

Surface wave envelope fitting for S wave velocity structure of the oceanic upper mantle

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Physical characteristics of the oceanic lithosphere and asthenosphere is essential to reveal the mechanism of plate tectonics. The V_p/V_s ratio is one of the most important parameters to constrain chemical composition and temperature. Takeuchi et al. (2020) revealed the depth profile of the P wave velocity beneath the northwestern Pacific plate using waveforms for earthquake events in Northeast Japan observed by broadband ocean bottom seismometers (BBOBSs). The purpose of this study is to infer continuous S wave structure from the crust to the asthenosphere using the same data set. This enables us to reveal the V_p/V_s structure averaged over the event-station path.

Data used in this study is the vertical component of the BBOBSs deployed in the Northwestern Pacific from 2010 to 2014. We collected higher quality waveforms for earthquake events around the Japan trench (Figure 1). We calculated the amplitude of envelope of Rayleigh waves at each period and group velocity and stacked for bin1 (data for events in the continental plate) and bin2 (data for events in the vicinity of the trench). We also calculated synthetic waveforms for the PA5 model (Gaherty et al., 1996) and stacked in the same procedures. We picked the amplitude peak locations for overtone and fundamental mode branch to characterize the shape of envelopes and compared observed peaks and synthetic ones. At periods shorter than 40 s, observation and synthesis for bin 2 are similar with each other, while there are significant discrepancies for bin1 (Figure 2). These results suggest that pure oceanic structure of crust and uppermost mantle in our study region can be well represented by the PA5 model, but raypaths passing through the continental plate are affected by shallower structure of the continent. In the presentation, we plan to also show the measurements for longer period and the S wave velocity structure model obtained from these data.

Keywords: surface wave, lithosphere, asthenosphere

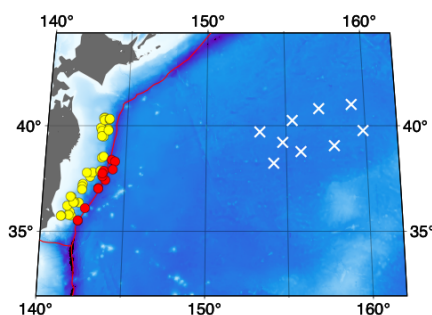


Figure 1. Map of stations (white crosses) and events (bin1: yellow circle, bin2: red circle) used in this study.

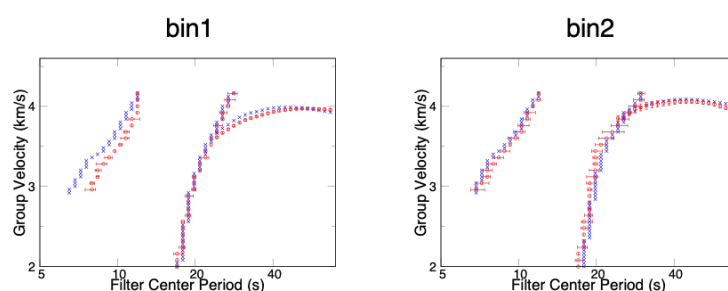


Figure 2. Amplitude peak of surface wave envelope for each bin. The red dots are observed peaks and blue cross are synthetic ones.