

Kinematic features of ascending volcanic clouds at Asama volcano, Japan: A series of the eruption on 15-18 September 2004

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[Introduction]

From September 15 to 18 2004, about 2000 eruptions occurred in Asama volcano, Central Japan. During these eruptions, movements of volcanic clouds were automatically recorded by video cameras. We obtained the kinematic features of ascent processes of volcanic clouds from video records, and compare them with the preliminary results obtained in laboratory experiments and theoretical analyses.

[Data]

We mainly used the sequence of images that were obtained at Karuizawa weather station, south-southeast of 7 km from the vent of Asama volcano, every 2-3 seconds, and also used the video records at Asama Volcano Observatory that is east of 4 km from the vent.

The upper air observations, including temperature, humidity, wind speed and wind direction at pressures were obtained from daily ascents of a rawinsonde at 9 and 21 o'clock (JST) by Japan Meteorological Agency. We used the data obtained at Tateno and Wajima stations, 140 km southeast and 180 km northwest, respectively.

[Atmospheric conditions]

The directions of the wind are consistent with that of the flow of the volcanic clouds for each case. At the height of 3000 to 5000 m a.s.l., corresponding to the volcanic clouds height, wind speeds are less than several m/s and no inversed layers were found. We interpret that atmospheric conditions have no hindrance for the ascent.

[Method]

From the time-series of recorded images, we can find the coordinates of the locations of the volcanic clouds in pixel, which are measured from the bottom in the image, and then calculated the locations in meter as a function of time with the assumption of wind direction and vent location.

[Result and Discussion]

Most of the volcanic clouds had isolated symmetric shapes, spreading linearly with height and roughly keeping its shapes as it ascended. We deduced that the ratio of radius expansion to height is around 0.30. The squares of the top clouds heights that are measured from the virtual origin are well proportional to time. These features are consistent with the characters of a thermal moving through incompressible uniform surroundings, which is well known from dimension, theoretical and experimental analyses.

Some reports from witnesses and records of high sensitive cameras indicate that successive strombolian-like eruptions may only have occurred at the nighttime on September 16. We also deduced that the ascent processes of volcanic clouds had more disturbances than that of another period.