

活火山における能動監視 -桜島火山へのアクロス設置- Active Monitoring at Active Volcanoes - Deployment of ACROSS at Sakurajima Volcano

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Quantitative monitoring of magma transport process is essentially important for understanding the volcanic process and prediction of volcanic eruptions. To realize this monitoring, a project, an establishment of active monitoring using a vibration source called ACROSS in Sakurajima volcano, is being underway and will be finished by the end of March 2012. In this report we show how the ACROSS source was deployed in Sakurajima volcano, and also show the feasibility of monitoring using ACROSS vibrator system for Sakurajima volcano in terms of detectability of signal and its temporal variation due to reasonable change in volcanic structure. Sakurajima volcano is one of the most active volcanoes in the world, which made about 1000 explosive eruptions in 2011, and has been intensively monitored by high-performance observation networks operated by institutions such as Sakurajima Volcano Research Center of DPRI, Kyoto University. Therefore, Sakurajima volcano is one of the best volcanos as a first test site for volcano monitoring with ACROSS.

ACROSS source is deployed in the northwestern flank of the volcano at the site of former Sakurajima Clean Center. Two vibrators are deployed, which were originally operated as a four-vibrator system. The control-gear, that is originally designed to operate the four-vibrator system, has been already modified for two-vibrator system and in operation at Toyohashi site. We brought the system to Sakurajima volcano in order to prevent unexpected troubles. The two vibrators are firmly fixed in a basement, that is called a "core-coupler", which is build with steel-beamed frame. The core-couple is cemented in the square-shaped hole with a dimension of 4.3 x 3.8m and 3m depth. As the ground of the site is not solidified well for the vibrator, twelve stakes are driven to the depth of 5m and the centroid of the vibrator is situated at a depth of about 1.5m below the surface, that is 0.5m deeper than that of Toyoyashi site. The vibrators can produce a sinusoidal force of about 10^6 N at 15Hz, and can be reduced by changing eccentric moment of the mass. The operation will be made with an accurately repeating sweep signals with a frequency range of about 10-20Hz that are synchronized to GPS clock. We look for best parameters for operation when the deployment finished.

Before operation we simulated the wave propagation with a 3D structure model of Sakurajima volcano and assess the detectability of signal in the seismic stations in the volcano. 3D model is made based on a structure model (Miyamachi et al. 2010), and implemented for the simulation system GEOWAVE. The attenuation is given by the analysis using the data of the explosion experiment in 2008. The simulation shows that the maximum change in the signal can be observed at the seismic stations in the southeastern flank of the volcano if the magma ascent beneath the Showa or Minamidake craters. Based on the estimation of the distance-dependent attenuation relationship by Yamaoka et al. (2011), the signal of an ACROSS vibrator can be recorded with a signal-to-noise ration of 10 for the whole area of Sakurajima island for the staking length of 3 months. We will, therefore, be able to monitor the change of signal that may be correlated with long-term activation or deactivation of the Sakurajima Volcano with ACROSS system.

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