

Time variation of volcanic plume during the eruptions of Asama Volcano in 2004 detected by IR imagery

Tsuneomi Kagiya[1]; Etsuro Koyama[2]

[1] Graduate School of Science, Kyoto University; [2] Earthquake Research Institute, Univ. of Tokyo

It has been recognized that volcanic plume has a certain kind of time variation according to the volcanic activity. In recent years, acquisition and processing techniques for a continuous infrared or visible image has been developed to examine a variation of volcanic plume easily. Kagiya et al. (2000) and Hiyama et al. (2002) examined volcanic plumes of the 2000 Eruption of Usu Volcano, and found a periodic variation in 12 seconds. It is very interesting if such a rhythm commonly exists or not in other volcanoes. It is also interesting if such a rhythm depends on a state of volcanic activity. Moreover, it is necessary to verify a reliability of the result, because the development of this analysis is on the way. From this viewpoint, visible and infrared images were taken in many volcanoes, and the analysis was tried.

In Asama Volcano, we have carried out infrared observation since August 2002, and succeeded to capture the successive imageries before and after the eruptions in 2004. We could detect long and short term variations in volcanic plumes during these 2 years. This paper presents some results in Asama Volcano.

We could detect long term variation as follows. The quantity of the volcanic plume has been decreased after minor eruptions in April, 2003. In February and March 2004, IR imagery could not detect any anomalous plume. However, the quantity of the volcanic plume turned to increase from April, and large anomalous plume was observed on July 25. According to the GPS observation by Geographical Institute, dyke intrusion was detected beneath Asama in the end of July. The activity of volcanic plume continued to be high by the middle of August, and decreased at the end of August, just before the eruption on September 1. The height of the volcanic plume was low just after the eruption, but turned to increase from September 13, and eruptions occurred again from September 14. Especially, minor eruptions occurred successively from September 16 to 17. After the successive minor eruption stage, large explosions occurred intermittently and the height of the plume turned to decrease. This variation of the height of the plume reflects the change of the volcanic activity.

We could detect short term variation as follows. Volcanic plume showed a certain time variation in all period. We got time series data of the average temperature on the certain vertical line, which is crossed by volcanic plume, and examined a spectrum analysis. As a result of analysis, some peaks were confirmed at the multiple of 0.0025Hz at 4 AM. And this peak was found to move from low frequency to high according to the eruptive activity; 0.007Hz at 7 AM. This result indicates that Asama Volcano has some resonance beneath the crater (conduit), and the characteristic length of the conduit changed to be short during the successive minor eruptions. After this successive minor eruption stage, lava cake was found within the crater. This evidence is consistent with our estimates.