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# Added value of GOCE data to the recovery of linear trends in natural mass re-distribution in the Earth's system

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Many natural processes in the Earth's system manifest themselves in the form of large-scale mass re-distribution: accumulation and ablation of continental water stocks, melting of glaciers and ice sheets, glacial isostatic adjustment, large earthquakes, etc. Monitoring long-term trends in mass re-distribution is of vital importance for water management, climatology, solid Earth studies and other applications. The primary tool for a direct observation of large-scale mass-redistribution is the K-Band Ranging (KBR) instrument on board the satellite gravimetry mission Gravity Recovery And Climate Experiment (GRACE). Unfortunately, the GRACE KBR data suffer from an anisotropic sensitivity and a limited spatial resolution of the derived models (not better than 300 – 500 km). For this reason, there are on-going attempts to supplement these data with other available information.

The focus of the presented study is a combination of GRACE data with high-low Satellite-to-Satellite Tracking (hl-SST) and Satellite Gravity Gradiometry (SGG) measurements acquired by the Gravity Field and Steady-State Ocean Circulation Explorer (GOCE) satellite mission. More than one year of GOCE data are currently available, which allows us to analyze their added value in the context of the recovery of linear trends in the natural mass re-distribution. A key element in producing the combined GRACE/GOCE solutions is the accurate estimation and application of stochastic models of frequency-dependent noise in the exploited data sets, so that their optimal combination is ensured. Furthermore, an accurate stochastic description of data noise is needed to produce an adequate covariance matrix of noise in model parameters. This matrix is required to build the statistically optimal Wiener-type filter, which is applied to the produced models in the post-processing stage. The obtained model is compared to the one produced with the same scheme but without the usage of GOCE data. The difference between the trends from these two models is quantified in order to draw conclusions about the impact of GOCE data, depending on the geographical location and the strength of the trend signal. In particular, a comparison of the trends observed at the coasts of some polar regions (Greenland, Alaska, West Antarctica) allows us to assess the sharpening of the obtained images when GOCE data are incorporated.