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A Note on a Remarkable Temperature Record at Aberdeen

By C. S. DURST, B.A.

During the morning of December 12th, 1913, a depression passed to the northward of the British Isles and an occlusion travelled over the Scottish stations giving a pronounced squall at Aberdeen in which the wind veered from SSW to WNW between 10h. 30m. and 11h. Unfortunately, since directions were only recorded by a Robinson anemometer it is not possible to state precisely when the change occurred. The Dines velocity recorder, however, showed an increase of wind from 2 miles per hour at 10h. 30m. to 42 miles per hour in a gust at 10h. 55m. The photographic barograph showed a rise in pressure which began at about 8h. 15m. and continued until some hours after the squall without any pronounced excursions. The photothermograph, however, gave an unusual trace. The temperature rose from about 47°F. at 10h. 30m. to 51°F. at 10h. 52m. It remained at that high figure for five minutes and then fell to 48°F. during the next hour. The relative humidity meanwhile after being between 80 and 90 per cent. up to 10h. 40m. fell to 60 to 70 per cent. between 10h. 50m. and noon. No rain fell at Aberdeen during the day of this occurrence. There are two alternative explanations of the rise in temperature as the front passed, (a) that a small portion of warm air still remained at the surface, (b) that it was a föhn effect due to the cold air passing down from the hills to westwards of Aberdeen, reinforcing the descending currents which are known often to occur in the rear of occlusions.

The objection to the first of these lies in the humidity observations which fell both absolutely and relatively when the temperature began to rise and it would seem that the second is the more likely explanation.

When a front or an occlusion passes over a mountain range there has been shown to be a tendency for a pocket of the receding air to be trapped between the mountain and the advancing air on the windward side. A corollary is therefore that on the leeward side there must be a more rapid descent of the advancing air than of the receding air and in descending this advancing air will be warmed adiabatically. This effect is probably favoured by the topography of Aberdeen, for it lies in a bay of the hills formed by the valleys of the Dee and the Don. As a consequence when a front passes from west to east, the receding air tends to flow out from the bay but can only be replaced by air descending down the sides of the hills the route for air from westward and flowing round the hills being cut off by the protruding arms of the bay. The downward currents at that point may be further reinforced possibly by the tendency for air to flow downwards in a wind which is passing from land to sea.

That some such history is true of the air which gave this remarkable rise in temperature is further supported by three pieces of evidence.

(i) The dew point of the warm air was 40°F. which would be reached adiabatically at a height of 2,400 feet, which is approximately the height of the highland over which the wind had come.

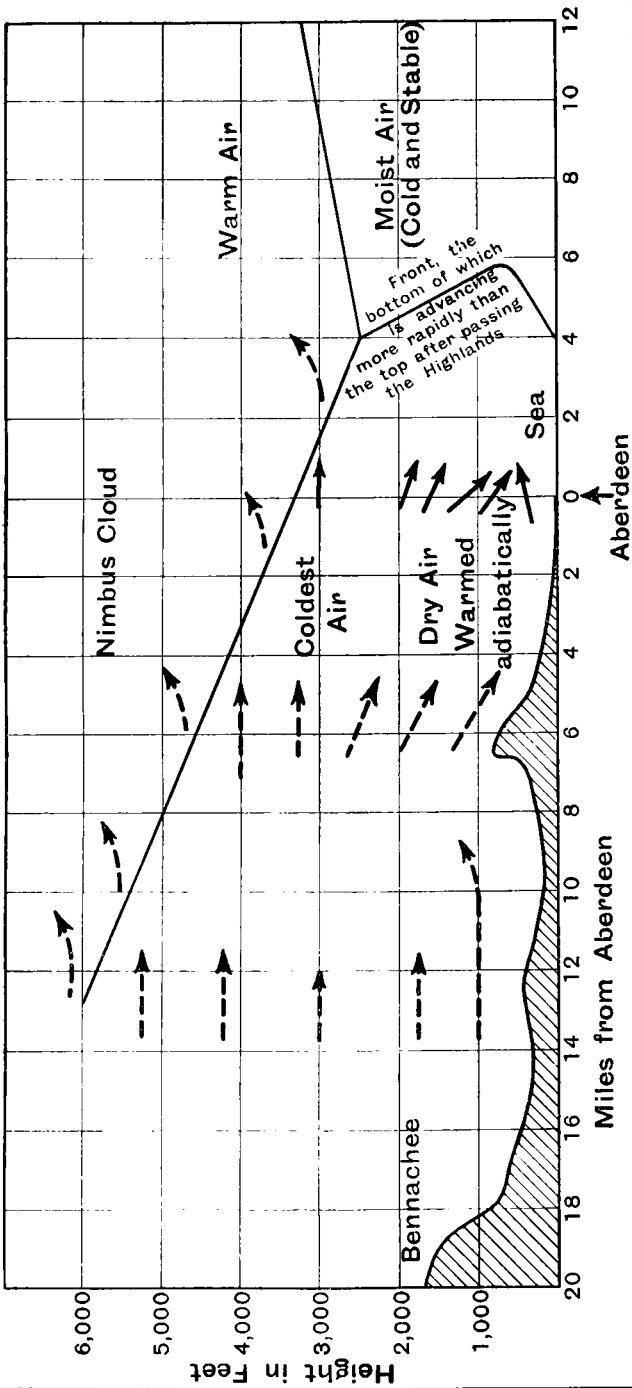
(ii) There was no rain recorded at Aberdeen, probably indicating that the descending current was evaporating any precipitation falling through it.

(iii) At 10h. 55m. on this day a pilot-balloon was released from Aberdeen just after the squall and it was the remarkable record of its ascensional velocity which first attracted the writer's attention to this occasion.

The details of the ascent are given in the *Geophysical Journal* for December, 1913, and are as follows:—

| Height | | Vertical Velocity of Balloon. | | Horizontal. | | | Upward Vertical Velocity of Air. | |
|--------|-------|-------------------------------|----------|-------------|-----------|--------|----------------------------------|----------|
| | | | | Direction. | Velocity. | | | |
| m. | ft. | m/s. | ft./min. | | m/s. | m.p.h. | m/s. | ft./min. |
| 100 | 330 | 3.0 | 590 | 282° | 13.5 | 30 | +0.1 | +20 |
| 250 | 820 | 1.8 | 350 | 283° | 21.3 | 47 | -1.1 | -220 |
| 340 | 1,120 | 0.6 | 120 | 282° | 21.3 | 47 | -2.3 | -450 |
| 500 | 1,640 | 2.0 | 390 | 286° | 21.6 | 48 | -0.9 | -180 |
| 750 | 2,460 | 2.2 | 430 | 287° | 22.0 | 49 | -0.7 | -140 |
| 925 | 3,050 | 2.9 | 570 | 289° | 16.1 | 36 | 0.0 | 0 |

SCHEMATIC DIAGRAM OF THE SITUATION IN THE NEIGHBOURHOOD
OF ABERDEEN AT 10.55 ON DEC. 12. 1913.

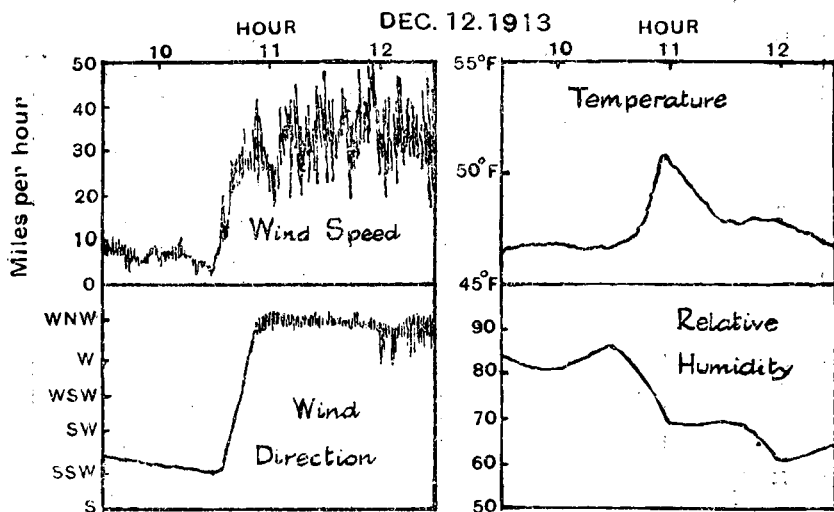


The balloon was followed with two theodolites until at 1010 metres it "entered loose nimbus base of low type of cumulo-nimbus" (the base presumably of the squall cloud), and it is recorded that at the end of the flight the balloon shot very rapidly upwards into the cloud. The wind was very constant in direction during the flight and varied little in speed.

The free lift was 48 gm.; assuming a vertical velocity of 2.9 m/s (570 ft./min.) for the balloon in still air, the vertical velocities of the air are given in the last column. Thus it is seen that there was in fact a descending current amounting to, on an average, 0.7 m/s (140 ft./min.) from the surface to the cloud base.

