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# Investigating different filter and rescaling methods on simulated GRACE-like TWS variations for hydrological applications

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Terrestrial water storage (TWS) variations obtained from GRACE play an increasingly important role in various hydrological and hydro-meteorological applications. Since monthly-mean gravity fields are contaminated by errors caused by a number of sources with distinct spatial correlation structures, filtering is needed to remove in particular high frequency noise. Subsequently, bias and leakage caused by the filtering need to be corrected before the final results are interpreted as GRACE-based observations of TWS.

Knowledge about the reliability and performance of different post-processing methods is highly important for the GRACE users. In this contribution, we re-assess a number of commonly used post-processing methods using a simulated GRACE-like gravity field time-series based on realistic orbits and instrument error assumptions as well as background error assumptions out of the updated ESA Earth System Model. Two non-isotropic filter methods from Kusche (2007) and Swenson and Wahr (2006) are tested. Rescaling factors estimated from five different hydrological models and the ensemble median are applied to the post-processed simulated GRACE-like TWS estimates to correct the bias and leakage. Since TWS anomalies out of the post-processed simulation results can be readily compared to the time-variable Earth System Model initially used as "truth" during the forward simulation step, we are able to thoroughly check the plausibility of our error estimation assessment and will subsequently recommend a processing strategy that shall also be applied to planned GRACE and GRACE-FO Level-3 products for hydrological applications provided by GFZ.

Kusche, J. (2007): Approximate decorrelation and non-isotropic smoothing of time-variable GRACE-type gravity field models. J. Geodesy, 81 (11), 733–749, doi:10.1007/s00190-007-0143-3.

Swenson, S. and Wahr, J. (2006): Post-processing removal of correlated errors in GRACE data. Geophysical Research Letters, 33(8):L08402.