Geophysical Research Abstracts
Vol. 20, EGU2018-16647, 2018
EGU General Assembly 2018

'Crash testing' calibrated HBV model parameters under contrasting flood seasonality conditions

Klaus Vormoor (1), Maik Heistermann (1), Axel Bronstert (1), and Deborah Lawrence (2)

(1) Institute for Earth- and Environmental Science, University of Potsdam, Germany (kvormoor@uni-potsdam.de), (2) Hydrology Department, Norwegian Water Resources and Energy Directorate (NVE), Oslo, Norway

There is an increasing concern that hydrological models used in climate change impact assessments are not perfectly suited to deal with changes in the hydrometeorological conditions and their related catchment processes due to the conceptual representation and parameterization of the hydrological system. From this perspective, we need to verify the transferability of both model structures and calibrated model parameters under transient hydro-climatological conditions. Since there is no general solution for ensuring the robustness of calibrated model parameters under transient conditions, transferability always needs to be verified for a specific setting that is characterized by, among others: the region, its scale and its dominant hydrological processes, and the transient properties of hydrometeorological conditions. This way, we may increase the confidence in our hydrological model when applied in impact studies.

In this study, we investigate the transferability of calibrated HBV model parameters under stable and contrasting conditions in terms of flood seasonality and flood generating processes (FGP) in five Norwegian catchments with mixed snowmelt/rainfall regimes. We apply a series of generalized (Differential) Split-Sample Tests using a 6-year moving window over (i) the entire runoff observation periods, and (ii) over two subsets of runoff observations distinguished by the seasonal occurrence of annual maximum floods either during spring or autumn. The transferability of calibrated model parameters is investigated in terms of model performance losses when transferring best-fit parameter sets from calibration periods to validation periods with similar and contrasting flood seasonality conditions. Results indicate a general model performance loss due to the transfer of calibrated parameters to independent validation periods by -5 % to -17 % on average. However, there is no indication that contrasting flood seasonality exacerbates performance losses which contradicts the assumption that optimized parameter sets for snowmelt dominated floods (during spring) perform particularly poorly on validation periods with rainfall dominated floods (during autumn) and vice versa. Thus, the results indicate that the dominance of a FGP plays only a minor role for optimizing the corresponding model parameters, as long as the process shows some minimum level of prominence in the calibration period (at least 38 % in this study).

Based on the assumptions we have made in our testing protocol, the results are promising news for (flood-) hydrological impact modelling under climate change using the HBV model in Nordic catchments with projected shifts in their seasonal high-flow regime as long as the dominant 'future processes' are represented to a certain degree in the calibration period. However, our results also highlight the need for careful selection of calibration periods and for applying a range of calibrated best-fit parameter sets in the multi-model ensembles assessing the hydrological impact of climate change.