

# Regional differences of sea ice floe size distribution in the Arctic

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## Introduction

Floe size distribution (FSD), which is important to the physical processes in the marginal ice zone, is controlled by ice advection, thermodynamics and dynamics. These physical conditions are different between the western and the eastern Arctic. In this presentation, the results are from “pre-ponding” period, showing no major melt ponding. Pre-ponding period covers between early May to July, but different among the sites.

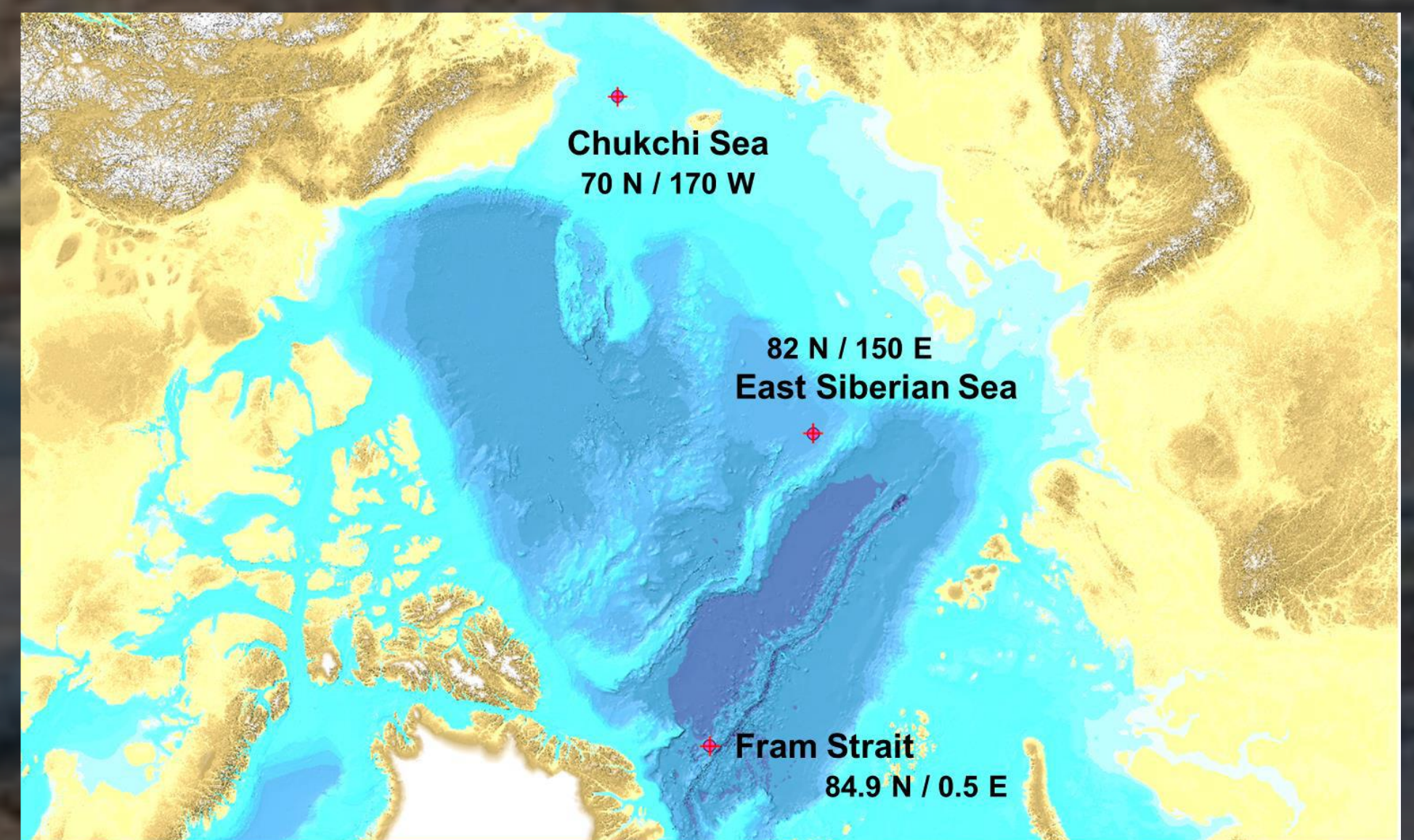


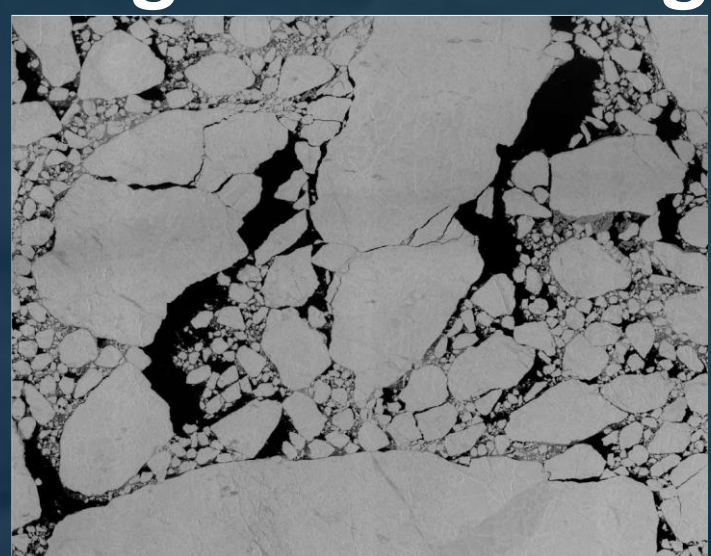
Fig. 1. Bathymetric map of the Arctic Ocean with the three selected sites.

## Method

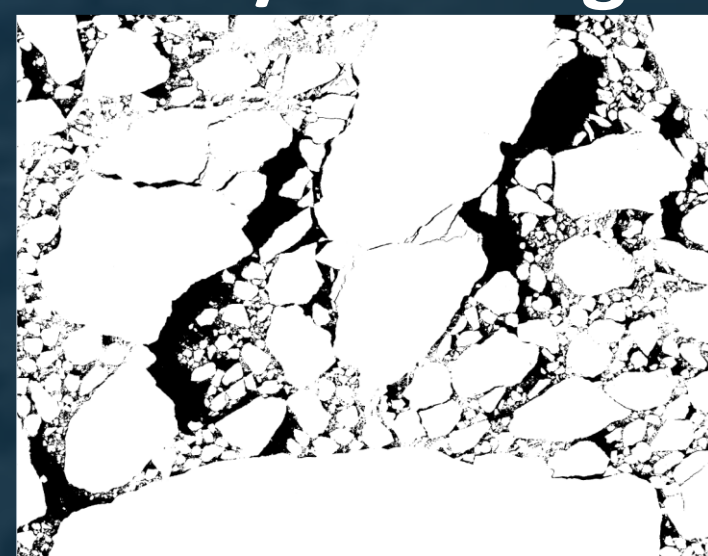
We analysed the FSD data derived the images from MEDEA and synthetic aperture radar (SAR) TerraSAR-X in Chukchi Sea (70°N, 170°W), East Siberian Sea (82°N, 150°E) and Fram Strait (84.9°N, 0.5°E).

