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Spatial and temporal change of seismic activity beneath Mt. Ontake before the small eruption in 2007

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1. Introduction
The process of magma intrusion is revealed by not only the spatial and temporal change of hypocentral distribution of the earthquakes that have occurred before or after the eruption but also the mechanisms of earthquakes. The small eruption occurred at Mt. Ontake in the end of March 2007. A number of earthquakes occurred before the eruption and the number of earthquakes reached a peak in the middle of January 2007. A very-long-period event occurred (Nakamichi et al., 2009) on 25 January 2007 and after that, low-frequency events increased. An expansion was observed at the GPS sites around Mt. Ontake in the period from December 2006 to January 2007. In this study, we applied the double-difference (DD) method (Waldhauser and Ellsworth, 2000) to determine the location of the hypocenters of the earthquakes that have occurred around Mt. Ontake from 30 December 2006 to 31 March 2007. We also determined focal mechanisms of the earthquakes.
2. Determination of the hypocenters by the DD method
We checked the travel times of first motions of the earthquakes and applied DD method. As results, the averages of the errors are about 115 m for EW component, about 83 m for NS component and about 127 m for depth component. We determined the mechanisms from the polarities of P wave first motions. Two clusters of hypocenters were located. One is the beneath Mt. Ontake at depths of 0-3 km below sea level. The other exists at depths of 7-9 km below sea level at the area where is about 10 km north-northeast from the summit. We assumed three velocity structures to determine the hypocenters. The difference of the velocity structures affected only the cluster beneath the summit.
3. Mechanisms and Discussion
Almost all the focal mechanisms in that term are high-angle reverse faults in the period when the seismic activity beneath the summit reached a peak in the middle of January 2007. The polarities at stations close to the summit are dilatational, therefore there is a possibility that non-double-couple components exists in the focal mechanisms. It is supposed that the magma intruded in the middle of January 2007 beneath the summit and stopped rising below the depth where the hypocenters were determined. The magma intrusion did not affect the stress field in and around the hypocenters to produce normal-fault or strike-slip-fault focal mechanisms. The small eruption in the end of March 2007 was phreatic eruption. Therefore, it is supposed the eruption has been caused by the heat or the volcanic fluid like water vapor separated from magma after the magma intrusion has stopped.

Keywords: Mt. Ontake, eruption, seismic activity, hypocenter determination, Double-difference method, focal mechanism