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Comparisons of modelling performance using different representation of spatial variability

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Spatially distributed hydrological models are increasingly applied to account for the spatial variability of main forcing variables such as precipitation and physical features (e.g., soil type and land use) within a basin. A major reason for the use of spatially distributed rainfall-runoff model is the hypothesis that by accounting for the spatial variability of precipitation and physical features within a basin, better simulation results can be achieved at the basin outlet.

The main objective of this research is to explore a solution to the question: will a higher spatial resolution of model input data necessarily, as most people assume, lead to a better model performance? An attempt is made to modify the conceptual rainfall-runoff HBV-IWS model to incorporate a spatially distributed structure. Its predictive performance is then assessed and compared with other model versions of the HBV-IWS, ranging from lumped to semi-distributed structure, in accordance with the study objective.

To reproduce the spatial variation of the meteorological input at the catchment scale, external drift kriging is applied to interpolate from the available point measurements over the investigated area. The calibration of the different model versions are carried out by means of the simulated annealing optimization algorithm. For this optimization, aggregated Nash-Sutcliffe coefficients at different time scales are adopted as the objective function.

The simulated hydrographs obtained using different model versions are analyzed through the comparisons of the computed Nash-Sutcliffe coefficient and other goodness-of-fit indexes. The results indicate that the distributed model version does not outperform the other model versions for the applied study catchment using the

available model input data.

The case study is carried out by using data of a meso scale catchment located in the southwest of Germany.