Short period variation of volcanic plume of Usu Volcano detected by IR imagery

Tsuneomi Kagiyama[1], Youhei Hiyama[2], Takayuki Kaneko[3], Jun-ichi Hirabayashi[4]

[1] Earthquake Research Institute, University of Tokyo, [2] ERI, Univ. of Tokyo, [3] Volc. Res. C., ERI, Univ. Tokyo, [4] VFRC, Tokyo Inst. Tech.

http://hakone.eri.u-tokyo.ac.jp/vrc/kagiyama/index.html

Volcanic smoke seems to be breathing, and its intensity depends on the volcanic activity. Is it true? And what physical parameter decides the situation? The authors carried out the IR observation in Usu Volcano after the 2000 Eruption; in April, September and December in 2000. We used TVS2000MK2 by Nippon Avionics Co., and installed it 1.6 km northwest from the active vent. 512 frames of IR imagery are recorded in a certain time intervals. We selected the intervals in 0.1 sec and 1sec. We set up a certain horizontal line in the imagery, and examined the maximum temperature of the smoke, which crosses this line. By tracking the maximum temperature for all 512 imageries, we got a temporal variation of the temperature of volcanic smoke. Comparing a result in April, September and December, the following interesting evidence was found. The maximum temperature showed a temporal change in the period for about 4 seconds in April, and this period changed to be longer in September and December. And a harmonic vibration of the temperature was found by the spectrum analysis. The fundamental period was defined around 10 seconds for all stages, but the higher mode was remarkable in April. This fact may give the impression that the activity of the smoke declined. The length of the tube is estimated from the fundamental period and the velocity of the medium within the tube. Since the velocity of the mixture of water and steam is extremely less than water, about 20-30 m/sec, the length of the tube is estimated about 200-300 m. This value is consistent of the depth of the water saturated layer beneath the crater zones obtained by electromagnetic survey by Mogi(2002). These facts suggest that phreatomagmatic explosions were triggered by the oscillatory variation of the pressure of water saturated layer.