M.O. 347.

# The Meteorological Magazine

Air Ministry :: Meteorological Office

Vol. 67
June 1932
No. 797

LONDON: PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE

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## The Life Work of William Henry Dines

By E. G. Bilham, B.Sc.

The death of W. H. Dines on Christmas Eve, 1927, represented a loss to science of more than ordinary magnitude. For more than thirty years he had been the most arresting figure in meteorology. He had enriched our instrumental resources with the products of his mechanical genius, opened up to us the new realm of the upper air, revolutionised our ideas of the thermal structure of the atmosphere and, in his latter years, set out to explore fresh fields in the domain of radiation. His fame was world-wide and our sorrow in his loss was shared wherever meteorology was studied.

It is the custom of mankind to perpetuate the memory of its great men, and it was natural that the Royal Meteorological Society should seek to perpetuate the memory of one of the greatest of its Fellows. Funds were collected, and in 1929 it was decided that the memorial to Dines should take the form of a volume of his collected papers. This volume is now in our hands, and surely no one who peruses it will question the wisdom of the Society's decision. To quote the words of the Preface:—" . . . it is a memorial built of materials selected and shaped by the prospector himself, and it represents his life as he made it, by enterprise and achievement. No granite pillar or marble block could bring other workers into such close contact with the spirit of research undertaken and accomplished.

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and none could furnish a more inspiring incentive to further endeavour."

Here then is the life work of W. H. Dines between two covers. The work of the editing committee has been done well, and the format of the volume is worthy of the purpose it is intended to serve. The papers are arranged in four sections: I, Anemometry and Instrument Design, with an Introduction by Dr. Whipple. II, The Investigation of the Upper Air, with an Introduction by Mr. L. H. G. Dines. III, Radiation, with an Introduction by Lieut.-Col. Gold; and IV, Miscellaneous Papers, with an Introduction by Mr. R. G. K. Lempfert. Sir Richard Gregory has written the Preface and Sir Napier Shaw's obituary notice is reprinted from the *Proceedings of the Royal Society.* At the end of the volume there is a list of 92 papers, articles and letters not reproduced in the volume. To look at this list and at the four hundred pages of his work in the body of the volume is to realise, in some measure, the magnitude of Dines' output.

Section I contains the classical papers on wind pressure, and on the comparison of anemometers which Dines wrote as a member of the Wind Force Committee appointed by the Royal Meteorological Society in 1886. The paper on "Anemometer Comparisons," published by the Society in 1892, is of particular interest, for here in no more than four pages, half of them devoted to diagrams, is all that he ever wrote about his tube anemograph. The brevity of his remarks about this revolutionary instrument has, indeed, proved rather exasperating to his successors. He gives us, for instance, the relation $W = .000731\ V^2$ for the pressure difference W in inches of water set up by the head in a wind of V miles per hour, but does not tell us the value of the air density in which this relation is applicable. On the important question of the shaping of the float to give a linear velocity scale, he contents himself with saying that "the chamber N is not exactly conical, but bulges out slightly in the central parts." On the other hand we have, in another paper, very complete details about the liquid indicator which he devised for the purpose of obtaining eye readings of velocity, with the aid of a pressure head and vane. This instrument, though very simple and efficient, never obtained much popularity and is now practically unknown. The same remark applies to the helicoid anemometer, described by Dr. Whipple as perhaps the most ingenious of Dines' inventions.

We are indebted to Mr. J. Baxendell for a description of the float thermograph made by Halliwell for the Fernley Observatory, Southport. Though Dines did not design this particular instrument it incorporated the basic features of one which Dines had designed at Oxshott. In this instrument the thermometric substance is mercury, contained in a huge coil of narrow-bore copper tubing, sealed at one end and communicating at the other with a glass tube containing a float to which the recording pen is attached. For his original instrument Dines designed a very ingenious float which would move up and down the tube without sticking. This was the forerunner of the float of his float barograph, in which friction was eliminated even more satisfactorily by surrounding the float with steel balls.

In connexion with Dines' tilting rain-gauge, the descriptions and drawings of which are reproduced from the *Meteorological Magazine* (Vol. LV, 1920), there is an editorial note which concludes with the sentence "New types of gauge with reliable syphons have been produced in recent years and there is no scope for the ingenious tilting gauge." This is an unfortunate remark, because in my view the position is exactly the reverse. The design of a syphon to work with exact precision in open-air conditions, no matter how slowly the water (*dirty* water be it remembered) may rise in the ascending arm, presents almost insuperable difficulties and it cannot be said that designers have solved the problem. Dines knew all about this difficulty, and in his rain-gauge he arranged for the syphon to be started by the sudden tilting over of the whole receiver under the action of gravity, when 10 mm. of rain had been collected. By this device the action of the syphon was rendered uniform and positive in all conditions. After some years of experience with natural syphon gauges my view is that the Dines gauge is vastly superior even in the rather crude form in which it existed at Benson fifteen years ago.

Section II, on the Investigation of the Upper Air, occupies more than half the volume. It is a very pleasant experience to see these epoch-making papers bound together in orderly sequence and to be able to trace the development of Dines' ideas and methods from their beginning, when Dines, like almost everyone else, believed in the convectional theory of cyclones, to their maturity when the convectional theory had been disproved, and he had accumulated a mass of facts about the upper atmosphere which was, to quote *The Times*, "a matter for national congratulation." He began in 1901 with kites of the Hargreaves type and meteorographs made by Richard of Paris. From the outset he made his own kites and associated gear, and it is not long before we find him making his own meteorographs. By 1907 he had produced his balloon meteorograph and, in association with Mr. C. J. P. Cave, was beginning the great series of upper air soundings with which we are now so familiar. Dines' originality of outlook permeates all these papers from beginning to end. We may infer from his Presidential Address to the Society in 1902, printed in Section IV of the volume, that he was attracted to the idea of treating meteorological data by statistical methods based on the theory of probability, and it was appropriate that one who had accumulated so much new data by new methods should also employ new methods when the time came to analyse and discuss them. The results he obtained by means of the method of correlation are one of the outstanding achievements in meteorology and are too familiar to all of us to need further mention here.

In Section III, on Radiation, we find the same sequence of progress as in the first two sections, first some speculations and inferences from existing knowledge, next the design of new instruments, finally the presentation of important new knowledge gained from the new instruments. In this section the speculations are found in a paper on "The Heat Balance of the Atmosphere," presented to the Society in 1917. By constructing a sort of balance sheet for the earth and the atmosphere, he was able to make rough estimates of the radiation upwards and downwards from the atmosphere, the radiation from the earth reflected back again by the atmosphere, and so forth. In 1920 he constructed his radiometer for determining directly the long wave radiation and diffuse solar radiation from the sky. Between 1921 and 1927 the results obtained at Benson with this instrument were published regularly in the *Meteorological Magazine*. In the present volume they are gathered together and form a very valuable collection of data.

The last section contains miscellaneous papers not falling into the classification of the main sections. Here we find the description of his apparatus for demonstrating the formation of the tornado cloud, the papers in which he refuted the general belief that exceptionally cold periods are associated with high barometric pressure, his Presidential address on "The Element of Chance applied to Various Meteorological Problems," and a remarkable address on "Climate and its effect on the Average Length of Life," which he read before the Sanitary Institute in 1896. He maintained that high temperature was deleterious and low temperature beneficial to human health, and he practised what he preached in this connexion. I have vivid recollections of the complacency with which he regarded the conditions during the cold winter of 1916-7, when a temperature of − 4°F. was registered at Benson, and the barometer in the outbuilding where I worked was sometimes unreadable because the mercury in the attached thermometer had descended out of sight into the bulb.

It would be ungrateful to end this account of the Dines Memorial Volume without expressing admiration for the Sectional Introductions. These are really valuable additions to the book, pulling it together, so to speak, into a coherent whole. Quite obviously, a great deal of care and thought has gone to the making of the volume, and Dr. Brooks, who saw the volume through the press, is in particular to be congratulated on the success of the undertaking. The publication of the collected writings of a single worker has never previously been undertaken by the Royal Meteorological Society, and it is given to few men to merit such an honour. It will have served its purpose if it inspires us lesser mortals to imitate Dines' fixity of purpose, his passion for truth, his contempt for verbosity, his hatred of sham and his clarity of exposition. If a motto were wanted for this work nothing could be more appropriate than the words we read every week on the cover of *Nature*:

"To the solid ground
Of Nature trusts the mind that builds for aye."

Dines assuredly "built for aye," and this book affords the best evidence of the solidity of the ground on which he built.

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## Problems in Meteorological Optics

It is well known that the "circumscribed halo" changes in form as the elevation of the sun increases. The metamorphosis is illustrated in the diagram, which was constructed by Prof. W. J. Humphreys. As the circumscribed halo closes in on the halo of 22° the reverse curvature at the points of contact is lost. Mr. S. E. Ashmore, who observed the metamorphosis recently, has asked me to say at what elevations of the sun the curvature at the points in question changes sign.

