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regionalization of the potential to increase rainfall-runoff model performance by multi-objective calibration using modis data over Austria

Martin Kubáň[1], Patrik Sleziak[2], Adam Brziak[1], Kamila Hlavčová[1], and Ján Szolgay[1]
[1]Slovak University of Technology, faculty of civil engineering, Department of Land and Water Resources Management, Slovakia (kubanmartin171@gmail.com)
[2]Slovak Academy of Sciences | SAV · Department of Mountain Hydrology

A multi-objective calibration of the parameters of conceptual hydrologic models has the potential to improve the consistency of the simulated model states, their representativeness with respect to catchment states and thereby to reduce the uncertainty in the estimation of hydrological model outputs. Observed in-situ or remotely sensed state variables, such as the snow cover distribution, snow depth, snow water equivalent and soil moisture were often considered as additional information in such calibration strategies and subsequently utilized in data assimilation for operational streamflow forecasting. The objective of this paper is to assess the effects of the inclusion of MODIS products characterizing soil moisture and the snow water equivalent in a multi-objective calibration strategy of an HBV type conceptual hydrological model under the highly variable physiographic conditions over the whole territory of Austria.

The methodology was tested using the Technical University of Vienna semi-distributed rainfall-runoff model (the TUW model), which was calibrated and validated in 213 Austrian catchments. For calibration we use measured data from the period 2005 to 2014. Subsequently, we simulated discharges, soil moisture and snow water equivalents based on parameters from the multi-objective calibration and compared these with the respective MODIS values. In general, the multi-objective calibration improved model performance when compared to results of model parametrisation calibrated only on discharge time series. Sensitivity analyses indicate that the magnitude of the model efficiency is regionally sensitive to the choice of the additional calibration variables. In the analysis of the results we indicate ranges how and where the runoff, soil moisture and snow water equivalent simulation efficiencies were sensitive to different setups of the multi-objective calibration strategy over the whole territory of Austria. It was attempted to regionalize the potential to increase of the overall model performance and the improvement in the consistency of the simulation of the two-state variables. Such regionalization may serve model users in the selection which remotely sensed variable or their combination is to be preferred in local modelling studies.