Figure 1.

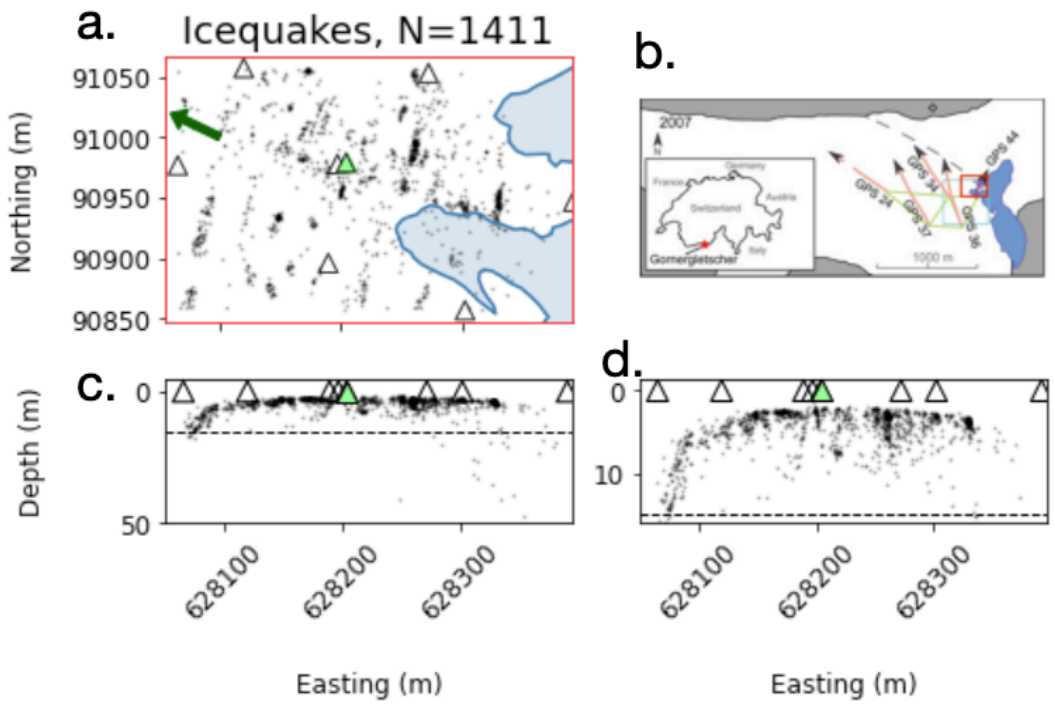

Figure 1. (A) Map view of icequakes used in study (black dots), stations active during 2007 (black triangles) and station J8 used in this study (green-filled triangle). The maximum lake extend is shown in blue, and the dark green arrow shows the general flow of the glacier. (B) || *Recreated with permission from Garcia et al, 2018 — I have not asked yet*. Regional of study area (red box), with the map inset showing the national scale, along with the weather station (black diamond) and GPS stations used in this study. The pink lines and arrows indicate the GPS stations' overall displacements from June 5th to July 21st. (C, D) Depth of icequakes across array.

Figure 2.

