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Modelling Nitrate uptake in river networks using the new mHM water quality model

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To understand the spatial distribution and temporal dynamics of nitrate uptake in river networks under different land use are critical for the protection of river ecosystem and drinking water supply. To this end, distributed grid-based hydrological water quality models are required. The multi-scale Hydrological Model (mHM) was integrated with the nitrate transport and reaction (NTR) routines. The main equations of NTR routines were introduced from the HYPE (Hydrological Predictions for the Environment) model, which has been fully verified in the literature. The new coupled mHM model with the NTR routines is able to calculate the hydrographs at any point and also the distribution of state variables, which makes it possible to present the distribution of inorganic nitrogen uptake in the whole river network.
First, the model is successfully calibrated and validated in the Selke catchment (463 km2) using three gauging stations during the period of 1994-2004 in terms of hydrographs and inorganic nitrogen concentrations. Then, the model performance for in-stream Nitrate uptake predictions are presented and analyzed temporally and spatially, considering the Selke river network characteristics. Particularly, how much the land use affects the amount and the intra-annual dynamics of in-stream uptake are discussed using one forest-dominant sub-catchment (Meisdorf, where forest share is about 72%) with another agriculture-dominant sub-catchment (Hausneindorf, where agriculture share is about 76%). In addition, the seasonal variation of model in-stream nitrate uptake predictions are compared with calculated values using the nitrate assimilatory uptake approach generated from high frequency sensor measurements.