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Depth variations in seismic velocity in the subducting crust: Evidence for fluid-related embrittlement for intermediate-depth earthquakes

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Introduction

This supporting information contains a text file on the characteristics of guided waves in the subducting crust at eastern Hokkaido, northern Japan, and two figures.

1. SupportingInformation-text01.docx

Text S1: Characteristics of the guided-P wave and guided-S wave.

Figure S1: Example of waveforms and wave features of observed guided waves

Figure S2: Errors in seismic velocity estimation from differential travel time for the inter-event distance of 100 km.

Figure S3: Example of shot gathers at station N.SAMH for earthquakes that occurred at depths of shallower than 75 km.

Figure S4: Example of shot gathers at station NOBUKA for earthquakes that occurred at depths of deeper than 75 km.

Text S1: Characteristics of the guided-P waves and guided-S waves

The guided waves that are recorded at the western side of the Hidaka mountain range in Hokkaido, northern Japan have some characteristics.

Characteristics of the guided-P waves are summarized in *Shiina et al.* [2014] as follows:

- P1. Observed for earthquakes located near the upper boundary of the Pacific slab beneath eastern Hokkaido.
- P2. Recorded between the direct P and direct S waves and arrived 2-10 s after the direct P wave (Figure 2).
- P3. Dominated vertical component with amplitude often larger than that of the direct wave (Figures 1c and S1).

Similarly, characteristics of the guided-S wave observed in this study are summarized as follows:

- S1. Observed at the western side of the Hidaka mountain range for earthquakes located near the upper boundary of the Pacific slab beneath eastern Hokkaido and accompanied with the guided-P wave.
- S2. Recorded after the direct S wave with delays of 3-15 s (Figure 2).
- S3. Dominated horizontal components with amplitude similar to or larger than that of the direct S waves (Figures 1c and S1).

In this study, therefore, we identified the guided-P and guided-S waves based on the characteristics described above.