A schematic diagram has been constructed of a section of the surfaces of discontinuity and the profile of the country over which the air in rear of the front has passed in arriving at

AUTOGRAPHIC RECORDS AT ABERDEEN



Aberdeen. On it have been inserted the lines of flow of the air as recorded by the pilot-balloon ascent and arrows to indicate the presumed flow of the air above and below the surface of discontinuity. The shape of the front has been sketched in by the following line of argument:—

(i) The southerly wind in front of the occlusion has not travelled over the highlands, indeed there is some evidence to show it has flowed round rather than over hills. Hence it is probably stable air with a small lapse rate.

(ii) The west-north-westerly wind in rear of the front has flowed over the highlands and is therefore probably in neutral equilibrium with a lapse rate of the dry adiabatic.

(iii) On these two premises and since surface temperatures in the southerly current and in the main body of the west-north-

westerly current are not very dissimilar, the air at the height of 2,500 feet to 5,000 feet will be colder behind the occlusion than in front and so the occlusion will be of the cold front type.

(iv) The lowest portion of the front is bent back owing to its retarding by the highlands and it is presumed that this retarded portion will advance more rapidly than the main portion of the front as the hills are left behind, thereby generating the downward currents recorded by the pilot-balloon ascent.

The diagram is of necessity entirely speculative in regard to the slopes of the surfaces of discontinuity but still it serves as a picture of the probable deformation of a cold front or an occlusion in passing across mountainous country and of the effect that such deformation can have on the vertical wind currents.

The Contamination of Mercury in Barometer Cisterns

By J. E. BELASCO, B.Sc.

The rusting which occurs in the interior of cast iron cisterns such as are to be found in Kew pattern barometers, causes the mercury surface to become contaminated. This has been avoided in recent barometers by using a cistern of stainless steel, polished inside. Even so, there remain other sources of contamination. Observations on Fortin and Newman barometers, which possess glass cisterns, reveal that after a time the mercury surface becomes tarnished. This is due to the effect of damp air, etc., and occurs in all types of barometers. Pure mercury remains unchanged in the presence of dry air at ordinary temperatures. In damp air and in contact with sulphur and carbon compounds and ozone, the surface becomes contaminated and tarnishes. When the mercury tarnishes, it leaves a deposit on the walls of the cistern of the barometer. This is probably a contributory cause of the variation in the shape of the liquid surface, so that after a time there will be a tendency for the surface to become flatter and for its lustre to disappear.

We will first examine the effect of contamination in the Kew pattern barometer. Since the mercury surface in the cistern is not visible, the loss of lustre does not matter. The change in the surface tension due to the tarnishing is, however, important, since there is no means of adjusting the zero of the scale. Experience shows that in Kew barometers with dirty mercury there is a tendency to read low. All Kew pattern barometers have cisterns sufficiently large to make capillary depression of the mercury negligible. Hence the error due to tarnishing arises from the varying conditions of the angle of contact between the mercury and the walls of the containing cistern. When the mercury in the cistern is clean, the meniscus

is convex, but if it becomes so dirty that the curvature disappears, the surface becoming plane, then the level of the mercury surface in the cistern will fall to a position defined by the condition that the volume of the mercury is constant, provided that the actual height of the barometer column has remained constant. The flatter the mercury meniscus in the cistern, the greater is the tendency of the barometer to read low. To what extent the contamination, due only to atmospheric influences, alters the shape of the mercury surface is not definitely known, though there will be a tendency for the surface to become flatter after a considerable period of time, causing the barometer to read lower by an amount which may be as much as 0.4mb. in the case of 1.3in. cisterns.

In the Fortin and Newman types of barometer, which employ glass cisterns, the effect of a contaminated surface is not to cause an error arising from the varied conditions of the angle of contact, but to give rise to an error when setting the fiducial point flush with the contaminated mercury surface, since it is difficult to see the reflected image of the knife edge or pointer in the dirty surface.

To overcome the contamination of the mercury surface due to the influence of damp air, Dr. Whipple, of Kew Observatory, suggested the fitting of a purifying apparatus to the cistern inlet of a Newman barometer. Professor J. C. Philip, F.R.S., of the Imperial College of Science, advised activated carbon granules as the most suitable material to act as a filter. Activated carbon consists of granulated charcoal specially treated. It is capable of adsorbing large quantities of all impurities likely to be present in the air of a room in which a barometer is usually installed. The more easily a gas is condensible, the more easily is it adsorbed by the carbon. The rate of adsorption of moisture is considerable. Indeed, the weight of the carbon varies with the amount of water vapour present, though it is not immediately adsorbed. Saturated air when drawn through 1cm. thickness of activated carbon will be found on the other side to have a humidity of only a few per cent. The carbon will adsorb very largely carbon and sulphur compounds; nor is ozone likely to reach the mercury surface, decomposition occurring on the surface of the activated carbon granules due to catalytic action or oxidation of the granules.

In order to test the effect of the filtration of the air in contact with a mercury surface by means of activated carbon granules, the following experiment was carried out at Kew Observatory using quality R, 2-3mm. granules kindly supplied by Ernest E. Mayer, Fawsitt and Co., Ltd., London. Approximately equal quantities of air were drawn over clean mercury surfaces, in one case the air being unfiltered, and in the other the air was filtered through activated carbon. The bottles con-

taining the mercury were about the same size as a barometer cistern. An ordinary filter pump was used to draw the air through the apparatus, which was arranged so that the flow through both bottles was about equal. The rate of flow through each bottle was approximately 40 litres per hour. After about 2,500 litres of air had been passed through each bottle the mercury in the bottle without the filter showed a very slight tarnishing over the whole surface and, in addition, there was a faint patch of dirt below the inlet tube. The mercury in the bottle with the filter remained clean until about 5,000 litres had passed, when a very faint patch of dirt appeared under the inlet tube, but the remainder of the surface was not perceptibly tarnished; the mercury in the bottle without the filter was still more tarnished than that in the other bottle. The amount of solid impurities in the quantity of air drawn through the bottles was of the order of one or two milligrams, and only a portion of this would deposit on the mercury surface.

Now the air going into the cistern space of a barometer is that necessary to keep the pressure equal to atmospheric. Over a given interval of time this will depend upon the "barometric activity." An approximate estimate of this can be obtained by dealing only with successive peaks and troughs of pressure, assuming the change linear between these peaks and troughs. During the three winter months, December, 1927, January and February, 1928, the change of pressure in London necessitated an inflow of about 36cc. of air. This represents 144cc. per annum, which is equivalent to 14.4 litres in 100 years. With such small inflows of air the service time of the activated carbon would be considerable, probably of the order of 30 to 40 years. About 1cm. is the minimum effective depth of the activated carbon granules.

In conclusion, therefore, it seems reasonable to assume that in barometers with glass cisterns in which impure air is the main source of contamination of the mercury surface, the use of an activated carbon filter would allow the mercury to remain clean for a very long period.

OFFICIAL NOTICE

Discussions at the Meteorological Office

The series of meetings for the discussion of recent contributions to meteorological literature, especially in foreign and colonial journals, will be resumed at the Meteorological Office during the session 1928-9. The meetings will be held on alternate Mondays at 5 p.m., beginning on Monday, October 15th, 1928, when Dr. G. C. Simpson, C.B., F.R.S., will open the discussion of a

paper by F. M. Exner, entitled "Über die Zirkulationen, kalter und warmer Luft zwischen hohen und niedrigen Breiten." (*Wien, Sitzber. Ak. Wiss. IIa*, 137, 1928, pp. 189-225.)

The dates for subsequent meetings are as follows:—

October 29th, November 12th and 26th, December 10th, 1928; January 21st, February 4th and 18th, March 4th and 18th, 1929.

The Director of the Meteorological Office wishes it to be known that visitors are welcomed at these meetings.

Correspondence

To the Editor, *The Meteorological Magazine*

Transport of Sea-Spray by Gales

The paper on this subject in the July number fails to notice the most complete examination of the occurrence of salt in rain-water, as affected by gales, carried out by a chemist and geologist. About 1890-1 the late Wm. Ackroyd, F.I.C., Public Analyst for Halifax, explored the subject from various angles and collected material from published sources as well. There are abbreviated papers by him in the *Reports of the British Association* meetings 1900-2 and elsewhere; but the most complete account of his research is to be found in Vol. XIV of the *Proc. Yorks Geol. Soc.*, pp. 401-21, under the title "On the Circulation of Salt and its bearings on Geological Problems." Therein he quotes at some length from the original authority for the records relating to the storm of 1839, viz.: "Narrative of the Dreadful Disasters occasioned by the Hurricane which visited Liverpool, Jan. 6th and 7th, 1839." The most remarkable of these records was undoubtedly that sent from Alford, near Boston, in Lincolnshire (about 140 miles from Liverpool) where "every tree and hedge in the bleak situations were encrusted over (like a hoar frost) with a powerful alkali which an eminent chemist pronounced to be muriate of soda."

Curiously, Mr. Ackroyd was able to collect fresh direct evidence almost as remarkable of the same storm, over 60 years afterwards, for Canon Tristram, of Durham, wrote to him in 1902 of what came under his own observation in 1839. "At the castle, Castle Eden, which stands on a bluff not far from the east coast of the County of Durham, and overlooking the sea, on the morning of January 7th all the windows of the castle facing west were covered with a saline incrustation like hoar frost, while those on the east face had not a trace of salt on them."

