Poster #156

Digital Watershed: Advanced Watershed Characterization across Scales

Haruko Wainwright[1], Baptiste Dafflon[1], Emmanuel Leger[1], Susan Hubbard[1], Nicola Falco[1], Heidi Steltzer[2], Chelsea Wilmer[2], Ken Williams[1]

[1] Lawrence Berkeley National Laboratory
[2] Fort Lewis College

Contact: Haruko Wainwright [hmwainwright@lbl.gov]

Predictive understanding of watershed function and dynamics is often hindered by the heterogeneous and multiscale fabric of watersheds. In particular, biogeochemical cycling involves complex hydrological-biogeochemical interactions occurring from bedrock-to-canopy, including plants, microorganisms, organic matter, minerals, dissolved constituents, and migrating fluids. Understanding and quantifying such interactions across heterogeneous watersheds is critical for estimating and predicting integrated ecosystem responses – such as carbon and nutrient export and impacts to water quality – under climate changes and other perturbations.

Under the Watershed Function SFA, we develop novel watershed-characterization methodologies to quantify complex watershed systems across scales, using advanced sensing, inversion, and machine learning approaches. Through explicitly bridging information derived from “on the ground" observations and remote sensing data, we catalyze the development of the fundamental scientific linkages among interacting processes in the watershed. Particular focus is to quantify and distribute subsurface and biogeochemical properties by exploiting their co-variability with geomorphology and vegetation (i.e., plant functional types and their dynamics) that can be measured by remote sensing. First, we couple surface geophysics (seismic and electrical) and multiple remote sensing (i.e., airborne LiDAR, UAV) to quantify the co-variability between geomorphology and subsurface structure, and then to estimate the bedrock depth and other subsurface properties across the watershed. Second, we develop an advanced data fusion and machine learning-based approach to estimate the plant functional types and traits over the watershed in high-resolution by integrating multispectral images and airborne LiDAR. The detailed distributions of plant characteristics are then used to scale biogeochemical properties across the watershed. By characterizing heterogeneous properties over the watershed, we aim to develop the new ‘Digital Watershed’ concept for model parameterization and validation.