Geophysical Research Abstracts, Vol. 8, 06481, 2006
SRef-ID: 1607-7962/gra/EGU06-A-06481

Volcanic signals by two-phase flow instability at Miyakejima volcano, Japan

E. Fujita

National Research Institute for Earth Science and Disaster Prevention, Japan

Miyakejima volcano, Japan, is showing extraordinary activities since 2000, i.e., caldera formation at the summit, enormous seismic swarms and huge gas emission of volcanic gas which forces the evacuation of the residents as long as 4 years. Associated with this volcanic activity, seismic and ground deformation observation network of NIED detected some clues to know the static and dynamic mechanisms beneath the volcano. Especially, some phenomena recorded repetitive disturbances in crustal deformation and seismic swarms: “Tilt-steps” and “VLP earthquakes” occurred in the period of caldera formation at the summit region in 2000. From 2002, “banded-tremor” has been observed in some periods of activity. These are inferred to be closely related to the activity in thermal-fluid systems as follows.

“Tilt-step and 50-s VLP earthquakes” occurred 46 times in every 12 - 60 hours, and the data analysis suggested that the source is a cyclic jerky opening of magma sill at the depth of about 6-7 kilometers depth. This opening and periodicity can be modeled by the instability of two-phase flow in the magma plumbing system called pressure-drop oscillation. This non-linear phenomenon is like a pumping system with gas-chamber valve. “Banded-tremor” is sometimes observed, and their source locations are in quite shallow part beneath the summit. Their characteristics are as follows: 1) one active period is about 1- 2 days, 2) characteristic frequency is about 4-8 Hz, 3) the duration of one packet is characterized in two groups about 400-500 s and 900 s and 4) the recurrence time is constant about 45 minutes in 2002, and about 25 minutes after 2003. We assume that the hydrothermal system just beneath the summit would be the source. The observed frequencies, duration and recurrence time can be consistently modeled by the hydrothermal two-phase flow instability. The cycle of between stable and unstable state corresponds to the recurrence of banded tremor and tremor packet seems to reflect density wave oscillation.