Poster #22-29

Influence of Hyporheic Exchange on Coupled S-Fe-C Biogeochemical Cycling in Riparian Wetland Sediments

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Riparian wetland hyporheic zones, where oxic surface water and anoxic groundwater mix, exhibit dynamic conditions that drive steep redox gradients and promote hotspots and hot-moments of diverse and fluctuating microbial activity. There is growing evidence that highly active "cryptic" sulfur cycling processes drive the fate of iron and carbon and respond to dynamic hyporheic fluxes in riparian wetlands. These "hidden" or "cryptic" sulfur redox processes are not well constrained in freshwater systems but can include the production of reactive intermediate S species that promote further biotic and abiotic redox reactions (including those coupled with Fe reduction and methane oxidation), thus supporting higher rates of sulfur biogeochemical cycling than otherwise expected in these low sulfate environments. The overall goal of this project is to develop a mechanistic understanding of how hydrologic flow influences coupled abiotic-biotic Fe-S- methane cycles in riparian wetlands. Our specific objectives are to (1) measure the fate and transport of Fe, S, and CH_4 in dynamic riparian wetlands, (2) evaluate the microbial community structure and potential function driving these cycles, (3) incorporate "cryptic" S-Fe-C processes into a reactive transport model to examine hyporheic flux impacts, and (4) assess how increased sulfate loading can alter coupled S-Fe-C processes. We will present preliminary results of our geochemical analyses (Fe and S speciation and abundance in sediments, porewaters, and surface waters) and hydrologic flux measurements in an organic-rich riparian wetland at Tims Branch, part of the Argonne Wetland Hydrobiogeochemistry SFA. We will compare these results to findings at a riparian wetland site in northern Minnesota with higher surface water sulfate loading, for which we have implemented a reactive transport model that has provided evidence for these cryptic sulfur redox processes.