Sanyuan Jiang, Michael Rode, and Seifeddine Jomaa

How much data are needed to identify a hydrological water quality model?

Hydrological water quality models are increasingly used to investigate runoff generation and nutrient transport processes as well as to predict global change impacts. Therefore, model identification, in terms of structure and parameterization, is prerequisite for these purposes. The objectives of this study are: to (i) identify an integrated stream flow and water quality model, (ii) evaluate impacts of different data contents on model calibration and (iii) investigate their temporal/spatial variations. To this end, the HYPE model (HYdrological Predictions for the Environment) was set up at Selke catchment (463 km^2) to simulate water flow and stream nitrate concentration. In addition, the nonlinear parameter estimator PEST was combined with HYPE model to carry out parameter estimation, sensitivity analysis and uncertainty analysis. The classical calibration approach – whereby the water flow is calibrated first and the calibration of the nitrate-N variable follows – is compared with the calibration approach where both variables are calibrated simultaneously. Results revealed that similar statistical model performances were achieved from these two calibration methods. Whereas, uncertainties of both water flow and water quality parameters decreased with the latter calibration method indicated by narrower 95% confidential intervals. It can be explained that an increase of calibration variables increases constraints on both runoff and water quality processes and forms a trade-off between these simulations. In future, additional water quality variables, such as: P and DOC will be included in the calibration of the HYPE model. Also, continuous high resolution discharge and water quality concentrations will be used to identify the model and improve understanding of runoff and water quality processes at catchment scale.