M.S. Defense Announcement
Jack Cahill
Tuesday, July 25, 2023, at 10:00 am

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Defense
CIRA Commons or via Teams

Post Defense Meeting
Riehl Conference Room (211 ACRC)

Committee:
Elizabeth Barnes (Adviser)
Eric Maloney (Co-adviser)
Matthew Ross (Ecosystem Science and Sustainability)

Errors of Opportunity: Using Neural Networks to Predict Errors in the Unified Forecast System (UFS) on S2S Timescales

Making predictions of impactful weather on timescales of weeks to months (subseasonal to seasonal; S2S) in advance is incredibly challenging. Dynamical models often struggle to simulate tropical systems that evolve over multiple weeks such as the Madden Julian Oscillation (MJO) and the Boreal Summer Intraseasonal Oscillation (BSISO), and these errors can impact geopotential heights, precipitation, and other variables in the continental United States through teleconnections. While many data-driven S2S studies attempt to predict future midlatitude variables using current conditions, here we instead focus on post-processing of the National Oceanic and Atmospheric Association's (NOAA) Unified Forecast System (UFS) to predict UFS errors. Specifically, by looking at when/where there are errors in the UFS, neural networks can be used to understand what atmospheric conditions helped produce these errors via explainability methods. Our 'Errors of Opportunity' approach identifies phase 4 of the MJO and phases 1 and 2 of the BSISO as significant factors in aiding UFS error prediction across different regions and seasons. Specifically, we see high accuracy for underestimates of geopotential heights in the Pacific Northwest during Spring and as well as high accuracy for overestimates of geopotential heights in Northwest Mexico during Summer. Furthermore, we demonstrate enhanced error prediction skill for overestimates of Summer precipitation in the Midwest following BSISO phases 1 and 2. Most notably, our findings highlight that the identified errors stem from the UFS's failure to accurately forecast teleconnection patterns.