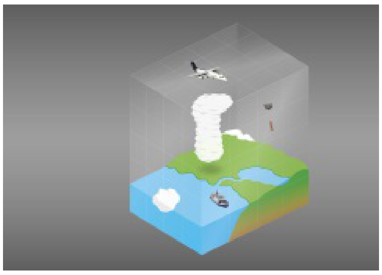

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Assessing the predictability of mesoscale precipitation processes in landfalling atmospheric rivers using AR Recon dropsonde observations

Atmospheric River Reconnaissance (AR Recon) is an airborne meteorology field campaign designed to improve the observation of impactful weather events ahead of landfall on the U.S. West Coast. Observations of the full profile of moisture, winds and temperature within atmospheric rivers (AR) during their evolution and propagation over the northeastern Pacific Ocean provides useful information for numerical weather prediction, which is an initial value problem. While AR Recon observations were assimilated in near real-time by global forecast models, the collected data are also key to better understanding the dynamical processes that define AR characteristics, such as their intensity, propagation, duration and precipitation production. This presentation utilizes AR Recon observations from 2018 and 2019 to evaluate the ability of a near real-time version of WRF in representing the evolution of mesoscale precipitation processes, such as narrow cold-frontal rainbands and mesoscale frontal waves, which strongly modulate AR characteristics. The representation of these processes in numerical weather prediction is an important challenge for forecasting precipitation impacts in the Western U.S.. Specific predictability challenges and opportunities for advancement are detailed through the example of a well-observed case study during the 2019 field campaign in which dropsonde data was collected along transects of an AR and its attendant cyclone as it underwent rapid cyclogenesis offshore of Southern California. Through dropsonde observations in the offshore environment, and radiosonde observations of the same features 24 hours later during landfall, it is shown that WRF skillfully represents the physical processes responsible for the development and maintenance of an impactful narrow cold-frontal rainband, for example. However, uncertainty in the timing, orientation, propagation and inland extent of this feature limits the extent to which the model can be used to predict associated hazards at small scales. This analysis and a range of additional examples lend confidence to the utility of WRF as a situational awareness tool for short-to-medium range forecasting of mesoscale precipitation processes in landfalling ARs. Importantly, the continued development methodologies to assess the representation of physical processes in global and mesoscale models using AR Recon observations will provide advanced insight into precipitation forecast uncertainty in landfalling ARs.

Primary author: Dr CANNON, Forest (Scripps Institution of Oceanography)

Co-authors: Dr WILSON , Anna (Scripps Institution of Oceanography); Dr RALPH, F. Martin (Scripps Institution of Oceanography); Dr MICHAELIS, Allison (Scripps Institution of Oceanography); OAKLEY, Nina (Desert Research Institute); DEMERDJIAN, Reuben (Scripps Institution of Oceanography)

Presenter: Dr CANNON, Forest (Scripps Institution of Oceanography)

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