High Resolution Sea Ice Floe Size and Shape Data from Knox Coast, East Antarctica

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Abstract

This dataset contains floe size distribution data from a very high resolution (pixel size: 0.3 m) optical satellite image of sea ice, acquired on 16 Feb. 2019 off the Knox Coast (East Antarctica). The image shows relatively small ice floes produced by wave-induced breakup of landfast ice between Mill Island and Bowman Island. The ice floes are characterised by a narrow size distribution and angular, polygonal shapes, typical for sea ice broken up by waves.

Specification table (data records)

Subject area	Physical Oceanography, Polar science, Sea ice, Remote sensing
More specific subject area	Sea ice–wave interactions
How the data was acquired	Processing (image segmentation + object identification) of a very high resolution optical satellite image of sea ice
Data format	binary Matlab (.mat) files
Geographic location	65.55398°S, 101.9066°E
Date of image acquisition	16 Feb. 2019
Data source location	MOST Wiedzy Open Research Catalog, Gdańsk University of Technology, Gdańsk, Poland
Data accessibility	The dataset is accessible and is publicly and freely available for any research or educational purposes

Background

The floe size distribution (FSD) is an important characteristic of sea ice, influencing several bulk sea ice properties (e.g., its mechanical strength, lateral melting/freezing rates, etc.), as well as physical processes in the atmospheric/oceanic boundary layers over/under the ice cover. Therefore, an increasing number of research studies is dedicated to the analysis of the observed FSD data in different sea ice, weather and wave conditions, as well as to developing theoretical and numerical methods allowing FSD information to be taken into account in sea ice and climate models.

This dataset contains FSD data extracted from a very high resolution (pixel size 0.3 m) optical satellite image of sea ice (Fig. 26.1; original image acquired by Maxar Technologies, https://www.maxar.com/, and purchased from Overview, https://www.over-view.com/). Contrary to most existing similar datasets, the present one contains information on small ice floes (mean size 18, 13, and 51 m in sectors A, B, C, respectively) which have a narrow size distribution and polygonal, angular shapes, indicating that they were formed by fracturing of continuous ice cover by wave action in the time period shortly preceding the time of acquisition of the analysed image.
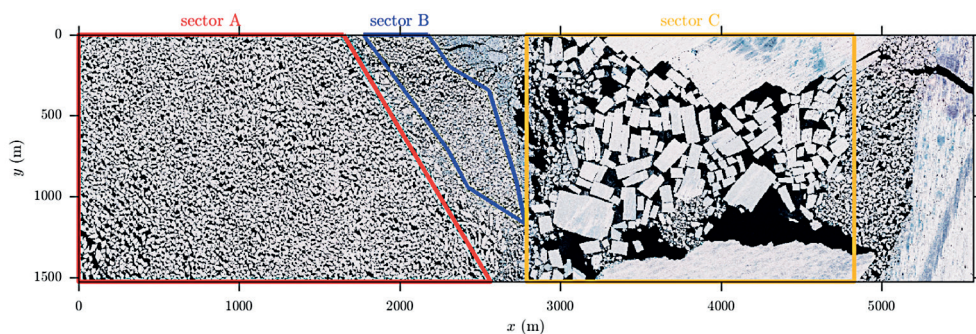

Fig. 26.1. Sea ice image used as the source of floe size and shape data created in this study, with the boundaries of analysis sectors A, B and C

The dataset contains data on the location, size, and selected geometrical properties of ice floes identified in three different parts of the image (sectors A, B, C in Fig. 26.1).

Methods

The fragments of the image from each sector (Fig.26.1) were processed as follows: k-means clustering was applied to the original image in order to identify 3 classes of pixels, corresponding to the open water, dark ice and light ice. Dark ice pixels fully surrounded by light ice were reclassified to light ice, the remaining dark ice to water. Then, a binary image was created (1=light ice, 0=water), and the tools from the Matlab Image Processing Toolbox, combined with ImageJ, were used for object identification (with manual corrections of floes' boundaries where necessary). Finally, selected geometric properties of each floe were computed, including surface area, minimum and maximum

caliper diameter, elongation, rectangularity and minor/major axes of a fitted ellipse (see Fig. 26.2 for an example). Details of the image processing are described in Herman, Wenta and Cheng (2021). The analysis of FSD data in Herman, Wenta and Cheng (2021) is based on methods described in Herman, Evers and Reimer (2018).
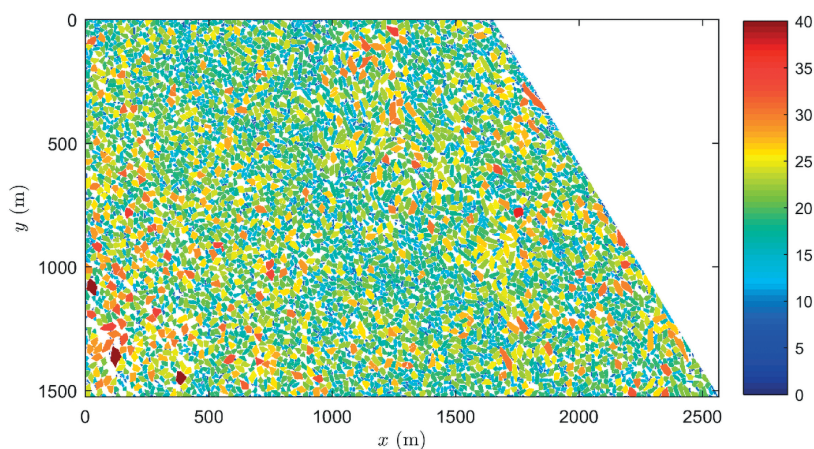

Fig. 26.2. Map of floe width (in m) from sector A, based on floe size data from the present dataset

Data availability

Dataset DOI
10.34808/h3ye-4d45

Dataset License
CC-BY-NC

References

Herman, A., Evers, K.-U., and Reimer, N. (2018) 'Floe-size distributions in laboratory ice broken by waves', *The Cryosphere*, 12(2), pp. 685–699, DOI: 10.5194/tc-12-685-2018.

Herman, A., Wenta, M., and Cheng, S. (2021) 'Sizes and shapes of sea ice floes broken by waves – a case study from the East Antarctic coast', *Frontiers in Earth Science*, 9, DOI: 10.3389/feart.2021.655977.