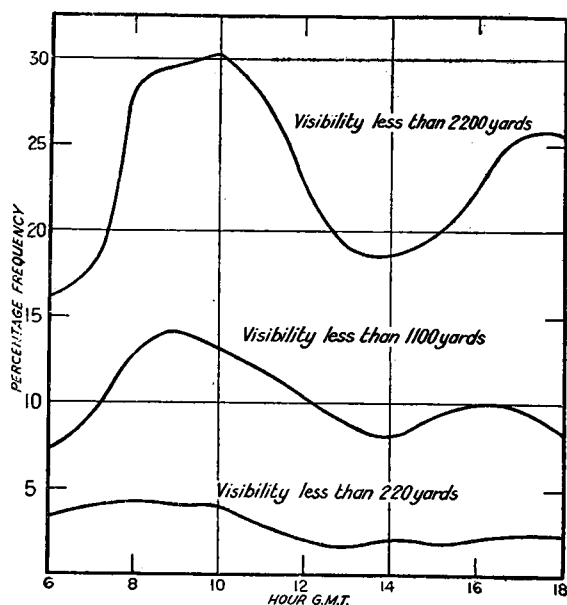


FIG. 1.

objects at 220 yards, 1,100 yards and 2,200 yards were visible at Croydon at various hours in winter. The investigation is also confined to winter since fog is comparatively rare at inland places in summer, and when it does occur its incidence is in the very early mornings. In the spring and summer fogs do occur over the sea and sometimes in those months these fogs drift a short way inland, but the investigation of fogs of that nature would have to follow a different line from that of the winter fogs.

At a number of key stations which have sent in climatological summaries for a period of years the normal frequency of fogs is known. The new data now collected will be dealt with statistically, in the first instance, by counting up the number of days with thick fog, fog and mist at each place and comparing these numbers with those of the key stations. By this means it will be possible to obtain approximate values of the normal frequency of fogs for all the new stations even though observations are made over one winter.

It will moreover be possible with these data to obtain an insight into the effect on fog frequency of height above the surrounding country by comparing stations in various types of topography. Similarly, by choosing out days with certain wind directions, it may be possible to find out more precisely than is at present known how

far away from a town the visibility is affected seriously by its smoke, and finally, by comparing sites with similar types of topography but different soils, it may be possible to learn definitely how far the type of soil affects the prevalence of fog.

When these questions have been solved, it will be possible by examining the lie of the land at any place, even though observations have not been made at it, and by comparing its topography with that of other places where observations of fog are available, to deduce fairly accurately how often fog is likely to occur at that particular spot.

C. S. DURST

Wet- and Dry-Bulb Hygrometry

In meteorological practice the accurate measurement of atmospheric humidity is made by means of wet- and dry-bulb thermometers, and in particular by means of an Assmann ventilated psychrometer. The "Dictionary of Applied Physics" (Vol. 3, p. 424) gives a curve in effect relating the depression of the wet bulb with the velocity of aspiration past the wet bulb which shows the depression increasing with velocity until a velocity of about 5 m/sec. is reached, when the depression becomes constant. Less than half this velocity is obtained with the Assmann psychrometer using a clockwork driven aspirating fan, and further, the velocity depends on the extent to which the motor is wound. Obviously, therefore, this instrument cannot yield thoroughly reliable measurements of humidity unless very great precautions are taken. This was confirmed by Best* who made comparisons between such instruments and a psychrometer with an electrically driven fan (velocity of aspiration 5.1 m/sec.) as now marketed by Casella. An electrically operated psychrometer is not always suitable for use in the open however, needing as it does a conveniently placed electric supply "point".

A recent paper by Simons† on the determination of low relative humidities by means of wet and dry thermocouples has led the writer to some considerations on psychrometry which may be of general interest and assist in a better experimental determination of humidities.

As far as the writer can discover from a search in the literature of the subject it does not seem to have been appreciated fully that it is not merely the velocity of aspiration which determines the amount of the wet-bulb depression but also the ratio of the surface area of the bulb to its volume. There is no adequate theory of evaporation to apply in a detailed way to the ventilated wet bulb, but certain factors are of obvious importance. For a constant humidity and velocity of aspiration below the critical it seems clear

* A. C. Best, *London Quart. J. R. met. Soc.* 56, 1930, pp. 365-73.

† A. Simons, *London, Proc. phys. Soc.*, 48, 264, 1936, pp. 135-44.

that the depression must be very nearly proportional to the surface area of the bulb, except in the region of maximum depression—the greater the surface exposed to the air stream the greater will be the quantity of water evaporated—and inversely proportional to the volume of the bulb, i.e., to the heat capacity of the bulb for a given thermometric liquid. Now for a cylindrical or spherical bulb the ratio of the surface area to volume is inversely proportional to the diameter d . Hence the smaller the bulb the greater this ratio becomes and the less the velocity of aspiration required to produce the maximum wet-bulb depression.

In support of these conclusions the figures already referred to in the "Dictionary of Applied Physics" and the results of Simons (loc. cit.) may be considered. The Assmann psychrometer (either as originally used by Assmann or the Casella pattern) is fitted with thermometers whose bulbs are about 5mm. diameter. Simons' thermocouple elements were made of 0.063 mm. diameter wire, and the values of $1/d$ for the Assmann and thermocouple elements are in the ratio of 0.013 : 1. Taking 5 m/sec. as the critical velocity for the Assmann the above argument would suggest a critical velocity of about 6 cm./sec. for the thermocouple. Simons actually found the critical velocity to be about 2 cm./sec. !

In general it is probably not desirable to replace mercury-in-glass thermometers by thermocouples, but two recommendations seem to be worth making :—

(1) That the present thermometers in use in Assmann clockwork psychrometers be replaced by others with finer bulbs of about 2 mm. diameter, say, so that the velocity of aspiration obtainable with the clockwork driven fan would be about sufficient to give the maximum depression. Errors due to conduction down the stem should be negligible.

(2) For humidity measurements of precision from apparatus to be used in a Stevenson Screen, wet and dry thermocouples might be used, for the air flow through screens is rather indeterminate and the appropriate factor to use in the humidity formula on any occasion is by no means certain when mercury-in-glass thermometers are used. Apart from periods of complete calm there would, however, be a constant factor to apply in the case of a small thermocouple.

With respect to (1) above, it may be noted that the thermometers supplied with Casella's Sling Psychrometers have bulbs approximately 2 mm. diameter and these instruments were shown by Best (loc. cit.) to give quite accurate measurements of humidity. Assuming a whirling rate of 3 rev./sec. and a radius of action of the bulb of 15 cm., the "aspiration" velocity is about $2\frac{1}{2}$ m./sec. which should be sufficient to produce maximum depression for the size of bulb. There should be no difficulty in obtaining a thermometer of similar bulb size for use in the Assmann psychrometer.

P. A. SHEPPARD.

OFFICIAL PUBLICATION

The following publication has recently been issued :—

PROFESSORIAL NOTES

No. 70. *Observations of the blueness of the sky.* By J. S. Farquharson, M.A. (M.O. 336j.)

Observations of the blueness of the sky were made three times daily by means of a scale of standard tints devised by F. Linke, for 2 years at Cattewater (Plymouth) and Croydon and for $4\frac{1}{2}$ years at Cranwell. The greatest blueness of the sky is found at Cattewater, the least at Croydon, and this is attributed to the greater atmospheric pollution due to smoke at Croydon. The diurnal variation shows a maximum blueness at midday, especially in winter; at Croydon and Cranwell the sky is bluer in summer than in winter, but at Cattewater the greatest blueness occurs in spring.

Royal Meteorological Society

The monthly meeting of this Society was held on Wednesday, April 22nd, at 49, Cromwell Road, South Kensington, Dr. F. J. W. Whipple, F.Inst.P., President, in the Chair.

