

Mechanism of high concentration events of sulfur dioxide at the surface around Sakurajima Volcano

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One hour data of SO₂ and SPM (Suspended Particulate Matter) at 20 surface stations in Kagoshima Prefecture for eleven years since 2001 were analysed, together with dispersion images of Sakurajima plumes obtained by automatic long-term recordings at the sites 10-15 km away from the source at different directions supplemented by occasional satellite data and meteorological information.

Yearly variation of high concentration events of SO₂ and SPM reflected the eruptive activities of Minamidake crater at the summit, which gradually decreased in this century, and Showa crater at the eastern shoulder of the mountain, which started in 2006 and has become very active since 2009. Temporal variation of the events depends strongly on the direction and distance of a site from two nearby sources, and the meteorological condition which may change within few hours. The advection of SO₂ and SPM from the volcano can be inferred from plume images, as the volcanic gas tends to behave together with the plume.

When the upper wind is strong enough, exceeding 10 m/sec at 925 hPa which is close to the summit height, the plume tends to be blown down to the foot of the mountain and then rises somewhat following the pattern of mountain-lee wave. If there is a station at the foot in a narrow area downstream from the source, one may find high concentration of SO₂ exceeding 100 ppb and associated SPM in many cases. In the narrow area downwind of the plume, relatively high concentration events may often be seen at a distance 20-40 km from the source.

When there is a calm wind, the plume rises a few hundred meters or more from the crater, and the concentrations of SO₂ and SPM at the surface stay rather low. The situation is similar in the case of a big eruption with heavy ash-fall, which are mostly coarse-grained near the volcano. However, high SO₂ concentrations at the ground may also happen in light winds when convective mixing on sunny days brings the SO₂ (and SPM) back to the ground level at the downstream.

In some cases, SPM is almost lacking in a plume classified as white one with little ash components. On the other hand, an overall increase of SPM was sometimes found at almost all stations owing to the drift of Asian dust or polluted air from Chinese continent.