FIRE: THE FIRST-YEAR INNOVATION & RESEARCH EXPERIENCE

CLIMATE COMPUTING

Exploring the Relationship Between January-February Cyclone Position and Arctic Sea Ice Loss

Emilio Guardado, Minook Jung, Jacob Royle, Vaghesan Sundaram, Vichetuttama Sam, Dr. S.T. Strey

Abstract

- This study investigates how the geographic position of an Arctic storm's track determines its effects on subsequent ice change.
- We utilize the Community Earth System Model (CESM) with GIAF component set and COREv2 dataset to simulate three January-February storm events: Feb. 1981, Feb. 1988, and Jan. 2008. These storms possess similar characteristics, but occur over different regions.
- Sea ice variables will be analyzed over a twelve month term period (six months pre and post event) and compared against a long term control mean from February 1948 to February 2011.
- We hypothesize that the storms tracks which spent more time over the ice sheet edges will result in a greater sea ice loss.

Methods

Component Set: f19_g17 (For fully coupled atmosphere, ocean, land, and sea ice components).
Control Case: Mean from February 1948 to February 2011
Test Cases - Arctic storm tracks

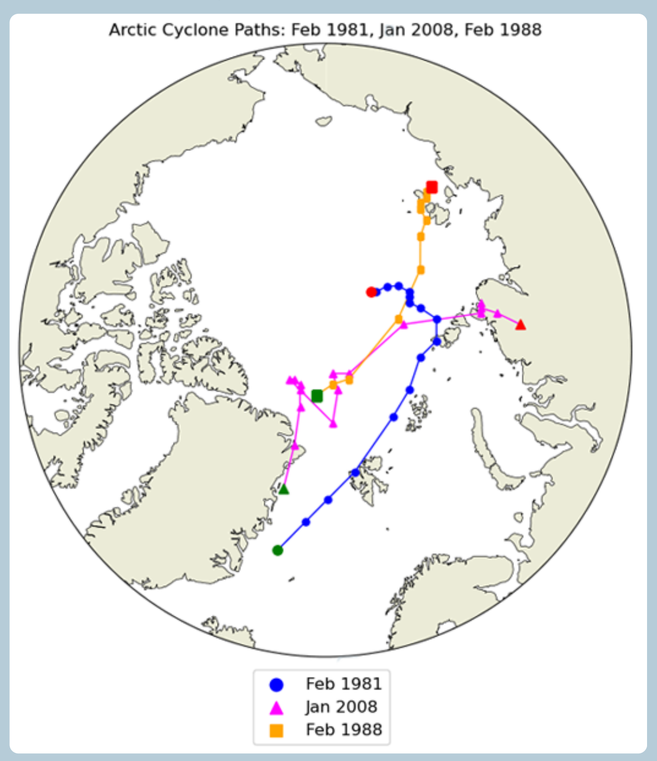
- 1: February 1981
- 2: February 1988
- 3: January 2008

Discussion

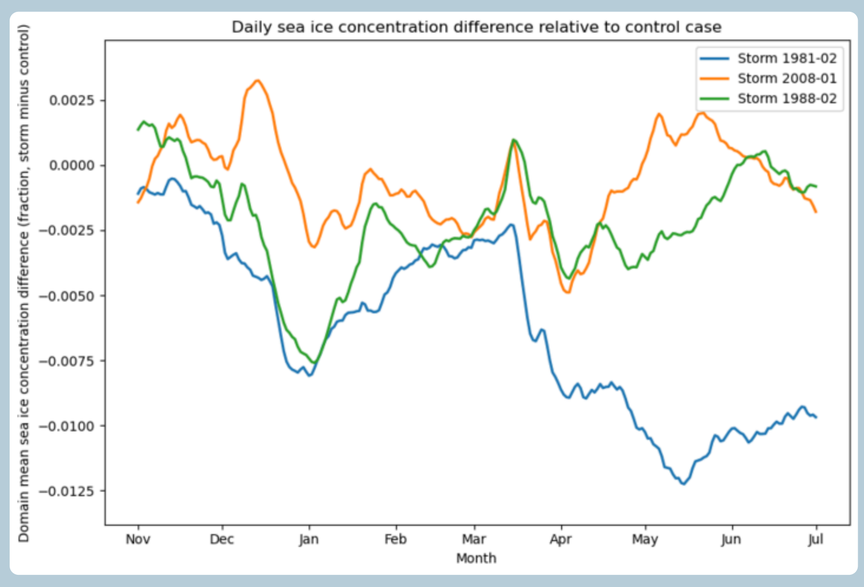
- The 2008 storm, which spends the most time closest to the edge of the sea ice pack, shows the most significant decrease in sea ice concentration compared to the rest of that year.
- The 1981 storm shows a short decrease in sea ice concentration, but it quickly returns to the previous amount and is not a very significant difference. This storm spends most of its time over the ice, but further inland than the 2008 storm.
- The 1988 storm shows the least significant impacts on sea ice concentration, which is reflected by the storm tracks map showing it spending the majority of its time above the center of the ice sheet.
- The difference maps for ice area and thickness reflects the locations of the storms, showing some of the most losses in the edges of the ice sheets where the storms passed through.