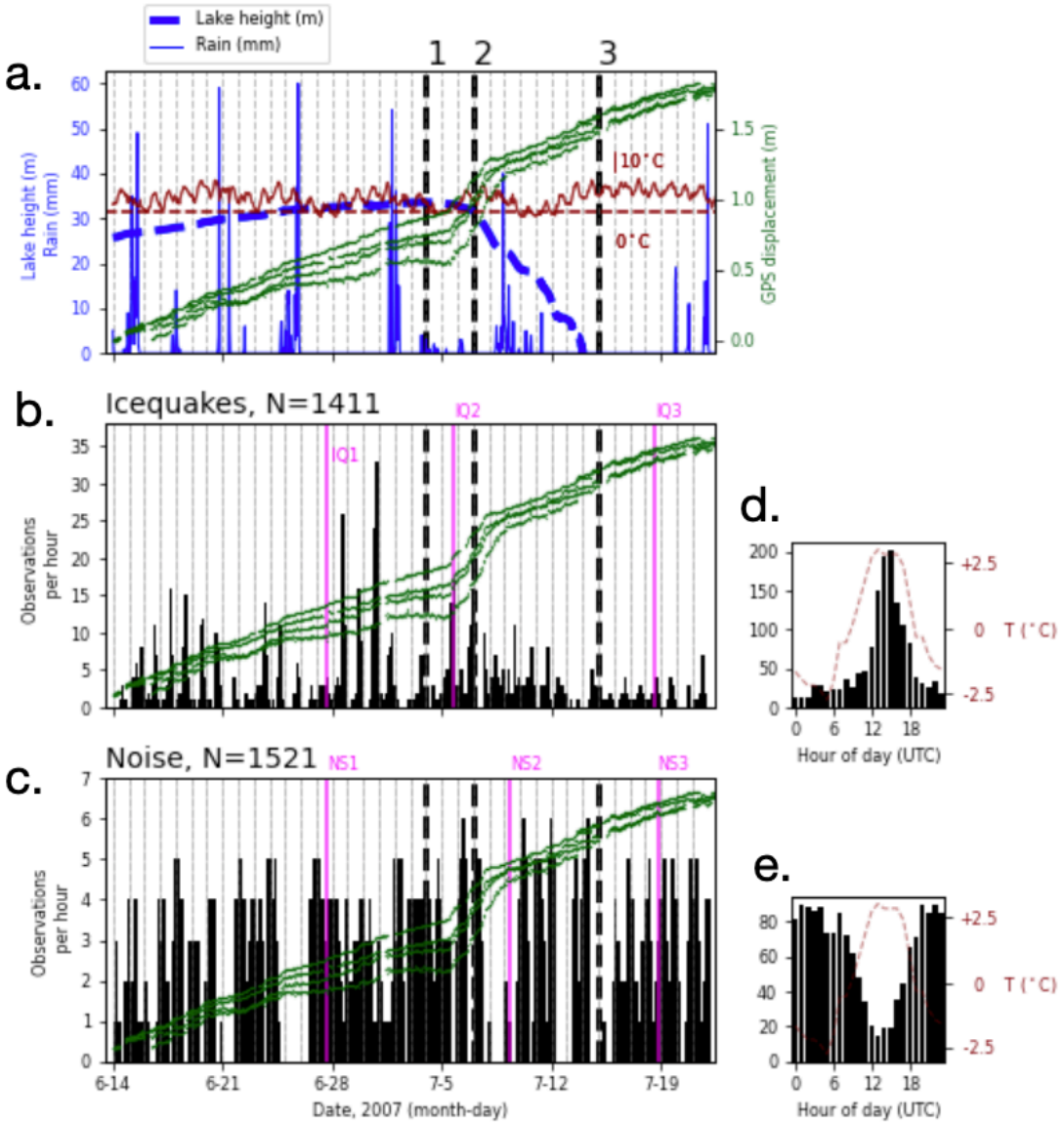

Figure 2. (A) Geophysical measurements (Garcia et al., 2018), including GPS displacement (green lines), lake level (thick dashed blue line), precipitation amount (thin, solid blue line), and ambient temperature (burgundy line). (B,C) Events binned by hour through time. Fuchsia lines show where the example events in Figure 3 are sampled; one each during midseason, drainage, and post-drainage (see Table 1). (D,E) Events per hour of the day (UTC). Burgundy dashed line shows the mean hourly deviation from daily mean temperature.

Figure 3.

