Distribution of seismic scattering coefficients in the crust beneath the Onikobe area

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1.Introduction

Onikobe earthquake of M5.9 occurred on August 11, 1996 and the aftershocks were observed by densely distributed temporal stations. Three-dimensional seismic velocity structure [Onodera et al. (1998), Nakajima and Hasegawa (2003)], distribution of S-wave reflectors [Hori et al. (1999)] and the attenuation characteristics of S-coda waves [Miura et al. (2002)] were investigated using the data obtained by the aftershock observation. In the present study, we used these data and estimated distribution of relative scattering coefficients based on an inversion of the coda energy residuals in and around the Onikobe area.

2.Data

Focal depths were shallower than 10km and seismic waves recorded at an epicentral distance shorter than 20km were analysed. The numbers of UD, NS and EW component waveforms analysed are 259, 325 and 324, respectively.

3.Method

The analysis procedure is based on the method developed by Nishigami(1991). The region was divided into blocks with the size of 0.05deg in horizontal direction and 5km in depth. We analysed the coda part with lapse times greater than 2.0 times of S-wave travel times. A coda envelope is calculated from the observed coda waves by band-pass filtering (central frequency is 12Hz) and calculating mean square of an amplitude (window length is 0.5s) for every 0.5s. The residuals are obtained by taking the ratio of the observed coda envelope to the envelope for homogeneous scattering coefficients. Scatterers were distributed at 2km interval and scatterers in the same block were assigned the same scattering coefficient. Under the assumption of a spherical symmetry for source radiation, S to S single isotropic scattering, and homogeneous Q, we derived a relative scattering coefficient in each block. The earth's surface was treated as a free surface with reflection coefficient of 1.0.

4.Result

We found that the scattering coefficients are large at the depth of 0-10km under and around the volcano. The coefficients were negative for the depth of 15-20km beneath the Onikobe caldera. This minus scattering coefficients were considered to be caused by the high attenuative region beneath the caldera. The depth of the attenuative region was estimated to be around 5-10km by the numerial experiments.

References

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