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Improving the realism of hydrologic model through multivariate parameter estimation

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Increased availability and quality of near real-time observations should improve understanding of predictive skills of hydrological models. Recent studies have shown the limited capability of river discharge data alone to adequately constrain different components of distributed model parameterizations. In this study, the GRACE satellite-based total water storage (TWS) anomaly is used to complement the discharge data with an aim to improve the fidelity of mesoscale hydrologic model (mHM) through multivariate parameter estimation. The study is conducted in 83 European basins covering a wide range of hydro-climatic regimes. The model parameterization complemented with the TWS anomalies leads to statistically significant improvements in (1) discharge simulations during low-flow period, and (2) evapotranspiration estimates which are evaluated against independent (FLUXNET) data.

Overall, there is no significant deterioration in model performance for the discharge simulations when complemented by information from the TWS anomalies. However, considerable changes in the partitioning of precipitation into runoff components are noticed by in-/exclusion of TWS during the parameter estimation. A cross-validation test carried out to assess the transferability and robustness of the calibrated parameters to other locations further confirms the benefit of complementary TWS data. In particular, the evapotranspiration estimates show more robust performance when TWS data are incorporated during the parameter estimation, in comparison with the benchmark model constrained against discharge only. This study highlights the value for incorporating multiple data sources during parameter estimation to improve the overall realism of hydrologic model and its applications over large domains.

Reference:

Rakovec, O., Kumar, R., Attinger, S. and Samaniego, L. (2016): Improving the realism of hydrologic model functioning through multivariate parameter estimation. *Water Resour. Res.*, **52**, http://dx.doi.org/10.1002/2016WR019430doi:10.1002/2016WR019430