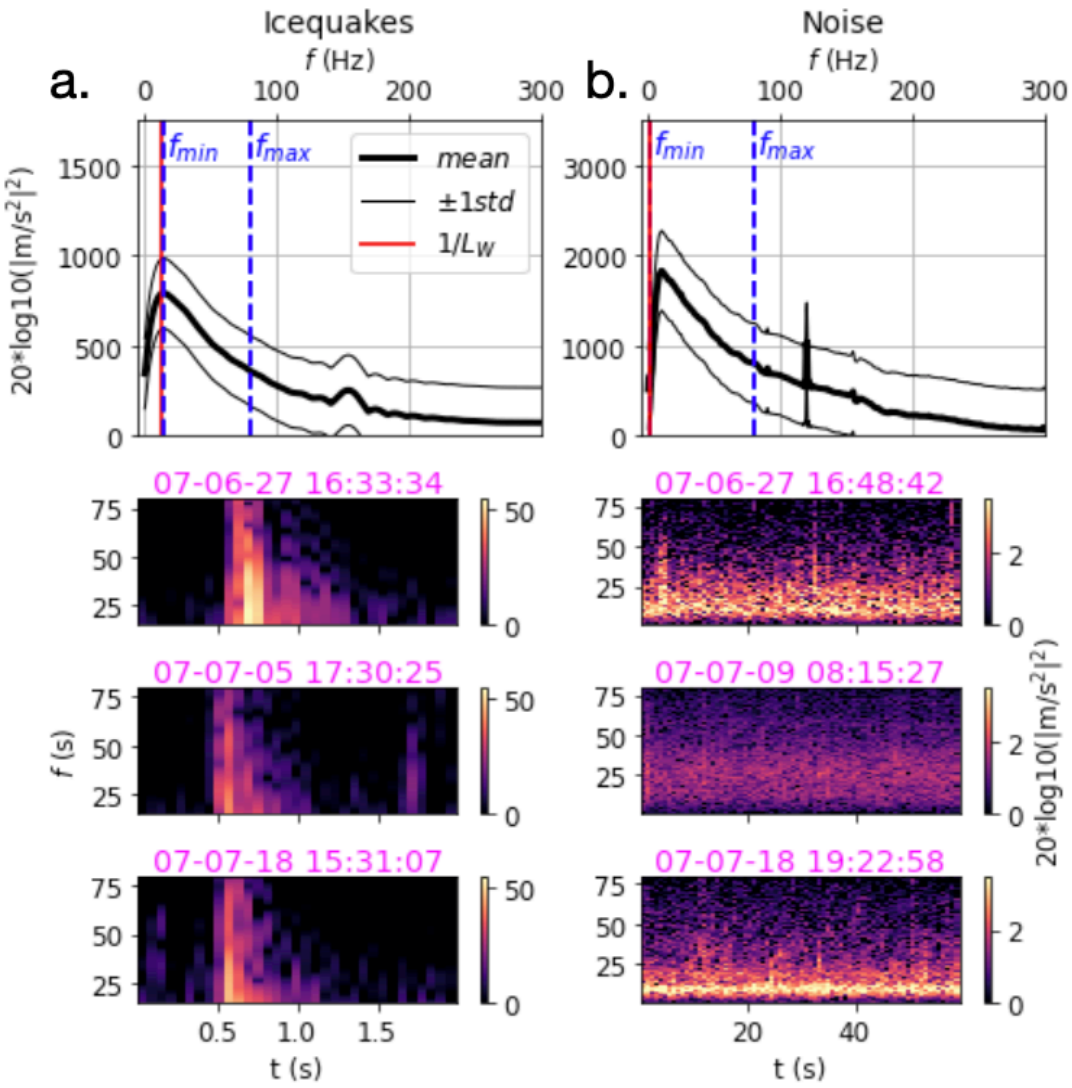

Figure 3. Spectrogram parameter choices used in this study. Top panels show mean spectra and the frequency bounds (blue dashed lines) used to filter the spectrograms during preprocessing. Red lines show the inverse of the window length used for calculating spectrograms. The bottom three panels show the example spectrograms indicated in Figure 2.

Figure 4.

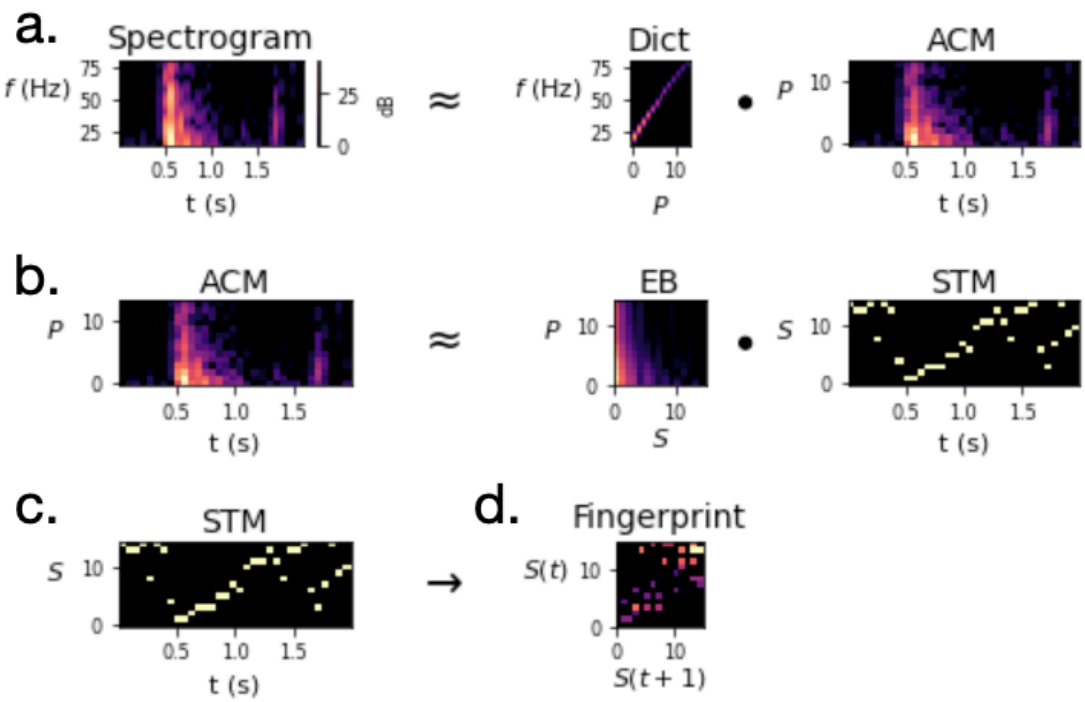

Figure 4. SpecUFEx workflow (see “Methods” in main text for details)

Figure 5.

