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Calibration of the global hydrology model WGHM with water storage variations from the GRACE mission

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At this stage, the GRACE (Gravity Recovery And Climate Experiment) mission has recorded a five years time series of mass variations on the earth, including changes in total continental water storage. Thus, GRACE provides a comprehensive calibration data set for large-scale hydrological modelling. The WaterGAP Global Hydrology Model (WGHM) simulates the continental water storage of the most important water storage components, including interception, soil, snow, groundwater and surface water. In its original version, the model is calibrated against observed river runoff and forced by climate data at a 0.5 degree resolution. Comparisons of measured and simulated seasonal variability of total water storage in large river basins partially show significant differences, especially for the seasonal amplitude. In this study, first results towards a new calibration of WGHM against GRACE data are presented.

For model uncertainty and sensitivity analysis for seasonal total storage change, parameter sets of the 40 model parameters were derived by Latin Hypercube Sampling. The results show that the most important parameters for storage change vary between the river basins, depending on which storage components are predominant in each basin. The ability of the model to reflect measured time series of storage change is assessed in view of the derived model uncertainty range, leading to an insight into possible structural model errors. As also GRACE data contain errors, an adequate filtering technique is required and, to ensure consistency, WGHM model data have to be treated in the same way. The effect of the filter type on model evaluation and calibration results is examined.

Towards the final aim of our work to achieve a multi-objective optimum parameter set calibrated against total water storage and river runoff, a calibration against GRACE

data has been performed as a first step. The results show the trade-off in model performance between storage change and runoff and provide valuable insight into model behaviour in different river basins. Overall we present the current performance of our work on calibration of the global hydrology model with GRACE data to emphasize the innovative contribution of this satellite mission to the field of hydrological modelling.