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The International Meteorological Conference at Warsaw, September, 1935.

A meeting of the International Meteorological Conference was due in 1935, and by the invitation of the Polish Government and of Dr. J. Lugeon, Director of the Meteorological Service of Poland, it was held in Warsaw from September 6th to 13th, under the Presidency of Prof. E. van Everdingen. The Conference was well attended by delegates from all parts of the world; the British delegation included Sir George Simpson, K.C.B., F.R.S., Director of the British Meteorological Office, Lt.-Col. E. Gold, Dr. C. E. P. Brooks and Miss D. G. Chambers, while the Empire was further represented by the Directors of the Meteorological Services of Canada, India, Malaya, Hong Kong, British East Africa, Southern Rhodesia, South Africa, Australia, New Zealand and Samoa.

Much of the work of the Conference is done by specially appointed Commissions, and meetings of most of these were held in Danzig or Warsaw before or during the Conference. Special interest attached to the work of the Commissions for Climatology and Synoptic Weather Information, both of which studied several difficult questions of international practice.

The Climatology Commission, which met at Danzig, was occupied mainly with the methods of observation and the publication of the results. The most widespread form for the publication of climatological data is the table of monthly and annual values. An international form of publication was agreed on as early as 1874, but since that date changes have been made independently in different countries, so that the various yearbooks are now no longer comparable. A revised form of publication was proposed by Dr. Hesselberg and adopted with some modifications. The headings of the form received detailed consideration. At present climatological tables are not always completely intelligible to anyone not acquainted with the language, and to get over this difficulty a series of letter indices has been agreed upon, such as P for Pressure, U for relative humidity, etc. These, and the use of uniform international weather symbols, should obviate the language problem.

On the subject of symbols, reference must be made to the question of thunder. The symbol T was adopted at Paris in 1896 to indicate days on which distant thunder was heard, but it has always been a source of confusion. Thunder cannot occur without lightning, and if the lightning is not seen, it is because of special circumstances such as time of day. The Climatology Commission therefore took the point of view that the real distinction should be between a thunderstorm over the station and a thunderstorm in the neighbourhood. Both should be indicated by the symbol for thunderstorm, but in the latter case it should be enclosed in brackets.

For many purposes monthly climatological data are required very soon after the close of each month, and for some years the Commissions for Climatology and Synoptic Weather information have been discussing a plan for the regular broadcasting of such data. The final details were completed at Danzig and Warsaw. The proposed transmissions will include in a suitable code pressure, temperature and rainfall, and for certain isolated stations the sea temperature and resultant wind. Marine data based on ships' observations will also be included. The data issued by each country will be collected into continental groups and a selection for each continent will be re-transmitted as world broadcasts from suitable stations. It is proposed for example, that Rugby should issue the data for western and central Europe, Washington those for North America, etc. The messages are to be issued as early as possible in the month following that to which they refer, and not later than the 5th.

To make full use of these monthly broadcasts normal values will be required for comparison. The Climatology Commission designated the period 1901 to 1930 as a standard period for these normals, and also recommended that as many countries as possible should publish climatological charts based on this period.

Most of the work of the Synoptic Commission was naturally concerned with matters of technical detail, but here also the goal was complete uniformity of international practice. As a result of the extension of air routes, many pilots now fly regularly from one country to another, and in order that they should be able rapidly to obtain all the information they require about wind, weather, cloud heights, etc., it is essential that the observations in all countries should be made and coded in a similar manner, and also entered on the working synoptic charts according to a uniform plan. For this purpose detailed instructions in the use of the codes have been drawn up as a basis for international usage, and a standard " station model " has been adopted for entering the information on the charts.

The work of the other Commissions, though no less important for international meteorology, was mostly too technical to be described in detail here, but brief reference must be made to the adoption by the Conference of the report of the Commission for Bibliography. This report contains a classification for meteorological literature, based on the extension of the Dewey Decimal Classification by the International Institute for Documentation, but entirely revised to meet the requirements of modern meteorology. It is proposed to bring this classification into use in the Meteorological Office Library on January 1st, 1936.

Most of the work of the main Conference consisted in the discussion, adoption or amendment of the reports of the various Commissions. The great and growing importance of meteorology in aviation however constantly raises new problems which cannot always await a meeting of the International Meteorological Conference or Committee. To deal with these problems, the Conference at Warsaw appointed a new Commission, the purpose of which is to keep in close touch with the requirements of aviation and to maintain and develop the necessary meteorological organisation.

Insoluble Matters brought down by Rain

By J. H. Coste of the Atmospheric Pollution Research Committee

It is well known that rain water, especially that brought down in or near towns, frequently contains particulate matter. Some of the solid matter found in rain-gauges is dust which has settled on the funnel in dry weather and has been washed into the collecting vessel by rain, whilst some is brought down with the rain itself. The nature of all this matter is of great interest from the point of view of the investigation of atmospheric pollution, and meteorologists who make observations of rainfall could greatly help the work of the Research Committee of the Department of Scientific and Industrial Research on Atmospheric Pollution by examining the solid matter entering their gauges.

The chemical examination made in the routine analysis of the water collected in deposit gauges used in the Committee's investigations only shows the total amount of insoluble matter and its content of tar and of matters lost on ignition ; that is, it divides the insoluble matter into tar, other organic matters with combined water, and mineral matter, without giving any information as to the proximate nature of the solid deposit. Further work would be welcomed, but the amount of work done on a sample of deposit is already large and further requirements would throw considerable work on the chemists who undertake it and expense on the contributing authorities.

Many of the voluntary observers who now undertake rainfall observations would probably be interested in the investigation of the particulate matter collected in their gauges. Whilst it is unlikely that more than a very few would be able to make a chemical examination of this matter, those who possess microscopes or have friends who are microscopists, may feel that the examination of the deposit which settles out when the rain water, after having been measured, is set aside would open up an interesting and useful field of microscopical work, the collected results of which would be of great value in relation to the investigation of atmospheric pollution.

Equipment.—Very little is required beyond the microscope and its accessories. The bare minimum is a conical glass vessel of suitable size in which the measured water can be poured and left for the insoluble matter to settle to the bottom and a pipette or dipping tube with which to draw off the deposit after the supernatent water has been carefully decanted or siphoned off. Some wine glasses, especially the old shape of champagne glass, are very suitable as sedimenting vessels or a small conical photographic measure may be used. The pipette may be a piece of glass tubing, with ends smoothed in a flame, and rather longer than the depth of the sedimenting vessel. This is manipulated by closing the upper end with the forefinger, or with a rubber teat. Medical men familiar with Sir Almroth Wright's tube and teat technique will be able to devise suitable apparatus, made of drawn-out glass tubing, and may be able also, to obtain useful measures of the volume of deposits by their height up glass tubes of known internal diameter.

The microscope need not be an elaborate one. Most of the structures to be looked for can be distinguished with a good 1-in. or $\frac{2}{3}$-in. objective with a quite low eyepiece under illumination by transmitted light (mirror illumination) but examination of the dried deposit with dark field illumination is often convenient. For this purpose the old-fashioned Lieberkuhn would be very suitable. I have used the silvered side reflector and, alternatively, a half bull's-eye placed on the stage in such a position that the light from a lamp is focussed on the object from the side. This gives excellent dark field illumination with objectives up to $\frac{1}{6}$ in. and can be made by cutting the lens from a torch lamp through an axial diameter. It is sometimes advantageous to put a slip of coloured (green) paper under the slide. A small magnet, which may be a magnetised gramophone needle mounted in a glass tube with sealing wax or shellac, is useful in identifying particles of magnetite.

What to look for.—Antony van Leeuwenhoek in his 147th letter to the Royal Society, wrote " On the 19th of September, 1701, it rained a little while about the forenoon, whereupon I caught some of the rain, as pure as I was able to, in a clean East Indian porcelain dish : . . . . . I discovered therein many little bits of dust, otherwise called particles, such as generally float in the air, consisting of very little bits of burnt wood, or charcoal, wherein I could make out the horizontal and ascending vessels ; also a little bit of straw, and many blackish particles which I imagine to be congealed particles out of smoke from the coals that our smiths and brewers burn : and among these was a pretty structure composed of round globules clotted together just like the little stars that we see in the snow in winter."

The rain water of to-day contains much the same things that the Dutch draper saw over 230 years ago.