FSD retrieved by the algorithm described in Hwang et al. (2017)

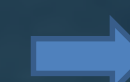
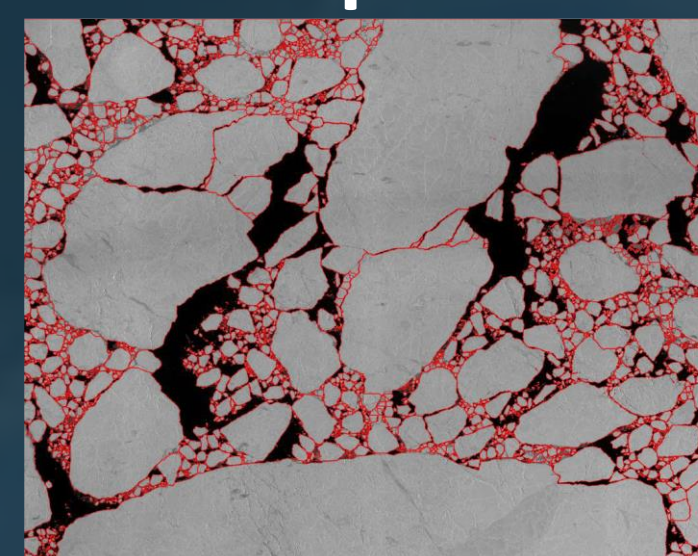
### Original GFL image



### Water/Ice image



### Floe separation



### Floe size statistics

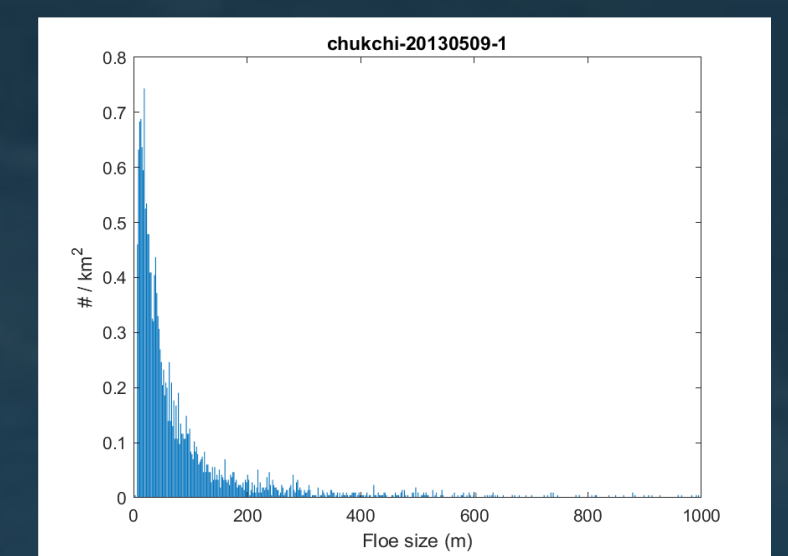


Fig. 2. Retrieval of sea ice floe size distribution (FSD) from satellite imagery.

## Results

### ➤ Ice thickness, ice age and sea ice concentration

Eastern Arctic > Western Arctic

### ➤ Dynamic conditions

Wind speed: Eastern Arctic > Western Arctic

Wave height: Eastern Arctic > Western Arctic

### ➤ Thermodynamic conditions

- Depth of ocean mixed Layer

Eastern Arctic > Western Arctic

- Sea surface temperature

Western Arctic > Eastern Arctic

### ➤ Cumulative floe number density $N(p, \Omega)$ : the number of ice floes per unit area in a region $\Omega$ with size larger than or equal $p$

➤ Chukchi Sea contains a larger percentage of smaller floes and undergoes a smaller interannual variability in the FSD compared to other two sites (Fig 3).

➤ The cumulative floe number density distribution is related to a **power-law relationship** of the form  $n(p) = cp^{-\alpha}$  (e.g., Rothrock and Thorndike, 1984; Hwang et al., 2017).

