EGU21-3334
https://doi.org/10.5194/egusphere-egu21-3334
EGU General Assembly 2021

Ground-based radar interferometry of sea ice dynamics

Dyre Oliver Dammann[1], Emily Fedders[1], Andrew Mahoney[1], Mark Johnson[2], Franz Meyer[1], and Mark Fahnestock[1]

[1]University of Alaska Fairbanks, Geophysical Institute, Fairbanks, USA

[2]College of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Fairbanks, USA

Arctic sea ice has retreated significantly over recent years. This ongoing sea ice decline has major implications for Arctic warming which motivates efforts to improve modeling capabilities. Human activities are also affected as sea ice is becoming less stable making ice roads, on-ice operations, and subsistence activities challenging in certain regions. To enhance modelling capabilities, ice use, and safety near sea ice, it is crucial to understand how sea ice deforms and fractures on the km-scale. Satellite remote sensing provides important insight into the mechanisms of large-scale sea ice deformation. However, analysis is frequently hampered by suboptimal data availability and lacks the spatiotemporal resolution necessary to resolve key processes.

We examine ground-based radar interferometry as a tool to bridge the gap between spaceborne remote sensing and sea ice lab and in-situ measurements during two field campaigns. We deployed a Gamma portable radar interferometer (GPRI) during a drifting ice camp in the Beaufort Sea during spring 2020. Based on this data, we demonstrate the ability to derive km-scale 2-dimensional strain/stress fields through inverse modeling. This analysis also highlights the ability to resolve mm-scale variations in dynamic behavior between different ice regimes. We also deployed a GPRI at a fixed reference point on shore in Utqiaġvik, Alaska. This enabled the tracking of absolute motion over several hours revealing near uni-axial elastic divergence in response to offshore wind.

Our analysis included efforts to remove signals from continuous antenna tilt due to ice motion when stationed on ice. We also needed to take steps to remove atmospheric phase contributions from the data obtained in Utqiaġvik during late spring. Overall, ground-based radar interferometry shows promise as a tool to track mm-scale sea ice dynamics. This may enable new insight into rheological behavior of sea ice and potentially the monitoring of dynamic precursors to fracture, which may improve safety near ice operations.