The following papers were read and discussed :—

L. H. G. Dines, M.A.—*A form of apparatus for obtaining samples of the atmosphere from great heights.*

The paper describes an apparatus which has been evolved by the Upper Air Section of Kew Observatory, in conjunction with Professor F. Paneth and Dr. E. Glückauf, of the Royal College of Science, for obtaining samples of the atmosphere from great heights for subsequent analysis of the helium content of the air. The instrument is raised by means of a free sounding balloon, and all relevant dimensions and details are given. The mode of operation is described.

E. W. Hewson, M.A.—*The application of wet-bulb potential temperature to air mass analysis.*

The horizontal component of the motion of air has been traced by means of upper wind observations, and the vertical component found by the use of wet-bulb potential temperatures. Knowing therefore the trajectory of the air, it has been possible to make an accurate study of the changes in the humidity mixing ratio x . Several situations have been investigated by this method, and independent checks confirm the accuracy of the results obtained by it. A discussion of the possible magnitude of the errors involved is given.

W. E. Knowles Middleton.—*The apparent colour of lights at night; with an observation of "blue fog."*

On the basis of the Commission Internationale de l'Eclairage (1931) colour metric, an expression is developed for the colour co-ordinates and luminosity of a given light-source seen at night through an atmosphere of known optical properties. This is applied

to an observation on a mercury vapour lamp in a highly selective haze of the type sometimes called "blue fog."

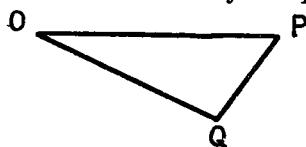
A meeting of the Royal Meteorological Society will be held at Edinburgh on Wednesday, September 16th, on the occasion of the assembly of the International Union of Geodesy and Geophysics at Edinburgh. It is anticipated that there will be addresses by Prof. F. Linke on "Moving cloud pictures", by Mr. R. H. Weightman on "Stratosphere flights in America," and by Dr. A. H. R. Goldie and Dr. A. Crichton Mitchell on "The Story of Ben Nevis Observatory."

Correspondence

To the Editor, *Meteorological Magazine*

Wind at Sea

I do not remember to have seen mention, in any discussions of wind at sea of the fact that observations from ships normally give the wind relative to the (moving) surface of the water and not the wind relative to a fixed point on the earth's surface. If there is a wind whose true velocity is represented by OP and an ocean current whose



velocity is represented by QP , then the observed wind will be represented by OQ . This is true of winds obtained on board ship, whether they are measured by an anemometer and corrected for the

motion of the ship through the water, or whether they are estimated from the appearance of the surface of the sea. This conclusion is independent of the depth of the surface current in both cases: but in the first case the speed of the ship through the water must be taken relative to the surface water, which would usually be the practice.

There is no practical means by which a ship in the open sea, away from land, can correct its observations of wind to give the true wind instead of the relative wind (except by deducing the current from astronomical observations). Naturally these corrections are not, in practice, applied; so that in all winds reported by observers at sea, it is the relative wind and not the true wind which is reported: and this relative wind has been used in the preparation of charts, tables and descriptive accounts of wind at sea. Fortunately, the speed of the wind is usually so much greater than the speed of ocean currents, that the relative wind reported from ships will generally be sufficiently near the true wind to be useful for meteorological purposes.

Near land the true velocity of the ship could be obtained from observation on fixed marks; and hence the true velocity of the wind derived from anemometer records on board the ship by the application of a correction for the ship's true velocity. True winds could also be obtained direct from anemometer records on a ship at anchor.

The fact that the appearance of the surface of the sea depends on the relative wind, and not on the true wind, is easily overlooked. It has an important bearing on the problem of wind and tide. The suggestion that there is a connexion between the wind and the tide has often been put forward, and some observations bearing on the question were discussed a few years ago in the *Meteorological Magazine* without any very definite conclusion being reached.

Ocean currents are generally slow, but in the case of the tides changes of current in the neighbourhood of land are well known and marked. Tidal currents frequently run at 1 or 2 knots and sometimes at 5 knots or more: and they must produce their effect on the apparent wind. For example, if the air were calm, in the sense that there was no motion of the atmosphere relative to the fixed surface of the earth, an observer on a vessel in a current of 5 knots would experience a wind of force 2: so would the surface of the sea, i.e., the surface would not be calm but there would be short waves.

Seamen are accustomed to observing the force of the wind by the appearance of the surface of the sea. This is true not only of observations made by them at sea, but also, in many cases, of observations made by seamen at coast stations; consequently, it would be surprising if they did not find that there was a connexion between the wind so observed and the tide. This would be an apparent and not a real connexion so far as the true motion of the air is concerned: consequently, it would not be found if winds recorded by an anemometer ashore were used for the comparison. (This does not mean that there is no variation of true wind with tide: there probably is a small variation).

The times of tidal currents do not have an invariable relation to the times of high and low tide: the relation varies with the place: frequently the stream turns at or near the times of high and low water; but in some places it may turn at half tide: thus the relation of observed wind to tide will vary with the relation of tidal stream to tide.

In the foregoing remarks it has been tacitly assumed that the true wind is unaffected by the ocean current: that would not be strictly true: in the case of a steady permanent current over a wide region the surface wind would probably be appreciably affected by the current, and conversely, in the case of a steady wind blowing for some time the ocean current would be affected by the wind. But it is unlikely that the tidal streams in the neighbourhood of land, which extend over relatively small areas for relatively short periods of time, would affect substantially the true wind; though the converse would not be true: the wind may and does affect tidal streams.

The fact that the state of the sea depends on the relative wind mollifies slightly the hardships of the landsman who ventures on coastal waters in a rowing boat. If he finds himself in the unhappy position

of having to row against the wind *and* against the tidal stream he may take some small consolation from the fact that the sea will be slightly less rough than if there were no tide; while if he is rowing *with* the tidal stream *against* the wind, the assistance obtained from the tide enables him the better to bear the slight consequent increase in the roughness of the sea.

May 4th, 1936.

E. GOLD.

Unusually brilliant Circumzenithal Arc observed at Aberdeen, March 24th, 1936

A particularly brilliant example of the circumzenithal arc was observed here at 15 h. on March 24th, 1936.

Earlier in the afternoon the halo of $22\frac{1}{2}^{\circ}$ was seen—the sky then being covered with striated cirrus. By 15h. the cloud had become cirronebula (about 6-tenths) and the $22\frac{1}{2}^{\circ}$ halo had practically vanished. A rather faint arc of contact could, however, be seen. To the right and left of the sun were very well marked parhelia, each displaying brilliant colouring. The mock-sun ring was visible for some 15° to 20° to the right of the right-hand parhelion and perhaps 10° to the left-hand parhelion and showed a quite distinct bluish colour. No trace of the mock-sun within the halo could be seen.

The most noteworthy part of the phenomena was the circumzenithal arc. This was rather narrow at first but displayed well-marked colour effects. The arc slowly broadened and at the same time its coloration became extremely brilliant and well defined (red, yellow, green and violet being noted). Of particular interest was the violet colouring, this being very deep and of a brilliancy rarely seen.

The phenomena were visible for some twenty minutes but then gradually faded, with the exception of the parhelion to the left of the sun; this was visible until 16 h. 40 m., when it was obscured by lower cloud.

W. F. WATSON.

The Observatory, King's College, Aberdeen, March 25th, 1936.

[The circumzenithal arc described above was certainly the most brilliantly (or strongly) coloured arc of its kind that I have yet seen, the saturation of the colours approaching that found in an average rainbow.

I was able, by employing the appropriate filter, to photograph the arc in the yellow-green region of the spectrum (see photograph reproduced as the frontispiece of this number of the magazine). In view of the fact that the blue-green, blue and violet spectral regions were absorbed by the filter, the arc appears in the photograph approximately only half as broad as it appeared to the eye.

