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Spatially distributed lateral Nitrate Transport modelling in Subsurface Flow at the Catchment Scale

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In river catchments nitrogen transformation and storage processes during lateral transport are important in controlling nitrogen loads of surface waters. There is a lack of approaches which capture lateral flows and associated nitrogen transformation in a spatially distributed way. The aim of this paper is to develop a new conceptional nitrogen transport and transformation model which simulates the lateral nitrate transport in subsurface flow from the source area to the receiving water body. The developed tool is based on the Object Modelling System (OMS) framework and consists of the analytical spatially distributed hydrological model J2000, the nitrate recharge model Meta Candy and a new groundwater nitrogen routing component. The nitrogen subsurface transport component uses a variable number of sub storage layers for each hydrological response unit. Nitrate degradation is calculated stoichiometrically according to a predefined amount on oxidisable substrate depending on the rock type. The decrease of subsurface nitrate reduction capacity can be simulated time and space depended. The new modelling approach was tested in a small agricultural lower mountain range catchment of Thuringia, Germany. The calibration of the nitrogen model using a four year period showed reasonable results for nitrate load calculations with a Nash and Sutcliff coefficient of 0.79. The four year validation period leaded to NS values of 0.69. There was a clear relationship between the goodness of the hydrological simulations and the nitrate concentration calculations. The temporal dynamic of nitrate concentrations could only be simulated satisfactorily if the share of different runoff components on total runoff was simulated reasonably. Due to short residence times of interflow nitrate degradation was restricted to base flow components. The new ap-

proach can be used to target nitrogen source areas within a catchment and assess the impact of these source areas on nitrogen load of surface waters in a spatially distributed way.