J164-014 **Room: Ocean B** **Time: May 26 11:00-11:15**

Characteristics of the Moho transition zone (MTZ)-2: Evaluation of seismological characteristics using synthetic seismograms

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1. Introduction

The previous talk (Ike et al., this session) discussed the seismological characteristics of Moho, such as continuity and discontinuity, shown in MCS reflection records. Here, we discuss these characteristics and the nature of Moho Transition Zone (MTZ) using waveform simulation. Note that the next talk will discuss their petrological interpretation (Kasahara et al., this session).

2. Waveform simulation and travel-time calculation

We used 2D Finite Difference Method (FDM) code for the waveform simulation (Larsen, 2000). We calculated the pressure waveforms by assuming appropriate Vp, Vs, density, and Q values. We used 4-Hz Ricker wavelet as explosive sources placed at the water depth of 30m. The travel times for P-waves are partially calculated by graph method (Kubota et al., 2005).

3. Structural models for the crustal and upper-most mantle

We used 2-D horizontal layered structure (l=250km, z=45km) in which grid spacing is 30m in space and 2ms in time. Crustal structure consists of four major layers beneath the water depth of 6 km: sedimentary layer (Vp=1.8-2.2km./s), basaltic upper crust (Vp=2.5-6.5km/s), lower crust, and upper mantle. We evaluate four velocity models based on several previous works (e.g., Penrose model obtained from deep sea drilling, several models discussed in Dick et al (2006), etc.).

(A) Sharp Vp boundary at Moho discontinuity: Vp discontinuously increases from Vp=6.8-7.0km/s in the lower crust to Vp=7.6, 8.0 or 8.8km/s in the upper mantle. Vp=8.8 is a case of seismic anisotropy.

(B) MTZ beneath the lower crust: Vp gradually increases in the mixing layer of crustal materials and mantle materials where Vp increases from 7.0 to 8.0km/s. We show four cases for the thickness of MTZ (dh=0.5, 1, 2, 5km).

(C) Sharp Vp boundary and MTZ: Vp discontinuously increases from 7.0 to 7.6km/s at the upper boundary of MTZ, and Vp gradually increases from 7.6 to 8.2km/s in MTZ. We consider four cases for the thickness of MTZ (dh=0.5, 1, 2, 5km).

(D) Lack of large velocity contrast in MTZ (i.e., Hess model): Vp gradually increases from 6.8 to 8.2km/s through the lower curst and upper-most mantle. Here we assume a large amount of serpentinized peridotite in MTZ.

4. Seismic characteristics within Models A-D

For comparing the features of deep seismic reflectors in the companion MCS reflection study, we describe the characteristics of reflection phases from MTZ observed at smaller offset distance of 5km on synthetics seismograms.

(A) PmP (reflected P-wave from Moho discontinuity) has large amplitude at small offset distance. The amplitude of PmP increases when a velocity gap is large at Moho. PmP's amplitude at 0-offset is 1/5-1/3 of the amplitude of the reflections from the seafloor and sediment/hard-rock boundary.

(B) Reflected phases (Px1P, Px2P) from the top and bottom of MTZ, and refracted phase in MTZ occur. Travel time of Px2P changes with the thickness of MTZ. Amplitude of Px1P is 1/50 of the reflected P-wave at the seafloor and soft-sediment/hard-rock boundary but Px2P's amplitude are generally small.

(C) Amplitudes of Px1P for all cases are similar to PmP in Model A associated with Vp=7.6km/s. Px2P from the bottom of MTZ is extremely small.

(D) The absence of PmP: It is difficult to discriminate the appearance of PmP from Model D to Models B or C.

We propose that (1) the resolution of reflection phase from MTZ observed at a small offset distance depends on an aperture of MCS reflection survey as well as the nature of MTZ (e.g., velocity and its gradient), and (2) wide-angle reflections and refracted waves with far offsets are more useful to understand MTZ.

5. Conclusion

Using waveform simulation, we evaluated petrological models for MTZ. The models are technically straightforward, and they are useful to evaluate seismic characteristics that are observed in MCS and refraction/wide-angle reflection records focused on determining Vp structure and its gradient in MTZ.