EGU21-7129
https://doi.org/10.5194/egusphere-egu21-7129
EGU General Assembly 2021

Land Water Storage Variabilities in GRACE and Climate Models – How do they compare and which future changes can we expect?

Laura Jensen[1], Annette Eicker[1], Henryk Dobslaw[2], and Roland Pail[3]
[1]HafenCity University, Geodesy and Geoinformatics, Hamburg, Germany (laura.jensen@hcu-hamburg.de)
[2]Helmholtz Centre Potsdam, German Research Centre for Geosciences (GFZ), Potsdam, Germany
[3]Technische Universität München, Institute of Astronomical and Physical Geodesy, München, Germany

Climate change will affect terrestrial water storage (TWS) during the next decades by impacting the seasonal cycle, interannual variations, and long-term linear trends. But how exactly will the variability change in the future? Reliable projections are needed not only for sensible water management but also as input for long-term performance studies of possible Next Generation Gravity Missions (NGGMs).

In this contribution, an ensemble of climate model projections provided by the Coupled Model Intercomparison Project Phase 6 (CMIP6) covering the years 2002 – 2100 is utilized to assess possible changes in TWS variability. To demonstrate performance and identify shortcomings of the models we first compare modeled TWS to globally observed TWS from the Gravity Recovery and Climate Experiment (GRACE) and its follow-on mission (GRACE-FO) in the time span 2002 – 2020. We then analyze changes in the variability of TWS from model projections until the end of the century and the consensus on such changes within the model ensemble.

Based on these projections, we find that present-day GRACE accuracies are sufficient to detect amplitude and phase changes in the seasonal cycle in one third of the land surface after 30 years of observation, whereas a five times more accurate NGGM mission could resolve such changes almost everywhere outside the most arid landscapes of our planet. We also select one individual model experiment out of the CMIP6 ensemble that closely matches both GRACE observations and the multi-model median of all CMIP6 realizations. This model run might serve as basis for multi-decadal satellite mission performance studies to demonstrate the suitability of NGGM satellite missions to monitor long-term climate variations in the terrestrial water cycle.