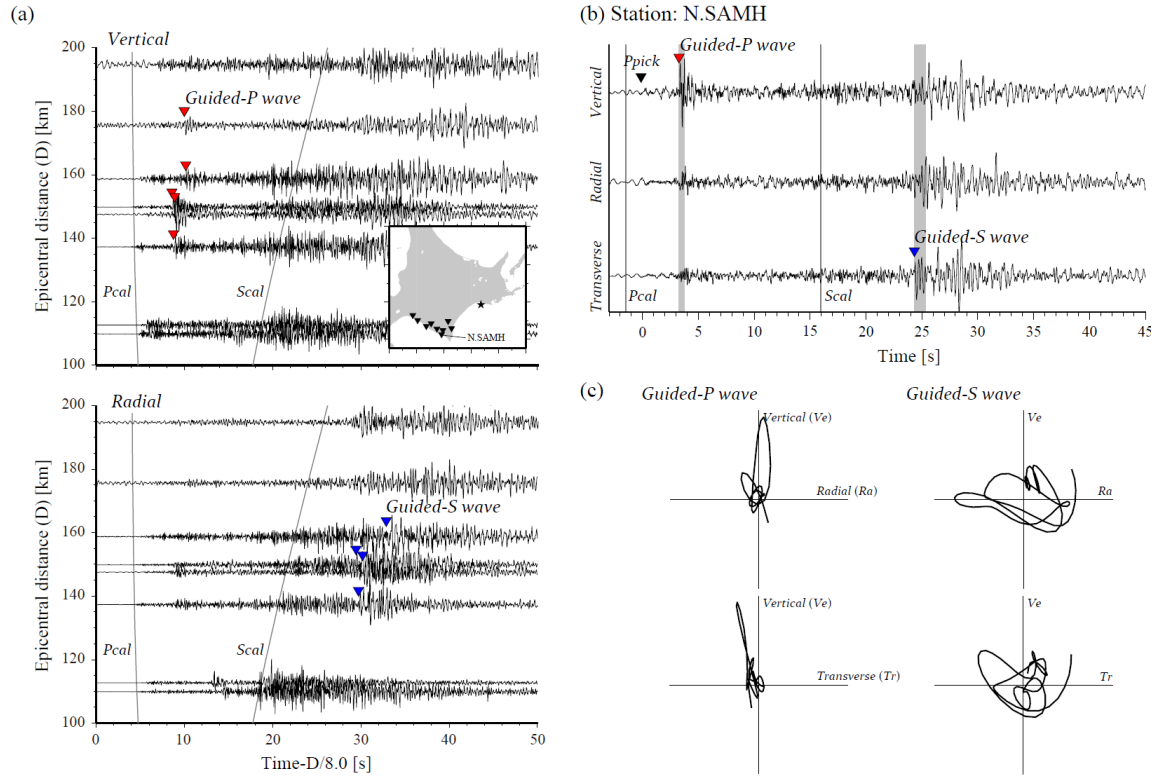


Figure S1.

Examples of seismograms that show the guided waves for an earthquake located at the top of the Pacific slab beneath eastern Hokkaido, northern Japan. (a) Band-pass filtered (1-12 Hz) seismograms in (top) vertical and (bottom) radial components. Hypocenter and stations are shown as a star and inverted triangles in the inset map. Arrivals of the guided-P waves and guided-S waves are denoted as red and blue inverted triangles, respectively. Gray curves indicate theoretical arrival times of the direct P and direct S waves for the JMA2001 1D velocity model [Ueno *et al.*, 2002]. (b) Three component seismograms at the station N.SAMH. Locations of the hypocenter and the station are plotted in the inset map of Figure S1a. Black inverted triangle denotes arrival of the direct P wave. Other lines and symbols are same in Figure S1a. (c) Particle motions of the guided-P wave and guided-S wave for time windows shown by gray bands in Figure S1b.

