From Rifle to RMBL: MODEX activities at LBNL's new RMBL/East River field site

Christine E. Pribulick[1], Reed M. Maxwell[1], Rosemary W. Carroll[2], Carl I. Steefel[3], Chad Hobson[2], Li Yang[3], Wenming Dong[3], Amy M. Kenwell[1], Alexis K. Navarre-Sitchler[1], and Kenneth H. Williams[3*]

[1]Colorado School of Mines; Golden, Colorado (USA)
[2]Desert Research Institute; Reno, Nevada (USA)
[3]Lawrence Berkeley National Laboratory; Berkeley, California (USA)
[*]khwilliams@lbl.gov; ph: 510.701.1089

As part of LBNL's Genomes-to-Watershed Scientific Focus Area (SFA) research program, Modeling-Experiment (MODEX) activities have begun at a new field station within the upper East River catchment, located near the town of Crested Butte, Colorado. The East River is one of two major tributaries that form the Gunnison River, which in turn accounts for just under half of the Colorado River's discharge at the Colorado/Utah border. Emblematic of many mountain headwater catchments within the upper Colorado River Basin, the site is home to the Rocky Mountain Biological Laboratory (RMBL), which enables data sharing related to hydrology, meteorology, phenology, and coupled vegetation-microbiology studies of direct relevance to LBNL's SFA program.

Data collection activities started in May 2014 indicate the site is well suited for addressing the primary research objective of the LBNL SFA project, which is to quantify the impact of climate-induced changes in hydrology and vegetation on biogeochemical functioning at the scale of the watershed. Initial observations suggest varying responses in water isotope composition and nutrient concentration to changes in river discharge. Hyporheic exchange between the East River and its associated floodplain deposits has been shown to induce sharp gradients in redox sensitive elements, with gaining reaches exhibiting evidence of carbon mineralization coupled to a variety of reductive pathways. Pools of sediment-associated carbon exhibit strong spatial gradients in both total concentration and lability.

The catchment is presently being modeled at 10m resolution using ParFlow, a parallel, integrated hydrologic model. Driven by meteorological forcing, ParFlow is able to capture land surface processes and represents surface and subsurface interactions through saturated and variably saturated heterogeneous flow. The model assesses hydrologic changes accompanying shifts in both meteorological inputs and vegetation distribution to capture variations in energy and water budget components. In the near term, coupling this watershed model with one describing a diverse suite of genome-resolved elemental cycling pathways, including carbon, nitrogen, and sulfur transformations, will provide an improved understanding of the response of the subsurface biome to hydrologic transitions induced as a result of global climate change. In addition, a low gradient subdomain within the larger catchment model serves as one of two use cases for DOE's IDEAS project. The East River use case seeks a better understanding of aquifer redox status and climate impacts on watershed carbon and nitrogen cycling through higher fidelity, multi-scale models simulated at high spatial resolution.