Supporting Information for

Evaluating Automated Seismic Event Detection Approaches: An Application to Victoria Land, East Antarctica

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Introduction

This supporting information provides several supplemental figures, which complement the discussion in the main text. These include our SNR threshold analysis for the MF approach, example events that were identified once transfer learning was applied, the velocity model used in our event relocation, and maps of all relocated events, regardless of their uncertainty thresholds. Additionally, a table summarizing the number of relocated events is provided.
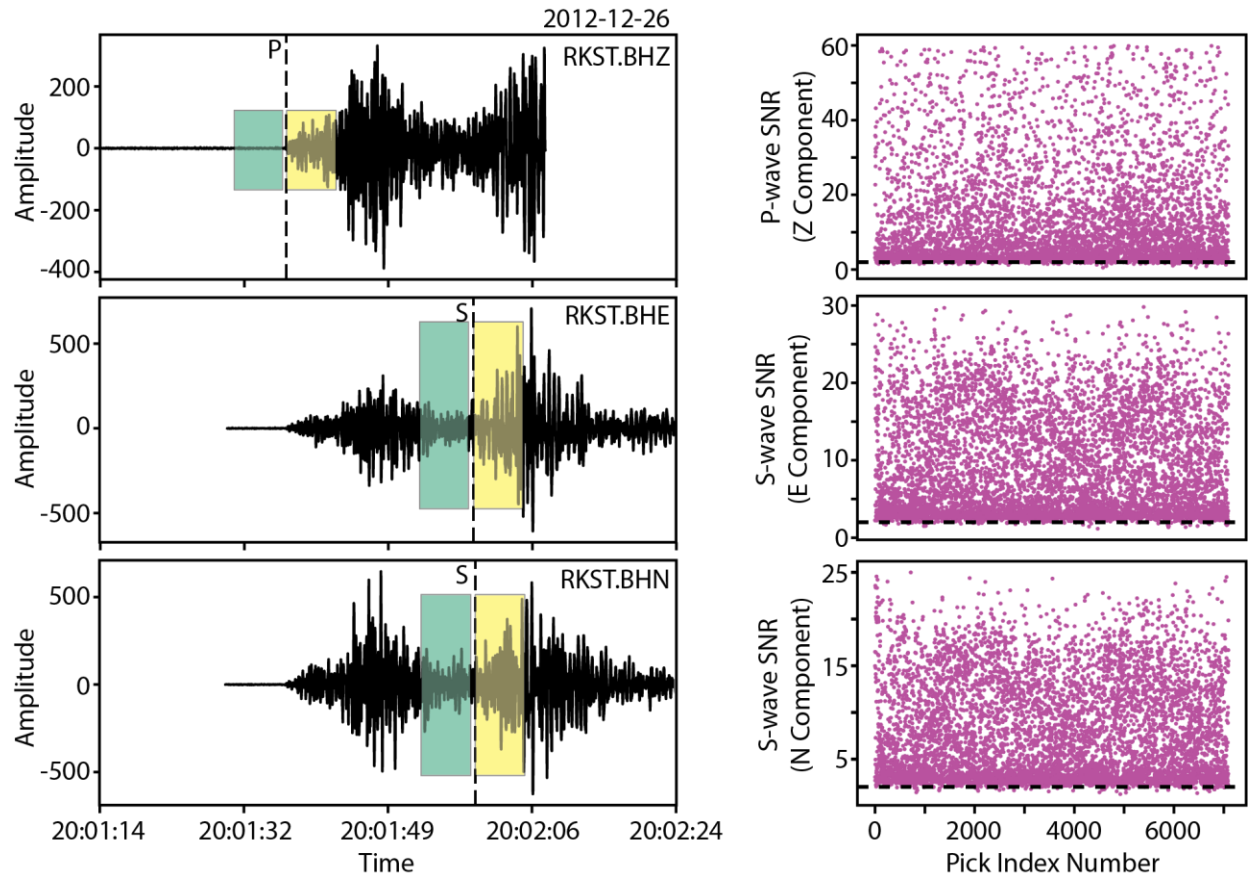
Figure S1. (left) Example three-component data from station RKST (Fig. 1) with the P- and S-wave arrivals from a December 26, 2012 event marked by vertical dashed lines. Green and yellow boxes highlight the portion of the waveform used to define the SNR noise and signal windows, respectively. (right) Scatter plots showing the pick-specific SNR values for all events in the initial MF catalog. Horizontal dashed lines mark the selected SNR of 2.0 applied to both our P- and S-wave picks. The x-axis just reflects the index (identification) numbers associated with each pick.
