Beyond the black box: In-situ quantification of subsurface solute transport using electrical geophysics

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Date(s)	Monday 30th April 2012 (16:15-17:15)
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Host: Stefan Krause

Connectivity between stream and their aquifers over short spatial and temporal scales (i.e., hyporheic exchange) underpins a number of ecosystem processes. The hyporheic zone has been referred to as a “river’s liver” due to the pollutant processing that occurs along short subsurface flowpaths. Traditional characterization of hyporheic exchange relies upon solute tracer studies coupled with spatially sparse observations in streams and monitoring wells. Recent advances using near-surface electrical resistivity (ER) allow monitoring of solute tracers in-situ with high spatial and temporal resolution. By coupling electrically conductive stream tracer studies with ER methods, spatially complete information about the exchange of tracer between streams and aquifers can obtained. This seminar demonstrates the use of ER to image hyporheic exchange in both two and three-dimensions. Geophysical images are used to construct tracer breakthrough curves across multiple transects, by comparing images during the tracer study to background (pre-tracer) images. The spatially complete images are next analyzed using temporal moment analysis, to compress the temporal trends into descriptive statistics and identify dominant solute transport processes (e.g., transient storage dominated, advection dominated, etc.). The spatially complete data set is a dramatic improvement over traditional methods, which would otherwise provide only reach-averaged values, or single observations in space. Using ER, solute dynamics may be analyzed throughout the heterogeneous subsurface, improving our ability to identify flowpaths at different temporal scales of stream connectivity. Future application will greatly enhance our ability to understand the fate and transport of stream solutes in near-stream aquifers.