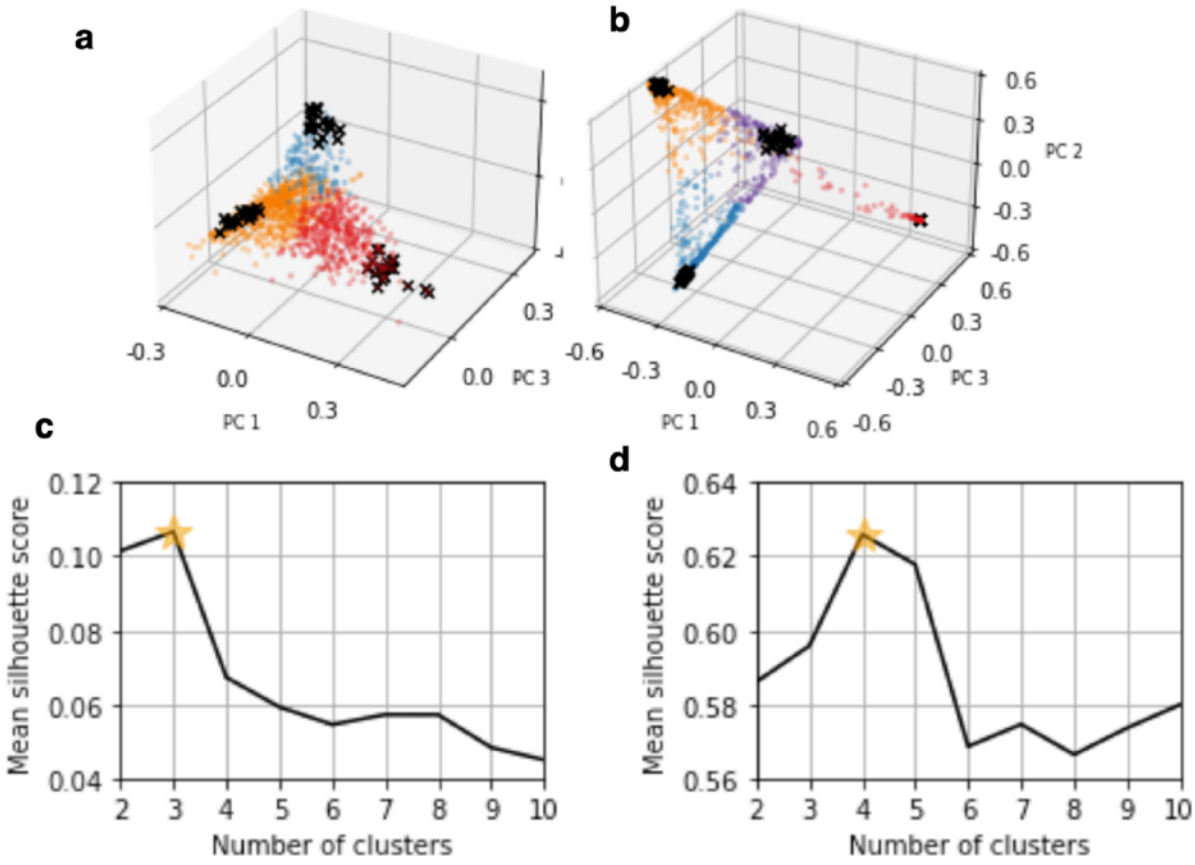

Figure 5. Clustering analysis. (A,B) 3-D PCA projections of fingerprints, colored by cluster assignment. Black x's show the top 20 representative events . (C,D) Mean silhouette scores after performing k-means for 2-10 clusters, with a star for the final choice for number of clusters.

Figure 6.

