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Identification and uncertainty analysis of a hydrological water quality model with varying input data information content

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The rivers in central Germany are moderately to heavily polluted by nutrient inputs from point and diffuse sources. The objectives of this study are (i) to assess the new HYPE model (HYdrological Predictions for the Environment) for simulating runoff and inorganic nitrogen (IN) emissions at nested and spatially heterogeneous mesoscale catchments; (ii) to investigate the temporal and spatial variations of IN leaching and (iii) to investigate effects of calibration data on hydrological parameter identification. A multi-site and multi-objective calibration approach with help of Markov chain Monte Carlo (MCMC) was employed for parameter optimisation and uncertainty analysis. Results showed that parameters related to evapotranspiration were most sensitive in runoff simulation, while the nitrogen processes were mainly controlled by plant uptake and denitrification. Runoff was reproduced quite well for both calibration (1994-1999) and validation (1999-2004) periods (including the extreme dry year of 2003) at all three gauge stations, with a lowest Nash-Sutcliffe (NSE) of 0.86. The dynamics of soil moisture during extreme climatological events were well captured. Corresponding to spatial variability of hydrological regimes and land use, IN concentrations showed an increase in magnitude and a decrease in dynamics from upstream to downstream, reflecting the combined effects of increasing nutrient inputs and decreasing IN in-stream retention. The IN load was simulated well at monthly time intervals, with a lowest NSE of 0.69. Results revealed high IN emissions in winter and low values in summer; the area-weighted IN emission load decreased along the stream channel. Therefore, it is concluded that the IN emission is mainly controlled by runoff in this study catchment. From the preliminary result, we found that the 95% parameter confidence intervals of hydrological parameters decreased when IN concentration observations were included in hydrological parameter calibration. In the on-going work MCMC is used to investigate effects of calibration data information content in terms of observation variable and temporal and special resolution on parameter identification and predictive uncertainty.