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Supporting Information for

Roughness of ice shelves is correlated with basal melt rates

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Introduction

This supporting information document contains four supporting figures and one supporting table. The first figure (Figure S1) shows the distribution of roughness over pinning points and shear margins for Pine Island and Ross. The second figure (Figure S2) shows the spectra of tracks going in the along flow and transverse to flow directions for the Pine Island ice shelf. The third figure (Figure S3) shows the spectra for the remaining ice shelves in our survey. The last figure (Figure S4) shows melt rate vs roughness for Pine Island, taken on a point by point basis across the ice shelf. Finally, Table S1 includes direct links to the data sets that were used in our manuscript.

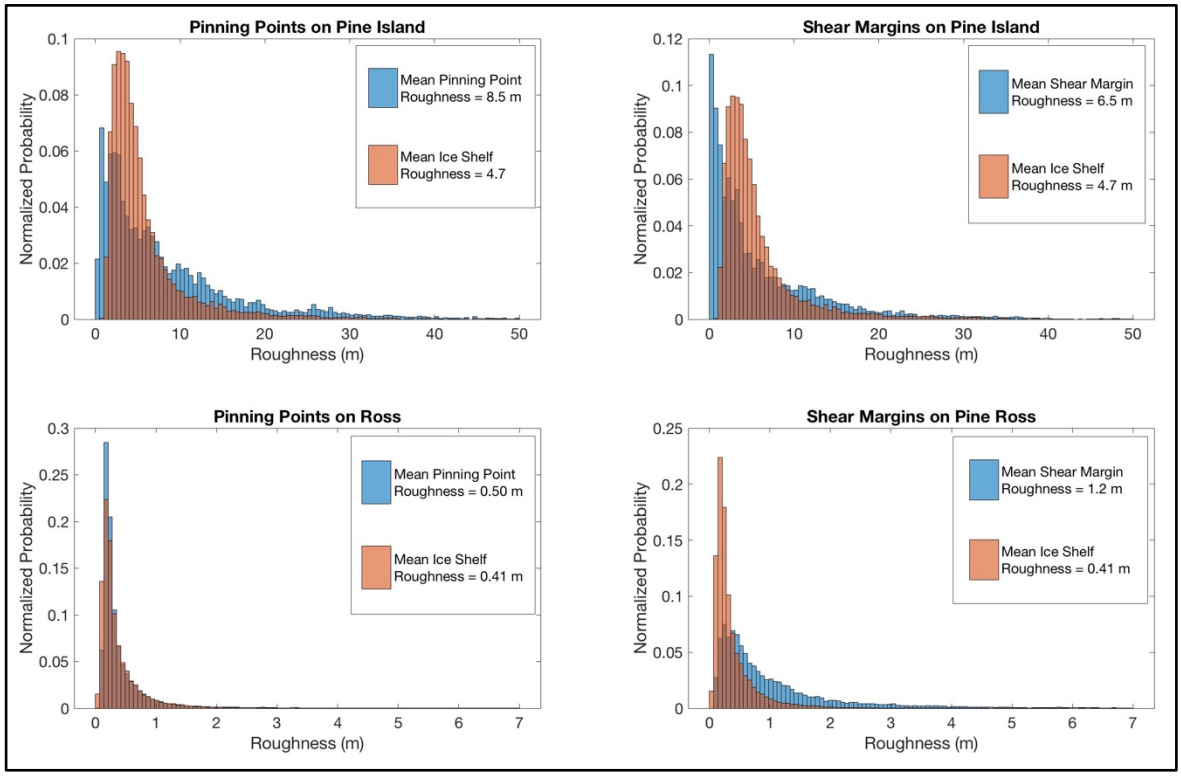

Figure S1: Distributions of roughness around pinning points and shear margins for both Pine Island and Ross compared to the distribution of roughness across each total ice shelf. For both features of both ice shelves, roughness is always higher relative to the mean roughness, indicating that pinning points and shear margins make ice shelves rougher. The analysis for pinning points is taken for all documented pinning points on each ice shelf, rather than just the example pinning point that is shown in Figure 2a and Figure 2e.

