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Elevational, Seasonal, and Decadal Dependence in Climate Change in a Mid-Latitude Mountain System, Niwot Ridge, Colorado Rocky Mountains, USA

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Abstract
We contrasted 58-year climate records of two high-elevation sites in the Colorado Rocky Mountains Front Range, USA: one subalpine (3021m) and the other high alpine (3739m). The sites, separated by only 6km horizontally and 700m in elevation, exhibited different longterm behavior in temperature, precipitation, and growing-season variables. From 1953-2010, monthly maximum temperatures increased in the subalpine through the year, but in the alpine decreased significantly in early winter. Frost-free season onset was later and termination earlier, so the growing season shortened, reflecting decreasing spring/fall temperature minima. In an apparent contradiction in the subalpine, growing degree-days increased due to increasing summer maxima. Monthly precipitation increased in the alpine October-April, while the subalpine saw no significant trends. The apparently decoupled trends suggest that synoptic dynamics and local surface energy processes act differently for the high alpine tundra vs. subalpine closed-canopy forest. A more detailed examination of the temperature record showed cooling at both sites until ~1980, followed by warming. Precipitation series show corresponding periods of increasing then decreasing precipitation. These multidecadal patterns suggest that alpine and subalpine climate signals are not as decoupled as they appear but rather that synoptic and landscape-scale processes differentially modify a regional multidecadal signal.