EGU23-5486, updated on 29 Nov 2023
https://doi.org/10.5194/egusphere-egu23-5486
EGU General Assembly 2023

How realistic are multi-decadal reconstructions of GRACE-like total water storage anomalies?

Charlotte Hacker
Institute for Geodesy and Geoinformation, University Bonn, Bonn, Germany (hacker@geod.uni-bonn.de)

The Gravity Recovery and Climate Experiment (GRACE) mission has monitored total water storage anomalies (TWSA) globally with unprecedented resolution and accuracy since 2002. However, many applications require a data-based, multi-decadal extended record of TWSA prior to the GRACE period as well as bridging the eleven-months gap between GRACE and its successor GRACE-FO. Statistical and machine-learning 'reconstruction' approaches have been developed to this end, mostly via identifying relations of GRACE-derived TWSA to climate variables, and some regional or global land data sets are now publicly available.

In this contribution, we compare the two global reconstructions by HUMPHREY AND GUDMUNDSSON (2019) and LI ET AL. (2021) mutually and against output from the the WaterGAP hydrological model from 1979 onwards, against large-scale mass-change derived from geodetic satellite laser ranging from 1992 onwards, and finally against differing GRACE/-FO solutions from 2002 onwards.

We find that the reconstructions agree surprisingly well in many regions at seasonal and sub-seasonal timescales, even in the pre-GRACE era. We find larger differences at inter-annual timescales which we speculate are in part due to the way reconstructions are trained and in part on which specific GRACE solution they are trained as well as the climatological characteristic of the region. Our comparisons against independent SLR data reveal that reconstructions (only) partially succeed in representing anomalous TWSA for regions that are influenced by large climate modes such as ENSO.