

HARREBOW-TALCOTT, VILLARCEAU, ex-meridians, circumpolars, and of the prime vertical; and for determining the azimuth of a beacon, a description of the use of the transit instrument and the theodolite.

Chapter XV is devoted to the method of altitude position lines and of equal altitudes. It can be used with the theodolite, but better with the prismatic astrolabe for which tables and diagrams are indicated which facilitate the preparation of the observations and their working. The author does not perhaps give quite enough prominence to the great advantage offered by the astrolabe over the theodolite on account of the absence of graduation and above all of the use of the mercury trough, the latter being much more certain in use than the bubble level.

The succeeding chapters are concerned with the measurement of gravity and deal with the formula of CLAIRAUT and his generalisations, the use of g to find the shape of the earth, corrections, absolute and relative methods of measurement, various pendulums, measurement of gravity at sea, and the torsion balance.

The three last chapters show how the shape of the earth has been determined, whether by triangulation or by measurements of g . We find there a narrative of the principal measurements made, and are shown the methods for obtaining the deviation from the vertical, for using LAPLACE'S points and for tracing the contour lines of the geoid.

Methods of correction in accordance with the hypotheses of isostasy and with those of PRATT and AIRY are rapidly indicated. The volume concludes with a summary review of the vexed questions of oceanic tides, periodical variations of the vertical, the variation of latitude, and the tides of the earth's crust.

P. V.

THE CONTINENTAL UNDULATIONS OF THE GEOID.

by

R. A. HIRVONEN.

(24 × 17 cm., 89 pp. + 7 fig + 1 pl. - *Suomen Geodeettisen Laitoksen Julkaisuja*, Helsinki, 1934).

The author was entrusted by Professor HEISKANEN with an investigation as to whether existing materials are sufficient to give any information respecting the undulation of the geoid; as to what order are the warpings of the geoid; and as to the degree of accuracy to be expected from the use of STOKES'S formula in the reduction of gravity observations.

The results of the author's calculations indicate that a wide field still remains open for improvement as regards reliability; this is due to lack of observations or to the fact that the observations which have been made are not distributed equally over the earth. The author has estimated that 2,000 observations uniformly distributed would be sufficient for the complete solution of the existing problems of the general shape of the geoid, the distance between the observation points being 500 km. This condition should be easily reached by international co-operation. The present results attained are, however, sufficiently satisfactory to ensure that our results are correct as regards their sign and their order of magnitude.

The departure of the geoid from the ellipsoid does not generally exceed 100 metres and on an average is ± 50 metres.

The ellipticity of the equator can be considered as a fact sufficiently proved. The value $2f = 140$ m. calculated by the author is stated to be in all probability too small rather than too great. The direction of the longer axis is somewhat westwards from Greenwich. It is impossible to discuss the depth to which this ellipticity reaches inside the earth.

The rapid progress of gravity measurements will soon make the results obtained obsolete and useless, if they cannot be easily corrected. Therefore the most expedient method of organising this work ought to become one of the objects of study of the International Geodetic Association.
