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A Year's Experience of the Universal Decimal Classification in Meteorology

By C. E. P. BROOKS, D.Sc.

After the International Meteorological Conference at Warsaw in September, 1935, had adopted the revised section for Meteorology in the Universal Decimal Classification,* preparations were at once begun for the introduction of this classification into the Library of the Meteorological Office. At that time the subject classification in use was that of the International Catalogue of Scientific Literature, which had been adopted in 1897. The earlier edition of the Universal Decimal Classification was not used in the Meteorological Office, as the section on meteorology was not regarded as satisfactory. The date fixed for the official change to the Decimal Classification was January 1st, 1936, but in order to gain experience in the latter, all literature received during the last three months of 1935 was classified on both systems. The Universal Decimal Classification has now been in use in the Meteorological Office Library for over a year, and some account of the difficulties encountered and the methods adopted to deal with them, may be of interest to the librarians of other meteorological institutions considering the adoption of this classification.

It was soon found that one of the greatest bugbears of the

* The meteorological classification, with an account of the principles on which it is based, was printed in the *Quarterly Journal of the Royal Meteorological Society* for January, 1936, pp. 134-44.

meteorological numbers—their length—did not in practice prove a serious inconvenience. The initial figures for Meteorology, 551.5, are longer than those of, for example, Botany, 58, and at first the possibility of substituting some conventional letter such as M was considered, but this proved unnecessary. The full numbers are now used regularly, and no difficulty has resulted.

In other ways also the purely meteorological part of the classification has on the whole proved successful, though it has been found advisable to define the scope of a few numbers in greater detail than was possible in the schedule. As an example may be mentioned the sub-division 551.506.1. The title of this is “Weekly, monthly and annual weather reports and bulletins,” but the general title of 551.506, “Observational data (including weekly, monthly and annual means)” shows that it should also include periodical publications of observational data for any one meteorological element, such as rainfall, and tables of rainfall observations are classified here and not under 551.577, Precipitation. In practice, however, it was found convenient to distinguish between the data which are found in most meteorological year books, such as rainfall or wind direction, and those which are rarely found in the ordinary year books, such as data of atmospheric pollution. An annual report containing only the latter would be given two numbers, i.e., 551.506.1 and 551.510.42 (058), and would therefore appear under “Atmospheric Impurities” as well as under “Observational data,” the (058) indicating that it is an annual publication. It would occupy too much space to give all these definitions in full here, but the Director of the Meteorological Office will be pleased to supply copies to Librarians of Meteorological Services and Institutions interested in the Universal Decimal Classification.

Much greater difficulty was experienced in dealing with border-line subjects, even where a definite number was assigned in the meteorological classification. For example, it was necessary to distinguish carefully between 551.586, Bioclimatology; 614, Hygiene; and 615.834, Climatotherapy. In this connexion it may be remarked that the subject of Bioclimatology is growing so rapidly that it is already desirable to sub-divide the number 551.586, and a provisional schedule has been made for use in the Meteorological Office Library.

Some border-line papers are classified by means of the colon, the sign of relationship, which has proved of the greatest value. A few examples of colon numbers are given in the general tables, such as 551.5 : 016, General Meteorological Bibliographies, and 551.5 : 92, Biographies of Meteorologists. Another compound number of frequent occurrence is 551.508.1 : 621.396.9, Radiosonde meteorographs (literally “Instruments for upper air investigation; Application of Wireless”) which in spite of its formidable appearance, is already an old friend. The subject

"Daylight illumination" when discussed from the meteorological standpoint receives the compound number 551.521 : 535.24 (Photometry in relation to radiation). The number for aerial navigation, 629.13, is also frequently found in association with various meteorological numbers.

"Meteorological Societies and Institutions" have the compound number 551.5 : 06. For our purposes it was found desirable to discriminate between International, National and Private Institutions, e.g., between the International Meteorological Organisation, the British Meteorological Office and the Royal Meteorological Society. A distinction somewhat along these lines is now part of the official tables of the Universal Decimal Classification, though unfortunately not in a very convenient form.

Apart from a relatively few numbers such as these, representing subjects which are closely bound up with meteorology, border-line papers may deal with the relations of meteorology to almost the whole range of human knowledge. Here it was considered undesirable to classify the non-meteorological aspects in extreme detail.

The result of connecting two numbers by a colon is in effect to construct a new sub-division for each of them. For example, the meteorological tables do not include a specific number for the subject of "Effects of wind on buildings," but "Effects of wind" is 551.556 and a suitable sub-division is readily made by combining this with the number for buildings, giving 551.556 : 69. There are many sub-divisions of 69 representing different types of building, but for the purposes of a meteorological library it is not necessary to discriminate between them, and the one class is sufficient. To obtain uniformity in dealing with non-meteorological subjects a standard list of numbers has been compiled, and finer sub-divisions of these numbers are ignored. In the same way most of the finer sub-divisions of the geographical classification are ignored. In the Universal Decimal Classification the geographical numbers are carried into the most minute detail, but the general arrangement unfortunately leaves much to be desired.

Since any compound number is written in two ways, it requires two entries in the subject index. Where, however, two numbers frequently occur in conjunction, as with radio-sonde meteorographs, labour can be saved by making all the entries under one number, merely inserting a cross-reference under the other number. Thus in the Meteorological Office Library all papers on radio-sondes are entered under "Instruments for upper air investigation" but not individually under "Applications of wireless." This procedure is also adopted in a few cases where the two numbers connected by the colon are both meteorological, if the subject is clearly defined and of frequent occurrence. The works on "Air-mass climatology" are all entered under 551.582 : 551.515.8, but not individually under 551.515.8 : 551.582.

Apart from the problems of classification, it was necessary to decide how the great subject bibliography based on the old classification should be handled. This bibliography is a continuation up to the end of 1935 of section F of the International Catalogue of Scientific Literature, which ran from 1900 to 1914, and it includes many thousands of entries. The re-classification of the whole of these was not practicable, especially as the entries are on a series of foolscap sheets for each number and not in the form of a card index. All that could be done was to collate the two classifications as far as possible, so that cross references could be made from one to the other, and tables were constructed for this purpose.

The disadvantage of a break in continuity will, no doubt, continue to be felt for many years, but it is hoped that this will soon be more than counter-balanced by the advantage of a modern and more flexible classification, and one which is already being widely adopted by meteorological institutions in all parts of the world.

Unusual Persistence of Fog

The period November 19th–28th, 1936 in the Manchester and Liverpool areas was characterised by almost continuous fog, which for the greater part of the period was thick (visibility less than 220 yards), at any rate in the Manchester area. Such continuity has not been experienced before by any of the members of the Staff of this station so that it was felt that some details of the occurrence should be made more widely known.

The first signs of fog appeared on Thursday, November 19th as, with pressure steadily rising, a ridge of high pressure began to intensify over the British Isles with its axis approximately north-east to south-west. Visibility during the afternoon of this day fell to 600 yards owing to a light easterly wind which carried smoke from Manchester over the aerodrome. Before midnight the sky cleared and dense fog appeared before 7h. G.M.T. on the 20th. Though the fog on this day decreased in intensity during the midday period visibility was consistently below 1,100 yards except for a period of less than an hour about 16h.

The 21st was almost a repetition of the 20th—dense fog early, visibility improving to 1,100 yards by 15h. 40m. and falling below that distance by 17h. 15m. with fog (visibility 220 yards) by 18h. 20m. When the visibility fell to below 1,100 yards on this occasion we were not destined to see this visibility point for nearly a week, i.e. until 4h. 15m. on Saturday, November 28th. Surely this is in itself remarkable, but actually only for a very brief period during this time did visibility reach 220 yards, so that from 18h. 30m. approximately on the 21st to 10h. 40m. on the 28th visibility was practically continuously below 220 yards, i.e. a period of over 160 hours of thick fog.

During the evening of the 28th visibility again grew steadily worse after 18h. 30m. and fell to 5 yards in many places by 22h.; soon after midnight however a freshening SW. wind dispersed the fog.

The variations of thickness of the fog are worthy of note. For most of the thick fog period visibility varied from 30 to 150 yards but at times, notably on the night of the 24th and the afternoon and evening of the 27th visibility at times was 1 to 3 yards and it was difficult to find one's way about on foot, the outline of the kerb alone being really visible. On these occasions, the smoke and dirt in the fog were indescribable, causing it to have a rancid smell whilst evidence of the presence of sulphurous compounds was only too obvious, from the effect they had on the eyes, nose and throat.

After two or three days of the fog the soot deposit began to get more and more definite and soon everything exposed to the fog was covered by a black wet slime, making even grass and shrubs appear drab (it is impossible to say exactly how their colour was modified). On one day a pilot flying over Liverpool in the fog, while trying to land at Speke Airport, encountered slight ice formation, but the ice was almost black. Several cotton mills in this area not equipped with air purifying plant had to close down as the pollution in the air was soiling the yarn as it was being spun.

On Saturday, November 28th, visibility after being 60 yards at 7h. steadily improved to 1,400 yards at 16h. the sky being practically clear and the wind north-westerly force 1-2. During the afternoon visibility in the north of the city improved to several hundreds of yards and racing took place at Broughton in bright sunshine, but a football match in progress on the south side of the city had to be abandoned before half-time owing to the re-formation of dense fog. Undoubtedly the wind direction and speed largely contributed to the adverse conditions experienced in this case. By dusk visibility was again below 500 yards generally and by 20h. shallow thick fog was widespread, the moon being plainly visible; by 22h. however the fog was dense, visibility generally less than 5 yards and the sky obscured.

C. W. G. DAKING.

F. Edwards, Esq., writing from Romiley near Stockport gives some interesting details covering the period 12 noon on November 21st to 7h. on November 22nd. His attention is mainly concentrated on peculiar temperature changes during this period, but his account includes also some interesting details of fog at Romiley. In view of the proximity of Stockport to Manchester the facts related bear indirectly on the subject matter of the foregoing note.

Although the night of November 21st-22nd was cloudless at Romiley there was a brief rise in temperature of 2° F. at 20h.

followed by a more noticeable rise of 5° F. beginning at midnight and persisting for 2 hours. In spite of the fog at Manchester, and as Mr. Edwards stresses, at many other stations at 7h. on the 22nd, visibility at Romiley was 20 miles and after daybreak the temperature rose steadily to 48.5° F. by 11h. 15m. It was not until 12h. 15m. that fog drifted up from the valley from south-west, visibility falling to 200 yards and the thermograph falling to 41.2° F. After a temporary clearance during which the temperature began to rise, the wind suddenly shifted to NNW. force 2 and a mass of fog reduced the visibility to 100 yards with a sharp drop in temperature. At this stage at a height of 800 ft. there was clear sky and bright warm sun with a SE. breeze of 10–15 m.p.h., whilst the tops of chimneys and the tops of the Peakland hills were all standing out above the fog. Ultimately a dense fog bank settled down for the night and temperature fell to a minimum of 24° F.—an unusual range for a November day of 24.4° F.

