



Effect of lateral topographical density on geoid in Iran

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Gravity reduction from the Earth's surface to the geoid requires knowledge of topographical mass density. However, in practice the constant density 2.67g/cm^3 is mostly used to approximate the actual density because of the difficulty and complexity of obtaining the actual density. This approximation introduces errors in the reduced gravity, and consequently, in the geoid. Recently, the Geographical Information System (GIS) was introduced as an efficient tool to geo-reference actual bedrock densities to digital geological maps.

As a part of the effort towards the construction of the 'one-centimeter geoid' for Iran, the effects of the lateral variation of topographical density on gravity and geoid were investigated in Iran. Density values were estimated from the geological maps of Iran (the maps produced by GSI, Geological Survey of Iran) and bedrock density tables compiled for use in the Arc View and Arc Map GIS. The $5^\circ \times 5^\circ$ mean and point topographical effects were computed from height and density data available on a $30'' \times 30''$ grid. The mean direct topographical density effect (DDE) on gravity ranges between -30 and 30 mGal (mean of -0.77 mGal) at the geoid for more than 93% of Iran. The secondary indirect topographical density effect (SIDE) on gravity varies between -0.28 and 0.65 μGal (mean of 0.03 μGal). The primary indirect topographical density effect (PIDE) on the geoid changes from -0.9 to 2.11 mm (mean of 0.1 mm). Our results suggest that the effect of topographical density lateral variations is significant enough and ought to be taken into account for the determination of the one-centimeter geoid.

Key words: Geoid - Gravity – Density – Iran