NOTES, ABSTRACTS, AND REVIEWS.

THE FUNDAMENTAL EQUATIONS IN THE HYDROLOGY OF RIVER REGIONS.

By KARL FISCHER.

[Abstracted from translation made by W. W. Reed from *Meteorologische Zeitschrift*, 1921, pp. 331-336.]

The author discusses the fundamental equations in the hydrology of rivers. These equations are necessarily based upon one's conception of the relative quantities of water vapor originating over oceans and land areas, respectively. Since the amount of water vapor carried by ocean winds that pass over continental areas is not susceptible of definite determination and, moreover, since the moisture that falls as rain on land areas may be reevaporated, not only once but several times, the discussion of the relations between these quantities and the run-off from land areas must naturally take on an academic character.

The author starts with the simple proposition,

$$N = A + V \qquad (1)$$

where N is the amount received at the surface of the ground, A is the run-off, and V is the evaporation.

His second step is to consider the quantity of water vapor carried by the air which passes over any watershed.

The author distinguishes by M the amount of water vapor coming, in the last analysis, from the sea: over against this is placed the run-off, A, as before, and, E, the amount of water vapor escaping (evaporating) into the air, so that his fundamental equation now becomes

$$M = A + E \qquad (2)$$

The question as to the relative amounts of vapor transported from the ocean to the land, and vice versa, is discussed. The author comments upon the view of Brückner on this and other closely related subjects, and the latter makes a rejoinder. The translation of both Fischer's article and Brückner's rejoinder are filed in the Weather Bureau Library, where they may be consulted by those interested.—*A. J. H.*

THE VARIABILITY OF TEMPERATURE IN SUCCESSIVE MONTHS AND THE PERIODIC OSCILLATIONS OF ANNUAL TEMPERATURE IN GERMANY.

By FRANZ BAUR.

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For this investigation there were taken as a basis temperature observations for the period of 50 years from 1870 to 1919, inclusive, at the following 10 stations in Germany: Königsberg (Prussia), Berlin, Hamburg, Breslau, Leipzig, Munster (Westphalia), Bamberg, Frankfort-on-the-Main, Munich, Karlsruhe (Baden).

From the monthly means of temperature for these 10 stations there was calculated the mean temperature for Germany in each month of the 50 years and the departure from the 60-year mean. For the representation of the temperature contrasts between successive months there was introduced the concept of "month-to-month change in temperature," the difference in the temperature departures of two directly successive months. The mean value of a series of such differences was called "month-to-month variability." In Germany the month-to-month variability amounts on an average to 1.7° C. It shows an annual and a semiannual oscillation. The annual oscillation is a result of the annual march of the "mean" variability of the monthly means of temperature, which is greater in winter than in summer; the semiannual oscillation is caused by the annual march of temperature itself, since the minima of the double wave of month-to-month variability occur where the temperature shows a maximum or a minimum. To the annual march of month-to-month variability there corresponds also the annual march of tendency to maintain the sign of temperature departure. This shows a considerable amount of tendency (not accidentally caused) only from February to March. This tendency to maintain temperature departure from February to March is plainly an accompanying circumstance to the phenomenon that in Germany the character of the winter with reference to temperature extends in most cases to the following March. Especially does this prove true for mild winters. In the years 1870 to 1919, inclusive, in 78 per cent of the cases (in Germany) a too-warm March followed a too-warm winter.

By means of Fourier's analysis investigation was made as to whether the month-to-month variability shows periods of more than a year's duration. There were calculated the amplitudes of 52 different periods, of which the shortest was 1.6 years, while the longest period was 20 years. For the determination whether those periods for which there resulted the greatest amplitudes are actually present, there was employed Schuster's test, as well as a phase test given by Professor Ansell. It resulted that periods of month-to-month variability in temperature of 2, 2.5, 3.4, 4.5, and 5.5 years duration are very probably real.

From the definition of "month-to-month variability" it could be demonstrated by a simple mathematical deduction that it can contain true periods only when the course of the temperature itself contains true periods, and that the temperature periods must be twice as long as the periods of month-to-month variability. As the double annual wave of month-to-month variability is a result of the annual temperature wave, so to the periods of month-to-month variability of 2, 2.5, 3.4, 4.5, and 5.5 years there correspond temperature periods of approximately 4, 5, 7, 9, and 11 years. In order to make a decision as to the reality of the periods the temperature departures were subjected to further analysis. It could be established conclusively that in the temperature course in Germany for the years 1870 to 1919 there are contained actual periods with duration of oscillation nearly 2.5, 4, 7, and 11 years. The analysis of the annual temperature departures gave the greatest amplitudes for an 18-year period and a 36-year period. The observational data is for a period too short to establish with certainty the reality of periods so long, still the close agreement of the 18-year period with the Chaldean period of lunar eclipses and with the period of the movement of the moon's nodes and the agreement of the 36-year period with the well known Brückner period make the reality of these periods quite probable.

In the period from 1870 to 1919 the maximum of the 11-year temperature period falls two-thirds of a year after the sun spot maximum.[1]

By ascertaining the amplitudes and the phases of the well-known temperature periods for shorter lengths of

[1] It is generally recognized that terrestrial temperatures are at a minimum at times of sun-spot maximum.—EDITOR.