

Dimension of the heterogeneity in the subduction zone in the Tokai region, Japan

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Scattering phenomena of seismic waves provide useful information about heterogeneous structures of the Earth. Coda waves of shallow earthquakes comprise S wave packets scattered by heterogeneities in the crust or the upper mantle. Therefore they convey the information on the heterogeneity in the crust or the upper mantle. We study coda waves generated in the crust and the mantle in the Tokai region to investigate the characteristics of the heterogeneity in the subduction zone. The region has an advantage that there are many seismic stations and many seismic events with a large depth range of hypocenters. In this study we focus on the source depth dependence of coda wave characteristics.

Seismic sources used here are small earthquakes, which occurred in a relatively small area to the north-east of Hamana-Ko (Lake). The source depths range from 10 to 40km. The seismic waves analyzed here are those recorded by stations in arrays of NIED. Coda-Q values of ten frequency bands from 1.5 to 24Hz are determined using an ordinary method.

The obtained coda-Q values show a clear source-depth dependence. The values for shallower than 20km earthquakes are lower than those for deeper events. In particular, the source-depth dependence is strong in low frequency bands; no dependence is observed at high frequencies. The dependence is strongest at 4 Hz. It is likely that the dependence is derived from vertical variations in the attenuation or the heterogeneous structure in the crust and the uppermost mantle. One of the most possible structures is a zone between the crust of Japan Is. and the subducting Philippine Sea slab. We can estimate a characteristic dimension of the heterogeneity from the characteristic frequency of the coda waves. Given the frequency of 4 Hz and the S wave velocity of about 4 km/sec, the dimension is calculated to be of the order of one km.