Influence of the Sierra Barrier Jet and Atmospheric Rivers on the distribution of precipitation in Northern California

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Atmospheric rivers (ARs) are usually associated with extreme precipitation events and flooding, as they play a key role in the transport of moisture from the ocean to the continent, responsible for 20-50% of the annual precipitation in California. Mesoscale processes from the interaction of frontal systems with topography can influence orographic precipitation in the region. One important mechanism is the Sierra Barrier Jet (SBJ), which is defined as a low-level jet blowing parallel to the Sierra Nevada and forms in response to the deceleration of stably stratified south-southwesterly flow as it approaches the west slope of the Sierra Nevada. Previous studies suggest that a majority of extreme precipitation events during the cold season occur in association with ARs in conjunction with SBJs, increasing orographic precipitation in the area and modifying the precipitation distributions across the Sierra Nevada and the north of the Central Valley.

This study will highlight the results of a ~20-year climatology of the SBJ using wind profiler observations, their associations with landfalling ARs, and their influence on modulating climatological variability, spatial variability, and orographic gradients in precipitation across northern California. Using the Weather Research and Forecast (WRF) model, a case study of a strong SBJ event that occurred in conjunction with an intense AR was analyzed to investigate how well WRF resolves the vertical structure, intensity and duration of the SBJ.