Geophysical Research Abstracts
Vol. 14, EGU2012-10405, 2012
EGU General Assembly 2012

Monitoring of lateral hyporheic exchange fluxes and hyporheic travel times at the newly established Steinlach Test Site, Germany

K. Osenbrück, D. Lemke, M. Schwientek, M.C. Callisto Alvarez, Th. Wöhling, and O.A. Cirpka
Water and Earth System Science (WESS), Department of Geosciences, University of Tuebingen, Tuebingen, Germany (karsten.osenbrueck@uni-tuebingen.de)

Hyporheic exchange is believed to significantly contribute to the retention and degradation of pollutants during downstream transport in surface waters. A better understanding of the relevant hydraulic drivers of stream water infiltration into the hyporheic zone in conjunction with the associated biogeochemical processes is needed in order to quantify the self-cleaning potential of rivers and to predict water quality changes. Key parameters include the spatial and temporal variation of stream water infiltration (i.e. hyporheic exchange) and the distribution of hyporheic travel times.

In this study we present the setup, performance and first results of a multi-disciplinary hyporheic monitoring program at the newly established Steinlach Test Site (STS) near Tübingen in Southern Germany. The STS covers an area of about 0.6 ha and consists of a river loop located within a sub-catchment of the Neckar river. The main objective is the quantification and interrelation of hyporheic processes including hyporheic exchange, travel-time distributions, microbial community dynamics and biochemical pollutant turnover at the groundwater-surface water interface. Here we will focus on the extent and time scale of hyporheic exchange fluxes at the STS derived from time series of temperature (T), specific electrical conductivity (EC), and δ18O of water. The STS is equipped with more than 30 piezometers, most of them containing automatic water level, T and EC probes. Additional water samples for major ions, stable isotopes and other water quality parameters were taken in the course of flood events in summer 2011. The sand and gravel aquifer in the subsurface of the STS is characterised by a complex geometry with heterogeneous hydraulic conductivity. Low residence times in the southern part are confirmed by a small to negligible response in EC and T at the respective piezometers compared to the large variation of EC in the stream water. Using deconvolution techniques, a mean travel time of 3 to 4 days can be estimated for the outlet from the EC and δ18O data after major flood events. However, the fitted models also indicate a significant contribution (about 30%) of a much older water component which has not been identified yet. Possible sources include less permeable flow paths across the river loop, discharging groundwater, or hillslope water. The latter most likely plays only a minor role based on simple chemical mixing calculations. Combining the spatial point information of estimated mean travel times with aquifer geometry derived by geophysical and exploratory methods will allow an estimation of the magnitude of hyporheic exchange through the river loop at the STS.