Quantifying Stream-Groundwater Interactions and Biogeochemical Cycling at Several Spatial and Temporal Scales

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Interactions of streams and groundwater have been identified as a key driver of water quality in surface waters over the past several decades. However, the techniques used to quantify these interactions, and therefore the impact on biogeochemical cycling has, until recently, either been over-simplified (i.e., overly interpreted signals from tracer experiments) or overly detailed requiring extensive field data (i.e., groundwater flow modeling). We have developed several techniques to provide straight-forward quantification of stream-groundwater exchanges at a variety of spatial and temporal scales. In this presentation, we will present applications of (a) stream water (and solute) mass balance approaches for reach-scale investigations, (b) simple techniques to deconvolve tracer breakthrough curves into transport component mass-fractions, and (c) electrical geophysics techniques to reveal the 2-D and 3-D extent and temporal dynamic of actively exchanging stream water through riparian aquifers. We will also present some of the implications for using these techniques in field investigations of environmental geochemistry and biogeochemical cycling. The incorporation of these techniques has allowed us to revise our conceptual models of stream-groundwater interactions and their potential to influence stream and subsurface water quality.