Evolution of flowpaths in an alpine watershed of the Colorado Front Range, USA

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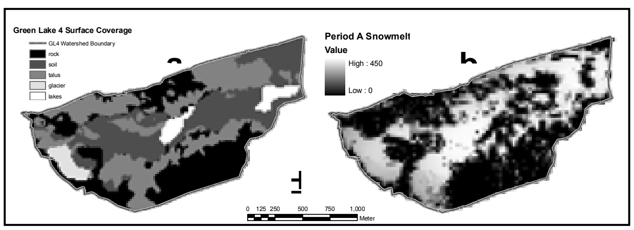
High elevation ecosystems are sensitive to climate and atmospheric deposition change. The end member mixing approach has brought limited improvement in understanding how these systems might respond to changes in process level forcing [1] since chemical end members are assumed to not react and therefore spatially differentiated flowpaths cannot be determined with this approach. Mixing between end members leads to chemically distinct water compositions.



a) **b)**

Figure 1: a) End member distribution in the GL4 catchment, b) Snowmelt distribution in spring in the GL4 catchment.

Potential physical flowpaths in Green Lake 4 (GL4) watershed were determined using reactions between end members and the extent of mineral weathering using chemical data, the mineral assemblage and PHREEQC. Distribution of snowmelt over distinct periods was modelled to determine the contribution of each source water composition during the period. This coupled use of mixing models and the reaction path approach promises a better approach to understand catchment hydrology in reponse to changes in forcing.

[1] Liu, F. *et al.* (2004) *Water Resour. Res.* **40,** W09401.

Environmental voltammetry to characterize microbial habitats

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Microbes in any natural environment utilize redox species as electron donors and acceptors to drive metabolic reactions, these redox species are often aligned in gradients that can vary in scale over many orders of magnitude. Voltammetric microelectrodes can be used to determine redox speciation *in situ*, in real time, and at spatial scales down to tens of microns. A number of microbially important redox species can be characterized with these electrodes, including a number of key sulfur and iron species, as well as oxygen, manganese, and other metals. We can couple this with tools to investigate microbial communities to describe geochemical niches that specific microbial communities inhabit, gather information about the microbial physiology of dominant organisms, and investigate the kinetics of microbial metabolisms under environmental conditions. We will present results from work with neutrophilic iron oxidizing microorganisms to describe kinetic controls on microbial habitat and from work on different communities of microbes associated with sulfuric acid speleogenesis in a cave system to illustrate the use of voltammetric microelectrodes to address these ideas.