Geophysical Research Abstracts, Vol. 8, 04802, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04802

Investigating the impact of dynamic interactions at the groundwater - surface water interface on floodplain water balance and chemistry

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Experimental investigations in German and English floodplain catchments proved a tight interaction between the floodplain vegetation, the water balance and the surface water dynamics of the adjacent rivers. Experimental results from these catchments lead to a qualitative understanding of the controls of wetland groundwater - surface water interactions which are determined by pressure head gradients, by the physical and chemical characteristic of the hyporheic zone as well as by vegetation dynamics. The coupled IWAN model was set up in order to quantify the exchange rates between groundwater and surface water in dependence of landuse and management practices and to assess the importance of the temporally and spatially dynamic interactions at the groundwater - surface water interface for the floodplain water balance and water quality. The model was calibrated and validated for several subcatchments of the Havel river in North-eastern Germany and an overall good model efficiency could be obtained. The model was successfully applied for water balance and nitrate dynamics simulations at different German floodplain catchments. The importance of interaction processes at the groundwater - surface water interface for the floodplain water balance, for the groundwater chemistry as well as for the river discharge and water quality could be quantified. It was shown that a major impact of the floodplain groundwater dynamics on the river discharge and subsequently on the water quality is limited to the low flow seasons in summer. Although the overall model efficiency was satis-

fying in general, discrepancies in the spatial distribution of the goodness of fit were detected which are mainly caused by the assumption of spatial mean values for the controlling parameters at the hyporheic zone interface. In order to improve the spatial correctness of the simulation results experimental investigations started at two English catchment sites dealing with the identification and quantification of the key parameters which control the hyporheic zone hydrology and chemistry. Therefore the hyporheic zone key physical characteristics which determine the fluxes across the groundwater - surface water interface are investigated by geophysical and tracer techniques. Thus, estimates of the spatial variability of stream bed hydraulic conductivities and of flow velocities could be obtained. Furthermore investigations of hydro-chemical characteristics of the hyporheic zone started involving advanced analytical techniques as DET (Diffusive Equilibrium in Thin-Films) or in situ redox analyses in order to characterise the hyporheic zone controls on chemical processes as nitrogen metabolism. Based on the experimentally gained results estimation uncertainties of spatially variable physical parameters as hydraulic conductivities could be minimized. First model analyses using the more detailed information of hyporheic zone parameters show promising improvements of the spatial representation of processes at the groundwater - surface water interface what subsequently leads to a better accuracy of the simulation results.