G. A. CLARKE.]

Halo Phenomena witnessed at Sealand

During the last days of March, 1936, halo phenomena were fairly frequent and the following two occurrences appear to be of unusual interest.

On March 20th, at about 9h. 15m., when the sky was 7-tenths covered with altocumulus and cirrostratus, a solar corona and halo were visible (Fig. 1). The angular measurements shown were made with a theodolite. The upper arc of contact and the horizontal circle, or mock sun ring, were particularly well developed, the latter extending almost the whole distance from the mock suns to the centre.

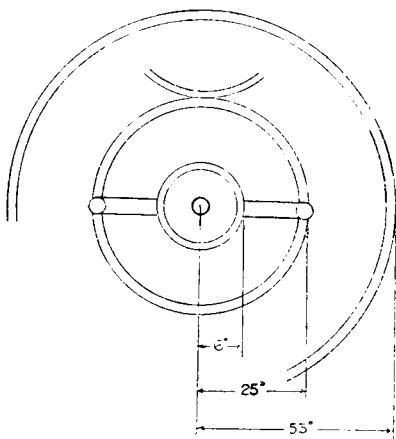


FIG. 1

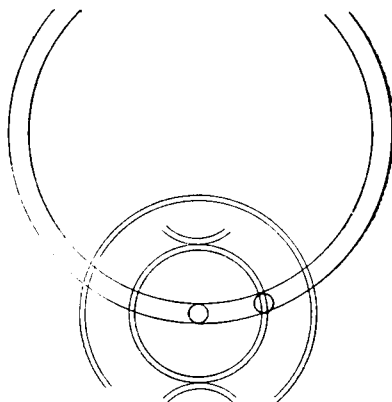


FIG. 2

The second case was a lunar halo which persisted from about 20h. 30m. on the 28th to 1h. on the 29th (Fig. 2). The sky was completely covered with a layer of cirrostratus which was so thin that even the faintest stars were plainly visible so that, except for the halo phenomenon, one would have thought that the sky was cloudless. Apart from the lower portion of the halo of 46° which was below the horizon (Llantysilio Mountains) the halos of 22° and 46° were complete. One of the paraselenae, the one on the right, was visible and the horizontal circle was almost complete. Both upper and lower arcs of contact were exceptionally well defined. A remarkable feature of this phenomenon was that the horizontal circle was approximately double the width of the halo. No colours were visible, but the whole phenomenon had a "milky white" appearance.

GEO. R. READ

Roker, Station Road, Great Saughall, Chester, April 14th, 1936.

Lunar Cross at Waringstown

A precursory sign of coming frost and of the apparent presence of ice crystals in upper reaches of the atmosphere was evident on the night

of April 6th at 9.10 p.m. The moon, about full at the time, having risen an hour or two previously, was shining through a veil of homogeneous cirrus haze. Radiating from the moon in four different directions like searchlight beams, were four shafts of light forming a very convincing cross, with the moon at the intersection of the arms. The angular measurement of the vertical shaft, including the moon, was about nine lunar diameters; the traverse shaft, also including the moon, would have been about five lunar diameters: from extremity to extremity in each case. The night was perfectly calm, illumination good; and the spectacle lasted about 10 minutes.

WM. J. GIBSON.

Waringstown (near Lurgan) Co. Down, May 2nd, 1936.

The abnormal Weather at Ross-on-Wye

The present season is proving abnormal in many ways. The recent winter has been persistently wet, following a wet autumn, and March was the seventh consecutive month with rainfall above normal. From September to March inclusive the rainfall here was 25.75 inches—nearly $8\frac{1}{2}$ inches above normal (or roughly 50 per cent).

But the strangest feature is the sunshine. Since records began here in July, 1914, I can find no instance of the first three months of any year passing without a single day's record reaching as much as 8 hours. Yet this has been our experience in 1936—the best record being only 7.9 hrs. on February 8th. Yet in spite of the absence of very high daily records February had a sunshine total of 90.4 hrs.—the result of consistency. Again in March there were five sunless days in succession (10th–14th inclusive), for which I can find no precedent. The total sunshine for the month, 70 hrs., is not our lowest, as in 1916 and 1928 the totals were 60 and 64 hrs. respectively. In March, 1928, the best day's record was only 7.4 hrs., as compared with one of 7.7 hrs. in March, 1936.

Our normal experience here is that records of 8 to 9 hrs. occur in February, the latter figure being exceeded in most seasons, whilst March usually provides records ranging from 9 to more than 11 hrs. in one day. Even April, to date, has not yet yielded as much as 7 hrs. in one day.

In other districts—especially in the far north and also in south-east England—there does not appear to have been this paucity of large daily records. And what of the cause of the dullness here?

F. J. PARSONS.

The Observatory, Ross-on-Wye, April 9th, 1936.

Note on the Past Winter

The winter of 1935–6 was remarkable for its regular alternation of very cold and very mild wet spells, the latter being unusually accentuated on the continent. In Scotland, however, the winter was

decidedly rigorous. At some places, at no great altitude above sea-level, snow lay on the ground for nearly three months, and the fact that just before Christmas ice was forming in salt-water lochs, like Etive on the west coast, seems worthy of comment. Occurrences of sea-ice round the coasts of the British Isles are less rare than is commonly supposed, but they should always be carefully recorded as a useful index of the severity of a winter. In February ice appeared in the Essex tidal creeks. On January 17th, 4 to 5 inches of snow was lying on Hampstead Heath, more than at any time since the blizzard of Christmas, 1927. Very little, however, lay in central London, and the general lack of snow in London during the last 8 years is without a parallel for a very long period.

L. C. W. BONACINA.

35, Parliament Hill, Hampstead, N.W.3, May 5th, 1936.

NOTES AND QUERIES

Visibility in Specified Directions in the Early Morning

When stationed in Egypt it was noticed that at Heliopolis the visibility, soon after sunrise, appeared to be considerably greater towards the north-east than towards the south-west and in order to examine this effect further a series of observations of visibility towards each of the directions, north-east, south-east, south-west and north-west was taken during August, September and October, 1928, within three hours of sunrise. Heliopolis lies to the north-east of Cairo* so that the normal visibility objects are situated to the west of a line running roughly north and south through the station, and the outlook over the remaining directions is desert. Observations towards south-west and north-west were therefore of actual objects, but towards north-east and south-east the visibility estimates were based on the apparent obscuration in much the same way that visibility is estimated at sea. The minimum distance appropriate to each visibility letter was used in the analysis and the mean distances in each direction, cases of fog being excluded, were then determined.

The results are given in Table I and it will be seen that on an average, visibility towards north-east was not exceeded by that in any other direction, while the poorest visibility was always experienced towards south-west; towards north-west and south-east the visibility was approximately the same in each direction.

These figures indicate that when the elevation of the sun is small and the relative humidity high, visibility is greatest looking towards the sun, and least looking away from the sun—a conclusion to be anticipated from a consideration of Bennett's† work on the scattering of light by suspensoids if the hygroscopic nuclei present scatter the incident light from the sun and produce "glare". The effect is,

* See *Meteorological Magazine*, 67, 1932, p. 229, Fig. 1.

† *London, Quart. J. R. met. Soc.*, 56, 1930, pp. 6-10.

no doubt, accentuated by the greater number of nuclei in the air in the immediate vicinity of Cairo than over the desert and these nuclei will have their maximum concentration about sunrise when

TABLE I. VISIBILITY IN MILES AT HELIOPOLIS, 1928.