Mr. Ackroyd's personal contribution was based upon weekly tests for salt in the water of Widdop Reservoir at 1,000ft. on the axis of the Pennines, west of Halifax, and in comparison

with it, the water collected weekly in the rain gauges at Widdop and on four other moorland gathering grounds. The tests were made for fifteen weeks through the winter of 1900-1. The records for two weeks (December 24th and January 14th) were abnormally high, the excess of salt in the gauges in December being brought by a westerly gale, with a maximum velocity of 43 miles an hour on the 20th. "During the week in January . . . strong continuous east winds blew from the North Sea, with a very light rain or snow-fall, a combination sufficient to account for the excess of salt." The last sentence is quoted from another paper by Wm. Ackroyd, "The Presence of Salt in Fresh Waters," in the *Halifax Naturalist*, VIII (1903), pp. 11-14, as the meteorological explanation appears to be omitted in his principal paper (as above). But this latter should be consulted for the details and discussion of the analyses and the problem generally.

W. B. CRUMP.

Hawcroft, Weetwood Lane, Leeds. 8th August, 1928.

Light Winds and Quick Fall of Pressure

A curiosity of synoptic charts was exhibited on the charts for 7h., 10h. and 13h. of Tuesday, August 7th, 1928. At the first of these three hours Stornoway reported a barometric fall of $2\frac{1}{2}$ mb., at the second of $3\frac{1}{2}$ mb., and at the third of 4mb., these big falls being associated with a vigorous secondary depression moving up from the south. In each case the pressure gradient suggested that winds should be at least moderate in force but in each case Stornoway reported "calm." It is interesting to record that Thorshavn, further north, reported similarly "calm" at the three hours mentioned though possessing a very definite gradient and continued "calm" at 16h. when falling 4mb. and on to 18h. when falling $3\frac{1}{2}$ mb.

Within my experience I have not known calms persist so long under similar conditions, and it would be interesting to know the reasons that prevailed in this particular case.

Incidentally, the depression followed Guilbert's rule that its movement should be towards the abnormally light wind for it travelled directly towards and right across Stornoway.

W. H. PICK.

10th August, 1928.

NOTES AND QUERIES

Thunderstorms during August

An interesting spectacle occurred (at Cleethorpes) on the evening of August 13th about sunset, when a thunderstorm was blown across by a SSW wind. A vivid contrast was seen

between the inky black clouds and the varying depths of colour produced by the setting sun behind the falling rain. The colour was a deep purple on the fringe of the clouds, and gradually grew to a light orange towards the earth. During this time there were continual flashes of lightning and rumbles of thunder.

A. H. BLOW.

On August 20th, at 2 p.m., a detached house at High View, Pinner, was struck by lightning. The following account is sent by Miss Elsie Thorpe:—

“The sky was lit suddenly by terrible flash and lurid flames swept over the garden. A tree appeared to be on fire; the flames then came across garden to house and an ear-splitting crash of thunder and explosion, plunging us in immediate darkness. According to eye witness, cinders fell from sky in front. Knowing the house had been struck, we went downstairs and found the room where wireless was installed damaged. The set was not touched. The wireless was to earth. Sulphur fumes came from room. There were four holes blown in the wall over bay window—plaster all over floor and in ornaments—curtain rod scorched in two places. The lightning had gone to earth through electric light and blown four switches—two main ones and two others. The tree where wire was, was struck. Have since picked up several pieces of cinders, looks like burnt coke. One heavy piece, some metal included in it weighing 7 oz., in a bed in front garden, which had nothing of the kind in it before this happened. The electricians seem to think we’ve had a marvellous escape and that the wireless saved the house.”

At Barnstaple we had an extraordinary storm on August 24th at 4 p.m., when for 10 minutes frozen ice of various shapes fell with great violence, breaking vegetation and cutting off the stalks of corn, &c. Two hours afterwards I found any number of pieces as large as a 6d. and $\frac{1}{2}$ in. thick, and the drifts under the walls were still visible 4 hours afterwards. The storm was accompanied by thunder. Some of the ice fragments were elongated and faceted like cut diamonds.

Three fields away to the south-west there was no hail, but it continued here east and north-east up to Exmoor, Brayford and High Bray having much the same storm as I have to record.

H. SANDFORD CLAY.

A violent thunderstorm occurred at Armagh on August 29th from 3.30 to 4.30 p.m. B.S.T. The rain and hail amounted to 1.66 in. and the storm was followed by floods. The observer, Mr. W. F. A. Ellison, remarks that “the phenomenal character of the hailstorm of August 29th can be realised when it is stated

that a good deal of hail was still lying on September 1st. The low grass minima on the 29th and 30th (34° and 31°F . respectively) were due to hail lying."

Opening of New Headquarters of Meteorological Department of India at Poona

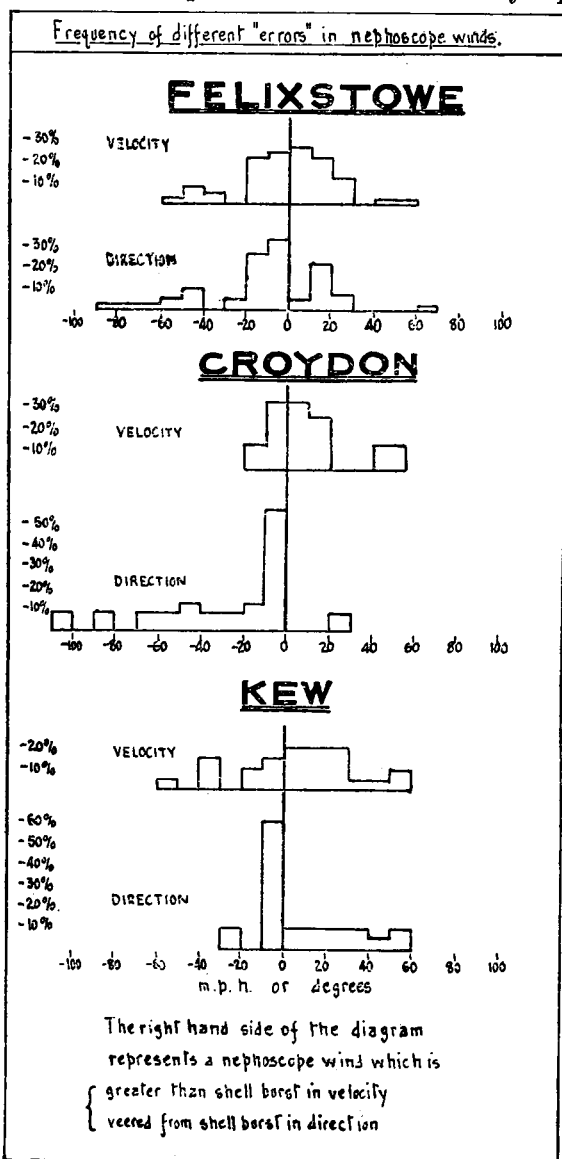
On July 20th His Excellency the Governor of Bombay performed the official opening ceremony of the new headquarters which have been built for the Meteorological Department of India at Poona, about eighty miles to the east-south-east of Bombay. The new building lies between the Colleges of Agriculture and Engineering, in an enclosure having an area of more than ten acres, which provides space for observational as well as for administrative and computing work. Although the Department has now been in existence for 53 years, it has never previously occupied a building specially designed for its needs, the previous headquarters at Simla having been only temporary. The site at Simla was especially unsuitable for upper air investigation, and that essential branch of meteorology was carried on at Agra. The work done at the latter station has shown the vital importance of upper air data for monsoon forecasting in India; the new headquarters at Poona, in the direct path of the south-west monsoon, provide an excellent site for its continuance, and a feature of the new building is a special tower for the release and observation of meteorological balloons. In his address His Excellency referred also to the advantage that in its new home the Department would be in close touch with the shipping interests of Bombay, while the near neighbourhood of the College of Agriculture is a good augury for the continuation of the efforts of the meteorologists to assist the cultivators, which have had such happy results in the past.

All meteorologists will join with His Excellency in wishing success and prosperity to Dr. Normand and his staff in their new surroundings.

A Comparison between Upper Winds deduced from observations with Nephoscopes and those obtained by the Shell-burst method

It has been the custom at stations reporting to the Forecast Service of the Meteorological Office during recent years to deduce the velocity of the wind at high levels from determinations made by nephoscope of the apparent motion of clouds of the alto and cirrus types, the usual assumption being made that the apparent motion is due to the cloud being carried horizontally by the wind at that level. Clearly in addition to possible error caused by vertical motion, there may be error due to growth of the

cloud at one edge and dissipation at the opposite edge. An extreme case of this is the formation of a "banner" cloud near a mountain peak: such a cloud may appear to be stationary



even in a strong wind. Two further assumptions are made, in order to change the angular velocity into actual velocity in miles per hour as shown in the Upper Air Supplement to the *Daily Weather Report*, namely, that all clouds of cirrus type are at a height of 5 miles, and all alto clouds at 3 miles. These are obviously liable to cause further errors.

Determinations of upper wind made by observations of the apparent drift of the smoke due to a bursting shell are likely to be much more accurate, for in such determinations the height of the smoke puff is normally measured directly, and since the smoke puff is not likely to change its shape rapidly, its motion can be followed easily. We may therefore use measurements made

in this way as a standard of comparison for testing the accuracy of the ordinary nephoscope measurements.

