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Supporting Information for

Tracking Multiyear Sea-Ice Variation in the Arctic Ocean over Decades with Microseism

Jui-Chun Freya Chen[1], Sunyoung Park[1], Douglas R. MacAyea[1]

[1]Department of the Geophysical Sciences, The University of Chicago, IL, USA

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Text S1

The variance-covariance matrix analysis (Figure S1) reveals the trade-off structure among $\boldsymbol{\beta}_0$, $\boldsymbol{\beta}_1$ (the coefficient associated with ocean-wave speed), and $\boldsymbol{\beta}_2$ (the coefficient associated with sea-ice concentration). There are relatively strong trade-offs between $\boldsymbol{\beta}_0$ and $\boldsymbol{\beta}_1$, as well as between $\boldsymbol{\beta}_0$ and $\boldsymbol{\beta}_2$, showing significant negative correlations (the cross-correlation coefficients for the latter are close to -1). On the other hand, the covariance between $\boldsymbol{\beta}_1$ and $\boldsymbol{\beta}_2$ is positive, and the corresponding correlation coefficients (Figure S1f) are the smallest compared to the other two cases (Figures S1d and e). This indicates that the ocean-wave speed and sea-ice concentration terms can explain the microseism variation with reasonable independence, without a strong trade-off.

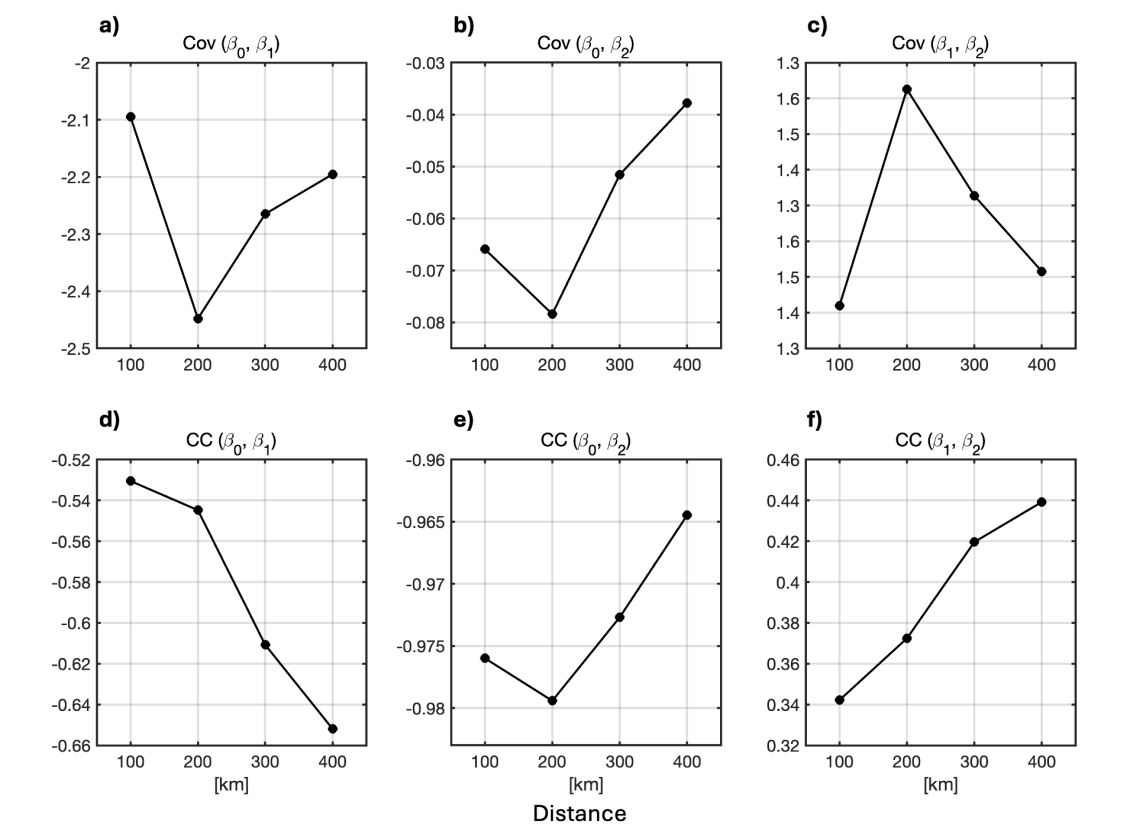

Figure S1. (a-c) Covariances and (d-f) correlation coefficients between different coefficient pairs, evaluated at all distance ranges (D).