Burnt wood can usually be detected by its obviously woody structure, which can easily be studied by crushing the middle of a burnt match (the working end seems to contain siliceous particles) ; the blackish particles, imagined by Leeuwenhoek to be congealed smoke, are really something of that sort, being soot. They have no definite structure . . . . Coke particles are also blackish and can be recognised by their obvious foam structure, and sharp outlines showing where gas cavities have been crushed leaving hollows which are clearly parts of spheres. The " pretty structure " was probably a cluster of globules of ash from a forge or other high temperature furnace. Single spheres, some glassy, others opaque with a warty surface, explainable by the bursting of gas bubbles before solidification of the matrix, and some glassy with inclusions of gas bubbles, indicate industrial pollution, often from power stations, especially where pulverised fuel is burnt. Sometimes almost black spheres are found. These, if rough, are usually coke ; if smooth a magnet may show them to be strongly ferromagnetic. Spheres always indicate the product of a high temperature, since for them to be formed the ash of the fuel must have been fused. The magnetite spheres referred to can only be formed if the temperature has reached about 1,600° C. Pollen grains which may be found in country districts, although more or less spherical, are obviously less dense than those of ash. I was in Arcachon in the spring of 1934 and was puzzled by the streets being apparently strewed with flowers of sulphur. When I found the same yellow dust also on the sand of the beach I collected a sample. The microscope showed that the yellow particles were the pollen of *pinus maritima* which is grown all over the district for the production of turpentine. Sand grains, although not always as sharp as in the drawing of a deposit from Kew Observatory, can usually be identified by their character. They frequently contain inclusions of other minerals. Sand from the sea and especially from dunes, is usually rounded owing to erosion. Vegetable hairs are often branched. Textile fibres may frequently be recognised as such by the fact of being dyed. Cotton fibres resemble flattened and twisted tubes. Wool fibres have a surface structure not seen in vegetable ones, silk is apparently structureless. It is easy and much better to examine known materials, which are easily obtained, rather than to rely on drawings or photographs, as most of the structures are better studied by focussing up and down so as to see different planes, thereby getting a notion of their three-dimensional form.

It will have been seen from the above that the nature of the solid matter brought down in rain, especially if considered in relation to the wind direction, should give an indication whether the dust in the air is that normal to the district or has been brought from other places, e.g., if in a rural district, besides vegetable tissues, charred wood, ash and a few textile fibres, much coke and many spheres are found, it is clear that pollution from an industrial district is being brought over the place of rainfall.

I attach a form suggested for entering results. It will be noted that the expression " sintered " means particles which are fused only superficially and have, therefore, not assumed the spherical form.

SOLID MATTER IN RAIN collected at ....
.... from .... to............................,
193....

Colour

Spheres—	*Irregular*—
Colour	Aggregates
Glassy	Coke
Opaque, bubbly	Coal
,, coke	Magnetic
,, magnetic	Sand
Sintered—	Charred Wood
Colour	*Fibres*—
Glassy	Textile
Opaque, bubbly	Plant Hairs and Tissues
Magnetic	Wood
	Unidentified (describe)

Not seen	—	Many	++
Few	(+)	Predominant	+++
Some	+		

OFFICIAL PUBLICATION

The following publication has recently been issued :—

GEOPHYSICAL MEMOIRS.

No. 65. *Transfer of heat and momentum in the lowest layers of the atmosphere*. By A. C. Best, B.Sc. (M.O. 356h.).

This memoir is divided into four parts and deals with various aspects of turbulence in the layer of the atmosphere nearest the ground. The first part describes the results obtained from two years' continuous records of temperature differences over the height intervals 2·5 cm. to 30 cm. and 30 cm. to 1·2 m. Average values and extreme values of these temperature differences are given. These results have also been combined with those obtained by Johnson* to give a picture of the temperature distribution from 2·5 cm. to 17·1 m. The times of maximum temperature and the diurnal range of temperature at various heights are discussed and values for the coefficient of eddy conductivity are obtained.

The second part discusses a number of experiments carried out with a hot wire anemometer to determine the vertical gradient of wind velocity between the heights 2·5 cm. and 5 m. under various conditions as to temperature gradient and wind velocity.

The experiments with a hot wire anemometer provided a large number of instantaneous readings of wind velocity. These have been analysed in the third part of the memoir to give the distribution of deviations from the mean velocity.

The results of a large number of experiments with two small bi-directional vanes to investigate the gustiness of the wind in the lateral and vertical directions are described in the last part. The effects of height up to 5 m., vertical temperature gradient and wind velocity are considered and the magnitude of eddy velocities is deduced.

Discussions at the Meteorological Office

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

October 28th, 1935. *On the causes of rainfall variations in Europe and their relations to other meteorological factors.* By R. Höhn. (Zwönitz, 1934.) (In German.) *Opener*—Dr. C. E. P. Brooks.

November 11th, 1935. *The layer of frictional influence in wind and ocean currents.* By C. G. Rossby and R. B. Montgomery. (Cambridge, Mass. Pap. phys. Oceanogr. Met., Vol. 3, No. 3, 1935.) *Opener*—Mr. A. F. Crossley, M.A.

Correspondence

To the Editor, *Meteorological Magazine*

Green Clouds seen from Edinburgh

The green clouds seen from Edinburgh by Lt.-Col. T. C. Skinner, as reported in the *Meteorological Magazine* for August, 1935, pp. 157–8, seem likely to have been coloured by diffraction owing to minute liquid particles as the sun shone through the thin cloud. This phenomenon of iridescent clouds, which appears to be more frequently seen in the north-eastern United States than in cloudier and milder Great Britain, has been described at length in the *Monthly Weather Review*, Washington, February, 1925, pp. 49–58.

The radiation of pink bands across the sky from a point where the sun happens to have reached after setting has been traced definitely here to shadows of dense clouds on or below the horizon,

* *London, Geophys. Mem.*, No. 46, 1929.

which cut out some of the general sunset illumination of the sky. The hard cumuli mentioned by Mr. Moon in the *Meteorological Magazine* for August, 1935, p. 158, when he observed such a phenomenon recently, suggest general conditions which may well have made possible the occurrence of similar, shadow-throwing clouds elsewhere at the time.

CHARLES F. BROOKS.

Blue Hill Meteorological Observatory, Milton, Massachusetts, U.S.A., September 2nd, 1935.

Forecasting Weather from Height of Barometer and Temperature of Wet Bulb

In connexion with the above question it is perhaps worth calling attention to the equations for "average numerical relations between pressure, rainfall and wind speed" as given on p. 16 of *Geophysical Memoirs*, No. 53. The data which the equations summarize exclude days on which marked discontinuities passed the stations, whilst, corresponding roughly to classification on a basis of wet-bulb temperature, there is separation into cases of tropical and polar air respectively. The data used relate to daily means or totals. Equations are given for Aberdeen, Kew and Eskdalemuir. The Kew equations, for example, for average rainfall (in mm.) in 24 hours are $R = \cdot 10\ (1035 - p)$ and $R = \cdot 05\ (1035 - p)$ for tropical and polar air respectively. The interesting point is that in all cases the factor in brackets, considered with reference to sea level pressure, is approximately $(1035 - p)$. The coefficients outside the brackets are ·05 and ·06 respectively for Aberdeen and ·16 and ·07 respectively for Eskdalemuir.

The influence of topography is evidenced in the relative sparseness of warm air rainfall at Aberdeen and its relative abundance at Eskdalemuir in the same pressure conditions. These linear equations do not apply closely even to the averages in the case of very low pressures and it is perhaps scarcely necessary to point out that in individual cases in general there is not close correlation with the results indicated by the formulae, which are intended simply to represent the averages.

Some frequency tables are given in the same memoir; where forecasting is the object, it is desirable to approach the subject from the aspect of frequencies as Lieut.-Commdr. Beatty has indeed done.

In the same way as the rainfall data suggest a cessation of precipitation (or upward air movement) as sea-level pressure tends to 1035 mb., so do the wind data suggest cessation of horizontal air movement for a sea-level pressure which for polar air is about 1060 mb. and for tropical air about 1050 mb.

A. H. R. GOLDIE.

August 21st, 1935.

Effect of Drought on the Run-off of Subsequent Rainfall

The drought of July and August, 1935, at Goff's Oak, Herts, with the exception of showers producing 0·09 in. on August 12th and 0·02 in. on July 27th, lasted from July 20th to August 22nd and was finally broken by the heavy rainfall of 0·90 in. associated with the thunderstorm on the morning of August 23rd.

During the drought the soil, which in this locality is mainly London Clay or Boulder Clay, had become so hardened by the sun that a pick-axe was required to pierce the surface. Beneath the turf the ground was a mosaic of fissures about ¼ to ½ in. in width and several inches in depth. The stream, Cuffley Brook, which drains an area of about five square miles above the bridge shown in Fig. 1, had ceased to flow by the end of June. This catchment area, all of which lies within a radius of three miles from the rain-gauge, is mainly open grassland with a little woodland in the west and north.

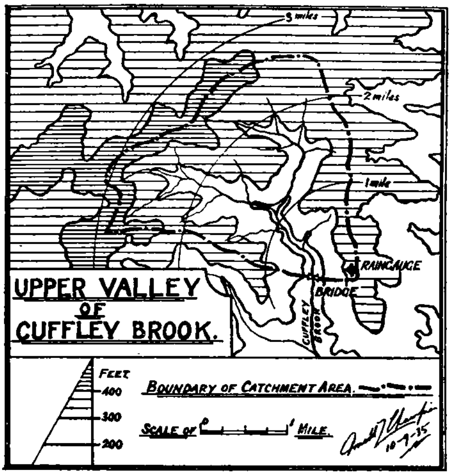

FIG. 1.