Stockport lies some 6–7 miles south-east of Manchester and under the Peakland hills so that throughout the period indicated, with a prevailing light SE. breeze it was mainly free from drifting industrial smoke fog and haze until some local effects caused a change in the surface wind as at 12h. 15m. and again at 13h. 40m. A consideration of the upper air distribution over England however suggests that other and more important conditions were also operative at Romiley both to account for the variability of the visibility and the peculiar temperature changes.

The aeroplane ascents at Mildenhall show that towards the end of the week in question, a very warm air mass overlay the cold surface layers. On the afternoon of November 20th, the cold surface air extended to about 4,300 ft. but by Saturday morning the 21st the surface of separation or base of the inversion had fallen to about 1,200 ft. Above the surface of separation warm dry air prevailed—at 2,300 ft. 45° F. and 71 per cent relative humidity. It is feasible to suppose that subsequently the inversion came lower, and the facts suggest that at about midnight on the 21st the station at Romiley at a height of 510 ft. was affected by the warmer air from above and the temperature rose. Surface radiation was then active for the remainder of the night, but with sunrise the air temperature steadily rose to the high level recorded. All the evidence indicates that the warmer air from above never, as a whole, reached the surface, and the fog was trapped between the lower lying ground and the base of the inversion.

Without a detailed examination of the records it is of course impossible to delineate the areas where the warmer air from above may have penetrated almost to the surface but an almost complete clearance of the prevailing fog towards morning at Upper Heyford and Cranwell for example, suggests that the drier air came very close to the surface. On the Air Ministry roof in central London there

was a slow irregular rise in temperature from 20h. on the 21st to 6h. on the 22nd, again with a clear sky throughout. During Sunday, November 22nd, the gradient for easterly winds increased which would have the effect of increasing the depth of the cold air near the surface, so that it is to be expected that during Sunday, the warm air would be lifted above the level of Romiley with the establishment of conditions suitable for persistent fog. The aeroplane ascent on November 23rd showed the cold air to have a depth of about 2,000 ft.

F. H. DIGHT.

Dense Fog at Bournville

It is thought that a few comments on the dense fog of November 21st–26th, 1936, easily the most prolonged experienced at Bournville since observations were commenced in 1911, may be of general interest.

At 9 o'clock on the morning of the 21st there was a belt of dense but beautifully white fog at ground level. So shallow was this belt at first that the sunshine recorder, which is on a roof some 80 ft. above ground level, registered 3·8 hours of sunshine during the day.

It was extremely depressing in the week which followed to see the gradual blackening of the fog owing to the accumulation of Birmingham's products of combustion. What slight breezes there were came from the north-east and aggravated the contamination of the air in so far as Bournville was concerned. Rarely has there been in the Midlands a more striking indication of the need for smoke abatement.

0·07 in. of rain fell during the afternoon of the 26th. This had a hydrogen ion concentration value of 3·0 which is remarkably acid for Bournville. During the week copper and silver articles within doors acquired a lustrous black film within an hour or two of cleaning. Out-of-doors, metals, for example the copper rim of the rain gauge, displayed an unusual black iridescence. Pavements, roads, grass verges, window sills, etc., became intensely sooty within a short time. Housewives, window cleaners and others will have tangible reminders of this visitation for many days.

The fog was not dispersed completely until the advent of a fresh south-westerly breeze on the 29th.

J. K. BEST.

Cadbury Brothers Ltd., Bournville, December 3rd, 1936.

Persistent Fog at Rotherham

From the point of view of persistence and of density, no fog in my fifteen years of observing the weather has equalled the one just ended here. It was first in evidence on Friday morning, November 20th, but had dispersed by noon; Saturday was a pleasant misty day, but the fog had returned by Sunday morning the 22nd, and from

then until Friday a state of fog persisted continuously ; it was thick—visibility less than 220 yards—until Wednesday and then moderate—visibility 220–1,100 yards—until Friday when it disappeared.

LESLIE ATKINSON.

187, *Broom Lane, Rotherham, Yorkshire, December 1st, 1936.*

Snow in the Rain-gauge

In summarising the rainfall records received in the Meteorological Office periods of snow often give rise to considerable difficulties. In some cases the gauge may become buried in a local snow-drift, while in others the snow may be blown out of the funnel. Then there are the difficulties experienced by the observer in making readings during semi-arctic conditions. In the case of certain monthly gauges on exposed moors the observer often runs considerable risks of getting lost in the blinding blizzards or buried in snow drifts during extreme conditions. The inspector usually sees such stations during the summer months, but many observers have commented on the severity of the conditions and even asked that the suggestion should be made to their employee that under such conditions the round of reading the gauges should be undertaken by two observers together, in order to minimise the risks of disaster and make the trip more bearable. Fortunately heavy falls of snow are relatively rare in most parts of the British Isles and the depth of snow as it falls is fairly uniform over large areas, much more uniform than in the case of intense rains. Each such storm warrants therefore special study and it is all the more desirable that reliable records of the precipitation should be obtained. At Headquarters it is usually necessary to plot the values for individual days and the monthly totals covering periods of snow and to suggest modifications to the values in certain cases.

In order to obtain the most reliable results the observers are asked to make the following measurements:—(1) the amount of water (i.e. actual rain or thawed snow) in the gauge, (2) the amount of unmelted snow (also converted into water) including any snow immediately above the funnel, which should be separated and pressed into the funnel, and (3) the depth of fresh undrifted snow. The sum of (1) and (2) gives the amount of precipitation for entry in the register ; (3) is an additional piece of useful information. If these three observations are supplied it is usually practicable, in conjunction with the maps showing the general distribution of the precipitation over the country, to ascertain whether the final figure given for the precipitation is the best estimate available.

Messrs. Hancock and Pinnock in their article in the October number of the magazine have made suggestions for obtaining more

reliable readings under (2). They contend that the methods suggested in "Rules" are unsatisfactory, even under the relatively mild conditions prevailing on the south coast. These methods are (a) if no precipitation is falling the gauge may be brought indoors so that the contents may be melted, (b) a cloth dipped in hot water may be applied to the outside of the funnel and receiver or (c) a definite amount of very warm water may be poured into the gauge. Observers were asked to comment on the method suggested by Messrs. Hancock and Pinnock, which consisted of applying heat by the use of the solid fuel "Meta" under the funnel of the gauge. It is now possible to give a summary of the comments already received.

Mr. G. B. Davie, of Moreton-Hampstead, Devon agrees with Messrs. Hancock and Pinnock "that considerable difficulty is experienced in melting snow in the rain-gauge, when the amount is large, by the approved methods." Mr. Davie finds that when the depth of snow is 2 inches or more the method (c) of adding very warm water is unsatisfactory and he advocates tipping the snow out of the funnel and into some receptacle for melting indoors.

Mr. D. L. Champion, of Goff's Oak, Hertfordshire reports that on rare occasions he has found the funnel half full of snow and ice. Then he has added .50 in. of very warm water but it has been found necessary to pour the liquid at least twice through the funnel before all the solid matter is washed through. Mr. Champion has not tried the method advocated by Messrs. Hancock and Pinnock but considers the standard method quicker and safer than that of applying dry heat to the funnel.

Mr. A. E. Moon of Hastings has always found the method of wrapping a hot cloth round the funnel of the gauge quite satisfactory, while if snow is falling at the time of observation the contents of the funnel are turned out into a flat dish rather larger than the funnel. Again Mr. Moon has not tried the proposed new method which he considers may result in a loss by evaporation or the weakening of a joint in the funnel.

Mr. J. G. Goodyear sends the following comments based on his experiences at certain of the Meteorological Office stations. "I have never found much difficulty in melting snow and ice by the method of pouring hot water into the funnel. I think the problem is not the fact that there is snow and ice, but that a supply of hot water may not be easily available at 7 a.m. on a winter morning at all stations. This lack of hot water applied at certain stations I have served at, and I agree with Messrs. Hancock and Pinnock that the application of dry heat in some form is a very excellent method—though the best method is undoubtedly that of an electric current illuminating a bulb. This applies a steady gentle heat and reduces the loss by evaporation, which otherwise might be considerable, to a minimum. The excellence of this method was

demonstrated at Upper Heyford where the self-recording gauge was heated in this way, thus melting the snow as it fell and at the same time preventing the water in the float-chamber from freezing".

On the whole the most useful result of the correspondence arising from the article by Messrs. Hancock and Pinnock seems to be that of directing attention to a simple procedure not mentioned in "Rules for Rainfall Observers," viz. to scrape out the entire contents of the gauge into a suitable vessel for subsequent measurement indoors. The procedure is likely to be particularly useful when precipitation is occurring at the hour of observation. In any case it is desirable that the vessel should be covered during transit.

Mr. Hudleston, in his experiments at Hutton John (see articles in *British Rainfall* 1926 to 1933) was concerned with comparative readings from various gauges. He therefore usually preferred to wait until the snow had melted without the application of artificial heat before taking readings. Where necessary, however, he used hot water obtained from a thermos flask. He suggested on page 288 of his final report in *British Rainfall*, 1933 that useful additional information is supplied by taking, with the funnel inverted, a "cheese" of the snow off the ground at some place where it seems to be of average depth and melting at leisure. This corresponds with method (3) above of measuring the depth of fresh undrifted snow.

Reference should also be made to the useful hints to assist the rainfall observer in securing reliable readings during the winter, given in an article by Mr. Bilham on "Rain-gauges in Winter" in this magazine for December 1929.

J. GLASSPOOLE.

OFFICIAL PUBLICATIONS

The following publication has recently been issued :—

PROFESSIONAL NOTES

No. 73. Notes on the behaviour of the anemograph at Lizard.

Compiled from reports by M. J. Thomas, B.Sc. (M.O. 336m.)

This paper contains an account of certain experiments to determine the cause and the character of eddies which made the anemograph at Lizard behave in an abnormal manner. The eddies were found to be formed in the lee of certain houses and by means of balloons and streamers the forms of the eddies were successfully mapped out.

Discussions at the Meteorological Office

The dates for these meetings in the New Year have been altered and the meetings will now take place on—

January 11th and 25th, February 8th and 22nd and March 8th, 1937.

Royal Meteorological Society

The Buchan Prize of the Royal Meteorological Society for 1937 has been awarded to Mr. C. S. Durst, B.A., for papers contributed to the *Quarterly Journal* of the Society during the years 1931–1935.

The opening meeting of this Society for the present session was held on Wednesday, November 18th, at 49, Cromwell Road, South Kensington. Dr. F. J. W. Whipple, F.Inst.P., President, was in the chair.

