

GLOBAL MEET ON CLIMATE CHANGES AND SUSTAINABILITY



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Linking timescale-dependent Antarctic sea ice kinematic observations to ice thickness

Abstract: Sea ice kinematics impacts the global ocean-atmosphere system in numerous ways: modification of albedo, ice cover, and ice mass; heat transmission between atmosphere and ocean; and ice thickness distribution. Such research is often conducted using in situ and remotely-sensed observations of ice motion. In recent work, an ice motion product generated from overlapping sections of multiple individual swath pairs – the so-called swath-to-swath (S2S) approach – has been favourably evaluated by buoys in the Arctic. This new product is better able to represent drifting buoy trajectories, however, it has yet to be applied to ice kinematics research. In this study, we investigate the Antarctic sea ice differential kinematic parameters (DKPs) represented by divergence and maximum shear rate computed from the new S2S ice motion product, and compare these with the daily-map (DM)-derived DKP magnitudes. Results indicate that S2S-derived DKP magnitudes are highly timescale-dependent and well represented by an exponential relationship. Furthermore, the exponential DKP curve parameters in this work are shown to correspond well to ice thickness, thus enabling a new class of Antarctic ice thickness proxy observations. This technique lays the groundwork for the possibility of new proxy measurement of ice thickness back to at least 1991, when the high-accuracy S2S measurements of ice motion become available.

Biography: Dr. Tian earned her Ph.D. in Antarctic sea ice dynamics from the University of Tasmania, Australia, in 2023. She is currently a Postdoctoral Researcher at the University of Wisconsin-Madison, USA. Dr. Tian specializes in the remote sensing of polar sea ice dynamics, with expertise in algorithm development, product validation, and appliance. As the Primary Investigator (PI) for a NOAA-funded ice dynamics project, she leads groundbreaking research in sea ice dynamics field. Dr. Tian has authored four peer-reviewed papers in prominent scientific journals.