

## Application of Ensemble Sensitivity to AR Recon Operations

Ryan D. Torn

*University at Albany, SUNY*

Atmospheric Rivers (AR) are often associated with significant precipitation along the West Coast of the United States. These features typically originate over the Pacific Ocean and previous research has shown that are often characterized by a lack of observations, including from satellites. Consequently, these features may have significant initial condition uncertainty, which in turn can translate into higher variability and error in numerical model forecasts. Despite this, there have been relatively few studies that have quantitatively documented how uncertainty in specific aspects of the AR (e.g., wind, moisture content) and surrounding essential synoptic features (e.g., surface cyclone, upper trough position) could impact the subsequent precipitation forecast over land. One method of quantifying this is through ensemble-based sensitivity analysis, which utilizes the statistics of a forecast ensemble to establish these associative relationships. Regions of large sensitivity denote locations where to direct additional observations that could improve the forecast.

This study describes the application of ensemble-based sensitivity to ECMWF ensemble and GEFS forecasts for AR Recon flight planning operations, including in the Eastern Pacific, Atlantic, and the Western Pacific Basins. Currently, there are multiple types of forecast metrics that are utilized, including precipitation, integrated vapor transport, geopotential height, and potential vorticity. For many cases, the largest sensitivity values are associated with the position of shortwave troughs embedded within the upper-tropospheric trough within Eastern Pacific during active periods. The evolution of these features subsequently modulates the position, orientation, and timing of the AR and in turn impacted the location where the precipitation was maximized. The talk will conclude with a preview of the sensitivity climatology being constructed for various points along the US West Coast, which can be used to guide future observation deployments.