The following papers were read and discussed :—

Ivan D. Margary.—*Report on the phenological observations in the British Isles from December, 1934, to November, 1935.*

This report, which is issued annually, was published in July.

Sir Gilbert Walker and E. W. Bliss.—*World Weather VI.*

The fluctuations of pressure, temperature, and rainfall in winter in the region of the North Atlantic had been studied as a connected system in the last paper of this series ; and a similar system is now shown to hold in the spring, summer, and autumn. But the amount of persistence is small, so that the results are of little value for foreshadowing weather ; nor does a consideration of the trade wind region lead to success in this respect. Similarly, the Southern Oscillation which was found active in the summer and winter seasons over a large part of the globe is now shown to function in the two remaining seasons ; and while that of March to May has little control over the following quarter, the Southern Oscillation of September to November has a correlation coefficient of $\cdot 90$ with the Oscillation of December to February. Thus there are a number of relationships between $\cdot 60$ and $\cdot 82$ available for foreshadowing weather.

Correspondence

To the Editor, *Meteorological Magazine*

Rainbow with Vertical Shaft

As the observation of an extraordinary rainbow by Mr. Francis Druce was published* without the explanation asked for by the author, I venture to draw your attention to the explanation to be found in Bravais' article on the rainbow.†

The image of the sun reflected in a smooth sheet of water may give rise to a rainbow the centre of which, like that of the ordinary rainbow, is at 180° from the sun, but at a height above the horizon equal to that of the sun.

If the sheet of water is slightly ruffled, the image of the sun forms a trail of light, each point of which may give rise to a fragment of an extraordinary rainbow. The envelope of these arcs is a vertical arc, tangential to the ordinary rainbow, similar to that of which

* See *Meteorological Magazine*, 71, November, 1936, p. 230.

† Bravais, A. Notice sur l'arc-en-ciel. *Annu. mét. Paris*, 1849, pp. 311–31.

Mr. Druce has sent such a beautiful photograph. The sun must have been reflected in the sea.

L. BESSON.

Service Météorologique de la Ville de Paris, Paris, November 25th, 1936.

[As the paper by Bravais referred to by M. Besson is not readily accessible in this country, at Dr. Whipple's suggestion a translation of the relevant part (page 320) is given here.

"If the sun is near the horizon, and if the surface of the sheet of water is slightly ruffled, the bow produced by the reflected image assumes a remarkable appearance; its upper part disappears; the lateral parts alone remain visible in the form of vertical columns tangential to the right and left parts of the ordinary bow. The reflected image of the sun is then greatly elongated in the vertical direction; the reflected bow is the envelope of a series of bows of the first order having their centres in the vertical through the sun; these bows are almost superimposed on each other in the parts near the horizon; but they are separated from one another towards their uppermost parts, and the dispersal of brightness resulting from this separation of the various bows tends to render them invisible in this part of the sky. It was in this form that the phenomenon was seen by Bowman shortly after sunrise (Report of the British Association, 1840, Notices and Abstracts, page 12). Playfair and Brandes similarly saw only the lateral parts of the bows of reflection; they were tangential to the ordinary bow over a length of 7° to 8° . The height of the sun above the horizon was only 2° ." Ed. M.M.]

Mr. Druce and Miss Campbell are to be congratulated on securing such happy evidence for an almost unique phenomenon, the vertical shaft beside a rainbow.

May I elaborate a little the explanation given by M. Besson that the shaft was produced by light reflected from the water before reflection from the raindrops? It would hardly be expected according to the Bravais theory that the shafts would be so well defined that colours could be seen, so, to explain Mr. Druce's observations the theory should perhaps be modified. Can it be that in the actual case the sea waves were very regular owing to a swell passing from the open sea into the Sound to the east of Skye? The need for such a special combination of circumstances, low sun, distant shower, calm sea, strong swell in the right direction, would account for the rarity of a phenomenon which, so far as I know, has not been observed for nearly a century. F. J. W. WHIPPLE.

Kew Observatory, Richmond, Surrey, December 3rd, 1936.

Irisation and Altocumulus Lenticularis

On October 16th, 1936, an interesting example of altocumulus lenticularis, of thick lens shape, was observed at Abbotsinch. From the

commencement of observation at 14h. 30m. until 17h. 10m., when it was obscured by a sheet of lower cloud, it remained practically stationary although the wind up to 5,000 ft. was 30 to 50 m.p.h. (by pilot balloon ascent), and the speed at the cirrus level was shown by nephoscope observation to be about 100 m.p.h. At 14h. 30m. there was a small cumulus under the altocumulus in such a position that it reflected the sun's rays on to the base of the upper cloud, clearly revealing an undulating or roll structure. When first observed, the altocumulus was surmounted by an anvil of dense cirrus, which was fibrous at the upper edge, and the whole of this cloud mass exhibited beautiful irisations on the western and upper edges, the sun being concealed by the altocumulus. The bands of colour were in the order of the spectrum, red being nearest to the sun.

Statistical evidence provided by pilot balloon ascents shows that, in general, iridescence on cloud at Abbotsinch occurs with an air flow from a direction between 230° and 260° from north, i.e., one which passes over the hills in west Renfrewshire which lie west-south-west of the station.

We may infer therefore that irisation is due to diffraction by waterdrops in cloud newly formed in vertical air currents. These drops are consequently of uniform size, an essential condition for iridescence. This view has been advanced by Sir Napier Shaw.* The apparent lack of movement in the altocumulus was hence due to its formation in an ascending air current on the western side, where irisation was observed, and to its dispersion in a downward current, on its eastern side. The cloud was in what may be called a state of "dynamic equilibrium".

A. M. YOUNG.

Meteorological Station, Abbotsinch, Paisley, November 6th, 1936.

Corona at Bala

I observed on Friday night, November 27th, 1936, a rainbow effect round the whole of the moon. The colours were very distinct, a band of yellow, then blue, then green and finally white. The moon was almost overhead and the effect lasted while a thin high cloud covered the moon. This was for about $2\frac{1}{2}$ minutes from 10.25 to 10.27 $\frac{1}{2}$ p.m. The effect was on the cloud.

W. WALKER.

Plas Coch Hotel, Bala, north Wales, November 29th, 1936.

Triple Corona at Aberdeen

A very fine triple corona was witnessed here at 21h. 45m. G.M.T. on Sunday, November 29th, 1936. Shortly before this time the sky was covered with altocumulus combined with altostratus. This by 21h. 30m. was clearing rapidly and very beautiful irisation

* Manual of Meteorology, Vol. III, p. 85.

effects were seen along the edge of the altocumulus sheets. It was noticed that four long bands of higher thin cloud were moving rapidly out of the north-west. These bands were quite distinct from the altocumulus, which latter cloud was passing away leaving the thin higher bands quite clear. The bands were very translucent, and the brighter stars could be seen through them. One of these bands of cloud passed over the moon at 21h. 45m. and showed magnificent corona effects. Three distinct coronae were observed. In the first the aureole was very clear and definite indeed, the brownish-red ring being unusually strong. Next came violet—perfect in colour and well defined. This was followed by green, yellow and red. The second corona was quite clear and the colours of violet (rather faint), green and yellow (both strong) and again red were perfectly distinct. In the case of the third corona the colours noted were green and yellow (both clearly distinct) and red (rather faint).

This triple corona lasted for about five minutes only, but was followed about fifteen minutes later by a very brilliant single corona.

W. F. WATSON.

The Observatory, King's College, Aberdeen, November 30th, 1936.

“Weeping” Trees

A familiar sight during fog is the “weeping” of trees. A less frequent case occurred here on the evening of November 25th, 1936. Fog, not very dense, had persisted for several days, but on this day the air cleared, and after sunset the visibility was fairly good, the street lamps showing clearly at over a mile; the sky was overcast, wind NE. force 1, temperature about 33° F. But the elm trees were weeping very copiously indeed, so that the ground below had puddles of water, and the hedges also were dripping. All the time the streets were quite dry, and the air felt fairly dry for the time of day but unfortunately no humidity readings are available. The air temperature had been rising from 30·1° F. at 13h. to 32·8° F. at 17h., but the rise was so slow that it cannot in itself account for the heavy condensation. This continued till about 20h. 30m. when a very light drizzle set in wetting the roads, so that the drip from the trees was not so conspicuous.

W. G. KENDREW.

Radcliffe Meteorological Station, Oxford, November 28th, 1936.

Ben Nevis and its Snow Problems

In an address to the International Commission for Snow, which sat in Edinburgh from September 14th–16th, 1936, entitled “Drift problems suggested by severe snowstorms in the British Isles with special reference to the Scottish snow-beds”, I lamented the closing of the Ben Nevis Observatory on the ground that it required men

living on the spot to study the relation of the drifting and avalanching of snow to the snow-beds which last all the year round in the great Alt-a-Mhuilin corrie on the northern flank of the mountain. A knowledge of the precise relationship in question would be of much interest from the point of view of climatology, hydrology and glaciology alike. According to the records of the Ben Nevis Observatory, snow accumulates on the summit of the Ben to the great depth of 8 feet in May; but it has been estimated since that this great accumulation only represents quite a small fraction of the amount of snow which actually falls on the summit, the greater part being blown off by the terrific winds. Now since the summit is only clear of snow for a few weeks in late summer and early autumn it is fairly evident that if the snowfall of Ben Nevis came with calmer weather, clearance would be quite impossible in the time available. It would appear, indeed, that the critical factor preventing the formation of small glaciers in the Highlands to-day is the severity of the drifting, whereby large quantities of snow are blown off the summits and ridges and scattered on to the lower ground where under present climatic conditions it soon disappears.

All parts of the British Isles at an elevation greater than 1,000 feet above sea-level—one might almost say above 500 feet—are liable now and then to severe drifting snowstorms, but the Grampian summits of Scotland lie so near to the limit of perpetual snow that drifting becomes a determining factor.

As regards the more or less permanent snow-beds in the corries of Ben Nevis, Braeriach and other Scottish mountains it should be noted that such small snow fields or semi-glaciers must be far more sensitive to the climatic rhythm from year to year and century to century than fully developed glaciers would be. Had our predecessors through the centuries recorded the size and condition of these residues of the winter snows we should now be in possession of a climatic index of incomparable value. Hence we should see to it that our successors are possessed of it by commencing systematic observations.

Quite a number of people in Scotland are interested in the subject, and it is hoped to organize a scheme of research. I should like to conclude this note with a reference to Mr. Seton Gordon's fine book "The Cairngorm Hills of Scotland" which portrays most impressively the environmental importance of snowfall in the Highlands.

L. C. W. BONACINA.

15, Christ Church Rd., London, N.W. 3, October 20th, 1936.

Waterspouts off the Coast of Kent

The following information has been received from Lieutenant A. A. C. Gage, R.N. :—

During the period September 28th–October 2nd, 1936 no less than 5 waterspouts were observed at sea between Sheerness and Dover.

