**Tractable Characterization of Complex Watershed Behavior Using Geophysical Methods**

**ABSTRACT**

Quantifying how terrestrial systems respond to climate change and extreme events is challenging due to the complexity of associated processes that occur from bedrock-to-canopy and over a wide range of spatial and temporal scales. This presentation will describe the development of several new approaches to help bridge these compartments and scales, with a focus on the use of geophysical approaches to integrate and scale information from hydrological, geochemical and microbial datasets.

We first explore the use of new characterization approaches in an Arctic tundra ecosystem, where increasing temperatures are thawing the carbon-rich permafrost, potentially leading to significantly increased production of greenhouse gasses. We discuss the value of ecosystem zonation methods, which seek to represent regions in the landscape that have unique distributions of properties that influence carbon flux, including microbial community diversity. We then discuss the use of new methods to quantify the structure and function of a mountainous watershed in the Upper Colorado River Basin, where droughts and early snowmelt may influence downgradient water availability and water quality. Through use of above-and-below ground autonomous monitoring systems, we are developing a ‘window’ into the critical zone, which is enabling us to watch the system behave in near-real time. We are finding that early snowmelt can potentially lead to cascading effects on coupled vegetation-microbial-hydrologic behavior that can dramatically affect water, nutrient and carbon cycles.

The recent advances are leading to insights about how these systems function and respond to perturbations - from local scales (where native processes occur) toward watershed scales (that are relevant for managing natural resources).

**Susan Hubbard, PhD**

**Associate Lab Director for Earth & Environmental Sciences, Lawrence Berkeley National Laboratory**

As the Associate Lab Director for Earth & Environmental Sciences at Berkeley Laboratory, Dr. Hubbard leads a premier group of ~500 scientists with expertise in climate science, terrestrial ecosystem science, environmental and biological system science, fundamental geoscience, and subsurface energy resources.

Susan’s research focuses on quantifying how terrestrial environments function, with a particular emphasis on using geophysical methods to explore how hydrological, geochemical and biological processes interact to govern larger scale system behavior. She earned her PhD in Civil and Environmental Engineering at UC Berkeley, where she has been recognized as a Distinguished Alumni. Prior joining Berkeley Lab, she was a geologist at the US Geological Survey and a geophysicist in industry. She founded the American Geophysical Union (AGU) Hydrogeophysical technical committee and co-edited the first book on Hydrogeophysics.