The theory of the circumscribed halo is well known; it depends upon the assumption that the light is refracted through hexagonal prisms with their axes horizontal, and that the effective rays which determine the position of the halo pass through the prism with minimum deviation. By straightforward, though not very elegant, mathematics I find that the condition that the circumscribed halo may have no curvature at the upper point of contact is:

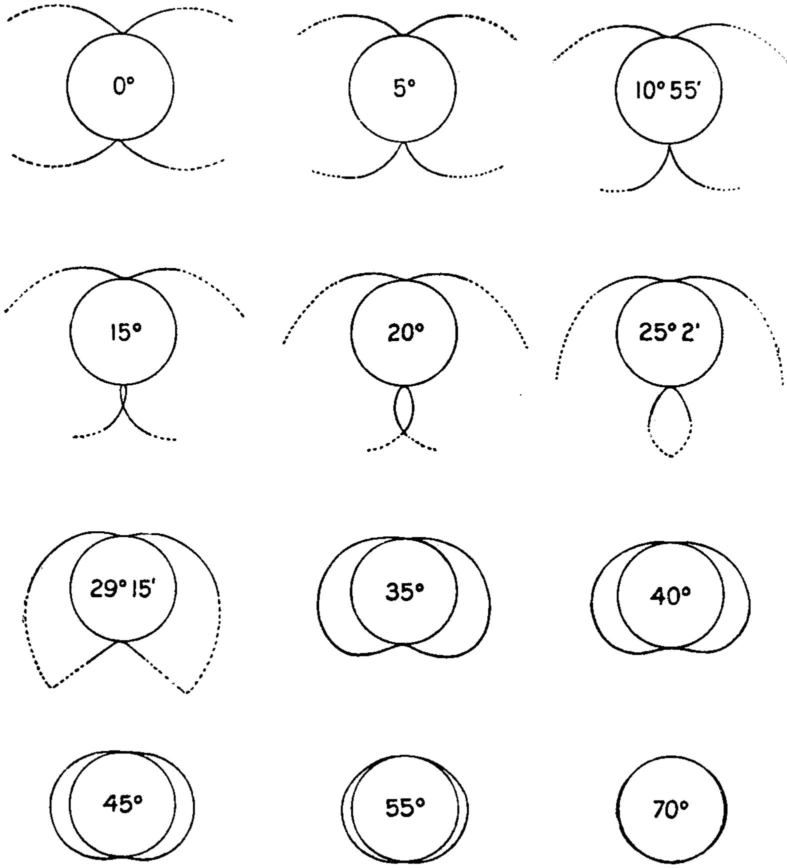
$$(\tan H + \tan \tfrac{1}{2} D)^2 = \frac{4}{\sin 2D}\left[\left(1 - \frac{1}{n^2}\right) \tan \tfrac{1}{2}(D+A) - \tan \tfrac{1}{2} D\right]$$

In this equation $D$ is the minimum deviation of the light, $A$ the refracting angle, $n$ the index of refraction for ice and $H$ the height of the sun. Writing $A = 60°$, $n = 1.31$, $D = 21° \, 50'$, I find that $H = 38\tfrac{1}{2}°$. The condition for no curvature at the lower point of contact is the same as that for the upper point, except that a minus sign is to be substituted for the + in the bracket on the left. With the same assumptions I find that $H = 49\tfrac{3}{4}°$.

It will be seen that these results are consistent with Pernter's diagrams, which were used by Prof. Humphreys to make the composite diagram which we have borrowed.

A second question raised by Mr. Ashmore is at what elevation of the sun can parhelia occur on the circumscribed halo.

Parhelia are produced by the refraction of light by prisms with vertical axes. It is an instructive little experiment to hold up a prism with its axis vertical and notice how such objects as window frames seen through the prism are beautifully curved. If a number of lights were placed one above the other the topmost light as seen through the prism would appear furthest from its actual position. Similarly when the sun is high in the heavens the distance of a parhelion is greater than when the sun is low. We have seen that the circumscribed halo shrinks




THE METAMORPHOSIS OF ARCS TOUCHING THE 22° HALO
Upper and lower tangent arcs at solar elevations indicated
(*Reproduced from Philadelphia, Pa., J. Frank. Inst., Vol.* 188, 1919, p. 630)

as the sun's elevation increases; at the same time the distance between sun and parhelia increases, so that the parhelion, as it moves outwards, will for *some* elevation be exactly on the circumscribed halo. We are asked to find that elevation.

To solve Mr. Ashmore's problem we have to find the condition that light coming from the parhelion may have been refracted either by a vertical prism in the ordinary way or by a horizontal prism, both prisms producing the same deviation. In the first place it is to be noticed that the plane containing the rays from the sun and the parhelion must be equally inclined to the vertical and horizontal, *i.e.*, must have an inclination of 45°. It can now be proved that, if the distance in azimuth betwen sun and parhelion is $2B$, whilst the elevation of the sun is $H$, then :

$$\cos B = \tan H$$

$$\text{and } (3-n^2)\tan^2 B + 2\sqrt{3}\tan B - (2n^2-2) = 0$$

Solving these equations I find that $B = 20° 0'$, $H = 43° 13'$, and further, that the distance betwen the parhelion and the sun should be 28° 52′. By comparisons of the solutions of the two problems it appears that when the parhelion is on the circumscribed halo that halo is curved downwards at both points of contact.

The other point in which Mr. Ashmore is interested is why the horizontal circle, or mock sun ring, is generally not seen between the parhelia and the sun. This has been discussed before and the answer seems to be that in the neighbourhood of the 22° halo and especially outside the halo there is much light refracted through the prisms, but not with minimum deviation. The parhelic circle would not be perceived against the bright background. Inside the 22° halo, and especially quite close to the sun, the general glare would make the mock sun ring faint by comparison. Moreover, this ring is produced by light reflected by the facets of vertical prisms and near the sun the effective area of the facets is small. Perhaps it is more remarkable that the ring is sometimes described as going right through the sun than that in observations such as Mr. Ashmore's it stops short.

F. J. W. WHIPPLE.

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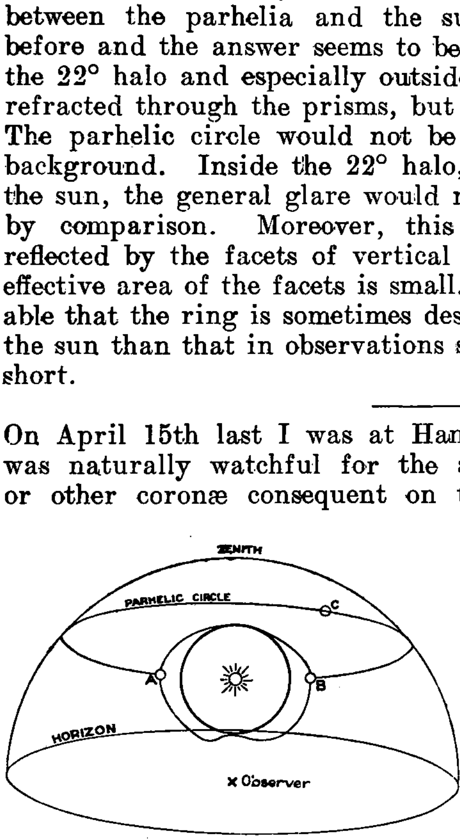
On April 15th last I was at Hamble, near Southampton, and was naturally watchful for the appearance of Bishop's Ring or other coronæ consequent on the recent volcanic eruption. At 14h. 4m. my attention was directed upwards by an aeroplane, and I saw the phenomena indicated in the diagram, all visible simultaneously. The halo of 22° was brilliant and prismatic, likewise the circumscribing ellipse. Both had the red nearest the sun. A and B were bright parhelia, with spectral colours, red on the inside, situated at opposite ends of the maximum diameter of the ellipse. From the parhelia stretched the parhelic circle, right round the sky, but between




The partial ellipse marked "parhelic circle" represents the intersection of a horizontal plane with the vault of the sky at an elevation of 42° (at 14h. 4m.)

A and B it was totally invisible. The parhelic circle is seldom observed between the parhelia of 22° and the sun owing to the brilliance of the latter. However Mr. A. Moon has recorded an observation of it* on October 19th, 1930, and another† on April 18th, 1931. In my observation the parhelic circle was white; the anthelion was invisible, but a paranthelion C of 120° became faintly visible as a colourless patch of illumination on the east side of north at 14h. 33m. The other paranthelion, if it had existed, would have been hidden by clouds. The halo of 46° was invisible the whole time. The remoteness of the locality from civilisation precluded my obtaining a theodolite, but my estimates were made with care. The semi-major axis of the ellipse was about 5° greater than the radius of the halo, *i.e.*, the major axis of the ellipse was about 54°. Angot‡ states that the major axis is usually about 64°, and N. H. Smith§ gives an observational value of 58°. I saw no trace of parhelia on the halo of 22°. It is according to theory, and well illustrated by observation in this case, that the sky is darkest inside the 22° halo, and less dark, but not normal, between the halo and the ellipse. The morning had been stormy, and beneath the structureless uniform sheet of cirrostratus, heavy mammato-cumulus spread over from the north-east. The phenomenon was very faint at 14h. 40m, but at 15h. 5m. I could still distinguish the arcs and parhelia.

There are several points worthy of note in this display. Firstly, the inferior arc of contact to the ellipse was normal, not inverted (a normal arc is convex to the sun) and hence the ellipse bore a curious deformation at the region of the shortest diameter. Secondly, in a brief scrutiny of the available literature, I have been unable to find a reference to parhelia on the circumscribing ellipse. They were not paranthelia, and they cannot be regarded as secondary parhelia of the 22° mock-suns (as Bravais has suggested for those of 46°) since the latter were absent. I have observed parhelia displaced perhaps a degree outside the halo; Angot‡ says that they go further afield with increase in the sun's altitude, and Dr. Whipple|| states the same for paraselenæ. But it is difficult to explain away 5° or even more on this theory. And in this case was it merely an accident that the parhelia were on the ellipse?

My last remark is to voice a little uncertainty as to the minimum value of the sun's altitude necessary for the existence of the ellipse. Angot‡ states that the arc of contact changes its curvature when the sun is 31° up; Whipple quotes it as about

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**London, Meteorological Magazine*, 64, 1931, p. 287.

†Loc. cit., 66. 1931, p. 101.

‡Traité Elémentaire de Météorologie, 1907, p. 269.

§*London. Meteorological Magazine*, 63, 1928, p. 140.

||Loc. cit., 66, 1931, p. 167.

40°. These conditions were satisfied on April 15th. But Angot states that for the ellipse the sun must be 45°, which was not the case in my observation. Finally, can anyone explain why the parhelic circle stopped abruptly at the parhelia?

All my observations were made with the unaided eye.

S. E. Ashmore.

*Windwhistle Cottage, Grayshott, Hindhead, Surrey. April 22nd*, 1932.

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I observed here last Friday, April 15th, a very complete halo-display at about 5 p.m. The sky was covered with a very light cirrus film, and, in addition to the usual 22° ring, which was complete and quite strongly coloured, the north and south mock-suns were distinctly seen, with a portion of the horizontal halo outside each of them. Also there was a clearly defined upper arc of contact, which caused the 22° ring to be very bright at that point. Around the whole was the 45° halo, not bright but quite distinct. This is the first time that I have ever seen this latter ring, although I have looked for it often.

After dark there was a lunar halo of 22°, but not nearly so complex as the afternoon display.

E. W. Goodman.

*Old Dean Hall, Camberley, Surrey. April 17th*, 1932.

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## Royal Meteorological Society

The monthly meeting of this Society was held on Wednesday, May 18th, at 49, Cromwell Road, South Kensington, Prof. S. Chapman, F.R.S., President, in the Chair.