Visibility towards	August.			September.		October.	
	5h.	6h.	7h.	6h.	7h.	6h.	7h.
NW.	9	9	10	8	9	8	9
SE.	8	10	10	8	9	7½	8½
NE.	11	11	10	9½	9½	8½	10
SW.	4½	4½	5	4	4	4½	4½
No. of obs.	11	12	11	29	27	29	26
Sunrise	5h. 26m.			5h. 39m.		5h. 56m.	
Range of relative humidity at 3h.	79 to 94% ₀			74 to 95% ₀		75 to 97% ₀	

All times are local time.

the nocturnal inversion, which is well developed throughout the year inland in Egypt, is at its maximum, but the differences are sufficiently large to indicate that the position of the sun, when the elevation of the latter is small, should be taken into account when visibility is under consideration.

WILLIAM D. FLOWER.

REVIEWS

Visibility in Meteorology. The theory and practice of the measurement of the visual range. By W. E. Knowles Middleton. Size 9 in. × 6 in., pp. viii + 104. *Illus.* Published by Mr. Milford at the University of Toronto Press, Toronto, 1935. 8s. 6d. net.

This monograph is designed, as the author states in his preface, to indicate the work done in the theory and measurement of visibility (defined as the brightness-contrast between adjacent bodies), and of visual range (defined as the maximum distance of clear vision); though short, it covers considerable ground.

The first half of the book is a consideration of the mathematics of the subject. For the most part, the mathematics have been followed through in detail; but in any case, there are abundant references to original papers. In these chapters visual range, by the use of threshold of contrast, is considered under differing circumstances. Thus the author gives the investigations, done under conditions of scattering and absorption by aerosols, etc., with black, white and grey objects against different backgrounds; emphasis is laid on the consideration of snow as such a background. Light sources are similarly considered, and the author lays stress, rightly, on the fact that much work needs to be done in the examination of coloured lights under different

background conditions. Results are given for conditions of both night and day for the above cases; diffuse illumination also receives attention. This theoretical work is only followed through so far as it has practical application; thus, vertical and oblique visibility receives only the comment that it is a neglected field.

Chapters VI-X are concerned with the experimental side of the determination of visibility and visual range; the author discusses the use of photometers and visibility meters for both types of observation. His comments on the various instruments mentioned are interesting, and he favours the use of visibility meters rather than photometers for the determination of visual range. The last three chapters of the book are devoted to a detailed consideration of the drawbacks of the present system of measuring visual range, and the author gives some suggestions as to how to overcome these difficulties; in some cases, however, these suggestions do not appear entirely satisfactory. He comments on the determination of visibility readings at night, and advocates his own useful scheme of a system of lights of suitable strengths, which would be equally appropriate for day and night observations. Chapter IX also deals with the relations between visual range, and various meteorological elements (such as relative humidity, and diurnal variation); he comments briefly on relations with each element, but there are very few calculated figures quoted in this connexion, which seems rather a pity. Presumably his references cover this defect.

The book provides a useful survey of the work done in the field of visibility, and at the same time gives a condensed, yet fairly full summary of the more practical side of the subject applied in particular to navigation and observational meteorology. The bibliography is very good; its position at the end of the book makes it easy for reference. The diagrams printed are satisfactory, but more might have been introduced with advantage.

G. W. HURST.

Memorie del R. Ufficio Centrale di Meteorologia e Geofisica. Serie III.
Vol. V. Ministero dell'agricoltura e foreste, Rome, 1935.

This large volume contains a rich harvest from the meteorological activity in Italy during recent years. It includes ten memoirs, the majority of which deal with climatology and the investigation of the upper air. S. Aurino has a long memoir of 90 pages, with numerous tables, on the climate of Naples, while E. Guerrieri deals with intense falls of rains in the same city and G. Frongia discusses the climate of Cagliari, and the Director, E. Oddone, contributes with O. Burchi, an account of the snowfall of Sestola, including tables of daily falls from 1890 to 1930. The upper air memoirs include summaries by P. Gamba of the pilot-balloon observations at Pavia in 1917-8, and by G. Ingrao of those in 1933; the latter author also has a summary of the distribution of temperature in the free air above Pavia. Two other memoirs consist of an account by E. Oddone of

the preparations for prospecting the sub-soil of Italy by seismological methods, and a study by P. Gamba of the surface temperatures of the north-eastern waters of the Adriatic in relation to the precipitation in the basins of the affluent rivers and other local meteorological conditions. Another gives the results of an investigation by G. Roncali into the secular variation of terrestrial magnetism in Italy and neighbouring countries which he extends back to 20,000 B.C., by means of the magnetic characteristics of the lavas of Etna; he also gives a summary of the results of similar investigations into lavas of all parts of the world dating from various geological periods between the Permo-Carboniferous and the Tertiary, which leads him to the suggestion that while the magnetic axis has always made a small angle with the axis of rotation, it has sometimes changed its sign.

BOOKS RECEIVED

Meteorological Observations for 1933 and for 1934. Prepared in the Meteorological Office, Wellington. E. Kidson, D.Sc., Director, Wellington, N.Z., 1934 and 1935.

OBITUARY

Sir Joseph Petavel, K.B.E., F.R.S.—It must have come as a shock to many readers of the *Meteorological Magazine* to hear of the death of Sir Joseph Petavel on March 31st. Sir Joseph was only sixty-two years of age and although he had undergone a serious operation at the end of last year, few of his friends realised that he might not pull through.

As Director of the National Physical Laboratory, Sir Joseph frequently came into contact with meteorologists; but it is not in that capacity that meteorologists know him best, for, thirty years ago he made valuable contributions to our knowledge of the upper atmosphere, which at that time was very meagre, and in more recent years the leading part he has played in the development of aerodynamics has constantly brought his name before meteorologists.

The *Meteorological Magazine* is not the place to give an account of Sir Joseph's great contributions to pure and applied science, but many readers will be interested to know how Sir Joseph, an engineer both by training and inclination, became interested in the upper atmosphere and consequently one of our leading authorities on aerodynamics.

Sir Arthur Schuster was greatly interested in meteorology and when a suitable vacancy occurred on his staff at Manchester University he decided to establish a lectureship in meteorology. I was appointed to the post and commenced to lecture on meteorology and mechanics in October, 1905. I was very keen on doing upper-air work, but we had no money for the equipment; that was, however, a small matter to a man in his twenties. I hunted round and found

a suitable spot for a kite station on the Derbyshire moors near to Glossop, and Mr. W. H. Dines presented me with some kites and an old winding winch, of which more later. Schuster found me a few pounds with which to buy an old boiler and steam engine to drive the winch, and the Glossop upper-air station was established in the spring of 1906. It was my practice to ask students and others who were interested—and who was not interested in flying kites?—to come to Glossop and help with the work. One day when looking for someone to accompany me I met Petavel and asked him to come. With his usual readiness to help he consented and we set off—and I think I am justified in saying that that was a real turning point in Petavel's life.

The winding gear which had been given by Mr. W. H. Dines had been made by him for his work on kite flying from a boat on the west of Scotland. It was a most ingenious winding gear; but anyone who ever saw pioneer apparatus made by Mr. W. H. Dines will know that there was nothing "engineering" about it. Petavel was highly amused. During the afternoon the winch gave trouble, as it always did, and when winding in, a piece of tin—which had been used for strengthening the wooden drums on which the wire was wound—got caught up in the wire and made such a mess of the whole complicated arrangement that it was clear the winch had at last come to the end of its life.

In the train on our way back to Manchester, Petavel made humorous remarks about the winch, and said that it should have been built of metal instead of wood and bits of tin. I stood up for the design, knowing so well the wonderful results obtained by Mr. Dines with that and other winches made on the same principle. Rather exasperated I turned to him and said that I had obviously got to get a new winch and asked if he, as an engineer, could design a better one than Mr. Dines. He took up the challenge and in a few days produced drawings of a winch, practically on the same principle as Mr. Dines's, but made of metal and introducing certain obvious improvements.

Schuster again found the money, and a local engineering workshop built a winch to Petavel's design. The winch was installed at Glossop in the summer term of 1906 and Petavel came several times to try it out with the kites. By that time I had, on the recommendation of Professor Schuster, been appointed to the staff of the India Meteorological Department and so my work at Glossop had to come to an end.