Four of them were close enough to the ship for it to be noted that their height was about 500 feet, their diameter 50-150 feet, their speed 10-15 knots and their life less than 5 minutes.

All of them formed from heavy cumulonimbus cloud but one dispersed before actually descending to sea level. In two of the remaining three cases, the sea was disturbed considerably. The direction of spin in each case was clockwise as far as could be judged.

The visibility during these few days was exceptional: the northerly wind, reaching force 6 about midday each day, was accompanied by occasional heavy showers of rain.

NOTES AND QUERIES

The Relation between Wind and Visibility in Winter

The effects on visibility of the drift of smoke from industrial areas and of fog from the Thames estuary, which have been so clearly set out in recent notes in this magazine*, doubtless have been of great interest to meteorologists and many others, and as a result of the interest stimulated, it was decided to ascertain if the smoke from the industrial areas to the east of London has any appreciable effect on the visibility at Goff's Oak, Herts.

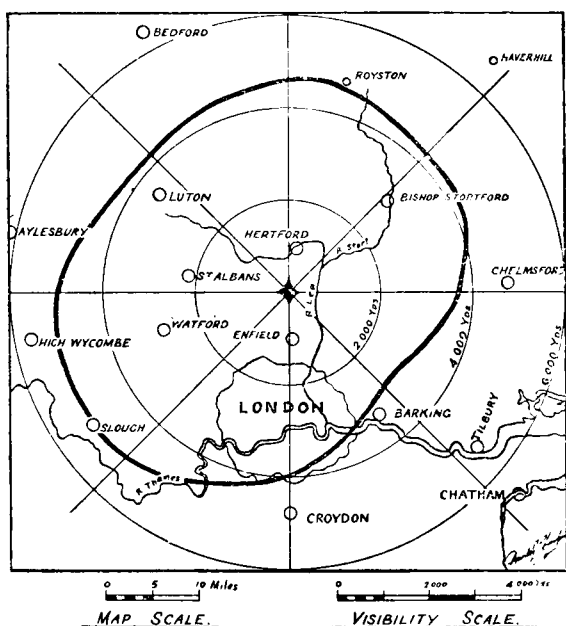


FIG. 1.

Observations of visibility and wind at 7 a.m. and 11 p.m. (Civil Time) for the months of September to March in the winters of 1934-5 and 1935-6 were available; and since, for topographical reasons, visibility on clear days of a conspicuous object on the horizon, is limited to about four miles, it was assumed that the maximum possible visibility was 6,600 yards. Within this limit, the mean visibility was estimated for winds from each of the eight points of the compass, and the resultant curve is shown in the composite map, Fig. 1.

It will be seen, that the atmospheric pollution from the industrial

* See Vol. 71, 1936, pp. 157 and 183.

area east of London and along the Thames towards Tilbury, reduces the visibility with SE. winds by about 1,300 yards below the average. The fogs of the lower Lea Valley, with its own smoke-producing factories, have considerable effect on visibility with winds from the east; while the residential and business areas to the west and north of London are also effective in reducing visibility when the wind is in the south, the reduction is not so serious as with SE. or E. winds. The slight reduction in visibility indicated with NW. winds may possibly be due to pollution from the industrial areas around Luton and Dunstable.

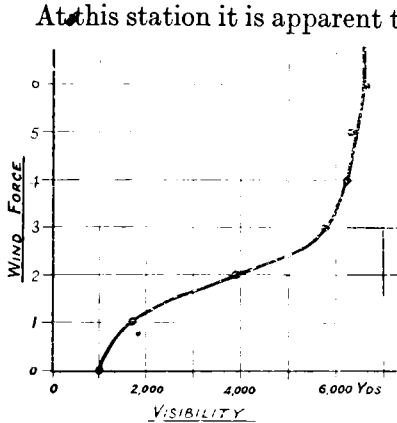


FIG. 2.

At this station it is apparent that fog in winter is usually associated with calm (or nearly calm) conditions, and in order to ascertain the effect of wind velocity on visibility, the mean visibility was calculated for winds of each force on the Beaufort scale, irrespective of direction. The resultant curve, shown in Fig. 2, indicates that there is usually a marked improvement in visibility as the wind increases from force 1 to force 3, but the improvement falls off rapidly with any further increase in velocity and the curve appears

to become asymptotic to the "maximum visibility" line $V = 6,600$ yards, at about force 6.

Doubtless curves from data at other stations would have different characteristics, owing to differences in exposure relative to the natural horizon; and doubtless also, different curves would be obtained for different hours of observation at the same station. Curves from stations where the "maximum possible" visibility exceeds 6,600 yards, would bring to light some interesting facts regarding the relation between wind velocity and horizontal visibility.

DONALD L. CHAMPION.

Showers and Squalls at Ismailia, Egypt, July 28th and 29th, 1936

A very heavy shower occurred at Ismailia during the afternoon of both July 28th and 29th.

The occurrence of rain in July is almost unique.

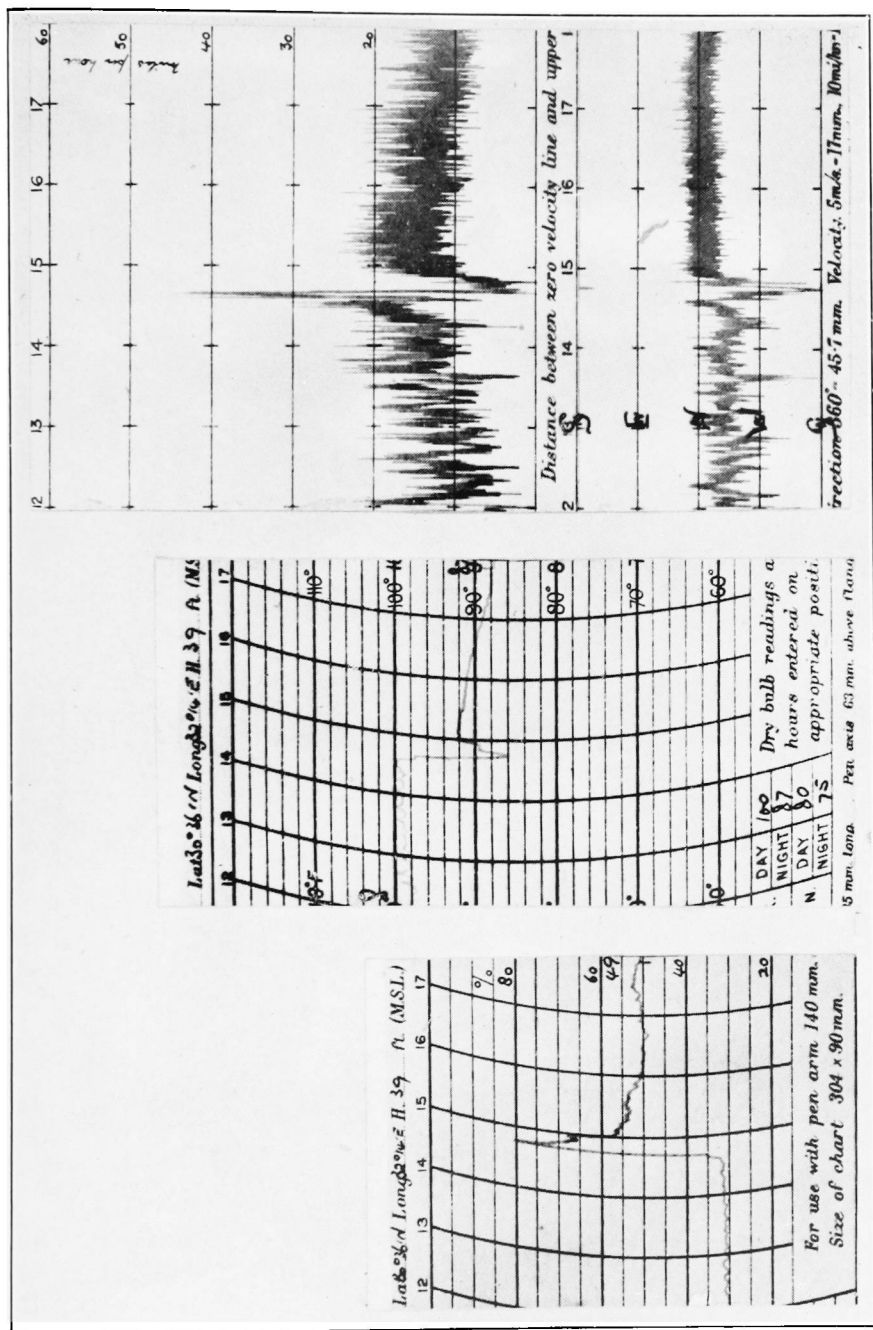
As far as can be ascertained from records no rain has been recorded for at least 33 years. Old inhabitants, both European and native, agree that the rain was unprecedented, and had not occurred within living memory. So unusual was it that many natives were terrified, saying that it was a judgment of Allah. It so happened that the heaviest rain fell in the native quarter of the town on both occasions; and the falls of 3.2 mm. and 4.0 mm. at the Meteorological Office

