Geophysical Research Abstracts, Vol. 8, 04424, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04424

A new high-resolution geoid for Iran with emphasise on different modification procedures and new GRACE geopotential model

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This study describes a new high-resolution geoid for Iran. The Iranian gravimetric geoid (IRGG2005) covers the area between 25N-40N and 42E-63E. This study focuses on the impact of different modification of Stokes's formula and Global Geopotential Models (GGM). Four different implementations of Stokes's formula are employed: Molodensky et al. (1962), modified Wong and Gore (1969), Vanicek-Kleusberg (1987) models and a least-squares spectral weighting proposed by Sjöberg (1991). The geoid model computed by the Vanicek-Kleusberg solution provides the best residuals relative to the GPS-levelling data used for an independent evaluation of computed geoid models. The use of EGM96 global geopotential model and the new model GGM02S from GRACE twin-satellites is studied and some differences between two global models are observed. Classical topographic correction formulas are improved to consider long-wavelength contributions. Also, the effect of a Bouguer shell is included in the formulae, which is neglected in classical formulas. The gravimetric geoid is compared with GPS-levelling derived geoid heights at 200 GPS stations distributed over Iran. The Vanicek-Kleusberg method agrees the best with a -117 cm mean and 67 cm standard deviation in the differences between gravimetric and GPS geoid heights. The gravimetric geoid was also fit to the GPS-levelling derived geoid using least-squares collocation. The results after fitting show the standard deviation of differences reduced to 36 cm. For comparison, the official national geoid of Iran (Hamesh and Zomorrodian 1992) yields a -26 cm mean and 114 cm standard deviation of agreement with the same GPS stations. After fitting to the GPS stations, the standard deviation reduces to 61 cm for the Hamesh and Zomorrodian (1992) geoid. We conclude that the new geoid model could be used for further applications in Iran.