2015年6月の臨時観測によるストロンボリ火山の噴火地震の相対震源決定

Relative hypocenter determination of eruption earthquakes at Stromboli volcano based on a temporal observation in June 2015

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Earthquakes associated with eruptions of magma or gases are repeatedly observed with intervals of several or tens of minutes or hours on Strombolian explosions. The source of these earthquakes is likely the source of magma explosions associated with the rapid change of pressure in a conduit. Hypocenter determination of these eruption earthquakes enables us to understand the shape or location of the conduit. However, they generally have obscure onsets of P or S phases, which disable us to use general hypocenter determination methods using arrival times of these phases.
In our previous study, we developed a new relative hypocenter determination method using deconvolution and master event method (Sugimura et al., 2015, JpGU, VSJ). Deconvolution filter enables us to automatically obtain higher resolution of the arrival time difference between a master event and a slave event and to separate the arrivals of two or three explosion events occurring in a very short time. In June 2015, we developed a temporal seismic network at Stromboli volcano. In this study, we determine relative hypocenter locations of eruption earthquakes using our method and the temporal observation data.
In the observation, we deployed five short-period seismometers at 200 m-1 km from the crater at Stromboli volcano. To obtain higher accuracy of source locations, we deployed them at west of the crater or the lower altitude than the expected source. The signals were recorded with a sampling frequency of 250Hz (Kinkei System, EDR-X7000) or 200 Hz (Hakusan Kougyou, LS-8800). Observation period was about two days in the beginning of June 2015.
In addition to our data, we analyze the signals obtained by the two permanent broadband seismic stations of Department of Earth Sciences of the University of Florence. In our analysis, we use band pass filter for the signals at 0.2-0.4 Hz. We choose a master event and use deconvolution filter to obtain arrival time differences between the master event and the slave events. We further calculate time differences of the arrival time differences between two stations using cross correlation of the deconvoluted waveforms. This enables us to eliminate origin time differences and to express these time differences as linear functions of the relative source locations from the master event.
We assume ~200 m beneath SW crater for the master event and the wave velocity of 1000 m/s. The result shows that the relative source locations are distributed in the range of ~200m in depth and sub-vertically. In future, we will consider a more possible source location of a master event and compare the source of short-period signals to understand the mechanism of magma explosions in a conduit at Stromboli.

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