As shown in Fig. 2, there were ten rain-days between August 22nd and September 5th giving an aggregate fall of 2·48 in. This fall would amount to about 800,000 tons of water in the catchment area in Fig. 1, of which 290,000 tons fell during the 24 hours ending at 6h. on the 23rd, but the brook did not commence to flow under the bridge until about 21h. on September 5th; and then the stream was only about 12 in. in width and an inch or so in depth. The flow had stopped again by 6h. 30m. on the morning of the 6th.

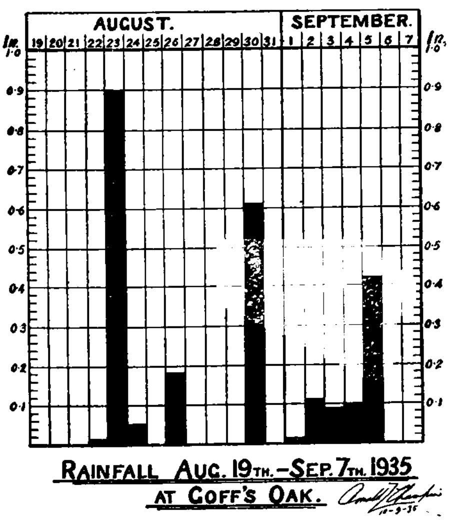

FIG. 2.

Even with a generous allowance for evaporation, it would seem, therefore, that the popular belief that heavy rain after a drought runs off instead of soaking in, is erroneous, at least as far as clay soil is concerned.

Since Cuffley Brook is one of the many tributaries of the river Lea, it follows that little of the ten days rainfall could have reached the latter. It would appear that towns relying on the larger rivers for their water supply, as also those relying on deep wells, may feel the effect of drought for some considerable time after the termination of the dry spell.

DONALD L. CHAMPION.

7, Robinson Avenue, Goff's Oak, Waltham Cross, Herts, September 10th, 1935.

Frequency of Calms in Winter

The high relative frequency of calms in winter, especially in December, at two inland places in the south-east of England as recently brought to light by Messrs. Champion and Ashmore is somewhat perplexing. I am inclined to think that December, more than most months, requires a good term of years to get a true picture, and I think it would be of interest to quote a passage from a recent paper by Dr. J. N. Carruthers " On the Flow of Water through the Straits of Dover as gauged by Continuous Current-Meter observations at the Varne Lightvessel (50° 56′ N., 1° 17′ E.)."* In the course of discussing the part played by wind in controlling the flow of water in the Straits, Dr. Carruthers refers to the extremely anomalous character of the months of December from 1926 to 1931—the six Decembers for which records of the water flow have been analyzed. Thus December, 1929, a month of stormy SW. winds, provided a stronger flow in the normal direction from English Channel to North Sea than any month of any name, whereas four out of the six Decembers in question gave a very small net or residual flow in that direction owing to the frequency of " hold-ups " and reversals. He proceeds " It is of interest to remark that a review in the *Geographical Journal* of February, 1931, p. 198, of an earlier paper by the present writer contained an expression of opinion that ' a longer term of years will show that a December of the stormy type of 1929 occurs more frequently than a notably fine one like 1926 or an intensely cold one like 1927 '. When we consider the seven Decembers, 1920–1926, included in our Dungeness wind table as well as the five, 1930–1934, in our Varne wind data table we find good reason to agree with this." Here we have testimony for coastal and open-sea stations in south-east England rather to the storminess than to the quietness of December. I should say from common experience of the London climate that dead calms actually are more frequent in winter than in summer, but that quiet weather with just a perceptible breeze is far more habitual and lasting in summer. Stagnation in winter is fog-breeding and fortunately does not as a rule last very long. Possibly the discrepancy is to be explained on these lines.

L. C. W. BONACINA.

35, Parliament Hill, London, N.W.3, September 4th, 1935.

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* Ministry of Agriculture and Fisheries, Series II, Vol. XIV, No. 4, 1935.

Dust-Devils

These phenomena—more properly termed " miniature whirlwinds " —are not so rare in England as might be supposed. Given suitable conditions, hot sun and light wind, they are quickly formed, and usually as rapidly disperse.

On August 2nd at 13h. 36m. G.M.T. a whirlwind (dust-devil) of this kind entered the north corner of the bottom of my back garden which borders on the Downs, and carrying with it a column of chalk dust and small stones, travelled in a southerly direction, threw itself against the back of the house, the stones rattling against the windows like hailstones. The column was about 20 ft. high, judging from surrounding objects and the whole duration of the phenomenon was about 30 seconds.

The wind was quite calm both before and after the dust-devil had passed, shade temperature being 66° F.

DONALD W. HORNER.

St. Lawrence, Surrenden Road, Brighton, 6, September 24th, 1935.

NOTES AND QUERIES

Veer of Southerly Winds with Height in Egypt†

At Ismailia on the Suez Canal a new anemometer was recently erected on the aerodrome, 7 ft. above the Office roof and 22 ft. above the ground. The exposure is poor, the Office itself being surrounded by buildings between north-east and south-south-east and between south-west and west-north-west. The old anemometer stood about a mile to the northward, 50 ft. above the ground with a very free exposure. The two anemometers were run simultaneously for five months in winter and it was found that though the mean speed differed by an amount little more than could be accounted for by the difference in height, the direction record of southerly winds at the new site showed a backing of 20° to 30° compared with the old site. For winds from between NW. and NE. the difference is much smaller, sometimes zero and occasionally of opposite sign. The direction record of the new instrument is sometimes very oscillatory, especially with south-westerly winds, though it is not difficult to make out the mean direction. The discrepancy is not due to errors of orientation of the instruments. The explanation may be simply that at the new site the winds are deflected so as to blow along the main line of buildings, but an alternative explanation is that the difference of direction is due to the difference between the heights of the anemometers, and a rapid veer of southerly winds with height.

The behaviour of southerly winds in various parts of Egypt is known to be peculiar. Thus L. J. Sutton* gives the average veer of such winds as 69° for an increase of height of 1,280 ft., compared

* *Cairo Phys. Dept. Paper,* No. 17.

† Based on information supplied by Mr. J. Durward.

with an average veer for all winds of only 25°. The difference in the effective height of the anemometers at Ismailia is at least 30 ft., and if we assume that southerly winds veer rapidly in this interval, the difference in direction would be explained.

This hypothesis was tested by summarising (Table I) the directions shown by pilot balloon ascents at Ismailia during January to March 1934 (old site) and 1935 (new site) and comparing them with those at Heliopolis near Cairo (January–March, 1934–5).

TABLE I.—CHANGE OF DIRECTION OF SOUTHERLY WINDS WITH HEIGHT

	Ismailia.		*Heliopolis.*
	1934 (old site).	1935 (new site).	1934–5.
Surface	191°	179°	185°
0–500 ft.... ...	203°	203°	206°
500–1,000 ft. ...	216°	228°	242°

At Heliopolis ascents when the surface wind was from other directions show only a small change of direction in the first 1,000 ft. All the ascents considered were made before 8h. local time. The anemometer at Heliopolis is at a height of 40 ft. above the ground.

The effect at Heliopolis depends to some extent on the wind velocity but is not confined to light winds, as shown in Table II, which gives the average veer of southerly and westerly winds between the surface and a height of about 750 ft.

TABLE II.—VEER OF WINDS OF DIFFERENT SPEEDS

Surface wind speed (m.p.h.)	0–5	6–10	11–15	16–20	above 20
Veer of southerly winds ...	71°	61°	45°	36°	24°
Veer of westerly winds ...	37°	20°	26°	6°	—

The average surface speed of both southerly and westerly winds is about 10 m.p.h., but at 750 ft. southerly winds have an average speed of 15 m.p.h. and westerly winds of 19 m.p.h. Both the veer of southerly winds and the increased speed of westerly winds with height are equivalent to the super-position of a west wind of 9 m.p.h. on a surface wind of 10 m.p.h. from south and west respectively.

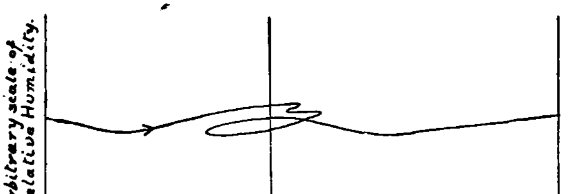
A westerly component of this nature would result from a temperature gradient from south to north, and such a gradient does exist at Heliopolis because the average minimum temperature at that station is 5–6° F. higher than over the cultivated area of the Delta to the northwards. The probable cause of this temperature difference is however a general drainage of cold air off the high ground to the south and south-east on to the low-lying cultivated surface, and this would itself cause a marked veer of southerly winds in the lowest layers. Possibly both factors enter into the phenomena. The abnormal veer does not continue after 10h. or 11h. and this explanation does not apply to Ismailia, where it continues throughout the day. At the latter station therefore the local exposure would seem to be the more probable explanation.