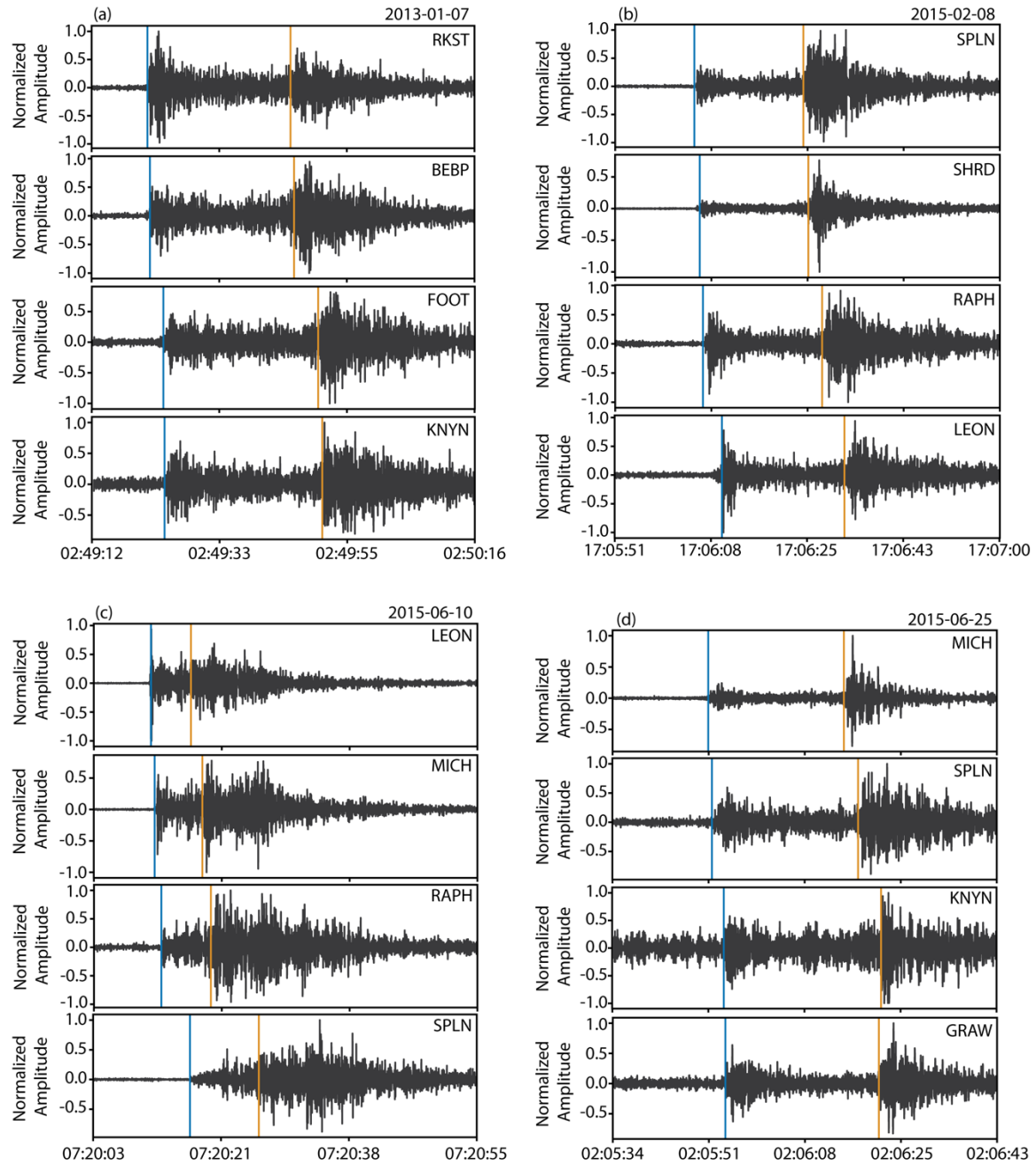
Figure S2. Four example events that were not identified by the STA/LTA technique and hence were not included in the initial SL catalog; however, once transfer learning was applied, the events were detected by the fine-tuned GPD model. The fixed STA and LTA window lengths prevented the method from detecting these seismic signals. In each panel, the blue and orange lines mark the P- and S-wave picks, respectively, and station names are listed on the right. Only vertical channel records are shown for simplicity.
