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The added value of remote sensing products in constraining hydrological models

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Over the last decades, more sources of information, especially remotely sensed products, have become available for hydrological modelling, but a robust calibration of a hydrological model still largely depends on the availability of streamflow data. In this research, we determine the model parameters of four conceptual hydrological models (HYPE, HYMOD, TUW, FLEX) in a parameter selection procedure using a set of 10 remotely sensed products (e.g. MOD16 evaporation, SMOS, GRACE). These products were selected in order to cover a varying number of important water balance components, such as evaporation and soil moisture storage. Initially, the models were applied with random parameterizations over 27 catchments across Europe. Each product was given an accompanying objective function, often the coefficient of determination between the product and the relevant state or flux (e.g. MOD10A snow with modelled snow states). Each parameter was then weighted with the relevant objective functions to determine new a-posteriori parameter bounds. Final feasible parameter sets were obtained by these new parameter bounds, thus without the use of discharge time series.
In comparison with calibrated model performances, initial results show that the combined use of remotely sensed products can provide reasonable model performances as well. Besides evaluation on general streamflow performances, we also assess the model's performance with regard to a set of hydrological signatures, such as rising limb density or peak distribution.
Eventually, this combined use of remotely sensed products for constraining conceptual hydrological models will lead to enhancements in predictive capabilities, especially for data sparse regions.