

Supporting Information for: Estimating The Sea Ice Floe Size Distribution Using Satellite Altimetry: Theory, Climatology, and Model Comparison

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Text S1: Comparison of power-law exponent estimators.

Included as a Supplementary File is a directory entitled compare_estimates. The MATLAB code how_does_pl_do.m generates a synthetic power law distribution of variable size, exponent, and beginning, computes the moment-based fit (Eq. 13) for a variety of n and a fixed $\epsilon = 1$, and compares this to the VC estimator (Eq. 14). The plots vary the number of samples, and
5 compare how $\alpha_{n,\epsilon}$ compares to $\hat{\alpha}$ and the “real” power-law data. The default choices are $\epsilon = 1$, $\alpha = 2$, n ranging from 0 to 2, and the number of samples spaced logarithmically by powers of 5 from 5 to 3125.

Text S2: Choosing a measurement threshold for average statistics

Fig S1(a-b) shows the mean seasonal cycles (a) and yearly average representative radius (b) for different choices of the number of chords required to include a given CICE grid cell and month in the Arctic average, for 0,5,10,15,25,35,50, and 100 chosen
10 chords. Fig. S1(c) shows the percentage of all chord lengths being included in that average in each year, and Fig. S1(d) the areal fraction of those regions for each choice. Higher chord length requirements exclude regions at lower latitudes in favor of those nearest the pole with the largest floe sizes. The shape and magnitude of the seasonal cycle and annual cycle is largely robust for choices in the range from 10-50 chord lengths, but choosing larger thresholds reduces the area being considered. When a threshold of 100 is chosen, within each year, less than 10% of area-month combinations have sufficient measurements.