An estimation of water and mass discharge rate from Miyake-jima summit crater (1)

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Infrared thermal image and video image, which is taken by Japan Meteorological Agency, have been collected in digital tape recorder at 2 seconds interval at Ako district of Miyake-jima since October 25, 2001. At the same area, air-temperature, humidity and atmospheric pressure have been observed at 30 minutes interval. By pursuing the light and shade patterns of the infrared thermal images and photo images, we obtained the rising velocity of the plume. From temperature distribution of the plume, we get the width and mean temperature of the plume at an arbitrary height. Using the method based on the conservation of mass and energy (Fukui, 1995) and these observation data, we estimated the water and heat discharge rate of the plume. The mean values in November were 40000 ton/day and 1600MW.

Immediately after the onset of the eruption of last year, Miyake-jima has effused a large amount of volcanic gases from its summit crater. In order to access the volcano-hydrothermal phenomena, we estimated the water and heat discharge rate from the summit crater.

We have observed the plume rising from the summit crater at Ako district of Muyake-jima since October 25, 2001. Infrared thermal image and video image, which is taken by Japan Meteorological Agency, were collected in digital tape recorder at 2 seconds intervals. At the same area, we have observed the air-temperature, humidity and atmospheric pressure at 30 minutes intervals. By pursuing the light and shade patterns of the infrared thermal images and photo images, we obtained the rising velocity of the plume. From temperature distribution of the plume, which was taken by infrared thermometer, we get the width and mean temperature of the plume at an arbitrary height.

Using the method based on the conservation of mass and energy (Fukui, 1995) and the observation data: rising velocity, plume width, plume mean temperature and meteorological conditions, we estimated the water and heat discharge rate of the plume. This analysis was made if we get the clear images of the plume.

Water and heat discharge rate were 10000 ton/day and 300MW on October 28, 80000 ton/day and 2600MW on November 5, 40000 ton/day and 1200Mw on November 6, 60000 ton/day and 1700MW on November 12, 50000 ton/day and 1700MW on November 15, 40000 ton/day and 1200MW on November 20, 30000 ton/day and 1100MW on November 25, and 10000 ton/day and 200MW on November 28. We also analyzed the data which were taken from a patrol boat of the Maritime Safety Agency on September 19 and the water and heat discharge rate were 580000 ton/day and 18000MW. The mean water and heat discharge rate in November were 40000 ton/day and 1600MW.

These results are underestimation because we use the temperatures, which were obtained at the plume margins, and we substitute the surface humidity for the humidity at high altitude. Although absolute value is uncertain, we can discuss the relative variation of water and heat discharge rate. If we assume that the result on September 19 indicates the mean value in September, the mean water and heat discharge rate in October is one order smaller than that in September. The mean water discharge rate in October is same order with the mass flux of SO2. This result probably indicates that the water originated form the ground water has been exhausted by the progress of volcanic activity and water degassed from magma mainly comes to constitute the plume.