*G. Bransby Williams, M.Inst.C.E.—The Rainfall of Assam.*

This paper deals with the geographical distribution of the mean annual rainfall of the province of Assam. The subject is of special interest from a meteorological point of view. Assam is the wettest province of the Indian Empire, and contains Cherrapunji (where the mean annual rainfall is 460 inches), reputed to be the wettest place in the world. The period of the south-west monsoon is of greater length in Assam and Burma than in north and central India, and there is a marked difference between the seasonal distribution of the rainfall in these countries. Tables appended to the paper show the variations from the mean of the average rainfall during periods of wet and dry consecutive years. The probability of the year's rain at any station in Assam being less than any given percentage of the mean has been worked out. It is found that the chance is 400 to 1 against the rainfall in any one year being below 50 per cent. of the mean.

*J. Wishart, M.A., D.Sc.—On the secular variation of rainfall at Rothamsted* (*Memoirs*, Vol. 3, No. 27).

A detailed study of the rainfall at Rothamsted over the 76 harvest years 1854-1929, has revealed the fact that not only have there been sensible changes in the average yearly rainfall of a similar character to those observed at other stations in England and Wales, but the distribution of rainfall throughout the year has changed. The maximum in autumn (and equally the minimum in spring) occurs significantly later to-day than was the case 76 years ago, but there is some sign that this movement is now reversing its direction, as appeared to have happened towards the end of the eighteenth and again in the middle of the nineteenth centuries, as judged from early records at a number of other stations. It would be interesting to have similar detailed analyses of the rainfall data at other places.

*C. E. P. Brooks, D.Sc., and Theresa M. Hunt.—The zonal distribution of rainfall over the earth (Memoirs,* Vol. 3, No. 28).

The mean annual rainfall in each five-degree zone was calculated separately for the land and sea areas by a planimetric method, using the best available rainfall charts for each country or ocean. The results show maxima over the land in latitude 0-5°S., and 55°-60°S., a minimum about latitude 30°S.; over the sea, maxima about 50°N., 0-10°N., and 40-45°S., minima about 40°-50°N., 20°-30°N., and 20°S. The figures are compared with those obtained by previous investigators. The average zonal rainfalls in each month are then computed from the annual figures by means of the annual variation at a representative series of stations, island stations being employed for the oceans. An appendix gives the average rainfall of a number of separate countries.

## OFFICIAL PUBLICATIONS

The following publication has recently been issued :—

GEOPHYSICAL MEMOIRS. No. 54. *The Structure of wind over level country.* Report on experiments carried out at the Royal Airship Works, Cardington. By the late M. A. Giblett, M.Sc. (Superintendent of the Airship Division of the Meteorological Office) and other members of the staff of the Office (M.O. 331d).

The wind blowing over the surface of the earth does not flow in a steady stream but is composed of a succession of gusts and lulls; and just as the designer of a pier needs to know in what way his structure will be buffeted by the waves of the sea, the engineer, and even more the designer of aircraft, needs to know how his structures will be buffeted by the gusts of the wind. To gain some knowledge of the details of these buffetings some important investigations have been made by the Meteorological Office at Cardington, Beds., during the last five years.

This publication contains a description of the instruments used and the results obtained. The instruments were anemometers with special clocks by which the time scales were exaggerated in such a way as to show the details of the air flow during the gusts and lulls. A network of such anemometers was formed so that the change of air flow during the gusts could be followed from place to place.

The general results of these investigations was to reveal that the structure of the wind is very different when the air is being heated from below by warmer ground, a condition which is generally associated with the daylight hours, from what it is when the air is being cooled from below by colder ground. A theory of the structure of wind is put forward which enables a mental picture to be formed of how gusts and lulls occur.

The memoir has copious appendices giving the actual values of the measurements made, and it is interesting to learn that on one occasion when the wind was blowing betwen 20 and 30 miles per hour there was a sudden change of 135° in one minute. On another occasion during a thunderstorm there was an increase of wind speed from calm to nearly 50 miles per hour in less than three minutes.

# Correspondence

To the Editor, *The Meteorological Magazine.*

## Grey Rain

On May 1st a very heavy thunderstorm occurred here between 2.30 and 3.10 p.m. It was accompanied by very heavy rainfall and some hail. The darkness was very pronounced. During the storm 0.65 inches of rain fell, of which some 0.50 fell in about 10 minutes. But what is more worthy of note, the rain water as seen in the measuring glass of the gauge was discoloured a deep grey hue—about the tint of grey flannel—suggesting the presence in the upper atmosphere of volcanic ash caused by the recent Andes eruptions.

The rainfall in a succeeding storm later in the afternoon was quite clear.

JOHN B. KARSLAKE, Lt.-Col.

*Silchester, Nr. Reading, Hants.* *May* 14*th*, 1932.

## A Rapidly Dissolving Anvil Cloud

Not having witnessed before such a quick change in the appearance of an anvil cloud, perhaps the occurrence may be considered sufficiently noteworthy to record.

After about four hours' continuous rain during Friday afternoon, April 29th, 1932, a welcome streak of blue sky became visible along the southern horizon. At 17h. 55m. G.M.T. a column of dense white cirrus was seen in the south, rising apparently from behind the cumulus tops low on the horizon and cut off at the top by the receding cloud layer from which rain was still falling. At 18h. 10m. G.M.T. a complete anvil cloud was revealed. The lateral extension was decidedly cirriform and the pointed end (to the right) unusually long. After a few minutes' observation the dense vertical part was found to be rapidly shrinking, more especially at the top and bottom, and by 18h. 22m. G.M.T. it had disappeared. Eight minutes later the lateral extension to the left had dispersed and the pointed end, extending from roughly south-west to west-south-west, was moving from approximately 155° and its wispy margins were dissolving slowly. It was finally lost to view behind high strato-cumulus in the west at 18h. 40m. G.M.T.

J. S. Smith.

*Royal Aircraft Establishment, S. Farnborough, Hants. May 7th*, 1932.

## Halo Structure at Waringstown

Mr. W. Gibson, of Waringstown, Co. Down, has forwarded a sketch of halo phenomena which he observed from there on April 27th, 1932. He writes: ". . . associated with a falling barometer and a somewhat gusty SSW. wind, the lower part of the southern sky was covered with alto- and cirro-stratus cloud, but higher up and more eastward the sun was shining strongly through a very light, almost insignificant, veil of cirro-nebulæ, whilst ragged billowy clouds of the cirro-cumulus type, apparently propelled by a strong upper current of air passed northwards from the cirri-status cloud bank. At 9.15 a.m. G.M.T. a magnificent halo complex began to form around the sun, and at 9.30, when again observed, the structure was more complete and uniform, besides exhibiting the rainbow spectrum. A thickening of the upper part vertically above the sun suggested the formation of a tangent arc of contact, faintly seen with down-turned ends. At 9.35 a.m. G.M.T. a complete halo of 22° of arc shone strongly, the colours varying from a distinct red inside to a mauve on the outside. East and west of the sun, and one degree outside this halo, and almost on the same plane as the sun, two faint parhelia or mock suns were seen, together with two white parhelic arcs of a mock sun ring, which if complete would have passed over the sun. The parhelic arcs had a characteristic upward curvature. The parhelia and tangent arcs faded about 10 a.m. G.M.T., but the halo, incomplete at times, was seen during the remainder of the day, after which rainy conditions set in."

# NOTES AND QUERIES

## Comparison of Screen and Hangar Minimum Temperatures

When the responsibility of issuing frost warnings first fell upon the local meteorological officers at R.A.F. aerodromes, it was found that such information as could be given about the anticipated minimum temperature in the free air was not sufficient. A statement such as " air temperature expected to fall to 26°F." conveyed to the R.A.F. personnel concerned inadequate means of foreseeing how such a temperature would affect the water and oil in the engines of their aeroplanes, housed in comparatively warm hangars. It was therefore usual for those receiving the forecast to ask the meteorological officer what the minimum temperature was likely to be in the hangars themselves.

In order that a satisfactory reply to such questions could be given at this station, Leuchars, a minimum thermometer was exposed on one of the central piers of a service brick-built hangar, at a height of 7 feet 9 inches above the ground, which is the mean height of the water-cooled aeroplane engines in use here. Readings were taken throughout three winters at 9h. G.M.T. and compared with the minimum temperatures recorded in the screen during the previous 24 hours. With these readings a dot diagram was constructed to give the difference hangar minimum minus screen minimum with different values of screen minimum.

The observations were made during the months of November, December, January, February and March, since the average minimum during these months at Leuchars is between 34° and 36°F. Table I shows the number of reliable observations available :—

TABLE I.—NUMBER OF OBSERVATIONS AVAILABLE.

| Screen Minimum °F. | November | December | January | February | March | Total |
|---|---|---|---|---|---|---|
| 20 - 22 | — | — | — | 3 | — | 3 |
| 22 - 24 | 2 | — | 2 | 4 | 2 | 10 |
| 24 - 26 | 4 | 3 | 6 | 2 | 1 | 16 |
| 26 28 | 4 | — | 7 | 5 | 5 | 21 |
| 28 - 30 | 4 | 3 | 8 | 8 | 7 | 30 |
| 30 - 32 | 2 | 7 | 11 | 9 | 10 | 39 |
| 32 34 | 3 | 9 | 8 | 5 | 6 | 31 |
| 34 - 36 | 2 | 4 | 10 | 11 | 4 | 31 |
| 36 - 38 | 2 | 3 | 2 | 1 | 4 | 12 |
| 38 40 | 2 | 2 | — | — | 2 | 6 |
| 40 - 42 | — | 5 | — | 1 | 2 | 8 |
| 42 - 44 | 1 | — | — | — | 4 | 5 |
| 44 - 46 | — | 3 | — | — | — | 3 |
| TOTAL | 26 | 39 | 54 | 49 | 47 | 215 |

The results given by examination of dot diagrams are set out in Table II.

For the lower values of night minima, the difference between hangar minimum and air minimum is greatest during the month of March, followed in order by November, December, January and February, when the difference is least. For the highest values of night minima the difference tends to become small and more uniform over the different months.

