MULTIPLE SCATTERING AND MODE CONVERSION AS REVEALED FROM ACTIVE SEISMIC EXPERIMENTS AT ACTIVE VOLCANOES

Prof. Mare Yamamoto

(Solid Earth Physics Laboratory, Department of Geophysics, Graduate School of Science, Tohoku University, Sendai, Japan, e-mail: mare@zisin.gp.tohoku.ac.jp)

Abstract

Volcano is one of the most heterogeneous fields in the Earth's crust, and the understanding of such inhomogeneities may provide us important information on various volcanic processes. In the previous studies on the seismic wave propagation at active volcanoes, the diffusion model has been widely used to model the energy transportation, and the contribution of P and S waves and their mode conversion have not been well recognized partly due to lack of dense observations capturing spatio-temporal pattern of energy propagation.

In this presentation, we show an observational evidence of mode conversions and multiple scattering at Asama volcano, Japan revealed by an active seismic experiment with a dense seismic network. The observed spatial distribution of propagating energy emitted from the explosive source shows a pattern exhibiting two slopes which is indicative of multiple scattering and conversion scattering of two modes having different scattering coefficients. To explain the observed pattern, we modeled the energy propagation using the radiative transfer theory assuming multiple isotropic scattering including conversion scatterings, and quantitatively estimated scattering parameters. Estimated total scattering coefficients for P-to-S and S-to-S scattering are about three times larger than that of P-to-P scattering, and the mean free path of S-wave is about 1 km for 8-16 Hz band. These results suggest the mode conversion and multiple scattering have an indispensable effect on the seismic energy propagation in heterogeneous volcanic environments.

Although the study at Asama volcano above succeed in estimating the scattering parameters beneath the volcano, we miss the direct evidence of energy partitioning between P and S energies since the network at Asama volcano is composed mostly of vertical sensors. In this presentation, we also present recent studies on the separation of P and S energies and quantification of the energy partitioning revealed by our observation at Sakurajima volcano with a dense three-component seismic array.