



On the R- approximations of the Earth's surface topography

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The determination of a function describing the Earth's surface topography on a generally irregular grid is important for the interpretation of gravity data, calculation of the corrections for the topography and construction of maps of plumb line deviations. Thus, we have the problem of describing a surface D, or more specifically, the problem of constructing an approximation of a surface D that will be used in the calculation of the function (the derivative of the potential with respect to the coordinate). We can write

where are the observation points. If the model of the plane Earth is adopted, the surface D may be represented by a function of two variables , parametrizing points on an equipotential surface.

Then, the correction for topographic masses (the gravity reduction) is calculated by the approximate formula

, (1)

where, in the case of a detailed survey, the plane must be such that

(a) approximate formula (1) (ensuring a required accuracy) can be used for all , where is a finite simply connected area in the plane and

(b) for all . (2)

The main computational procedure consists of the construction of an analytical approximation of the function (3) From its values given on a set of points ; this approximation should be valid on the entire integration domain. The analytical approximation can be constructed by the R-approximation method, which is a variant of the linear integral representation method based upon the Radon-transform.

The values used for the construction of the analytical approximation are given, first, immediately at the observation points; second, on a certain set of points of topographic maps on an adequate scale (for example, it is desirable to use topographic maps on a 1:10 000 scale in the case of a detailed gravity survey on a scale 1:25 000); third, on a certain set of characteristic points of the relief (these values must be measured during gravity surveys).

The method proposed in this topic for the Earth's topography description with the help of R-approximations is effective for solving various geophysical, geomorphological, an geodetic problems. Using this method, the values of the function describing the topography can be determined on an arbitrary grid. Therefore, the preliminary regularization of initial data, their ordering, and so on, are not required. A smoother topography is reconstructed to within a few centimeters, whereas mountainous topography is reconstructed less accurately (1-3 sm with a height contrast of about 1000 m).