Poster #21-40

River Corridor Processes Impacting Nutrient and Metal Export in the East River

Patricia Fox[1], Michelle Newcomer[1], Dipankar Dwivedi[1], Wenming Dong[1], Nick Bouskill[1], Markus Bill[1], Mark Conrad[1], John Christensen[1], Christian Dewey[2], and Peter Nico[1*]

[1] Lawrence Berkeley National Laboratory, Berkeley, CA
[2] Stanford, Palo Alto, CA

Contact: psnico@lbl.gov

BER Program: SBR
Project: Berkeley Lab Watershed Function SFA
Project Website: watershed.lbl.gov

The river corridor is generally defined as including the main river channel as well as the following associated River Corridor Elements (RCE): hyporheic zones, meanders, lagoons, sediment deposits, riparian zones, floodplains, topographic hollows, beaver dams, off-channel wetlands, and other key landscape features. These features are increasingly recognized as important components of headwater catchments. Hydrologic connectivity along river corridors and across RCE is considered to be one of the key controls of geochemical exports of metals and nutrients to streams but this connectivity changes with climatic and seasonal conditions, e.g. spring snowmelt or monsoon storms, making the emergent functioning of the system dynamic across time and space. The efforts reported here have focused on quantifying and modeling the biogeochemical processes and hydrologic connectivity taking place in particular RCE to assess and simulate their impact on geochemical export in the East River. The RCEs focused on to date include vertical and horizontal hyporheic exchange across meanders and river bedforms supported by laboratory experiments, modeling simulations, and extensive field geochemical sampling. Our extensive research activities have revealed some novel insights including: 1) meander geomorphology supports extensive lateral redox gradients which is shown to enhance metal export from the meander to the river; 2) sediment heterogeneity is the determining factor for whether a meander is functionally classified as ‘oxidizing’ or ‘reducing’; 3) hydrology perturbations combined with knowledge of vertical hydro-stratigraphy together enhance later redox zonation and Fe, C export, and 4) evidence of substantial vertical redox zonation and anoxic microzone development beneath the riverbed that may support substantial and enhance river denitrification as climate warms. Our future river corridor efforts will focus on vertical hyporheic exchange with a particular emphasis on the development of a mechanistic stream/benthic/hyporheic system model with various hypothesis testing capabilities for understanding the role and implications for decadal scale nitrogen exports. In addition, the preliminary work has indicated the potential importance of off channel wetlands as important RCEs whose functioning and impact require further development. Lastly, it is a key goal of this effort to develop numerical scaling schemes based on the interconnection of RCEs that can be applied across large sections of the East River as well as other adjacent drainages.