Unusual Feature of a Meteorograph Record obtained from within the Stratosphere

A sounding made from Sealand at 17h. 20m. G.M.T. on February 11th, 1935, in the ordinary course of the International days reached a maximum height of 16·2 Km. The balloon did not burst, but evidently developed a small leak which allowed it to float for many hours. It fell in Luxembourg, apparently about 12 hours after the start, having travelled 650 Km. in a direction 122° east of north.

From the peculiar behaviour of such floating balloons it seems probable that they develop a small leak after the rubber has become permanently strained to such a degree that there is little resiliance left to force the gas out; they, therefore, descend with a very small vertical velocity.

Unfortunately, owing to an error, the record in the troposphere is missing; in the stratosphere, however, it is reasonably good, and on the descending record of the hygrograph at the height 12·8–13·2 Km. a remarkable feature can be most clearly seen. The diagram shows an enlarged view of the portion of the record in question, height being indicated by the horizontal co-ordinate, the movement of the hygrograph scriber by the vertical one. The record is perfectly clear in the original and there seems to be no getting away from the fact that the balloon on the descent fell to about 12·9 Km., then took a short excursion upwards, fell again to 12·8 and then rose to 13·2 before resuming its normal descent once more. The tropopause was found at 12·1 Km., so that this rising and falling took place inside the stratosphere. On the record of temperature a confused mass of lines occurs at the same level, the details cannot be made out very well, and all that can be said is that there is nothing corresponding to the adiabatic fall of temperature which would be expected if a vertical current had lifted the instrument by the amount shown. The apparent variations of relative humidity have not much significance since the reversal of motion as regards height causes slight fictitious movement of the recording scriber in the direction at right angles.



Enlarged portion of Baro-Hygrogram.

It is difficult to conceive of any instrumental defect which could artificially produce a record like this, but it is equally difficult to imagine it as a real phonomenon in the atmosphere. A little further down on the descent, just below the tropopause, there are traces of something similar happening again, but the record is not so clear; a rise from 11·2 to 11·9 Km. is there suggested. A study of the International Section of the *Daily Weather Report* does not reveal any signs of thunderstorms in France at the time of the sounding.

A suggestion has been made by Colonel Gold that the balloon may have been covered with snow which fell off by instalments during the descent. This seems a possible explanation and one that would fit in with the characteristics of the record perfectly. We should have to postulate the balloon acquiring a heavy coat of snow on the ascent, carrying it up to a height of 16 Km. without much evaporation, bringing it down again to 13 Km. and then dropping portions of perhaps 10 to 50 grammes at a time. It is unfortunate that as the record of the troposphere is missing we cannot discover whether or not the balloon passed through heavy clouds from which such an accumulation of snow could have been derived.

L. H. G. DINES.

The Rainfall of Rotuma, Fiji

We have received from Mr. R. Osborn, of Suva, Fiji, details of a long rainfall record which has been maintained at Rotuma, Fiji, lat. 12° 30′ S., long. 177° 5′ E., height above M.S.L. 90 ft. The observer is Mr. A. E. Cornish. The record extends from 1912 onwards

	Rainfall.			Raindays. Average.*	Max. fall in 24 hrs.†
	Average.	Wettest.	Driest.		
	in.	in.	in.		in.
January	13·79	24·27	3·10	21	9·32
February ...	16·04	27·01	5·12	21	8·50
March	13·53	22·89	3·51	21	5·44
April	11·79	24·95	4·46	20	3·75
May	12·93	24·80	3·43	20	10·55
June	9·39	18·46	2·26	17	4·82
July	7·91	24·47	1·07	18	3·85
August	10·53	21·18	2·78	20	5·29
September ...	9·88	35·41	2·09	19	5·10
October	11·56	25·28	3·15	19	4·85
November ...	13·76	28·58	4·98	20	6·69
December ...	12·51	24·70	2·53	21	4·04
Year ...	143·62	168·13	101·28	237	—

* 1913–1932. † 1926–1932.

and for the 21 years ending 1932 gives an average rainfall of 143·6 in., which is high for Fiji, though there are wetter stations in the same group. The mean values are as shown in the above table.

REVIEWS

India Meteorological Department, Scientific Notes, Vol. VI. No. 61 —*Evaporation in India calculated from other Meteorological Factors.* By P. K. Raman, B.A., and V. Satakopan, M.A.

The values of the mean daily evaporation in each month at 80 stations in India have been calculated from a formula given below, which was found to give results in good accord with actual determinations of evaporation at eight stations. The data so obtained have been used for the construction of charts showing the distribution, month by month, of the mean daily evaporation over India and the charts are briefly discussed.

The formula used is a slight modification of one due to Carl Rohwer, namely:—

$$E = (1{\cdot}465 - 0{\cdot}186B)\,(0{\cdot}44 + 0{\cdot}118W)\,(e_s - e_d)$$

where E is the mean daily evaporation in inches of water,
B is the barometric pressure in inches of mercury,
W is the daily mean wind velocity at 4 ft. above ground level in miles per hour,
e_s is the pressure of saturated vapour at the temperature of the water surface, in inches of mercury,
e_d is the actual vapour pressure of the air, in inches of mercury.

The modification to the formula consists in the replacement of the term $e_s - e_d$ by $\left(\frac{100}{h} - 1\right) e_d$ where h is the mean relative humidity. The two formulae are identical if the temperature of the water surface is assumed to be equal to the air temperature.

A little consideration shows that however successful it may have been in America and India, the formula fails to represent the results obtained from an evaporation tank under the conditions prevailing at Camden Square. Here the factors involving B and W do not vary much with the season and the formula implies that the evaporation in any month is nearly proportional to $e_s - e_d$, or to the "saturation-deficit" if we assume that the mean water temperature is equal to the mean air temperature. At Kew Observatory the mean value of the saturation deficit is about 5·1 mb. in June and about 1·4 mb. in December. The formula indicates that the mean rate of evaporation in June should be about 3·6 times as great as in December; actual observations at Camden Square show that the rate in June is more than 30 times as great as in December.

By British standards, the values of the calculated evaporation in India are rather startling. For many stations the figure works out at over 100 in. a year and at one, Sholapur, it reaches 174·8 in.

E. G. BILHAM.

Why the Weather? By Charles E. Brooks, Ph.D., with the collaboration of Eleanor Habler Brooks and John Nelson. Revised and enlarged. Size $8\frac{1}{4}$ in. by $5\frac{1}{2}$ in., pp. XVII + 295. *Illus.*, New York, 1935.

Dr. C. F. Brooks has the art of making brief but readable accounts of weather phenomena, and has contributed many such notes to the American press. In 1924 a selection of these was published in book form under the title " Why the weather ? " and proved a valuable addition to popular meteorological literature. The volume has now been revised and enlarged by the addition of further notes. They are arranged in consecutive order according to season and subject and though they necessarily remain somewhat disconnected, the volume is quite readable. Each note being complete in itself, the comprehensive index also converts the book into a valuable glossary, and as such it is worth its place on the shelves of any meteorological library.

Elaborate analysis would be out of place in a newspaper article, and the book is primarily descriptive ; the accounts of phenomena such as ice storms, cyclones and tornadoes are excellent, and should be especially useful to lecturers. The part played by the weather in everyday life is not forgotten, and there are some useful hints for the home-maker and housewife. The author is in fact highly successful in answering the query " How the weather ? " ; in giving the " Why ? " he is always lucid and generally accurate but at times perhaps rather dogmatic. Pros and cons are difficult to weigh in half a page.

The definitions and conventions are of course American and do not always accord with those used in Great Britain. On a hill-side, we expose a rain-gauge with its rim horizontal, not parallel with the slope of the ground, and English readers will be puzzled by the definition of sleet as pellets of ice which rattle on the roofs and windows. There is no special term in America for a mixture of rain and snow. These differences of nomenclature are liable to cause confusion in international meteorology, but the popular usage is well-established in both countries and cannot be gainsaid.

A special word must be said of the illustrations, which are numerous —there are no fewer than 50 photographs—and uniformly excellent. Spectacular phenomena appear to be more frequent in America than in England, and the author has certainly made a representative collection. The publishers are to be congratulated on the attractive get-up and the absence of misprints.

Study of the Minor Fluctuation of the Atmospheric Pressure (1). By Tadao Namekawa. Reprinted from the Memoirs of the College of Science, Kyoto Imperial University, A, Vol. XVII, No. 6, 1934, pp. 405–30.

In this paper the author explains the short period fluctuations of pressure and wind recorded by the microbarograph and the anemograph, by relating them to waves formed at a horizontal surface of discontinuity. Such a " surface " of discontinuity is generally an inversion of temperature extending through a small vertical thickness, and for the purpose of this paper may be regarded as analogous to the surface of separation between two liquids of different densities, in an open containing vessel. That waves may develop at the common surface of the two liquids, whether the liquids be at rest or in relative motion horizontally, is well known and the mathematical treatment of the problem in this case is comparatively simple owing to the fact that liquids may be assumed to be incompressible. In the case of the atmosphere, however, changes of pressure involve changes of temperature and density. These complicate the wave problem and an exact solution cannot be obtained. The author, however, derives a solution by making certain assumptions, the validity of which is upheld by the agreement found later between the theory and observational facts.