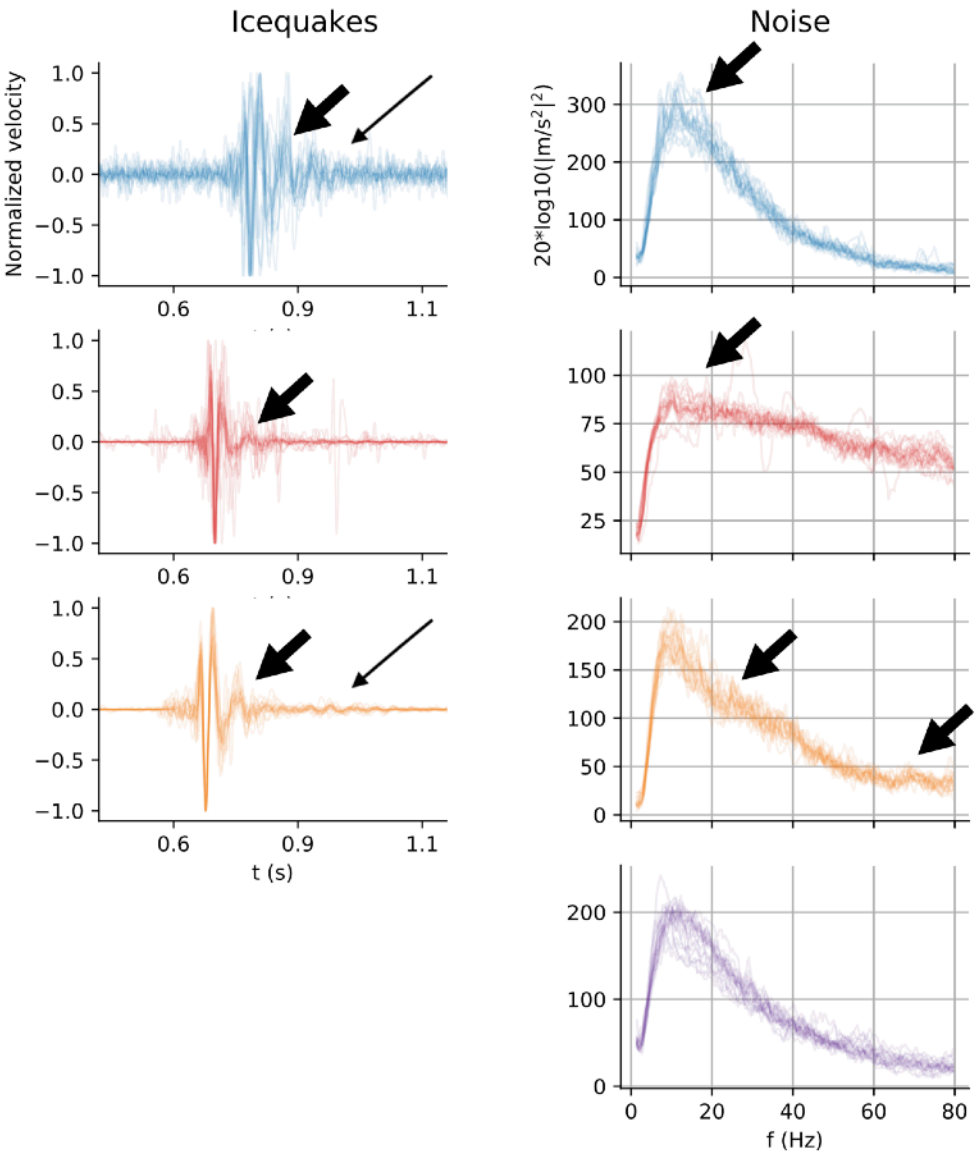

Figure 6. Left column shows top 20 representative waveforms for each icequake cluster, aligned to maximize correlation and trimmed in time. Thick black arrows show clusters' unique secondary phase arrivals, and thin black arrows show cohesion in the coda. Right column shows the top 20 representative spectra for each noise cluster, where black arrows indicate spectral peaks that appear unique to that cluster.

Figure 7

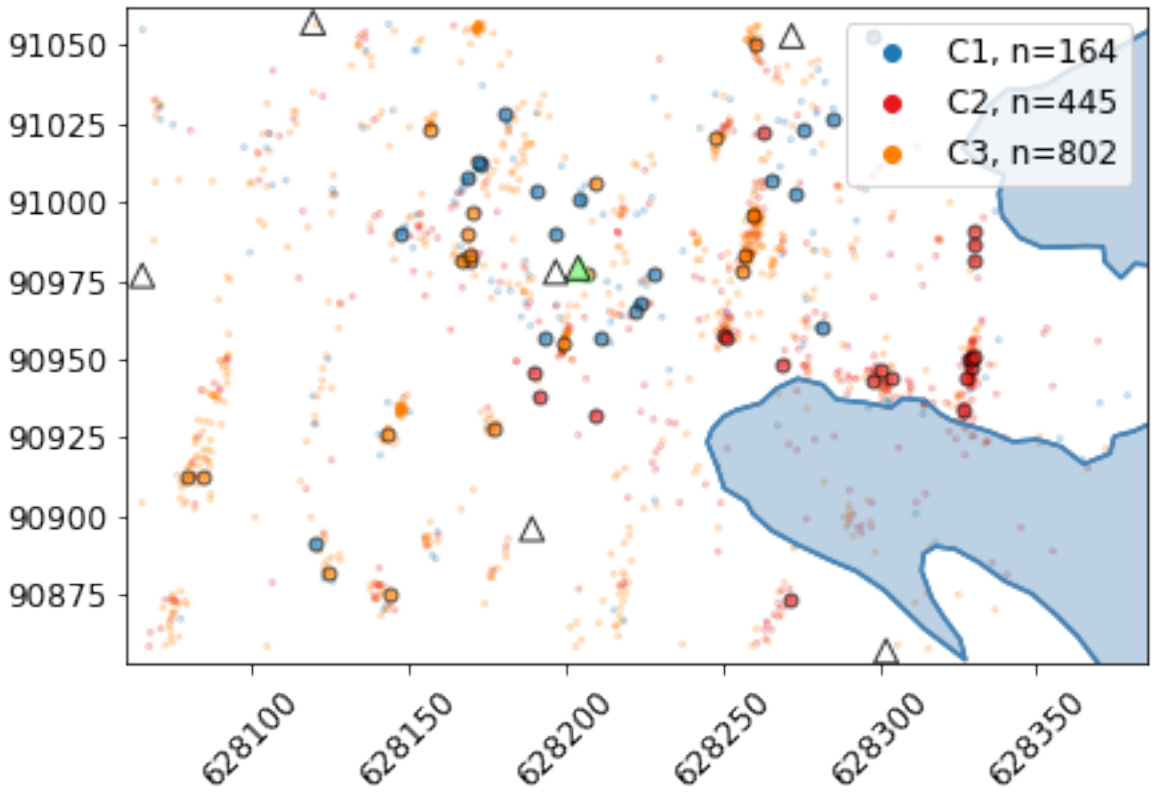

Figure 7. Map view of icequakes colored by cluster assignments, with top 20 representative events outlined in black. Symbols are otherwise identical to Figure 1A.

Figure 8.

