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Influence of the parameterisation of land management practices and the uncertainty of monitoring data on SWAT model calibration and evaluation

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Simulation models are powerful tools to evaluate the impact of land management scenarios on water quantity and quality at the watershed scale. However several problems still exist when using models for spatially explicit simulation of the environmental impact of land management options and environmental measures. In view of prediction and management of water quality on the watershed scale an accurate calibration and evaluation of the applied model is essential. Therefore adequate data bases in the form of i) input data (land management data) like crop rotations and management practices; and ii) calibration data (monitoring data) are needed. i) The problems that still exist with management data are: their availability (crop rotations and management practices) especially for large watersheds; management parameterisation and regionalisation depending on the respective model structure. ii) Uncertainties in the monitoring data influence the calibration and thus the parameter settings which affect the modelling results. Water quality monitoring data differ depending on sampling strategy: Load estimation results differ considerable depending on sampling strategy, used load estimation method and period of the estimation. Imprecision of load estimates limits their use in environmental assessment and management, trend detection, and watershed simulation. Overall goal of our study is to investigate the influence of parameterisation of management practice and uncertainty of monitoring data on model calibration and model evaluation. Hence, we tested how different adjustments of several management practices (tillage operation combinations, crops and fertiliser scenarios) affect model output parameters. Problems that arise with the regionalisation

of management practises are also discussed. Furthermore, we compared three different time-based sampling strategies and 4 different commonly used load estimation methods that we used model calibration. For our study we used the continuous-time river basin model SWAT (Soil and Water Assessment Tool) with spatial distributed parameters operating on a daily time step. SWAT has been developed to predict the long-term impacts of land management measures on water, sediment and agricultural chemical yield in large complex watersheds with varying soils, land use and management. Study area is the intensively used loess-dominated Parthe watershed (315 km^2) in Central Germany. The analysis has shown that the model is very sensitive to applied crop rotations and in some cases even to small variations of tillage practices. Based on the results of our analysis a ranking of sensitivity was elaborated. The monitoring data analysis show that the load estimation results differ considerable depending on sampling strategy, used load estimation method and period of interest. This leads to different parameter settings in model calibration and evaluation. Therefore we recommend the use of more than one estimation method to describe the water quality situation, because of the wide range of load estimation results which should be used for model calibration and evaluation.