Geophysical Research Abstracts
Vol. 21, EGU2019-9469-1, 2019
EGU General Assembly 2019

Spatiotemporal evaluation of a semi-distributed hydrological water quality model in a nested catchment in Central Germany

Salman Ghaffar, Seifeddine Jomaa, and Michael Rode

Helmholtz Centre for Environmental Research - UFZ, Department of Aquatic Ecosystem Analysis and Management, Magdeburg, Germany (salman.ghaffar@ufz.de, seifeddine.jomaa@ufz.de, michael.rode@ufz.de)

Nutrient catchment models are increasing considered as important decision-making tools in exploring the biogeochemical processes and testing the effect of future land use and climate changes effects. However, the development of a comprehensive decision tool requires an adequate evaluation of the model capability to predict the different physiographical characteristic of the studied catchment.

For this purpose, the semi-distributed hydrological water quality model HYPE (Hydrological Predictions for the Environment) was tested to represent the measured Nitrate-N (NO_3-N) and Total Phosphorus (TP) concentrations and loads at different spatially-distributed internal gauging stations that were not included in the calibration process. The nested meso-scale Selke catchment (463 km2, central Germany) was used for this study. First, discharge, NO_3-N and TP concentrations were simulated at three gauging stations for a 20 year period in the main stem of the stream; Silberhuette, Meisdorf and Hausneindorf, representing the three key geographical features of the Selke catchment from upstream to downstream parts. Second, 13 internal stations, covering different stream order, soil type and land use classes were utilised for testing the spatiotemporal performance of the model. In this study, multi-site and multi-objective calibration approach and an uncertainty analysis were conducted using the DREAM (DiffeRential Evolution Adaptive Metropolis) algorithm. Results showed that the model could represent reasonably well the discharge for both calibration (1994-1998) and validation (1999-2014) periods at three main gauging stations, with lowest Nash-Sutcliffe efficiency (NSE) of 0.75 and percentage bias (PBIAS) of water balance of less than 18%. Results indicated less performance during the validation period, due to the reduction of number of precipitation stations compared to the calibration period. The dynamics of NO_3-N and TP loads were well represented by the model in the three main gauging stations during the whole simulation period (1994-2014) with the lowest NSE and PBIAS of 0.71 and 9%, respectively. Results, also, showed that the HYPE model simulations agreed well with the measured NO_3-N and TP loads for the whole simulation period in the 13 internal gauging stations. The model could mimic better the nutrient concentrations in the diffuse source-dominated sub-catchments compared to the point-source dominated sub-catchments. Results suggested that combination of multi-site and multi-objective calibration using key archetypes gauging stations can ensure sound spatiotemporal identification of the semi-distributed model parameters.