3-D seismic wave velocity structures in the Nankai and Japan Trench subduction zones derived from marine seismic surveys

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A realistic offshore model of 3-D seismic velocity field around Japan that controls numerical results of seismic wave simulations has not been proposed because of basic difficulty of offshore geophysical observations. But many marine seismic refraction and reflection surveys have been carried out in the offshore region of Japan during past a few decades. We therefore constructed realistic 3-D seismic velocity models for the Nankai and Japan Trench subduction zones to improve the precision of seismic wave simulations by compiling from the marine seismic survey results.

For the Nankai model, we first collected 29 seismic refraction survey results. We defined P-wave velocities of 3.5 km/sec for accretionary prism, 5.4+0.0055$*$z km/sec for oceanic layer 2, 6.5+0.0055$*$z km/sec for oceanic layer 3, and 8.1+0.0053$*$z km/sec for oceanic mantle based on the survey results, where z is depth from sea surface in km. Poisson's rations were set up based on results of Takahashi et al. (2002) and rock experiments, which are 0.37 for accretionary prism, 0.32 for oceanic layer 2, 0.30 for oceanic layer 3, and 0.26 for oceanic mantle, respectively. The surface of each layer between the profiles was interpolated to make a grid-shaped data with an interval of 1 minute along latitude and longitude lines.

Some of the marine seismic surveys carried out in the Japan Trench subdution zone show refractions from island Conrad and Moho together with signals from oceanic structures. Accordingly, the Japan Trench model contains of not only oceanic structure but also island arc upper, lower crusts, and mantle. Number of seismic profiles we used in the model is 11 which is very fewer than that of the Nankai model. The P-wave velocities for the layers are properly assumed based on the Japan Trench surveys. But the information of S-wave velocities rely on the result from the Nankai model since there is no any S-wave information estimated from the surveys in the Japan Trench subduction zone. Finally, P and S-wave velocities for the layers and their configurations of upper surface are provided for seismic wave simulations.

Seismic waves generated from a M 7.4 intraplate earthquake occurred in the Philippine Sea plate off Kii Peninsula were calculated to verify the new velocity model we constructed here (Hayakawa et al., SSJ fall meeting, 2005; Ikegami et al., SSJ fall meeting, 2005). Long-period ground motions recorded in the Kanto basin successfully reappear in the simulations, which have not been well-reproduced by using the conventional velocity model.