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WaSiM-ETH- Model Performance and Parameter Sensitivity at Increased Spatial Scale

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WaSiM-ETH (Water Balance Simulation Model) is widely used distributed hydrological model. Its various modules represent process physics underlying different surface and subsurface hydrological phenomena. Various studies such as stream flow modeling, snowmelt, tracer and solute transport modeling have been conducted using this model. Moreover, recently this model has been applied to access climate change impact on catchment hydrology.

We applied this model for rainfall and runoff modeling of two sub-basins of Friberger Mulde which is an East German mountainous catchment. The area of Zoblitz sub-basin is 129km^2, most of that is under forest with silt loam soil. The most of the area of Nossen (580km^2) sub-basin is under agriculture with silt loam soil. The heterogeneity present in these sub-basins makes them hydrologically sensitive. Different parameters contribute in flood generation process which is complex in nature. We analyzed the relationship between various rainfall events and runoff generated as the model output. Furthermore, sensitivity of various model parameters has been estimated. Model was calibrated at daily time scale for two sub-basins of Friberger Mulde. The Zoblitz basin, situated in southern region, is mostly forested and mountainous. This was calibrated using 500 m grid size and Nossen basin was calibrated using 1000m grid size.

We analyzed model performance for larger input grid size with same calibration parameters. We varied the input grid from 500m to 3500m for Zoblitz basin and from 1000m to 7000m for Nossen basin. This increase in grid size was done using nearest neighborhood criteria. We evaluated model performance for each grid size and found

that there is a significant variation from smaller to larger grid size. We found a significant reduction in model efficiency (Nash-Sutcliffe efficiency) for both sub- basins, however, with out any important trend. For some grid sizes, model performance was better than that of calibration. To understand this variation, we evaluated sensitivity of key calibration parameters with every input grid size. The upper and lower bounds have been used to asses the sensitivity of parameters for peak flow. We found that flow density (dr) and scaling factor for base flow (Q_0) are less sensitive to peak flow at increased grid size. On the other hand, storage coefficients (kelsqd, kelsqi) for surface runoff and interflow are more sensitive at larger grid size for both sub-basins. There is no significant trend in sensitivity of snow melt fraction (C_0) and base flow correction factor (K-rec) for both sub-basins.