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Waveform Modeling for Low Velocity Anomaly beneath the Stagnant Slab in the Izu-Bonin Subduction Zone

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The tomography model by Fukao et. al. (2001) displays a thin layer of low velocity anomaly (LVA) lying right beneath the stagnant slab (flattened high velocity anomaly (HVA)) in the Izu-Bonin subduction zone although this feature has not been confirmed yet. We found some P waveforms which sampled the region strongly and show anomalous broadening. In general many of the triplicated waveforms that sampled the region with stagnant slabs are modeled with a layered structural model such as Model M3.11 or M2.0 if not iasp91. Here, M3.11 is characterized by an HVA in the deeper part of the transition zone (525 to 660 km) relative to a standard model iasp91, and a depression of the discontinuity depth to 690 km. M2.0 has a similar HVA to Model M3.11 but without a depression of the discontinuity. The anomalous broadened waveforms could not be modeled by any of the layered models even though they propagated through the same region as that of M3.11 or M2.0 data. We presumed that the LVA right beneath the stagnant slab could have caused the broadened waveforms. Thus, we tested the effect of LVA by inserting a thin layer of LVA into our existing models (M3.11 or M2.0) using a finite difference code (e3d, Larsen and Schultz, 1995) and reproduced broadened waveforms. It seems that the tomography model has detected the thin layer of LVA (~50 km) beneath the stagnant slab. In comparison, we found a thin LVA layer exists above the discontinuity in the Kurile subduction zone. The different locations of LVA zones, i.e., beneath or above the discontinuity, may be reflecting the thermal conditions associated with the stagnant slabs.