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Validation of CHAMP and GRACE derived EGMs and some notes on the combined adjustment of heterogeneous height systems

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With the advent of the recent gravity field satellite missions of CHAMP and GRACE new satellite-only EGMs have been developed promising improved accuracy for low to medium frequencies of the gravity field spectrum. The first aim of the present work is to validate the performance of the recently developed satellite-only EGMs from CHAMP and GRACE. To assess the improvement in gravity field modeling that the new models offer two methodologies were employed. The first one is based on spectral analysis of a number of new EGMs estimated from CHAMP and GRACE, using their degree and error-degree variances. In this way, their performance against each other and with respect to EGM96 was assessed and the parts of the gravity field spectrum that each one represents more accurately were identified. From the analysis performed it was concluded that the latest GFZ EIGEN2 model is more accurate in the waveband between harmonic degrees n=2-5, the CSR GGM01C model between n=6-116, and the EGM96 between n=117-360. The second approach followed to assess their accuracy was through comparisons with a number of GPS/Leveling data over Greece. The computations have been limited to the maximum degree that each model offers. From the achieved results we identified the part of the gravity spectrum that each EGM describes more accurately to determine a so-called “combined” EGM. Finally, numerical experiments were carried out for the combined adjustment of heights from different sources to connect and unify the vertical datums between continental regions and the Greek islands. The heights to be adjusted are satellite altimetry SSHs, gravimetric geoid heights, orthometric heights and TG records. The adjustment is performed in the space domain following a least-squares scheme, accounting for the height errors through the co-factor matrices of the input data.