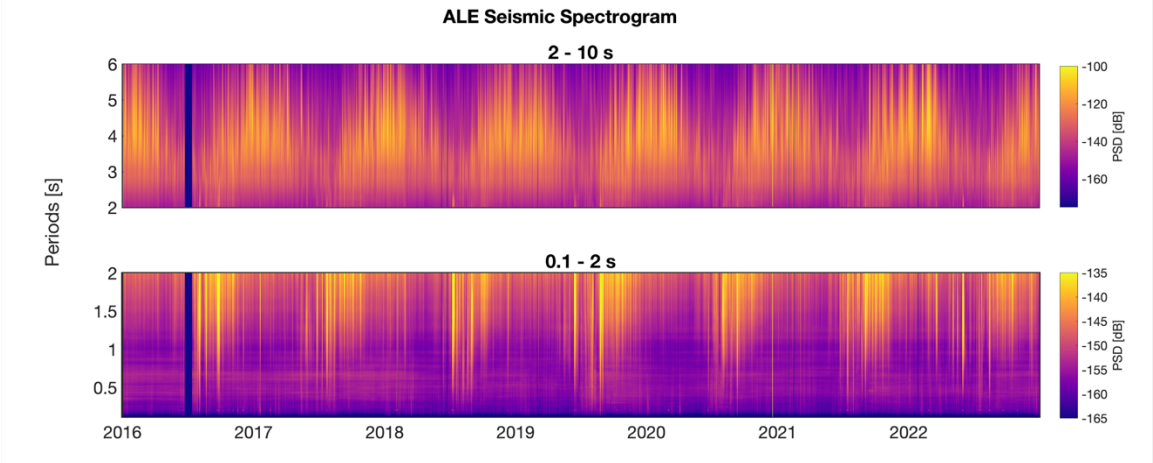

Figure S2. Seismic spectrogram in (a) 2 − 10 s and (b) 0.1 − 2 s of ALE from 2016 − 2022. Color shading shows the power spectrum density in dB.

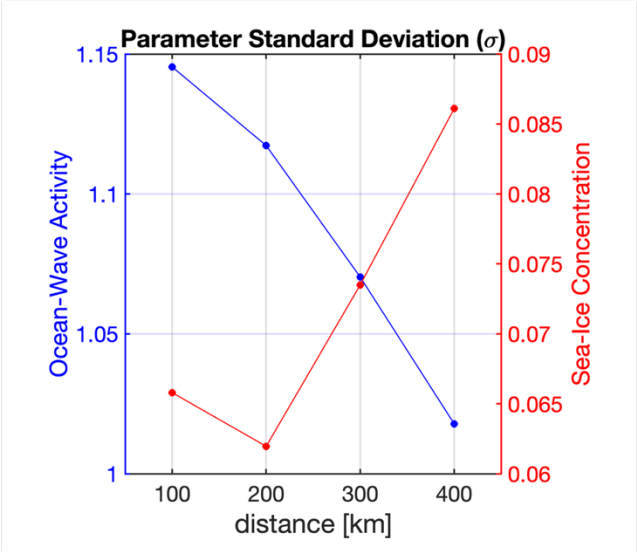

Figure S3. The standard deviation of each parameter, $\boldsymbol{U_o(t)}$ in the blue line and $\boldsymbol{S(t)}$ in the red line, in equation (3) as functions of $\boldsymbol{D}$.