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Supporting Information for

Seismic noise interferometry reveals transverse drainage configuration beneath the surging Bering Glacier

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Text S1. Noise correlations and dv/v measurements

The noise correlation and monitoring procedures follow references [*Zhan et al.*, 2013b] and [*Brenguier et al.*, 2008]. We first cut the raw noise records on three components (north, east, and vertical) into 30-min long segments and apply spectral whitening between 0.05Hz and 2Hz, with tapers to 0.02Hz and 4Hz on the two ends. Then we cross-correlate and stack the individual correlation functions with normalized amplitudes in 60-day moving windows and 15-day overlaps. The bi-monthly correlations for both the vertical-vertical and east-east components show high coherence throughout the twelve years (Figure S1). We stack all the bi-monthly correlations to construct a reference correlation function for each component pair (Figure S1), with which individual correlations are correlated to estimate time shifts. We measure the time shifts dt after filtering the correlations in a specific period band (e.g., [T1, T2] = [1s, 2s] in Figure S1) and use a sliding time window of length four times T2 and a step of a quarter of T2. We exclude measurements of time shift with correlation coefficients lower than 80% or in time windows with correlation coefficients lower than 80% more than half of the time. Finally, the relative velocity changes dv/v are estimated from the average dt/t values in the time windows of [5s 25s] and [-25s, -5s], corresponding to the direct waves and early coda waves propagating between GRIN and KHIT.

Text S2. Reference 1D velocity model for testing the four end-member scenarios

We construct the 1D reference model based on a few different studies, in the Bering Glacier region or in other glaciers. *Conway et al.* [2009] measured the ice thickness in the sampled section of Bering Glacier to be around 500m on average. We assign Vp=3700m/s and Vs=1820m/s to the ice layer [*Harper et al.*, 2010]. We add a 50m firn layer on top with Vp of 3400m/s and Vs of 1500m/s. *Fleisher et al.* [2006] reported a till layer near the front of the retreated Bering Glacier after its 1994 surge. Here we add a 10m till layer with Vp=1700m/s and Vs=250m/s to the 1D reference model [*Blankenship et al.*, 1987]. Using active source seismic survey, *Worthington et al.* [2012] found there is a 5-km sediment layer below the Bering Glacier and the surrounding areas, with Vp as slow as 3650km/s, close to values for water-saturated sediment Based on empirical relations [*Brocher*, 2008] we assign Vs=1980m/s to the top of the sediment layer, which gradually increases to 2280m/s until reaching the hard rock layer at 5km depth. Note that the 1D model is highly simplified and parameters are often based on measurements from other glaciers. Therefore, the predicted dispersion curves and their changes only qualitatively represent the expected features, and may not match the details in specific observations.

