Investigating the Role of Sea Ice Loss in Arctic Temperature Amplification

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Introduction

- The Arctic is warming ~2-3x faster than the rest of the globe
- Sea ice loss is a primary driver of Arctic surface temperature amplification
- The extent to which sea ice concentration (SIC) and sea ice thickness (SIT) contributes to observed Arctic warming remains unclear

Methods and Data

- We perform a series of CAM6 simulations following the PAMIP protocol to quantify Arctic warming contributions from various mechanisms in two scenarios:

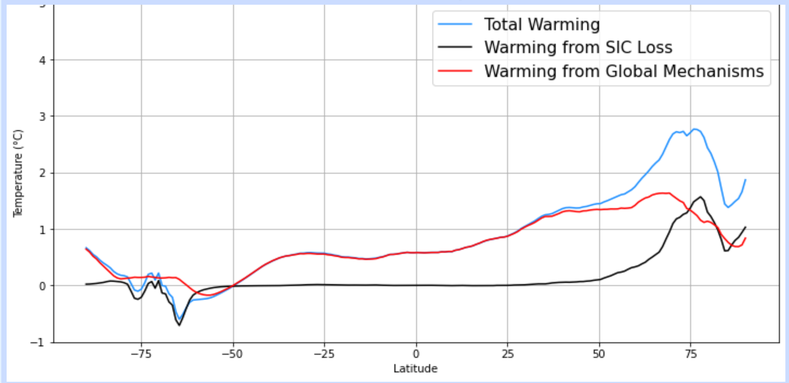
1980 - 2019	**Present day (1979-2008 climatology) to near 2045 (RCP8.5)**
1. Warming from Global Mechanisms	1. Warming from SST's
2. Warming from SIC Loss	2. Warming from SIC Loss
3. Warming from SIT Loss	3. Warming from SIT Loss

Acknowledgments

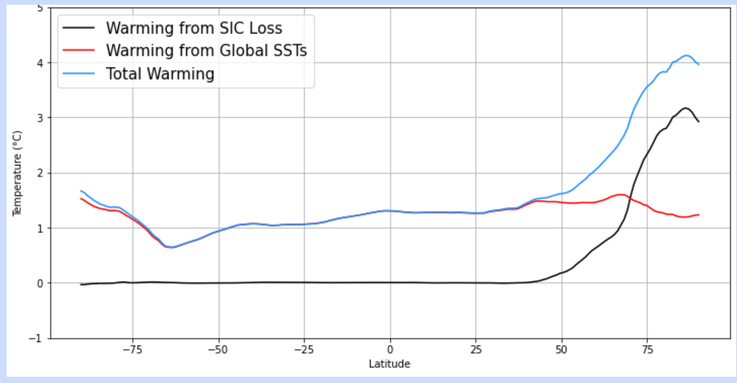
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Arctic Amplification Mechanisms

1980 - 2019 Zonal Temperature Trends



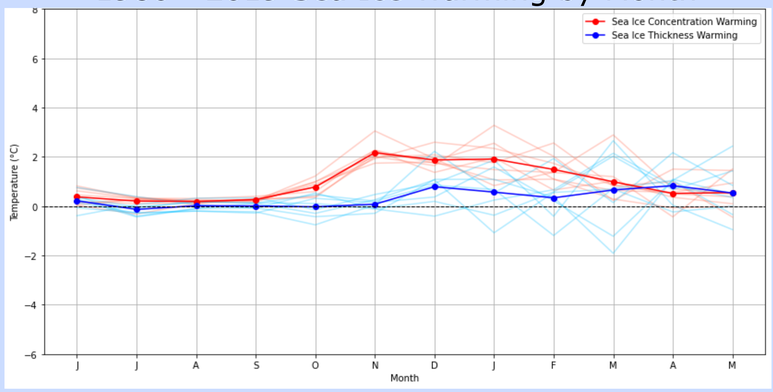
Future Time Slice Zonal Temperature Trends