Schuster did not wish the work at Glossop, which had really not yet started to give results, to cease, and as Petavel, who was then free, was familiar with the work and obviously interested, Schuster asked him to carry on the lectureship and run the Glossop station. For two years Petavel gave lectures on mechanics and, with the assistance of students, ran the Glossop Kite Station, but as far as I know he did not give any lectures on meteorology. The upper air

work was extended to include the use of registering balloons which were sent up from Manchester. The results of the observations were published by Petavel in collaboration with W. A. Harwood and Miss M. White and are well-known contributions to our knowledge of the upper atmosphere. During this period, Petavel made his first personal contact with the upper air in a free balloon.

In 1908, Petavel was appointed Professor of Engineering in the Manchester University and towards the end of 1909 the Glossop Kite Station came to an end after four years eventful and useful life. Petavel was now a Professor of Engineering with considerable knowledge of the upper atmosphere and he naturally became a member of the Advisory Committee for Aeronautics which was formed in 1909. When the Aeronautical Research Committee was formed in 1917, Petavel was a member and chairman of the Aerodynamics Sub-Committee, and in 1919, as Director of the National Physical Laboratory, he became responsible for one of the three largest equipments for aerodynamic research in the world.

Science has lost one of her real devotees and Government has lost a most efficient servant, but many of us have lost a true friend whose memory will always be associated with the flowers, especially the daffodils, which he planted so extensively at his home at Bushey House, and with which he loaded his guests so lavishly.

G. C. SIMPSON.

NEWS IN BRIEF

We learn that Herr Hilding Köhler, Professor at the University of Uppsala, who has been acting as Director of the Meteorological Institution at the University of Uppsala since September, 1934, has been definitely appointed Director from April 1st, 1936.

We learn that the Senate of the University of St. Andrews has awarded the degree of D.Sc. to Major A. H. R. Goldie, Superintendent of the Meteorological Office, Edinburgh, for a thesis entitled "The mechanism of the depressions of temperate latitudes."

The Weather of April, 1936

Pressure was above normal over western Canada, the United States (except the western coast), Bermuda, the northern North Atlantic, Greenland, Iceland, the British Isles, Spitsbergen, western Siberia and north-west Africa, the greatest excesses being 3.2 mb. near lake Athabasca, 4.7 mb. near Nantucket and 4.3 mb. at Reykjavik. Pressure was below normal along the west coast of the United States, over eastern Canada and over Europe, the greatest deficits being 1.6 mb. at the Skagen, 2.6 mb. at Madeira and 3.5 mb. at 60° N. 60° W. In Sweden temperature was generally about normal and precipitation between 50 and 75 per cent above normal.

The main feature of the weather of April over the British Isles was

the persistence of the cold air current from the north during the first 19 days and also at times during the later part of the month. The month will also be remembered for the wintry weather experienced during Easter, and in many parts as the coldest April for several years. In England rainfall was near to average but sunshine was deficient in the south, while in Scotland and north Ireland sunshine totals were much above normal and rainfall was deficient. The small depression which crossed England in an easterly direction at the beginning of the month gave rain generally on the 1st and 2nd, becoming heavy in the south on the 3rd, when 1·22 in. were measured at Ipplepen (Devon). Snow and sleet were reported from Scotland on the 3rd, and south England on the 3rd and 4th, while mist or fog occurred locally in England on the 1st and 2nd. The 4th was a sunny day in Scotland, over 11 hrs. being recorded in many parts, and 11·7 hrs. at Oban and Dunbar. From then to the 11th, mainly sunny weather prevailed with cold northerly winds but scarcely any precipitation, 41° F. was the maximum at Edinburgh, Rothamsted and Rhayader on the 5th. The 9th was the sunniest day of this period, when 11·8 hrs. were recorded at Morecambe, and 11·2 hrs. at Aberystwyth, York and Rhayader. From the 12th–16th the weather remained cold but accompanied by rain, hail, sleet or snow, the precipitation being most at the beginning of the period, when the snow impeded traffic in parts of the south. A thunderstorm occurred at Armagh on the 13th and north-easterly gales were experienced in north Scotland on the 14th, while local mist or fog was reported from south-east and east England on the 14th. The 17th–19th were brilliantly sunny days, 13·5 hrs. were recorded at Ilfracombe, 13·4 hrs. at Weymouth and 13·1 hrs. at Ross-on-Wye and Sealand on the 18th. The cold sunny weather, with occasional sleet or snow showers continued in the north on the 19th–22nd, but a small depression centred off the mouth of the English Channel brought general rain, sleet or hail to the south. On the 21st there were strong SW. winds in the English Channel and a gale at Pembroke, while 1·23 in. of precipitation fell at Cardigan and 1·05 in. at Abergavenny (Monmouth). During these first 23 days frosts occurred frequently over the whole country, being most severe on the 4th–6th, 16th–19th, and on the 23rd, 10° F. was reported on the ground at Dalwhinnie on the 19th, 11° F. at Dalwhinnie on the 16th, Auchincruive on the 17th and Dumfries on the 23rd, and 15° F. at Dumfries, Eskdalemuir and Penrith on the 6th. On the 23rd a depression approached from the Atlantic giving heavy rain locally in Ireland, 1·92 in. at Fofanny (Co. Down) on the 23rd, and from then to the 26th mild unsettled weather with rain at times, but bright periods, prevailed. For the last few days the weather was mainly sunny and mild, 66° F. was reached at Hull and 65° F. at Tottenham on the 28th, but in the south there were also cool northerly winds. The distribution of bright sunshine for the month was as follows:—

		Diff. from			Diff. from
	Total	normal		Total	normal
	(hrs.)	(hrs.)		(hrs.)	(hrs.)
Stornoway ...	162	+ 5	Chester ...	169	+33
Aberdeen ...	177	+26	Ross-on-Wye ...	145	- 2
Dublin ...	128	-34	Falmouth ...	167	-21
Birr Castle ...	151	- 3	Gorleston ...	169	- 1
Valentia... ..	170	+11	Kew	132	-17

Miscellaneous notes on weather abroad culled from various sources

Cold squally weather, accompanied by occasional snow or sleet, prevailed over the north of France during Easter and a heavy snowstorm occurred to the north of Paris on the afternoon of the 12th. In Germany the weather was generally sunny and cool during Easter, but a fall of snow was reported from the Palatinate. Rain and gales were experienced generally over Spain on the 13th and south-westerly gales continued in the south during the 14th and 15th, when the P. and O. liner *Ranpura*, conveying the Chinese art treasures, grounded on the sandy bottom off Punta Mala, near Mayorga, inside the Bay of Gibraltar. Fog occurred in the north of Italy on the 15th, when an air liner crashed near Turin. Heavy rain and gales over the Upper Adriatic on the 15th and 16th caused floods over the whole city of Venice on the 17th. Fog occurred at Gothenburg on the 17th. Storms and floods were again experienced in Portugal about the 19th. Cold weather, with sleet and severe snowstorms, occurred in south Germany on the 17th-18th. Navigation re-opened at Vasa Kasko (Finland) on the 21st and at Riga on the 23rd. Fog occurred at Vasa on the 24th. (*The Times*, April 13th-25th.)

Heavy and frequent rains were reported from most of Abyssinia early in the month except in the Tigré. A dense sandstorm occurred at Port Said on the 12th. Severe drought prevailed in western Libya during April and a quantity of cattle were transported from there to the Bengasi region where the rainfall had been abundant. (*The Times*, April 11th-13th.)

A severe storm occurred near Nagasaki on the 3rd, during which the *Taiko Maru* foundered—14 people were drowned. High winds and sandstorms were experienced in the neighbourhood of the Persian Gulf on the 8th. Further blizzards were experienced in Mongolia about the 12th and many cattle lost. (*The Times*, April 6th-13th.)