The second part of the paper gives in detail a graphical method for the application of this formal solution to a particular case. The author shows that, given the height above ground and amount of the temperature inversion, the temperature distribution and the wind in the two air masses (all of which may be obtained by observation), then the period and velocity of propagation of any system of waves which may develop at the surface of separation can be calculated. Such waves will give rise to fluctuations of wind and pressure at the ground, and if sufficiently large, the fluctuations will appear on the autographic records, in particular the microbarogram. In the two cases discussed, general agreement is found between observation and theory.

Some interesting points emerge from the theoretical discussion. If the upper and lower air masses are moving with the same velocity pressure oscillations will not appear at the ground even though waves may develop at the inversion. In order that pressure waves may appear, the velocity difference must approximate to a certain critical value. The absence of microbarograph oscillations when an inversion is known to exist may be due to the non-adjustment of velocities in the two air masses. Circumstances may also arise in which fluctuations of wind at the ground are unaccompanied by pressure oscillations.

The paper is a courageous and successful attempt to solve what is an extremely difficult problem. It contains, however, a number of mathematical errors, which, together with the complexity of the method adopted for the graphical solution makes the reading difficult. The approximations and assumptions made at various stages might, with advantage, be more fully explained.

A. G. Forsdyke.

BOOK RECEIVED

Noctilucent Clouds. By E. H. Vestine (Reprint from J. Roy. Astr. Soc., Canada. July–August and September, 1934).

OBITUARY

Miss E. F. Mellish.—We regret to learn of the death on August 23rd last of Miss E. F. Mellish of Hodsock Priory, Worksop. From 1927, following the death of her brother, Lt.-Col. Henry Mellish, Miss Mellish had maintained the valuable climatological observations at the Priory which date back to 1876 in respect to rainfall and to 1879–81 in respect to other elements. The value to climatology of a long and homogenous record such as that of Hodsock Priory can hardly be over-estimated, and it is pleasing to learn that the new tenant, Mr. Edward Dixon, intends to continue the observations as in the past.

We regret to learn of the death of Prof. Dr. Wilhelm Grosse, former Director of the Meteorological Observatory in Bremen.

NEWS IN BRIEF

Dr. Otto Hoelper " Privatdozent " for Meteorology at the Technische Hochschule at Aachen has become Director of the Meteorological Observatory at Potsdam.

Erratum

AUGUST, 1935, p. 171, line 41, *for* " 15·6 hrs. at Pembroke " *read* " 14·6 hrs. at Pembroke on the 30th."

The Weather for September, 1935

Pressure was below normal in the United States, eastern Canada and across the North Atlantic to northern, central and south-eastern Europe and western Asia, the greatest deficits being 9·1 mb. at Lerwick and 2·6 mb. in southern Texas. Pressure was above normal in Alaska, western and northern Canada, Greenland, Spitsbergen and over the western Mediterranean, Spain and the southern North Atlantic to Bermuda, the greatest excesses being 8·4 mb. at Jan Mayen, 6·6 mb. at Kodiak (Alaska) and 2·8 mb. at Lisbon. In Sweden, temperature was below normal in the north and middle but above normal elsewhere, while precipitation was considerably in excess.

In the British Isles the weather of September was very unsettled with frequent thunderstorms and during the middle of the month, severe gales. Rainfall was considerably above normal while sunshine totals were variable. Temperature was also above normal in the south, 70° F. being exceeded on several days and 60° F. on three or four nights. From the 1st to 6th a complex low pressure system covered the British Isles giving unsettled weather with heavy rain locally at times. Thunderstorms occurred at many places in England on the 1st, 2nd and 4th, but there were considerable bright periods ; 2·10 in. and 3·18 in. of rain fell at Borrowdale (Cumberland) on the 1st and 2nd respectively and 1·57 in. at Frome (Somerset) on the 3rd. On the 5th the anticyclone over Iceland began to spread south-eastwards and extended across the British Isles to France by the 6th. Generally fair to fine weather with early morning mist or fog prevailed from the 6th to 10th. Dunbar had 12·3 hrs. bright sunshine on the 6th, Thunderstorms were reported from the Channel Islands on the 9th and ground frosts locally in the north on the 8th. On the 10th a depression advancing from the Atlantic brought rain to Ireland and from then to the 21st complex low pressure systems passed across the country. During this period gales were frequent, rainfall was heavy at times and thunderstorms occurred in different parts of the country on each day from the 13th–17th and again on the 21st; 2·28 in. fell at Barnard Castle (Durham) on the 21st, 2·26 in. at Borrowdale (Cumberland) on the 18th (followed by floods) and 1·90 in. on the 18th and 1·46 in. on the 19th at Trecastle (Brecon). Much sunshine, however, was recorded on several days. Berwick-on-Tweed had 10·9 hrs. sunshine on the 13th and 19th, and Durham 10·9 hrs. on the 19th. On the 14th a line squall accompanied by hail and thunder moved across the country. From the 15th to 20th the winds in England and parts of Ireland remained generally fresh to strong in force, increasing to gales at times especially in the south on the 16th and 17th when extensive damage and several casualties were reported both along the south coasts and also from shipping in the English Channel and off south Ireland. Beaufort force 9 was recorded at Pembroke at 18h. on the 16th and at Scilly Isles and Pembroke at 1h. on the 17th. Among the highest gusts recorded were, on the 16th, 96 m.p.h. at 21h. 45m. at Scilly Isles and 92 m.p.h. at 21h. at Manston (Kent) and on the 17th 85 m.p.h. at 2h. 10m. at Pembroke. Early on the 19th another gale swept the whole country and was again strongest in the south but generally it was not so severe as the previous one. A gust of 67 m.p.h. was recorded at 0h. 35m. at Pembroke. Fog occurred at the mouth of the English Channel on the night of the 19th–20th and mist or fog more generally in the English Channel and south and south-east England on the 21st when a slight ridge of high pressure passed across the south of the country. From the 22nd to 27th depressions and ridges of high pressure passed alternately across the country, the depressions bringing heavy rain and local thunderstorms on the 22nd and 24th and hailstorms in the Midlands on the 22nd, 2·75 in. were measured at Oughtershaw (Yorkshire) on the 22nd and 1·79 in. at Cambridge on the 24th. The 23rd and 25th on the other hand were both fine cool sunny days generally; Bath had 11·2 hrs. bright sunshine on the 23rd and Inchkeith 10·9 hrs. on the 25th. Ground frosts were recorded in the north and west on the 24th and 25th and generally over the whole country on the 26th. With the approach of a new depression temperature rose considerably on the 27th and remained high until the evening of the 28th, 74° F. was recorded at Greenwich and 73° F. at Hull on the 27th. From the 27th to 30th conditions were again unsettled with a few scattered thunderstorms, moderate rain and short bright periods and occasional local mist or fog. The distribution of bright sunshine for the month was as follows :—

	Total (hrs.)	Diff. from normal (hrs.)		Total (hrs.)	Diff. from normal (hrs.)
Stornoway ...	117	+3	Chester ...	131	+7
Aberdeen ...	141	+17	Ross-on-Wye ...	149	+13
Dublin	124	−9	Falmouth ...	143	−17
Birr Castle ...	101	−18	Gorleston ...	159	+1
Valentia... ...	96	−28	Kew	151	+6

Miscellaneous notes on weather abroad culled from various sources

Severe storms were experienced in north France and Belgium on the 17th, especially along the north French coasts where much damage was done to the fishing fleets and several lives were lost. Storms also occurred along the Dutch coast on the night of the 24th. Thick fog was experienced off Brest on the night of the 27th. Unusually early heavy snowstorms paralysed traffic in Finland at the end of the month when oats and potatoes lay under 12 in. of snow. A violent storm caused much damage at Velez Malaga, Spain, about the 30th. (*The Times*, September 6th–October 1st.)

The disastrous floods in China continued to extend during the early part of the month when the Yellow River was swelling into Weishan Lake which in turn poured its overflow into the Pulao River. Many of the dykes on this river gave way between the 3rd and 8th inundating over 300 villages. On the 12th one of the main dykes on the Grand Canal collapsed and another large tract of northern Kiangsu was flooded with great loss of life. To the south of the flooded areas the country is suffering from drought. The monsoon continued active generally in India during the middle of the month ; at Colaba, Bombay, 11 in. more rain than normal had been recorded during the season while in the Deccan more rain was required. A typhoon swept over Kion Siou island and the east coast of Japan on the 25th and 26th ; 230 people were killed chiefly in landslips and 4 Japanese destroyers damaged. (*The Times*, September 4th–October 2nd.)

Early in the month the drought in the northern cattle country of South Australia was broken by plentiful rains and rain measuring ½ to 1½ in. fell in parts of Queensland ; later lighter falls occurred elsewhere in Queensland and in New South Wales. (*The Times*, September 10th–17th.)