Although one is not justified in regarding the shell-burst determinations as giving perfectly true values of the wind they may usefully be regarded in this way for our present purpose, which is to determine the order of magnitude of the errors made

in the nephoscope measurements. The word "error" will therefore be used to denote the quantity obtained by subtracting the shell-burst velocity from the corresponding nephoscope value; similarly with the direction expressed in degrees clockwise from north. An example will make the process clear: By shell-burst the velocity might be 90 m.p.h., and the direction 20° (i.e., from about NNE), and by nephoscope 140 m.p.h. from 315° (i.e., from NW). The errors would in this case be + 50 m.p.h. and $- 65^{\circ}$. (Positive errors in direction correspond with winds that are veered relative to the "true" wind.) The errors have been worked out in this way for three places in south-east England, for the years 1926 and 1927, using the shell-burst observations of upper wind supplied by the Meteorological Office, New Ranges, Shoeburyness, as the standard of comparison. Nephoscope observations made on clouds of cirrus type have been compared with shell-burst readings at 21,000 to 25,000 feet height and on clouds of alto type with shell-bursts at 12,000 to 18,000 feet. As complete simultaneity in time was not usually obtainable, pairs of readings were used which differed in time by amounts up to 4 hours. Shell-burst measurements are not usually taken at Shoeburyness on days when the surface wind is strong. The comparison does not therefore include such days. The highest shell-burst velocity included in the comparison was one of 82 m.p.h. while only a few exceeded 50 m.p.h. The following table indicates the results obtained, and these are also shown in the figure.

TABLE SHOWING PERCENTAGE FREQUENCY OF "ERRORS"
BETWEEN THE LIMITS SHOWN.

Miles per hour or degrees.

| -100 | -90 | -80 | -70 | -60 | -50 | -40 | -30 | -20 | -10 | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 |
|------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|
| Felixstowe (48 observations) | | | | | | | | | | | | | | | | | |
| Velocity | | | | | | | | | | | | | | | | | |
| | | | | 2 | 6 | 4 | - | 17 | 19 | 21 | 17 | 10 | | | 2 | 2 | |
| Direction | | | | | | | | | | | | | | | | | |
| | | 2 | 2 | 2 | 4 | 8 | | 21 | 28 | 4 | 17 | 6 | | | | | 2 |
| Croydon (20 observations) | | | | | | | | | | | | | | | | | |
| Velocity | | | | | | | | | | | | | | | | | |
| | | | | | | | | 10 | 25 | 25 | 20 | | | - | 10 | 10 | |
| Direction | | | | | | | | | | | | | | | | | |
| 5 | | 5 | | 5 | 5 | 10 | 5 | 5 | 10 | 45 | - | - | 5 | | | | |
| Kew (25 observations) | | | | | | | | | | | | | | | | | |
| Velocity | | | | | | | | | | | | | | | | | |
| | | | | 4 | - | 12 | | 8 | 12 | 16 | 16 | 16 | 4 | 4 | 4 | 8 | |
| Direction | | | | | | | | | | | | | | | | | |
| | | | | | | | 8 | - | 48 | 8 | 8 | 8 | 9 | 4 | 8 | | |

From these figures it is clear that nearly two-thirds of the errors in direction do not exceed 20° ; while for velocity slightly

over two-thirds do not exceed 20 m.p.h. As might be expected large errors, due no doubt to the clouds observed being at a very different height from the assumed 3 or 5 miles, are rather frequent.

Notes on the Cirro-Cumulus Cloud Observed on December 8th, 1926.

The photograph which forms the frontispiece of this number of the *Meteorological Magazine* was taken at 12h. 15m. on December 8th, 1926, and shows the remarkable development that occurred in a patch of cirro-cumulus cloud during the very short period in which it was visible between the sheets of strato-cumulus and cumulus at the time present in the sky.

When first seen, a sheet of dark strato-cumulus was clearing away (it may be seen in the bottom left-hand corner of the picture) and, in doing so, it disclosed a singularly clear-cut series of waves of cirro-cumulus, whose chief feature was the extreme sharpness of their edges. These did not fade gradually into the intervals of blue sky between them, but remained very definitely sharp and clear and strongly defined. This same effect is often seen when "lanes" of blue sky traverse a sheet of upper cloud which seems to be transitional between cirro-stratus and cirro-cumulus.

It took less than a minute to make my camera ready to take the picture, but by that time, short though the interval was, the smooth uniform waves had begun to thin out and a most unusual state of turbulence had been set up in them. A series of small "holes" almost like vortices, and very suggestive of "sunspots," rapidly formed across the waves at an angle, which if allowance be made for the angular elevation of the cloud, must have been between 45 and 60 degrees. These "vortices," if the term may be employed, were remarkable for the fact that their inner edges were exceedingly clearly defined, and seemed on account of their greater brilliance to be denser, or thicker, than the surrounding parts of the cloud, as though their sunward borders were reflecting more sunlight than did the opposite ones. I am tempted to think that perhaps there may have been a series of downward "bursts" of warmer or much drier air, particularly as this development marked the commencement of a rapid disintegration and disappearance of the bulk of the cloud, which had virtually vanished in less than the five minutes during which the lower cloud had permitted a view to be obtained.

The synoptic chart for that day shows a markedly "westerly" pressure distribution, pressure being high for the time of year (1022mb. at 7h., rising to 1025mb. at 13h.). The wind was light, backing from WSW (7h.) to SSW (18h.). The

weather was fair during the forenoon, but by 18h. had become cloudy with a widespread layer of alto-stratus or fused alto-cumulus. The pilot-balloons in the forenoon showed a north-westerly wind at 6,000 ft. with a sudden rise of velocity between 6,000 ft. and 8,000 ft. of about 50 per cent. It is possible therefore that the air in the upper layers was very much stratified, and considerable further differences in velocity may have existed at the still higher levels where this cloud was formed.

I have observed quite a number—and photographed a few—of these eddy-like disturbances in the upper cloud layers, but never in the whole of my observations have I seen so remarkable an example as the one just described.

G. A. CLARKE.

The Expedition of the *Marion*

The valuable work which is being done by the United States Coast Guard in maintaining the Ice Patrol* in the waters off Newfoundland, following the courses of dangerous icebergs and warning ships of their neighbourhood, is this year being extended by an expedition to the birthplace of the bergs in the fiords of western Greenland. For this purpose the *Marion* has been specially fitted out as a surveying ship, and was due to sail from Boston on July 12th, under the command of two oceanographers (Lieut.-Commander Edward H. Smith and Lieut. N. G. Rickets). In an account issued by the U.S. Coast-guard, it is stated that "the object of her quest is to learn everything possible regarding the behaviour of the icebergs from the time they break off the Greenland glaciers until they finally melt in the warm tropical waters of the North Atlantic." The investigation is especially directed towards the study of the complex currents of the region of Baffin Bay.

The programme of the *Marion* was to proceed first to Newfoundland and thence across to Greenland, a distance of 600 miles along which temperature and salinity soundings, and samples of the sea bottom, were to be taken at intervals of 25 miles. "Echo" soundings with the fathometer were also to be taken every half-hour, to order to provide detailed topography of the ocean-floor. The whole of the apparatus is electrically controlled, and a comparison of the equipment with that carried by the *Challenger* in 1872 illustrates the great changes which have taken place in the technique of oceanographical surveying in the past 56 years. Further, the *Marion* will be in touch with the world throughout by means of a short-wave radio. From the southern extremity of Greenland she will zig-zag backwards and forwards between the west coast of Greenland and

*See *Meteorological Magazine*, 60, 1925, p. 229.

the coast of Labrador, gradually proceeding northwards until that part of west Greenland is reached where the great bergs actually originate from the glaciers of the inland ice. Among the problems which it is hoped will be solved by these cross sections of temperature and salinity between Greenland and North America are the origin of the famous "North Water" and the extent to which a branch of the Gulf Stream influences the coast of west Greenland. It is also hoped that the echo soundings will result in the location of new fishing banks of economic value.

It is an interesting coincidence that the *Marion* was due to sail from Sydney, Nova Scotia, on July 17th, just twenty years to a day after Admiral Peary steamed from there in the *Roosevelt* on his last and successful drive for the North Pole. The cruise is expected to last about two months and to cover some 4,000 miles.

A later despatch from the United States Coast Guard reports that on August 8th the *Marion* had reached the base of the great Jakobshavn Glacier, in about 70°N, which is recognised as the birthplace of a large number of icebergs during spring and early summer.

Meteorological Observations in the Eastern Desert of Egypt

The *Geographical Journal* for August, 1928, contains (pp. 144-158) a paper by Mr. K. S. Sandford on "The Wadi Um Dud in the Eastern Desert of Egypt," which he visited in February, 1926. The region lies in latitude 27°N., long. 32°W., about 25 to 30 miles north-east of the Nile; the general altitude is about 1,000ft. above sea level. In view of the water-supply difficulties, the meteorological element of greatest interest is the rainfall, which is very spasmodic. "At rare intervals heavy rainstorms may be expected in this region; they flood the Wadi and a *seil* or torrent dashes down it, sweeping everything away and moving great blocks of stone. The signs of the passage of a *seil* are clear enough for years afterwards. . . . Periodically, however, lighter rain may be expected, which provides a less violent flood, often very localised . . . a few weeks later it is possible to mark the exact limits of the last rain by looking at the vegetation . . . There had been a number of local showers over the area, and our drinking-water was probably, in part at least, only a few months old."

