Geophysical Research Abstracts
Vol. 13, EGU2011-12588, 2011
EGU General Assembly 2011

Hydrologic gains and losses, hydrologic turnover, and stream network controls on streamwater composition

Timothy Covino, Brian McGlynn, and John Mallard
Montana State University, Montana, USA

Increasingly, streams and groundwater are viewed as a single resource, and are now known to be continuously interacting and exchanging water. Typical stream-groundwater studies have focused on hyporheic scale exchanges, which occur at smaller spatial (meters) and temporal (minutes) scales, but have neglected the influence of larger scale (kilometers and days to years) interactions in controlling the movement of water and solutes across watersheds and stream networks. At these larger scales, the bidirectional movement of water between streams and groundwater leads to hydrologic turnover – or the fractional turnover of streamwater – which has important implications for hydrological and biogeochemical processes and exert influence over streamwater composition, hydrologic mass balances, and solute, nutrient, and pollutant transport downstream. We used consecutive conservative tracer injections (chloride, Cl-) across 10 stream reaches to investigate hydrologic gains and losses in the 11.7 km2 Bull Trout Watershed of central Idaho, USA. We found strong relationships between reach discharge, median tracer velocity, and gross hydrologic loss to groundwater systems across the continuum of stream types and sizes in the watershed. Next, we implemented these empirical relationships within a watershed scale network model to simulate hydrologic gains, losses, and fractional turnover of streamwater from the headwaters to the outlet of the 11.7 km2 watershed. We demonstrate that hydrologic gains and losses, and streamwater turnover exert strong controls on streamwater composition and solute transport throughout the stream network. Furthermore, we assess proportional contributions of watershed runoff to streamwater composition and the relative influence these contributions have on compositions observed across the stream network. These dynamics provide insight into the internal mechanisms that partially control the hydrologic and biogeochemical signals observed along stream networks and at watershed outlets.