Results

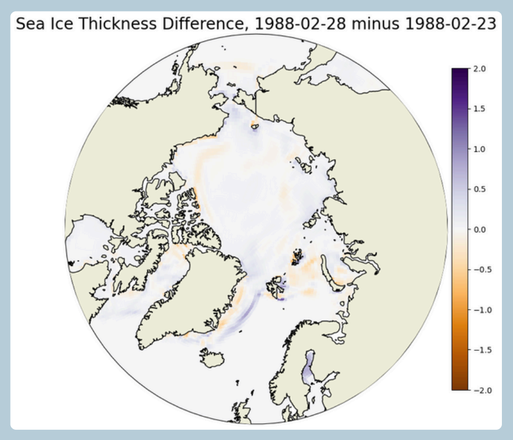
1. Arctic Cyclone Paths: Feb. 1981, Jan. 2008, Feb. 1988

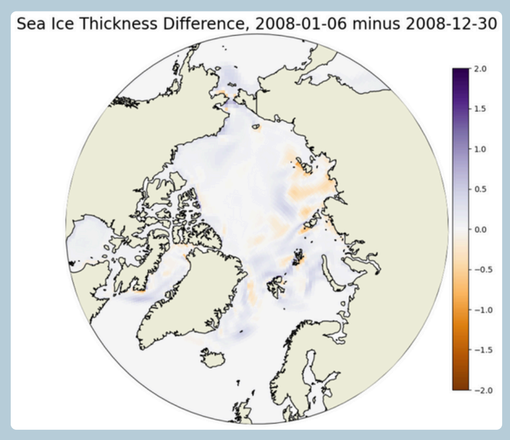


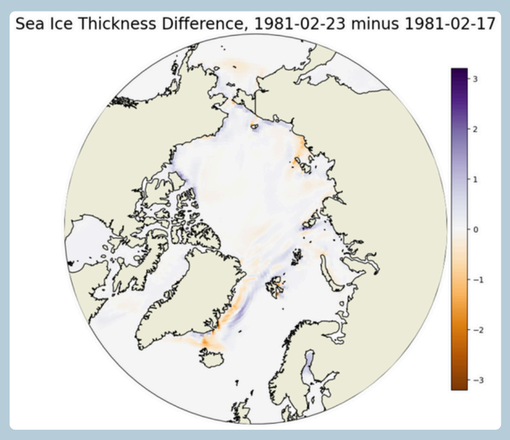
2. Time series of the difference in Sea Ice Concentration between control case and test cases

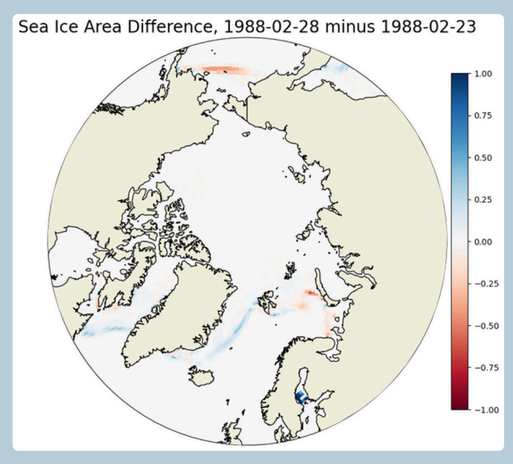


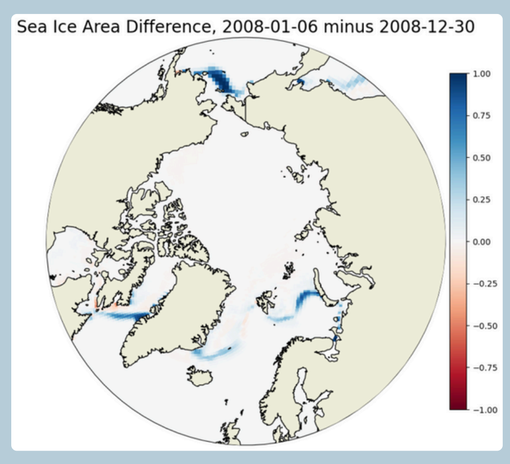
3. Difference maps between 1 day after the storms minus 1 day before the storms

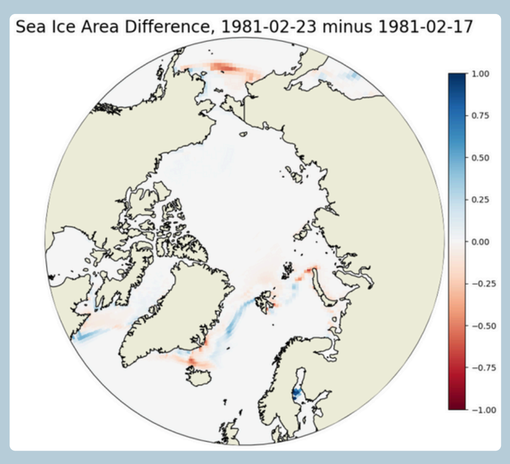












Future work

- Extend the study to include the summer melt season to see if the vulnerability of sea ice to storm location changes seasonally.
- Simulate a larger population of winter storm events over varying sea ice conditions.

Acknowledgements

We would like to acknowledge high-performance computing support from the Derecho system (doi:10.5065/qx9a-pg09) provided by the NSF National Center for Atmospheric Research (NCAR), sponsored by the National Science Foundation.

Animated Data

https://vichetu.wixsite.com/fire298-poster