Observations were taken with whirling thermometers on most afternoons, the highest temperature recorded being 81°F. at 2.15 p.m. on February 12th. On the 15th at 3.30 p.m. with a dry bulb of 77°F. a relative humidity of 28 per cent. was noted; but the readings were mostly between 30 and 50 per cent.

A minimum thermometer exposed each night gave an average

reading of about 32°F., with 27° on one occasion at 1,200ft. The prevailing wind in winter is from north; it commences at 9 to 9.30 a.m. and dies away about sundown; it is less marked in cloudy weather. In March this wind is replaced by a hot wind from south. Nights are still and cold with occasional gusty winds down the wadis. By day occasional gusts of wind blow up the wadis, especially in the early part of the morning.

Review

Metropolitan Water Board.—Twenty-second annual report on the results of the chemical and bacteriological examination of the London waters for the twelve months ended 31st December, 1927. By Sir Alexander Houston, Director of Water Examination, Metropolitan Water Board, Size 13 x 8in. pp. 101, illus., London. P. S. King and Son, Ltd., 1928, price 2ls.

Shrouded behind the official austerity of the above title, as Portia's portrait within its leaden casket, will be found not only the results indicated in the title, but also a further instalment of Sir Alexander Houston's characteristic and human word-paintings. This instalment describes in his own inimitable and entertaining way the gathering ground of the River Lee which supplies London with one-quarter of its water. The account, which appears under the title "The Lee as a source of water supply," extends to about one-half the volume. It does not pretend to concern itself only with water and the physical geography and geology of the area. In the author's own words:—

"Can anyone think of the lovely seas surrounding our shores, of the incomparable, although changeable skies above us, of the lovely mountains and kindly valleys, of the exquisite lakes and charming rivers of our beloved country, without passing into realms of romance? . . . If we add to the refrain of our song the historical setting of many of our water supplies, the music must surely stir the hearts and imagination of a wide circle of readers."

But, he says, in another place,

"the Philistines welcome no digressions; they see only the open road in front of them."

On the other hand

"others look to the beginning and end of things, the alluring surroundings of a subject, the association of ideas, the belief that there is nothing under the sun which is not related, in greater or less degree, to a thousand other things, which to unseeing eyes may seem to be irrelevant. These are the hill-top worshippers who regard everything in life as wonderful, and who, rightly or wrongly, fail to see why even questions of water supply should be ruthlessly shorn of all the elements of romance, and be regarded wholly and without sentiment as a matter of quantity, quality, and financial expediency. However these things may be, we have finished our meagre repast and enjoyed a friendly pipe."

And so we read about Izaak Walton and fishing, animals, birds, churches, men and things in large number. all interwoven with

a highly interesting and well-illustrated account of the River Lee from its source to Feilde's Weir, and of the country which it drains.

This kind of "report" must be of absorbing interest to readers of the "humanities" as well as to the specialists. But the author says—

"the last section, the results of analyses, should be ignored by the general reader; it is crammed with figures as dry as dust, and is meant only for the perusal of chemists, bacteriologists and technical experts who have to study these things for the good of their souls."

We think the author is here a little unkind to himself. Many who are not experts who have read the author's preliminary remarks will no doubt turn with anticipation to his tables and find points of interest in them.

We commend most warmly this further instalment of a highly successful attempt to invest with life the dry bones of official statistics, which are undoubtedly of general interest. We hope that the author and the Metropolitan Water Board will conspire to produce further similar investitures in due course and that on the next occasion they will turn their attention also to the title page, which might with advantage breathe a similar spirit and at least give a broader hint of the interesting things which lie behind its cover.

R. CORLESS.

Obituary

Captain Roald Amundsen.—With the discovery of part of the wreckage of the aeroplane in which Captain Roald Amundsen set out on June 18th in search of the wrecked *Nobile* party, it seems that all hope of finding Amundsen and his companions alive must now be abandoned. Amundsen was born at Borge, in Norway, in 1872. His interest was aroused by Nansen's successful crossing of the Greenland ice in 1888, and he attempted to join the Arctic expedition of the *Fram* in 1892. Disappointed in this, he joined the crew of a sealer in order to obtain training in Arctic work. At the age of 25 he was engaged as mate of the Belgian Antarctic expedition of 1897-9, and in 1903 he led an expedition in a small ship, the *Gjøa*, to the American Arctic Archipelago with the purpose of fixing anew the position of the north magnetic pole and re-discovering the north-west passage. The expedition lasted for three years and was successful in both its objects.

Amundsen's next ambition was to reach the North pole by drifting in the ice, but he was anticipated by Peary. He accordingly deflected the *Fram* to the Antarctic and reached the Ross Sea early in 1911. On October 20th, 1911, he set out across the ice and, favoured by fortune, reached the South pole on December 14th, five weeks before Captain Scott.

The Arctic project was not resumed until 1918, in the *Maud*, and met with great difficulties, which convinced Amundsen that Arctic exploration would be carried out most successfully by air. The first attempt, in 1922, was spoilt by stormy weather, but in 1925 he started from Spitsbergen with Lieut. Dietrichsen in two specially built flying boats, which reached $87^{\circ}43'N$ before being forced to come down. The party experienced great difficulty in returning to Spitsbergen in one of the machines, the other being abandoned.

In May, 1926, Amundsen and Ellsworth finally reached the North pole in the airship *Norge I*, which set out from Spitsbergen and continued across the Arctic Ocean to Alaska.

News in Brief

A note in *Nature* for August 18th, 1928, states that during a typhoon about 400 nautical miles east of Luzon readings of a mercurial barometer gave the abnormally low figure of 886.8mb., corrected for temperature, gravity and height. This reading, which was checked by several persons, is more than 30mb. lower than the previous "record" of 918.9mb. at False Point, Orissa, India, on September 22nd, 1885.

In a circular from the Observatoire Talence, M. Henri Mémery attributes the hot weather of July to the recrudescence of solar activity, in connexion with the sunspot maximum which appears to be located in 1928.

The Weather of August, 1928

Fair sunny weather prevailed generally in the south of England during August but further north, where sunshine and rainfall were both above normal in many places, the conditions were somewhat unsettled.

From the 1st to the evening of the 5th the weather over the country generally was fair and dry with the exception of south-eastern England where rain on the 1st and 3rd was associated with shallow depressions over southern England and northern France respectively. The amounts measured on the 1st were small but on the 3rd 2.08in. occurred at Blandford (Dorset) and 1.83in. at Jersey. The 5th was one of the sunniest days of the month, over 13hrs. bright sunshine being recorded at many places and 14.3hrs. at Jersey. During the night of the 5th-6th a depression off our north-west coasts caused rain in western Ireland and this spread across the whole country as the depression passed north-eastwards; 1.69in. fell at Douglas, 1.62in. at Fofanny (Co. Down), and 0.93in. at Dumfries on the 6th and 2.22in. at Borrowdale on the 7th. On the 8th the

south of England came under the influence of the anti-cyclone over France and fair sunny warm weather prevailed there generally until the 19th. Sunshine records were good on most days and temperature frequently rose above 70°F., 84°F. being recorded at Greenwich and 81°F. at Tottenham on the 11th. Over the rest of the British Isles fair weather prevailed from the 8th to 10th and again between the 15th and 18th., but from the 11th to 14th a depression passed across northern Ireland and Scotland giving rather heavy rain locally but many hours of sunshine; 1.22in. of rain fell at Eskdalemuir on the 11th. Thunderstorms occurred in many places on the 11th, 12th and 13th. From the 19th to 29th a belt of low pressure extended from the Atlantic across the British Isles to the North Sea, and was associated generally with slight rain though there were heavy falls locally, 2.59in. at Felixkirk (Yorks), 2.15in. at Geltsdale (Cumberland) on the 20th and 2.14in. at Chewton Mendip (Somerset) on the 27th. Thunderstorms occurred frequently but there were also long spells of bright sunshine. During the last two days of the month a ridge of high pressure spread across the whole country. The 30th was sunny but on the 31st there was slight rain locally in the south. Sunshine totals were generally above normal. The total of 195hrs. at Valentia was 40hrs. above normal, that of 187hrs. at Dublin, 25hrs. above normal, that of 20hrs. at Kew, 13hrs. above normal. At Stornoway the total was 2hrs. above normal, at Falmouth normal, but at Aberdeen 38hrs. below normal.

Pressure was above normal from Spitzbergen across Iceland to Newfoundland and Bermuda, and over central Europe, Italy, south France and Spain, the greatest excess being 9.6mb. at Jan Mayen. Pressure was below normal across Scandinavia, British Isles, northern Germany, western France to Portugal and the Azores, the greatest deficit being 4.1mb. in the Atlantic at about 50°N, 30°W. Generally temperature was above normal and rainfall below normal, except in southern Scandinavia, where the reverse was the case, and in Portugal, where the temperature was below normal.

