Impact of atmospheric winter circulation on sea ice anomalies in the Arctic seas

Välisuo, Ilona

2022-06-28

Välisuo , I , Nygård , T & Uotila , P 2022 , Impact of atmospheric winter circulation on sea ice anomalies in the Arctic seas . in EMS Annual Meeting 2022 . EMS Annual Meeting 2022 , Bonn , Germany , 05/09/2022 . https://doi.org/10.5194/ems2022-152

http://hdl.handle.net/10138/349751
https://doi.org/10.5194/ems2022-152

EMS Annual Meeting Abstracts
Vol. 19, EMS2022-152, 2022
https://doi.org/10.5194/ems2022-152
EMS Annual Meeting 2022

Impact of atmospheric winter circulation on sea ice anomalies in the Arctic seas

Ilona Välisuo[1], Tiina Nygård[1], and Petteri Uotila[2]
[1]Finnish Meteorological Institute
[2]University of Helsinki

Arctic sea ice is steadily retreating due to climate warming, but regional and seasonal variations in Arctic sea ice are important. This study aims in understanding how the winter atmospheric circulation affects the sea ice drift and how ice motion contributes to regional sea ice concentration and thickness anomalies. Sea ice conditions in late winter and spring are crucial for predicting summer sea ice. Understanding the mechanism that affect the spring sea ice concentration and thickness have potential to improve sea ice predictions year-round.

Atmospheric pressure patterns affect the thermodynamic vertical structure of the atmosphere, heat and moisture transport to the Arctic, and radiative and turbulent fluxes at the surface (eg. Nygård et al 2021). Circulation types also control surface wind speed and direction, and are closely linked to ice drift speed (eg. Mallett et al 2021). Winter atmospheric circulation can precondition spring sea ice anomalies and summer melt by ice dynamics (eg. sea ice transport to lower latitudes where it is more vulnerable to melt) and thermodynamics (eg. positive surface energy balance anomalies prohibiting ice growth in winter leading to thinner ice in spring).

In this study we present a Self Organizing Maps (SOM) clustering of the winter (December-March) mean sea level pressure to detect the typical circulation patterns. The SOM-analysis covers the period from December 2000 to March 2021. The circulation patterns, or SOM nodes, are linked to atmospheric conditions (surface energy balance and wind speed) and sea ice conditions (concentration, drift speed and thickness). We use data from ERA5, ORAS5, and PIOMAS reanalyses, and Polar Pathfinder Sea Ice Motion and Cryosat2-SMOS ice thickness remote sensing products. We show how the circulation types are linked to near surface wind speed and direction, and consequent sea ice drift. As a result, we analyze if the circulation patterns can be linked to sea ice anomalies thought sea ice dynamics or thermodynamics.