



Regional atmospheric mass and moisture flux modeling and comparison to GRACE signals

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Estimation of large scale water balances is still an unsolved challenge in hydrological sciences. The GRACE satellite mission provides a completely new opportunity to investigate seasonal large scale water mass changes based on measurements of gravitational attraction changes from space.

Our study contributes to assessing the potential of GRACE data for hydrological applications. Our approach assumes that vertically integrated atmospheric moisture convergence equals 1) precipitated minus evapotranspired water masses and therefore equals 2) aggregated surface runoff minus water storage changes. Using observed basin runoff, this interrelation allows us to compare GRACE derived water storage changes with modeled atmospheric moisture convergences.

As regional atmospheric modeling is expected to yield more accurate meteorological fields than global model results, we use the WRF model for dynamic downscaling of global atmospheric fields and hence derive high resolution fields of air pressure, horizontal moisture flux divergence, precipitation, evapotranspiration, soil water, etc.

Our study focuses on sensitivities and uncertainties of regionally modeled atmospheric mass and moisture fluxes due to specific model setup, origin of global driving data (NCEP vs. ECMWF) and spatial resolution. This is performed over four climatological regions: Australia, Sahara, Siberia and the Amazon. The first three regions are characterized by a seasonally simplified hydrological mass balance: either evapotranspiration or precipitation is close to zero. Central Australia represents a region with no outlet, meaning runoff is negligible. The Sahara also has zero runoff and for the

dry periods evapotranspiration is close to zero. Siberia, comprising the catchments of Lena and Yenisei, has negligible evapotranspiration for the winter months. The Amazon region is considered as representative for basins with high precipitation and evapotranspiration terms.

We applied WRF in 30 km horizontal resolution for the years 2002 to 2006 and the four regions mentioned. Correlations between GRACE data and regionally modeled moisture fluxes and water storage changes are shown. Uncertainty bounds of the atmospheric moisture flux computations are presented.