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# Scrutinising the scale dependent efficiency and uncertainty of predicting nutrient attenuation in the riparian and hyporheic corridor

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Riparian zones are well acknowledged for their ability to attenuate nutrients and buffer the impact of diffuse pollution. Their ameliorative function has been considered in river management plans as required by the European Water Framework Directive. We present the results of a simulation of riparian water balance and nutrient dynamics in nested floodplain catchments from ranging 2 - 1000 km2, coupling the hydrological processes of the unsaturated soil zone with riparian groundwater dynamics and the interactions to the surface water. The results of this model simulation indicate that riparian nutrient attenuation can be crucial for the river nutrient concentrations and thus, for in stream ecological health. However, a sensitivity analysis also detected, that the spatial pattern and temporal dynamics of exchange fluxes, residence times and transformation rates are mainly controlled by the conditions at the direct interface between groundwater and surface water, the hyporheic zone. Although the hyporheic zone and its impact on exchange fluxes and redox conditions, on nutrient transformation and attenuation have been intensively studied on the plot scale in the last 15 years, there is little known about the large scale impact of hyporheic functioning. In an experimental field study on a stream reach of a North English river, hyporheic nitrogen profiles in nested piezometers have been analysed in dependency of the degree of groundwater - surface water mixing and the resulting streambed redox conditions, and oxygen levels. The results of this study indicate, that even on the smaller scale, an intensive variability of spatial patterns of hyporheic exchange fluxes, nutrient transport, transformation rates and direction can be found, which have a temporally variable impact on the in stream nutrient conditions and may, at certain times, superimpose the impact of the wider riparian processes. Based on these results we discuss the need and strategies of how to upscale the experimentally gained local knowledge for the use in meso-scale hydro-chemical modelling approaches in order to allow a river basin wide assessment of streambed nutrient attenuation or release. This includes the discussion of parameter and model uncertainties and to what degree the consideration of more complex hyporheic process dynamics can be beneficial for the predictive capacity of river basin models.