TABLE II.—DERIVATION OF HANGAR MINIMA FROM SCREEN MINAMA.
I.—Difference derived from dot diagrams.
II.—Derived Hangar Minimum.

| Screen Minimum °F | November | | December | | January | | February | | March | | Winter | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | I | II | I | II | I | II | I | II | I | II |
| 22 | 7·3 | 29·3 | 6·4 | 28·4 | 4·9 | 26·9 | 4·8 | 26·8 | — | — | 5·3 | 27·3 |
| 23 | 6·9 | 29·9 | 5·9 | 28·9 | 4·6 | 27·6 | 4·3 | 27·3 | — | — | 5·0 | 28·0 |
| 24 | 6·5 | 30·5 | 5·6 | 29·6 | 4·3 | 28·3 | 4·0 | 28·0 | — | — | 4·6 | 28·6 |
| 25 | 6·0 | 31·0 | 5·2 | 30·2 | 4·0 | 29·0 | 3·6 | 28·6 | — | — | 4·3 | 29·3 |
| 26 | 5·5 | 31·5 | 4·9 | 30·9 | 3·8 | 29·8 | 3·3 | 29·3 | 7·0 | 33·0 | 4·0 | 30·0 |
| 27 | **5·0** | **32·0** | 4·6 | 31·6 | 3·5 | 30·5 | 3·1 | 30·1 | 6·1 | 33·1 | 3·7 | 30·7 |
| 28 | 4·6 | 32·6 | **4·2** | **32·2** | 3·3 | 31·3 | 2·8 | 30·8 | 5·2 | 33·2 | 3·4 | 31·4 |
| 29 | 4·2 | 33·2 | 3·9 | 32·9 | **3·0** | **32·0** | 2·5 | 31·5 | 4·4 | 33·4 | **3·1** | **32·1** |
| 30 | 3·8 | 33·8 | 3·6 | 33·6 | 2·8 | 32·8 | **2·3** | **32·3** | 3·9 | 33·9 | 2·9 | 32·9 |
| 31 | 3·4 | 34·4 | 3·3 | 34·3 | 2·6 | 33·6 | 2·1 | 33·1 | 3·5 | 34·5 | 2·7 | 33·7 |
| 32 | 3·1 | 35·1 | 3·1 | 35·1 | 2·3 | 34·3 | 1·9 | 33·9 | 3·2 | 35·2 | 2·5 | 34·5 |
| 33 | *2·8* | *35·8* | *2·8* | *35·8* | 2·1 | 35·1 | 1·6 | 34·6 | *2·9* | *35·9* | *2·3* | *35·3* |
| 34 | 2·5 | 36·5 | 2·4 | 36·4 | *1·8* | *35·8* | *1·4* | *35·4* | 2·6 | 36·6 | 2·1 | 36·1 |
| 35 | 2·3 | 37·3 | 2·1 | 37·1 | 1·5 | 36·5 | 1·2 | 36·2 | 2·4 | 37·4 | 2·0 | 37·0 |
| 36 | 2·0 | 38·0 | 1·8 | 37·8 | 1·3 | 37·3 | 1·0 | 37·0 | 2·2 | 38·2 | 1·8 | 37·8 |
| 37 | 1·8 | 38·8 | 1·5 | 38·5 | 1·0 | 38·0 | 0·8 | 37·8 | 2·0 | 39·0 | 1·6 | 38·6 |
| 38 | 1·5 | 39·5 | 1·3 | 39·3 | 0·8 | 38·8 | 0·7 | 38·7 | 1·9 | 39·9 | 1·4 | 39·4 |
| 39 | 1·2 | 40·2 | 1·1 | 40·1 | 0·6 | 39·6 | 0·5 | 39·5 | 1·8 | 40·8 | 1·3 | 40·3 |
| 40 | 1·0 | 41·0 | 0·9 | 40·9 | 0·4 | 40·4 | 0·4 | 40·4 | 1·7 | 41·7 | 1·2 | 41·2 |

It is agreed among the service personnel here that they would take precautions against frost if a hangar minimum of less than 36°F. were expected. This level is shown in italics in Table II, and is seen to occur with an air minimum of 33° to 34°F. in any winter month. The division at freezing-point is shown in heavy type in Table II, and shows as being most likely in February, and least likely in March.

The critical level of 30·4°F. is likely to be reached in a hangar if the air minimum is expected to be 24°F. in November, 25°F. in December, 27°F. in January, and 28°F. in February. It has not been recorded during March.

In general, for the winter months as a whole, there is danger of freezing point being reached in a hangar if a screen minimum of 27°F. or less is expected; if 28° to 30°F. is anticipated in the air, the risk of freezing is small, while for 30°F. or above it is very slight, except in February. For low temperatures outside, the hangar is much warmer; for temperatures about 40°F. it is almost as warm outside as in.

R. H. MATHEWS.

## The mildness of the winter 1931-2 in Scotland in comparison with previous winters.

During the period October to March very mild conditions prevailed generally in Scotland, the mean temperature over the country as a whole being the highest on record, this record extending from 1866 to the present day. Since the winter of 1866-7 the next warmest winter was 1920-1, on which occasion the mean temperature for the country was 0.3°F. lower than in last winter. The winters of 1873-4, 1881-2 and 1924-5 were each 0.5°F. lower. Reliable records prior to 1866 were few and insufficient to give a comparatively accurate average for the country as a whole. Mean temperature values, however, for the Edinburgh district from 1764 are given in Mossman's "Meteorology of Edinburgh." An examination of these records for the winter six months, October to March inclusive, when taken in conjunction with the past winter, indicates that the winter of 1845-6 was for Edinburgh 0.1°F. warmer than that of 1931-2, while the winter of 1857-8 equalled that of last winter. From the above it might be deduced that the winter of 1931-2 (October to March), with the exception of perhaps the winter of 1845-6, was perhaps the mildest winter in Scotland for at least 168 years. There was in this period, October, 1931 to March, 1932, very little snow in Scotland; in April, however, most districts experienced snow, the month of April being cold. May was also cold and, in spite of the open winter, these two months resulted in plant growth being greatly retarded. It was not until the approach of June that the countryside began to exhibit full leaf.

J. CRICHTON.

## The Rainfall of May, 1932.

In spite of the recent wet Mays of 1924, 1925 and 1931, that of 1932 stands out for the frequency of cyclonic rains over England and Wales, some of which were unusually heavy. The month will be remembered for the widespread flooding, including that in the Don Valley at Bentley, of the Trent at Burton and Nottingham, and of the Severn and Avon in Worcestershire. The total rainfall was less than the average over most of the north-west of Ireland and of Scotland, many stations reporting less than 80 per cent. of the average. Over the British Isles as a whole the general rainfall was 174 per cent. and there were four wetter Mays in the series back to 1870, *viz.*, 1925, 1924, 1886 and 1878 with 181, 187, 175 and 176 per cent. respectively.

Over the English Lake District little more than the average was recorded, but over most of England and Wales the total rainfall exceeded twice the average. More than three times the average was recorded over a large area in central England stretching from Huddersfield to Newbury, while over part of Worcestershire there was just over four times the average.

The general rainfall over England and Wales was 221 per cent. of the average, compared with 217 in May, 1924, 206 in May, 1886, and 205 in May, 1878. Values for earlier years back to 1727 have been computed recently. There were six other Mays with more than twice the average. The values for the earliest years are naturally less reliable, but it is reasonable to conclude that May, 1932, ranks as the wettest May during the last 160 years and that there were only two wetter Mays in the whole series.

The prevalence of dull and cool weather is confirmed by the record of evaporation from a free water surface, as measured at Camden Square (London), the total of 1.65 in. being 0.78 in. less than the average and less than that recorded in any May since the record commenced in 1885, with the one exception of that of 1898 with 1.56 in. But for the small evaporation the effects of the flooding might have been appreciably lessened.

At Ombersley (Holt Lock) on the river Severn to the north of Worcester, 8.29 in. or 404 per cent. of the average was recorded, and the total was the largest for any month since the record commenced there in 1879. At Evesham 7.37 in. was recorded, and the month was the wettest there since 1865 with but two exceptions. It was the wettest May on record since before 1855 at Surbiton (Surrey) with 4.51 in.; since before 1874 at Slough (Upton) with 4.47 in.; and since before 1867 at Nottingham with 6.13 in.

The most striking rains occurred on the 1st and 2nd, the 15th, and from the 20th to 23rd. At Ombersley (Holt Lock) the amounts for these days were respectively 1.78 in., 0.56 in., 0.62 in., 1.20 in., 0.82 in., 0.18 in., and 1.26 in., and there were 24 rain days during the month. The rainfall of May 20th and 23rd of 3.46 in. was, however, less than that of May 11th to 13th, 1886, when 3.66 in. was recorded at that station. May, 1886, is remembered for the heavy rains that occurred between the 11th and 13th, and the disastrous floods they produced over the greater part of the west and midland counties of England; at Worcester the flood was higher than any that had occurred there since 1770. The persistent cyclonic rains of these three days gave 7.09 in. at Burwarton, near Brown Clee Hill, in Shropshire, and more than 4 in. was recorded over some 3,500 sq. miles in Shropshire, Hereford, Monmouth, Montgomery, and parts of the adjoining counties.

Over the Thames Valley above Teddington the general rainfall on May 1st, 1932, was 1.02 in., on the 15th 0.41 in., on the 20th to 23rd 1.82 in., and on the 27th to 29th 0.78 in. The general rainfall was 5.32 in. and the month was the wettest May since before 1881, the next wettest May being that of 1924 with 4.76 in. The amounts recorded during the periods June 13th to 15th, 1903, and October 23rd to November 18th, 1894, far exceeded that recently recorded.

Widespread thunderstorm rains occurred over England and Wales on the 1st, 2.15 in. being recorded at Bromyard, which caused flooding in the Frome Valley, and 2.31 in. at Lampeter (Falcondale Gardens) in Cardiganshire. At Upper Heyford, to the north of Oxford, rain commenced at 14h. 40m. on Sunday afternoon, the 1st, and continued but for a break of 2½ hours until 7h. 50m. on the 2nd, as much as 2.04 in. falling within 17hrs. 10min. Many roads in the Chippenham, Swindon and Cricklade area, and in the Ludlow, Kidderminster and Evesham area were rendered impassable. Pershore racecourse, to the south-east of Worcester, was under water to a depth of more than 2 ft. as a result of the flooding of the river Avon.

Heavy falls also occurred on the 15th, 2.79 in. being recorded at Northleach (Sherborne House), in Gloucestershire.

