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Regional time-variable gravity field with GRACE using tesseroid mascon approach

Observing and monitoring the different components of the hydrological cycle and their dynamics are essential steps to understand and predict natural disasters like floods and droughts, all of which periodically plague several nations. Consequently, monitoring and understanding the water cycle at global and regional scales plays a crucial role to better understand the Earth's climate and mitigate its associated hazards. As a component of the water cycle, terrestrial water-storage (TWS) reveals extreme climate conditions and mainly reflects the variations in the net-precipitation (precipitation minus evaporation). To monitor the spatiotemporal variations of TWS (also its changes), it would be necessary a complex nationwide hydro-meteorological network, which are not available over regions of, for example, Africa and South America. Nevertheless, in the absence of such network, space-borne geodetic sensor offers one such opportunity in which the satellite gravimetry measurements can be inverted to TWS fields. An active mission concept of the satellite gravimetry is the Gravity Recovery and Climate Experiment (GRACE), a joint project between the National Aeronautics and Space Administration (NASA) and *Deutsche Forschungsanstalt für Luft und Raumfahrt* (DLR).

However, the TWS fields are generally computed based on spherical harmonic coefficients (global carrier), which has not exploited the fundamental resolution of the observations. Therefore, in order to derive accurately results of GRACE-derived TWS, it is necessary to develop a regional recovery approach. The tesseroid approach, originally proposed for modelling the gravitational potential (and its functional) due to the topographic masses, provides a viable methodology in comparison with the traditional **mas**s **con**centration (mascon) approach. In this regard, a "tesseroid mascon approach" has been proposed at the GIK/KIT. The feasibility of tesseroid mascon has been investigated for recovering the water-mass variability based on the GRACE inter-satellites range-rate measurements. It was demonstrated that the tesseroid mascon solution is a viable alternative to the established methodologies of mascon modelling.

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