

Gravimetric geoid computation over Colorado based on the Remove-Compute Restore Stokes-Helmert scheme

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IAIG JWG 2.2.2 is conducting an international comparison experiment of gravimetric geoid computation over Colorado to examine the best computation methods. Within this framework, the land and airborne gravity data, digital elevation model, and GNSS/leveling data were made publicly available with the collaboration of National Geodetic Survey. In this study, we computed gravimetric geoid over Colorado using these data based on the Remove-Compute-Restore Stokes-Helmert scheme. We used XGM2016 model (Pail et al., 2017) as the background reference gravity field. The airborne gravity data were combined with the land gravity data based on Least Squares Collocation with the plane logarithmic covariance function (Forsberg, 1987). The residual terrain model was introduced following Omang & Forsberg (2000). Here we tested the two Stokes-Helmert schemes: the classical approach assuming the plane Earth (Moritz, 1980) and the UNB approach assuming the spherical Earth (Vanicek et al., 2013). Consequently, we computed gravimetric geoid over Colorado corresponding to the 194 GNSS/leveling data with a mean difference (MD) of 114.3 cm and a standard deviation of difference (SD) of 12.1 cm by the classical approach, and with MD of 85.6 cm and SD of 5.6 cm by the UNB approach, respectively. The UNB approach showed the better consistency with the GNSS/leveling geoid than the classical approach because it assumes the realistic Earth and applies the rigorous downward continuation to gravity data. Therefore, the rigorous computation method like the UNB approach should be used for precise computation of gravimetric geoid especially for high elevation regions like Colorado.