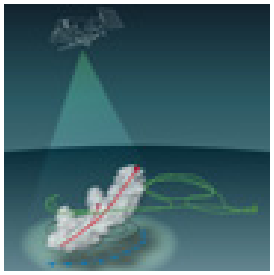

Contribution ID: **28** Type: **Oral presentation**

Adjoint Sensitivity and the Impact of Atmospheric River Reconnaissance Observations for North Pacific Forecasts

Tuesday, 10 March 2020 16:50 (20 minutes)

We will briefly summarize the results from two related studies. In the first study, the initial-state sensitivity and optimal perturbation growth for 24- and 36-h forecasts of low-level kinetic energy and precipitation over California during a series of atmospheric river (AR) events that took place in early 2017 are explored using adjoint-based tools from the Coupled Ocean–Atmosphere Mesoscale Prediction System (COAMPS). This time period was part of the record-breaking winter of 2016–17 in which several high-impact ARs made landfall in California. The adjoint sensitivity indicates that both low-level winds and precipitation are most sensitive to mid- to lower-tropospheric perturbations in the initial state in and near the ARs. A case study indicates that the optimal moist perturbations occur most typically along the subsaturated edges of the ARs, in a warm conveyor belt region. The sensitivity to moisture is largest, followed by temperature and winds. In an average sense, the sensitivity and related optimal perturbations are very similar for the kinetic energy and precipitation response functions. However, case-by-case differences suggest that optimal adaptive observing strategies should be metric dependent. The positive correlation between sensitivity magnitude and forecast error supports the relevance of adjoint-based calculations for predictability studies.

In the second study, we examine the impact of assimilating dropsonde observations collected during the AR 2018 field program on the Navy Global Environmental Model (NAVGEM) analyses and forecasts. We compare NAVGEM's representation of the ARs to the observations, and examine whether the observation-background difference statistics are similar to the observation error variance specified in the data assimilation system. Forecast Sensitivity Observation Impact is determined for each dropsonde variable, and compared to the impacts of the North American radiosonde network. We find that the reconnaissance soundings have significant beneficial impact, with per observation impact more than double that of the North American radiosonde network. Temperature and wind observations have larger total and per observation impact than moisture observations. In our experiment, the 24-h global forecast error reduction from the reconnaissance soundings can be comparable to the reduction from the North American radiosonde network for the field program dates that include at least two flights. In data denial experiments, the relative differences between the NAVGEM and ECMWF analyses decrease by up to 11% when the AR dopsondes are assimilated, but a systematic decrease in standard forecast error metrics over North America is difficult to detect.

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