A11A – 0044

The Spatial Distribution of Precipitation Frequency for Atmospheric River Storms in Northern California

CP^3_g NC STATE UNIVERSITY
Clouds and Precipitation Processes and Patterns Group

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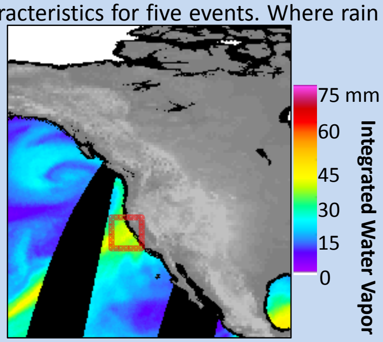
I. Introduction

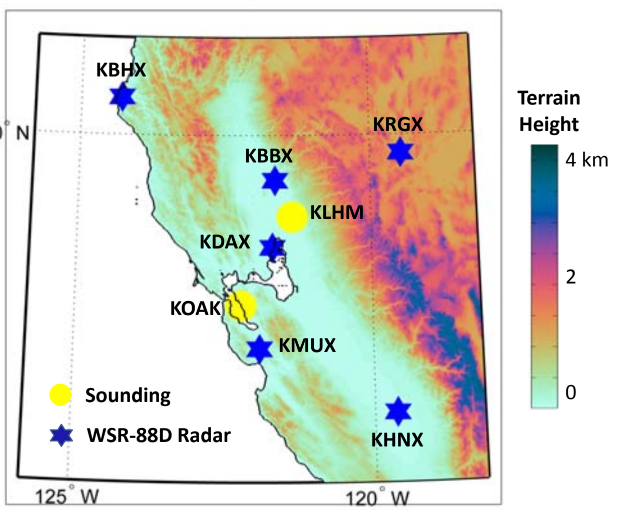
Purpose

Extratropical cyclones and their associated Atmospheric Rivers (ARs) are the primary source of water vapor for cool-season heavy precipitation storms in Northern and Central California. The long and narrow water vapor signature of ARs can be detected over the Pacific Ocean using passive microwave satellite data (below), allowing AR storms to be predicted a few days in advance. However, while all heavy precipitation events are associated with ARs, not all AR storms yield heavy rainfall. This study examines the spatial distributions of precipitation frequency in the context of AR and environmental characteristics for five events. Where rain falls, for how long, and at what rate are all factors in the geographic distribution of rainfall accumulation. We focus on where and for how long rain falls as these are simpler to obtain accurately from radar observations.



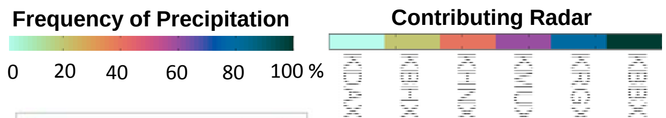
Source: Remote Sensing Systems (www.remss.com)

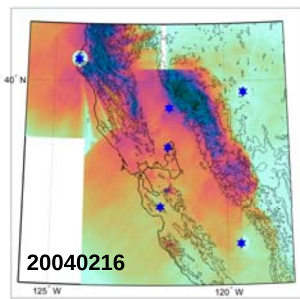
Study Domain



II. Methodology and Examples

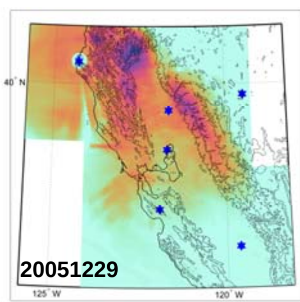
The Level II polar format data for each six minute volume from six National Weather Service WSR-88D radars were first interpolated to a 2 km x 2 km Cartesian horizontal grid at 2 km altitude. The data from each AR event are then combined to determine the frequency of precipitation, which is defined as the percentage of time during the storm that reflectivity ≥ 13 dBZ (rain rate ≥ 0.2 mm/hr) occurred at each grid point.

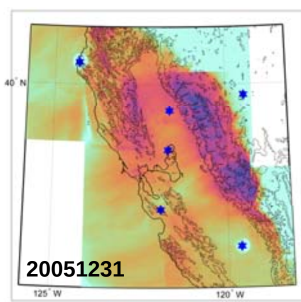


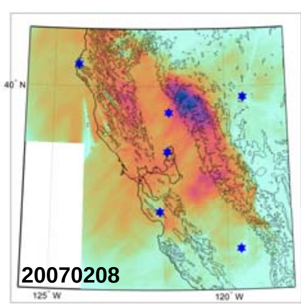


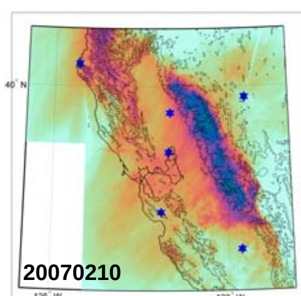
Combining the Data

We stitch together the precipitation frequency maps from each radar to construct a regional map. The maximum frequency value is used at grid points where there is data from more than one radar.



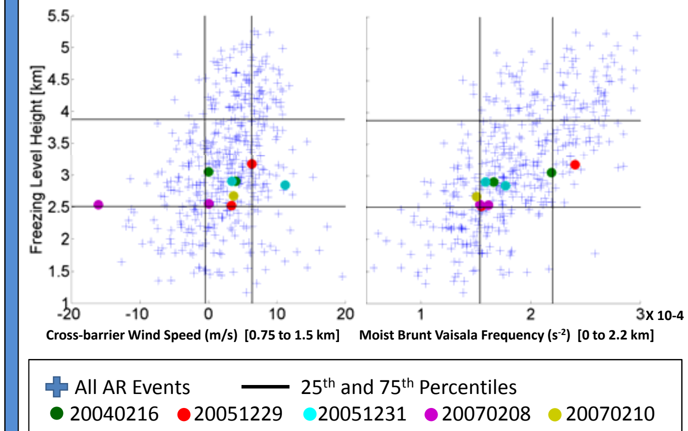


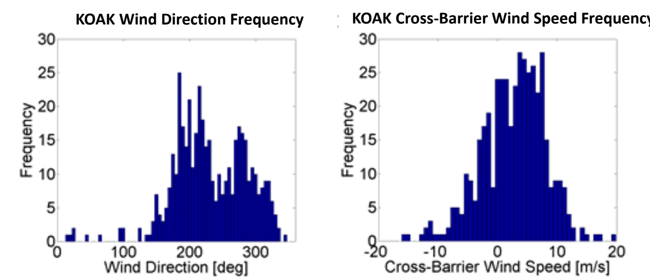




Atmospheric Sounding Analysis

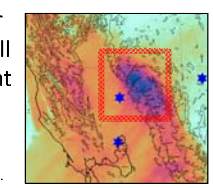
KOAK (Oakland, CA) – 439 soundings every (every 12 hours during AR events from Oct 1997 – Apr. 2011); KLHM (Lincoln, CA) – 68 soundings intermittently (~ 4-6 hours during events from Dec. 2010 – Mar 2011)





III. Summary

- There is considerable variability in the spatial distribution of precipitation frequency among AR storms. This is likely a consequence of the superposition of differences among storms in including: synoptic structure, AR width, speed of AR movement southward, and the variability of moisture fluxes within the AR.
- Higher freezing levels(> 4 km) are associated with higher stability and cross-barrier wind speed in AR storms.
- The Plumas National Forest in the Feather River Basin is a location of frequent rainfall during most AR storms, which is consistent with previous work that showed localized convergence in this area.



Acknowledgements
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