

ARCTIC SEA ICE LOSS AND NEAR-SURFACE WIND SPEED CHANGES RELATED TO SURFACE ROUGHNESS WITH THE COMMUNITY EARTH SYSTEM MODEL

Alice K. DuVivier¹, Stephen Vavrus^{2,3}, Marika M. Holland¹, Laura Landrum¹, Christine Shields¹, Rudradutt Thaker^{2,4}

¹NSF NCAR; ² University of Wisconsin, Madison; ³ Wisconsin State Climatology Office; ⁴ Department of Atmospheric and Oceanic Sciences, UW Madison
Contact: duvivier@ucar.edu

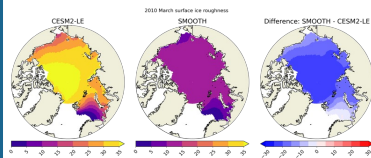
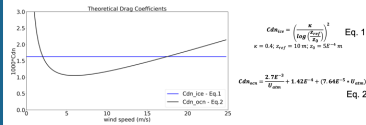


Motivation

The Arctic is changing more rapidly than anywhere else on the planet due to Arctic Amplification, and changes include observed and projected decreases in sea ice area and increases in near-surface wind speeds. **This study investigates regional and seasonal impacts of changing Arctic surface conditions due to sea ice loss on near surface wind speeds.**

Methods

- SMOOTH: Community Earth System Model version 2 (CESM2) with the roughness over sea ice set to be equal to that of the open ocean.
 - 1940 to 2015 spun up one member with historical forcing. Then ran five ensembles from 2015-2100 using SSP3-7.0.



- CESM 2 Large Ensemble (CESM2-LE): 50 ensemble members using CMIP6 historical and SSP3-7.0 forcing.

Funding

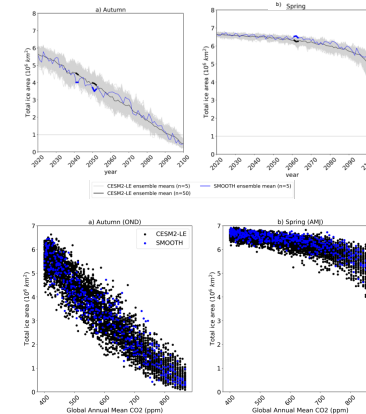
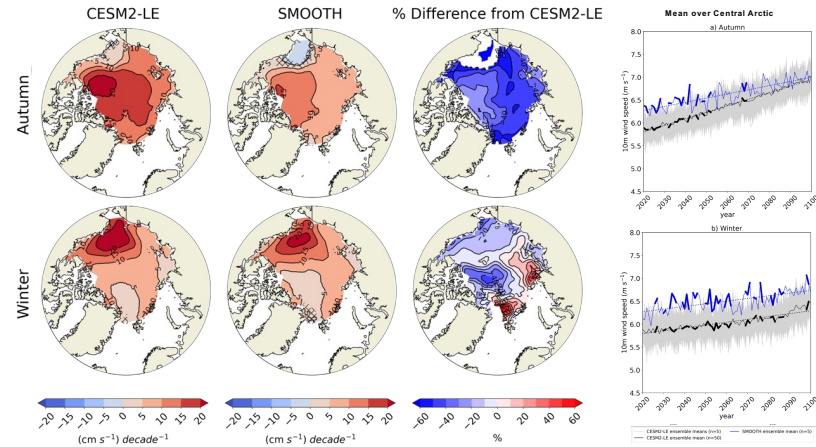
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Wind Speed Impact

- Decreasing atmospheric stability is the primary driver for strengthening near surface winds in autumn and winter.
- Autumn and winter wind speed increases are 30-60% lower without the accompanied decrease in surface roughness.
- Increasing atmospheric stability in spring and summer would lead to decreasing surface winds without the negative trend in sea ice roughness.
- Thus, changing surface roughness can be of similar importance as stability on wind trends in some regions and seasons, and it is important for setting the magnitude and sign of future wind speed trends.



Sea Ice Impact

- Sea ice trends are driven by warming temperatures due to global climate change and Arctic Amplification.
- Sea ice state and trends are not impacted significantly by roughness change. There are not significant differences between the CESM2-LE and SMOOTH experiments in total sea ice area or ice season length.
- Decreasing surface roughness lowers the momentum flux and sea ice speeds, but this does not have a significant impact on the sea ice mean state or trends in any season.

