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Effects of changes in terrestrial water storage on evaporation estimates at global scale: GRACE assimilation into GLEAM

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Overlooking subsurface lateral transfers and water table fluctuations in large-scale land surface models can potentially bias terrestrial evaporation estimates. When these models are used in a coupled context, these biases may lead to uncertainties in temperature predictions: an underestimation of latent heat fluxes may cause an overestimation of dry and warm conditions. This study aims to incorporate the Gravity Recovery and Climate Experiment (GRACE) satellite data of changes in Terrestrial Water Storage (TWS) into the Global Land Evaporation Amsterdam Model (GLEAM), a simple model dedicated to the estimation of terrestrial evaporation at the global scale. We use a Newtonian Nudging scheme to assimilate the TWS anomaly estimates from GRACE into GLEAM, in order to correct for the free drainage lower boundary condition in the model. We find a strong temporal correlation between time series of anomalies in GRACE and GLEAM root zone soil moisture, which eases the assimilation. However, the coarse spatial and temporal resolution of GRACE (1-degree grid cell at monthly time steps) compared to GLEAM (0.25-degree grid cell at daily time steps) is a major challenge for the assimilation. To account for the differences in resolution, GRACE TWS signals are disaggregated vertically into changes in the individual water stores and temporally into daily variations. Overall, this exercise will allow us to quantify whether, and how much, accounting for changes in terrestrial water storage can improve the estimation of soil moisture and regional evaporation fluxes at global scales.