紀伊半島東部における地震波減衰構造の推定

Three dimensional attenuation structure beneath the eastern part of Kii Peninsula, southwest Japan, derived from small earthquake spectra

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Low Frequency earthquakes (LFEs), one of slow earthquakes that occur in subduction zones, have been observed in the southwest Japan, especially in the Kii Peninsula. Clusters of LFEs are distributed along the isodepth contour of 30 to 40 km of the subducting Philippine Sea plate’s surface and more concentration is seen in the eastern part. Previous studies for seismic velocity and conductivity structures suggested that occurrence of such LFEs is closely related to the existence of fluid.
Q value, the parameter of seismic attenuation, has been used to study LFE because its values vary sensitively to the presence of fluid. For instance, Tsumura et al.(2016) estimated a three-dimensional attenuation structure in the Kii Peninsula, and revealed that a high Qp zone exists near LFE cluster in the western part of the study area. In the eastern part of the Kii Peninsula where LFE's activity is high, however, a detailed attenuation structure has not been estimated. Therefore in this study, we applied the inversion method (Tsumura et al., 2000) to estimate P wave attenuation structure there.
Adding to the data recorded in routine seismic stations, we used the data of the three dense seismic arrays which were settled in perpendicular or parallel direction in the east, the west and the south part of Kii Peninsula. The array length were about 90km (or 60km) with 1km station interval. Observation period were from December 2009 to May 2010 (for the E-W line in the south), from December 2010 to June 2011 (for the N-S line in the west), and from May 2015 to December 2015 (for the E-W line in the east). We selected 302 earthquakes which were recorded at 172 seismic stations and calculated 11133 spectra for P arrivals of time window ls for taking into account ray distribution. The sampling frequency is 100 or 200 Hz for the permanent stations and 200 Hz for the temporary stations. Furthermore, in order to express a three-dimensional Q structure, we divided the study region into 9, 11, and 6 portions in latitude, longitude, depth- direction respectively.
Derived Qp images show that a low Qp zone is seen at the depths of 30 to 40km in which high activity of the DLFEs in the eastern part of the Kii Peninsula. On the contrary, we can find patch-like high Qp zones were distributed in the same depth range at the western part of the Kii Peninsula. These high Qp zones coincide with the regions where the DLFE clusters exist. Both of these high and low Qp zones corresponds to the lower Vp and high Vp/Vs regions derived from travel time tomography. Although seismic velocities derived from travel time tomography and conductivity structures indicate that the existence of fluid in the source regions of LFEs, we can see the difference between attenuation parameters estimated for the eastern and western parts of the Kii Peninsula. These results may reflect the different physical properties of the eastern and the western parts and it affects the difference of LFEs’ activity in each side of the Kii Peninsula.

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