



Impact of streambed heterogeneity on hyporheic exchange fluxes under losing and gaining stream flow conditions

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Biogeochemical processes in streams are affected by water exchange between the surface and subsurface environments (e.g. hyporheic exchange). It has previously been shown that hyporheic exchange is strongly affected by the local morphology of the streambed and the flow conditions, including overlying water velocity and losing or gaining fluxes. The objectives of this work were to evaluate how the streambed heterogeneity is affecting hyporheic exchange. In addition, we tested how losing or gaining flow conditions are affecting the hyporheic exchange fluxes and the spatial distribution of the flow paths within the streambed.

Experiments measuring the combined effect of streambed heterogeneity and losing and gaining flow conditions on hyporheic exchange were conducted in a laboratory flume system (640 cm long and 30 cm wide). The flow in the flume is fully controlled including gaining or losing fluxes, and it was packed with heterogeneous sediments. An estimate of the solute exchange between the stream and the sediment was obtained from the analysis of a salt tracer (NaCl) injection into the overlying water, which then was monitored by an electrical conductivity meter. In addition, dye injections into the overlying water were used to visualize the effect of sediment heterogeneity on the flow paths in the streambed.

Experimental results showed that increasing losing and gaining fluxes resulted in a similar decline in the hyporheic exchange flux as previously observed for a homogenous streambed. However the location in which the hyporheic exchange takes place is different and is strongly influenced by the sediment heterogeneity. The spatial distribution of hyporheic exchange within the streambed will be discussed in light of the distribution of the local, horizontal and vertical hydraulic conductivities.