Rainfall in Australia was generally below normal except in Victoria and locally in Queensland and Tasmania. It was reported on the 9th that portions of the pastoral and wheat areas of Western Australia had been adversely affected by drought, involving serious loss of stock. (Cable and *The Times*, April 7th-9th.)

A tornado, said to be the third worst ever experienced, swept across Arkansas, Mississippi, Alabama, Tennessee, Georgia and South Carolina on the night of the 5th and morning of the 6th—408 people were killed and the damage in some of the towns amounted to over £1,000,000 in each. The St. Lawrence was opened to navigation on

the 13th which is said to be the earliest date since 1902. The weather was unsettled in the state of Buenos Aires during the first 8 days of the month. In the United States, temperature was generally below normal in the east, and in the west much below normal at first, becoming above normal about the 9th especially in the Mountain Region, but below normal again in the central states towards the end of the month, while precipitation was mainly below normal, except at first, in the eastern States and the Ohio Valley. (*The Times*, April 7th-15th and *Washington D.C., U.S. Dept. Agric., Weekly Weather and Crop Bulletin*.)

Daily Readings at Kew Observatory, April, 1936

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	1007.9	S.2	48	57	89	0.25	0.0	r ₀ -r 0h-11h. & 16h-
2	1016.1	N.3	51	53	87	0.03	0.0	r ₀ 2h.-7h. & 16h. [17h.
3	1017.8	ENE.4	41	45	69	0.10	0.0	r ₀ -rs 19h.-24h.
4	1015.0	ENE.5	35	48	54	0.11	2.6	r-r ₀ 0h.-6h.
5	1024.4	NE.4	37	43	56	—	1.4	
6	1022.0	NNE.3	39	44	59	—	0.6	m 21h.
7	1014.6	NE.4	35	48	50	—	3.9	
8	1019.6	NE.4	40	48	64	—	1.7	
9	1022.4	NE.4	43	51	65	—	3.2	
10	1020.5	NE.3	40	52	60	—	6.2	
11	1012.1	NNW.4	39	46	58	0.05	4.8	prh 14h.-17h.
12	1008.6	NNW.2	34	45	41	0.03	3.8	rs 16h. r ₀ 18h.-19h.
13	1004.0	SSE.2	34	43	83	0.06	0.9	rs-r ₀ 2h.-9h.
14	1003.6	NE.3	32	47	53	—	3.6	x early. f 9h.
15	999.8	NNW.4	35	46	69	—	4.2	x early.
16	1001.1	N.2	32	48	54	—	3.0	
17	1008.5	NW.4	33	50	34	—	10.2	x early.
18	1016.3	WNW.3	34	53	42	—	12.0	x early.
19	1014.7	NW.3	37	51	36	—	10.5	
20	1004.1	ENE.3	39	45	93	0.43	0.4	r ₀ -r 6h.-14h.
21	1001.9	SSE.4	32	47	56	0.19	0.9	x early. rs-r 16h.-24h.
22	1009.0	N.4	37	46	46	0.01	7.1	r ₀ 1h. & 5h. pr ₀ s ₀ 14h.
23	1016.7	WSW.2	30	51	40	0.01	5.6	x early. r ₀ 22h.-24h.
24	1017.1	WNW.3	43	60	46	0.06	8.5	r ₀ 0h.-3h.
25	1019.5	SW.4	51	61	75	0.01	0.6	r ₀ 18h. & 24h.
26	1016.5	WNW.3	48	57	65	0.35	7.6	r 0h.-6h. PRH 15h.
27	1025.8	NW.2	41	57	54	—	8.7	w early. pr ₀ 20h.
28	1026.4	NNW.2	39	63	41	—	10.6	w early.
29	1026.8	NW.2	47	60	57	—	3.1	w early.
30	1027.3	N.3	50	61	49	—	5.9	
*	1014.7	—	39	51	58	1.68	4.4	* Means or totals.

General Rainfall for April, 1936

England and Wales	...	96	} per cent. of the average 1881-1915
Scotland	...	54	
Ireland	...	73	
British Isles	...	81	

Rainfall : April, 1936 : England and Wales

Co.	STATION.	In.	Per cent of Av.	Co.	STATION.	In.	Per cent of Av.
<i>Lond</i>	Camden Square.....	1.36	88	<i>Leics</i>	Thornton Reservoir ...	2.69	158
<i>Sur</i>	Reigate, Wray Pk. Rd..	2.02	121	"	Belvoir Castle.....	1.72	112
<i>Kent</i>	Tenterden, Ashenden...	1.59	98	<i>Rut</i>	Ridlington	2.30	147
"	Folkestone, Boro. San.	1.89	...	<i>Lincs</i>	Boston, Skirbeck.....	1.76	130
"	Margate, Cliftonville....	.98	73	"	Cranwell Aerodrome...	1.71	129
"	Eden'bdg., Falconhurst	2.19	117	"	Skegness, Marine Gdns.	1.34	100
<i>Sus</i>	Compton, Compton Ho.	2.83	141	"	Louth, Westgate.....	1.81	108
"	Patching Farm.....	2.09	119	"	Brigg, Wrawby St.....	1.76	...
"	Eastbourne, Wil. Sq....	2.08	114	<i>Notts</i>	Worksop, Hodsock.....	1.27	86
"	Heathfield, Barklye....	2.94	159	<i>Derby</i>	Derby, L. M. & S. Rly.	1.65	101
<i>Hants</i>	Ventnor, Roy.Nat.Hos.	1.65	98	"	Buxton, Terr. Slopes...	1.91	65
"	Fordingbridge, Oaklands	1.76	96	<i>Ches</i>	Runcorn, Weston Pt....	1.50	87
"	Ovington Rectory.....	3.19	169	<i>Lancs</i>	Manchester, Whit. Pk.	.91	47
"	Sherborne St. John.....	1.72	97	"	Stonyhurst College.....	1.37	51
<i>Herts</i>	Royston, Therfield Rec.	1.56	99	"	Southport, Bedford Pk.	1.23	66
<i>Bucks</i>	Slough, Upton.....	1.63	114	"	Lancaster, Greg Obsy.	.56	25
"	H. Wycombe, Flackwell	1.44	89	<i>Yorks</i>	Wath-upon-Deerne.....	1.14	73
<i>Oxf</i>	Oxford, Mag. College...	1.55	100	"	Wakefield, Clarence Pk.	1.29	77
<i>N'hant</i>	Wellingboro, Swanspool	1.96	132	"	Oughtershaw Hall.....	1.65	...
"	Oundle	1.89	...	"	Wetherby, Ribston H..	1.58	90
<i>Beds</i>	Woburn, Exptl. Farm...	1.29	86	"	Hull, Pearson Park.....	1.63	105
<i>Cam</i>	Cambridge, Bot. Gdns.	1.32	97	"	Holme-on-Spalding.....	1.66	100
<i>Essex</i>	Chelmsford, County Gdns	1.29	100	"	West Witton, Ivy Ho.	1.34	62
"	Lexden Hill House.....	1.26	...	"	Felixkirk, Mt. St. John.	1.60	96
<i>Suff</i>	Haughley House.....	1.23	...	"	York, Museum Gdns....	1.48	92
"	Campsea Ashe.....	1.14	81	"	Pickering, Hungate.....	1.58	95
"	Lowestoft Sec. School...	1.20	81	"	Scarborough.....	1.03	66
"	Bury St. Ed., Westley H.	1.45	95	"	Middlesbrough.....	1.10	80
<i>Norf.</i>	Wells, Holkham Hall...	1.25	98	"	Baldersdale, Hury Res.	.98	41
<i>Wilts</i>	Calne, Castle Walk.....	2.09	...	<i>Durh</i>	Ushaw College.....	1.37	73
"	Porton, W.D. Exp'l. Stn	2.07	124	<i>Nor</i>	Newcastle, D. & D. Inst.	1.31	88
<i>Dor</i>	Evershot, Melbury Ho.	2.52	107	"	Bellingham, Highgreen	1.80	83
"	Weymouth, Westham.	1.23	74	"	Lilburn Tower Gdns....	1.61	81
"	Shaftesbury, Abbey Ho.	1.50	70	<i>Cumb</i>	Carlisle, Scaleby Hall...	.93	48
<i>Devon</i>	Plymouth, The Hoe....	1.84	81	"	Borrowdale, Seathwaite	2.60	38
"	Holme, Church Pk. Cott.	4.39	122	"	Borrowdale, Moraine...	2.40	43
"	Teignmouth, Den Gdns.	2.63	131	"	Keswick, High Hill.....	.92	30
"	Cullompton	2.42	106	<i>West</i>	Appleby, Castle Bank...	.64	33
"	Sidmouth, U.D.C.....	2.35	...	<i>Mon</i>	Abergavenny, Larchf'd	2.41	95
"	Barnstaple, N. Dev.Ath	2.28	108	<i>Glam</i>	Ystalyfera, Wern Ho....	3.52	93
"	Dartm'r, Cranmere Pool	5.40	...	"	Cardiff, Ely P. Stn.....	3.02	119
"	Okehampton, Uplands.	3.23	102	"	Treherbert, Tynywaun.	5.12	...
<i>Corn</i>	Redruth, Trewirgie.....	2.87	100	<i>Carm</i>	Carmarthen, Coll. Rd.	3.30	121
"	Penzance, Morrab Gdns.	2.92	120	<i>Pemb</i>	St. Ann's Hd, C.Gd. Stn.	1.94	100
"	St. Austell, Trevarna...	3.06	109	<i>Card</i>	Aberystwyth	1.71	...
<i>Soms</i>	Chewton Mendip.....	3.15	106	<i>Rad</i>	Birm W.W.Tyrmynydd	4.10	111
"	Long Ashton.....	2.71	124	<i>Mont</i>	Lake Vyrnwy	2.84	94
"	Street, Millfield.....	2.51	...	<i>Flint</i>	Sealand Aerodrome.....	1.74	...
<i>Glos</i>	Blockley	2.45	...	<i>Mer</i>	Dolgelley, Bontddu.....	2.19	60
"	Cirencester, Gwynfa....	1.95	104	<i>Carn</i>	Llandudno	1.13	67
<i>Here</i>	Ross, Birchlea.....	2.11	111	"	Snowdon, L. Llydaw 9..	4.44	...
<i>Salop</i>	Church Stretton.....	2.88	133	<i>Ang</i>	Holyhead, Salt Island...	1.36	65
"	Shifnal, Hatton Grange	2.28	136	"	Lligwy	1.17	...
<i>Staffs</i>	Market Drayt'n, Old Sp.	1.49	86	<i>Isle of Man</i>	Douglas, Boro' Cem....	1.11	46
<i>Worc</i>	Ombersley, Holt Lock.	1.78	117	<i>Guernsey</i>	St. Peter P't. Grange Rd.	1.73	86
<i>War</i>	Alcester, Ragley Hall...	1.93	114				
"	Birmingham, Edgbaston	2.02	116				