Heavy falls were widespread in the Midlands on the 21st, some of the largest totals being 3.58 in. at Holme-on-Spalding Moor, midway between Hull and York, 3.36 in. at Retford, 3.15 in. at Doncaster (Avenue Road), 3.08 in. at Osgodby to the south of York and at Sleights to the north of Scarborough, 2.87 in. at Pontefract, 2.86 in. at Barnsley (Jordan Hill), 2.85 in. at Wath-upon-Dearne to the west of Doncaster, and 2.65 in. at Thornton Reservoir in Leicestershire. The total rainfall at Wath-upon-Dearne for the 20th to 22nd amounted to 3.75 in. and at Retford to 4.56 in. J. Glasspoole.

## Books Received

*The railroads versus the weather*, by R. de C. Ward (reprinted from the Proc. Amer. Phil. Soc. lxx, No. 2, 1931).

*Deutsches Meteorologisches Jahrbuch*, 1930. Freie Hansestadt Bremen. Edited by Dr. A. Mey. Jahrgang 41, Bremen, 1931.

## Obituary

We regret to learn of the death of Professor J. W. Gregory, F.R.S., Professor of Geology in the University of Glasgow, at the age of 68. Professor Gregory is famous for his work on the "rift valleys" of eastern Africa, and he is also known to meteorologists for his studies of climatic change, published in the *Geographical Journal* under the title "Is the earth drying up?" and for his theory of the shifting of centres of glaciation. He was an authority on earthquakes, and was drowned in the Urubamba River in northern Peru while leading an expedition to study volcanic movements in that country.

## News in Brief

We learn that Mr. C. Stewart has retired from the Directorship of the South African Meteorological Service and has been succeeded by Mr. G. W. Cox as Acting-Director.

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It was announced in the list of Birthday Honours that Flying Officer J. B. W. Pugh, Officer Commanding Meteorological Flight, Royal Air Force, Duxford, has been awarded the Air Force Cross.

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## Corrigendum

MAY, 1932, page 95. The observations given in the note entitled "Maximum day temperatures in early Spring" refer to the meteorological station at South Farnborough, Hants.

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# The Weather of May, 1932

Pressure was below normal in a belt extending from the Ural Mountains across central Europe and southern Scandinavia to the eastern North Atlantic and from Alaska across British Columbia to the western and south-eastern United States and to north-east Canada, the greatest deficits being 5.2 mb. at Pt. Barrow and 4.9 mb at Kew. Pressure was above normal elsewhere, the greatest excesses being 7.3 mb. at Isafjord and 4.4 mb. at Cagliari (Sardinia). Temperature was above normal over Spitsbergen and most of Scandinavia, but below normal in northern Lapland and central and western Europe. Rainfall was deficient in Spitsbergen, parts of western Sweden and central Europe, and in excess in northern Norway and eastern Sweden being as much as 100 per cent. above normal in eastern Gothaland.

Over the British Isles May, 1932, was remarkable as being the wettest and dullest May on record at many places. Serious flooding occurred towards the end of the month in the Midlands. In the Hebrides, however, the rainfall was below normal, and at Tiree, in the southern Hebrides, sunshine was above normal. The month opened with high pressure over Iceland and low pressure over England and France. Heavy rain fell locally in England, but fair, sunny weather was enjoyed in the north and west. On the 2nd the anticyclone in the north spread southwards, and the fine weather gradually extended over the whole country accompanied by cold northerly winds; 12.8 hrs. bright sunshine were enjoyed at Tiree on the 2nd, 13.4 hrs. at Dundee on the 3rd, and 13.8 hrs. at Valentia on the 6th, but the temperature was low, 44°F. being the maximum at many places in the Midlands and Scotland on the 6th. By this time the depression over Denmark had moved westward and showers followed. Snow showers occurred in eastern Scotland and the Midlands on the 5th, 6th and 7th. The 8th was a sunny day, but a shallow depression off southern Ireland moved eastwards and heavy rain fell in south-east England on the 9th, but over 14 hrs. bright sunshine occurred in parts of Scotland on the 9th, and the 10th was sunny over the whole country. A complete change of weather occurred about the 11th. A deep depression lay over the Atlantic and secondary disturbances moved round it across the British Isles. Temperature rose considerably, and there was heavy local rain, particularly on the 12th and 15th, but many sunny periods. The 14th and 17th were especially sunny, with 13.7 hrs. at Berwick on the 14th and 15.1 hrs. at Tiree on the 17th. Another deep depression approached from the Atlantic on the 18th, and there ensued the warmest spell of the month when 75°F. was recorded at Gorleston, Tottenham and Greenwich on the 20th or 21st. The heaviest rain of the month occurred on the 21st and 22nd and caused severe floods in the Midlands. Subsequently pressure was low to the east and high over the Atlantic giving cool, unsettled weather. Day temperatures fell considerably, at Kew they fell from 74°F. on the 20th to 53°F. on the 25th. Good sunshine records were obtained locally on isolated days, and the 25th was generally sunny. On the 29th another depression approached from the west; temperature rose somewhat, moderate rain occurred in south Ireland on the 30th, but sunshine records were good in Scotland on the 30th and 31st and in east England on the 31st. The distribution of bright sunshine for the month was as follows :—

| | Total (hrs.) | Diff. from normal (hrs.) | | Total (hrs.) | Diff. from normal (hrs.) |
|---|---|---|---|---|---|
| Stornoway | 174 | —17 | Liverpool | 121 | —78 |
| Aberdeen | 135 | —52 | Ross-on-Wye | 104 | —99 |
| Dublin | 122 | —83 | Falmouth | 172 | —59 |
| Birr Castle | 133 | —49 | Gorleston | 130 | —95 |
| Valentia | 171 | —32 | Kew | 114 | —87 |

The special message from Brazil states that the rainfall was scarce in the northern regions with 3.38 in. below normal, irregular in the central regions with .04 in. below normal and plentiful in the south with 1.97 in. above normal. Crops generally in good condition except that excessive rains in the south affected somewhat the wheat and corn crops. Five anticyclones passed across the country. Frosts occurred in the south during the last ten days. At Rio de Janeiro pressure was 0.9 mb. above normal and temperature about 2°F. above normal.

*Miscellaneous notes on weather abroad culled from various sources.*

A severe storm swept over the Chambéry district on the 9th, and a severe storm also occurred in the Rhineland on the 16th, being especially violent in the village of Güls in the lower valley of the Moselle near Coblenz, where four houses collapsed owing

(*Continued on p.* 128.)

## Rainfall: May, 1932: England and Wales.

| Co. | Station | In. | Per-cent. of Av. | Co. | Station | In. | Per-cent. of Av. |
|---|---|---|---|---|---|---|---|
| *Lond* . | Camden Square | 3·76 | 213 | *Leics* . | Belvoir Castle | 5·23 | 247 |
| *Sur* . | Reigate, Alvington ... | 4·43 | 243 | *Rut* . | Ridlington | 4.31 | 213 |
| *Kent* . | Tenterden, Ashenden... | 2·73 | 174 | *Lincs* . | Boston, Skirbeck | 3·56 | 202 |
| ,, . | Folkestone, Boro. San. | 2·78 | ... | ,, | Cranwell Aerodrome ... | 4·62 | 255 |
| ,, . | Margate, Cliftonville... | 2·46 | 156 | ,, . | Skegness, Marine Gdns | 3·43 | 202 |
| ,, . | Sevenoaks, Speldhurst | 3·62 | ... | ,, . | Louth, Westgate | 4·01 | 197 |
| *Sus* . | Patching Farm | 3·62 | 196 | ,, . | Brigg, Wrawby St. ... | 4·75 | ... |
| ,, . | Brighton, Old Steyne.. | 2·70 | 167 | *Notts* . | Worksop, Hodsock ... | 6·54 | 328 |
| ,, . | Heathfield, Barklye ... | 2·66 | 148 | *Derby* . | Derby, L. M. & S. Rly. | 6·55 | 343 |
| *Hants* . | Ventnor, Roy. Nat. Hos. | 4·29 | 252 | ,, . | Buxton, Devon Hos. ... | 5·06 | 163 |
| ,, . | Fordingbridge, Oaklnds | 4·67 | 225 | *Ches* . | Runcorn, Weston Pt... | 4·78 | 207 |
| ,, . | Ovington Rectory | 5·28 | 243 | ,, . | Nantwich, Dorfold Hall | 5·06 | ... |
| ,, . | Sherborne St. John ... | 4·55 | 234 | *Lancs* . | Manchester, Whit Pk. | 4·44 | 209 |
| *Berks* . | Wellington College ... | 4·45 | 239 | ,, . | Stonyhurst College ... | 5·14 | 180 |
| ,, . | Newbury, Greenham... | 6·21 | 331 | ,, . | Southport, Hesketh Pk | 3·60 | 172 |
| *Herts* . | Welwyn Garden City... | 3·71 | ... | ,, . | Lancaster, Strathspey | 5·24 | ... |
| *Bucks* . | H. Wycombe, Flackwell | 4·63 | ... | *Yorks* . | Wath-upon-Dearne ... | 6·15 | 303 |
| *Oxf* . | Oxford, Mag. College... | 5·51 | 308 | ,, . | Bradford, Lister Pk. ... | 3·94 | 188 |
| *Nor* . | Pitsford, Sedgebrook... | 4·91 | 257 | ,, . | Oughtershaw Hall | 5·70 | ... |
| ,, . | Oundle | 3·36 | ... | ,, . | Wetherby, Ribston H. | 6·03 | 291 |
| *Beds* . | Woburn, Crawley Mill | 4·92 | 253 | ,, . | Hull, Pearson Park ... | 4·51 | 233 |
| *Cam* . | Cambridge, Bot. Gdns. | 4·05 | 230 | ,, . | Holme-on-Spalding ... | 6·78 | ... |
| *Essex* . | Chelmsford, County Lab | 3·69 | 256 | ,, . | West Witton, Ivy Ho. | 3·58 | 159 |
| ,, . | Lexden Hill House ... | 3·06 | ... | ,, . | Felixkirk, Mt. St. John | 4·69 | 249 |
| *Suff* . | Haughley House | 3·08 | ... | ,, . | Pickering, Hungate ... | 4·69 | 239 |
| ,, . | Campsea Ashe | 3·44 | 229 | ,, . | Scarborough | 6·58 | 345 |
| *Norf* . | Norwich, Eaton | ... | ... | ,, . | Middlesbrough | 4·46 | 232 |
| ,, . | Wells, Holkham Hall | 3·52 | 219 | ,, . | Balderdale, Hury Res. | ... | ... |
| ,, . | Swaffham, The Villa... | 5·35 | 294 | *Durh* . | Ushaw College | 3·99 | 185 |
| *Wilts* . | Devizes, Highclere | 5·74 | 317 | *Nor* . | Newcastle, Town Moor | 3·50 | 175 |
| ,, . | Bishops Cannings | 5·33 | 273 | ,, . | Bellingham, Highgreen | 2·62 | 113 |
| *Dor* . | Evershot, Melbury Ho. | 5·88 | 288 | ,, . | Lilburn Tower Gdns... | 2·97 | 129 |
| ,, . | Creech Grange | 3·03 | 149 | *Cumb* . | Geltsdale | 3·42 | ... |
| ,, . | Shaftesbury, Abbey Ho. | 3·76 | 178 | ,, . | Carlisle, Scaleby Hall | 3·03 | 127 |
| *Devon* . | Plymouth, The Hoe... | 4·61 | 223 | ,, . | Borrowdale, Seathwaite | 7·50 | 109 |
| ,, . | Launceston, Werringt'n | 4·21 | ... | ,, . | Borrowdale, Moraine... | 5·24 | ... |
| ,, . | Holne, Church Pk. Cott. | 5·54 | 175 | ,, . | Keswick, High Hill... | 3·23 | ... |
| ,, . | Cullompton | 3·73 | 173 | *West* . | Appleby, Castle Bank | 3·50 | 159 |
| ,, . | Sidmouth, Sidmount... | 4·12 | 210 | *Glam* . | Cardiff, Ely P. Stn. ... | 4·34 | 174 |
| ,, . | Filleigh, Castle Hill ... | 3·27 | ... | ,, . | Treherbert, Tynywaun | 8·48 | ... |
| ,, . | Barnstaple, N. Dev. Ath | 3·12 | 151 | *Carm* . | Carmarthen Friary ... | 4·99 | 181 |
| ,, . | Dartm'r, Cranmere Pool | 6·30 | ... | *Pemb* . | Haverfordwest, School | 4·65 | 186 |
| *Corn* . | Redruth, Trewirgie ... | 5·03 | 217 | *Card* . | Aberystwyth | 4·20 | ... |
| ,, . | Penzance, Morrab Gdn. | 4·87 | 219 | ,, . | Cardigan, County Sch. | 4·43 | ... |
| ,, . | St. Austell, Trevarna... | 5·41 | 223 | *Brec* . | Crickhowell, Talymaes | 5·30 | ... |
| *Soms* . | Chewton Mendip | 6·54 | 237 | *Rad* . | Birm W.W. Tyrmynydd | 5·24 | 153 |
| ,, . | Long Ashton | 5·93 | 281 | *Mont* . | Lake Vyrnwy | 4·43 | 141 |
| ,, . | Street, Millfield | 4·73 | 247 | *Denb* . | Llangynhafal | 3·27 | 148 |
| *Glos* . | Blockley | 6·85 | ... | *Mer* . | Dolgelly, Bryntirion... | 6·33 | 191 |
| ,, . | Cirencester, Gwynfa ... | 6·18 | 300 | *Carn* . | Llandudno | 2·72 | 143 |
| *Here* . | Ross, Birchlea | 5·64 | 265 | ,, . | Snowdon, L. Llydaw 9 | 11·55 | ... |
| ,, . | Ledbury, Underdown.. | 6·04 | 296 | *Ang* . | Holyhead, Salt Island | 2·53 | 129 |
| *Salop* . | Church Stretton | 5·03 | 195 | ,, . | Lligwy | 3·82 | ... |
| ,, . | Shifnal, Hatton Grange | 4·83 | 235 | *Isle of Man* | | | |
| *Worc* . | Ombersley, Holt Lock | 8·29 | 404 | | Douglas, Boro' Cem. ... | 4·20 | 166 |
| *War* . | Birminghm, Edgbaston | 6·81 | 318 | *Guernsey* | | | |
| *Leics* . | Thornton Reservoir ... | 6·30 | 313 | | St. Peter P't. Grange Rd. | 2·63 | 155 |

