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Investigation of terrain corrections using digital elevation models with different resolution

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Gravity-related studies (determination of orthometric heights, geoid modelling, gravity reduction, and lateral density changes of topographical masses etc.) require high resolution digital terrain models. High frequency topographical data lead to accurate gravity field solutions. In a rough topography Bouguer plate may induce terrain correction errors. Additive terrain corrections to the simple Bouguer corrections cope with the diversions from actual topography. The terrain correction can be calculated by Digital Elevation Models (DEMs) with regular grid using computer programs.

The classical approach of computing terrain correction is to use cylinder template which divides topography into compartments defined by sectors and zones. The method can reveal different results of terrain correction depending on the partitioning formats of the templates used and the actual terrain surface within the compartments. In this study, various DEMs were applied to investigate their effects on terrain corrections. Calculations over cylinder templates are based on different resolutions for inner and outer zones. Inner grid with higher resolution involves 5 zones and the others are described as outer zones. 1, 3 and 15-arc second resolutions of SRTM data are employed to create internal and external grids. The topographic structure was divided into compartments with Hayford-Bowie template for 2681 gravity stations in Konya, Turkey. The terrain corrections associated with run time values, mean value 0.13 with std. deviation about 6.39 mGal, 89.3 in seconds, for inner and outer zones of 1-arc second resolution are taken as reference for the comparison. The running time for 3 and 15-arc second for internal and external zones takes 0.6 seconds for adequate accuracy. However, the model with only 15-arc second resolution has far values from the reference one up to 10 mGal some stations. According to the results from the numerical analysis, 3 and 15-arc second internal and external zones are quite effective and saving time.

Keywords: Terrain correction, Gravity reduction, Cylinder templates, Digital Elevation Models