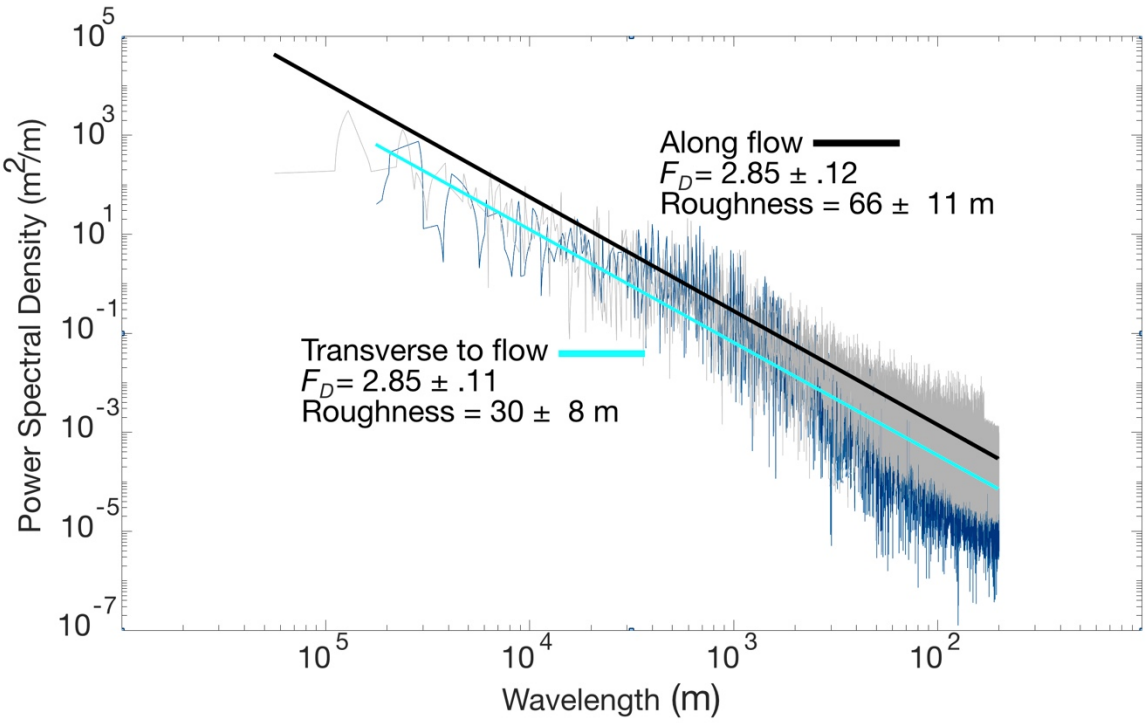

Figure S2. The spectra of tracks going roughly in the along flow (grey spectra) and transverse to flow (blue spectra) directions for Pine Island. When taken individually, both spectra still obey a power law with a statistically similar slope to that of the ice shelf as a whole.

