

Active monitoring by using ACROSS in Sakurajima volcano - observation report 3 -

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In 2012, in order to realize quantitative monitoring of magma transport process, we deployed the ACROSS (Accurately Controlled Routinely Operated Signal System) vibrator system composed of two vibrators in the site that is 3.6 km apart from the northwest of the Minamidake crater of Sakurajima.

On September 2012, we have started the full-scale operation under synchronized control of two vibrators with a frequency modulation, in which the modulation period is 50 seconds and the frequency range is 5 to 15 Hz, to produce broad frequency range of signal: one vibrator 'SKR1' with a signal frequency range of 7.510Hz +/- 2.50Hz and the other 'SKR2' with the range of 12.505Hz +/- 2.50Hz. The signal from the ACROSS source is routinely monitored with more than 20 permanent seismic stations in and around Sakurajima volcano. Five temporal seismic stations are also deployed to increase the spatial coverage of monitoring. The signals recorded at the seismic stations are deconvoluted with the source function to obtain the transfer function between the source and the receivers.

In this report, we estimated the daily transfer functions for the SKR2 vibrator at each station by every 5 days stacked data during a whole period (400 days from September 19, 2012 to October 23, 2013) of the operation. It is obviously found that these daily transfer functions vary temporally. To detect quantitatively the temporal variation of the transfer functions, we analyzed the variation of the transverse component (Tt) of the transfer functions at 7 seismic stations located in Sakurajima Island as follows:

(1) We analyzed the transfer function obtained at temporal seismic station 'GOMI' located at about 50m apart from the ACROSS source to verify the stability of power of the seismic waves generated by the ACROSS source. According to the result, we rejected the transfer function evaluated during a period of the unstable power condition from a whole period of the operation.

(2) We visually inspected arrival times and amplitudes for the specific phases in the transfer functions at each station during the period of the stable power condition of the ACROSS, and obtained the quantitative temporal variation for the specific phases.

(3) On a simple assumption that the specific phases are SH waves (the transverse component of the transfer functions), we presumed the depth range where each specific phase propagated in the 5 horizontally layered model simplified from the results of the exploration seismic experiment (Miyamachi et al., 2013).

(4) We compared the temporal variation of the specific phases with activity of volcanic eruptions by JMA, the temporal change of the N-S and E-W horizontal distances (GPS data) in Sakurajima Island, and the temporal change of strain at the HAR station measured by Kyoto University.

In the presentation, we will show the observation results in detail. This ACROSS research project in Sakurajima volcano is still in a pioneering stage, and we have plans in the future to continue our project.

Keywords: Sakurajima volcano, ACROSS