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# Source mechanism of the explosion earthquakes associated with the moderate-scale vulcanian eruptions at Mt. Asama, 2004

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Mt. Asama is one of the most active volcanoes in Japan. During the 2004 Asama volcanic activity, five moderate summit eruptions were observed. All of these eruptions were of the vulcanian type, and seismic signals accompanying the eruptions were recorded by up to 8 broadband stations around the volcano. Ohminato et al. (2006) analyzed the waveform data by imposing strong restrictions on both the source locations and source mechanisms. We re-analyze the same data using looser restrictions. The results are essentially the same as those shown in the previous study.

The results of the waveform inversions that assume a point source show that the force systems that are exerted at the source region are dominated by vertical single force components. The source depths with dominant single force components are less than 200m below the bottom of the summit crater. In the source time history of the vertical single force component, two downward forces separated by 5-6 s are clearly seen. Between these two downward forces, an upward force component can also be seen.

The initial downward force roughly corresponds to the sudden removal of a lid capping the pressurized conduit. In contrast to the origin of the initial downward force, the origins of the following upward force and the latter downward force are relatively ambiguous. One possible explanation for the upward force is that it is a drag force originating from the viscous magma ascending in the conduit. When the magma in the conduit gains upward linear momentum, the rest of the earth must gain downward linear momentum. Some of the upward linear momentum of the magma column can be transferred to the conduit wall, thus exciting seismic signals.

In order to clarify the origin of the upward single force component, we investigated the possibility of a vertically extended force system. We conducted a grid search for the best source combination of two point sources of single force components. The best waveform-match solution was obtained when we put one of the two point sources of single forces near the top of the conduit and the other point source 2000m below the first one. The residual of the waveform match and the corresponding AIC value were better than those obtained when we assumed only one point source of single force components.

According to the lid-removal model, the initial downward force does not require a compensating upward force. However, the upward force following the initial downward force requires a counterpart in order to preserve the vertical total linear momentum. The results of the analyses that assumed two point sources suggest that the conduit has its ’bottom’ above sea level, and this ’bottom’ works as a deep source of the secondary single force component.