Poster #13

Investigating Bedrock Through Canopy Structure, Organization and Connectivity of an Arctic Watershed

E. Léger, B. Dafflon, J. Peterson, C. Ulrich, F. Soom, S. Biraud, A.P. Tran, H. Wainwright, J. Ajo-Franklin, and S.S. Hubbard

[1] Lawrence Berkeley National Laboratory, Berkeley CA

Contact: Emmanual Léger [eleger@lbl.gov]

Improving understanding of Arctic ecosystem functioning and parameterization of process-rich models that simulate feedbacks to a changing climate requires advances in quantifying ecosystem properties, from within the bedrock to the top of the canopy. In Arctic regions having significant elevation gradients and subsurface heterogeneity (bedrock, permafrost, ground ice), quantifying surface and subsurface structure, organization and connectivity of watershed elements is critical yet particularly challenging. In particular, the degree of connectivity or isolation of individual watershed elements will control whether changes in one element will propagate beyond the site of change or remain isolated in space.

In this study, we evaluate linkages between physical properties (incl. soil properties, bedrock depth, permafrost characteristics), hydrological conditions and geomorphic characteristics. This study takes place in a Seward Peninsula Watershed near Nome AK, which is characterized by variable vegetation, significant elevation gradients, extensive bedrock, and discontinuous permafrost. We use a multi-method acquisition strategy to characterize below and above ground properties and their linkages, including point-scale measurements, electrical resistivity tomography, seismic refraction and low-altitude aerial imaging. Data integration and analysis is supported by numerical approaches that simulate dynamic hydrological and thermal processes.

Overall, this study enables the identification of watershed structure and the links between various soil properties (water content, temperature, electrical conductivity), landscape properties (incl. wetness conditions, vegetation, topographic metrics) and the bedrock/permafrost distribution and characteristics in a representative Arctic watershed. For example, results show that permafrost is more present under grassy areas and water saturated soil, while shallow rocky soil is often correlated to regions having no permafrost and increased drainage. These results are consistent with preliminary conceptual models developed for the investigated site. In addition, low-altitude aerial imaging shows promise to extend the landscape organization analysis approach to larger regions in the Arctic. The obtained information about organization and connectivity of the landscape is expected to be useful for improving predictions of Arctic ecosystem feedbacks to climate.