

Three dimensional attenuation structure beneath the northwestern part of Kii peninsula, central Japan

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Beneath the Kii peninsula which is located above the subducting Philippine Sea (PHS) plate, it is known that there are several interesting seismic phenomena such as an intensive seismic swarm in the shallow crust and occurrence of non-volcanic low frequency earthquakes around the top of the PHS plate at the depths between 30-40km [Mizoue et al.,1983; Kato et al.,2010]. Previous geophysical studies suggested that geofluid is related to the occurrence of such seismic events [Hirose et al.,2008; Kato et al.,2010&2014]. In this study, we determined a 3-dimensinal attenuation structure to obtain a new information about physical properties in the study region because Q value is a sensitive parameter for the existence of fluid or cracks and effect of temperature.

We applied a combined inversion in which source parameters, site effects and Q values are determined simultaneously [Tsumura et al.,2000] for small earthquakes' spectra. Seismic waveforms were observed at the routine Hi-net seismic stations by NIED and temporary dense seismic arrays of arranging east-west direction and north-south direction at the southern and western parts of the Kii peninsula, respectively. We selected 247 earthquakes which were recorded at 113 seismic stations and calculated 8616 spectra for P arrivals of time window 1.28s for taking into account ray distribution.

Derived Qp images show that high attenuation zone($Q_p < 200$) exists at the northwestern part of Kii peninsula in the depths shallower than 15km. This high attenuation zone has the similar horizontal extent as that of seismic swarm's source region. The other region shows moderate Qp (about 400 to 800) except the southern part of the Kii peninsula where Qp is less than 400. For the depths between 15 to 38km, high attenuation zone continued from the shallower part beneath the swarm region, however its horizontal extent becomes small at the deeper than 25km. We found that patch-like high Qp zones were distributed in the region just above isodepth contour 30 to 40km of the PHS plate. These high Qp regions coincide with the region where many low frequency earthquakes occur. In the NW-SE vertical Q cross section at the western part of the Kii peninsula, we can clearly see that the high attenuation zone is located just beneath the seismic swarm region and its distribution corresponds to a low velocity zone estimated from travel time tomography [Hirose et al.,2008; Kato et al.,2014]. From the result of reciever function analysis[Kato et al.,2014] , subducting Philippine sea plate's oceanic basalt is considered to start conversion to eclogite just beneath the swarm region and the high attenuation and low velocity zone may reflect the existence of fluid due to the dehydration proceess. Another feature we should mention is existence of low attenuation zone at the mantle wedge just above the source region of low frequency earthquakes. This low attenuation zone shows higher velocity than surroundings. We'd like to integrate various geophysical data and argue the physical property of these regions.

[References]Hirose et al., J. Geophys. Res., 113, B09315, doi:10.1029/2007JB005274;Kato et al., Geophys. Res. Lett., 37, L15302, doi:10.1029/2010GL043887;Kato et al., EPS, 66:18,2014;Mizoue et al., Bull. Earth Res. Inst., 58,287-310,1983;Tsumura et al., Tectonophysics, 319, 241-260, 2000

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