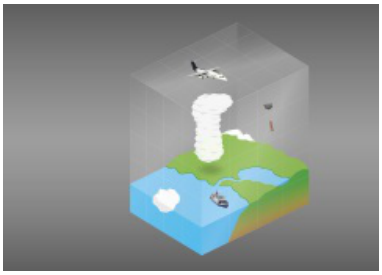

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Impacts of Dropsonde Observations on the Predictability of Landfalling Atmospheric Rivers

Landfalling Atmospheric Rivers (ARs) provide between 30-50% of precipitation but can also cause major flooding events in the western U.S. Accurate forecasts of a landfalling AR can improve water management decisions. Sparse observations over the Pacific have limited the improvement of forecast skills for the western U.S. due to the poor upstream initial conditions. While the numerical weather prediction reaps the benefits of satellite data over the oceans, those data poorly represent the low-level circulation and the vertical structure of water vapor in ARs. E.g., the landfall position error in the National Centers for Environmental Prediction Global Forecast System is about 400 km at 3-day lead time.

In the winters of 2016 and 2018, nine aircraft reconnaissance missions were carried out targeting AR conditions on the eastern Pacific. More than 600 dropsondes measured vertical profiles of wind, water vapor, temperature, and pressure. The impact on the forecast accuracy of ARs by assimilating these dropsonde data is evaluated. Four experiments are conducted using the Weather Research and Forecasting (WRF) model with the Community Gridpoint Statistical Interpolation (GSI) system: no data assimilation (CONTROL), with the dropsonde data assimilated (DROP), with conventional data assimilated (REGULAR), and with both conventional and dropsonde data assimilated (ALLDATA). Comparisons between DROP and CONTROL show that the 1-3 day precipitation forecast error it is reduced by 5-25% when assimilating dropsondes with GSI-WRF. With the dropsonde data assimilated, WRF better simulates small features of the integrated water vapor transport and the finer structures of the precipitation and its coverage area. The value of dropsondes in addition to the conventional observations is assessed by comparing the REGULAR and ALLDATA runs. This work will also investigate the impacts of employing different error-covariance matrix on the ensemble generations used for GSI hybrid data assimilation.

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Track Classification: Workshop: Observational campaigns for better weather forecasts