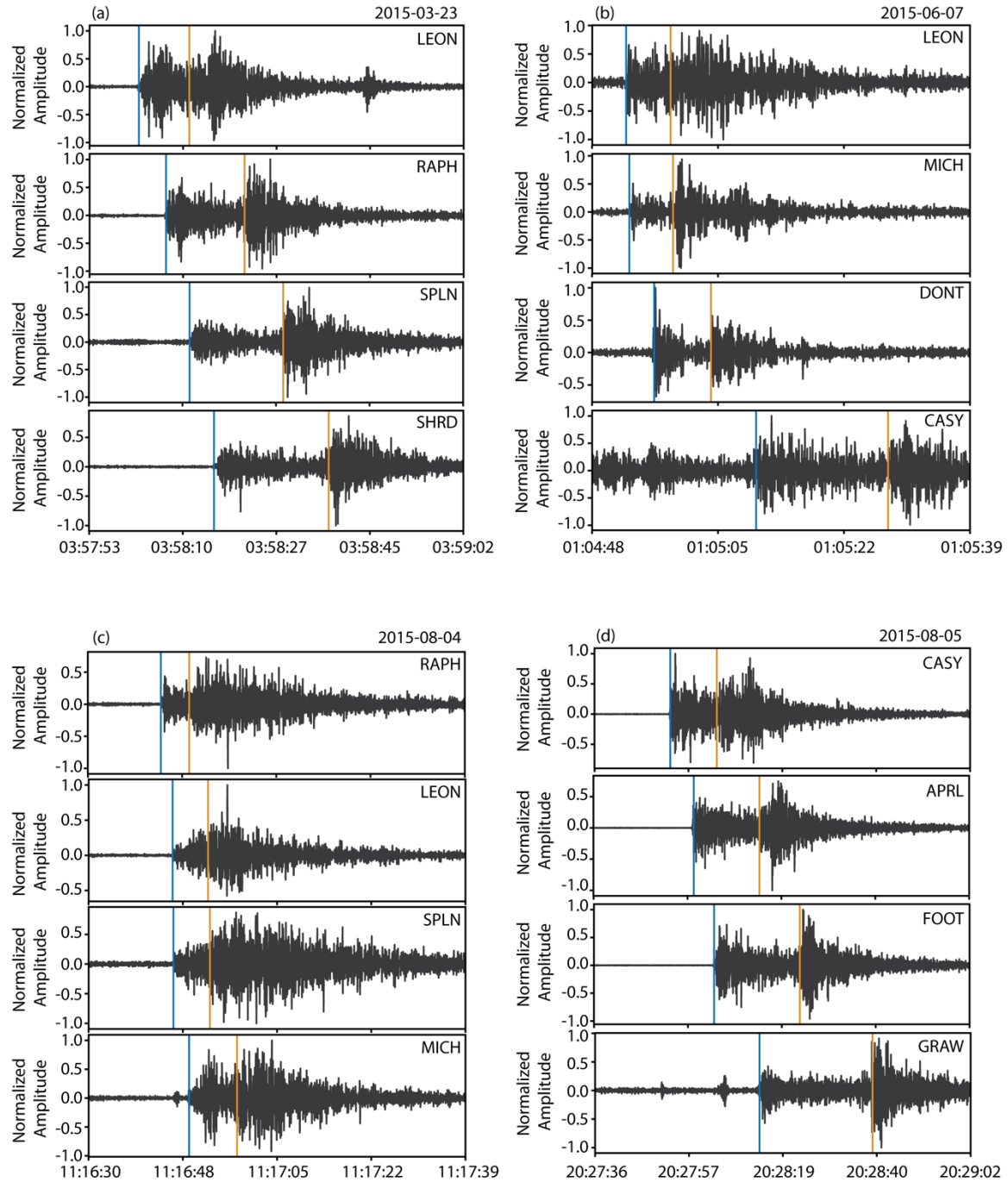
Figure S3. Four example events that were not identified by the MF approach and hence were not included in the initial MF catalog; however, once transfer learning was applied, the events were detected by the fine-tuned GPD model. The events were missed prior to transfer learning because they did not sufficiently correlate with any of the MF template events. Panels are plotted in the same fashion as in Figure S2.
