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Peak Flow Analysis with WaSiM-ETH - Model Parameter Sensitivity and Input Data Quality

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WaSiM-ETH is a widely used, distributed rainfall–runoff model. Its various modules represent the process physics of surface and subsurface hydrology. WaSiM-ETH has been applied to detailed flow, snowmelt, irrigation control, tracer and salt transport modelling.

In order to improve the accuracy of rainfall-runoff modelling, this paper comprises a detailed sensitivity analysis of WaSiM-ETH and describes our investigation of the necessary input data quality and density for representative rainfall-runoff modelling. We also describe calibration and validation for our reference site, a fast reacting, mountainous 129 km^2 catchment in Eastern Germany. The catchment is forested to about 50%, the rest of the area is used for agricultural purposes on soils which are dominated by loam. Different hydrological conditions in the catchment have been taken into account, therefore our study comprises dry and wet periods, years with summer peaks, years with winter peaks due to rainfall and years with winter peaks due to snowmelt processes.

The physically based modelling in the study comprises snow accumulation and snow melt, evapotranspiration, surface storage, infiltration and vertical soil moisture transfer, soil moisture in root zone and ground water zone, where the unsaturated zone is represented by the one dimensional Richards Equation.

Detailed sensitivity analysis was performed for each module, covering the snow model, evapotranspiration and the unsaturated zone model. To state on the needed quality of input data we checked the model reaction for a variety of land use and soil parameters. The effect of different interpolation techniques, such as IDW, Thiessen

and external drift kriging for meteorological input data is described depending on the density of the available information. In a further step we transferred the model to a neighbouring basin with similar characteristics. Based on the model validation for this test site we verify our statements concerning model parameter sensitivity and input data quality.

As a result of our study we are able to give a ranking for measures to improve model performance for model parameters as well as for input data.