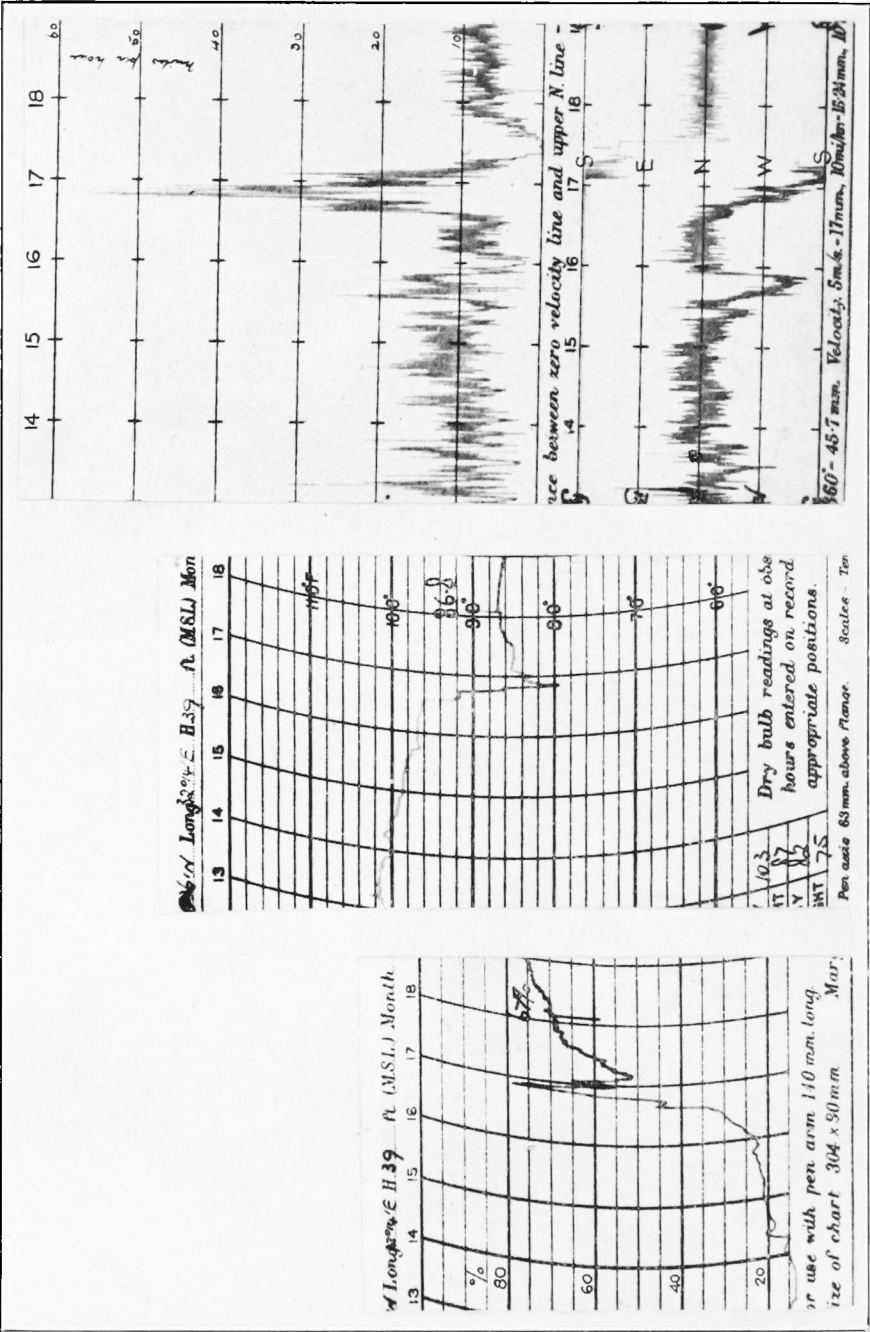
were evidently not the heaviest that occurred. Streets on both occasions were flooded in the native quarter, though only a very little rain fell elsewhere. Pressure distribution at 6h. G.M.T. on the 28th showed that the usual "low" over Iraq had deepened, and that there was a well-defined trough and front extending from it in a west-south-west direction across Syria to the eastern Mediterranean. This front appeared to move at about 18 m.p.h. in a south-easterly direction and was probably near Port Said about 12h. G.M.T., the wind having veered NNW. This was the only indication as the sky was cloudless; but the pressure there was over 2 mb. higher than at Ismailia while the gradient between Ismailia and Suez was negligible. The first indication at Ismailia was a line of cumulus to north-west and north. This line of cloud is, however, quite common in summer, marking the front of the usual northerly sea-breeze, which sets in sometime during the afternoon. On this occasion, however, the cumulus increased considerably in size when the line was nearly over Ismailia. The wind was north-westerly, moderate and rather gusty, and the temperature about 100° F. At 14h. 40m. G.M.T. the wind veered N. in a strong squall, gusts reaching 46 m.p.h., and was accompanied by a heavy shower, the sky both to north and south being almost cloudless. Temperature fell rapidly to 86° F. and relative humidity rose from 32 per cent to 80 per cent, most of the change taking place in under five minutes. The wind fell immediately afterwards for ten minutes and then settled down at 14h. 55m. G.M.T. to a steady moderate breeze from north. Temperature at the same time rose to 92° F. and relative humidity fell to 56 per cent. It seems that the latter temperature and humidity indicated approximately that of the new air, the extra fall of temperature and rise of relative humidity being attributal to rain. Rain was reported with a cloudy sky at Toussoum, seven miles south-south-east of Ismailia, about 16h. G.M.T. and a squall from north-west at Deversoir, fifteen miles south-south-east, later. The front appeared to become diffuse after this, as beyond cloud no special phenomena were reported from the Suez Canal stations further south.

On the 29th a very similar set of conditions prevailed, though with certain differences. Another front moved south-eastward, and again appeared to be situated near Port Said about 12h. G.M.T. Temperatures were generally much higher than on the previous day; but a "heat low" was situated inland, pressure being 2.5 mb. lower at Ismailia than at Port Said, and about 1 mb. lower than at Suez. This distribution is fairly normal, however, for the time of year, though showing greater pressure differences.

A marked fall of temperature from 98° F. to 86° F. and a rise of humidity from 34 per cent to 78 per cent occurred at Port Said between 12h. and 15h. G.M.T.

The line of cloud worked up from north-west as on the 28th, but the front became almost stationary over Ismailia about 13h. G.M.T. This cloud increased in amount during the afternoon and had





grown to large cumulonimbus by 16h. G.M.T. A violent squall with gusts reaching 57 m.p.h. accompanied by heavy rain occurred at 16h. 30m. G.M.T., commencing from N. and backing during the squall rapidly through W. and S. to SE., after which a gentle northerly breeze set in. The fall of temperature and rise of relative humidity were even larger than on the 28th. No rain was reported on this occasion at the Suez Canal stations to southward; but a northerly squall was experienced at Toussoum at 17h. 10m. G.M.T., and from NE. at Geniffa, about 35 miles south-south-east of Ismailia, at 18h. 15m. G.M.T.; the sky at all stations being cloudy.

It seems probable that with the conditions obtaining the topography of the country was the essential cause of the rain. To the north of Ismailia on the western side of the Suez Canal is a large area of desert, as far as the edge of Lake Menzaleh near Kantara, while east of the Canal is entirely desert. The desert is, of course, very dry and hot. At Ismailia the Canal broadens into Lake Timsah, and a cultivated and heavily irrigated strip of land extends from it in a westerly direction along the fresh water canal, and southward along the western side of the Suez Canal to the Great Bitter Lake. South of this strip is unbroken desert.

It seems probable that sufficient moisture for "cloud and rain making" was obtained from the lake and this strip of land near Ismailia, and in conjunction with the forced ascent of air on the arrival of the cold front, was sufficient to produce rain. In the usual weaker "sea-breeze fronts" it is quite common for the cloud to increase greatly on reaching Ismailia area.

In the case of the squall of the 29th, it seems that a definite small centre formed on the almost stationary front and a more "tornado effect" occurred. There is evidence at 18h. G.M.T. of a separate low pressure area having formed between Cairo and Suez, and altocumulus castellatus was observed at Port Thewfik.

No special phenomena were recorded at other Middle East stations; but these are so far apart that the actual conditions obtaining at any one time are largely a matter of conjecture. T. F. TWIST.

Humours of Meteorology

A correspondent of a New Zealand newspaper evidently feeling the term "cyclonic" inadequate recently described a storm in New Zealand as "a strong nor-westerly wind . . . of almost *anti-cyclonic* force". The italics are ours.

REVIEWS

Zweites Köppen-Heft der Annalen der Hydrographie und Maritimen Meteorologie. pp. 94, *Illus.*, 8 folding charts. Deutsche Seewarte, Hamburg, 1936.

In 1926, on the occasion of the 80th birthday of Professor Wladimir Köppen, the Deutsche Seewarte published a "Köppen-Heft" which

included contributions from many of his old friends and colleagues in all parts of the world. Ten years later a second special volume commemorates his 90th birthday, but this is a more personal contribution, being entirely the work of the staff of the Deutsche Seewarte and its marine and overseas correspondents.

Fourteen articles are included, dealing as would be expected, largely with various aspects of marine meteorology—comparison of estimates of wind force at sea with measurements of velocity; diurnal variation of temperature; wind and swell; sub-tropical cyclones etc. Land and upper air meteorology are not forgotten however, as for example in the discussion on mountain observations and high-level charts.

An interesting feature is a series of reproductions of Köppen's handwriting at intervals of ten years from 1876 to 1926. In 1926 he wrote that his life's work was done; in a brief foreword Dr. Spiess, President of the Deutsche Seewarte, comments on the way in which events falsified this forecast, and the handwriting of 1936 still shows plenty of vigour.

Die Frequenz der Sonnenhalobeobachtungen in den Niederlanden, besonders von 1914–1931. By C. Visser, De Bilt, K. Ned. Meteor. Inst. No. 102. Med. en Verh. 37, pp. 86 (Dutch) + 9 (German Summary). *Illus.* 's Gravenhage, 1936.

The records of optical meteorological phenomena systematically collected by the Dutch Meteorological Institute over many years, and published annually in "Onweders, Optische Verschijnselen enz. in Nederland", provide a mine of information on the frequency of occurrence of the various types of haloes at different hours and different seasons. These have been studied statistically by C. Visser. For the common halo of 22° his tables are based on more than 13,000 observations, which show that this halo is most frequent in April and May, when temperature contrasts in the upper air are greatest, with a secondary maximum in August and a minimum in December. These features remain even after correction for length of day, etc., though the resulting annual curve is much flatter. The most favourable hours are about noon and the most favourable elevation of the sun, 56 – 59° .

Similar tables are given for the upper arc of contact and mock suns of the 22° halo, circumzenithal arc and halo of 46° , all of which show a similar annual variation except that the secondary maximum tends to come in October or November instead of August. They are, however, most frequently observed with a comparatively low sun, 12 – 15° for the arcs of contact and mock suns, 20 – 23° for the halo of 46° . Even the rare Arc of Lowitz follows roughly the same distribution, the smoothed table based on 68 observations showing a maximum in April and a secondary maximum in September. This phenomenon is discussed in detail and in the last chapter a new explanation is given, based on an experimental investigation, in

which a hexagonal prism, with a refracting angle of 60° , undergoes two rotatory movements in such a way that it rolls round the surface of an imaginary cone. Other halo phenomena are listed but are too rare for statistical treatment.

The text is in Dutch but the tables are fully intelligible and there is an adequate summary in German.

Kan man förutse, huruvida en vinter blir varm eller kall? and Kan man förutse, huruvida en sommar blie torr eller regnig? By O. Pettersson. Göteborg, 1935.

In these two papers Professor Pettersson sets out the bearing of his researches into lunar tides of long period on the problems of climatic pulsations. In the first he shows how the nine-year lunar "node-apside" period dominates the winter temperature of Berlin, the date of breaking-up of ice on Lake Malar, and the rainfall of Lund. Superposed on this is a longer periodicity which fits in closely with the cycle of 186 years in the orientation of the major axis of the lunar orbit compared with that of the earth. This effect takes place partly by inducing changes in the flow of warm ocean currents into the Arctic, and partly directly in the earth's atmosphere. The variations in the combined action of the earth and moon also affect sunspots and so give rise to an apparent relation between the frequency of sunspots and terrestrial weather.

