# Hydrologic responses of an alpine wetland to changes in climate, Front Range, Colorado

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**Abstract.** Alpine wetlands have been suggested to be among the most sensitive types of wetlands to changes in climate. Yet, little is known about the hydrology of alpine wetlands and how hydrologic processes respond to changes in climate. Here we report on the results of monitoring and tracer studies from May to October from 2003-2007 from a 2-ha wetland in Green Lakes Valley collected as part of the Niwot Ridge LTER program. We evaluated the vulnerability of hydrologic controls by determining the relationships between outlet discharge, surface and subsurface water levels, residence time, storage, precipitation events, source waters, and flow paths of the wetland. Outlet discharge increased to 650 $m^3$/day on June 27, consistent with snowmelt-dominated source waters. However, peak discharge occurred following a rain event, consistent with a "flashy" hydrograph. Water levels from piezometers show periods of both subsurface discharge and recharge over the season. Results from a LiBr tracer yielded a residence time of ~38 hours, suggesting a significant amount of hydrologic storage within the wetland. Seasonal $\delta^{18}O$ values range from -18‰ to -9‰, suggesting changing source waters and flow paths. Initial mixing model results suggest that a nearby rock glacier has a higher contribution during drought. As climate warms and precipitation shifts from snow to rain, alpine wetlands will have increased flashiness and greater contributions from source waters such as rock glaciers and permafrost. Changes in climate that reduce snowfall may reduce subsurface recharge, which may cause potentially irreversible effects to the hydrology of alpine wetlands.