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Optimizing the simulation of riverine species flow preferences

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Riverine biota have distinct demands on the discharge regime. To quantify these demands, discharge time series are translated to ecohydrological indicators, e.g. magnitude, timing or duration of baseflow or peak flow events. These indicators are then related to species occurrence and/or absence to establish the feedback response of aquatic species to hydrological conditions. These links can be used in conjunction with hydrological simulations for predictions of species occurrences.
If differences between observed and simulated ecohydrological indicator values are too high, such predictions can be wrong. Indicator differences can be due to poor input data quality and simplified model algorithms, but also depend on how the model was optimized. For instance, in case the model was optimised towards a single objective function, e.g. minimizing the difference between simulated and observed Q95, differences between simulated and observed high flow indicators will be smaller as compared to baseflow indicators.
In this study, we are working towards assessing this error depending on the optimisation of the model. This assessment is based on a multi-objective vs. single-objective model optimization which we have realised in the following four-step approach: (1) sets of highly relevant ecohydrological indicators are defined; (2) the hydrologic model is optimised using a multi-objective function that combines all indicators; (3) the hydrologic model is optimised using single-objective functions with one optimisation round for each indicator and (4) the differences between all optimisation methods are calculated.
By assessing these absolute (simulated vs observed) and relative (simulated vs simulated) differences, we can evaluate the magnitude of the possible error band when optimising a hydrological model towards different ecohydrological indicators. This assessment can be used to optimize hydrological models for depicting preferences of riverine biota more effectively and improve the predicted species response to simulated ecohydrological processes.