Lateral structural variation assoiated with stagnant slab in the northwestern Pacific region

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Recent seismic tomography models determine a large-scale subhorizontal high velocity anomaly (HVA) in the northwestern Pacific subduction zones. This HVA has been interpreted as stagnant slab that is a large volume of subducted cold slab in the upper mantle transition zone. Regional triplicated waveforms are highly sensitive to the transition zone structure with velocity discontinuities. Using this approach, previous studies pointed out shorter wavelength variation of the structure than the tomographic images, and identified distinct structural boundaries in the mantle transition zone.

Here we expand the study to resolve the detailed structure of lateral variation with stagnant slab. We examined broadband body wareforms of deep focus events that occurred near the Kurile subduction zone and the Izu-Bonin subduction zone at a depth of 300 km and greater with a magnitude of 5.5 and greater. Our new database accordingly consists of P and SH waveforms of 49 events in the study region with a simple source time function and a good S/N ratio. This database has dense sampling of rays around the structural boundary. Results show distinct structural boundaries where the velocity structure changes rapidly from a model to another. These structural boundaries suggest that horizontal velocity gradient exists and the depth of the 660 km discontinuity changes rapidly associated with stagnant slab. Some waveforms that sampled the structure near the boundaries show substantial broadening like coda and cannot be modeled using existing models. The broadened anomalous waves suggest SV to P conversion in an anomalous low velocity zone beneath the hypocenter. Lateral velocity gradient could make the complex system of phase transformation and produce such anomalous zones.