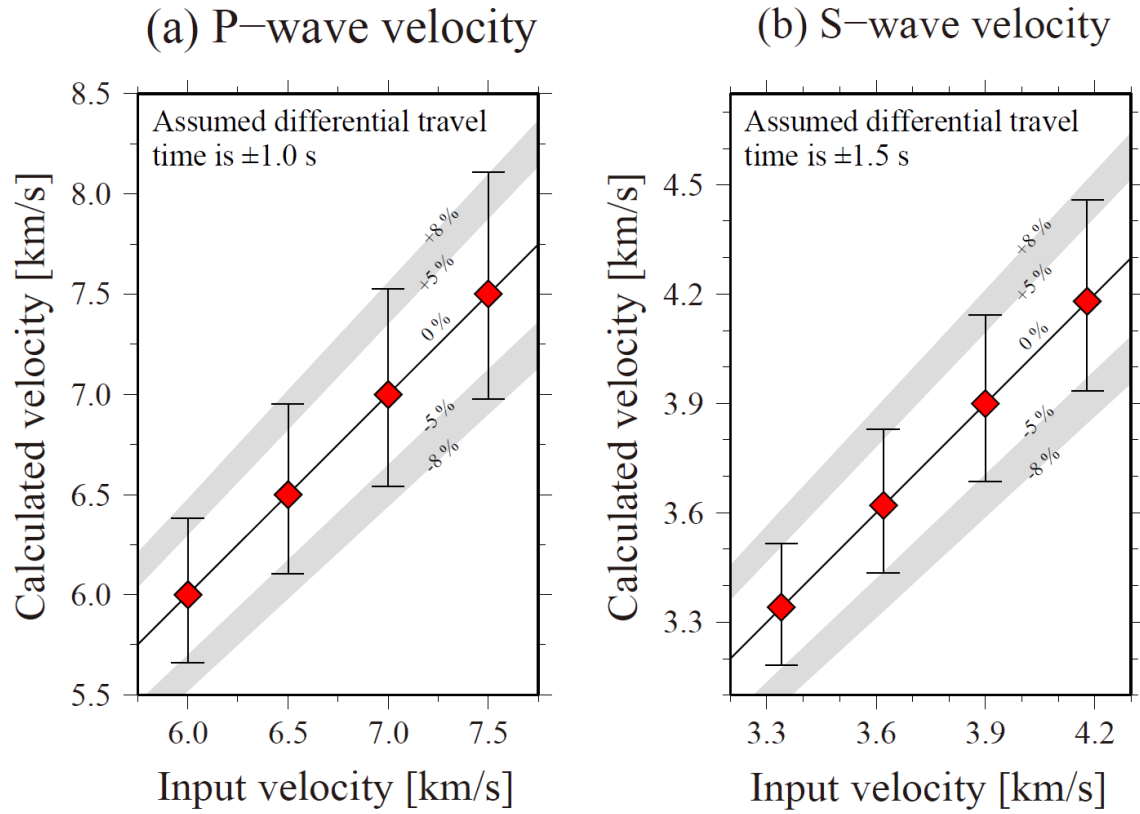


Figure S2

Uncertainties in the estimate of (a) P- and (b) S-wave velocities. Input P- and S-wave velocities are plotted as red diamonds and error bars indicate expected velocity uncertainties if errors in travel time differences of guided-P waves and guided-S waves are assumed to be ± 1.0 s and ± 1.5 s, respectively, for an earthquake pair with an inter-event distance of 100 km. Inclined lines correspond to the uncertainty in the velocity of 0 % and shaded belts indicate the uncertainty ranges of +5 to +8% or -5 to -8 %.