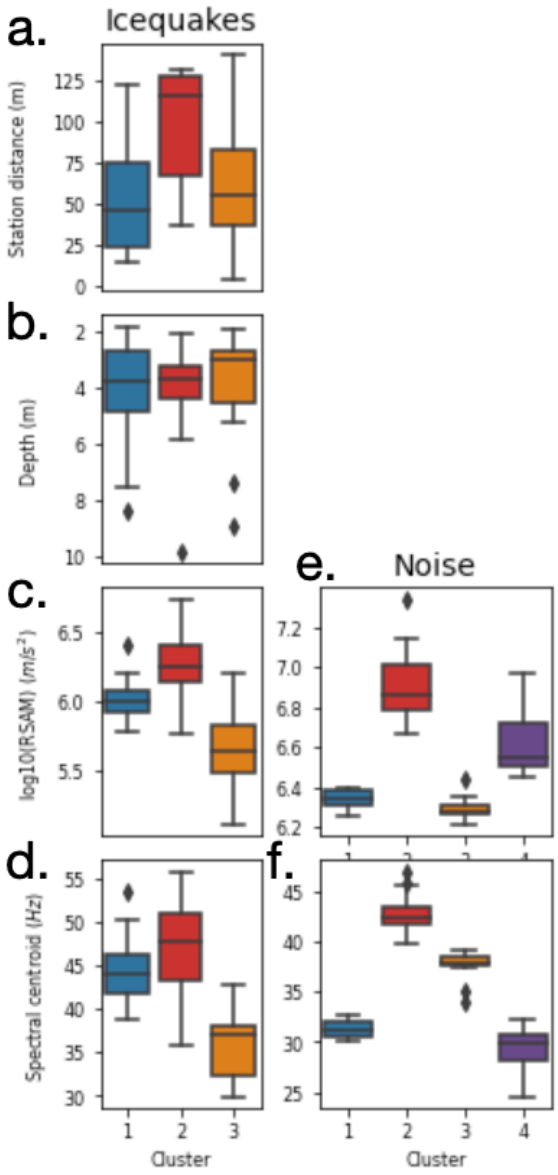

Figure 8. Box-and-whisker plots of top 20 events from icequakes (left column) and noise (right column). Boxes enclose the 25th-75th percentiles of data, with a line indicating the 50th percentile (median). Descriptions of the measures are given in the main text.

Figure 9.

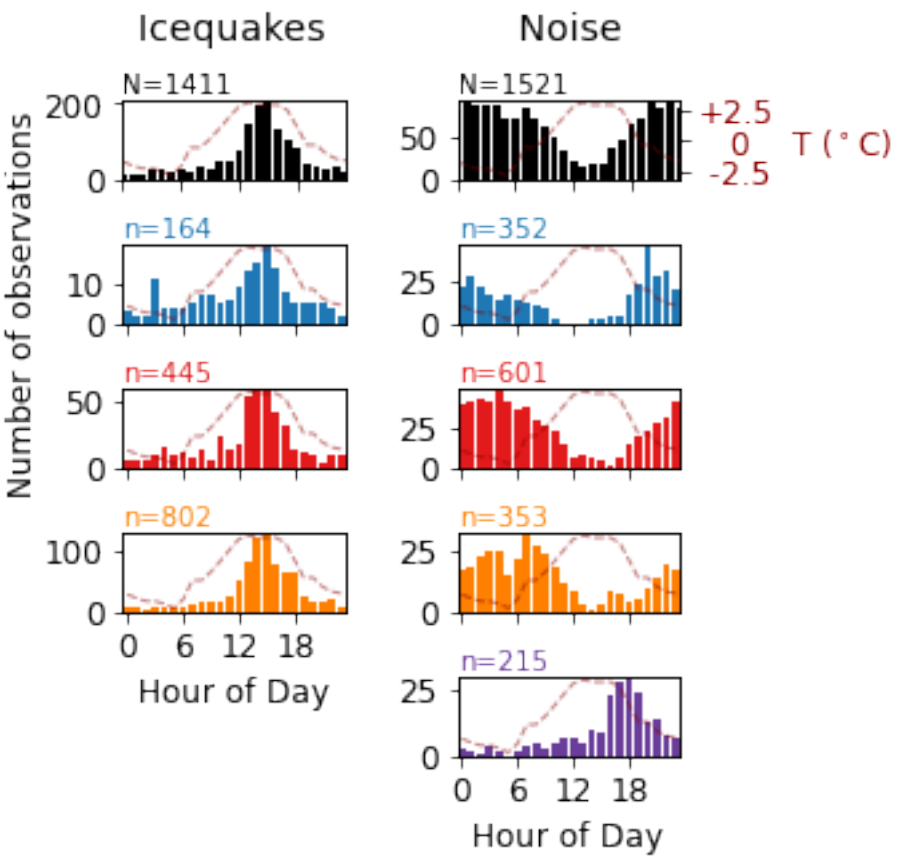

Figure 9. The number of hourly (UTC) icequakes (left column) and noise observations (right column), separated and colored by cluster assignment, where the top panels show the entire dataset (black bar plots, identical to Figure 2 D,E).

Figure 10.