A hurricane swept over Cuba on the night of the 1st and then passed across Florida Keys on the 3rd where much damage was done and nearly 300 people were killed. On the 4th it was travelling along the west coast of Florida where it did much damage to the citrus crops and by the 5th it was passing through Georgia but with its force much abated. On the 27th a hurricane passed close to Jamaica doing much damage to the banana crop there and then travelled north-west to Cuba passing over Cienfuegos on the 28th. From there it moved to the Florida Straits and then travelled north-east missing the coasts of Florida. By October 1st its centre was 300 miles north-east of Bermuda and its force much abated. In Cienfuegos

35 people were killed, and much material damage as well as damage to crops was done in Cuba, Caymanbrac, Grand Bahama and north-west Abaco. Fairly general but moderate rain occurred in the Argentine towards the end of the month. Temperature was mainly below normal in the United States, except in the extreme west, at first but later the warmth spread from the west across the country while the rainfall was generally deficient, except in the Atlantic and Gulf States during the week ending the 10th. (*The Times*, September 4th–October 1st, and *Washington D.C.*, *U.S. Dept. Agric.*, *Weekly Weather and Crop Bulletin.*)

Daily Readings at Kew Observatory, September, 1935

Date	Pressure, M.S.L. 13h.	Wind, Dir., Force 13h.	Temp. Min.	Temp. Max.	Rel. Hum. 13h.	Rain.	Sun.	REMARKS. (see vol. 69, 1934, p. 1).
	mb.		°F.	°F.	%	in.	hrs.	
1	1011·0	S.2	58	71	74	trace	0·9	tlr_0 19h.–20h.
2	1010·8	SW.3	59	68	69	0·10	7·7	pr during day.
3	1012·8	SW.4	54	70	55	0·02	8·0	pr_0 11h. & 21h.
4	1007·0	W.2	55	67	58	0·29	5·4	r early, rt 9h.–10h.
5	1011·1	SW.3	53	67	72	0·33	4·5	r_0 4h.–5h., r 18h.–23h.
6	1019·2	WNW.2	50	65	55	trace	10·8	w early.
7	1022·6	N.2	45	64	48	—	9·3	w early.
8	1023·1	ESE.3	48	67	52	—	10·1	w early.
9	1021·8	SE.2	52	64	63	—	0·7	
10	1024·7	SSE.2	47	65	52	—	6·7	w early.
11	1015·4	SE.2	48	68	53	—	7·7	w early.
12	1008·0	S.3	53	71	65	—	3·1	w early.
13	1012·1	SW.3	57	69	56	—	4·4	d_0 7h.
14	1010·3	SW.4	55	69	58	0·03	7·2	pr 13h.
15	999·2	SW.4	55	64	75	0·04	1·8	pr 9h.–13h.
16	1001·8	SW.3	52	63	61	0·09	3·6	r_0 18h.–23h.
17	994·6	SW.5	54	63	63	0·13	7·4	r early, pr_0 9h.–13h.
18	1010·6	SW.3	52	61	56	0·06	6·7	r 1h., pr 13h., r 23h.
19	1002·7	WSW.5	57	71	55	0·18	7·5	r–r_0 0h.–6h.
20	1016·4	SW.4	59	70	78	0·02	1·4	r_0 early.
21	1020·5	ESE.2	50	69	82	—	2·4	F early.
22	1008·8	W.4	60	67	77	0·11	2·0	rR 10h.–11h., r_0 21h.
23	1018·4	W.3	46	62	52	trace	9·6	r_0 1h.
24	1011·1	SSW.3	47	59	92	0·40	0·0	r–r_0 5h.–9h. & 11h.–[20h.
25	1016·3	WNW.4	50	58	48	—	9·2	
26	1019·4	SSW.2	39	60	62	0·01	1·9	r_0 20h.–24h.
27	1012·9	SW.3	55	70	77	0·01	3·6	r_0 0h.,18h.&21h.
28	1008·9	S.2	61	70	77	0·07	2·6	r_0 0h.–9h., tlr_0 21h.–[22h.
29	1011·5	WNW.3	53	59	92	0·46	2·4	r–r_0 2h.–13h. & 23h.
30	1003·6	SW.3	54	58	69	0·18	1·7	r–r_0 0h.–9h.,prh 12h.
*	1012·2	—	53	66	65	2·55	5·0	* Means or totals.

General Rainfall for September, 1935.

England and Wales ...	210	per cent. of the average 1881–1915.
Scotland	172	
Ireland	196	
British Isles	198	

Rainfall: September, 1935: England and Wales

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av.
Lond .	Camden Square..........	3·02	166	*Leics* .	Thornton Reservoir ...	4·80	265
Sur .	Reigate, Wray Pk. Rd..	4·28	206	„ .	Belvoir Castle...........	4·23	226
Kent .	Tenterden, Ashenden...	3·83	179	*Rut* .	Ridlington	3·96	206
„ .	Folkestone, Boro. San.	3·45	...	*Lincs* .	Boston, Skirbeck.........	2·14	122
„ .	Eden'bdg., Falconhurst	4·47	197	„ .	Cranwell Aerodrome...	4·95	278
„ .	Sevenoaks, Speldhurst.	3·71	...	„ .	Skegness, Marine Gdns.	2·17	120
Sus .	Compton, Compton Ho.	4·70	168	„ .	Louth, Westgate.........	4·31	213
„ .	Patching Farm..........	5·12	213	„ .	Brigg, Wrawby St.......	3·58	...
„ .	Eastbourne, Wil. Sq....	5·93	237	*Notts* .	Worksop, Hodsock......	3·39	223
„ .	Heathfield, Barklye....	6·42	262	*Derby*.	Derby, L. M. & S. Rly.	4·16	252
Hants.	Ventnor, Roy.Nat.Hos.	4·18	169	„ .	Buxton, Terr. Slopes...	7·26	224
„ .	Fordingbridge, Oaklnds	3·43	159	*Ches* .	Runcorn, Weston Pt....	4·89	183
„ .	Ovington Rectory.......	5·10	223	*Lancs*.	Manchester, Whit. Pk.	5·23	219
„ .	Sherborne St. John......	3·76	183	„ .	Stonyhurst College......	8·76	229
Herts .	Royston, Therfield Rec.	3·92	208	„ .	Southport, Bedford Pk.	6·78	246
Bucks.	Slough, Upton............	3·61	205	„ .	Lancaster, Greg Obsy.	9·01	266
„ .	H. Wycombe, Flackwell	4·35	222	*Yorks*.	Wath-upon-Dearne......	3·74	237
Oxf .	Oxford, Mag. College...	4·37	260	„ .	Wakefield, Clarence Pk.	3·61	226
Nor .	Wellingboro, Swanspool	4·19	233	„ .	Oughtershaw Hall.......	11·10	...
„ .	Oundle	2·83	...	„ .	Wetherby, Ribston H..	5·64	313
Beds .	Woburn, Exptl. Farm...	3·98	222	„ .	Hull, Pearson Park......	4·21	245
Cam .	Cambridge, Bot. Gdns.	4·80	298	„ .	Holme-on-Spalding......	4·14	238
Essex.	Chelmsford, County Lab	3·16	184	„ .	West Witton, Ivy Ho.	5·56	258
„ .	Lexden Hill House......	3·05	...	„ .	Felixkirk, Mt. St. John.	4·31	237
Suff .	Haughley House.........	3·18	...	„ .	York, Museum Gdns....	5·20	320
„ .	Campsea Ashe...........	4·25	222	„ .	Pickering, Hungate......	4·70	246
„ .	Lowestoft Sec. School...	3·59	183	„ .	Scarborough..............	3·61	202
„ .	Bury St. Ed., WestleyH.	4·54	228	„ .	Middlesbrough...........	4·00	241
Norf. .	Wells, Holkham Hall...	3·47	183	„ .	Baldersdale, Hury Res.	7·93	317
Wilts .	Calne, Castle Walk......	5·89	...	*Durh* .	Ushaw College...........	6·02	299
„ .	Porton, W.D. Exp'l. Stn	3·62	207	*Nor* .	Newcastle, Town Moor.	2·63	129
Dor .	Evershot, Melbury Ho.	5·47	206	„ .	Bellingham, Highgreen	4·24	177
„ .	Weymouth, Westham.	2·93	139	„ .	Lilburn Tower Gdns....	3·20	136
„ .	Shaftesbury, Abbey Ho.	3·45	142	*Cumb*.	Carlisle, Scaleby Hall...	4·54	168
Devon.	Plymouth, The Hoe....	4·19	164	„ .	Borrowdale, Seathwaite	18·00	191
„ .	Holne, Church Pk. Cott.	6·61	184	„ .	Borrowdale, Moraine...	17·91	239
„ .	Teignmouth, Den Gdns.	2·61	131	„ .	Keswick, High Hill......	9·05	214
„ .	Cullompton	4·18	186	*West* .	Appleby, Castle Bank...	6·07	240
„ .	Sidmouth, U.D.C........	2·86	...	*Mon* .	Abergavenny, Larchf'd	4·96	212
„ .	Barnstaple, N. Dev.Ath	4·61	171	*Glam* .	Ystalyfera, Wern Ho....	10·63	243
„ .	Dartm'r, Cranmere Pool	8·50	...	„ .	Cardiff, Ely P. Stn.......	8·29	267
„ .	Okehampton, Uplands.	7·16	221	„ .	Treherbert, Tynywaun.	14·97	...
Corn .	Redruth, Trewirgie......	4·66	149	*Carm* .	Carmarthen, The Friary	7·24	209
„ .	Penzance, Morrab Gdn.	3·51	120	*Pemb* .	St. Ann's Hd, C. Gd. Stn.	5·10	187
„ .	St. Austell, Trevarna...	4·41	138	*Card* .	Aberystwyth	7·39	...
Soms .	Chewton Mendip.........	6·49	211	*Rad* .	BirmW.W.Tyrmynydd	11·15	289
„ .	Long Ashton............	7·88	329	*Mont* .	Lake Vyrnwy	10·73	304
„ .	Street, Millfield..........	3·87	171	*Flint* .	Sealand Aerodrome......	4·64	225
Glos .	Blockley	5·26	...	*Mer* .	Dolgelley, Bontddu......	8·25	194
„ .	Cirencester, Gwynfa....	5·81	264	*Carn* .	Llandudno	4·65	218
Here .	Ross, Birchlea...........	3·83	200	„ .	Snowdon, L. Llydaw 9..	20·08	...
Salop.	Church Stretton.........	4·53	223	*Ang* .	Holyhead, Salt Island...	6·00	224
„ .	Shifnal, Hatton Grange	3·62	188	„ .	Lligwy	7·64	...
Staffs.	Market Drayt'n, Old Sp.	3·88	191	*Isle of Man*			
Worc .	Ombersley, Holt Lock.	3·41	193		Douglas, Boro' Cem....	5·81	176
War .	Alcester, Ragley Hall...	3·80	213	*Guernsey*			
„ .	Birminghm, Edgbaston	3·77	211		St. PeterP't.Grange Rd.	3·20	123

