# Inversion analysis of S coda wave envelope based on radiation transfer theory - Estimation of heterogeneous structure of Izu Oshima volcano -

*Takahiro Ueda[1]

1. Department of Geophysics, Graduate School of Science, Tohoku University

It is well known that short period seismic waves are strongly influenced by heterogeneous structures in the crust or shallow structures. Analyses using seismic sources near the ground surface such as artificial sources and seismic wave interferometry have reported that strong heterogeneity appears remarkably due to shallow sediments of volcanoes. On the other hand, there are few studies in which volcano-tectonic earthquakes are used, and the characteristics of heterogeneous structure down to deep regions ( 10 km) of the volcanoes have not been well investigated. In this study, based on the Multiple Lapse Time Window method (Fehler et al. 1992) based on radiative transfer theory, we evaluate heterogeneity of the volcano structures, using an inversion method to obtain the intrinsic attenuation value, scattering attenuation value, the energy radiated from the source, and the site amplification factor, a of the Izu Oshima volcano. We use the seismic waveforms recorded at 4 V-net stations at Izu Oshima. From January 2014 to January 2018, events of M1.5 to M3.5, 150 earthquakes within 10 km deep are analyzed. Bandpass filters of 1-2 Hz, 2-4 Hz, 4-8 Hz, and 8-16 Hz bands are applied, and the envelope waveforms of the direct waves and coda waves of S waves are obtained in each frequency band. The Green’ s function is calculated based on the radiative transfer theory of the S wave multi isotropic scattering. The amplitude is expressed by the product of the site amplification factor, the energy radiated from the source, and Green’ s function. We fit the observation envelope with the theory and determine the internal attenuation and the scattering attenuation as well as site factors and source energy.
The results show that the scattering attenuations are 0.0393, 0.0210, 0.0027, 0.0001 in the 1-2 Hz, 2-4 Hz, 4-8 Hz, and 8-16 Hz bands, respectively, and the intrinsic attenuation was 0.0054, 0.0056, 0.0029, 0.0006. The average values of Japan's crustal structure (Calocoré and Sato, 2010) are almost same with intrinsic attenuation of this study, while the value of the scattering attenuation is larger by about 10 times in the low frequency region around 1.5 Hz. In addition, it is smaller than the results for very shallow part (Yamamoto and Sato., 2010, Hirose et al., 2019) by 1 to 2 orders of magnitude.
Based on the above results, the scattering attenuation parameter is dominant in Izu Oshima compared to the Japanese crust, compared to the internal damping, which is in harmony with the results of the previous study that the scattering damping is large around the active volcano , And it seems that the influence of the minute heterogeneous structure of the shallow part of the crust appeared strongly. In addition, theoretical envelope was well obtained by the envelope inversion method proposed in this research, and it was shown that it is effective as a method to evaluate the radiation energy and the radiation energy of the epicenter.

Keywords: coda wave, volcanic structure

 