Rainfall : April, 1936 : Scotland and Ireland

Co.	STATION.	In.	Per cent of Av.	Co.	STATION.	In.	Per cent of Av.
Wig	Pt. William, Monreith.	·59	27	Suth	Tongue	2·80	107
"	New Luce School.....	1·20	45	"	Melvich.....	1·52	66
Kirk	Dalry, Glendarroch.....	1·04	34	"	Loch More, Achfary....	3·43	71
"	Carsphairn, Shiel.....	1·97	48	Caith	Wick	1·28	64
Dumf.	Dumfries, Crichton R.I.	·65	29	Ork	Deerness	1·08	52
"	Eskdalemuir Obs.....	1·47	43	Shet	Lerwick	1·35	59
Roxb	Hawick, Wolfelee.....	1·69	75	Cork	Dunmanway Rectory...	2·70	65
Selk	Ettrick Manse.....	1·31	37	"	Cork, University Coll...	1·58	60
Peeb	West Linton.....	1·64	...	"	Ballinacurra.....	1·79	69
Berw	Marchmont House.....	1·62	80	"	Mallow, Longueville....	2·56	105
E.Lot	North Berwick Res....	1·08	77	Kerry	Valentia Obsy.....	2·68	73
Midl	Edinburgh, Blackfd. H.	1·41	96	"	Gearhameen.....	3·40	59
Lan	Auchtyfardle	1·03	...	"	Bally McElligott Rec...	1·63	...
Ayr	Kilmarnock, Kay Pk....	1·07	...	"	Darrynane Abbey.....	2·46	72
"	Girvan, Pinmore.....	·95	32	Wat	Waterford, Gortmore...	1·77	71
Renf	Glasgow, Queen's Pk....	1·06	54	Tip	Nenagh, Cas. Lough....	2·85	114
"	Greenock, Prospect H..	1·55	43	"	Roscrea, Timoney Park	2·09	...
Bute	Rothsay, Ardenraig...	1·84	...	"	Cashel, Ballinamona...	2·33	95
"	Dougarie Lodge.....	1·16	...	Lim	Foynes, Coolnanes.....	2·62	107
Arg	Ardgour House.....	2·94	...	"	Castleconnel Rec.....	2·58	...
"	Oban	1·56	...	Clare	Inagh, Mount Callan...	4·42	...
"	Poltalloch.....	2·05	68	"	Broadford, Hurdlest'n.	2·32	...
"	Inveraray Castle.....	3·42	74	Wexf	Gorey, Courtown Ho...	2·24	103
"	Islay, Ballabus.....	1·93	67	Wick	Rathnew, Clonmannon.	2·27	...
"	Mull, Benmore.....	3·20	41	Carl	Hacketstown Rectory...	2·54	96
"	Tiree .....	...	...	Leix	Blandsfort House.....	2·54	97
Kinr	Loch Leven Sluice.....	1·16	60	Offaly	Birr Castle.....	2·28	107
Fife	Leuchars Aerodrome...	·52	33	Dublin	Dublin, FitzWm. Sq....	1·98	104
Perth	Loch Dhu.....	2·65	56	"	Balbriggan, Ardgillan...	1·49	75
"	Balquhider, Stronvar.	...	...	Meath	Beauparc, St. Cloud....	1·94	...
"	Crieff, Strathearn Hyd.	1·17	54	"	Kells, Headfort.....	1·26	50
"	Blair Castle Gardens...	·65	31	W.M	Moate, Coolatore.....	1·79	...
Angus	Kettins School.....	·53	29	"	Mullingar, Belvedere...	2·12	90
"	Pearsie House.....	·73	...	Long	Castle Forbes Gdns.....	1·50	63
"	Montrose, Sunnyside...	·34	19	Gal	Galway, Grammar Sch.	2·05	...
Aber	Braemar, Bank.....	·83	35	"	Ballynahinch Castle...	2·91	114
"	Logie Coldstone Sch....	·79	39	"	Ahascragh, Clonbrock.	2·44	96
"	Aberdeen, Observatory.	·70	37	Mayo	Blacksod Point.....	...	...
"	Fyvie Castle.....	1·50	70	"	Mallaranny	3·65	...
Moray	Gordon Castle.....	·97	55	"	Westport House.....	2·48	92
"	Grantown-on-Spey .....	...	...	"	Delphi Lodge.....	4·59	80
Nairn	Nairn	·74	49	Sligo	Markree Castle.....	1·25	47
Inv's	Ben Alder Lodge.....	1·51	...	Cavan	Crossdoney, Kevit Cas..	1·18	...
"	Kingussie, The Birches.	1·26	...	Ferm	Enniskillen, Portora...	·61	...
"	Loch Ness, Foyers.....	1·29	59	Arm	Armagh Obsy.....	·56	27
"	Inverness, Culduthel R.	·76	...	Down	Fofanny Reservoir.....	2·38	...
"	Loch Quoich, Loan.....	3·15	...	"	Seaforde	·96	37
"	Glenquoich.....	2·80	43	"	Donaghadee, C. G. Stn.	·85	42
"	Glenleven, Corroure...	2·70	66	"	Banbridge, Milltown...	·76	37
"	Fort William, Glasdrum	2·19	...	Antr	Belfast, Cavehill Rd....	1·06	...
"	Skye, Dunvegan.....	1·73	...	"	Aldergrove Aerodrome.	·74	35
"	Barra, Skallary.....	1·28	...	"	Ballymena, Harryville.	1·10	42
R&C	Alness, Ardross Castle.	...	...	Lon	Garvagh, Moneydig....	·99	...
"	Ullapool	1·98	64	"	Londonderry, Creggan.	1·29	50
"	Achnashellach	3·31	59	Tyr	Omagh, Edenfel.....	1·18	45
"	Stornoway, Matheson...	2·04	67	Don	Malin Head.....	·80	...
Suth	Lairg.....	1·49	65	"	Killybegs, Rookmount.	1·02	...

