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Climate change impact on hydrological processes at a catchment scale

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It is very likely that the assumption of stationarity of hydrological processes will be not valid in future climate. The nonstationarity of flow projections may result from the nonstationarity of precipitation and temperature (hydrological model inputs) but also it can be related to the changing flood regime from snow-driven to rainfall-driven process, due to the rising air temperatures. It is necessary to understand how the changing flood regime is represented by the rainfall-runoff models. In this study the search for the possible causes of the nonstationarity of high flow projections is performed using the sensitivity analysis of different hydrological model components to temperature and precipitation changes. In this way we can better understand how the changing flood regime is represented by the rainfall-runoff models. Two conceptual hydrological models, HBV and GR4J and one Data Based Mechanistic model are applied to one Norwegian (Polmak) and one Polish (Narewka) catchment with snow-melt driven flood regimes. Both catchments show nonstationarity of long-term (130-year) based trends, with decreasing annual maximum flows in Polmak and positive trends in Narewka. The methodology applied utilised the modelling chain including GCM/RCM based future climate model projections, bias correction of precipitation time series and the hydrological precipitation-runoff models calibrated separately for high and low flows using the available observations of precipitation, temperature and discharge from the period 1971-2000. Results show that despite of the same input data applied, each model gives different flow projections. The sensitivity study indicates that the main reason of those differences lies in different representation of catchment processes applied by each model. The methods of combining the projections are analysed.