L2017 Data Processing Steps and Geographic Analysis

To produce Figure 3 in the main text we first re-gridded WRF and PRISM to a common, regular latitude longitude 4 km grid using the xESMF package bi-linear resampling algorithm. The geographic mountain region shapefiles were taken from the Snethlage et al. 2022 data set (Figure S1) and the shapefiles of which are available from their publication.

Data from WRF and PRISM grid cells are clipped to each mountain shapefile using the rio-xarray python package. The weather station locations used in PRISM are downloaded from the PRISM metadata files (available in the TMIN and TMAX datasets from prism.oregonstate.edu). The geopandas library was used to read the station metadata csv files, and rioxarray was again used to clip cells from WRF/PRISM containing a station observation.

Figure S1: Major mountain range geographic domains as defined by Snethlage et al. 2022. A) Sierra Nevada, B) Cascades, C) Idaho-Bitterroot, D) Great Basin, E) Greater Yellowstone, F) Western Rockies, G) Colorado Plateau, H) Southern Rockies.
Classifying stations into physiographic categories (slope, ridge, valley) was performed using the “whitebox tools” (https://www.whiteboxgeo.com/) package implemented in QGIS, and specifically the “DevFromMeanElev” function to create a terrain-position index (TPI). Regions with a value > .5 are considered ridges, regions < .5 are considered valleys, and everything in between are considered “slopes”. The terrain classification is performed using the hydrosheds v1 dem (https://www.hydrosheds.org/dem) which has a 30 arcsec resolution. Figure S2 shows the results of the TPI output with PRISM stations overlain for the Western United States. To produce Figure 3 of the main text, the TPI for each station point was determined by finding the closest point to the lat/lon of that grid cell.

Figure S2: Terrain Position Index (TPI) map (left) with the locations of PRISM measurement stations shown (purple dots). A zoom-in region of the Southern Rockies is shown for reference. The right panel shows the relationship between topographic elevation and terrain position index.