➤  $\alpha_{chuk} = 1.7470 \pm 0.34$   $\alpha_{esiber} = 1.4645 \pm 0.35$   $\alpha_{fram} = 1.4607 \pm 0.25$

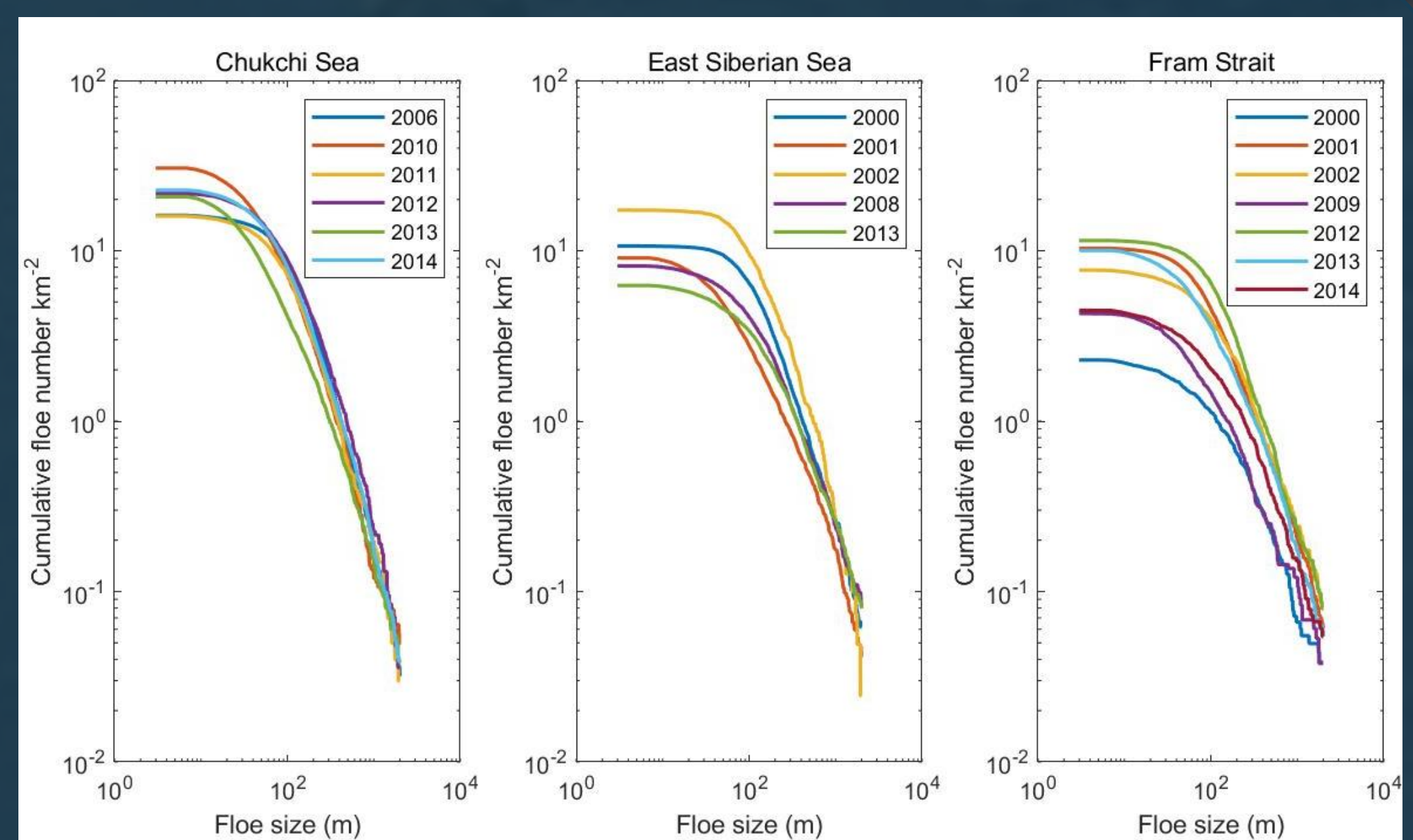


Fig. 3. Cumulative floe number density in the three selected sites

## Reference

- [1] Hwang et al., *Elementa*, 2017 .
- [2] Rothrock and Thorndike, *JGR*, 1984

## Acknowledgements

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