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Future Changes to Extreme Downslope Windstorms Across Northern Colorado Front Range

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1-2 PM (MT) FL2-1022 or Virtual | [Watch Live](#)

Downslope windstorms are common leeward of the Rocky Mountains across the High Plains of Colorado during October through March and can cause property damage and travel disruptions. These windstorms can also exacerbate fire weather, with one example being the Marshall Fire on 30 December 2021 that destroyed nearly 1,100 homes in northwest Denver suburbs. Previous work suggests that peak wind gusts at the NSF National Center for Atmospheric Research (NSF NCAR) in Boulder, Colorado have decreased in magnitude during downslope windstorms in recent decades. We hypothesize that the decrease in peak wind gusts in Boulder is due to a climatic shift in the lower-tropospheric temperature structure, which favors the temperature inversion layer that characterizes downslope windstorms to reside farther above mountaintop compared to events in the past. This change in the height of the inversion layer subsequently promotes decreased wind gust speeds at the surface.

To investigate this hypothesis and potential changes to downslope windstorms in a future climate, we employ high-resolution Weather Research and Forecasting (WRF) simulations and apply the pseudo-global warming (PGW) approach to investigate how climate change may impact downslope windstorm characteristics across the northern Colorado Front Range. ERA5 initial conditions are perturbed using projected future trends in temperature, wind, relative humidity, and geopotential height derived from the Community Earth System Model Large Ensemble (CESM-LENS2) to analyze how current windstorms would vary if they occurred in a future climate state. We focus on how changes in the vertical wind shear, temperature, moisture, and mountaintop inversion layers affect the intensity, duration, and spatial extent of the extreme downslope winds. [Event Website](#)