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Water mass changes inferred by gravity field variations with GRACE

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Since 2002 the Gravity Recovery And Climate Experiment (GRACE) mission has been measuring temporal variations of Earth's gravity field depicting with extreme accuracy how mass is distributed and varies around the globe. Advanced signal separation techniques enable to isolate different sources of mass such as atmospheric and oceanic circulation or land hydrology. Nowadays thanks to GRACE, floods, droughts, and water resources monitoring are possible on a global scale.
At GFZ Potsdam scientists have been involved since 2000 in the initiation and launch of the GRACE precursor CHAMP satellite mission, since 2002 in the GRACE Science Data System and since 2009 in the frame of ESA′s GOCE High Processing Facility as well as projected GRACE FOLLOW-ON for the continuation of time variable gravity field determination. Recently GFZ has reprocessed the complete GRACE time-series of monthly gravity field spherical harmonic solutions with improved standards and background models. This new release (RL05) already shows significantly less noise and spurious artifacts. In order to monitor water mass re-distribution and fast moving water, we still need to reach a higher resolution in both time and space. Moreover, in view of disaster management applications we need to act with a shorter latency (current latency standard is 2 months).
For this purpose, we developed a regional method based on radial base functions that is capable to compute models in regional and global representation. This new method localizes the gravity observation to the closest regions and omits spatial correlations with farther regions. Additionally, we succeeded to increase the temporal resolution to sub-monthly time scales. Innovative concepts such as Kalman filtering and regularization, along with sophisticated regional modeling have shifted temporal and spatial resolution towards new frontiers. We expect global hydrological models as WHGM to profit from such accurate outcomes. First results comparing the mass changes over the Mekong Delta observed with GRACE with spatial explicit hydraulic simulations of the large scale annual inundation volume during the flood season are presented and discussed.