In the second paper the mechanism of the direct lunar action on the earth's atmosphere is examined more closely as a gravitational problem. The resulting variations of pressure, complicated by the existence of the tropopause and the polar fronts, produce marked variations and recurrences of storminess. The discussion will interest those meteorologists who can read Swedish, though not all will agree with the author's conclusions.

BOOKS RECEIVED

Schweizerisches Forschungsinstitut für Hochgebirgsklima und Tuberkulose in Davos (i) *Gesamtverzeichnis der Publikationen*, by Prof. Dr. C. Dorno; (ii) *Verzeichnis der Veröffentlichungen*. Davos, 1935.

Resumen de las observaciones efectuadas en la red termoplúviométrica durante el año 1934. Observatorio de Igueldo, San Sebastian, 1935.

OBITUARY

Edward Kitto.—We regret to learn of the death on June 8th, 1936, of Mr. E. Kitto, Superintendent of the Falmouth Observatory from 1882 to 1913. Mr. Kitto's total period of service at the Observatory extended over more than 44 years. From May, 1869, he acted as Assistant to the late Mr. Lovell Squire, the Superintendent, until Mr. Squire's retirement in 1882, when Mr. Kitto

was appointed his successor. He became a fellow of the Royal Meteorological Society in the same year. Mr. Kitto's services under the Royal Cornwall Polytechnic Society covered practically the whole of the period during which Falmouth maintained the status of a First Order Observatory. He was well known as an accurate and most conscientious observer, and the long series of valuable data which we possess for Falmouth will remain as an enduring monument to his memory.

We regret to learn of the death on November 23rd, 1936, at the age of 59, of the Rev. James Gordon Hayes, M.A., for many years vicar of Storridge, in the diocese of Hereford. Mr. Hayes will be remembered as the author of a series of critical and historical works on Polar exploration among which may be mentioned "Antarctica" and "The Conquest of the South Pole."

We regret to learn of the death on November 27th, 1936, of Prof. Dr. Wilhelm Schmidt, Director since 1930 of the Central Institute for Meteorology and Geodynamics at Vienna.

ERRATUM

OCTOBER, 1936, p. 201, 4th line from bottom, *for* "Prof. Cario, Germany" *read* "L. V. Berkner, United States."

NEWS IN BRIEF

Dr. A. H. R. Goldie, F.R.S.E., has been made one of the secretaries to the Associations forming the International Union of Geodesy and Geophysics.

We learn that Commandant Correia Pereira has been appointed Director of the Portuguese Meteorological Service in succession to Commandant Morna.

The Nobel Prize for physics for 1936 has been divided equally between Professor Victor F. Hess, of Innsbruck, for his work on cosmic radiation, and Dr. C. D. Anderson, of Pasadena, for his discovery of the positron.

The Weather of November, 1936

Pressure was below normal over Greenland, eastern Canada, Iceland, Spitsbergen, Scandinavia, north Germany, the Netherlands, France, north Spain, north-east coast of Africa, Palestine and Turkey, the greatest deficits being 7·8 mb. at 60° N., 60° W., 9·0 mb. at Spitsbergen and 1·4 mb. near Erzerum (Turkey). Pressure was above normal over most of the United States, western and central Canada, Alaska and across Newfoundland and the North Atlantic to north-west Africa, the western Mediterranean, southern and central Europe and most of

Russia, the greatest excesses being 4.2 mb. at Sverdlovsk, 7.4 mb. at Horta and 12.2 mb. near Vancouver. Throughout the month an intense anticyclone lay over the Rocky Mountains exceeding 1030 mb. in the latter half. Temperature was mainly above normal and precipitation about or below normal in Sweden, Estonia, Germany, the Netherlands and most of Hungary.

The chief features of the weather of the British Isles during November was the general lack of sunshine, the frequency of gales in the first part of the month and the widespread inland fog in the later part. Rainfall was considerably above normal in south-east England but only about half the normal in parts of Scotland. In the main lines of the pressure distribution November falls into two parts. From the 1st to 17th the average distribution was similar to that for October 14th to 31st shown on p. 226 of the November, 1936, *Meteorological Magazine*. During the second period, from 18th to 29th, a ridge of high pressure extended from the Azores across the British Isles and central Europe to Russia and western Siberia, exceeding 1025 mb. south of Moscow, while the low pressure area formerly situated near Iceland was centred over Spitsbergen, where pressure averaged below 990 mb., and extended across Greenland. During the 1st strong winds and rain were experienced in north Scotland and Ireland but anticyclonic conditions with some mist or fog prevailed in the southern regions and on the 2nd extended also to the north. By the night of the 2nd however a large area of low pressure was advancing eastwards from the Atlantic and from then to the 13th depressions passed across the country. Unsettled stormy weather with rain most days occurred generally, the heaviest falls being on the 7th and 11th, 2.80 in. at Borrowdale (Cumberland) and 2.35 in. at Belleek (Co. Fermanagh) on the 7th and 2.15 in. at Emsworth (Sussex) and 2.00 in. at Compton (Sussex) on the 11th. Hail showers were reported on several days and thunderstorms in the Midlands and south Scotland on the 4th and 5th and in south England on the 8th and 9th, while snow was experienced on high ground in Scotland. Gales occurred generally in the south-west and west from the 7th to 9th, Beaufort force 10 being reached at Pembroke at 1h. on the 8th and force 9 at Pembroke, Lizard and Scilly at 1h. on the 9th. Gales also occurred in Ireland, west England and Scotland on the 11th and 12th and at isolated exposed places on other days. Sunshine records were mainly poor during this period except in Scotland and north England on the 3rd and 5th, and in south England on the 1st, 8th and 9th., 8.5 hrs. at Eastbourne on the 1st and 7.3 hrs. at Tynemouth on the 3rd, while temperature was generally above normal though ground frosts occurred at times. A short interval of fair to cloudy misty anticyclonic weather was experienced on the 13th-14th as a ridge of high pressure passed across the country but mild unsettled conditions were renewed on the 14th and lasted to the 18th with gales mainly

in Scotland on the 15th and on the east coast on the 17th-18th. Rain occurred on most days with 1.90 in. at Lake Vyrnwy, Montgomery on the 15th and 1.58 in. at Bolventor, Cornwall, on the 16th. On the 18th conditions changed and from then to the 28th an anticyclone covered the country giving quiet cold weather with widespread inland fog. The fog dense at times lasted in many parts of the Midlands, north England, south Scotland, and north Ireland, from the 20th to 28th.* Owing to the fog temperature did not rise above 28° F. all day at Morecambe on the 23rd and at Catterick on the 24th, while screen minima fell to 20° F. at some places on one or two nights—20° F. at Stonyhurst on the 23rd—and a ground minimum of 11° F. was recorded at Dalwhinnie on the 23rd. Sunny conditions obtained occasionally near the coast, generally on the 21st, 22nd and 28th—7.4 hrs. at Clacton and Lowestoft on the 21st. On the 27th a depression to the north caused rain in Scotland and Ireland, and on the night of the 28th another depression spread southwards and covered the country on the 29th and 30th bringing a return to mild rainy weather with gales in the north and west mostly on the 30th. Beaufort force 9 was reported from Lerwick at 13h. and 18h. on the 30th. The distribution of bright sunshine for the month was as follows:—

		Diff. from				Diff. from	
		Total	normal			Total	normal
		(hrs.)	(hrs.)			(hrs.)	(hrs.)
Stornoway	...	25	-20	Chester	...	47	-10
Aberdeen	...	62	+ 2	Ross-on-Wye	...	42	-24
Dublin	...	70	0	Falmouth	...	55	-24
Birr Castle	...	51	-11	Gorleston	...	58	-12
Valentia...	...	53	-11	Kew	...	41	-12

Miscellaneous notes on weather abroad culled from various sources

Severe gales were experienced over the North Atlantic, North Sea and Baltic during the first part of the month up to about the 17th when the Hamburg-Amerika line motorship *Isis* was lost with all her crew except one, many other vessels were damaged and members of their crew drowned and numerous liners were late berthing by as much as 24 hours. Wintry conditions prevailed in Madrid during the middle of the month. An unusually dense fog was experienced off south-east Norway on the 23rd. Gales were reported from Malta on the 24th and from the Bosphorus on the 25th. (*The Times*, November 4th-26th.)

Owing to heavy rains, the 40 ft. dam containing the residues of the Osarizawa Copper Mine at Akita, Hondo, Japan burst at 3 a.m. on the 20th and several hundreds of people in the nearby villages were drowned. Heavy rain was experienced in Palestine for the 3 days, the 21st-23rd, so that the airport at Gaza was under water on the 24th. (*The Times*, November 21st-25th.)

* See p. 252.

The total rainfall for the month in Australia was mainly considerably below normal except in parts of Western Australia. (*Cable.*)

In the United States during the early part of the month temperature was mainly below normal except along the Atlantic seaboard, but during the rest of the month temperature was mainly above normal in the western States, below normal in the eastern States and in the central States above normal at first, becoming cold later. Precipitation was generally deficient, except early in the month, in parts of the Atlantic seaboard and the Ohio Valley. (*Washington D.C., U.S. Dept., Agric., Weekly Weather and Crop Bulletin.*)

Daily Readings at Kew Observatory, November, 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	1024.0	WSW.2	35	50	74	0.03	7.4	x early, r ₀ 19h.-24h.
2	1017.6	N.2	45	53	82	0.02	0.0	r ₀ 0h.-5h. & 15h.
3	1013.5	SW.2	39	49	98	0.31	0.0	r ₀ -r 8h.-19h.
4	1014.8	W.2	43	52	61	—	2.1	fw early.
5	1005.2	SW.3	45	53	77	0.07	0.6	r ₀ -r 8h.-11h.
6	989.5	SSE.3	37	53	77	0.07	3.7	x early, r 17h.-20h.
7	980.0	S.4	43	50	76	0.16	2.3	r ₀ -r 2h.-10h.
8	988.4	SW.5	45	50	51	0.08	6.7	r 2h.-6h. prq 15h.
9	989.5	WSW.5	42	54	64	0.21	4.5	r 1h.-7h.
10	1003.3	WSW.4	44	49	66	—	3.2	w early, pr ₀ 13h.
11	1000.0	SSE.3	33	48	83	0.44	0.0	f early, r ₀ 12h.-24h.
12	985.6	SSW.5	48	54	88	0.57	1.1	r-r ₀ 0h.-21h.
13	1015.5	NNW.3	47	49	74	trace	0.9	r ₀ 4h. f 21h.
14	1017.7	SW.4	34	51	85	0.11	3.0	r ₀ 7h.-10h.
15	1022.3	SW.4	36	51	79	0.01	0.2	r ₀ 15h.-16h.
16	1014.1	W.2	51	54	71	0.17	0.0	r-r ₀ 18h.-24h.
17	1008.8	SW.4	51	56	91	0.38	0.1	r-r ₀ 0h.-20h.
18	1014.2	N.5	45	48	69	0.01	0.2	r ₀ 7h.-3h.
19	1023.3	NE.4	45	46	85	—	0.0	id ₀ 8h.-18h.
20	1035.1	ENE.4	40	45	65	—	0.5	
21	1032.9	E.4	38	45	76	—	2.6	w early.
22	1026.9	SW.1	38	41	97	—	0.0	x early, F 10h.-24h.
23	1021.2	NNE.1	33	38	92	—	0.0	F till 16h.
24	1019.2	NW.1	35	36	85	—	0.0	w early.
25	1021.9	NNE.2	32	39	90	trace	0.0	id ₀ 13h.-24h.
26	1017.7	NNE.2	38	43	90	0.01	0.0	d ₀ 9h.-7h. f 9h.-17h.
27	1018.8	NNE.2	32	42	84	—	0.4	f 9h.
28	1023.8	NW.2	38	42	84	—	0.0	f to 10h. & 20h.-24h.
29	1022.2	SW.3	31	44	89	0.13	0.0	Fe to 10h. r ₀ 12h.-20h.
30	1013.9	W.3	44	55	71	—	1.2	
*	1012.7	—	40	48	79	2.79	1.4	* Means or Totals.