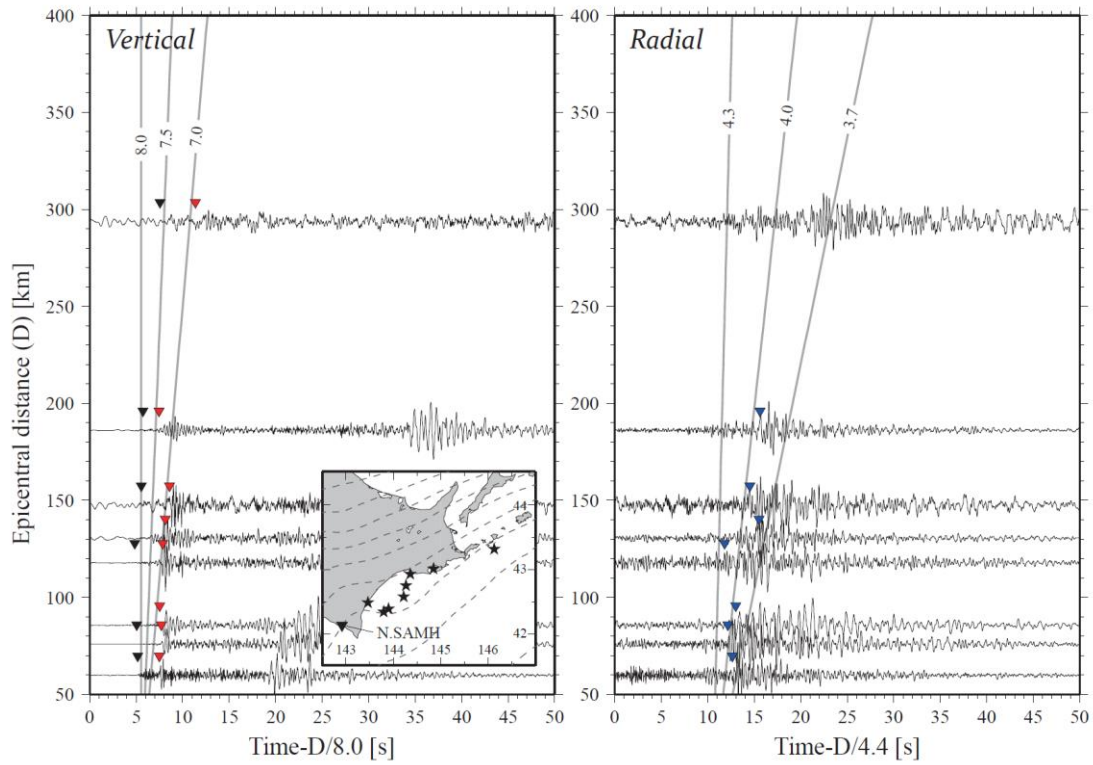


Figure S3

Examples of shot gather seismograms with guided waves recorded at the station N.SAMH for earthquakes that occurred at depths of shallower than 75 km. Band-pass filtered (1-12 Hz) seismograms in (left) vertical and (right) radial components are shown. Locations of the station and the earthquakes are shown in the inset map. Inverted triangles represent picked arrival times of direct P waves (black), guided-P waves (red), and guided-S waves (blue). Gray lines indicate arrival times calculated for three apparent velocities. Dashed lines in the inset map show isodepth contours of the upper boundary of the Pacific slab [Kita *et al.*, 2010] at 25 km depth interval.

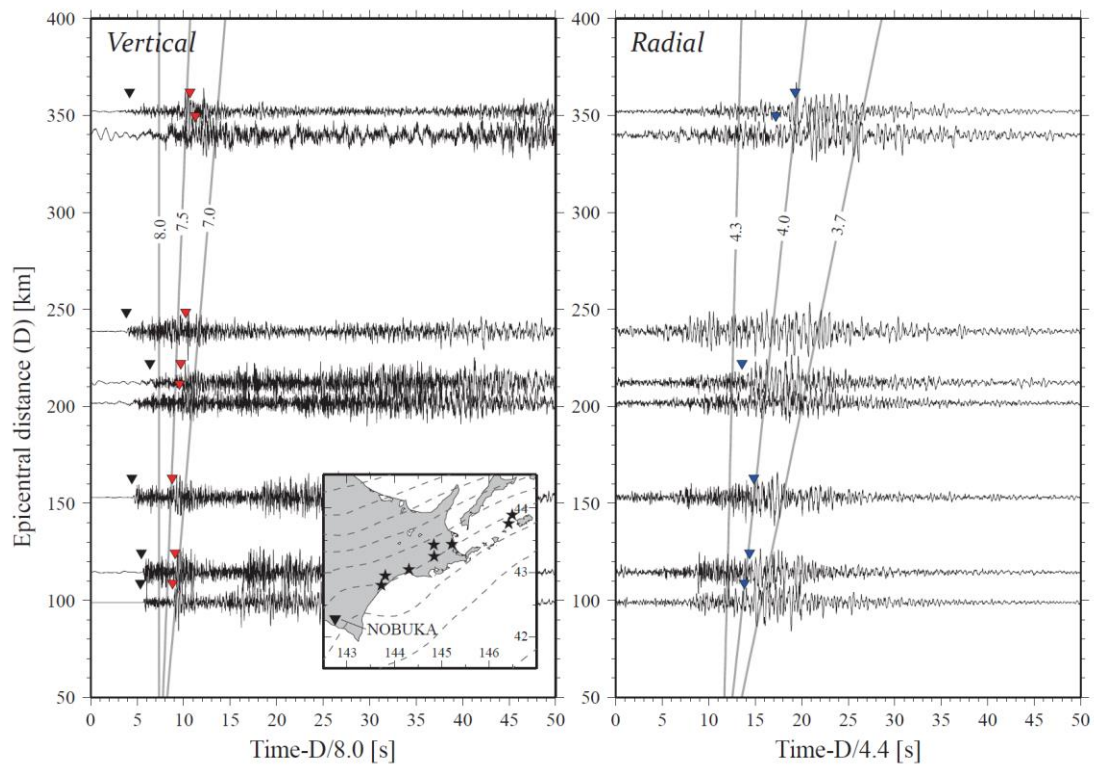


Figure S4

Examples of shot gather seismograms with guided waves recorded at station NOBUKA for earthquakes that occurred at depths of deeper than 75 km. Other symbols are the same in Figure S3.

Reference

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