## Rainfall: May, 1932: Scotland and Ireland.

| Co. | Station | In. | Per-cent. of Av. | Co. | Station | In. | Per-cent. of Av. |
|---|---|---|---|---|---|---|---|
| *Wigt.* | Pt. William, Monreith | 3·30 | 140 | *Suth.* | Melvich | 3·43 | ... |
| ,, | New Luce School | 3·04 | 107 | ,, | Loch More, Achfary | 3·51 | 80 |
| *Kirk.* | Carsphairn, Shiel | 3·55 | 84 | *Caith.* | Wick | 1·40 | 68 |
| *Dumf.* | Dumfries, Crichton, R.I | 2·59 | ... | *Ork.* | Pomona, Deerness | 1·14 | 57 |
| ,, | Eskdalemuir Obs. | 3.39 | 103 | *Shet.* | Lerwick | 1·48 | 71 |
| *Roxb.* | Branxholm | 2·45 | 109 | *Cork.* | Caheragh Rectory | 7·12 | ... |
| *Selk.* | Ettrick Manse | 2·97 | 81 | ,, | Dunmanway Rectory | 8·07 | 237 |
| *Peeb.* | West Linton | 3·61 | ... | ,, | Ballinacurra | 3·79 | 160 |
| *Berw.* | Marchmont House | 2·32 | 94 | ,, | Glanmire, Lota Lo. | 4·41 | 180 |
| *E.Lot.* | North Berwick Res. | 2·41 | 121 | *Kerry.* | Valentia Obsy | 4·94 | 156 |
| *Midl.* | Edinburgh, Roy. Obs. | 2·83 | 138 | ,, | Gearahameen | 7·40 | ... |
| *Lan.* | Auchtyfardle | 2·41 | ... | ,, | Killarney Asylum | ... | ... |
| *Ayr.* | Kilmarnock, Kay Pk. | 2·84 | ... | ,, | Darrynane Abbey | 4·63 | 155 |
| ,, | Girvan, Pinmore | 3·30 | 111 | *Wat.* | Waterford, Gortmore | 4·04 | 176 |
| *Renf.* | Glasgow, Queen's Pk. | 2·98 | 122 | *Tip.* | Nenagh, Cas. Lough | 2·70 | 109 |
| ,, | Greenock, Prospect H. | 2·76 | 80 | ,, | Roscrea, Timoney Park | 2·74 | ... |
| *Bute.* | Rothesay, Ardencraig. | 2·97 | 98 | ,, | Cashel, Ballinamona | 3·54 | 147 |
| ,, | Dougarie Lodge | 2·61 | ... | *Lim.* | Foynes, Coolnanes | 1·61 | 69 |
| *Arg.* | Ardgour House | 3·93 | ... | ,, | Castleconnel Rec. | 2·75 | ... |
| ,, | Glen Etive | 3.98 | 80 | *Clare.* | Inagh, Mount Callan | 2·98 | ... |
| ,, | Oban | 2·67 | 88 | ,, | Broadford, Hurdlest'n. | 3·78 | ... |
| ,, | Poltalloch | 3·43 | 119 | *Wexf.* | Gorey, Courtown Ho. | 5·52 | 248 |
| ,, | Inveraray Castle | 3·52 | 89 | *Kilk.* | Kilkenny Castle | 2·97 | 134 |
| ,, | Islay, Eallabus | 2·32 | 87 | *Wick.* | Rathnew, Clonmannon | 4·74 | ... |
| ,, | Mull, Benmore | 4·20 | ... | *Carl.* | Hacketstown Rectory | 5·09 | 196 |
| ,, | Tiree | 1·20 | ... | *Leix.* | Blandsfort House | 3·07 | 126 |
| *Kinr.* | Loch Leven Sluice | 3·81 | 156 | ,, | Mountmellick | 2·60 | ... |
| *Perth.* | Loch Dhu | 4·80 | 107 | *Offaly.* | Birr Castle | 2·75 | 123 |
| ,, | Balquhidder, Stronvar | 2·58 | ... | *Kild'r.* | Monasterevin | 2·83 | ... |
| ,, | Crieff, Strathearn Hyd. | 3·16 | 127 | *Dublin* | Dublin, FitzWm. Sq. | 3·30 | 161 |
| ,, | Blair Castle Gardens | 2·80 | 138 | ,, | Balbriggan, Ardgillan. | 3·77 | 181 |
| *Angus.* | Kettins School | 2·45 | 101 | *Meath.* | Beauparc, St. Cloud | 3·63 | ... |
| ,, | Dundee, E. Necropolis | 2·91 | 139 | ,, | Kells, Headfort | 3·50 | 130 |
| ,, | Pearsie House | 3·73 | ... | *W.M.* | Moate, Coolatore | 1·97 | ... |
| ,, | Montrose, Sunnyside | ... | ... | ,, | Mullingar, Belvedere | 3·33 | 136 |
| *Aber.* | Braemar, Bank | 3·76 | 158 | *Long.* | Castle Forbes Gdns. | 3·15 | 124 |
| ,, | Logie Coldstone Sch. | 3·81 | 153 | *Gal.* | Ballynahinch Castle | 2·58 | 72 |
| ,, | Aberdeen, King's Coll. | 2·82 | 121 | ,, | Galway, Grammar Sch. | 2·61 | ... |
| ,, | Fyvie Castle | 2·46 | 95 | *Mayo* | Mallaranny | 2·63 | ... |
| *Moray* | Gordon Castle | 2·07 | 98 | ,, | Westport House | 2·64 | 93 |
| ,, | Grantown-on-Spey | 3·82 | 164 | ,, | Delphi Lodge | 6·51 | 108 |
| *Nairn.* | Nairn, Delnies | 2·62 | 146 | *Sligo.* | Markree Obsy | 2·77 | 101 |
| *Inv's.* | Ben Alder Lodge | 3·68 | ... | *Cavan.* | Belturbet, Cloverhill | 2·37 | 95 |
| ,, | Kingussie, The Birches | 3·17 | ... | *Ferm.* | Enniskillen, Portora | 2·71 | ... |
| ,, | Loch Quoich, Loan | 3·24 | ... | *Arm.* | Armagh Obsy | 2·68 | 113 |
| ,, | Glenquoich | 3·93 | 72 | *Down.* | Fofanny Reservoir | 6·67 | ... |
| ,, | Inverness, Culduthel R. | 3·09 | ... | ,, | Seaforde | 3·83 | 146 |
| ,, | Arisaig, Faire-na-Squir | ... | ... | ,, | Donaghadee, C. Stn. | 2·24 | 99 |
| ,, | Fort William, Glasdrum | 3·28 | ... | ,, | Banbridge, Milltown | 2·43 | ... |
| ,, | Skye, Dunvegan | 2·49 | ... | *Antr.* | Belfast, Cavehill Rd. | 3·20 | ... |
| ,, | Barra, Skallary | 1·13 | ... | ,, | Glenarm Castle | 2·76 | ... |
| *R&C.* | Alness, Ardross Castle | 3·38 | 130 | ,, | Ballymena, Harryville | 2·18 | 76 |
| ,, | Ullapool | 1·57 | 61 | *Lon.* | Londonderry, Creggan | 2·17 | 83 |
| ,, | Achnashellach | 2·57 | ... | *Tyr.* | Omagh, Edenfel | 2·96 | 114 |
| ,, | Stornoway | 1·50 | ... | *Don.* | Malin Head | 1·66 | ... |
| *Suth.* | Lairg | 2·93 | 115 | ,, | Dunfanaghy | 2·30 | ... |
| ,, | Tongue | 2·34 | 98 | ,, | Killybegs, Rockmount. | 1·82 | 51 |

