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Modelling in-stream nitrogen retention in the 4^{th} order lowland river Weisse Elster, Germany

M. Rode, D. Wagenschein and T. Kebede

Helmholtz Centre for Environmental Research – UFZ, Department of Aquatic Ecosystem Analysis and Management, Germany (michael.rode@ufz.de)

Denitrification is an important sink of nitrogen in riverine systems and mainly linked to interstitial sediments and hence to river morphology. Studies which quantify this relationship are rare. In this paper we analyse the effect of river morphology on nitrogen load using the river water quality model WASP5. The revised model was applied to a 70.6 km river reach of the 4^{th} order river Weisse Elster (Germany) and measurements of the relevant water constituents were carried out for summer low-flow conditions (the Lagrange approach and 24h diurnal measurements). The program UNCSIM was used to determine parameter identifiability, which is based on the sensitivity and compensation effect of parameters. The uncertainty analysis was carried out using a Monte-Carlo-Analysis with Latin Hypercube Sampling including all 39 parameters of the model EUTRO. Model validation was reasonable with Nash-Suttcliffe efficiencies of 0.89 for nitrate-nitrogen, 0.30 for ammonium-nitrogen and 0.86 for phytoplankton concentrations. It was shown that nitrogen retention amounted to 23.4 % of the nitrogen load of the upper boundary and benthic denitrification was identified as the largest contributor to that sink. The retention varied significantly along the river section with amounts being almost 2.4 times higher in a natural reach compared with a heavy modified and channelized river section. The mean denitrification rate was 189 mg N/(m^2d). A sensitivity analysis indicated that the sinuosity is the most sensitive morphological factor on nitrogen loading, a 10 % increase of which causes a 2.4% decrease in inorganic nitrogen loading. There is a strong need to further develop the modelling of in-stream denitrification processes. We emphasize the need to include variable denitrification rates which depend on the sediment characteristics and the hy-

draulic exchange.