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Modeling and Validation of GRACE Regional 4-D Hydrological Mass Variations

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Hydrological or other geophysical mass redistributions lead to temporal variations of the Earth's gravity field which can be observed by the GRACE gravity mission with high accuracy. Traditionally in satellite gravity recovery problems the global gravity field of the Earth is modeled as a spherical harmonic expansion. Spatio-temporal gravity fields from GRACE are usually computed for fixed time intervals, like one month. Since the Earth's gravity field shows heterogeneous structures over the globe, a multi-resolution representation means an appropriate candidate for an alternative modeling.

In this contribution we determine a spatio-temporal gravity model from GRACE using the spherical wavelet technique for the spatial part and a one-dimensional B-spline expansion for the temporal variations, i.e., we end up with a four-dimensional (4-D) geopotential model of tensor product type. In opposite to the global spherical harmonics the spherical scaling functions and wavelets are quasi-compactly supported (highly localizing) on the sphere. Consequently, they establish a system of base functions well suited for regional modeling such as for continents or river basins. Since these functions are additionally derived from spherical harmonics, our approach allows for loading computations in the spectral domain as easily as in case of spherical harmonics.

Resulting mass variations are expressed in terms of equivalent water heights which are subsequently balanced with the net effect of precipitation and evaporation (inflow) reduced by runoff from river gauge data (outflow). The inflow is computed from horizontal fluxes of specific humidity as provided by NCEP reanalysis data. Furthermore our results are compared with the monthly mass grids from GRACE spherical har-

monic solution data products.