Rainfall: September, 1935: Scotland and Ireland

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av.
Wig .	Pt. William, Monreith.	5·16	177	*Suth* .	Melvich	6·06	216
,, .	New Luce School	5·12	143	,, .	Loch More, Achfary	11·22	195
Kirk .	Dalry, Glendarroch	6·01	163	*Caith* .	Wick	4·09	164
,, .	Carsphairn, Shiel	9·59	180	*Ork* .	Deerness	4·61	159
Dumf.	Dumfries, Crichton, R.I.	4·13	162	*Shet* .	Lerwick	3·59	119
,, .	Eskdalemuir Obs	7·25	196	*Cork* .	Caheragh Rectory	8·12	...
Roxb .	Hawick, Wolfelee	...	...	,, .	Dunmanway Rectory	8·85	216
Selk .	Ettrick Manse	7·64	211	,, .	Cork, University Coll.	6·80	254
Peeb .	West Linton	4·93	...	,, .	Ballinacurra	7·19	285
Berw .	Marchmont House	2·59	107	,, .	Mallow, Longueville	6·44	268
E.Lot.	North Berwick Res	2·36	113	*Kerry*.	Valentia Obsy	6·19	149
Midl .	Edinburgh, Roy. Obs.	3·24	158	,, .	Gearhameen	10·40	170
Lan .	Auchtyfardle	5·47	...	,, .	Bally McElligott Rec	4·75	...
Ayr .	Kilmarnock, Kay Pk	6·17	...	,, .	Darrynane Abbey	5·73	161
,, .	Girvan, Pinmore	4·46	116	*Wat* .	Waterford, Gortmore	6·74	247
Renf .	Glasgow, Queen's Pk	6·07	219	*Tip* .	Nenagh, Cas. Lough	5·39	192
,, .	Greenock, Prospect H.	8·78	185	,, .	Roscrea, Timoney Park	5·73	...
Bute .	Rothesay, Ardencraig	6·78	...	,, .	Cashel, Ballinamona	5·60	228
,, .	Dougarie Lodge	5·27	...	*Lim* .	Foynes, Coolnanes	6·13	219
Arg .	Ardgour House	13·26	...	,, .	Castleconnel Rec	7·15	...
,, .	Glen Etive	...	...	*Clare* .	Inagh, Mount Callan	8·70	...
,, .	Oban	9·96	...	,, .	Broadford, Hurdlest'n.	6·46	...
,, .	Poltalloch	8·11	178	*Wexf* .	Gorey, Courtown Ho.	5·06	204
,, .	Inveraray Castle	14·85	231	*Wick* .	Rathnew, Clonmannon.	3·45	...
,, .	Islay, Eallabus	8·15	195	*Carl* .	Hacketstown Rectory	4·55	163
,, .	Mull, Benmore	17·30	150	*Leix* .	Blandsfort House	5·49	202
,, .	Tiree	5·09	137	*Offaly*.	Birr Castle	5·67	247
Kinr .	Loch Leven Sluice	5·09	198	*Dublin*	Dublin, FitzWm. Sq.	3·53	184
Perth .	Loch Dhu	11·00	192	,, .	Balbriggan, Ardgillan	...	...
,, .	Balquhidder, Stronvar.	10·29	...	*Meath*.	Beauparc, St. Cloud	4·94	...
,, .	Crieff, Strathearn Hyd.	4·92	172	,, .	Kells, Headfort	6·01	226
,, .	Blair Castle Gardens	4·60	194	*W.M* .	Moate, Coolatore	5·60	...
Angus.	Kettins School	4·35	197	,, .	Mullingar, Belvedere	5·83	218
,, .	Pearsie House	5·62	...	*Long* .	Castle Forbes Gdns	8·26	287
,, .	Montrose, Sunnyside	4·12	207	*Gal* .	Galway, Grammar Sch.	6·13	...
Aber .	Braemar, Bank	3·66	146	,, .	Ballynahinch Castle	7·28	153
,, .	Logie Coldstone Sch	3·03	130	,, .	Ahascragh, Clonbrock.	7·29	235
,, .	Aberdeen, King's Coll.	4·24	191	*Mayo*.	Blacksod Point	5·68	146
,, .	Fyvie Castle	5·07	194	,, .	Mallaranny	7·63	...
Moray	Gordon Castle	3·71	148	,, .	Westport House	6·10	172
,, .	Grantown-on-Spey	4·43	179	,, .	Delphi Lodge	10·64	141
Nairn.	Nairn	3·56	162	*Sligo* .	Markree Obsy	6·20	183
Inv's .	Ben Alder Lodge	7·21	...	*Cavan*.	Crossdoney, Kevit Cas.	6·19	...
,, .	Kingussie, The Birches.	4·89	...	*Ferm* .	Enniskillen, Portora	4·34	...
,, .	Inverness, Culduthel R.	3·96	...	*Arm* .	Armagh Obsy	3·78	154
,, .	Loch Quoich, Loan	17·00	...	*Down*.	Fofanny Reservoir	6·78	...
,, .	Glenquoich	...	...	,, .	Seaforde	5·47	199
,, .	Arisaig, Faire-na-Sguir.	6·15	...	,, .	Donaghadee, C. Stn.	4·05	170
,, .	Fort William, Glasdrum	11·67	...	,, .	Banbridge, Milltown	2·91	118
,, .	Skye, Dunvegan	7·89	...	*Antr* .	Belfast, Cavehill Rd	4·92	...
,, .	Barra, Skallary	4·00	...	,, .	Aldergrove Aerodrome.	3·28	132
R&C .	Alness, Ardross Castle.	4·26	146	,, .	Ballymena, Harryville.	5·66	182
,, .	Ullapool	6·66	177	*Lon* .	Garvagh, Moneydig	4·47	...
,, .	Achnashellach	11·64	160	,, .	Londonderry, Creggan.	5·83	177
,, .	Stornoway	6·76	171	*Tyr* .	Omagh, Edenfel	5·61	184
Suth .	Lairg	4·58	162	*Don* .	Malin Head	5·22	...
,, .	Tongue	6·40	202	,, .	Killybegs, Rockmount.	5·41	...

