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Converted Ps amplitude variations on the dipping slab Moho beneath the Kii Peninsula: 2. Ray parameter dependence

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Receiver functions (RFs) analysis is a very useful method to detect seismic velocity discontinuities beneath a seismic station. One can also evaluate elastic properties at an interface from changes of Ps polarity and Ps amplitude. Ps amplitude depends primarily on the impedance contrast at an interface, but the variation of Ps amplitude on back azimuth (BAZ) of the incoming P wave is affected if the interface is dipping and/or anisotropic rock surrounds the interface. Moreover, difference of incidence angle of incoming P waves also causes the variation of Ps amplitude. Shiomi and Park (2009; AGU FM) defined "standard amplitude (SA)" of a converted phase at a dipping interface beneath a station, based on back azimuth dependence of the Ps amplitude, and applied this analysis to the stations located within the Kii Peninsula, central Japan. However, since precise estimation for an incidence angle to the dipping interface is difficult, ray parameter dependence to the Ps amplitude evaluation was not considered. It becomes a problem for stable estimation of the SAs. In this study, we check ray parameter dependence to the SA estimation, and revise it at each station in the Kii Peninsula.

Teleseismic waveforms recorded at the NIED Hi-net, F-net and AIST seismic stations in the Kii Peninsula are used. We select earthquakes with high signal-to-noise ratio observed from October 2000 to August 2010 with magnitudes 6.0 or greater. Checking distribution of BAZs and incidence angles of every teleseismic waveforms observed at each station, we confirm that 80% of the selected event is located in the south ($120^o \leq$BAZ$\leq 250^o$) of stations. Ray parameters of 10% of the events are larger than 0.077, which corresponds to 37^o of incidence angle to a horizontal interface. In the case of dipping interface, Ps amplitude change with BAZ becomes larger when incoming P waves have larger ray parameters. Since events located in the west or northeast of stations are fewer than other directions, the contribution of events with large ray parameter is not small in these directions. The Philippine Sea slab is subducting to west at the eastern Kii Peninsula and to north at the southern Kii. Therefore, the Ps amplitudes tend to become large for earthquakes occurred in these direction. This means the Ps amplitude may be overestimated when we do not take ray parameter dependence into account. In order to avoid this contamination, we first select events with ray parameter from 0.055 to 0.077. Moreover, we apply amplitude correction coefficients, which are numerically evaluated by the difference of converted phase amplitudes by a horizontal Moho discontinuity. We clearly confirmed that the Ps amplitudes decreases from 11% to 7% of the primary P wave as the oceanic Moho deepens to ~40 km, and the amplitudes becomes a constant, at 5-7% of the primary P wave. According to the P-T diagram of the Kii Peninsula region, we say that the Ps amplitude decrease likely reflects a phase transition from lawsonite blueschist to lawsonite-amphibole eclogite as water is released to the overlying layer, and this metamorphic fluids likely influence the occurrence of low-frequency nonvolcanic tremor. On the one hand, the regionality of standard amplitude distribution within the Kii Peninsula became unclear. To understand what happens along the subducting slab interface, it is important to construct models to explain the observed SA distribution as the next step.

I use the teleseismograms observed at AIST groundwater observation stations. I thank J. Park who provide me a source code for RF stacking analysis.

Keywords: Receiver function, Converted phase amplitude, Ray parameter, Kii Peninsula, Oceanic Moho, Philippine Sea plate