High concentration events of volcanic gas at the foot of Mt. Sakurajima and the behavior of volcanic clouds

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Abstract:

One-hour values of SO2 and SPM for one year in 1999 at four stations at the foot of Sakurajima Volcano are studied by comparing with ground observation images and meteorological data. Ground observations were done at four points at the other sides of the half-island Sakurajima as follows:

T: Tarumizu, 10.5 km SSE from the crater, by digital camera and video recorder.
B: Shin-Kamoike, 9.8 km WSW from the crater, by video recorder.
I: Iso, 10 km WNW from the crater, by digital camera once in a morning.
C: Terayama, 10 km NW from the crater, by video recorder.

At the points T, B and C, the video recordings were done by interval mode of 6-8 sec, while the digital camera at T was put in one-hour interval mode.

For meteorological data, we use upper wind data of 925 hPa at Kagoshima Local Meteorological Laboratory, and the mean sea level analysis.

We found that the main cause of high SO2 concentration events at all of the stations is when the winds around the summit are high enough to blow down the volcanic plume and gases to a measuring station downstream. Another mechanism is daytime convective mixing in good weather with mild or weak winds. The SPM data exhibit a strong correlation with the increase of the SO2 concentration in some cases, while in some cases without correlation. There are other causes of high concentration events of SPM, such as Asian dust, characterized by a universal rise in different stations.

There are seasonal variations at four stations for the times when the SO2 concentration exceeds 100 ppb. At Arimura station 2.7 km S from the crater, high concentration events are seen frequently in winter, when low-pressure systems lie to the east, resulting in strong northery winds. Oppositely, at the town office station 4 km NNW from the crater, the events are occasionally be seen in summer with strong southerly wind. At Kurokami station 5 km ENE from the crater, the events are seen in May, June and August, while at Akamizu station 5 km west from the crater in March, October and November, due to anti-clockwise winds around a low pressure system near the north or south of southern Kyushu. In most cases with video observation, volcanic plumes were found to be blown down toward a station often exhibiting the mountain lee wave. The temporal variation of the SO2 densities is very strong, following changes of the wind direction.