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Climate change and low flows: A regional impact assessment using simple statistical approaches

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The characteristics of low flow periods, primarily their low dynamics in space and time (as opposed to high flows), may allow for prediction using simple statistical dependencies on climatic and regional characteristics without the need to run complex hydrological models. Accordingly, it is hypothesized that climate change impact analysis for low flows via e.g. regression based approaches will yield adequate projections, whilst keeping data requirement, model set up and computation times to a minimum.
In this study panel data regression is applied to model a set of low flow indices simultaneously in time and space as a combined function of climatic indices and physiographic catchment descriptors. Study area is the federal state of Lower Saxony in northwestern Germany. For the available streamflow gauges annual low flow indices are derived from daily discharge series. They pose the target variables of the models. Inputs are temporally variable climatic indices, computed from several meteorological variables, and constant physiographic properties.
The panel data regression models are set up within a calibration period and validated in a combined split- and cross-validation procedure, allowing the assessment of temporal and spatial model performance. The spatiotemporal models appear to clearly outperform models individually reproducing spatial and temporal effects. The final models are applied to an ensemble of regional climate models in order to assess the future low flow development in the study area.