General Rainfall for November, 1936

England and Wales	...	121	} per cent of the average 1881-1915.
Scotland	...	81	
Ireland	...	104	
British Isles	...	107	

Rainfall : November, 1936 : England and Wales

Co.	STATION.	In.	Per cent of Av.	Co.	STATION.	In.	Per cent of Av.
<i>Lond</i>	Camden Square.....	3·07	130	<i>Leics</i>	Belvoir Castle.....	2·93	131
<i>Sur</i>	Reigate, Wray Pk. Rd..	4·68	150	<i>Rut</i>	Ridlington	2·03	88
<i>Kent</i>	Tenterden, Ashenden...	4·52	151	<i>Lincs</i>	Boston, Skirbeck.....	1·87	93
"	Folkestone, Boro. San.	4·43	...	"	Cranwell Aerodrome...	2·19	117
"	Margate, Cliftonville...	3·26	135	"	Skegness, Marine Gdns.	2·32	107
"	Eden'bdg., Falconhurst	5·02	141	"	Louth, Westgate.....	2·26	107
<i>Sus</i>	Compton, Compton Ho.	5·44	143	"	Brigg, Wrawby St.....	2·23	...
"	Patching Farm.....	4·97	140	<i>Notts</i>	Worksop, Hodsook.....	2·45	125
"	Eastbourne, Wil. Sq....	5·00	143	<i>Derby</i>	Derby, L. M. & S. Rly.	2·03	94
<i>Hants</i>	Ventnor, Roy. Nat. Hos.	5·26	164	"	Buxton, Terr. Slopes...	5·74	123
"	Fordingbridge, Oaklands	3·75	110	<i>Ches</i>	Runcorn, Weston Pt....	3·22	116
"	Ovington Rectory.....	4·35	131	<i>Lancs</i>	Manchester, Whit. Pk.	3·67	139
"	Sherborne St. John.....	3·37	118	"	Stonyhurst College.....	5·72	127
<i>Herts</i>	Royston, Therfield Rec.	3·21	138	"	Southport, Bedford Pk.	4·45	142
<i>Bucks</i>	Slough, Upton.....	3·37	152	"	Lancaster, Greg. Obsy.	5·07	127
"	H. Wycombe, Flackwell	3·39	132	<i>Yorks</i>	Wath-upon-Deane.....	2·80	137
<i>Oxf</i>	Oxford, Mag. College...	2·49	113	"	Wakefield, Clarence Pk.	3·09	146
<i>N'hant</i>	Wellingboro, Swanspool	2·35	109	"	Oughtershaw Hall.....	7·28	...
"	Oundle	2·35	...	"	Wetherby, Ribston H..	3·83	164
<i>Beds</i>	Woburn, Exptl. Farm...	2·14	96	"	Hull, Pearson Park.....	2·00	91
<i>Cam</i>	Cambridge, Bot. Gdns.	2·13	110	"	Holme-on-Spalding.....	3·27	150
<i>Essex</i>	Chelmsford, County Gdns	3·06	136	"	West Witton, Ivy Ho.	3·54	103
"	Lexden Hill House.....	3·25	...	"	Felixkirk, Mt. St. John.	3·22	131
<i>Suff</i>	Haughley House.....	3·28	...	"	York, Museum Gdns....	2·89	138
"	Campsea Ashe.....	3·73	168	"	Pickering, Hungate....	2·76	111
"	Lowestoft Sec. School...	2·70	115	"	Scarborough.....	2·46	100
"	Bury St. Ed., Westley H.	3·40	148	"	Middlesbrough.....	2·42	114
<i>Norf.</i>	Wells, Holkham Hall...	2·75	128	"	Baldersdale, Hury Res.	4·26	115
<i>Wilts</i>	Calne, Castle Walk.....	3·58	...	<i>Durh</i>	Ushaw College.....	3·13	123
"	Porton, W.D. Exp'l. Stn	2·79	106	<i>Nor</i>	Newcastle, D. & D. Inst.	3·00	136
<i>Dor</i>	Evershot, Melbury Ho.	3·98	93	"	Bellingham, Highgreen	3·17	92
"	Weymouth, Westham.	3·27	105	"	Lilburn Tower Gdns....	3·49	104
"	Shaftesbury, Abbey Ho.	3·02	93	<i>Cumb.</i>	Carlisle, Scaleby Hall...	3·48	116
<i>Devon.</i>	Plymouth, The Hoe....	3·33	91	"	Borrowdale, Seathwaite	17·00	133
"	Holne, Church Pk. Cott.	6·98	109	"	Borrowdale, Moraine...	13·71	134
"	Teignmouth, Den Gdns.	2·75	86	"	Keswick, High Hill.....	6·37	113
"	Cullompton	3·71	108	<i>West</i>	Appleby, Castle Bank...	4·26	128
"	Sidmouth, U.D.C.....	2·61	...	<i>Mon</i>	Abergavenny, Larchfd	4·23	111
"	Barnstaple, N. Dev. Ath	3·88	99	<i>Glam</i>	Ystalyfera, Wern Ho....	6·87	105
"	Dartm'r, Cranmere Pool	9·60	...	"	Cardiff, Ely P. Stn.....	4·26	102
"	Okehampton, Uplands.	7·30	137	"	Treherbert, Tynywaun.	11·48	...
<i>Corn</i>	Redruth, Trewirgie.....	5·33	109	<i>Carm</i>	St. Annarthen, Coll. Rd.	5·44	109
"	Penzance, Morrab Gdns.	5·02	110	<i>Pemb</i>	St. Ann's Hd. C. Gd. Stn.	4·55	120
"	St. Austell, Trevarna...	6·01	122	<i>Card</i>	Aberystwyth	5·18	...
<i>Soms</i>	Chewton Mendip.....	5·63	132	<i>Rad</i>	Birm W.W. Tyrmynydd	7·54	113
"	Long Ashton.....	4·78	151	<i>Mont</i>	Lake Vyrnwy	7·61	137
"	Street, Millfield.....	3·22	...	<i>Flint</i>	Sealand Aerodrome.....	2·46	...
<i>Glos</i>	Blockley	2·42	...	<i>Mer</i>	Blaenau Festiniog ...	12·21	126
"	Cirencester, Gwynfa....	3·06	103	"	Dolgelley, Bontddu....	9·96	161
<i>Here</i>	Ross, Birchlea.....	2·51	99	<i>Carn</i>	Llandudno	3·00	104
<i>Salop</i>	Church Stretton.....	4·43	151	"	Snowdon, L. Llydaw 9..	19·67	...
"	Shifnal, Hatton Grange	2·83	118	<i>Ang</i>	Holyhead, Salt Island...	3·44	83
<i>Staffs</i>	Market Drayt'n, Old Sp.	2·73	104	"	Lligwy	4·24	...
<i>Worc</i>	Ombersley, Holt Lock.	2·21	97	<i>Isle of Man</i>			
<i>War</i>	Alcester, Ragley Hall...	1·99	86		Douglas, Boro' Cem....	6·13	130
"	Birmingham, Edgbaston	2·91	122	<i>Guernsey</i>			
<i>Leics</i>	Thornton Reservoir ...	2·45	108		St. Peter P't. Grange Rd.	5·67	135

