M.S. Defense Announcement
Kyle Nardi
Tuesday, July 17, 2018 at 1:00pm

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Defense
ATS Large Classroom (101 ATS)

Post Defense Meeting
Riehl Conference Room (211 ACRC)

Committee:
Libby Barnes (Advisor)
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ASSESSMENT OF NUMERICAL WEATHER PREDICTION MODEL RE-FORECASTS OF ATMOSPHERIC RIVERS ALONG THE WEST COAST OF NORTH AMERICA

Atmospheric rivers (ARs) - narrow corridors of high atmospheric water vapor transport - occur globally and are associated with flooding and maintenance of the regional water supply. Therefore, it is important to improve forecasts of AR occurrence and characteristics. Although prior work has examined the skill of numerical weather prediction (NWP) models in forecasting ARs, these studies only cover several years of re-forecasts from a handful of models. Here, we expand this previous work and assess the performance of 10-30 years of wintertime (November-February) AR landfall re-forecasts from nine operational weather models, obtained from the International Subseasonal to Seasonal (S2S) Project Database. Model errors along the West Coast of North America at leads of 1-14 days are examined in terms of AR occurrence, intensity, and landfall location. We demonstrate that re-forecast performance varies across models, lead times, and geographical regions. Occurrence-based skill approaches that of climatology at 14 days, while models are, on average, more skillful at shorter leads in California, Oregon, and Washington compared to British Columbia and Alaska. We also find that the average magnitude of landfall Integrated Water Vapor Transport (IVT) error stays fairly constant across lead times, although over-prediction of IVT is more common at later lead times. We then show that northward landfall location errors are favored in California, Oregon, and Washington, although southward errors occur more often than expected from climatology. We next explore the link between the predictability of ARs at 1-14 days and synoptic-scale weather conditions by examining re-forecasts of 500-hPa geopotential height anomaly patterns conducive to landfalling ARs. Finally, the potential for skillful forecasts of IVT and precipitation at subseasonal to seasonal (S2S) leads is explored using an existing empirical forecast model (Mundhenk et al. 2018) based on the Madden-Julian oscillation (MJO) and the quasi-biennial oscillation (QBO). Overall, these results highlight the need for model improvements at 1-14 days, while helping to identify factors that cause model errors as well as sources of additional predictability.