Intense heat and dry weather broken by occasional severe thunderstorms in a few districts prevailed generally in south-western and central Europe during the first part of the month. Severe thunderstorms occurred in Switzerland and the Jura on the 3rd, 4th and 5th, in Bavaria on the 4th, in Portugal and south France on the 6th, in Alsace on the 12th and in central France about the 15th. Forest fires broke out in Savoy and other districts of France and in the Trentino and the Alpine glaciers melted rapidly this year. A hailstorm caused much damage to the crops between Haby and Mjaryd, Småland, Sweden on the 15th, and in spite of the heat, the hail is reported

to have remained in drifts for 24 hours. The heat wave which had continued for a month in Majorca came to an end about the 20th. Thunderstorms were again experienced in the neighbourhood of Geneva towards the end of the month and the vines were badly damaged. On the 29th a severe storm lasting about 15 minutes swept across Milan and caused ten deaths.

Five people were killed in a severe storm which devastated the town of Jijella (Algeria) and the coast between there and Bougie between 5.15 a.m. and 5.30 a.m. on the 17th.

The Amur (Siberia) and its tributaries continued to rise during the first part of the month and several hundred yards of railroad were swept away between Blagovyeschensk and Khabarovsk. Zeya (Siberia) was devastated by a storm followed by floods about the 29th. After 29 days of drought in Delhi and the greater part of the Punjab, rain fell steadily on the 22nd. It is hoped that it has come in time to save a part of the October crop. Heavy and continuous rain fell in the Bombay Presidency between the 25th and 30th and the crops are in good condition. Floods in the south-west of Weihsien in Shantung have caused the death by drowning of 1,800 people.

Favourable weather for harvesting was experienced in most parts of Canada and the crops were mostly good except that damage from frost occurred in Saskatchewan and parts of Alberta on the nights of the 22nd, 23rd, 24th, 28th and 30th. The heat wave which was experienced in New York and the whole of the Eastern seaboard at the beginning of the month came to an end about the 11th when severe rainstorms occurred. A hurricane which swept across Florida from east to west on the 8th and 9th did much damage to the crops and communications. A hurricane also passed across the greater part of Haiti on the 10th and here about 200 people were killed. Tornadoes were experienced in Minnesota and Iowa on the 20th when six people were killed. In New York State there were floods on the 27th owing to the rainstorms, and a heat wave between the 28th and 30th.

The special message from Brazil states that the rainfall was scarce in the southern and central regions, being 34mm. and 20mm. below normal respectively, and plentiful in the northern regions with 69mm. above normal. Six anticyclones passed across the country and windstorms were experienced in the extreme south. The crops were in good condition generally, except that in the north the cotton crop had suffered from unfavourable weather.

At Rio de Janeiro pressure was 1.3mb. above normal and temperature normal.

Rainfall, August, 1928—General Distribution

| | | | |
|-------------------|-----|------------|--------------------------------------|
| England and Wales | ... | 100 | } per cent. of the average 1881-1915 |
| Scotland | ... | 120 | |
| Ireland | ... | 132 | |
| British Isles | ... | <u>112</u> | |

Rainfall: August, 1928: England and Wales

| Co. | STATION | In. | Per- cent of Av. | Co. | STATION | In. | Per- cent of Av. |
|---------------|---------------------------|------|---------------------------|--------------------|---------------------------|-------|---------------------------|
| <i>Lond</i> | Camden Square | 2'60 | 118 | <i>Leics</i> | Thornton Reservoir ... | 2'81 | 100 |
| <i>Sur</i> | Reigate, The Knowle... | 2'62 | 114 | " | Belvoir Castle..... | 1'95 | 72 |
| <i>Kent</i> | Tenterden, Ashenden... | 1'50 | 65 | <i>Kut</i> | Ridlington | 3'02 | ... |
| " | Folkestone, Boro. San. | 1'55 | ... | <i>Linc</i> | Boston, Skirbeck | 1'68 | 70 |
| " | Margate, Cliftonville... | 1'20 | 62 | " | Lincoln, Sessions House | 4'32 | 176 |
| " | Sevenoaks, Speldhurst | 3'07 | ... | " | Skegness, Marine Gdns | 1'72 | 71 |
| <i>Sus</i> | Patching Farm | 2'08 | 83 | " | Louth, Westgate | 2'90 | 104 |
| " | Brighton, Old Steyne | 1'87 | 86 | " | Brigg, Wrawby St. ... | 4'29 | ... |
| " | Tottingworth Park | 1'62 | 60 | <i>Notts</i> | Worksop, Hodsock ... | 2'05 | 84 |
| <i>Hants.</i> | Ventnor, Roy. Nat. Hos. | 3'02 | 152 | <i>Derby</i> | Derby | 3'09 | 118 |
| " | Fordingbridge, Oaklnds | 2'41 | 92 | " | Buxton, Devon Hos. ... | 5'31 | 121 |
| " | Ovington Rectory | 2'46 | 91 | <i>Ches</i> | Runeorn, Western Pt. | 3'73 | 104 |
| " | Sherborne St. John ... | 2'69 | 111 | " | Nantwich, Dorfold Hall | 3'23 | ... |
| <i>Berks</i> | Wellington College | 2'16 | 93 | <i>Lancs</i> | Manchester, Whit. Pk. | 4'89 | 142 |
| " | Newbury, Greenham... | 2'15 | 82 | " | Stonyhurst College ... | 8'11 | 160 |
| <i>Herts</i> | Benington House | 2'43 | 100 | " | Southport, Hesketh Pk | 3'12 | 90 |
| <i>Bucks</i> | High Wycombe | 2'65 | 114 | " | Lancaster, Strathspey | 6'04 | ... |
| <i>Oxf</i> | Oxford, Mag. College | 1'36 | 60 | <i>Yorks</i> | Wath-upon-Deerne ... | 2'09 | 87 |
| <i>Nor</i> | Pitsford, Sedgebrook... | 1'79 | 74 | " | Bradford, Lister Pk. ... | 3'92 | 145 |
| " | Oundle | 1'47 | ... | " | Oughtershaw Hall..... | 7'82 | ... |
| <i>Reds</i> | Woburn, Crawley Mill | 2'77 | 120 | " | Wetherby, Ribston H. | 4'53 | 166 |
| <i>Cam</i> | Cambridge, Bot. Gdns. | ... | ... | " | Hull, Pearson Park ... | 3'71 | 128 |
| <i>Essex</i> | Chelmsford, County Lab | 2'72 | 125 | " | Holme-on-Spalding | 3'56 | ... |
| " | Lexden, Hill House ... | 2'26 | ... | " | West Witton, Ivy Ho. | 5'36 | ... |
| <i>Suff</i> | Hawkedon Rectory ... | 1'84 | 71 | " | Felixkirk, Mt. St. John | 5'10 | 179 |
| " | Haughley House | 2'02 | ... | " | Pickering, Hungate ... | 3'17 | ... |
| <i>Norfol</i> | Beccles, Geldeston | ... | ... | " | Scarborough | 3'75 | 135 |
| " | Norwich, Eaton..... | 1'80 | 76 | " | Middlesbrough | 3'42 | 125 |
| " | Blakeney..... | 3'00 | 133 | " | Baldersdale, Hury Res. | 5'78 | ... |
| " | Little Dunham | 2'28 | 84 | <i>Durh</i> | Ushaw College | 3'48 | 120 |
| <i>Wilts</i> | Devizes, Highclere | 2'43 | 84 | <i>Nor</i> | Newcastle, Town Moor | 4'35 | 149 |
| " | Bishops Cannings | 2'80 | 90 | " | Bellingham, Highgreen | 3'48 | ... |
| <i>Dor</i> | Evershot, Melbury Ho. | 1'94 | 62 | " | Lilburn Tower Gdns. ... | 4'47 | ... |
| " | Creech Grange | 2'49 | ... | <i>Cumb</i> | Geltsdale..... | 7'81 | ... |
| " | Shaftesbury, Abbey Ho. | 2'53 | 87 | " | Carlisle, Scaleby Hall | 6'52 | 158 |
| <i>Devon</i> | Plymouth, The Hoe ... | 2'12 | 69 | " | Borowdale, Rothwaite | 12'59 | ... |
| " | Polapit Tamar | 3'51 | 110 | " | Keswick, High Hill ... | 7'83 | ... |
| " | Ashburton, Druid Ho. | 2'96 | 79 | <i>Glam</i> | Cardiff, Ely P. Stn. ... | 4'06 | 94 |
| " | Cullompton..... | 1'72 | 56 | " | Treherbert, Tynywaun | 7'98 | ... |
| " | Sidmouth, Sidmount... | 2'03 | 72 | <i>Carm</i> | Carmarthen Friary ... | 4'78 | 103 |
| " | Filleigh, Castle Hill ... | 4'12 | ... | " | Llanwrda, Dolaucothy | 6'64 | 121 |
| " | Barnstaple, N. Dev. Ath. | 2'94 | 89 | <i>Pemb</i> | Haverfordwest, School | 3'95 | 95 |
| <i>Corn</i> | Redruth, Trewirgie ... | 2'19 | 64 | <i>Card</i> | Aberystwyth | 6'73 | ... |
| " | Penzance, Morrab Gdn. | 2'19 | 69 | " | Cardigan, County Sch. | 2'55 | ... |
| " | St. Austell, Trevarna... | 3'17 | 88 | <i>Brec</i> | Crickhowell, Talymaes | 4'70 | ... |
| <i>Soms</i> | Chewton Mendip | 5'41 | 121 | <i>Rad</i> | Birm W. W. Tyrmynydd | 6'57 | 122 |
| " | Long Ashton | 3'15 | ... | <i>Mont</i> | Lake Vyrnwy..... | 7'41 | 143 |
| " | Street, Hind Hayes ... | 1'95 | ... | <i>Denb</i> | Llangynhafal | 3'31 | ... |
| <i>Glos.</i> | Cirencester, Gwynfa ... | 2'05 | 68 | <i>Mer</i> | Dolgelly, Bryntirion... | 7'80 | 138 |
| <i>Here</i> | Ross, Birchlea | 2'03 | 79 | <i>Carn</i> | Llandudno | 2'48 | 82 |
| " | Ledbury, Underdown | 2'35 | 90 | " | Snowdon, L. Llydaw 9 | 14'15 | ... |
| <i>Salop</i> | Church Stretton..... | 3'48 | 107 | <i>Ang</i> | Holyhead, Salt Island | 2'96 | 93 |
| " | Shifnal, Hatton Grange | 2'94 | 105 | " | Lligwy | 3'83 | ... |
| <i>Worc</i> | Ombersley, Holt Lock | 1'40 | 52 | <i>Isle of Man</i> | Douglas, Boro' Cem. ... | 5'16 | 136 |
| " | Blockley, Upton Wold | 2'41 | 82 | " | | | |
| <i>War</i> | Farnborough | 1'67 | 61 | <i>Guernsey</i> | St. Peter P't. Grange Rd. | 1'89 | 81 |
| " | Birmingham, Edgbaston | 1'79 | 66 | | | | |

