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# Hydrological model parameter uncertainty in investigations of climate change impacts on peak flow across Europe

Klaus Vormoor (1), Deborah Lawrence (2), Batuhan Engin (6), Marta Martinkova (3), Marzena Osuch (4), Patrick Willems (5), and Ismail Yücel (6)

(1) Institute of Earth and Environmental Science, University of Potsdam, Germany, (2) Norwegian Water Resources and Energy Directorate (NVE), Norway, (3) T. G. Masaryk Water Research Institute, Czech Republic, (4) Department of Hydrology and Hydrodynamics, Institute of Geophysics, Polish Academy of Sciences, Poland, (5) Hydraulics Laboratory, Katholieke Universiteit Leuven, Belgium, (6) Middle East Technical University, Civil Engineering Department, Turkey

Mulit-model ensemble approaches are usually used to investigate the hydrological impacts of climate change and their associated uncertainties. Uncertainties introduced by differing GCM/RCM combinations are assumed to have the largest influence on the overall uncertainty whereas the uncertainty derived from the hydrological model parameterisation is often assumed to have only a minor influence within the entire model chain. However, this does not always need to be the case, especially when changes in flood seasonality are likely. Since hydrological model calibration is a well-established tool for hydrologists, this comprises a possible field for improvements within climate impact studies.

In this study we investigate the effect of using four different objective functions for the calibration of the HBV hydrological model in seven catchments across Europe, which represent differing geographical and climatological conditions. The objective functions used here are either modifications or extensions of the Nash-Sutcliffe criterion (NSE). Two of the objective functions are especially tailored to fit the model with respect to peak flows, while the other two are designed to estimate an optimal NSE whilst also minimising the volumetric bias. The global Dynamically Dimensioned Search (DDS) algorithm and a subsequent Monte-Carlo simulation was used to calibrate the HBV models for all seven catchments and to detect 4x25 best-fit parameter sets. These parameter sets are then applied to model the observed and future climate with respect to peak flows in all seven catchments. The aims of this study are (1) to address the parameter uncertainties associated by the 4x25 best-fit parameter sets and (2) to identify the objective functions that are best suited for calibrating the HBV model with respect to investigating changes in the frequency and intensity of flooding.