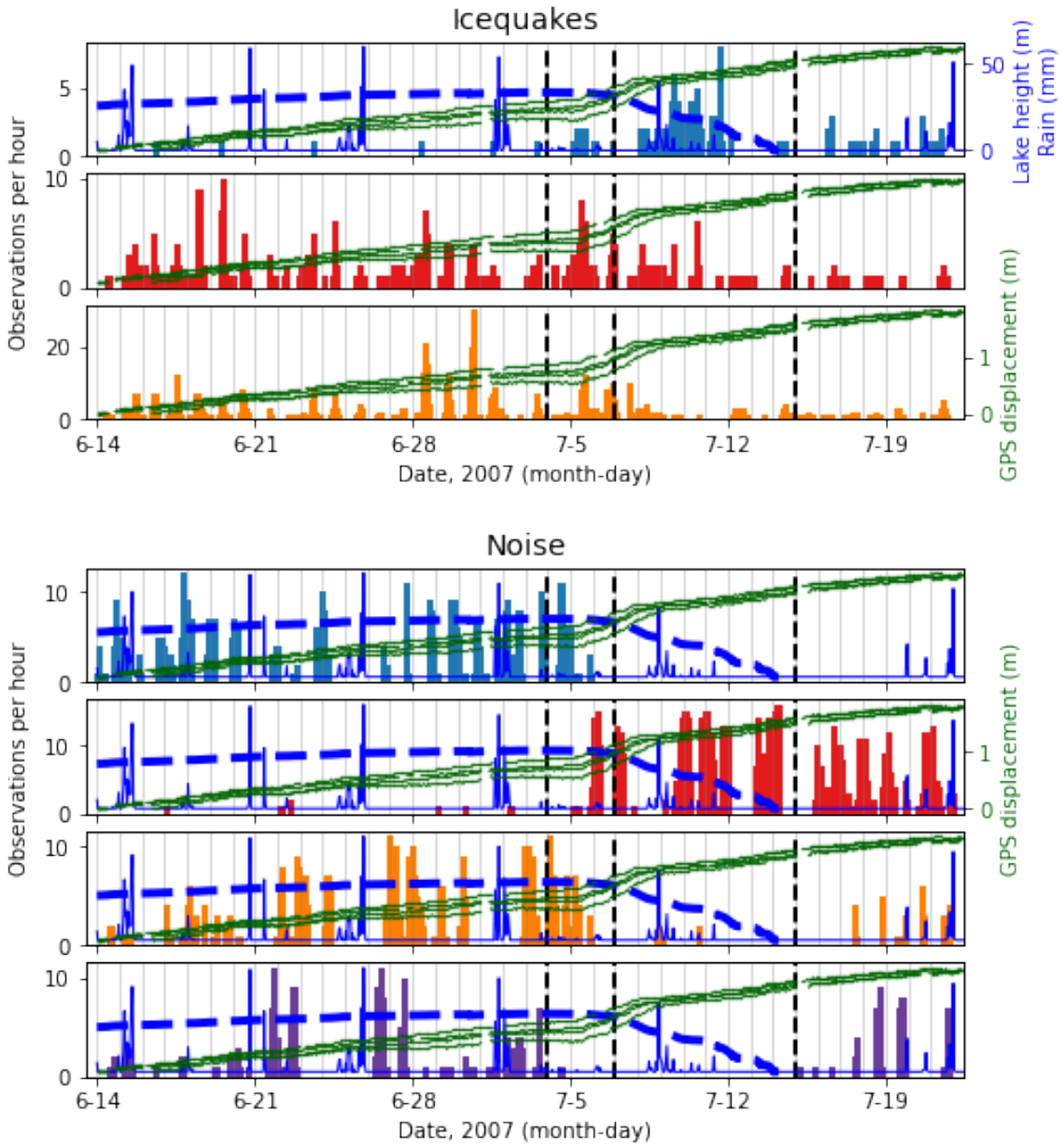

Figure 10. Similar to Figure 2, but now separated and colored by cluster assignment.

Figure 11.

