

Causes leading to enhancements in sulfur dioxide concentration observed by MAX-DOAS in Kyusyu

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We performed continuous observations of sulfur dioxide (SO₂) using the Multi-Axis Differential Optical Absorption Spectroscopy (MAX-DOAS) at Kasuga in Kyushu, Japan. Spectra measured at 310-320 nm were analyzed with the DOAS method to retrieve mean SO₂ concentrations for a 0-1 km layer with a horizontal scale of about 10 km. This spatial scale is expected to provide useful inputs for data assimilation. First, we focused on data acquired in July-August 2014. In the period, seven days were identified as the SO₂ level was high (>5 ppbv). Back trajectory analysis indicates that there were two categories; the one from a volcanic origin (the Aso volcano and the Sakurajima volcano) and the other from a continental origin (China and Korea). Based on these results, we performed quantitative analysis using data obtained from January 2014 to September 2016. The mean and the median of the daily maximum SO₂ concentrations in the period were 3.3 and 2.1 ppbv, respectively. We investigated the dependence of the observed SO₂ level on the size of the range to judge whether the observed air masses passed over volcanoes and found that the higher SO₂ concentrations were observed in air masses that passed closer to volcanoes. The mean of the daily maximum SO₂ values affected by the Aso volcano was about 6 ppbv, which is larger than that for the Sakurajima volcano (4 ppbv), suggesting that the influence of the Aso volcano was larger. To consider the continental effect, we analyzed relations between SO₂ and the length of residence time over China or Korea and between SO₂ and the time required for reaching Kasuga from China or Korea. However, no significant correlation was observed. In this case, the mean of the daily maximum SO₂ values was about 2.4 ppbv. The results were unchanged even if only influences of urban areas in China or Korea were considered. These results suggest that the impact of long-range transport of air pollution from China or Korea on enhancements in SO₂ concentration was smaller than that of volcanoes in Kyusyu. In this presentation, we will also discuss results of analysis including the explosive eruptions of the Aso volcano occurred on 8 October, 2016.

Keywords: SO₂, MAX-DOAS, volcano