

On evaluation of Newton integrals in geodetic coordinates: exact formulation and spherical approximation

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Abstract: Newton integrals for the potential and the vertical component of the attraction vector (gravitational effect), serve for evaluating various topographical effects (negative topographical corrections) as well as for evaluating the potential and the gravitational effect of various bodies and/or models of mass density distribution (real, constant or anomalous). Here we review global evaluation of the Newton integrals in geodetic coordinates (in Gauss ellipsoidal coordinates) formulated exactly and in spherical approximation. Various topographical corrections are addressed by investigating their definitions in terms of the upper and lower topographical boundary and the used density. Numerical aspects of the evaluation of the Newton integrals, such as the weak singularity treatment, split-up into spherical shell and terrain terms, and a requirement to integrate over the entire globe are also addressed. Implications associated with regional and local evaluation of the Newton integrals are indicated. Special attention is paid to the so-called “ellipsoidal topography of constant density” (“ETC”) and to NETC topo-corrections to potential and gravity. The abbreviation “NETC” stands for “No ETC” and represents the removal of the effect of “ETC” on potential or gravity.

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Key words: gravitational potential, gravitational effect, topographical correction, terrain correction, spherical shell, ellipsoidal topography, ETC, NETC space