# Climatological Table for the British Empire, December, 1931

| STATIONS | PRESSURE: Mean of Day M.S.L. (mb.) | PRESSURE: Diff. from Normal (mb.) | TEMPERATURE: Absolute Max. (° F.) | TEMPERATURE: Absolute Min. (° F.) | TEMPERATURE: Mean Values Max. (° F.) | TEMPERATURE: Mean Values Min. (° F.) | TEMPERATURE: Mean Values ½ max. and min. (° F.) | TEMPERATURE: Mean Values Diff. from Normal (° F.) | TEMPERATURE: Mean Wet Bulb (° F.) | Relative Humidity (%) | Mean Cloud Am'nt (0—10) | PRECIPITATION: Am'nt (in.) | PRECIPITATION: Diff. from Normal (in.) | PRECIPITATION: Days | BRIGHT SUNSHINE: Hours per day | BRIGHT SUNSHINE: Percentage of possible |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| London. Kew Obsy. | 1026·2 | +12·5 | 59 | 24 | 46·2 | 38·3 | 42·3 | + 2·0 | 39·3 | 87 | 7·7 | 0·54 | — 1·75 | 8 | 0·9 | 12 |
| Gibraltar | 1022·1 | + 2·0 | 70 | 40 | 62·9 | 47·5 | 55·2 | — 0·8 | 47·2 | 79 | 4·1 | 4·51 | — 1·10 | 8 | .. | .. |
| Malta | 1017·5 | + 1·3 | 68 | 44 | 59·9 | 52·4 | 56·1 | — 1·8 | 52·2 | 78 | 7·4 | 3·60 | — 0·11 | 22 | 3·4 | 35 |
| St. Helena | 1014·6 | + 0·7 | 69 | 56 | 64·9 | 57·4 | 61·1 | — 0·6 | 58·0 | 94 | 9·9 | 0·58 | .. | 10 | .. | .. |
| Sierra Leone | 1012·5 | + 1·6 | 88 | 69 | 86·3 | 74·6 | 80·5 | — 0·9 | 76·1 | 79 | 5·1 | 1·56 | + 0·14 | 5 | .. | .. |
| Lagos, Nigeria | 1010·8 | + 0·3 | 91 | 75 | 87·9 | 76·2 | 82·1 | + 0·6 | 77·3 | 86 | 7·6 | 0·93 | + 0·13 | 2 | .. | .. |
| Kaduna, Nigeria | 1013·1 | — 1·2 | 96 | 53 | 92·8 | 57·0 | 74·9 | + 1·6 | 59·8 | 36 | 1·5 | 0·00 | 0·00 | 0 | .. | .. |
| Zomba, Nyasaland | 1008·5 | + 0·2 | 88 | 60 | 79·3 | 64·5 | 71·9 | — 1·2 | .. | 79 | 8·0 | 15·27 | + 4·40 | 27 | .. | .. |
| Salisbury, Rhodesia | 1008·4 | — 0·4 | 84 | 53 | 78·5 | 59·8 | 69·1 | — 0·5 | 62·2 | 67 | 6·7 | 4·18 | — 1·91 | 12 | 5·6 | 42 |
| Cape Town | 1015·9 | + 1·6 | 93 | 47 | 78·3 | 58·3 | 68·3 | + 0·4 | 61·1 | 68 | 4·6 | 0·72 | — 0·09 | 9 | .. | .. |
| Johannesburg | 1009·8 | + 0·2 | 86 | 48 | 78·8 | 55·3 | 67·1 | + 1·6 | 57·1 | 58 | 3·6 | 4·37 | — 1·06 | 15 | 9·5 | 69 |
| Mauritius | 1014·0 | 0·0 | 89 | 67 | 84·9 | 70·7 | 77·8 | — 0·5 | 72·5 | 63 | 5·7 | 1·46 | — 3·27 | 14 | 9·3 | 70 |
| Calcutta, Alipore Obsy. | 1014·8 | — 0·9 | 81 | 51 | 78·3 | 59·4 | 68·9 | + 2·4 | 59·6 | 85 | 2·1 | 0·01 | — 0·23 | 0* | .. | .. |
| Bombay | 1012·3 | — 1·2 | 93 | 65 | 87·7 | 69·8 | 78·7 | + 1·3 | 67·5 | 72 | 2·9 | 0·69 | + 0·64 | 2* | .. | .. |
| Madras | 1012·0 | — 1·5 | 85 | 63 | 82·0 | 72·2 | 77·1 | + 0·4 | 73·0 | 85 | 7·8 | 10·35 | + 5·00 | 12* | .. | .. |
| Colombo, Ceylon | 1009·9 | — 0·4 | 88 | 69 | 85·0 | 73·1 | 79·1 | — 0·4 | 75·3 | 81 | 7·3 | 15·44 | + 10·32 | 22 | 5·6 | 48 |
| Singapore | .. | .. | 89 | 72 | 84·2 | 73·3 | 78·7 | — 1·2 | 75·7 | 85 | 8·2 | 11·93 | + 1·37 | 23 | 3·3 | 27 |
| Hongkong | 1019·7 | 0·0 | 75 | 42 | 67·7 | 59·5 | 63·6 | + 0·6 | 58·5 | 71 | 6·8 | 4·55 | + 3·48 | 7 | 4·7 | 43 |
| Sandakan | .. | .. | 91 | 74 | 86·9 | 75·1 | 81·0 | + 0·8 | 77·1 | 87 | .. | 15·01 | — 3·63 | 18 | .. | .. |
| Sydney, N.S.W. | 1013·3 | + 1·4 | 90 | 53 | 73·1 | 61·9 | 67·5 | — 2·6 | 63·9 | 72 | 6·1 | 3·35 | + 0·49 | 11 | 7·7 | 53 |
| Melbourne | 1014·9 | + 2·2 | 104 | 49 | 74·0 | 54·9 | 64·5 | — 0·3 | 57·4 | 63 | 4·1 | 0·60 | — 1·67 | 8 | 8·1 | 55 |
| Adelaide | 1014·5 | + 1·3 | 115 | 51 | 88·0 | 60·1 | 74·1 | + 3·0 | 60·1 | 33 | 3·8 | 0·22 | — 0·78 | 1 | 11·6 | 81 |
| Perth, W. Australia | 1012·8 | — 0·4 | 101 | 55 | 89·1 | 66·6 | 77·9 | + 7·1 | 63·9 | 38 | 3·7 | 0·37 | — 0·19 | 4 | 10.8 | 76 |
| Coolgardie | 1012·1 | + 0·9 | 105 | 52 | 92·8 | 61·9 | 77·3 | + 1·6 | 60·9 | 31 | 2·1 | 0·00 | — 0·69 | 0 | .. | .. |
| Brisbane | 1012·5 | + 0·5 | 98 | 62 | 83·3 | 67·0 | 75·1 | — 1·3 | 68·4 | 65 | 6·3 | 9·11 | + 4·14 | 14 | 8·5 | 62 |
| Hobart, Tasmania | 1013·6 | + 3·9 | 81 | 39 | 66·8 | 49·5 | 58·1 | — 2·1 | 52·0 | 56 | 5·4 | 0·17 | — 1·82 | 6 | 8·5 | 56 |
| Wellington, N.Z. | 1013·5 | + 1·3 | 74 | 42 | 59·1 | 52·5 | 55·8 | — 4·4 | 55·4 | 72 | 7·0 | 2·70 | — 0·52 | 10 | 8·2 | 54 |
| Suva, Fiji | 1010·5 | + 1·9 | 91 | 69 | 84·5 | 73·3 | 78·9 | — 0·1 | 74·3 | 77 | 6·8 | 9·50 | — 3·02 | 23 | 7·1 | 54 |
| Apia, Samoa | 1008·9 | + 0·6 | 89 | 71 | 85·7 | 72·9 | 79·3 | 0·0 | 75·8 | 76 | 5·8 | 8·98 | — 4·91 | 18 | 5·7 | 44 |
| Kingston, Jamaica | 1013·9 | — 0·1 | 91 | 66 | 86·4 | 68·9 | 77·7 | 0·0 | 67·4 | 85 | 3·4 | 0·92 | — 0·67 | 3 | 8·0 | 72 |
| Grenada, W.I. | 1013·5 | + 1·7 | 90 | 72 | 88·3 | 73·6 | 80·9 | + 2·7 | 74·1 | 75 | 3·3 | 6·57 | — 0·63 | 22 | .. | .. |
| Toronto | 1018·9 | + 1·3 | 51 | 11 | 38·8 | 27·8 | 33·3 | + 6·2 | 29·1 | 79 | 7·4 | 2·37 | — 0·10 | 9 | 2·5 | 28 |
| Winnipeg | 1017·5 | — 1·2 | 37 | —12 | 25·2 | 13·4 | 19·3 | +13·5 | .. | .. | 4·5 | 0·04 | — 0·90 | 3 | .. | .. |
| St. John, N.B. | 1013·7 | — 0·3 | 50 | 2 | 33·4 | 19·3 | 26·3 | + 1·9 | 22·1 | 74 | 6·6 | 3·03 | — 1·14 | 11 | 3·3 | 37 |
| Victoria, B.C. | 1010·0 | — 6.7 | 53 | 32 | 44·9 | 38·7 | 41·8 | + 0·7 | 39·4 | 88 | 8·0 | 2·56 | — 3·18 | 18 | 1·9 | 23 |

