J036-P003 Time: May 27 17:15-18:45

Physical properties at the aseismic plate boundary in the Japan Trench region by FDM method

Peyman Poor Moghaddam[1], Junzo Kasahara[2], Gou Fujie[3], Kimihiro Mochizuki[4], Mikako Nakamura[1]

[1] ERI, Univ of Tokyo, [2] Earthq. Res. Inst., Univ.Tokyo, [3] JAMSTEC, [4] EOC, ERI, Univ. of Tokyo

http://wwweprc.eri.u-tokyo.ac.jp/~kasa2

In 1996, we conducted a seismic refraction-reflection experiment at the Japan Trench region to clarify the relationship between seismicity and crustal structure. A number of seismic reflection and refraction experiments using Ocean Bottom Seismometers (OBSs) have been conducted. Consequently, a velocity structure model was obtained by travel-time inversion (Fujie et al., 2002). Extremely important results were obtained showing a strong correlation between seismic activity and the P-P reflection intensity from the subduction plate boundary. Considering the accuracy of the travel time inversion, possible causes to generate intense reflections were investigated. One of possibilities is the presence of low Vp materials such as water, serpentinites or clay.

To obtain more accurate estimate for the physical properties, we carried out the simulations using FDM method developed by Shawn Larsen (E3D code). It is 4th-order accuracy in space and 2nd-order accuracy in time. It is based on the elastodynamic formulation of the wave equation on a staggered grid. The absorbing boundary due to finite number of grids is also considered. The structure obtained by Fujie et al. (2002) has 140k m long and 30 km deep and is heterogeneous in horizontally and vertically. We added a thin low velocity layer to the above model.

The thin layer has various parameters such as Vp= 2km/s -4 km/s, Vp/Vs= 1.7 -3.0, and layer thickness= 100m -400m. Using these models, we computed the waveforms and wave field. The 5Hz and zero phases Ricker wavelet was used as source, and it is a reasonable approximation for control source used in the field experiment. We introduced appropriate Q structure.. Spacing for space is 25m and time grid is 1.5msecond.

In the field we used shots more than 4000 airguns and 100 explosives from the sea surface. Shot interval was 25m-50m. Due to limitation of computer resources, we computed 100m spacing traces and simulated the reciprocity of this model which we consider several receivers at the sea surface and one shot at the sea bottom (common source).

The synthetic seismograms are compared by observed waveforms obtained by Fujie (1999). The current result shows that the layer with Vp=2km/s-3km/s or Vp=4km/s and Vp/Vs=3.0 can explain the observation of high P-P reflectivity. These materials are quite different from the Vp values surrounding the plate boundary at the depth of 13km from the ocean surface. As the low Vp velocity suggests weak frictional strength, this material can explain the aseimicity in the intense P-P reflection zones.

Because the above simulation is limited in parameters, more extensive investigation is necessary.