Impact of Dropsondes from the Atmospheric River (AR) Reconnaissance Program on Forecast Skill of ARs and the Satellite Radiance Assimilation

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Abstract

Atmospheric rivers (ARs) over the western US are responsible for ˜30-50% of the annual precipitation, and their accurate forecasts are essential for aiding water management decisions and reducing flood risks. Sparse coverage of conventional observations over the Pacific Ocean can limit the improvement of forecast skill for these events. A targeted field program called AR Reconnaissance (Recon) was initiated in 2016 to better understand and reduce forecast errors of landfalling ARs at 1-5–day lead times. During the winter seasons of 2016, 2018-2020, 32 Intensive Observation Periods (IOPs) sampled the upstream conditions for landfalling ARs. This study assesses the impact on forecast accuracy of assimilating these dropsonde data. Data denial experiments with and without dropsonde data were conducted using the WRF model with the GSI hybrid 4DEnVar system.

Comparisons between the paired experiments demonstrate that dropsondes reduced the root-mean-square error in integrated vapor transport (IVT) and inland precipitation for more than 70% of the IOPs, averaged over all forecast lead times from 1 to 6 days. Dropsondes have improved the spatial pattern of forecasts of IVT and precipitation in all 15 IOPs in 2016, 2018-2019. IOP sequences (i.e., back-to-back IOPs every other day) show the most improvement of inland precipitation forecast skill.

Additional data denial experiments from January 23 to March 13 in 2020 were performed to investigate the anchoring impact of dropsondes with the NCEP GFS model. Radiance counts and total bias corrections show significant differences between the GFS paired experiments. The anchoring impact of dropsondes for radiance data are found to be far beyond the North Pacific and the western US.

Keywords: Reconnaissance, Data Assimilation, Anchoring Impact

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