



Examining processes that contribute to enhanced warming rates at high elevations

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During the last several decades, many studies, although not all, have found enhanced warming rates in high elevation regions relative to their lower elevation surroundings. Using a combination of observations and CMIP5 climate model simulations, we provide examples of how processes associated with three different climate variables (water vapor, snow cover, and clouds) can contribute to elevation dependent warming (EDW) through their effect on short-wave and longwave radiation both in recent decades as well as for model projections later this century. We provide explanations for why EDW can be found in some studies but not in others, sometimes even in the same regions. We also analyze the relationship between 21st century model projections of changes in free-air temperatures with temperature changes at the same elevations in mountains. The primary focus is on the Tibetan Plateau region and North America where we also consider lower mountain regions (~ 1500 m) than found in most EDW studies.