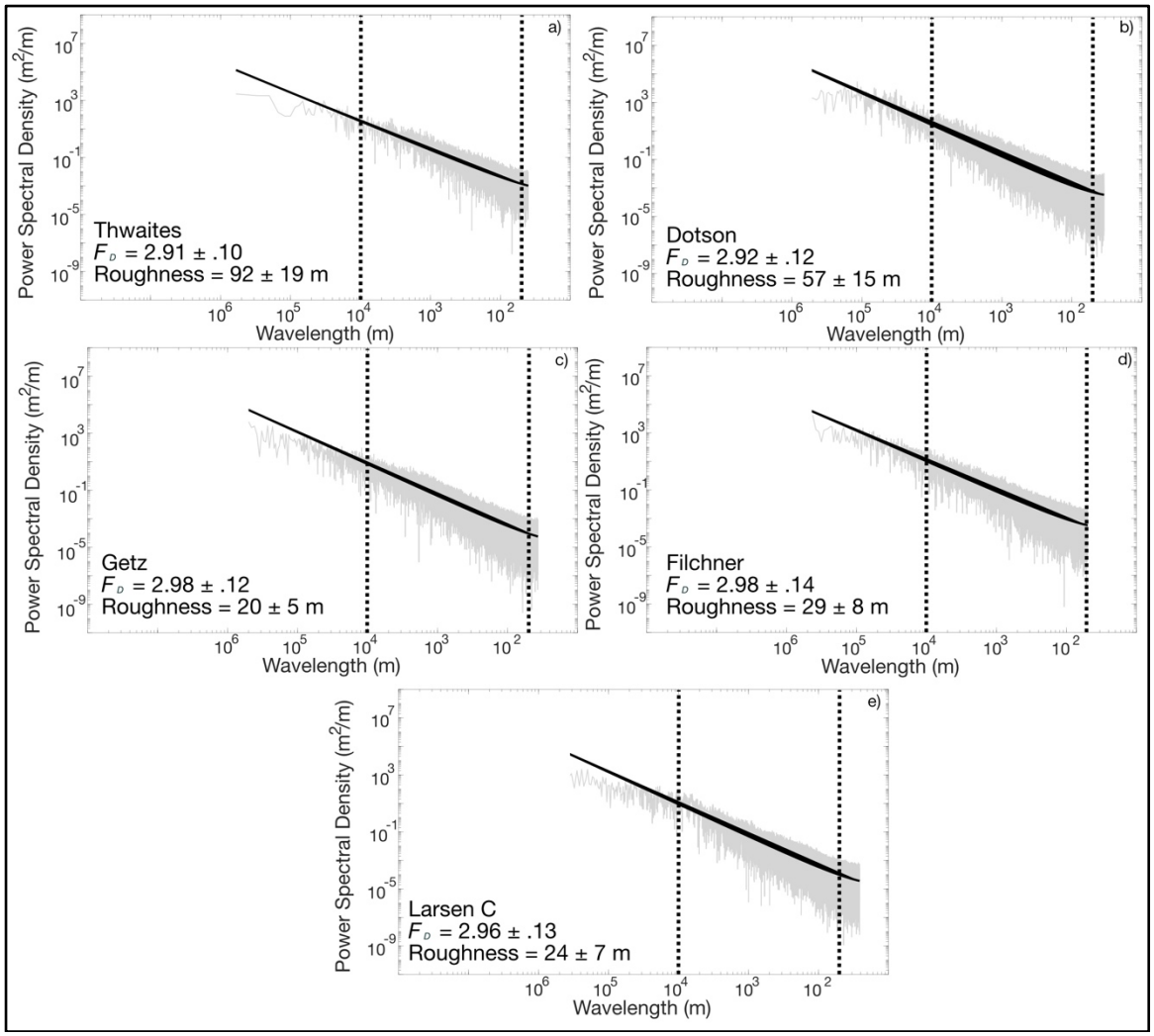

Figure S3. The power spectral density of all tracks going over the a) Thwaites, b) Dotson, c) Getz, d) Filchner, and e) Larsen C ice shelves. Also shown is a least squares fit of the power-law equation to each spectrum. Integration bounds used for calculating the average roughness for each ice shelf are plotted by the black dotted lines.

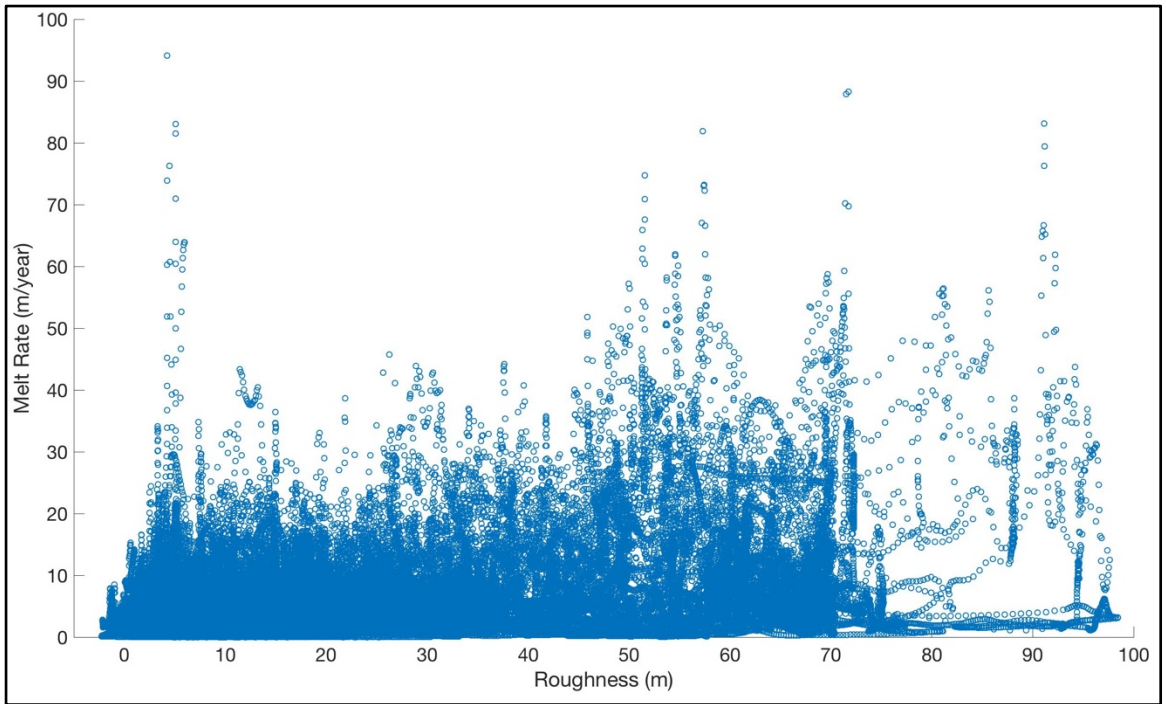

Figure S4. Melt rate vs roughness for the Pine Island Ice Shelf. Melt rates are obtained Adusmilli et al., 2020. Little correlation exists between roughness and basal melt when plotted on a point by point basis across the ice shelf.

Data Name	Data Source	Reference	Link to Data	Data timeframe
MCoRDS L2 Ice Thickness	Operation IceBridge	(Paden et al., 2010)	https://nsidc.org/icebridge/portal/map	2009 - 2016
Pine Island Ice Shelf 2011	Geophysics Data Portal	(Vaughan et al., 2012)	https://legacy.bas.ac.uk/data/aerogeo/dataset/pig/	2011
Total Ice Thickness	ROSSETTA-Ice	(Bell et al., 2020)	http://wonder.ldeo.columbia.edu/data/ROSETTA-Ice/DerivedProducts/DICE_IceThickness/	2019
Average Basal Melt	Multiple Sources	(Liu et al., 2015)	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4371949/bin/pnas.1415137112.sd01.xls	2005 - 2011

Table S1. Table 1 with expanded links to data products. Note that many of the data products require user registration in order to access.