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Analysis of low flow uncertainties under varying climatic conditions

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ABSTRACT

Changes in low flow indices under future climates are estimated for eight catchments in Poland. A simulation approach is used to derive daily flows under changing climatic conditions, following the RCP 4.5 and RCP 8.5 emission scenarios. The HBV rainfall-runoff model simulates flow. The model is calibrated and validated using flow observations from periods 1971-2000 and 2001-2010. Two objective functions are used for calibration: Nash Sutcliffe and log transformed Nash-Sutcliffe. Finally, the models are run using the bias corrected precipitation and temperature data simulated by GCM/RCM models for the periods 2021-2050 and 2071-2100. We derive low flow indices for the simulated time series, including the annual minima of 7-day mean river flows and the number, severity and duration of low flow events. We quantify the biases of low flow indices by the N-way ANOVA analysis supplemented with Tukey test. Results indicate a large influence of climate models, as well as objective functions applied during hydrological model simulations, on the low flow indices obtained. A comparison of indices from the two future periods with the reference period 1971-2000 confirms the trends obtained in previous studies, in the form of a projected decrease in the frequency and intensity of low flow events.