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Three Dimensional Attenuation Structure beneath the Northern Kinki Region, Japan

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Spectrum inversions assuming uniform Qs value (UQSI method) have been studied among many part of the country. Amaike et al.(2006) reported that the Qs obtained using the UQSI method depend on data ranges on hypocentral distances and the Qs decreases with the data ranges. Although, the causes of this phenomenon has not been cleared.

In this study, we obtained 3-D Qs structure using 3-D Qs spectrum inversion method (3DQSI method) with the discrete block size of 0.2 deg.* 0.2 deg. * 10 km and 0.2 deg.* 0.2 deg. * 20 km, and compared the 3-D Qs results with Qs by UQSI method reported by previous paper.

Data set are same as Nakamura et al.(2010), the 14,831 seismograms from K-NET and KiK-net from 1997 to 2007 that recorded 362 shallow and small earthquakes (h<=30 km and 4.0<=M<=6.0) were used for tomography. The ground acceleration Fourier spectra for inversion were calculated by using the S-wave portion and taking the geometric mean of the spectrum within +-0.5 Hz of central frequencies from 1 to 10 Hz every 1 Hz. The ground motion traces from the shallow earthquakes frequently have many later phases that consist of surface waves, therefore, the S-wave portion of records was selected to compare with the theoretical S-wave arrival time according to JMA2001. Other conditions for the tomographical calculations were in accordance with Nakamura(2009).

The Niigata-Ken Chuetsu area, Aichi-Gifu area and the northern Kinki region also show the good resolution in 1st layer (0-10 km in depth) and 2nd layer (10-20 km in depth). The active and quarternary volcanoes tend to show low-Qs at 0-10 km depth.

Fig.1 shows the relations between average Qs and frequency obtained by taking the average Qs over three study areas (A area:135.4-136.6 deg. E, 35.0-36.0 N, B area:135.2-136.2 E, 35.0-36.0 N, C area:135.4-136.6 E, 35.0-35.5 N) at layers 1 (0-10 km depth) and 2 (10-20 km depth).

Relation developed by Satoh et al. (2007) is also shown in this figure, they obtained $Qs=50f^{1.1}$ by using the UQSI method and data of 60 km in hypocentral distance. The C area employs only good resolution blocks, and the A and B areas contain some blocks which are not good resolution.

Differences among these areas are small, and the results at the shallow layer (0-10 km depth) are in good agreement with Satoh et al. (2007).

Theoretical ray paths from sources at 10 km depth calculated using JMA velocity model shows only upward traveling to stations within about 60 km in epicentral distance, although in the case for the stations distant from epicenter, the rays travel downward once, and, next upward.

Satoh et al. (2007) used the data within 60 km on hypocentral distance. Therefore, the result, $Qs=50f^{1.1}$, mainly reflects Qs of upper crust, and average Qs at layer 1 (0?10 km depth) in this study agrees well with $Qs=50f^{1.1}$.

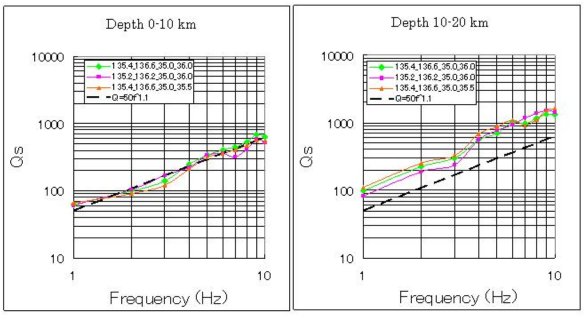

Fig.1 Comparison of Q_s values at the north Kinki region. Color solid lines: average Qs by 3DQSI method (This study). Broken line: Qs by UQSI method after Satoh et al(2007))

Keywords: 3-D attenuation structure, Qs, spectral inversion, tomography, depth dependence, the Kinki region