Structural features of the subducting slab beneath the Kii Peninsula: 2. Possibility of slab dehydration and anisotropic rocks

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Within the Nankai region in southwestern part of Japan, two recurrent megathrust earthquakes occur every 100 to 150 years. The rupture boundary of these megathrust earthquakes always exists at the southern tip of the Kii Peninsula. In this study, we report structural features of the subducting slab beneath the southern part of Kii Peninsula inferred from receiver function (RF) analyses, and hypothesize that anisotropic rocks, located just above the slab Moho, are related to dehydration of the slab mantle in this region.

Teleseismic waveforms recorded at the NIED Hi-net and F-net seismographic stations in the Kii Peninsula are used. We select earthquakes with high signal-to-noise ratio observed from October 2000 to October 2007 with magnitudes 6.0 or greater and their epicentral distances range from 30 to 90^o. We stack both radial and transverse RFs with consideration of the conversion-point-moveout caused by a dipping slab Moho and search for optimal depth, dip and plunge azimuth based on a grid-search at each station (*Park et al.*, 2007; *Shiomi and Park*, 2008). We compare the RF-estimated slab Moho with depth contours of the top of slab seismicity constructed by *Miyoshi and Ishibashi* (2004). At the southwestern part of Kii Peninsula, the plunge azimuth of the RF-estimated slab Moho is rotated 60^o clockwise relative to the top of intraslab seismicity, and the rotations abruptly change 30^o or more counterclockwise at the southeastern part of the peninsula. Since estimation error for the slab-Moho plunge azimuth is less than 10^o and deviations from the convergence direction within each region show the same polarity, we conclude the deviations are reliable. We hypothesize that anisotropic rocks at the slab Moho cause the deviation because we assume all media beneath each station is isotropic in our RF-stacking procedure. To confirm this hypothesis, we calculate synthetic RFs for the model that the oceanic crust or the wedge mantle is anisotropic. Based on numerical experiments, we confirm that the observed dip-direction divergence can be explained when the anisotropic oceanic crust has north-south directed fast axis. This tendency corresponds with the results of P-wave tomography by *Ishise et al.* (2007). According to some reports that the slab mantle beneath the southern part of Kii Peninsula contains significant volative components (e.g., *Seno et al.*, 2001; *Nakajima and Hasegawa*, 2007), so that dehydrated from the mantle of the subducting slab causes phase transition of the oceanic crust. Since the slab bends sharply and shows a north-dipping furrow shape beneath this region, the oceanic crust experiences compressional stress with E-W direction. P-axes of intraslab earthquakes occurring in this region show E-W to NW-SE directions, consistent with an E-W directed compressional stress field. This means that the major axes of rock minerals, especially low velocity materials or pores, should align N-S, and cause the anisotropic features beneath the southern Kii Peninsula. On the other hand, the region that shows large divergence of dip directions between the RF-estimated slab Moho and the intraslab seismicity is very limited within the southern part of Kii Peninsula. Possibly this angle discrepancy indicates the degree of slab-mantle dehydration.