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Automatic hypocenter determination of deep low-frequency earthquake beneath Mt. Asama volcano

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1.Introduction

Deep low-frequency (DLF) earthquakes beneath active volcanoes are considered to occur related to magma activity in the deeper part and studied since 1980's. But since their relationship with surface phenomena such as eruptions seems not to be so clear unlike that of shallow volcanic earthquakes, accumulation of analysis of DLF earthquakes is not enough. For the further accumulation of analysis, it is very important to detect more DLF earthquakes. Japan Meteorological Agency (JMA) monitors seismic activity with Earthquake Phenomena Observation System (EPOS) using data from seismic observation points operated by JMA, universities, National Research Institute for Earth Science and Disaster Prevention (NIED) and other related organs and make the seismological catalogue of the JMA. In the catalogue, "low-frequency" flags are appended to earthquakes occurred at 10km depth or deeper. LFE earthquakes can be distinguished from other earthquakes by them. But, data of seismometers which are operated in volcanic areas is not used in this process. On the other hand, these seismometers are used mainly to monitor shallow volcanic earthquakes. Hence for monitoring of LFE earthquakes, data of seismometers in volcanic areas is not considered. Then we tried to improve detecting power of LFE earthquakes by using data of them.

2.Analysis

We examined LFE earthquakes occurred beneath Mt. Asama, one of the most active volcanoes in Japan. We use waveform data obtained at 12 observation points on the volcanic body operated by JMA (10 points) and NIED (2 points). We also used waveform data from 7 points of High Sensitivity Seismograph Network (Hi-net) operated by NIED near Mt. Asama.

We made a program for automatic detection and hypocenter determination. We used modified energy ratio (MER) method (Hang et al., 2010), which is regarded to be more useful than STA/LTA method for time-picking in noisy waveform data, for detection of earthquake signal and picking of arrival time of P-wave and S-wave. We regarded the time section where signal appeared about the same time as the time earthquake was occurring to remove the effect of non-seismic oscillation of seismometer. We calculate the hypocenter with hypomh, hypocenter calculation program by Hirata and Matsu'ura(1987) using P-wave arrival time and S-wave arrival time at the observation points obtained with MER method. After the hypocenter calculation, we.

Keywords: Mt. Asama, deep low-frequency earthquake, automatic detection, automatic hypocenter determination