Construction of 3D Seismic Velocity Structure from a Tomography Model Combined with Broadband Waveform Modeling

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We construct an initial model of 3D seismic velocity structure from a tomography model (Fukao et al, 2001) combined with broadband waveform modeling for the northwestern Pacific subduction zone. We use a 3D finite difference (FD) code in the Cartesian coordinate (Larsen, 1995) to compute synthetics using the 3D velocity structure. The S wave velocity structure is constructed assuming a poisson body and the density model is adopted from a standard model iasp91 (Kennett and Engdahl, 1991). With the limitation of the block size in the tomography model, the grid interval of 10 km is set to assure stable calculations up to ˜0.030 Hz. Here, an Earth flattening is applied to transform data of the tomography model in the spherical coordinate to descriptions in the Cartesian coordinate. The validation of the Earth flattening transformation is confirmed by comparing the synthetic waveforms between the 3D FD and a reflectivity method using iasp91. Waveforms recorded at station HIA from deep focus events (deeper than 300 km) in the Kurile subduction zone are selected for modeling. Triplicated waveforms observed at this station sampled strongly the transition zone with stagnant slab.

Results show that the synthetics calculated with the initial model from the tomography model show long period features as the tomography model has the resolution of wavelength longer than 100 km due to the block size constraint. The tomography model indicates clear images of subducting slabs in the transition zone. However, it does not represent the detailed structures which are apparent in the observed broadband waveforms. While the tomography model displays stable long wavelength features of subducting slab, it has little information of finer structure associated the stagnant slab. The reference model of the tomography model does not have velocity discontinuities.