Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SVC52-04 Room:416 Time:April 28 11:00-11:15

Estimation of locations and migration of debris flows on Izu-Ohshima Island on 16 Oct., 2013 by seismic amplitudes

OGISO, Masashi[1*] ; YOMOGIDA, Kiyoshi[2]

[1]Matsushiro Seismological Observatory, JMA, [2]Grad. Sch. Sci., Hokkaido Univ.

Typhoon 1326 (Wipha) with heavy rainfall caused severe damage at Izu-Ohshima Island on 16 October 2013 with large-scale debris flow, probably not only a single event but sequence of flows.

Seismic networks on Izu-Ohshima recorded the signals originated from those debris flows. At least five events of large amplitudes are recognized in continuous records of seismographs.

It is hard to estimate the location of such events with conventional methods of epicenter determination because of the difficulty to identify any seismic phase arrivals. We estimate the locations of the five events with spatial distribution of seismic amplitudes (Battaglia and Aki, 2003; Kumagai et al., 2010). In this method, after correcting the site effect of each station, the RMS amplitude of high-frequency seismic waveform is assumed to decay only with geometrical spreading and intrinsic absorption. Although amplitudes depend on radiation pattern of seismic waves, the isotropic distribution of amplitudes could be assumed at high frequencies because of the scattering effect by small scale heterogeneity in the crust (Takemura et al., 2009). The location of each event is derived as the point of the minimum residual between observed and calculated amplitudes of all the seismic stations. Before estimating the locations of the five events, we apply the band pass filter of 5-10Hz to each seismic record. We assume that the filtered waveform is composed of S body waves only, S-wave velocity is 1.44km/s, and Q=100 for intrinsic absorption. We limit the search range of each event only on the surface of the island. Site factors of stations are estimated by amplitudes of coda waves for regional earthquakes.

The estimated locations of all the five events are located in an eastern side of Motomachi district, where huge causalities were suffered, agreeing with the debris flow traces mapped carefully after the disaster occurred. In addition, the location is migrated to the west (i.e., from the volcano flank to the sea coast) within its duration time of 60-80 sec except for one event with small duration time. Such migrations may correspond to the flow of debris, with its speed about few tens km/h. Time series of source amplitudes, that is, the maximum value and duration time of each event show the variability of the debris flows occurred on Izu-Ohshima Island within several hours on that day.

Generally, seismic networks focused on volcanic activities are generally composed of stations of higher density than other seismic networks. The records of such dense seismic networks are useful to analyze not only earthquakes and tremor on volcanoes, but also debris flows or other disastrous events, as shown in this study. The present location method using the spatial distribution of seismic amplitudes is conceptually able to apply in quasi-real time, so it should be useful to early estimation of location and magnitude of various disasters in and around volcanoes.

Acknowledgements

We analyzed the seismic waveforms recorded in the networks on Izu-Ohshima Island which are operated by Earthquake Research Institute of the University of Tokyo, the National Research Institute for Earth Science and Disaster Prevention, and the Japan Meteorological Agency. We used the digital elevation model and topographical map images of Digital Japan Web System provided by the Geospatial Information Authority of Japan.

Keywords: distribution of seismic amplitudes, locations and migration of debris flows, Izu-Ohshima Island