Modeling Ecosystem and Hydrochemical Responses to Climate Change at the Alpine Tundra Long-Term Ecological Research (LTER) Site of Niwot Ridge in Colorado Using a Dynamic Biogeochemical Model (PnET-BGC)

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A biogeochemical model (PnET-BGC) is reparameterized for alpine tundra and used in this study to evaluate effects of potential future changes in temperature, precipitation, solar radiation and atmospheric CO_2 concentration on the biogeochemistry and ecosystem productivity of an alpine tundra Long-Term Ecological Research (LTER) site at Niwot Ridge, Colorado. Future climate projections from coupled atmosphere-ocean general circulation models (AOGCMs) used in this study are derived from the latest World Climate Research Programme's fifth Coupled Model Intercomparison Project (CMIP5) models under two Representative Concentration Pathway (RCP) emission scenarios from the latest report of the Intergovernmental Panel on Climate Change (IPCC) AR5.

PnET-BGC model simulation shows a decrease in average snow water equivalent with a shift in hydrology characterized by later snow development and earlier snow melt. Our results suggest that aboveground net primary productivity (NPP) will increase as results of increasing temperature and atmospheric CO_2 concentration. Model results also show an increase in NO_3^- leaching due to increased net mineralization and nitrification. The watershed response to climate change in other major elements in surface water such as SO_4^{2-} and Ca^{2+} varies depending on the climate projection model selected.