On the removal of the effect of topography on gravity disturbance in gravity data inversion or interpretation

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A b s t r a c t : Four types of topographical corrections to gravity disturbance (to actual gravity) are investigated, distinguished by the density (real or constant–model) and by the lower boundary (geoid or reference ellipsoid) of the topographical masses. Each type produces a specific "topo–corrected gravity disturbance", referred to as "NT", "NTC", "NET", and "NETC". Our objective is to compare the four types and to study the physical meaning, in the light of gravity data interpretation/inversion, of these four gravity disturbances. Our method of investigation is the decomposition of the actual potential and actual gravity. It is shown, that the "NETC gravity disturbance" – i.e. the gravity disturbance corrected for the gravitational effect of topographical masses of constant density with the topo–surface as the upper boundary and the reference ellipsoid as the lower boundary – is rigorously and exactly equal to the gravitational effect of anomalous density inside the entire earth, i.e., below the topo–surface. The regions, where the four types of the topo–corrected gravity disturbance are harmonic, are studied also. Finally some attention is paid to areas over the globe, where geodetic (ellipsoidal) heights of the topo–surface are negative, with regard to the evaluation of the topo–correction and in the context of the gravimetric inverse problem. The strategy for the global evaluation of the "NETC topo–correction", or its evaluation in areas with negative ellipsoidal topography, is presented.

Key words: potential, gravitational effect, reference ellipsoid, geoid, density contrast, topographical effect, topo-correction

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