

## Joint assimilation of Total Water Storage Anomalies (TWSA) and discharge observations into a hydrological model

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Improving the quantification of freshwater fluxes and storages would be important for better understanding groundwater recharge and depletion, the human impact on climate change and the influence of the international trade on water resources. It would also be beneficial to improve the water management on a global scale. However, global hydrological models exhibit poor skills in reproducing observed water storage changes from the Gravity Recovery And Climate Experiment (GRACE), and GRACE assimilation efforts have not always improved the simulation of discharge.

Therefore, we assimilate GRACE-derived Total Water Storage Anomalies (TWSA) and, for the first time, in-situ discharge observations into the WaterGAP Global Hydrology Model (WGHM).

In this study, TWSA and discharge are assimilated separately and jointly into the WGHM with an Ensemble Kalman Filter for the Mississippi Basin from 2003 to 2012. In addition, the data assimilation framework is extended to enable the calibration of the WGHM model parameters. The resulting time series of the estimated water storages and fluxes are compared within the time period from above, but also within the validation time period from 2013 to 2016.