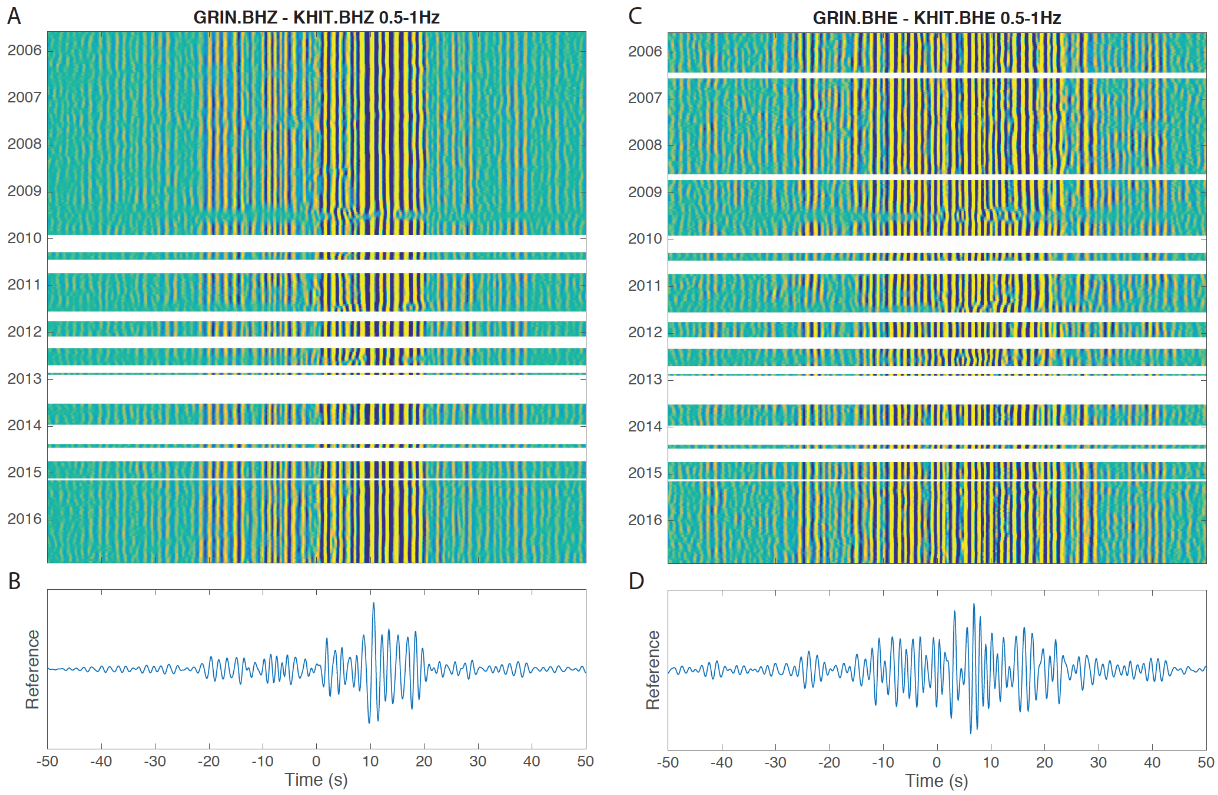

Figure S1. Twelve-year noise correlations between GRIN and KHIT. Correlations of the BHZ-BHZ and BHE-BHE component pairs are shown in (A) and (C), respectively. The reference correlations derived by stacking all the bi-monthly correlations are shown in (B) and (D). Gaps in (A) and (C) are due to either gaps in data or low (<0.5) correlation coefficients with the reference correlation function.

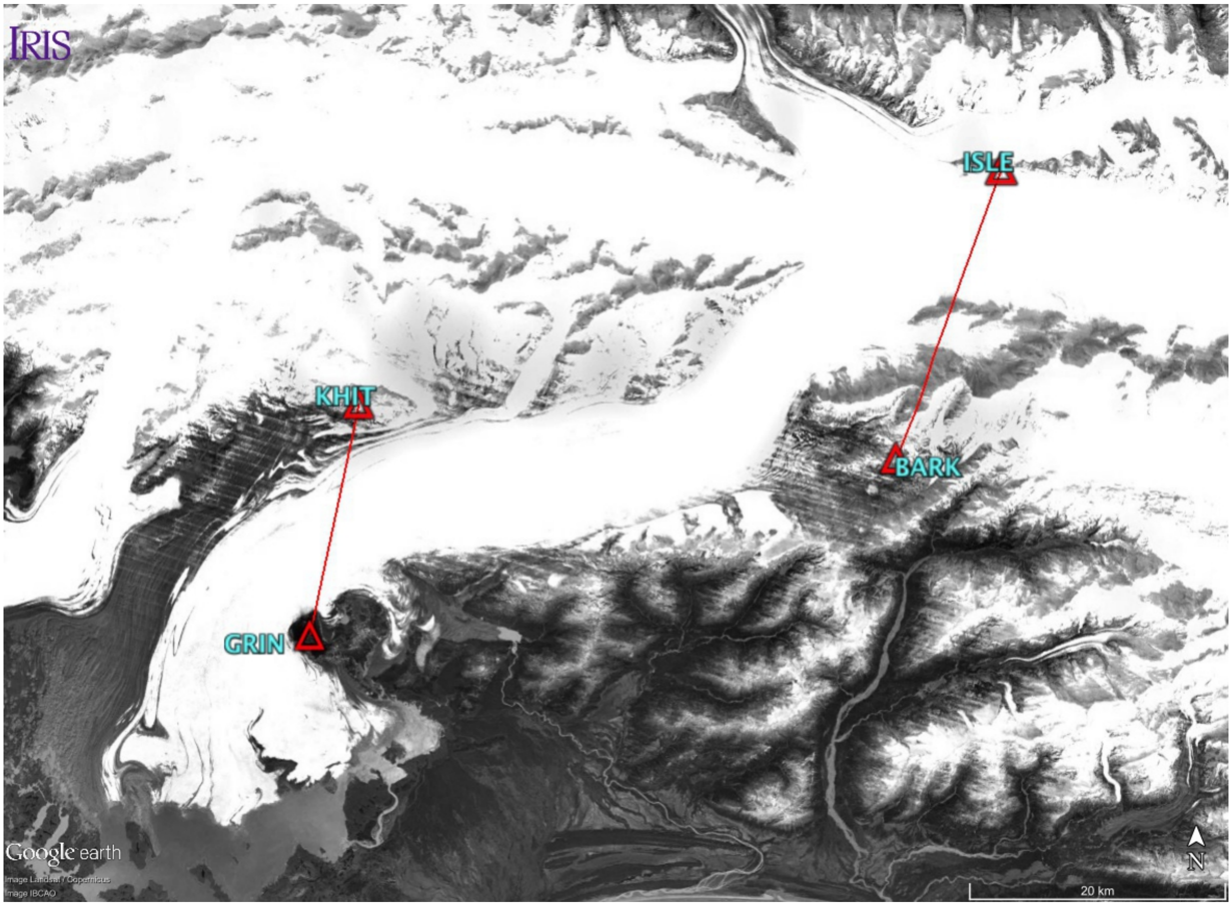

Figure S2. Map showing station pairs GRIN-KHIT and BARK-ISLE, which have similar pair distance and azimuth, but sampling different part of the Bering Glacier region.