Geophysical Research Abstracts, Vol. 7, 00096, 2005
SRef-ID: 1607-7962/gra/EGU05-A-00096

Integrated modelling of water balance and nutrient dynamics in wetlands

S. Krause, A. Bronstert

Institute of Geoecology, Potsdam University (skrause@rz.uni-potsdam.de)

Water balance and nutrient dynamics of floodplains are strongly influenced by the tight interactions between the river and the floodplain. For river basin management of lowland rivers the interaction between river and floodplain needs to be quantified. Successful modelling of floodplain water balance requires an adequate reflection of the hydrological characteristics and processes of wetlands. Hydrological processes of the unsaturated zone as well as groundwater flow processes and the interaction with surface water dynamics have to be implemented within the model concept. The model IWAN enables to process based simulation of integrated water balance and nutrient dynamics within floodplains. It combines the water balance routines of the hydrological model WASIM-ETH with the numerical simulation of lateral groundwater flow within the groundwater model MODLFOW and implements spatially and temporally variable interactions between groundwater and surface water. Watershed delineation based on digital terrain analysis algorithms is limited for lowland rivers because of unsufficient topographical heterogeneity. Additionally the specified surface catchment and groundwater catchment often differ intensively, thus, the boundary conditions for the model can not be consistently applied. For specification of the floodplain part which directly interacts with the surface water an algorithm was generated which is based on the regionalisation of local simulation results with the IWAN model. The application of these algorithm for the Havel river basin, located in the Northeaster German Lowlands, leads to the delineation of a ca. 100000 ha interaction zone, the so called ‘direct catchment’. This direct catchment is defined as the specific part of the floodplain which is directly influenced by surface water dynamics. Simulations of water balance with the IWAN model proof the importance of surface water - groundwater interactions for floodplain water balance. It also shows that during low discharge periods in summer groundwater runoff from the floodplain is the major component of

the discharge within the river although the importance of groundwater runoff during the entire year is relatively unimportant for river discharge. Additionally, the retention potential of the floodplain during flood periods could be quantified. For analysis of water and groundwater quality, the nitrogen metabolism within the groundwater and the transport of nitrate were simulated considering advection/dispersion as well as sorption and denitrification. The temporal variability of the denitrification range in groundwater in dependency of the imports from the root zone and the variable interaction with the surface water could be quantified. Simulation results show, although sometimes nitrate is transported by groundwater into the river there are also periods when nitrate from the river is transported into the groundwater were effective denitrification occur. In this way the floodplain sometimes works as source of nitrate, in other periods it becomes an important retention area. The analysis of the temporal variability of the transport directions shows that an enlargement of the surface water loads of nitrate from groundwater mostly occur during the ecologically important low discharge periods with only marginal loads within the river.