

浅間火山で頻発した小噴火の噴煙運動の特徴

—2004年9月15-18日噴火—

寺田 暁彦*・井田 喜明**・飯島 聖***・
吉本 充宏****・嶋野 岳人*****

(2005年4月11日受付, 2005年10月19日受理)

The Kinematic Features of Volcanic Clouds: A Series of Small Eruptions
from 15 to 18, September 2004, at Asama Volcano, JapanAkihiko TERADA*, Yoshiaki IDA**, Sei IJIMA***, Mitsuhiro YOSHIMOTO****
and Taketo SHIMANO*****

Some fundamental features of ascending volcanic clouds have been revealed using images of the clouds that were automatically recorded by video cameras for some eruptions at Asama volcano on 15 to 18 September, 2004. According to the analysis of 17 volcanic clouds that are nearly isolated and of a symmetrical shape, the radius of a cloud increases linearly with increasing height, meeting self-similarity of ascending motion nearly up to its maximum height. If the height is measured from a suitable virtual origin, the ratio of the radius to the height can be a constant that is identified with the entrainment constant. The entrainment constants determined in this way have a mean value of about 0.24 in good agreement with those obtained from previous laboratory experiments, even if the values are greater than 0.25 or less than 0.20 for 35% of the analyzed volcanic clouds. During the ascent of a cloud the height squared is nearly proportional to the time and the product of the radius and the ascent velocity is almost constant. These empirical relations are consistent with well-known characters of a thermal that moves in incompressible uniform surroundings. Coupling these kinematic features of the volcanic clouds with the Scorer's relation and the equation of state, we evaluate the total buoyancy, the total mass, the density and the mean temperature of the clouds that are regarded as thermals. The total buoyancy of most volcanic clouds did not change significantly during their ascent process. The cloud on 17 September has a relatively great density contrast and small total buoyancy, probably reflecting hot ash particles in it supplied by a Strombolian eruption at that time. The volcanic cloud discharged at 11: 54, September 15 contained ash of 2,500-3,700 tons or less with the mean temperature of 310-360 K or higher, and the volcanic cloud discharged at 8: 38, September 18 contained ash less than 8,300-9,100 tons with the mean temperature higher than 310 K or higher.

Key words: Asama volcano, thermal, volcanic cloud, buoyancy, entrainment

* 〒060-0810 北海道札幌市北区北10条西8丁目
北海道大学大学院理学研究科附属地震火山研究観測
センター

Institute of Seismology and Volcanology, Graduate
School of Science, Hokkaido University, North 10
West 8, Kita-ku, Sapporo 060-0810, Japan.

** 〒671-2201 兵庫県姫路市書写 2167
兵庫県立大学大学院生命科学研究科
Graduate School of Life and Science, University of
Hyogo, 2167 Syosya, Himeji 671-2201, Japan.

*** 〒389-0115 長野県北佐久郡軽井沢町追分 1151-2
気象庁軽井沢測候所
Karuizawa Weather Station, Japan Meteorological
Agency, 1151-2 Oiwake, Karuizawa, Kitasaku, Nagano

389-0115, Japan.

**** 〒113-0032 東京都文京区弥生 1-1-1
東京大学地震研究所
Earthquake Research Institute, University of Tokyo,
1-1-1 Yayoi, Bunkyo-ku, Tokyo 113-0032, Japan.

***** 〒980-8576 宮城県仙台市青葉区川内 41
東北大学東北アジア研究センター
The Center of Northeast Asian Studies, Tohoku
University, 41 Kawachi, Aoba-ku, Sendai 980-8567,
Japan.

Corresponding author: Akihiko Terada
e-mail: terada@eos.hokudai.ac.jp