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Validating hydro-meteorological fluxes using GRACE-derived water storage changes - a global and regional perspective

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Atmospheric and terrestrial water budgets, which represent important boundary conditions for both climate modeling and hydrological studies, are linked by evapotranspiration (E) and precipitation (P). These fields are provided by numerical weather prediction models and atmospheric reanalyses such as ERA-Interim and MERRA-Land; yet, in particular the quality of E is still not well evaluated. Via the terrestrial water budget equation, water storage changes derived from products of the Gravity Recovery and Climate Experiment (GRACE) mission, combined with runoff (R) data can be used to assess the realism of atmospheric models.

While on short temporal scales (inter-annual down to sub-seasonal) the modeled fluxes agree remarkably well with GRACE water storage changes, the models exhibit large biases and fail to capture the long-term flux trends in P-E-R corresponding to GRACE accelerations (Eicker et al. 2016). This leads to the assumption that despite the short time span of available gravity field observations, GRACE is able to provide new information for constraining the long-term evolution of water fluxes in future atmospheric reanalyses.

In this contribution we will investigate the agreement of GRACE water storage changes with P-E-R flux time series from different (global and regional) atmospheric reanalyses, land surface models, as well as observation-based data sets. We will perform a global analyses and we will additionally focus on selected river basins. The investigations will be carried out for various temporal scales, focussing on the short-term fluxes (month-to-month variations), for which models and GRACE agree well with correlations of the de-trended and de-seasoned fluxes time series reaching up to 0.8 and more. We will furthermore extent the study towards even higher temporal frequencies, investigating whether the modeled and observed fluxes show sub-monthly variability that can be detected in daily GRACE time series.

Eicker, A., E. Forootan, A. Springer, L. Longuevergne, J. Kusche (2016) Does GRACE see the terrestrial water cycle 'intensifying'? Journal of Geophysical Research - Atmosphere, in press