CREPUSCULAR TABLES.

by

JEAN LUGEON, DIRECTOR OF THE STATE METEOROLOGICAL INSTITUTE OF POLAND.

The interpretation of most visual or instrumental observations of the upper air necessitates a knowledge at any given moment of the exact position of the rays of the Sun with respect to the Earth, i.e. the duration of twilight or, in other words, the altitude of the zenith of these tangent rays at night.

It is known also that Hertzian waves, at certain frequencies, can pass from one continent to another, or from the Southern to the Northern hemisphere, only if the upper atmospheric layers are in total darkness. It is necessary therefore to know the illumination of the various refracting layers in any scheme of wireless transmission, in order to be able to ascertain the moments at which the wave lengths should be changed. Lastly, the daily variations of several elements of the ultra-stratosphere and of the ionosphere are so closely connected with the twilight or undulatory radiation of the Sun, to mention only the phenomena of photo-electric and quantum ionisation, that a universal study thereof implies also a delineation of the limits between the dark and lighted regions of the Globe.

The latter remark applies also to the penetration of the atmosphere by atmospherics and to the location in longitude and latitude of storm centres, connected with the thermodynamical discontinuities of the troposphere — so important a branch of practical meteorology.

The continuous phenomenon of the sweeping of our atmosphere by the tangent rays of the Sun will entail, besides, a fairly large amount of work necessitating a knowledge of the above elements.

These considerations have led the Director of the State Meteorological Institute of Poland to draw up Crepuscular (twilight) Tables giving the altitude of the tangent rays of the Sun at the zenith for all latitudes in single degrees. The Association of Terrestrial Magnetism and Electricity of the International Union of Geodesy and Geophysics expressed at its Lisbon General Assembly in 1933 the interest attached to the publication of such Tables.

The Tables computed by Mr. Jean LUGEON give the height of the tangent rays of the Sun at the zenith, not according to the formula

$$H = R \cdot \left(\frac{1}{\cos U} - 1 \right)$$

in which H is the height in kilometres of the tangent ray of the Sun, R the radius of the Earth, considered spherical, in kilometres, and U the angle of depression of the Sun, but according to a formula which takes into account the azimuth of the Sun and the ellipsoidal shape of the Earth. However, the problem has been simplified by neglecting refraction, parallax and the height of the observation spot, so as to publish only reliable geometrical data rather than data of a physical character subject to modification.

The Tables are drawn up as follows. Each page is devoted to the latitude at a single degree. The horizontal argument of the Table is the Sun's declination to the nearest degree. To this horizontal argument corresponds an hour angle of the Sun at setting or rising, expressed in hours and minutes. The vertical argument is the number of minutes counted since sunset or before sunrise. It is given at 10-minute intervals.

These Tables may be procured from the State Meteorological Institute of Poland, Nowy Swiat 72, Warsaw.

H. B.