Rainfall: August, 1928: Scotland and Ireland

| Co. | STATION | In. | Per- cent of Av. | Co. | STATION | In. | Per- cent of Av. |
|-------------------|---------------------------|-------|---------------------------|---------------|---------------------------|------|---------------------------|
| <i>Wigt.</i> | Stoneykirk, Ardwell Ho | 3'51 | 67 | <i>Suth.</i> | Loch More, Achfary ... | ... | ... |
| " | Pt. William, Monreith | 4'41 | ... | <i>Caith.</i> | Wick | 2'01 | 73 |
| <i>Kirk.</i> | Carsphairn, Shiel. | 9'13 | ... | <i>Ork.</i> | Pomona, Deerness | 1'35 | 47 |
| " | Dumfries, Cargen | 6'87 | 156 | <i>Shet.</i> | Lerwick | 3'02 | 100 |
| <i>Dumf.</i> | Eskdalemuir Obs. | 9'48 | 184 | <i>Ork.</i> | Caheragh Rectory | 4'98 | ... |
| <i>Roxb.</i> | Bransholm | 6'94 | 215 | " | Dunmanway Rectory... | 5'12 | 109 |
| <i>Selk.</i> | Ettrick Manse | 8'35 | ... | " | Ballinacurra | 6'21 | 167 |
| <i>Peeb.</i> | West Linton | 5'61 | ... | " | Glaumire, Lota Lo. | 6'28 | 172 |
| <i>Berk.</i> | Marchmont House | 4'40 | 133 | <i>Kerry.</i> | Valentia Obsy. | 8'68 | 181 |
| <i>Hadd.</i> | North Berwick Res. | 4'27 | 135 | " | Gearahameen | 9'80 | ... |
| <i>Midt.</i> | Edinburgh, Roy. Obs. | 4'85 | 157 | " | Killarney Asylum | 4'58 | 104 |
| <i>Ayr.</i> | Kilmarnock, Agric. C. | 4'31 | 110 | " | Darrynane Abbey | 5'61 | 129 |
| " | Girvan, Pimmore | 5'28 | 119 | <i>Wat.</i> | Waterford, Brook Lo. | 4'55 | 119 |
| <i>Renf.</i> | Glasgow, Queen's Pk. . | 3'20 | 90 | <i>Tip.</i> | Nenagh, Cas. Lough... | 4'00 | 101 |
| " | Greenock, Prospect H. | 5'38 | 99 | " | Roscrea, Timoney Park .. | 4'36 | ... |
| <i>Bute.</i> | Rothsary, Ardeneraig . | 4'98 | 102 | " | Cashel, Ballinamona .. | 5'09 | 143 |
| " | Dougarie Lodge | 4'50 | ... | <i>Lan.</i> | Foynes, Coolnanes | 5'04 | 130 |
| <i>Arg.</i> | Ardgour House | 7'39 | ... | " | Castleconnel Rec. | 4'30 | ... |
| " | Manse of Glenorchy ... | 7'30 | ... | <i>Clare.</i> | Inagh, Mount Callan... | 5'78 | ... |
| " | Oban | 5'37 | ... | " | Broadford, Hurdlest'n. | 5'64 | ... |
| " | Poltalloch | 4'42 | 90 | <i>Wexf.</i> | Newtownbarry | 5'71 | ... |
| " | Inveraray Castle | 7'79 | 118 | " | Gorey, Courtown Ho .. | 6'17 | 185 |
| " | Islay, Eallabus | 5'42 | 124 | <i>Kilk.</i> | Kilkenny Castle | 4'74 | 136 |
| " | Mull, Benmore | 10'20 | ... | <i>Wic.</i> | Rathnew, Clonmannon .. | 4'95 | ... |
| " | Tiree | 3'35 | ... | <i>Carl.</i> | Hacketstown Rectory... | 5'28 | 130 |
| <i>Kinr.</i> | Loch Leven Sluice | 5'46 | 143 | <i>QCo.</i> | Blandsfort House | 4'23 | 107 |
| <i>Perth.</i> | Loch Dhu | 8'75 | 130 | " | Mountmellick | 4'36 | ... |
| " | Balquhiddel, Stronvar | 6'21 | ... | <i>KCo.</i> | Birr Castle | 4'10 | 108 |
| " | Crieff, Strathearn Hyd. | 6'04 | 143 | <i>Dubl.</i> | Dublin, FitzWm. Sq. | 2'48 | 82 |
| " | Blair Castle Gardens ... | 5'47 | 162 | " | Balbriggan, Ardgillan. | 3'25 | 95 |
| <i>Forf.</i> | Kettins School | 4'01 | 121 | <i>Me'th.</i> | Beaupare, St. Cloud... | 3'46 | ... |
| " | Dundee, E. Necropolis | 5'18 | 153 | " | Kells, Headfort | 5'71 | 138 |
| " | Pearsie House | 6'98 | ... | <i>W.M.</i> | Moate, Coolatore | 5'23 | ... |
| " | Montrose, Sunnyside... | 3'67 | 131 | " | Mullingar, Belvedere... | 4'24 | 126 |
| <i>Aber.</i> | Braemar, Bank | 5'64 | 165 | <i>Long.</i> | Castle Forbes Gdns | 5'21 | 127 |
| " | Logie Coldstone Sch. | 4'28 | 135 | <i>Gal.</i> | Ballynahinch Castle ... | 8'49 | 154 |
| " | Aberdeen, King's Coll. | 2'31 | 84 | " | Galway, Grammar Sch. | 5'97 | ... |
| " | Fyvie Castle | 3'55 | ... | <i>Mayo.</i> | Mallaranny | 6'56 | ... |
| <i>Mor.</i> | Gordon Castle | 3'20 | 101 | " | Westport House | 5'24 | 129 |
| " | Grantown-on-Spey | 4'55 | 142 | " | Delphi Lodge | 9'59 | ... |
| <i>Na.</i> | Nairn, Delnies | 3'17 | 132 | <i>Sligo.</i> | Markree Obsy | 6'07 | 140 |
| <i>Inv.</i> | Ben Alder Lodge | ... | ... | <i>Cuv'n.</i> | Belturbet, Cloverhill... | 5'07 | 136 |
| " | Kingussie, The Birches | 4'20 | ... | <i>Ferm.</i> | Enniskillen, Portora... | ... | ... |
| " | Loch Quoich, Loan ... | 7'00 | ... | <i>Arm.</i> | Armagh Obsy | 6'86 | 190 |
| " | Glenquoich | 8'33 | 101 | <i>Down.</i> | Fofanny Reservoir | 6'30 | ... |
| " | Inverness, Culduthel R. | 3'95 | ... | " | Seaford | 4'28 | 114 |
| " | Arisaig, Faire-na-Squir | 3'19 | ... | " | Donaghadee, C. Stn ... | 4'37 | 131 |
| " | Fort William | 5'71 | ... | " | Banbridge, Milltown... | 4'05 | 116 |
| " | Skye, Dunvegan | 4'31 | ... | <i>Antr.</i> | Belfast, Cavehill Rd ... | 4'27 | ... |
| <i>R & C.</i> | Alness, Ardross Cas. | 5'26 | 178 | " | Glenarm Castle | 5'09 | ... |
| " | Ullapool | 3'53 | ... | " | Ballymena, Harryville | 4'57 | 131 |
| " | Torridon, Bendamph... | 4'49 | 68 | <i>Lon.</i> | Londonderry, Creggan | 6'31 | 136 |
| " | Achnashellach | 4'67 | ... | <i>Tyr.</i> | Donaghmore | 5'62 | ... |
| " | Stornoway | 2'19 | 55 | " | Omagh, Edenfel. | 6'34 | 148 |
| <i>Suth.</i> | Lairg | 2'86 | ... | <i>Don.</i> | Malin Head | 4'75 | 135 |
| " | Tongue | 3'28 | 103 | " | Dunfanaghy | 6'49 | ... |
| " | Melvich | 2'51 | 84 | " | Killybegs, Rockmount. | 6'91 | 123 |

