Poster #153

Geomorphic Controls on Riparian and River Geochemistry in the East River Watershed

Michelle Newcomer[1], Dipankar Dwivedi[1], Patricia Fox[1], Anna-Lena Grauel Anna-Lena Grauel, Mark Conrad[1], Markus Bill[1], Peter S. Nico[1]

[1] Lawrence Berkeley National Laboratory

Contact: Michelle Newcomer [mnewcomer@lbl.gov]

This section of the Watershed SFA focuses on how river morphology, specifically bedform and active and stranded meanders, impacts the redox processes in the associated sediments and therefore the export of carbon, metals, and nutrients into the river. For the bedform driven exchange effort, we employed a river box model to provide the boundary conditions for a subsurface flow and reactive transport model. A Bayesian approach was used for the river box model that allows gross primary productivity, respiration, and diffusion parameters to vary with season. We constrained the model with data including radiation, barometric pressure, water depth, temperature, pH, DIC, and atmospheric CO_2. Downscaled climate predictions of temperature and atmospheric CO_2 were used to force the models and to compare future and current hyporheic zone processing. Initial model results show that hyporheic zone redox conditions are enhanced over the summer growing season, but highly vary depending on the contributions from snowmelt baseflow.

For the meander focus, we combined sediment characterization and water sampling with reactive transport modeling investigations. Specifically, we collected sediment cores from transects across an active and stranded meander and installed piezometers for groundwater sampling. Both transects are characterized by coarse alluvial material (pebbles-cobbles) overlain by finer grained soil/sediment, however the thickness of the finer grained sediment layer varies from approximately 20-100 cm. Several hot spots of Fe-reduction in sediments were identified, which correlate well with measured dissolved Fe(II). TOC concentrations ranged from 0.36-3.29%, generally decreasing with depth. While $\delta^{13}C$ concentrations showed relatively little variation among samples, $\delta^{15}N$ varied significantly (-3.3 to 2.5 ‰) suggesting mixing of different sources of N (e.g., Mancos shale versus plants organic matter). Sediment $\delta^{14}C$ values ranged from -282 to -788 ‰ and were lower in deeper samples. The low $\delta^{14}C$ values suggest that shale kerogen may be a significant source of organic carbon in the floodplain.

The aggregated functioning of two active meander was explored using PFLOTRAN, and an integrated a biotic and abiotic reaction network. The three-dimensional model was able to predict the hydrological and biogeochemical fluxes in the subsurface. In particular, simulations results, consistent with observations, showed that nitrate, dissolved oxygen, and dissolved organic carbon values decreased, while iron (Fe (II)) values concentrations increased along the meander centerline transect away with distance from the stream. Results also demonstrated that hyporheic flow paths and sinuosity significantly impacted carbon and nitrogen export into the stream system.