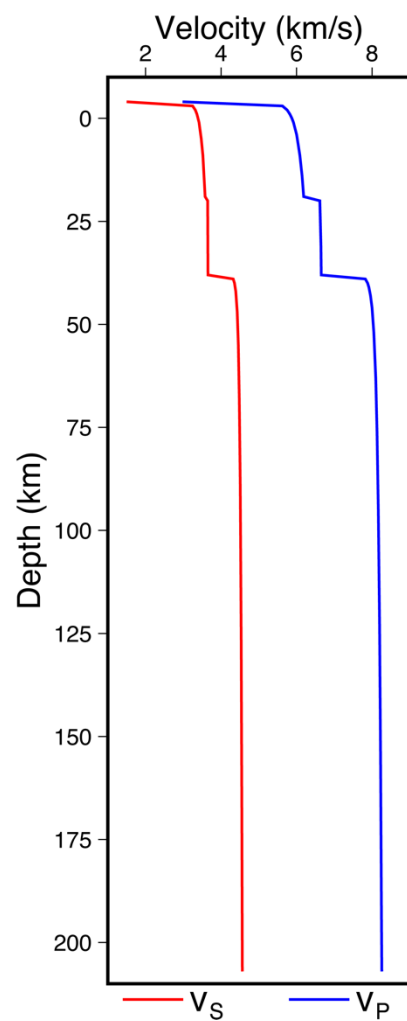
Figure S4. Seismic velocity model used to determine NonLinLoc relocations. S-wave velocity (V_S) is indicated by the red line, and P-wave velocity (V_P) is indicated by the blue line.
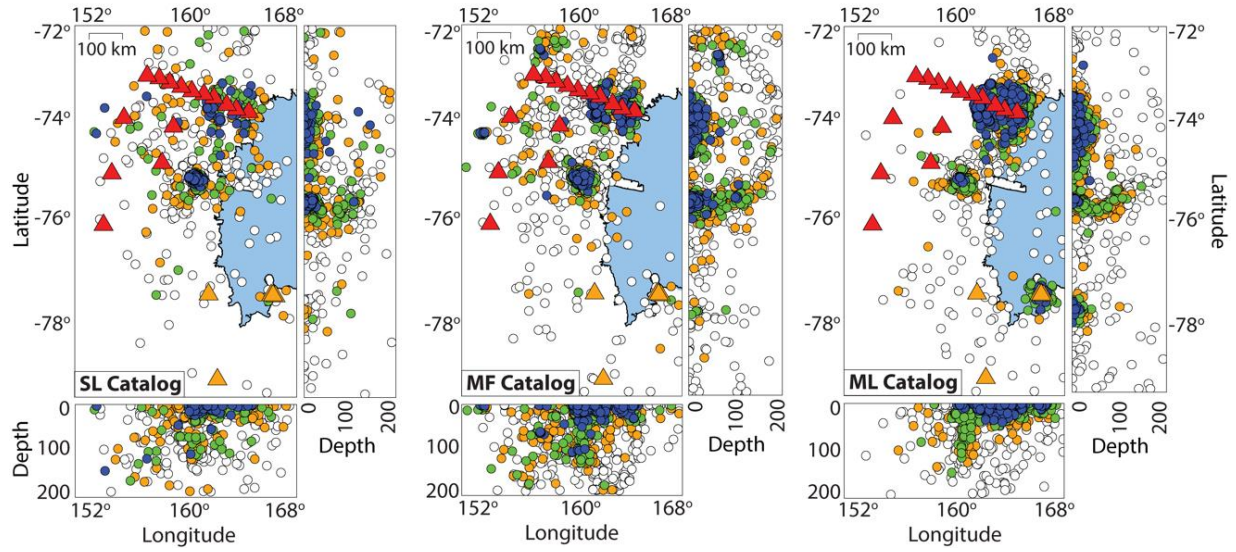
Figure S5. Seismic event relocations from NonLinLoc after the fine-tuned GPD model was applied to each catalog. From left to right: SL catalog, MF catalog, and ML catalog. Circles denote event locations, which are color-coded by their R_e group assignments. Blue: group A; green: group B; orange: group C; no fill: group D. See Table S1 for further details. TAMNNET stations are denoted by red triangles, and other stations are denoted by orange triangles.

Table S1. The number of events (in parentheses) within each Quality Group for each catalog after relocation. Group A and B events are plotted in Figure 8, and all events are plotted in Figure S5.

Catalog	Quality Group
Updated ML Catalog	A (332)
	B (568)
	C (506)
	D (691)
Updated MF Catalog	A (593)
	B (961)
	C (707)
	D (1300)
Updated IN Catalog	A (196)
	B (266)
	C (176)
	D (403)