Climatological Table for the British Empire, April, 1935

STATIONS.	PRESSURE. Mean of Day M.S.L.	PRESSURE. Diff. from Normal.	TEMPERATURE. Absolute. Max.	TEMPERATURE. Absolute. Min.	TEMPERATURE. Mean Values. Max.	TEMPERATURE. Mean Values. Min.	TEMPERATURE. Mean Values. ½ Max. and Min.	TEMPERATURE. Mean Values. Diff. from Normal	TEMPERATURE. Mean. Wet Bulb.	Relative Humidity.	Mean Cloud Am'nt	PRECIPITATION. Am'nt.	PRECIPITATION. Diff. from Normal.	PRECIPITATION. Days.	BRIGHT SUNSHINE. Hours per day.	BRIGHT SUNSHINE. Percentage of possible.
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	%	0–10	in.	in.			
London, Kew Obsy.	1010·1	− 4·3	61	33	54·0	41·2	47·6	+ 0·3	42·4	81	7·5	2·69	+ 1·24	21	3·8	27
Gibraltar	1017·5	+ 1·1	82	47	71·1	52·9	62·0	+ 1·1	51·7	78	3·8	1·74	− 0·95	4	...	...
Malta	1015·4	+ 2·0	76	46	64·3	54·8	59·5	− 1·4	54·4	75	4·6	0·22	− 0·64	3	9·8	75
St. Helena	1012·1	+ 0·1	73	59	68·6	61·7	65·1	− 0·2	62·5	91	9·2	4·60	...	25	...	...
Freetown, Sierra Leone	1012·7	+ 1·9	95	70	88·3	74·3	81·3	− 1·1	74·1	72	2·2	0·82	− 3·24	3	...	...
Lagos, Nigeria	1010·8	+ 1·4	93	68	88·9	76·9	82·9	+ 0·1	77·5	83	7·2	6·27	+ 0·19	15	6·3	52
Kaduna, Nigeria	1006·5	...	103	62	95·1	71·2	83·1	+ 1·6	69·3	57	3·9	1·65	− 1·43	4	7·8	63
Zomba, Nyasaland	1012·7	+ 0·2	83	54	75·8	59·3	67·5	− 1·8	62·4	72	5·8	0·72	− 2·94	6	...	...
Salisbury, Rhodesia	1014·8	− 1·1	83	45	75·7	51·1	63·4	− 2·3	56·7	63	3·1	0·01	− 0·98	1	8·3	71
Cape Town	1016·4	0·0	93	48	73·5	57·0	65·3	+ 2·1	57·3	81	5·5	2·70	+ 0·83	9	...	...
Johannesburg	1015·9	− 0·6	79	37	68·6	48·7	58·7	− 1·3	50·3	64	3·6	0·82	− 0·92	7	7·5	65
Mauritius	...	...	86	65	81·9	71·6	76·7	+ 0·9	74·3	85	6·4	16·10	+ 11·63	21	6·4	55
Calcutta, Alipore Obsy.	1006·6	+ 0·3	106	67	95·2	75·5	85·3	− 0·3	75·8	79	4·3	2·34	+ 0·16	3*	...	...
Bombay	1009·1	+ 0·3	90	72	88·2	75·6	81·9	− 1·2	73·8	74	3·2	0·02	− 0·03	0*	...	...
Madras	1007·6	− 0·8	102	75	93·0	79·0	86·0	+ 0·7	78·2	70	5·6	0·00	− 0·63	0*	...	...
Colombo, Ceylon	1009·3	+ 0·6	90	72	88·0	76·0	82·0	− 0·7	78·3	75	6·6	3·69	− 6·04	14	8·5	69
Singapore	1008·3	− 0·6	91	71	86·7	75·5	81·1	− 0·5	77·6	78	7·7	3·27	− 4·36	15	5·1	42
Hongkong	1011·3	− 1·3	85	57	74·3	67·1	70·7	− 0·1	67·8	87	9·1	2·45	− 3·20	8	2·6	20
Sandakan	1008·6	...	91	72	89·2	75·0	82·1	− 0·1	77·9	80	6·6	7·31	+ 2·82	9	...	...
Sydney, N.S.W.	1013·7	− 4·7	88	45	73·1	55·7	64·4	− 0·3	58·1	71	5·2	0·97	− 4·55	10	7·8	69
Melbourne	1014·5	− 5·0	89	44	67·6	52·3	59·9	+ 0·4	55·3	77	8·1	5·94	+ 3·77	20	3·0	27
Adelaide	1017·3	− 2·6	91	43	71·0	55·1	63·1	− 0·8	56·5	62	6·7	1·66	− 0·07	21	5·0	45
Perth, W. Australia	1018·6	+ 0·2	84	47	76·8	57·2	67·0	+ 0·2	56·8	60	4·4	2·07	+ 0·42	9	8·3	73
Coolgardie	1018·8	+ 0·2	99	43	75·6	52·1	63·9	− 1·1	56·0	54	4·1	0·90	− 0·06	3	...	...
Brisbane	1015·3	− 2·3	89	49	78·5	59·4	68·9	− 1·4	62·4	64	3·7	3·62	− 0·15	14	7·8	68
Hobart, Tasmania	1012·6	− 2·2	83	40	61·6	49·6	55·6	+ 0·4	51·0	79	7·6	8·50	+ 6·65	20	3·7	34
Wellington, N.Z.	1015·3	− 2·8	74	47	64·3	52·6	58·5	+ 1·4	55·4	77	6·0	1·79	− 2·09	12	6·2	56
Suva, Fiji	1010·6	0·0	89	69	85·0	73·4	79·2	+ 0·6	74·4	85	6·4	12·78	+ 0·57	26	5·1	44
Apia, Samoa	1009·5	− 0·4	88	71	85·6	74·5	80·1	+ 1·2	76·1	77	5·3	4·02	− 6·13	17	7·7	65
Kingston, Jamaica	1013·1	− 1·0	90	65	86·2	69·7	77·9	− 0·5	68·9	75	2·9	0·01	− 1·23	1	8·8	70
Grenada, W.I.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Toronto	1014·4	− 1·7	68	25	51·0	36·4	43·7	+ 1·6	38·1	70	5·8	0·73	− 1·56	9	6·2	46
Winnipeg	1019·7	+ 3·0	66	5	54·0	28·4	41·2	+ 3·5	28·6	83	5·8	1·00	− 0·40	5	7·0	51
St. John, N.B.	1010·5	− 2·9	58	18	47·0	25·8	36·4	− 2·6	33·3	69	5·7	2·64	− 0·87	9	6·4	47
Victoria, B.C.	1015·9	− 1·6	67	34	55·7	41·4	48·5	+ 0·6	43·6	64	4·5	0·38	− 1·14	6	8·6	63

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

(28253) Wt. 18/32 1000 10/35 Hw. G.377/6

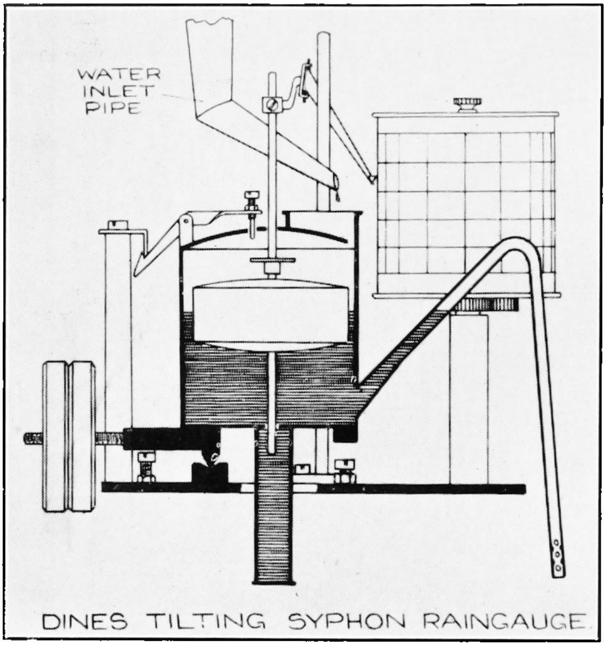


FIG. 1 (see p. 237).

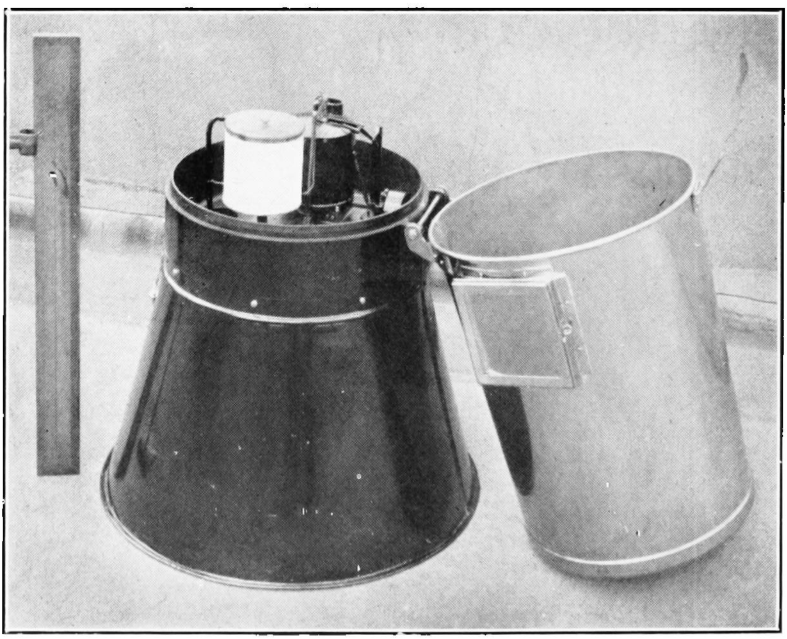


FIG. 2.—DINES TILTING SYPHON RAIN-GAUGE (see p. 237).