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Comparing different approaches for predictions in ungauged catchments

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Several methodologies for predictions in ungauged basins have been proposed to provide reliable streamflow predictions. In this work we compare two different approaches: 1) calibration of a lumped hydrological model in the signature domain, and 2) regionalization of the parameters of a semi-distributed hydrological model. The case study consists of some subcatchments of the Thur catchment in Switzerland, characterized by different meteorological (e.g. snow vs. rainfall dominated) and physical (e.g. lithology) properties. In the first case, we used signatures derived from the seasonal flow-duration curves calculated using an analytical mechanistic model to calibrate the parameters of the hydrological model; in the second case, a semi-distributed hydrological model was built on the entire Thur catchment, calibrated using some gauged subcatchments, and then used in ungauged location. In both the cases inference was done using Bayesian methods to account for the multiple sources of uncertainty: Approximate Bayesian Computation algorithms are used for the signature-domain calibration, in the first case, Markov chain Monte Carlo methods for the time-domain calibration, in the second case. Overall, both approaches produce reliable estimates of streamflow predictive uncertainty in most cases.