

Tilt changes associated with the small eruption at Mt. Asama on Feb. 2, 2009

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On February 2, 2009, a small eruption occurred at Mt. Asama, central Japan. A broadband seismic network operated by Earthquake Research Institute detected tilt-related signals associated with the eruption.

Input acceleration to a seismometer consists of that associated with the translational motion and that associated with the ground tilt. The transfer function of the typical broadband seismometer to the ground-velocity input is proportional to the square of the frequency in the frequency range lower than its characteristic frequency. It means that the output voltage is proportional to the time derivative of the ground acceleration. By time-integrating the signal in the frequency range lower than the characteristic frequency, we obtain signals proportional to the ground acceleration, which are proportional to the ground tilt

According to the tilt records obtained by the time-integration of the velocity records, stations near the summit area show hillside-up inclinations just before the eruption followed by the hillside-down tilt after the eruption. At the stations relatively far from the summit area, tilt changes before eruption are below noise level and thus not detected. However, tilt changes after the eruption are clearly detected at most of the stations, and their amplitudes and orientations are all systematically pointing to the region northwest of Mt. Asama.

Observed tilt data at the station near the summit are interpreted as the accumulation and release of the pressure before and after the eruption, respectively. On the other hand, the tilt data recorded by the stations relatively far from the summit area suggest the contraction at the northwest of Mt. Asama. The suggested position of the contraction is in good agreement with the position where magma repeatedly intruded before and during the recent summit eruptions at Mt. Asama. The observed tilt records suggest that the region of the magma intrusion contracts soon after the summit contraction during the summit eruption.