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Separating surface water body mass changes from GRACE water storage estimates

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Since 2002, the GRACE mission (Gravity Recovery and Climate Experiment) – a joint mission by NASA and DLR – has observed the terrestrial water storage and has improved our knowledge of the global water cycle significantly over the last 16 years. GRACE-derived information has been used to improve hydrological models in terms of model calibration and data assimilation. However, localized small-scale mass variations, such as caused by human-controlled reservoirs, that are spatially below the GRACE resolution but large enough in magnitude, can have a strong influence on the mass change signal. Even though GRACE can "see" these mass changes, they do not necessarily appear exactly at the location of their origin and with the correct magnitude. Thus they can distort the water storage estimate for neighboring areas or the average over a river basin.
In the newly established DFG Research Unit GlobalCDA, GRACE data (among various other geodetic and remote sensing data sets) shall be used to improve a global hydrological model via calibration and data assimilation. Prior to data assimilation, however, the GRACE signal has to be cleaned from these localized features (e.g. reservoir effects), which are not properly represented in the model, in order to make GRACE water storage estimates consistent with the model output.
In this presentation, we will discuss methods to quantify and remove the effect of the concentrated mass signals from the GRACE data based on a forward modeling of the expected small-scale mass features using altimetry and remote sensing information. Furthermore, we will discuss possibilities to include a comprehensive dataset of several types of surface water bodies (e.g. natural lakes, rivers) to estimate their combined influence on the GRACE signal on a basin-wide scale.