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Uncertainty analysis as a comparison tool between different scales of aggregation

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Currently, there is a growing awareness of input uncertainty in distributed hydrological modelling. Studies on aggregation effects of spatial input data including predictive uncertainty are rare. In this study the hydrological model WaSiM-ETH, which includes the Topmodel approach, was applied on a daily time step on different catchments with catchment areas varying from 100 km^2 to 2000 km^2 and catchment characteristics ranging from flat land till the lower mountain range. The model was calibrated with PEST for input grid resolution ranging from 25 m up till 2000 m. An extensive uncertainty analyses was conducted using the Monte Carlo Markov Chain (MCMC) method for all grid resolutions. The model outputs were compared from each catchment on the basis of Nash-Sutcliffe criteria, no differences of model performances could be found. This shows that calibrating the model has compromised the information losses due to disaggregation in the input grids. However the MCMC analysis revealed clear differences in predictive uncertainty between different input grid sizes. An improvement in the reliability of the model prediction could be observed with decreasing grid size. The performance of the model WaSiM-ETH was better the smaller the catchment sizes is. Furthermore a threshold in the grid resolution was found, which depends on the catchment area and characteristic. Using spatial resolutions finer than this threshold value didn't decrease the uncertainty of model predictions. For resolutions coarser than the threshold value a strong decrease in the reliability of model predictions was detected. The threshold grid size shifts towards coarse grid's aggregation.