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Scenario based analysis of management influences on wetland water balance and nutrient dynamics

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Management of the water balance of wetlands and floodplain areas often includes to deal with partially opposite demands of different stakeholders and landusers. Their requirements concern the temporal variability of water availability as well as the temporal and spatial distribution of wet areas in the floodplain and the controlling of groundwater depths in dependency to the particular landuse management. Unfortunately, the different demands on decision making are often furthermore strengthened by insufficient knowledge about the efficiency of different impacts and management strategies to the floodplain water balance. The joint research project 'Management Options for the Havel Catchment' goals to the improvement of the water quality in the Havel river as well as to stabilisation of the water balance within its catchment. It is one of the main goals of the project to close the gap between hydrological sciences and decision making to reach a sustainable river basin management. Therefore, the influences of different management strategies to the water balance and groundwater dynamics were analysed for several subcatchments of the Havel river. Scenarios have been generated, assuming changing conditions in landuse management as well as in river geometry. The model IWAN has been created for integrated modelling of water balance and nutrient dynamics of floodplains. It enables to an analysis of the interactions between a lowland river and its adjacent floodplain. An adequate reflection of the processes of the unsaturated soil zone and of the groundwater flow processes as well as of the interactions between groundwater and surface water is realised by the coupling of the hydrological model WASIM-ETH with the groundwater model MODFLOW. Nitrogen dynamics within the groundwater passage are simulated by the nutrient and transport model MT3D. This module is linked to the groundwater model and considers advection, dispersion and sorption as well as denitrification. The validation of the

IWAN model within a subcatchment of the Lower Havel River proofs its applicability for groundwater influenced floodplains. The effects of certain scenario assumption on water balance and nitrate dynamics in groundwater have been simulated using the IWAN model. A major impact of surface water - groundwater interactions of the floodplain on wetland water balance as well as on river discharge could be quantified. It was shown, that changes in landuse management have only minor influences on floodplain water balance whereas alteration of drainage structure and river geometry can cause substantial changes of the water balance. It could be verified that the interaction between river and groundwater of the floodplain in some periods cause an enhancement of nitrate within the river. On the other hand simulation results show also periods of nitrate retention from the river within the groundwater. The simulation of landuse change scenarios for analysing nitrate reduction within the groundwater showed the minor effects of management alteration for the inflow of nitrate to the river. Otherwise it also reflects the importance of landuse changes for the improvement of nitrate contents in groundwater and surface water quality respectively. Implementation of the simulation results in a multi criterial analysis tool and a decision support system will lead to a better understanding of the influences of management effects on wetland water balance and (ground)water quality and will hopefully help decision makers to find better decisions.