

Tilt change associated with the eruption of the Asama volcano on Feb. 2, 2009 observed by a Hi-net high-sensitivity accelerometer

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Change in the ground tilt associated with the eruption of Asama volcano on Feb. 2, 2009 (JST) was detected by a NIED Hi-net high-sensitivity accelerometer (tiltmeter). The change was clearly recognized at the Tsumagoi station, which is located at 10-km north from the Asama volcano. The observed tilt change is 0.024 and 0.031 micro rad in the westward and southward down direction, respectively. To estimate the change in one direction, the original record (20 samples/s) was low-pass filtered with a cut-off frequency of 0.02 Hz, and then the deviation from the trend that was estimated from the data between 30-60 minutes before the start of the eruption at 1:51 (JMA, 2009) was calculated. Although JMA reported that the change in tilt preceded 1 day before the eruption, the change at Tsumagoi was not clear due to the passage of a low pressure system on Jan. 31.

We also estimated the tilt changes during the previous eruptions of Asama volcano on Sep. 1 and 23 in 2004. The change during the eruption on Sep. 1, 2004 was 0.019 and 0.037 micro rad in the westward and southward down direction, respectively. The change on Sep. 23, 2004 was 0.011 and 0.013 micro rad in the westward and southward down direction, respectively. Although all the estimated changes indicated the south-westward down tilting, this direction does not coincide with that of the summit of Asama volcano where the eruption occurred. Although the data in a single station is not sufficient to constrain the source of the crustal deformation associated with the eruptions, the tilt change data will also contribute to a geodetic analysis of the source.

We observed different temporal variations in the tilt records between the eruptions in 2004 and 2009. During the eruption on Sep. 1, and Sep. 23, 2004, rate of tilt change was largest just after the start of the eruption. During the eruption on Feb. 2, 2009, however, the tilt change rate did not clearly accelerate just after the eruption. The rate became highest 17-18 minutes after the eruption, and the tilt change decelerated around 23 minutes after the eruption. During this eruption, seismic wave which predominates in 1-3 Hz was observed at the Tsumagoi station. Comparing the tilt change record and seismogram band-pass-filtered between 1-3 Hz, the maximum amplitude in the band-pass-filtered seismogram corresponds to the tilt acceleration at 17-18 minutes after the eruption. Then, the tilt movement decelerated as the amplitude of the seismogram decreases. Although it is hard to reveal the physical mechanism of the eruption solely from this observation, high-sensitivity accelerometers with high temporal resolution is helpful to discuss the detailed process of eruption.