MINUTES OF THE TORONTO MEETING

(Concluded from Aug.-Sept. BULLETIN, pp. 118-122)

MR. F. J. W. WHIPPLE—*The Diurnal Variation of Pressure: Facts and Theories.*

The regular oscillation of pressure shows remarkable regularities all over the globe, and it is, therefore, probable that it is connected in a simple way with its cause. The object of this paper is to emphasise the fact that there is an opening here for speculation as well as for more analysis of the records. The preparation of critical tables of pressure at places where barographs have been maintained for long periods requires international co-operation. Observational material is exceptionally rich in the British Isles, where a number of photographic barographs properly compensated for temperature changes and with open time-scales have been in operation for more than fifty years. The British records indicate that the average diurnal variation of pressure for a given time of year can be regarded as due to the combination of a nocal wave (a pure sine-curve) and a planetary wave. The planetary wave is not a pure sine curve; the changes in its form conform closely to changes in the sun's declination. It is pointed out that these facts are difficult to reconcile with Lord Kelvin's resonance hypothesis, and in conclusion other objections to that hypothesis are also mentioned.

DR. S. CHAPMAN discussed the paper. He remarked that the horizontal motion of the atmosphere attending the diurnal variation of pressure was 6 km.

PROF. W. J. HUMPHREYS—*The Relation of Wind to Height.*

On the average, perhaps, and especially on the equatorial side of cyclones, the wind varies as follows with height: Increases rapidly, but decreasingly so, with height up to 400 to 500 metres above the surface; then decreases slightly through, say, 300 metres; after this increases a little, and then remains, roughly, constant up to round 2,000 to 3,000 metres above the surface; here again often slightly decreases; and then through the next several kilometres increases in proportion to decrease of density. Directions of the wind and its temperature also are interestingly related to height above the surface.

All these observed facts are plausibly explained as effects of mechanical and thermal turbulence.

MR. J. BJERKNES—*The Importance of Atmospheric Discontinuities for Practical and Theoretical Weather Forecasting.*

Empiric investigations show that new-formed depressions usually consist of two oppositely directed air currents, the one warm and the other cold. Initially each current occupies about one-half of the region covered by the depression. The area of the cold air is, however, always increasing, and finally it embraces the whole of the depression in the lower layers. The warm air covers at the ground a correspondingly decreasing space (the warm sector). During the development of the depression, air from the warm sector will escape upwards and spread in higher layers. This motion involves a transformation from potential into kinetic energy (strengthening of the wind and deepening of the de-

pression). The kinetic energy of the depression decreases again as soon as there is merely cold air supply available for the ascending motion. The temperature distribution in the depression thus gives useful indications concerning the expected development.

The result may be formulated mathematically as an equation giving the acceleration of the different air masses relatively to each other. One may thus, at least theoretically, arrive at a mathematical forecast, provided that sufficient observational data are at hand. This is exemplified in a depression passing Central Europe on February 1, 1923.

MR. L. F. RICHARDSON—*Turbulence and Temperature-gradient among Trees.*

The writer has previously derived from theory a criterion for the increase of turbulence, applicable at a height in the free air great compared with the irregularities of the ground. By contrast the present investigation relates to observations made among trees. The temperature gradient was measured by a pair of thermo-junctions placed at different heights. This is compared with the gustiness as shown by a Dines pressure-tube anemometer.

SIR NAPIER SHAW discussed the parallel iron plate method used by Mr. Richardson for protecting his thermo-junctions from radiation. SIR FREDERIC STUPART remarked that the deforestation of the United States seems to have affected Canadian temperatures.

DR. J. S. OWENS—*The Automatic Measurement of Atmospheric Pollution.*

Refers especially to results of the automatic recorder designed by the author for the Advisory Committee on Atmospheric Pollution. The function of this is to measure the pollution of city air by smoke. A short description and references to fuller descriptions are given. The results obtained in London by this apparatus are compared with those of the author's dust counter (*Proc. Roy. Soc. A.*, Vol. 101, 1922) and show a good correspondence. Curves obtained by both methods in investigating the effect of suspended matter on obstruction of light are given; the relation between obstruction and dust content is shown to be nearly a straight-line one. From this comparison it appears that 1 milligramme of dust per cubic metre has the same effect as about 10,000 particles per cubic centimetre; thus 10^{10} smoke particles weigh 1 mg. approximately. The size of suspended dust particles is fairly uniform, but tends to increase during smoke fogs, probably due to their rapid formation giving insufficient time for grading by settlement.

MR. J. PATTERSON—*Upper Air Observations in Canada.*

Upper-air observations were commenced in Canada in 1911, but were partially interrupted by the war. It has not yet been possible to get balloons for carrying instruments equal to those of pre-war days; there are, however, good prospects of overcoming this handicap in the near future. During the past year an automatic apparatus for calibrating the meteorographs has been installed and the Dines meteorograph simplified. The results of the sounding balloon ascents during the past five years and the observations with pilot balloons in the Arctic will be dis-

cussed, together with the prospects of permanently extending the field of observations in the upper air to this region.

