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諏訪之瀬島火山における二酸化硫黄放出率の自動観測と地震観測との比較
Automated sulfur dioxide flux observation at Suwanosejima volcano, Japan, and comparing to seismic data

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Suwanosejima is a remote volcanic island located about 240 km south-southwest of Kagoshima city, Kyushu Island, Japan. This volcano has been erupting very frequently since early-1950s, and is one of the most active volcanoes in Japan. Previous studies on sulfur dioxide (SO_2) flux measurement of Suwanosejima are very limited and reported that daily average SO_2 flux from this volcano ranged about 5–15 kg/s [Mori et al., 2004; Hirabayashi et al., 2005]. Therefore, we conducted automated SO_2 flux measurement at Suwanosejima volcano to understand SO_2 flux variation with long-term observation at Suwanosejima volcano and to evaluate a relation between SO_2 flux and seismic data.

We developed automated SO_2 flux measurement system to conduct automated observation in such a remote island. The power consumption of the scanning instrument was significantly improved compared to that in the previous studies. The observation was conducted for January 21, 2013–May 7, 2013 (Period I) and November 5, 2013–the present (Period II). The observation system has been working without any trouble for more than 200 days in total showing robustness of the developed system.

SO_2 flux was calculated with a corrected differential optical absorption spectroscopy method for radiative dilution effect [Mori at al., 2006; Kern et al., 2009]. In the observation period of over 200 days, SO_2 flux was calculated for 40 days. The average SO_2 flux in the total observation period was 13.4 kg/s, which ranged from 5.9 kg/s to 34.5 kg/s. The average and the standard deviation in Period I were 16.9 kg/s and 6.2 kg/s, and those in Period II were 14.0 kg/s and 5.7 kg/s, respectively.

Since previously reported SO_2 flux in 2000s [Mori et al., 2004; Hirabayashi et al., 2005] were not corrected for the dilution effect, these values might be significantly underestimated. The average and the standard deviation of uncorrected SO_2 flux for the dilution effect in this study were 9.7 kg/s and 4.3 kg/s. This range was comparable to the range of the previous studies in 2000s. Considering above, SO_2 flux range has been stable since at least 2000s.

Surface and seismic activities in Period I (January 21–May 7, 2013) significantly differed from those in Period II (November 5, 2013–the present). Period I was in a continuous volcanic tremor period (September 2012–July 2013), and Period II was in an intermittent explosions and volcanic tremors period. In contrast to the surface and seismic activities, SO_2 flux variations in Period I and II were almost in the same range. This implies that degassing rate of magma for these two periods were similar. Therefore, the difference of surface and seismic activities which was observed in these periods needs to be explained considering the stable degassing magma rate.

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