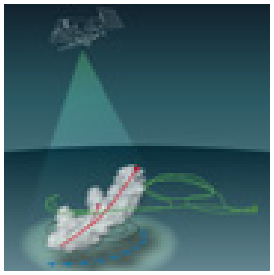

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GPM Satellite Radar Observations of Precipitation Mechanisms in Atmospheric Rivers

Wednesday, 11 March 2020 16:40 (20 minutes)

Despite numerous studies documenting the importance of atmospheric rivers (AR) to the global water cycle and regional precipitation, the evolution of their water vapor fluxes has been difficult to investigate given the challenges of observing and modeling precipitation processes within ARs over the ocean. This study uses satellite-based radar reflectivity profiles from the Global Precipitation Measurement Dual-Frequency Precipitation Radar (GPM-DPR), combined with kinematic and thermodynamic conditions in the vicinity of the precipitation diagnosed from the Climate Forecast System Reanalysis, to evaluate the characteristics and dynamical origins of precipitation in ARs that occurs upstream of warm conveyor belt ascent. Transects of 192 ARs over the Northeast Pacific Ocean between 2014 and 2018 are examined. Both stratiform and convective precipitation were abundant in these GPM transects and the precipitation was most often generated by forced ascent in the vicinity of a cold front in frontogenetic environments. Conditioning composite vertical profiles of reflectivity and latent heating from GPM-DPR on frontogenesis near the moist-neutral low-level jet demonstrated the importance of frontally-forced precipitation on atmospheric heating tendencies. A case study of a high-impact landfalling AR is analyzed using the Weather Research and Forecasting model, which showed how the precipitation processes and subsequent latent heat release offshore strongly influenced AR evolution. Although these precipitation mechanisms are present in global scale models, the difficulty that coarse-resolution models have in accurately representing resultant precipitation likely translates to uncertainty in forecasting heating tendencies, their feedbacks on AR evolution, and their relationship with warm conveyor belt processes, which collectively influence the predictability of high-impact weather events in the western U.S. and Europe.

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