Climatological Table for the British Empire, November, 1935

STATIONS.	PRESSURE.		TEMPERATURE.							Rela- tive Hum- idity.	Mean Cloud Am't	PRECIPITATION.			BRIGHT SUNSHINE.				
	Mean of Day M.S.L.	Diff. from Normal.	Absolute.			Mean Values.						Mean.	Wet Bulb. °F.	Am't. in.	Diff. from Normal. in.	Days.	Hours per age of day.	Per- cent. possi- ble.	
			Max.	Min.	°F.	Max.	Min.	°F.	1 Max. and 2 Min.										Diff. from Normal °F.
mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	%	0-10	in.	in.							
London, Kew Obsy.....	1005.8	- 8.8	62	29	50.4	40.6	45.5	+ 1.5	90	7.7	4.36	2.14	20	1.7	19				
Gibraltar.....	1017.8	- 0.2	73	48	65.2	53.3	59.3	- 0.7	84	6.4	4.30	2.13	15	...	...		
Malta.....	1016.2	+ 0.3	75	54	68.8	60.9	64.9	+ 1.0	77	6.7	4.38	0.81	11	5.9	58				
St. Helena.....	1013.1	- 0.5	67	53	61.7	52.9	58.3	- 1.3	93	9.5	0.72	...	8	...	...		
Freetown, Sierra Leone.....	1012.7	+ 3.5	90	68	86.2	72.1	79.1	- 2.1	84	5.9	7.70	1.58	15	...	...		
Lagos, Nigeria.....	1010.1	0.0	90	73	87.7	76.6	82.1	+ 0.4	77.7	88	2.33	0.34	4	7.0	59				
Kaduna, Nigeria.....	1008.6	...	95	54	92.1	58.5	75.3	- 0.9	61.4	59	0.00	0.21	0	9.3	80				
Zomba, Nyasaland.....	1006.8	- 2.1	92	59	81.7	64.6	73.1	- 2.5	65.7	63	6.42	1.34	12	...	...		
Salisbury, Rhodesia.....	1011.4	+ 0.3	91	49	81.6	58.0	69.8	- 0.9	59.5	47	2.86	0.74	8	7.3	57				
Cape Town.....	1016.6	+ 0.8	99	47	75.5	56.9	66.2	+ 1.8	58.6	62	3.5	1.10	6	...	...		
Johannesburg.....	1012.9	+ 1.0	86	39	76.9	51.2	64.1	+ 0.4	52.4	47	4.6	4.21	8	8.9	66				
Mauritius.....	1016.0	- 0.1	86	67	81.9	69.4	75.7	+ 0.2	72.0	75	6.8	4.19	22	6.4	49				
Calcutta, Alipore Obsy.....	1013.1	- 0.2	90	57	86.2	63.3	74.7	+ 1.2	63.9	79	1.1	0.00	0.65	0*	...				
Bombay.....	1012.3	+ 0.3	93	70	89.9	72.9	81.4	- 0.8	71.8	77	1.7	0.18	1*	...	...		
Madras.....	1012.0	+ 0.7	89	66	85.5	71.4	78.5	- 0.4	73.7	83	4.8	6.40	7.21	6*	...				
Colombo, Ceylon.....	1011.2	+ 1.2	87	71	85.0	73.5	79.3	- 0.7	75.8	78	6.0	11.93	21	6.7	57				
Singapore.....	1010.0	+ 0.6	89	73	85.5	75.3	80.4	- 0.2	76.8	79	8.4	9.86	23	4.6	38				
Hongkong.....	1016.9	- 0.7	84	54	75.9	67.8	71.9	+ 2.3	66.5	75	6.6	0.35	3	5.8	53				
Sandakan.....	1009.8	...	90	73	86.6	74.7	80.7	- 0.2	77.3	83	8.4	9.57	22	...	...		
Sydney, N.S.W.....	1014.1	+ 0.3	92	51	73.3	58.8	66.1	- 0.9	60.9	59	6.6	2.14	8	7.5	54				
Melbourne.....	1014.5	+ 0.1	96	44	71.0	49.9	60.5	- 0.8	54.5	57	6.8	2.06	14	6.0	43				
Adelaide.....	1015.9	+ 0.7	101	45	78.4	56.1	67.3	+ 0.3	56.3	35	6.3	0.91	7	8.3	60				
Perth, W. Australia.....	1015.8	+ 0.4	93	49	73.5	56.1	64.8	- 1.3	56.7	53	4.6	0.24	5	10.1	73				
Coalgardie.....	1012.4	- 0.7	107	48	85.6	57.1	71.3	+ 0.6	61.6	51	2.8	0.25	2	...	...		
Brisbane.....	1015.8	+ 1.2	97	57	81.2	63.2	72.2	- 1.3	64.7	55	4.6	1.26	5	9.8	73				
Hobart, Tasmania.....	1010.0	+ 0.4	84	39	64.5	48.4	56.5	- 0.7	50.4	56	6.6	2.91	15	7.0	48				
Wellington, N.Z.....	1009.2	- 2.9	71	37	60.2	46.2	53.2	- 3.6	50.2	70	5.9	2.84	18	6.2	43				
Suva, Fiji.....	1010.3	- 0.8	89	69	82.2	73.1	77.7	+ 0.6	73.7	82	8.2	26.55	27	2.8	22				
Apia, Samoa.....	1009.2	- 0.3	87	73	85.3	75.6	80.5	+ 1.8	77.1	79	6.9	15.45	21	5.7	45				
Kingston, Jamaica.....	1012.4	0.0	89	63	86.5	70.2	78.3	- 1.0	68.4	83	3.4	0.06	1	6.0	53				
Grenada, W.I.....	1010.8	+ 0.2	88	71	86	73	79.5	- 2.7	74	74	7	5.55	2.91	21	...				
Toronto.....	1020.0	+ 2.7	64	15	44.8	34.7	39.7	+ 2.0	36.6	85	7.5	2.37	12	2.3	24				
Winnipeg.....	1020.9	+ 3.5	41	- 8	21.5	5.5	13.5	- 7.8	...	...	5.2	0.90	8	3.2	35		
St. John, N.B.....	1020.3	+ 5.7	55	18	44.8	33.8	39.3	- 2.6	37.0	...	7.6	6.39	17	2.2	23				
Victoria, B.C.....	1021.5	+ 5.6	53	29	46.8	39.4	43.1	- 1.4	40.4	86	6.6	1.79	14	3.4	37				

Summer Indian stations a rain dog & a dog on which 0.1 in. or more rain has fallen.

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