Active monitoring at Active Volcano - Performance of ACROSS at Sakurajima volcano, Japan.

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First test on the monitoring of volcanic activity with continuous-operatable seismic source has started at Sakurajima volcano, Japan. This paper reports the methodology to estimate the performance of the source-receivers system before deployment. It also reports the actual performance of the source using the data of existing seismic stations in and around Sakurajima volcano.

We deployed seismic sources, named ACROSS (Accurately Controlled Routinely Operated Signal System) in Sakurajima volcano in March of 2012. Two sources are deployed in the northwestern frank of Sakurajima volcano with a distance of 3.6km from the main crater. With some preliminary test, we have started a test of continuous operation from 12 June to 18 September, 2012 with single frequency of 10.01Hz and frequency modulation between 10-15Hz. The first test was successfully finished with minor trouble even if this is the first opportunity to deploy the source in the remotely located volcano. The sources are in operation now with frequency modulation of 5-10 and 10-15 Hz.

Before the deployment we assessed the feasibility of monitoring of magma transport in Sakurajima with ACROSS system using existing datasets. For the assessment two issues are posed, one is whether we can obtain transfer function with enough signal-to-noise ratio (SNR) in Sakurajima, and the other is how we can detect the change in subsurface structure by using ACROSS signal under the realistic structure of the volcano.

Signal-to-noise ration (SNR) were estimated as a function of the stacking length and the soruce-receiver distance. With the distance-dependent attenuation model that is established in the Tokai area for the ACROSS source, we estimate the distance-dependent attenuation relation in Sakurajima volcano for the ACROSS source. By comparing the relation with the noise level in Sakurajima volcano we can estimate the time period that is necessary to obtain enough SNR. The result shows that ACROSS signal can be recorded with SNR of more than 10 within the distance of 5km if signal have been recorded for one month. The estimated distant-dependent attenuation relation is almost consistent with the real observation.

Wave propagation is numerically calculated with the 3D velocity and attenuation structure model, that is established based on the refraction experiment in and around Sakurajima volcano. With the model we calculated the wave propagation from a single force exerted at the planned source site, and compare it with the calculation in different model in which a low-velocity body is placed beneath the summit. The results show that the maximum change will be observed at an opposite region with respect to the summit. The analysis of the real monitoring data is now underway to reveal the source of temporal variation of the monitoring.