Video observation for volcano monitoring and prediction

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Various techniques are used in the volcano observation. The video image becomes an important information source for the description of volcanic eruption and the confirmation of eruption. At the present, it became possible that video images are recorded continuously including the night time, and that it is monitored from the remote location by the advance on the video imaging technique and communication technology.

The meteorological conditions affect the volcanic plume. However, volcanic activity is well reflected, and the precursor is done to the eruption. The video monitoring at the volcano becomes the importance on not only observation of the eruption but also non-eruptive volcanic plume observation. Visual observation such as height and quantity, color of volcanic plume was carried out, when the Japan Meteorological Agency was started in 1962. The technique for quantitatively evaluating the volcanic plume activity by using a monitoring video camera and an infrared camera by the Meteorological Research Institute was studied during 1980-84, and then the monitoring TV camera was installed at Kusatsu-Shirane volcano in 1985. At the present, the high-sensitive TV camera was installed at 22 volcanoes (Meakan, Tokachi, Usu, Tarumae, Hokkaido-Komagatake, Iwate, Bandai, Azuma, Adatara, Nasu, Asama, Kusatsu-Shirane, Ontake, Izu-Tobu Volcano Group, Izu-Oshima, Miyakejima, Unzen, Aso, Kuju, Kirishima, Sakurajima, and Satuma-Iwojima) and it would be able to be monitored in semi-real time from the remote site. The parts of these images are opened to public at the Web site of the Japan Meteorological Agency.

Some cases of evaluating volcanic activity by the quantitative analysis of the video images are discussed.

1) Volcanic plume activities of Usu and Miyakejima volcanoes

It is possible to estimate the thermal energy discharged from the volcano and H2O emission by using the video image analysis of the volcanic plume. The recent improvement of the personal computer facilitated the video image analysis. Therefore, it make possible that we apply the plume rise method (Kagiyama, 1978) for the video image data of enormous quantities and we obtain the detailed time change of heat discharge rate. We analyzed the image data of volcanic plume of the recent volcanic eruptive activities, i.e. the 2000 eruption of Usu volcano, and the degassing activity of Miyakejima volcano which began at August 2000. And then the end-of-eruption predicted from these data in the 2000 eruption of Usu volcano.

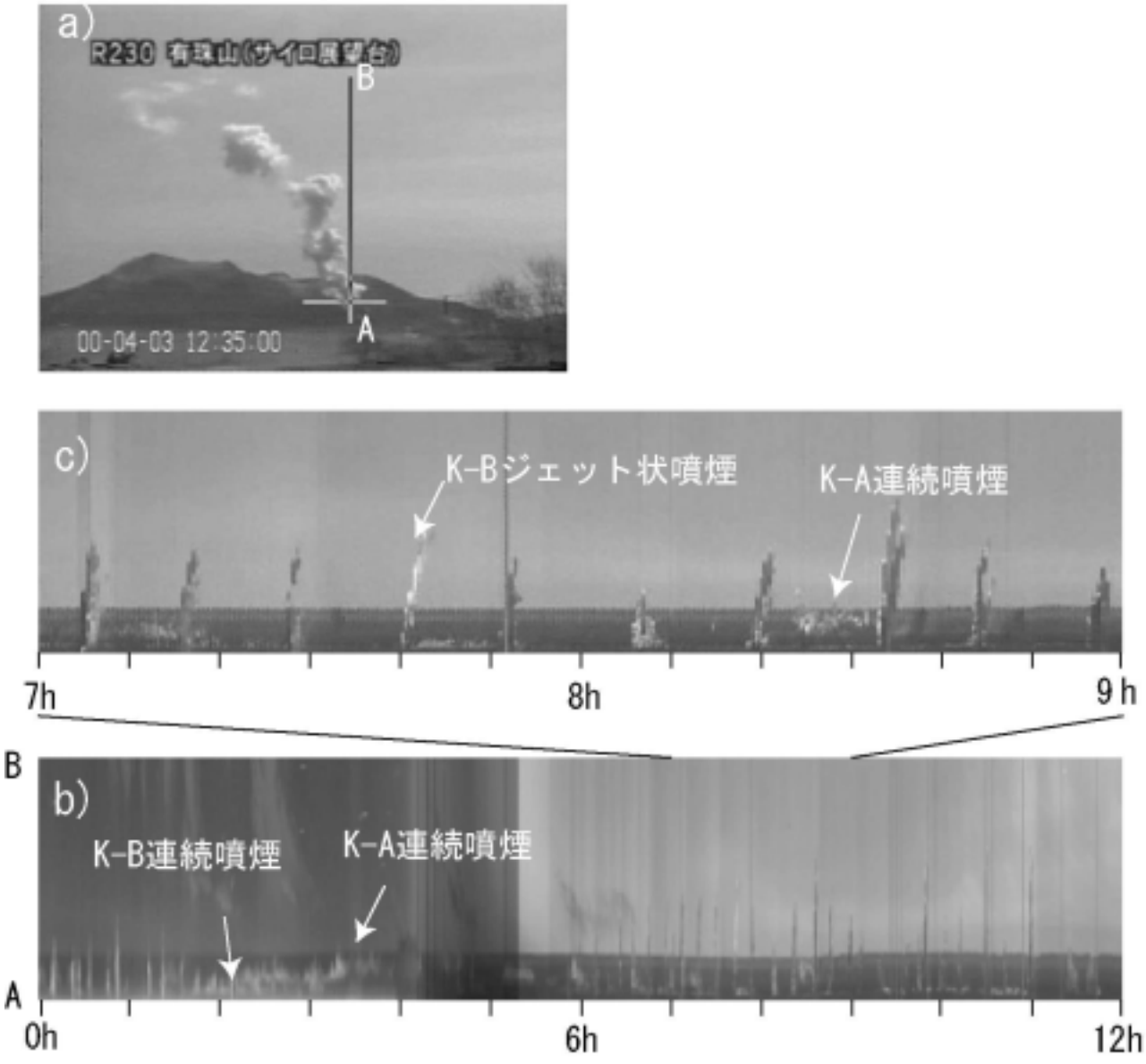
2) Dome growth and degassing at Unzen volcano

The detailed temporal changes of flow speed, thickness and height of lava dome have been obtained from the video images, theodolite observation, and photographic observation (Fukui, 1993). The flow speed of lava reflects the effusion rate of lava approximately. The flow speed was increased at the new lobe appearance, and it gradually decreased afterwards, and the aspect that the new lobe appeared was shown when it sufficiently decreased.

The average heat discharge rate and the flux of the magmatic water were estimated as 1600 MW and 370-440 kg/s, respectively. H2O flux was estimated as 83 kg/s from SO2 flux measured with COSPEC and the chemical composition of the high temperature volcanic gas (Hirabayashi et al., 1995). The difference of these H2O flux shows the different degassing process between H2O and SO2 (Fukui, 2002).

3) Application of the time-space video image

The time-space video image is create by to connect the strip images of each time. Figure a is an example of video image of the plume activity at Usu volcano on 3 April, 2000. Figures b and c are create by to connect the strip image AB in Figure a (the length and width of AB is 1920 m and 30 m, respectively). We can distinguish each eruption and are easy to understand the plume activity during the day.


a)
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B
A
00-04-03 12:35:00
c)
K-Bジェット状噴煙
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7h
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b)
K-B連続噴煙
K-A連続噴煙
A
0h
6h
12h