

Precise relocation of deep low-frequency earthquakes beneath Fuji volcano, in 1998 - 2001

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Deep low-frequency earthquakes (DLFs) have been observed at the seismic networks of ERI, NIED and JMA around Fuji volcano. The seismic observation near Fuji volcano started in 1982 by ERI. JMA deployed one station on the summit in 1987. Four borehole seismic stations near the volcano have been constructed in 1990 - 1997 by NIED. All stations are equipped with 3-component short-period seismometers. There are 11 stations within 15 km from the summit. Each organization routinely has located DLFs using its seismic network. We firstly combined data of three organizations, picked up arrival times of DLFs with careful identification of phases and determined their hypocenter precisely using the program hypoDD (Waldhauser and Ellsworth, 2000). Many DLFs occurred in two periods September - November 2000 and April - May 2001. In this period, the DLFs occurred at a rate of 20 - 70 per month, which is about ten times higher than those of background level. Generally, the LFs have little energy above 5 Hz, emergent P arrivals and strong S arrivals unlike those of shallow LFs. P and S waves of the DLFs are often contaminated by high-frequency (higher than 5 Hz) waves at close stations. They frequently occur as bursts of overlapping events. The duration of LF bursts is usually few minutes but occasionally 20 - 30 minutes. The maximum amplitude magnitude for the DLFs is about 3. We selected out 100 DLFs with good S/N ratios from the data set in 1998 - 2001 and located hypocenters for the 76 DLFs with reasonable precision. The RMS residuals for P and S waves by the hypoDD are reduced to 80% of those by an ordinary method. Magnitudes of the located LFs range from 0.4 to 2.2. The DLF hypocenters define an ellipsoidal volume some 5 km in diameter ranging from 11 to 16 km in focal depth. Consulting the location errors, the extent of the volume is significant. This volume is centered at 3 km northeast of the summit and its long axis directs southeast - northwest. The center of the DLF epicenters gradually migrated 1 km from southeast to northwest in 1998 - 2001. While the focal depths of the DLFs in 1998 - 1999 are at depths of 13 - 16 km, the DLFs located apparently shallow with time at depths of 11 - 16 km in the period from September 2000 to December 2001. Although no definite source mechanism of the DLFs have been revealed, the spatial extent and migration of the DLF hypocenters give a key to understanding the relation between the generation of DLFs and magmatic fluid.