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Title:PIPERS: Sea Ice Thickness Redistribution From Early Winter Deformation

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Text:

The morphology of sea ice deformation is important for the representation of deformation in sea ice models and interpreting satellite observations of ice thickness. Deformation features in the Antarctic differ from those in the Arctic, yet we have limited understanding of how deformation drives ice morphology. In this study, sea ice deformation is characterized and quantified with relevant statistics using high-resolution three-dimensional observations of ridges collected during the 2017 PIPERS cruise in the Ross Sea in early winter. These observations primarily consist of ice draft from multibeam sonar on an autonomous underwater vehicle (AUV) and are supplemented with terrestrial lidar for surface elevation and manual MagnaProbe for snow depth. We quantify ridge statistics such as roughness, symmetry (skew) and linearity using computer vision techniques and model the thickness distribution using generalized extreme value distributions. To understand how deformation processes determine these morphologies, ridge spatial statistics are verified using a three-dimensional Discrete Element Model, which also allows for investigating the effects of different initial floe statistics on resultant ridge morphology. This yields improved estimates of sea ice thickness redistribution due to ridging that will ultimately improve sea ice dynamic models, algorithms for remote sensing of ice thickness distribution and parameterizations of ice-ocean drag.