Geophysical Research Abstracts
Vol. 15, EGU2013-580, 2013
EGU General Assembly 2013

Soils and stream chemistry: When, where, and why are they linked?

William McDowell
University of New Hampshire, United States (bill.mcdowell@unh.edu)

The past three decades have witnessed a dramatic increase in research on dissolved organic matter (DOM) in surface waters. Recent work, for example, has shown the importance of DOM in lake food webs, river metal transport, and ocean optics. Except for those unusual systems with significant chemolithotrophy, all DOC is ultimately derived from photosynthesis, and most DOM that is found in surface waters appears to have originated from soil organic matter (SOM), rather than in situ from aquatic primary production. A variety of approaches have been used to arrive at these broad generalizations, and to understand the nature and strength of the relationships between SOM and DOM. I will review these approaches, and highlight areas where our current understanding is inadequate to fully understand the linkages between soils and stream chemistry. Early evidence from Hubbard Brook showed strong similarity in functional group composition in soil solution and stream water, and strong effects of mineral soils on DOM concentrations that are now known to be almost universal. Subsequent work in the US and Germany refined these observations, showing that selective sorption of various DOM fractions could account for divergence between DOM and SOM characteristics. SOM expressed as soil carbon stocks, C/N ratios, and wetland coverage have all been shown to be predictive of spatial variability in DOM concentrations, yet no unifying model exists that reconciles all these observations. Novel molecular characterization techniques (Pyrolysis-GC-MS; NIR) show promise in quantifying the differences and similarities between SOM and DOM, but this promise has not yet been fully realized. A number of significant questions regarding the soil-stream linkage remain unanswered. If stream DOM is linked to soils, what is responsible for the large DOM increases in many riverine systems that appear to have occurred without substantial (or at least measurable) changes in SOM? Are these changes permanent or only transient responses? Are differences in DOM (DOC:DON) driven by differences in SOM, or by nutrient availability that affects the stoichiometry of DOM as it undergoes degradation? With large regions of melting permafrost, how will soil-stream linkages be altered and what will the effects be on global carbon balances and downstream ecosystems?