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Geophysical Research Abstracts,
Vol. 10, EGU2008-A-01706, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-01706
EGU General Assembly 2008

Quantifying the impact of the stream-aquifer interaction on the surface-subsurface exchange

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The exchange of oxygen and nutrients between the well-aerated stream water and the subsurface water is crucial for the biochemical conditions of the hyporheic zone, i.e., the interface region between the stream and the deep aquifer. The hyporheic zone is extremely important for the ecology of the fluvial environment because of the rich microbial community that lives on the hyporheic sediments. The metabolic activity of these microrganisms controls the fate of nitrogen and phosphorus in the pore water, and influences the fate of these nutrients at the catchment scale. Unfortunately, the uncomplete knowledge of the complex hydrodynamics of the coupled surface-subsurface flow field often hinders the understanding of the ecological relevance of the hyporheic processes. A reasonable amount of information on these hydrodynamic conditions is required by biologists and ecologists in order to gain a deeper insight on these processes. This contribution analyses how the interaction between the groundwater table and the free-surface stream influences the hyporheic exchange induced by the bedforms through the streambed. The most representative characteristics of the hyporheic exchange - e.g., the depth of the hyporheic zone - have been parametrized in terms of a small number of easily measurable quantities. These information on the hyporheic flow field provide the fundamental basis for the study of the ecological functioning of the hyporeic zone.