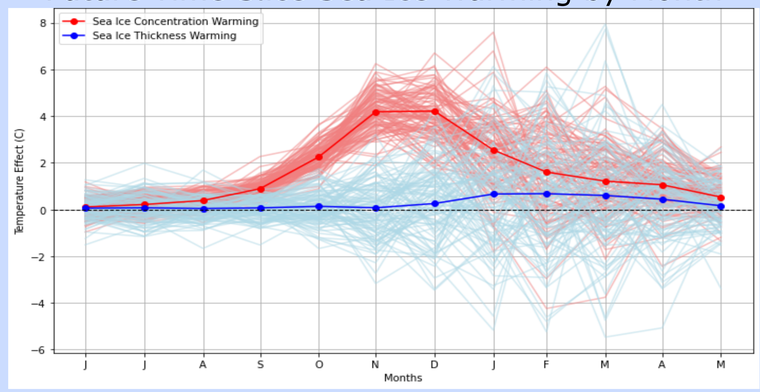
- SIC loss induced warming is mostly confined to the Arctic in both periods
- Majority of the amplification of surface warming can be explained by SIC loss in both periods

Thickness vs. Concentration

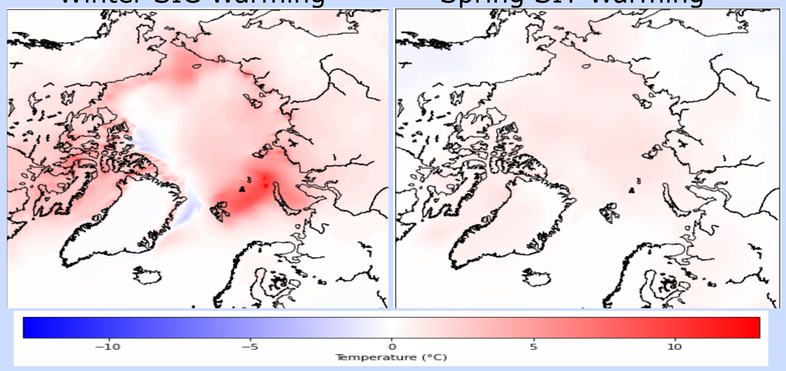
1980 - 2019 Sea Ice Warming by Month



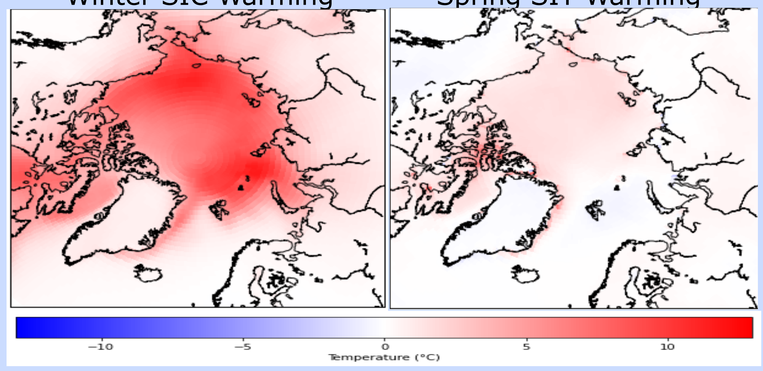
Future Time Slice Sea Ice Warming by Month



Winter SIC Warming | Spring SIT Warming



Winter SIC Warming | Spring SIT Warming



- SIC has a dominant influence on sea ice induced warming in both periods
- SIT variability only come into play seasonally
- The seasonal cycle of SIC and SIT effects remain similar between periods
- Future time slice shows increased SIC warming, especially in the late fall/early winter
- SIC warming displays noticeable changes in spatial distribution between periods

Conclusions

- Sea ice loss can explain a majority of the amplification of Arctic surface warming relative to the global mean in both observational and future scenarios
- Ice Thinning can also contribute to surface temperature amplification and variability in observational and future scenarios, especially during the winter and spring
- Although spatially variant and heightened in magnitude, the seasonality of warming in response to future sea ice concentration and thickness loss are similar to what is observed today