Rainfall : November, 1936 : Scotland and Ireland

Co.	STATION.	In.	Per cent of Av.	Co.	STATION.	In.	Per cent of Av.
<i>Wig</i>	Pt. William, Monreith.	3.44	80	<i>Suth</i>	Lairg.....	3.12	78
"	New Luce School.....	5.30	103	"	Tongue.....	...	...
<i>Kirk</i>	Dalry, Glendarroch.....	5.93	99	"	Melvich.....	3.05	76
<i>Dumf.</i>	Dumfries, Crichton R.I.	3.83	110	"	Loch More, Achfary...	6.94	81
"	Eskdalemuir Obs.....	5.35	92	<i>Caith</i>	Wick.....	2.65	84
<i>Roxb</i>	Hawick, Wolfelee.....	4.14	107	<i>Ork</i>	Deerness.....	2.98	76
<i>Selk</i>	Ettrick Manse.....	4.16	76	<i>Shet</i>	Lerwick.....	2.89	68
<i>Peeb</i>	West Linton.....	4.04	...	<i>Cork</i>	Dunmanway Rectory...	5.72	92
<i>Berw</i>	Marchmont House.....	4.03	134	"	Cork, University Coll...	3.46	86
<i>E.Lot</i>	North Berwick Res.....	2.31	103	"	Ballinacurra.....	2.94	73
<i>Midl</i>	Edinburgh, Blackfd. H.	2.11	94	"	Mallow, Longueville...	4.12	110
<i>Lan</i>	Auchtyfardle.....	3.78	...	<i>Kerry</i>	Valentia Obsy.....	5.44	100
<i>Ayr</i>	Kilmarnock, Kay Pk...	3.97	...	"	Gearhameen.....	9.80	101
"	Girvan, Pinmore.....	5.87	110	"	Bally McElligott Rec...	3.80	...
"	Glen Afton, Ayr San. ...	...	...	"	Darrynane Abbey.....	6.74	132
<i>Renf</i>	Glasgow, Queen's Pk...	3.93	105	<i>Wat</i>	Waterford, Gortmore...	2.97	80
"	Greenock, Prospect H...	4.94	77	<i>Tip</i>	Nenagh, Cas. Lough...	3.72	93
<i>Bute</i>	Rothsary, Ardenraig...	4.07	80	"	Roscrea, Timoney Park	3.15	...
"	Dougarie Lodge.....	5.13	98	"	Cashel, Ballinamona...	2.95	85
<i>Arg</i>	Ardgour House.....	8.35	...	<i>Lim</i>	Foynes, Coolnanes.....	5.18	130
"	Glen Etive.....	...	...	"	Castleconnel Rec.....	4.01	...
"	Oban.....	4.52	...	<i>Clare</i>	Inagh, Mount Callan...	10.22	...
"	Poltalloch.....	5.33	95	"	Broadford, Hurdlest'n.	2.78	...
"	Inveraray Castle.....	7.67	91	<i>Wexf</i>	Gorey, Courtown Ho...	3.66	105
"	Islay, Eallabus.....	5.13	95	<i>Wick</i>	Rathnew, Clonmannon.	3.42	...
"	Mull, Benmore.....	7.60	53	<i>Carl</i>	Hacketstown Rectory...	3.68	94
"	Tiree.....	4.39	91	<i>Leix</i>	Blandsfort House.....	3.67	110
<i>Kinr</i>	Loch Leven Sluice.....	3.04	85	<i>Offaly</i>	Birr Castle.....	3.07	99
<i>Fife</i>	Leuchars Aerodrome...	1.74	76	<i>Dublin</i>	Dublin, FitzWm. Sq....	2.28	85
<i>Perth</i>	Loch Dhu.....	5.25	60	<i>Meath</i>	Beauparc, St. Cloud...	3.46	...
"	Balquhider, Stronvar.	4.82	...	"	Kells, Headfort.....	2.68	79
"	Crieff, Strathearn Hyd.	2.67	62	<i>W.M.</i>	Moate, Coolatore.....	3.18	...
"	Blair Castle Gardens...	2.69	77	"	Mullingar, Belvedere...	3.43	100
<i>Angus</i>	Kettins School.....	1.98	64	<i>Long</i>	Castle Forbes Gdns.....	3.81	106
"	Pearsie House.....	2.87	...	<i>Gal</i>	Galway, Grammar Sch.	4.03	99
"	Montrose, Sunnyside...	...	...	"	Ballynahinch Castle...	6.99	117
<i>Aber</i>	Braemar, Bank.....	2.98	78	"	Ahascragh, Clonbrock.	4.07	101
"	Logie Coldstone Sch...	2.35	77	<i>Mayo</i>	Blacksod Point.....	5.03	97
"	Aberdeen, Observatory.	1.36	46	"	Mallarranny.....	7.01	...
"	Fyvie Castle.....	1.93	56	"	Westport House.....	5.51	112
<i>Moray</i>	Gordon Castle.....	1.65	57	"	Delphi Lodge.....	11.58	111
"	Grantown-on-Spey.....	2.08	70	<i>Sligo</i>	Markree Castle.....	4.69	111
<i>Nairn</i>	Nairn.....	1.47	62	<i>Cavan</i>	Crossdoney, Kevit Cas.	3.99	...
<i>Inv's</i>	Ben Alder Lodge.....	3.23	...	<i>Ferm</i>	Newtownbtlr, Crom Cas.	3.96	114
"	Kingussie, The Birches.	3.39	...	"	Enniskillen, Portora...	3.37	...
"	Loch Ness, Foyers.....	...	...	<i>Arm</i>	Armagh Obsy.....	3.76	132
"	Inverness, Culduthel R.	1.98	78	<i>Down</i>	Fofanny Reservoir.....	6.03	...
"	Loch Quoich, Loan.....	9.75	...	"	Seaforde.....	4.51	119
"	Glenquoich.....	7.42	61	"	Donaghadee, C. G. Stn.	3.06	100
"	Glenleven, Corroul...	6.66	89	<i>Antr</i>	Belfast, Cavehill Rd...	4.38	...
"	Fort William, Glasdrum	5.44	...	"	Aldergrove Aerodrome.	3.20	99
"	Skye, Dunvegan.....	6.13	...	"	Ballymena, Harryville.	4.62	114
"	Barra, Skallary.....	4.02	...	<i>Lon</i>	Garvagh, Moneydig....	4.41	...
<i>R&C</i>	Alness, Ardross Castle.	2.70	67	"	Londonderry, Creggan.	5.42	132
"	Ullapool.....	3.42	64	<i>Tyr</i>	Omagh, Edenfel.....	4.62	122
"	Achnashellach.....	4.51	49	<i>Don</i>	Malin Head.....	5.82	...
"	Stornoway, Matheson...	4.53	78	"	Killybegs, Rockmount.	4.75	...

ERRATUM.—Fort William, Glasdrum, October, 1936, for 9.63 read 10.63.

Climatological Table for the British Empire, June, 1936

STATIONS.	PRESSURE.		TEMPERATURE.							Mean Cloud Am't.	PRECIPITATION.		BRIGHT SUNSHINE.		
	Mean of Day M.S.L.	Diff. from Normal.	Absolute.		Mean Values.				Rela- tive Hum- idity.		Am't.	Diff. from Normal.	Days.	Hours per day.	Per- cent. age of possi- ble.
			Max.	Min.	Max. 1 and 2 Min.	Diff. from Normal.	Mean.								
								°F.							
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	%	In.	In.				
London, Kew Obsy....	1015.8	- 0.9	85	44	69.3	54.0	61.7	+ 2.7	81	7.2	3.53	+ 1.38	19	6.3	38
Gibraltar	1017.9	+ 0.6	89	52	70.1	59.2	64.7	...	78	4.0	0.14	...	1	...	...
Malta	1015.7	+ 0.5	95	59	75.7	65.1	70.4	- 2.3	70	3.5	0.01	- 0.08	1	11.2	77
St. Helena	1017.0	+ 0.7	66	53	61.9	55.2	58.5	- 2.0	90	8.4	2.87	+ 0.05	20	...	...
Freetown, Sierra Leone	1013.7	+ 3.4	88	67	84.6	71.2	77.9	- 2.4	83	6.6	18.28	- 1.76	24	...	...
Lagos, Nigeria	1013.5	+ 1.1	86	70	82.6	73.9	78.3	- 1.2	88	9.0	14.70	- 3.78	18	3.3	27
Kaduna, Nigeria	1008.8	...	96	60	86.5	68.9	77.7	+ 1.2	86	8.0	5.50	- 1.59	11	6.9	54
Zomba, Nyasaland	1018.9	+ 1.2	79	48	72.6	54.7	63.7	+ 0.8	71	5.5	0.07	- 0.41	1	...	...
Salisbury, Rhodesia...	1024.5	+ 2.4	77	33	69.9	43.3	56.6	- 0.3	63	1.6	0.03	- 0.02	2	9.0	81
Cape Town	1021.6	+ 1.5	86	38	67.1	49.4	58.3	+ 2.6	83	5.1	2.87	- 1.63	11	...	...
Johannesburg	1025.1	+ 3.0	69	27	62.5	42.1	52.3	+ 1.6	49	1.1	0.00	- 0.14	0	8.6	82
Mauritius	1020.7	+ 1.7	78	55	75.4	64.2	69.8	+ 0.4	71	4.7	1.71	- 1.09	23	7.7	71
Calcutta, Alipore Obsy.	999.8	+ 0.1	94	73	89.1	77.8	83.5	- 1.6	89	8.5	16.00	+ 4.09	23*	...	...
Bombay	1003.9	- 0.1	93	70	87.2	77.5	82.3	- 1.7	84	7.9	32.63	+ 12.76	21*	...	...
Madras	1004.4	+ 0.6	102	72	96.6	80.2	88.4	- 1.6	82	8.3	2.82	- 0.85	8*	...	...
Colombo, Ceylon	1010.3	+ 1.7	86	73	84.8	76.3	80.5	- 1.1	77	7.4	5.97	- 1.35	21	7.0	56
Singapore	1009.3	+ 0.4	89	72	86.1	76.6	81.3	- 0.2	79	6.3	3.65	- 3.22	16	6.6	54
Hongkong	1006.5	+ 0.7	92	76	87.5	79.4	83.5	+ 2.1	81	7.7	5.70	- 10.00	19	6.6	49
Sandakan	1009.1	...	92	73	88.7	74.9	81.8	+ 0.1	84	7.0	8.10	+ 0.60	15	...	...
Sydney, N.S.W.	1018.8	+ 0.9	70	41	62.7	45.6	54.1	- 0.6	72	3.9	2.83	- 1.91	9	6.7	69
Melbourne	1021.0	+ 2.5	61	34	56.1	43.6	49.9	- 0.5	45	7.2	2.68	+ 0.62	20	3.4	35
Adelaide	1023.0	+ 3.9	65	38	59.5	45.1	52.3	- 1.2	48	7.1	2.27	- 0.83	13	3.7	38
Perth, W. Australia ..	1020.2	+ 2.2	73	41	63.4	49.4	56.4	- 0.4	49	5.8	7.43	+ 0.49	15	5.0	50
Coalgardie	1021.6	+ 2.7	78	30	63.5	41.9	52.7	- 0.1	60	5.2	0.99	- 0.27	7	...	...
Brisbane	1016.9	- 1.4	79	41	68.3	51.1	59.7	- 0.5	53	5.0	1.90	- 0.89	8	6.3	60
Hobart, Tasmania.....	1018.8	+ 4.5	59	33	51.4	40.2	45.8	- 1.2	41	6.0	2.14	- 0.09	14	4.0	44
Wellington, N.Z.	1020.6	+ 5.7	58	36	53.1	42.6	47.9	- 1.6	45	6.9	3.33	- 1.44	13	3.8	41
Suva, Fiji	1015.4	+ 1.8	86	65	79.6	69.4	74.5	- 0.2	69	6.5	3.42	- 3.29	19	5.4	49
Apia, Samoa	1011.8	+ 0.2	87	69	84.4	73.1	78.7	+ 0.9	74	4.9	4.10	- 1.25	6	7.3	65
Kingston, Jamaica	1011.7	- 2.1	90	70	86.5	74.0	80.3	- 1.0	74	7.2	13.80	+ 9.70	18	4.3	33
Grenada, W.I.	1011.2	- 2.1	89	70	86	73	79.5	+ 0.5	74	5	6.27	- 1.98	20	...	...
Toronto	1012.8	- 1.9	87	48	75.0	54.8	64.9	+ 1.1	57	4.6	2.91	+ 0.25	9	10.0	65
Winnipeg	1012.9	+ 1.1	92	33	72.8	48.9	60.9	- 1.4	50	5.8	2.41	- 0.70	9	8.4	52
St. John, N.B.	1011.9	- 1.6	77	43	64.9	49.5	57.2	+ 0.7	53	7.1	3.17	- 0.10	17	5.9	38
Victoria, B.C.	1014.5	- 2.3	74	49	65.2	51.4	58.3	+ 1.3	55	5.5	1.68	+ 0.84	12	8.0	50

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