Geophysical Research Abstracts
Vol. 18, EGU2016-7974, 2016
EGU General Assembly 2016

Accuracy of classical definition of the geoid-to-quasigeoid separation

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The geoid-to-quasigeoid correction is often computed only approximately as a function of the simple planar Bouguer gravity anomaly and the topographic height of the computation point while disregarding the contributions of terrain geometry and variable topographic density as well as mass density heterogeneities distributed below the geoid surface. In this study we demonstrate that these contributions are significant and, therefore, should be taken into consideration when investigating the relation between the normal and orthometric heights particularly in the mountainous, polar and geologically complex regions. We demonstrate that the geoid-to-quasigeoid correction globally varies within -4.19 and 0.26 m while the corresponding values computed according to a classical definition are only negative and reach extreme values of -3.5 m. A comparison of these results reveals that inaccuracies caused by disregarding the terrain geometry and mass density heterogeneities distributed within the topography and below the geoid surface can reach +/-2 m or more in the mountainous regions.