



Added value of the GOCE satellite data to recovery of time-varying gravitational field

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Simultaneous operation of the Gravity Recovery And Climate Experiment (GRACE) and the Gravity Field and Steady-State Ocean Circulation Explorer (GOCE) satellite missions has motivated us to investigate the added value of the GOCE data to a time-varying gravitational field recovery, which is usually done on the basis of the GRACE data alone. First of all, we have estimated a number of monthly gravitational field solutions at the global scale in terms of spherical harmonic coefficients by a stand-alone processing of the GRACE K-Band Ranging (KBR) measurements. Then, we have combined the GRACE KBR measurements with the GOCE kinematic orbit data based on the GPS tracking observations, as well as with the GOCE Satellite Gravity Gradiometry (SGG) measurements (separately and jointly), following a similar estimation procedure. The GRACE KBR measurements and the GOCE orbit data have been processed according to the acceleration approach, whereas the GOCE SGG data have been treated as in-situ measurements in the gradiometer reference frame. In order to ensure the optimal combination of all the data, the power spectral density of noise in each of the data sets was estimated and used for a proper frequency-dependent data weighting. The obtained GRACE-only solutions and the combined ones have been compared with each other. The identified differences have been analyzed in order to identify those that can be explained by an added value of the GOCE data. The conducted analysis allows the added value of the orbit and the SGG data delivered by the GOCE mission to be quantified. Furthermore, it results in a number of recommendations regarding further improvements in the combined gravitational field modeling.