

# Persistent Cold-Air Pools in Mountainous Areas: Distribution, Simulation, and Air Quality

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Cold air pools (CAPs) and persistent cold air pools (PCAPs), a CAP lasting for more than one day, are common throughout the western U.S. during wintertime. During CAPs, cold stagnant air leads to pollutant accumulations, even in locations without major industrial sources of air pollution emissions. PCAPs can be identified using a bulk measure of atmospheric stability, valley heat deficit (VHD), calculated from vertical profiles of temperature. We use of VHD and investigate different methods of establishing a threshold VHD value to classify PCAP events at twelve locations across the western U.S. After the prevalence of the CAP events is determined, we evaluate numerical model performance during CAPs and PCAPs. Due to the stable atmospheric conditions, numerical weather prediction (NWP) and chemical transport models (CTM) often fail to simulate the acutely elevated pollutant concentrations during these events. Simulation results from Weather Research and Forecasting (WRF) model are compared with observations during PCAP events in Salt Lake City. Results show that WRF underestimates VHD during PCAPs. We also investigate the Community Multiscale Air Quality Modeling System (CMAQ) performance and find that the underestimation of PCAP strength (quantified by VHD) contributes to the underestimated air pollution concentrations from CMAQ.