Climatological Table for the British Empire, March, 1928.

| STATIONS | PRESSURE | | TEMPERATURE | | | | | | Relative Humidity. | Mean Cloud Am't | PRECIPITATION | | | BRIGHT SUNSHINE | | |
|-------------------------|--------------------|-------------------|-------------|------|-------------|------|-------------------|-------------------|--------------------|-----------------|------------------|-------------------|------|-----------------|------------------------|---------------|
| | Mean of Day M.S.L. | Diff. from Normal | Absolute | | Mean Values | | | | | | Am't from Normal | Diff. from Normal | Days | Hours per day | Percentage of possible | |
| | | | Max. | Min. | Max. | Min. | 1/2 max. and min. | Diff. from Normal | | | | | | | | Mean Wet Bulb |
| | | | | | | | | | | | | | | | | |
| London, Kew Obsy. | 1009.6 | -3.8 | 64 | 27 | 50.7 | 39.0 | 44.9 | +2.5 | 39.9 | 8.5 | 1.73 | 0.04 | 17 | 3.0 | 25 | |
| Gibraltar | 1015.4 | -1.6 | 72 | 47 | 63.1 | 52.5 | 57.8 | +0.3 | 52.1 | 6.4 | 4.49 | 0.30 | 20 | .. | .. | |
| Malta | 1013.5 | -1.3 | 63 | 47 | 59.5 | 52.5 | 56.0 | -1.1 | 53.3 | 6.8 | 4.32 | 2.84 | 18 | 5.3 | 44 | |
| St. Helena | 1011.9 | +2.4 | 73 | 58 | 68.9 | 60.7 | 64.8 | -2.0 | 61.9 | 8.4 | 5.45 | 0.51 | 25 | .. | .. | |
| Sierra Leone | 1011.2 | +0.5 | 92 | 71 | 88.9 | 75.3 | 82.1 | -0.3 | 75.6 | 3.8 | 1.68 | 0.52 | 4 | .. | .. | |
| Lagos, Nigeria | 1008.6 | -0.8 | 89 | 70 | 87.0 | 77.3 | 82.1 | -1.2 | 77.3 | 8.7 | 8.20 | 4.46 | 12 | .. | .. | |
| Kaduna, Nigeria | 1014.3 | +3.2 | 99 | .. | 94.5 | .. | .. | .. | 74.2 | .. | 1.21 | 0.77 | 3 | .. | .. | |
| Zomba, Nyasaland | 1010.1 | +0.4 | 86 | 60 | 80.5 | 64.2 | 72.3 | +1.0 | .. | 8.6 | 11.40 | 2.32 | 23 | .. | .. | |
| Salisbury, Rhodesia | 1008.9 | -0.3 | 84 | 52 | 80.4 | 58.9 | 69.7 | +1.5 | 62.0 | 6.1 | 3.09 | 1.41 | 17 | 7.5 | 61 | |
| Cape Town | 1014.8 | +0.3 | 100 | 53 | 77.5 | 58.6 | 68.1 | 0.0 | 59.7 | 4.6 | 0.57 | 0.34 | 7 | .. | .. | |
| Johannesburg | 1014.2 | +0.4 | 83 | 45 | 75.1 | 54.6 | 64.9 | +1.6 | 55.3 | 3.1 | 2.45 | 1.99 | 7 | 8.3 | 68 | |
| Mauritius | 1011.6 | -0.4 | 86 | 64 | 83.3 | 72.1 | 77.7 | -0.3 | 74.8 | 7.5 | 6.46 | 2.91 | 17 | 8.3 | 68 | |
| Bloufontein | .. | .. | 90 | 43 | 79.6 | 56.6 | 68.1 | +0.7 | 58.6 | 4.1 | 2.27 | 1.70 | 8 | .. | .. | |
| Calcutta, Alipore Obsy. | 1009.8 | -0.1 | 101 | 60 | 96.1 | 70.5 | 83.3 | +3.2 | 69.4 | 7.3 | 0.13 | 1.31 | 1* | .. | .. | |
| Bombay | 1010.4 | -0.5 | 91 | 67 | 86.4 | 73.5 | 79.9 | +0.4 | 71.1 | 1.0 | 0.00 | 0.02 | 0* | .. | .. | |
| Madras | 1010.7 | -0.2 | 95 | 63 | 90.2 | 70.9 | 80.5 | -0.6 | 73.4 | 2.6 | 1.04 | 0.85 | 3* | .. | .. | |
| Colombo, Ceylon | 1010.7 | +0.3 | 92 | 69 | 89.3 | 73.7 | 81.0 | -0.3 | 76.5 | 5.6 | 3.65 | 1.02 | 7 | 9.0 | 74 | |
| Hongkong | 1014.4 | -1.7 | 78 | 53 | 67.3 | 60.2 | 63.7 | +0.4 | 60.7 | 8.8 | 5.19 | 2.40 | 15 | 2.8 | 23 | |
| Sandakan | .. | .. | 91 | 74 | 87.8 | 75.4 | 81.6 | +0.5 | 77.8 | .. | 15.00 | 6.95 | 12 | .. | .. | |
| Sydney | 1016.2 | 0.0 | 89 | 55 | 78.6 | 63.8 | 71.2 | +1.9 | 66.4 | 4.4 | 4.46 | 0.33 | 11 | 7.6 | 62 | |
| Melbourne | 1016.7 | -0.3 | 97 | 48 | 76.4 | 58.7 | 67.5 | +3.0 | 61.2 | 6.6 | 4.18 | 1.92 | 10 | 6.3 | 51 | |
| Adelaide | 1016.2 | -0.9 | 104 | 52 | 81.2 | 59.1 | 70.1 | +0.3 | 59.0 | 4.5 | 1.05 | 0.00 | 4 | 7.7 | 63 | |
| Perth, W. Australia | 1015.2 | -0.1 | 99 | 52 | 79.8 | 59.8 | 69.8 | -1.3 | 61.9 | 6.0 | 0.10 | 0.65 | 3 | 9.3 | 76 | |
| Coorgardie | 1014.3 | -0.5 | 108 | 46 | 85.4 | 57.9 | 71.7 | 0.0 | 57.5 | 4.8 | 0.78 | 0.04 | 4 | .. | .. | |
| Brisbane | 1016.7 | +2.3 | 87 | 61 | 82.5 | 66.0 | 74.3 | 0.0 | 68.8 | 5.4 | 2.14 | 3.42 | 14 | 8.6 | 69 | |
| Hobart, Tasmania | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | |
| Wellington, N.Z. | 1020.2 | +3.0 | 75 | 46 | 68.0 | 55.6 | 61.8 | +1.3 | 59.0 | .. | 1.38 | 1.95 | 9 | 6.2 | 50 | |
| Suva, Fiji | 1008.7 | +0.2 | 92 | 73 | 86.8 | 76.0 | 81.4 | +1.3 | 77.9 | 7.8 | 16.39 | 1.69 | 24 | 5.6 | 46 | |
| Apia, Samoa | 1009.6 | +0.4 | 89 | 75 | 85.6 | 76.6 | 81.1 | +1.8 | 78.8 | 6.0 | 15.78 | 2.24 | 17 | 6.1 | 50 | |
| Kingston, Jamaica | 1014.9 | 0.0 | 89 | 66 | 85.1 | 68.7 | 76.9 | -0.2 | 66.8 | 8.1 | 0.11 | 0.91 | 2 | 8.7 | 73 | |
| Grenada, W.I. | 1010.4 | 2.3 | 88 | 69 | 85.5 | 72.0 | 78.7 | +1.0 | 73.0 | 4.5 | 2.17 | 0.57 | 14 | .. | .. | |
| Toronto | 1012.4 | -4.6 | 71 | 9 | 37.6 | 23.6 | 30.6 | +1.7 | 25.4 | 7.1 | 2.22 | 0.43 | 18 | 4.9 | 41 | |
| Winnipeg | 1017.7 | -1.1 | 62 | -14 | 30.5 | 12.4 | 21.5 | +7.1 | .. | 4.7 | 1.54 | 0.43 | 9 | 5.2 | 41 | |
| St. John, N.B. | 1012.9 | -1.3 | .. | .. | 34.6 | 22.5 | 28.5 | +0.1 | .. | 6.3 | 2.09 | 2.45 | 16 | 5.1 | 43 | |
| Victoria, B.C. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | |

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

CRANWELL

15 DEC 1929

METEOROLOGICAL
OFFICE



HAIL LYING A FOOT DEEP IN THE ROADWAY, THE MALL, ARMAGH, AUGUST 29TH, 1928. (*See p. 208.*)



THE FLOODED CRICKET FIELD IN THE MALL, ARMAGH, UNDER 2 TO 3 FT. OF WATER, AUGUST 29TH, 1928. THE FLOATING WHITE MASSES ARE HAIL. (*See p. 208.*)

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