Geophysical Research Abstracts
Vol. 16, EGU2014-10512, 2014
EGU General Assembly 2014

Reliable estimations of extreme low flows by integrating very low flows in the model performance evaluation with a multi-metric framework

Matthias Pfannerstill, Björn Guse, and Nicola Fohrer

Christian-Albrechts-University of Kiel, Institute of Natural Resource Conservation, Department of Hydrology and Water Resources Management, Kiel, Germany (mpfannerstill@hydrology.uni-kiel.de)

Hydrological models are helpful tools to predict hydrological extremes and to understand the main governing processes for flood and drought events. For reliable predictions of extremes in future simulation such as climate change estimations, a precise representation of high and low flows in hydrological models is required. As a consequence, the hydrological models have to be calibrated accurately to provide reasonable model results for the different phases of the hydrograph simultaneously. For this challenge, the different phases of the hydrograph have to be considered in multi-metric frameworks with appropriate performance metrics. Low flows need to be reproduced together with high flows without neglecting the other phases of the hydrograph.
In our study, we highlight the relevance of model evaluation for very low and low flows with separate performance metrics to achieve a satisfying model performance for the low flow prediction together with the overall discharge reproduction. Therefore, we present a multi-metric evaluation framework to identify calibration runs with a precise representation of the hydrograph. In order to consider a fairly balanced evaluation between high and low flow phases, we divided the flow duration curve into segments of high, medium and low flow phases, and additionally into extreme high and extreme low flow phases. The model performance was evaluated stepwise for these segments separately with the root mean square error (RMSE) together with further application of the Nash-Sutcliffe efficiency and the percent bias for the whole discharge.
Our results show that this evaluation method leads to an improved selection of model runs with enhanced overall model performance by the refined segmentation of FDC. By combining performance metrics for high flow conditions with low flow conditions, this study demonstrates the challenge of calibrating a model with a satisfactory performance in high and low phases simultaneously. Consequently, we conclude that an additional performance metric for extreme low flows should be included in model analyses to improve the overall performance in all phases of the hydrograph. With this extended multi-metric framework, more reliable predictions are realized for extreme low flow estimations.