Water Chemistry in Changing Headwater Glacier

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Abstract. Glaciers are retreating at an unprecedented rate. In mid-latitude alpine ecosystems the presence of glaciers and rock glaciers govern rates and ecology of alpine and sub-alpine ecosystems. Changes in the thermal environment due to the loss of isothermal habitat and inputs from glacier melt chemistry are altering alpine ecosystems in unpredictable ways. In particular, glacier may be a source of nitrogen that is altering alpine ecosystem dynamics. Loch Vale Watershed (LVWS) located within Rocky Mountain National Park. LVWS contains a surface glacier (Andrew's glacier) and a rock glacier (Taylor's glacier) at the headwater of each of the two drainages within the watershed. We collected precipitation from a National Atmospheric Deposition Site and surface water from multiple alpine lakes and streams during a particularly high and low snow year in the Colorado Front Range. We also sampled stream and lake sediments at each site to analyze the associated microbial community. Concentrations of nitrate and ammonium, relative abundance of amoA (the gene responsible for a key step in the microbial nitrification pathway), and the dual isotope signal to nitrate all point to snow melt as a key deliverer of nitrogen to ecosystems along the Colorado Front Range. However, late summer surface water chemistry is isotopically similar to the chemistry of glacial ice. This suggests that retreating glacier may be an additional source of N to alpine ecosystems and have the potential to alter microbial community composition, biogeochemical rate processes, and ecosystem function. These dynamics are most likely not unique to the Colorado Front Range and should be globally distributed as glaciers continue to retreat in high altitude ecosystems around the world.