An application of the ASL method to seismic activity at Tokachi-dake

*Nakatsuji Shujiro[1], Hiroshi Aoyama[1]

1. Institute of Seismology and Volcanology Hokkaido University

Hypocenter distribution of volcanic earthquakes in time and space is one of the important information in assessing volcanic activity. Low-frequency earthquake (LP events) and continuous tremor often occur at shallow part of volcano edifice. Those events are considered to have close relationships with volcanic fluids such as magma, water, and steam. However, since phase arrival times of those events are usually obscure, it is challenging to determine the hypocenter automatically.
Tokachi-dake volcano in Hokkaido has a number of LP and tremor events, along with increase in volcanic activity. To obtain precise hypocenter location of these events at Tokachi-dake, we adopt Amplitude Source Location (ASL) method (Battaglia and Aki, 2003). The ASL method is one of the hypocenter determination techniques that analyzes the amplitude ratio of seismic wave among different stations under the simple assumption on distance attenuation and isotropic radiation of high-frequency seismic signal. Since the ASL method doesn’ t require precise picking of seismic wave arrivals, it is potentially effective for hypocenter determinations of LP events and continuous tremor.
For introducing an assumption of isotropic radiation of seismic waves, the ASL method usually treats high-frequency signals over than 5Hz. Since such high-frequency seismic signals strongly are affected by a shallow ground structure, we first estimate site amplification effect at each station at Tokachi-dake by using coda normalization method (e.g., Phillips and Aki, 1986). We used 10 local earthquakes that occurred around Hokkaido in 2013-2016, and estimated site amplifications at 8 seismic stations, including 3 stations operated by Hokkaido University. Site amplification factors at Tokachi-dake clearly increase around Taisyo and 62-2 craters. Then we tried to determine the source location of volcanic earthquakes using the ASL method. As a preliminary analysis, we assumed the hypocenter locates at a shallow part of the volcano, and performed two-dimensional search of epicenter by fixing a source at the surface of topography. Consequently, estimated epicenters of tested events are well distributed around 62-2 crater. This result roughly matches the hypocenter distribution reported by JMA. The spatial distribution of estimation error should be examined at first. Then we will extend the searching algorithm in depth direction to estimate more detailed source locations.

Keywords: ASL method, Tokachi-dake, volcanic earthquake

