Ph.D. Defense Announcement
Bryn Ronalds
January 28, 2020 at 2:30 p.m.

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Ph.D. Defense

Tuesday, January 28, 2020
2:30 p.m.

Defense
ATS Large Classroom (101 ATS)

Post Defense Meeting
Riehl Conference Room (211 ACRC)

Committee:
Elizabeth Barnes (Advisor)
David Thompson
David Randall
Richard Eykholt (Physics)

Impacts of Arctic warming and sea ice loss on the Northern Hemisphere mid-latitude large-scale circulation

The consequences of the rapid warming of the Arctic and associated sea ice loss on the Northern Hemisphere atmospheric circulation is still largely debated. The uncertainty in the circulation response stems from a poor understanding of the underlying physical mechanisms of the remote response, regional and seasonal differences, differences between models and experimental set-ups, the large internal variability of the system, and the short observational record. This research seeks to address some of this uncertainty, specifically the uncertainty related to the physical mechanisms, regionality, and modeling differences.

Arctic sea ice loss leads to localized high latitude anomalous low-level easterlies, where the local surface temperature gradients are weakening, both in fully coupled and atmosphere-only climate model simulations. This response is consistent in both the North Atlantic and North Pacific basins, and lead to changes in wave breaking which can account for some of the difference in the wintertime-mean eddy-driven jet stream responses. Specifically, changes to wave breaking locations and frequency may account for the weakened and equatorward-shifted jet in the North Atlantic versus the strengthened and extended jet in the North Pacific in response to Arctic sea ice loss. This mechanism is tested in an idealized modeling framework.

Changes to the wintertime sub-seasonal variability in the low-level winds are also explored in this work. Consistent forced responses in the North Pacific are found across four climate models in an atmosphere-only, Arctic sea ice loss experiment. Associated with these changes in North Pacific zonal winds are downstream changes to the surface temperature variability over North America. Though small, the changes are considered robust and can help establish a causal link between Arctic sea ice loss and changes to wintertime weather regimes.