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Data-Driven and Scaling Factor methods of GRACE leakage correction: Can they be reconciled?

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Time variable satellite gravimetry, realized with the missions GRACE and GRACE-FO, allows for the only global observation of total water storage (TWS) changes. These observations are inherently smoothed due to the upward continuation of the gravity field at the satellite orbits. Additionally, the correlated errors seen as north-south stripes in global maps require further filtering to separate signal from noise. This causes the signal at any region to be biased by signal at neighboring regions, better known as leakage effect. Various methods have been proposed to mitigate leakage and to spatially assign TWS changes at smaller spatial scales than the satellite data is available by using auxiliary information. Unfortunately, there is a large spatio-temporally variable degree of discrepancy in the agreement or the disagreement within these methods, leaving the non-geodetic users of GRACE TWS changes with the complex question of choosing an appropriate method. The scaling factor approach and the Data-Driven Correction (DDC) approach are the most widely used methods. The scaling factor approach uses a numerical model output of TWS changes, whereas the DDC approach uses only GRACE observations to account for leakage.
Tripathi et al., 2022 (10.5194/hess-26-4515-2022) found for the Indus basin, that a newly proposed variant of the scaling factor method, called Frequency-Dependent scaling, using the WaterGAP (Water Global Assessment and Prognosis) hydrology model (WGHM v2.2d), produced results with a striking agreement against the results from the DDC approach. Therefore, this contribution extends the comparison of Frequency-Dependent scaling using WGHM v2.2d against the DDC method for 189 global hydrological basins. We achieved an agreement between the results from both methods well within the uncertainties of GRACE TWS observations for almost 85-90% of the global hydrological basins. Such an agreement can bring a much-needed consolidation in the treatment of leakage effect across the user community. The disagreement in the rest of the basins varies across time scales, such as long-term trends and periodic signals, and is being further analysed.