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# Nitrogen retention in a shallow groundwater-stream system of a lowland catchment

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Observed nitrogen loads in surface waters often do not reflect the actual input situation. In the present study we investigated this apparent retention of nitrogen in the 20 $km^2$ lowland catchment Schaugraben in northern Germany. Stream and seepage water as well as shallow groundwater was analysed for natural isotopic abundances of nitrate and DIC. N-turnover in soil water and shallow groundwater was examined through stable isotope tracer experiments. In-stream N-turnover was investigated in detail using the isotope pairing method applied in a newly developed benthic-flow-chamber. Nitrogen transport and turnover was simulated by one-way coupling of a soil (MRISK-N) and a groundwater model (MODFLOW). Nitrogen degradation in the saturated zone was simulated with a newly developed multi species reactive transport model (RT3D). In-stream processes were simulated with the water quality model AQUASIM. The surface near groundwater zone shows quiet high nitrate degradation-rates; hence nitrogen input is completely degraded after short distances. The main sources of nitrogen input are rapid discharge components and nitrogen inputs close to the drain channel. Within a stream section nitrogen input as well as nitrogen degradation processes occur. In-stream degradation can be identified as a dominating process in warm and dry periods in summer. Experiments show more than two times higher in-stream nitrogen degradation at night than in the daytime. In spring and early summer N-concentrations are dominated by N-inputs, N-degradation is only of minor importance. The areas adjacent to the drain channels play a key role for nitrogen input and transformation. The model approach allows the assessment of specific measures to enhance natural attenuation of nitrate.