Modeling the biogeochemical response of a flood plain to hydrologic forcing

S. MOLINS, B. ARORA, N. SPYCHER, J. N. JOHNSON AND C. I. STEEFEL

[1]Earth Sciences Division, Lawrence Berkeley National Laboratory

The quantification of the carbon fluxes, stocks, and transformations in soils and watersheds is critical for closing key biogeochemical cycles and for developing predictive understanding of climate change scenarios. The Old Rifle site is located on the flood plain of the Colorado River. At present, site-wide field investigations focus on microbial metagenomic analyses, saturated and unsaturated zone hydrology and quantifying selected biogeochemical variables including organic carbon pools and inorganic carbon fluxes. Modeling is used to integrate these data and address the overarching goal of understanding of the impacts of climate and land use changes on the terrestrial ecosystem behavior.

As component of the overall modeling approach, a *2-D Transect Infiltration* model has been developed. The specific goal of this component is to capture the biogeochemical response of the Rifle Flood Plain subsurface system to hydrologic forcing, including snow melt, Colorado River stage, infiltration from Rifle uplands, and fluctuations in water table elevation.

Reactive transport modeling of the coupled unsaturated-saturated zone is solved along a transect corresponding to the TT series of wells. Infiltration, including irrigation, in the Rifle uplands provides the upgradient boundary condition, while the down-gradient boundary is the Colorado River. Flow is solved under variably saturated conditions, while the treatment of biogeochemistry focuses on tracking the fate of O_2, N, and C. The simulations are performed for the April through September 2013 time frame, which covers the spring snow melt event at the site followed by the gradual water table lowering and seasonal temperature increase during the summer months. Material properties for unsaturated flow are available from textural data analysis.

Simulation results are constrained by measurements of water and carbon fluxes, along with water table elevation, and by isotope and major element chemistry. Simulations are used to evaluate the relative contribution of flux from the unsaturated zone versus lateral groundwater flow and investigate how water table fluctuation affect processes maintaining sub-oxic conditions in the aquifer; in particular, how gas entrapment in the capillary fringe affects this sub-oxic condition.