PROF. H. H. KIMBALL—*The Determination of Daylight Intensity from Automatic Records of Total Solar and Sky Radiation.*

Colour temperatures of sunlight and skylight, and the spectrum energy curves of radiation from the sun and from the sky, have been utilised to determine approximately the spectrum energy curve of the total radiation received on a horizontal surface, and its variation with atmospheric transmissibility and the solar zenith distance.

A comparison of these latter curves with the curve of "visibility of radiation" permits a prediction to be made of the variations to be expected in the ratio between the intensities of the vertical components of daylight and of the total solar and sky radiation.

This ratio has also been determined experimentally by comparing photometric measurements of daylight illumination on a horizontal surface with continuous records of the total solar and sky radiation made by a U. S. weather bureau thermoelectric pyrheliometer horizontally exposed.

The above investigations have been confined to skies that were either cloudless or else completely covered with clouds.

PROF. W. J. HUMPHREYS—*Rainmaking.*

Several of the more persistently urged schemes for producing rain are considered in respect to the underlying principles involved, and measured quantitatively to determine the question of their practical use.

These schemes include, especially: the production of loud noises; the use of chemicals; mechanical or forced convection; fog-collecting screens; dusting the sky; spraying liquid air on to clouds; and sprinkling clouds with electrified sand.

None of these rainmaking methods is practicable in the commercial sense of the term; but each, when treated quantitatively, is full of meteorological interest.

PROF. C. F. MARVIN—*Let us Simplify the Calendar and Publish Statistical Data in Standarized Summaries.*

Great masses of statistical data covering the fields of meteorology, yields and prices of crops, business and economic conditions, panics, &c., are now being annually accumulated.

To be fully useful to students for analysis in any of these fields these data need to be appropriately assembled, summarised in suitable units of time and sectional area or representative groups, and promptly, regularly, and systematically published. This is not now being done sufficiently, either with reference to much available data of past years or comprehensively for the future.

Our complex and awkward calendar, with months of unequal lengths made up of four weeks plus 0, 1, 2, or 3 days, apportioned according to the envy and whim of an old Roman Emperor, absolutely prohibits orderly and rational summaries of statistical data in suitable units of conveniently increasing time.

Let us promote the adoption of the simple equal-month calendar many others are now advocating, and thus make it easy, for all future time at least, to summarise data in units of weeks, fortnights, four-week months, thirteen-week quarters, and years of fifty-two exact weeks. It is an easy matter to absorb the unavoidable extra day in common years and the two such extra days in leap years.

Publication of detailed data *in extenso* is generally prohibitive because of the enormous mass available, and because investigators cannot undertake the huge task of making the necessary summaries. It is hoped and recommended that the meteorologists may set a good example to scientists dealing with great bodies of statistical data, by helping to secure calendar simplification, and to agree upon some standard superficial units of continental areas for which summaries of standard and representative data should be published.

These ideas have reference very largely to starting a system at the present time that will bring great benefits to future generations and posterity. To reap these same benefits ourselves we must wipe out the awkward summaries of back data we now use, and compute new summaries on the simplified-calendar basis. It will suffice if this be done for simply the major meteorological elements, and when we recall that the task might easily be apportioned among the many thousands of observers constantly on duty, the desired result can easily be attained.

PRESIDENTIAL ADDRESS by PROF. J. W. GREGORY, F.R.S., on *Inter-racial Problems and White Colonisation in the Tropics.*

(See pp. 113-118 in Aug.-Sept. BULLETIN).

DR. VAUGHAN CORNISH—*Wind, Wave, and Swell on the North Atlantic Ocean.*

During a voyage from Southampton to Trinidad and back by R.M.S. *Oruba* the author took the period of the waves several times daily, from which their speed was calculated. The speed of the wind was ascertained by means of a Robinson anemometer lent by the Meteorological Office.

The speed of the wind ranged from 13.9 to 23.6 statute miles per hour. That of the waves was in all cases less, the difference ranging from 1.0 mile an hour to a little more than 8.0 miles an hour. When swell and wave ran precisely in the same direction, and on one day when no swell was recorded, the speed of the wave was so nearly equal to that of the wind that the breeze blowing over the ridges was only equal to the "light air" which barely suffices to give steerage way to a fishing smack, and would be detected on land by drift of smoke, but would not move a wind-vane.

When the swell followed, but crossed the wave, the difference in speed of wind and wave was greater, and the difference increased rapidly when the crossing swelling swell was meeting, instead of following, the wave. When the waves were much slower than the wind their height was always small, and sometimes their fronts were short and irregular. It was evident that the growth of waves in both length and height was

much hindered by a crossing swell, and it can be safely inferred that the general absence of swell upon enclosed seas favours the rapid rise of waves.

The general run of the waves on the ocean shows the direction of the wind reliably. The direction of a breaker out at sea is intermediate between that of wave and swell—the breaker being formed when they override—so that the practice of observing the direction of the curl on the water as a method of determining the direction of the wind, gives an erroneous result whenever there is a crossing swell, which is usually the condition on oceans.

DR. W. H. HOBBS—*The Glacial Anticyclone.*

MR. R. A. FISHER—*Incidence of Rainfall in Relation to the Wheat Crop.*