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

# Climatological Table for the British Empire, Year 1931.

| 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. | 1015·2 | − 0·2 | 77 | 18 | 55·8 | 43·5 | 49·6 | − 0·1 | 44·9 | 86 | 7·8 | 23·83 | + 0·03 | 150 | 3.5 | 27 |
| Gibraltar | 1017·2 | − 0·7 | 95 | 38 | 72·5 | 57·0 | 64·8 | + 0·5 | 56·4 | 82 | 4·4 | 31·37 | − 4·45 | 81 | .. | .. |
| Malta | 1015·0 | − 0·4 | 104 | 42 | 71·5 | 61·0 | 66·2 | + 0·1 | 60·5 | 74 | 4·9 | 26·27 | + 6·41 | 100 | 8·1 | 64 |
| St. Helena | 1015·3 | + 0·8 | 73 | 51 | 64·1 | 57·3 | 60·7 | − 0·8 | 58·2 | 94 | 9·2 | 29·99 | .. | 205 | .. | .. |
| Sierra Leone | 1012·4 | + 1·0 | 94 | 64 | 86·1 | 71·6 | 78·9 | − 1·9 | 76·3 | 82 | 5·7 | 147·30 | − 9·93 | 184 | .. | .. |
| Lagos, Nigeria | .. | .. | 96 | 70 | 86·6 | 76·2 | 81·4 | + 0·9 | 77·1 | 83 | 8·6 | 83·55 | + 11·92 | 155 | .. | .. |
| Kaduna, Nigeria | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Zomba, Nyasaland | 1012·1 | − 0·2 | 94 | 47 | 78·7 | 61·4 | 70·0 | + 0·6 | .. | 70 | 5·5 | 56·93 | + 2·39 | 112 | .. | .. |
| Salisbury, Rhodesia | 1012·4 | + 0·2 | 92 | 37 | 77·8 | 55·0 | 66·4 | + 1·1 | 57·0 | 57 | 3·7 | 28·20 | − 3·35 | 81 | 8·1 | 67 |
| Cape Town | 1018·0 | + 1·0 | 102 | 33 | 72·1 | 54·9 | 63·5 | + 1·2 | 56·2 | 78 | 4·6 | 19·08 | − 5·96 | 110 | .. | .. |
| Johannesburg | 1015·7 | + 0·5 | 88 | 25 | 71·0 | 50·3 | 60·7 | + 1·0 | 50·4 | 55 | 3·3 | 29·37 | − 3·85 | 108 | 8·7 | 73 |
| Mauritius | 1016·1 | 0·0 | 89 | 55 | 80·8 | 68·3 | 74·6 | + 0·6 | 70·5 | 71 | 5·8 | 83·79 | + 34.13 | 208 | 7·9 | 66 |
| Calcutta, Alipore Obsy. | 1007·6 | 0·0 | 103 | 51 | 88·3 | 72·7 | 80·5 | + 1·7 | 73·2 | 86 | 4·9 | 65·38 | + 1·06 | 90 | .. | .. |
| Bombay | 1008·5 | − 0·7 | 95 | 63 | 87·8 | 74·8 | 81·3 | + 0·7 | 73·6 | 78 | 4·3 | 97·94 | + 25·75 | 91 | .. | .. |
| Madras | 1008·4 | − 0·4 | 108 | 63 | 90·8 | 75·7 | 83·3 | + 0·2 | 75·4 | 76 | 5·6 | 58·53 | + 8·97 | 65 | .. | .. |
| Colombo, Ceylon | 1010·3 | + 0·6 | 92 | 68 | 86·3 | 75·4 | 80·9 | − 0·1 | 77·0 | 79 | 6·8 | 106·38 | + 26·25 | 231 | 6·9 | 57 |
| Singapore | .. | .. | 94 | 70 | 88·0 | 75·1 | 81·6 | + 0·7 | .. | .. | .. | 100·67 | + 5·55 | 201 | 5·8 | 47 |
| Hongkong | 1012·1 | − 0·5 | 94 | 40 | 76·9 | 69·0 | 73·0 | + 0·7 | 68·2 | 77 | 7·3 | 80·39 | − 4·74 | 162 | 5·0 | 42 |
| Sandakan | .. | .. | 93 | 72 | 88·1 | 75·2 | 81·7 | + 0·4 | 77·5 | 82 | .. | 92·05 | − 32·74 | 132 | .. | .. |
| Sydney, N.S.W. | 1016·1 | + 0·2 | 104 | 38 | 70·8 | 56·2 | 63·5 | + 0·4 | 58·3 | 71 | 5·4 | 49·22 | + 1·74 | 153 | 6·9 | 57 |
| Melbourne | 1016·5 | + 0·2 | 104 | 33 | 66·4 | 49·0 | 57·7 | − 0·7 | 52·6 | 70 | 6·7 | 28·63 | + 3·16 | 164 | 5·4 | 43 |
| Adelaide | 1017·7 | + 0·7 | 115 | 38 | 71·9 | 52·6 | 62·3 | − 0·7 | 53·7 | 55 | 6·3 | 22·26 | + 1·08 | 145 | 7·0 | 56 |
| Perth, W. Australia | 1017·1 | + 0·7 | 104 | 37 | 73·6 | 55·3 | 64·4 | + 0·2 | 56·6 | 60 | 4·6 | 39·18 | + 4·81 | 118 | 8·0 | 65 |
| Coolgardie | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Brisbane | 1016·7 | + 0·8 | 100 | 42 | 77·9 | 60·5 | 69·2 | + 0·3 | 62·8 | 67 | 5·3 | 66·71 | + 21·42 | 132 | 7·7 | 64 |
| Hobart, Tasmania | 1012·0 | − 0·5 | 86 | 30 | 61·0 | 46·4 | 53·7 | − 0·7 | 48·1 | 65 | 6·4 | 27·17 | + 3·38 | 179 | 5·8 | 47 |
| Wellington, N.Z. | 1015·0 | + 0·3 | 74 | 32 | 57·7 | 47·5 | 52·6 | − 2·8 | 50·1 | 76 | 6·8 | 39·49 | − 8·55 | 163 | 6·0 | 49 |
| Suva, Fiji | 1012·0 | + 0·7 | 91 | 62 | 82·3 | 72·3 | 77·3 | + 0·3 | 73·1 | 79 | 6·9 | 122·60 | + 5·46 | 250 | 5·3 | 43 |
| Apia, Samoa | 1009·9 | − 0·4 | 89 | 66 | 85·2 | 74·0 | 79·6 | + 1·1 | 76·5 | 78 | 6·1 | 122·16 | + 12·45 | 182 | 6·4 | 53 |
| Kingston, Jamaica | 1012·6 | − 1·1 | 94 | 62 | 87·5 | 72·3 | 79·9 | + 0·6 | 71·1 | 83 | 4·7 | 33·22 | − 0·37 | 89 | 6·8 | 56 |
| Grenada, W.I. | 1013·4 | + 1·0 | 92 | 70 | 87·3 | 73·9 | 80·6 | + 1·7 | 74·0 | 76 | 5·1 | 102·71 | + 28·12 | 264 | .. | .. |
| Toronto | 1016·0 | − 0·6 | 98 | 0 | 57·2 | 41·5 | 49·4 | + 4·2 | 43·7 | 75 | 5·9 | 26·63 | − 4·65 | 124 | 5·7 | 45 |
| Winnipeg | 10 5·2 | − 1·0 | 100 | −21 | 50·6 | 32·1 | 41·4 | + 6·8 | .. | .. | 4·8 | 17·44 | − 2·75 | 91 | .. | .. |
| St. John, N.B. | 1014·2 | − 0·4 | 87 | − 6 | 51·0 | 36·9 | 43·9 | + 2·7 | 39·5 | 78 | 6·5 | 45·52 | − 2·56 | 163 | 4·8 | 39 |
| Victoria, B.C. | 1016·5 | − 0·2 | 86 | 31 | 56·4 | 44·7 | 50·5 | + 1·1 | 47·5 | 82 | 5·9 | 25·95 | − 4·36 | 145 | 6·3 | 48 |

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

(*Continued from p.* 123.)

to the floods and five people were drowned. Much damage was also done to the harvest and communications in the neighbouring districts. The opening to vehicular traffic of the road over the Simplon Pass, which was delayed owing to the heavy snow in April, occurred about the 26th. The ice was breaking up in most harbours of Sweden and Finland, but navigation was still somewhat impeded by ice even on the 25th. (*The Times*, May 10th-27th.)

At the beginning of the month 20 people were killed and over 100 injured by a tornado which swept across east Bengal, and as many as 500 people are believed to have been killed by a typhoon over southern Annam. A violent thunderstorm accompanied by hail occurred over several hundred square miles in the United Provinces on the 5th; about 13 people were killed and more than 100 injured. Some of the hailstones were reported to be larger than cricket balls. The storm destroyed the mango crop but helped end the rat pestilence. On the 9th a tornado struck the Mymensingh gaol, Bengal, killing 22 people and injuring about 100 others. The monsoon rains started in Rangoon on the 20th, which is later than usual. Torrential rain is reported to have destroyed the spring crop in 800 villages in north Honan. Eleven people were killed and much damage done by a cyclone over Madras about the 27th. (*The Times*, May 6th-28th.)

Beneficial rains fell for four days over a large area of Queensland, north-west New South Wales, and the north of South Australia, so that the agricultural and pastoral outlooks are much improved. (*The Times*, May 21st-23rd.)

Cool, cloudy weather after heavy rains delayed seeding in western Canada. During the early part of the month the central provinces suffered from severe drought, but later conditions in the western provinces were very good. In the United States temperature was above normal early in the month, but later cold weather spread gradually across from the east to the west. Rainfall was mainly below normal except in part of the Gulf States during the week ending the 24th, when it was much above normal. Heavy rain necessitated some replanting in the American cotton areas, but otherwise the conditions were good. A hurricane off the Bahamas was moving towards Bermuda on the 8th. (*The Times*, May 7th-June 2nd, and *Washington, D.C., U.S. Dept. Agric., Weekly Weather and Crop Bulletin.*)

## Rainfall, May, 1932—General Distribution

| | | |
|---|---|---|
| England and Wales ... ... | 221 | per cent of the average 1881-1915. |
| Scotland ... ... ... ... | 108 | |
| Ireland ... ... ... ... | 134 | |
| British Isles ... ... ... | 174 | |