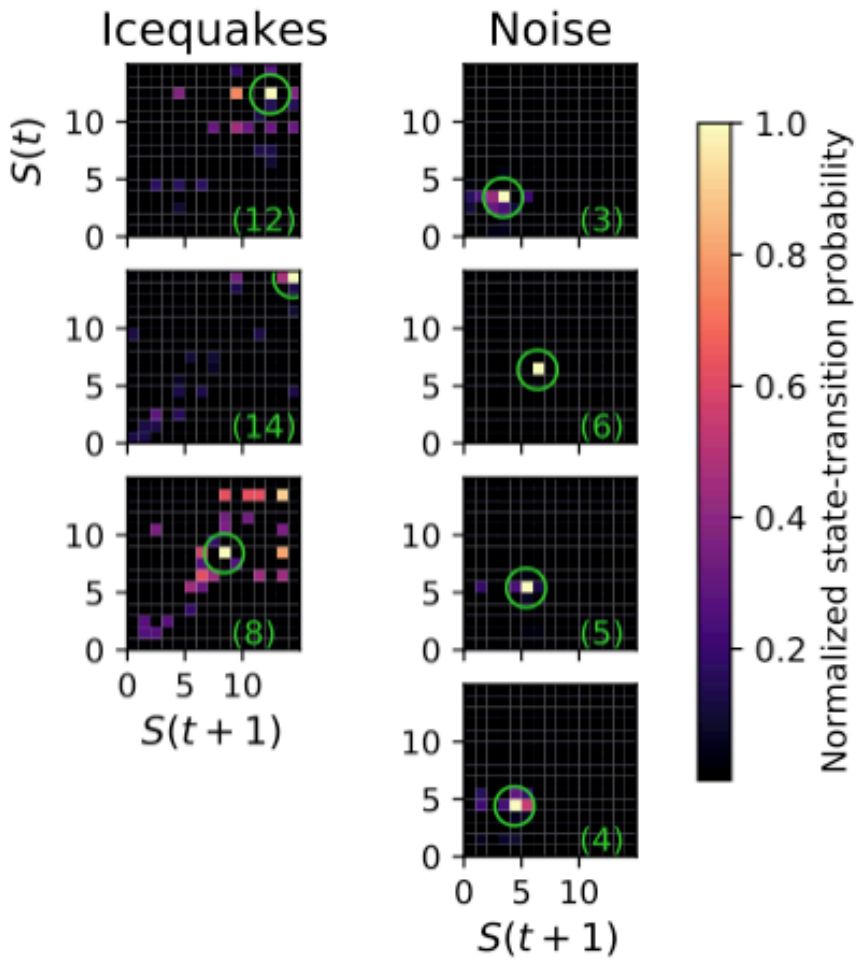

Figure 11. The fingerprints of the top representative events from each cluster, where the “key state” is circled and labeled in green.

Figure 12

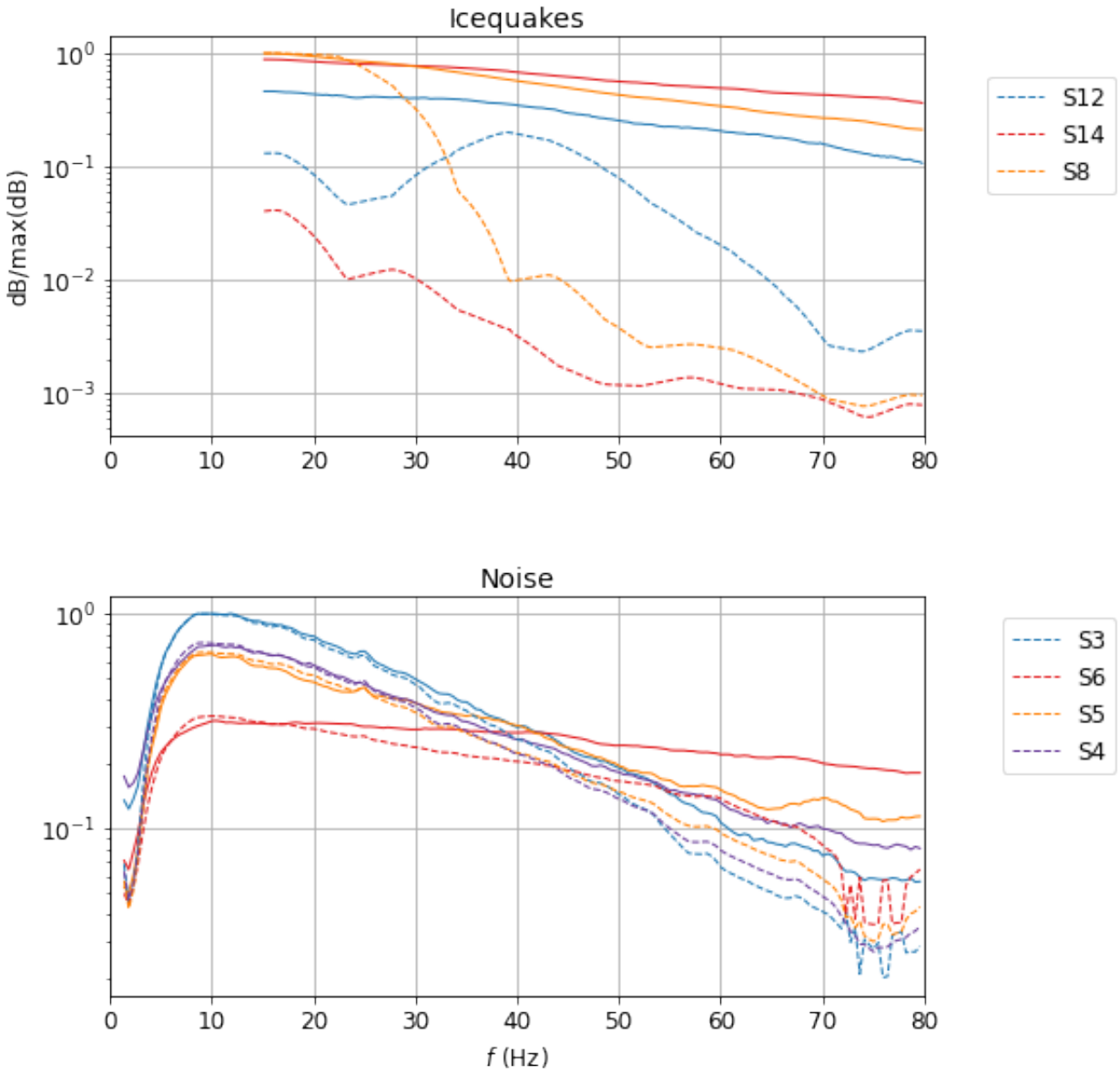

Figure 12. Comparison of clusters' "reconstructed spectra" (dashed lines) and "median spectra" (solid lines) for icequakes (top panel) and noise (bottom panel). The reconstructed spectra are labeled by the key states circled in Figure 11, and are colored by that fingerprint's appropriate cluster assignment.