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High Concentrations of Sulfur Dioxide and Sulfate Particles Observed in Suzu City, the Noto Peninsula in Late July 2012: On the Influence of the Smoke of Sakurajima

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Abstract

Measurements of SO₂ and sulfate aerosol concentrations in the atmosphere were performed in Suzu City, the Noto Peninsula, Ishikawa Prefecture in the summer of 2012. High concentrations of SO₂ and sulfate aerosols in PM_{2.5} were observed in late July when CO and O₃ concentrations did not increase. The high SO₂ and sulfate particles may not be due to anthropogenic air pollution. According to the atmospheric pressure pattern in summer and the results of trajectory analyses, the air mass over the Noto Peninsula was transported from the southern part of Kyushu. The large eruption of Sakurajima occurred on 24 July in 2012, and the fumes were transported to the Hokuriku district. Recently, the volcanic eruptions of Sakurajima have increased in activity and may highly affect the air environment, such as PM_{2.5}, over Japan.

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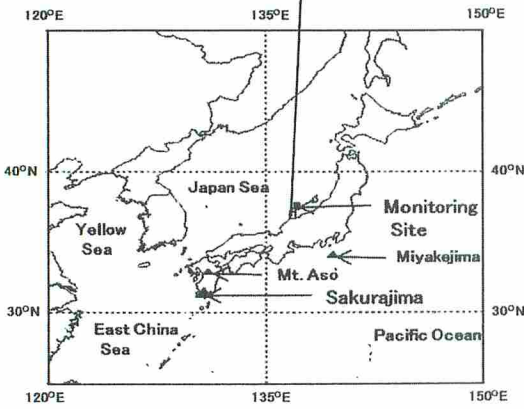
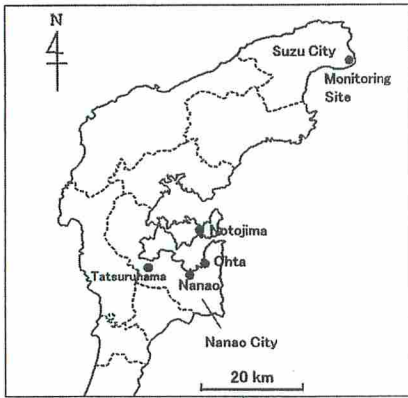


Fig.1 Map of Japan showing the locations of the monitoring site in Suzu City and Sakurajima. The locations of the air pollution monitoring stations (Notojima, Tatsuru-hama, Nanao and Ohta), Noto Peninsula, Ishikawa Prefecture are also shown.

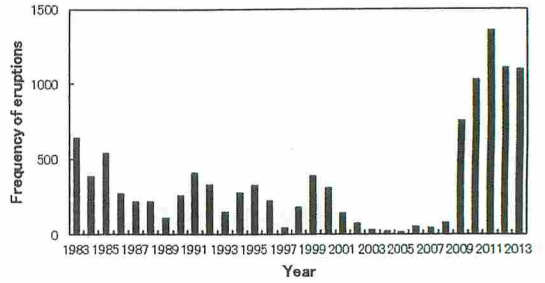


Fig.2 Annual frequency of eruptions of Sakurajima from 1983 to 2013. The data from Kagoshima Local Meteorological Observatory (http://www.jma-net.go.jp/kagoshima/vol/data/skr_erp_num.html) were plotted.

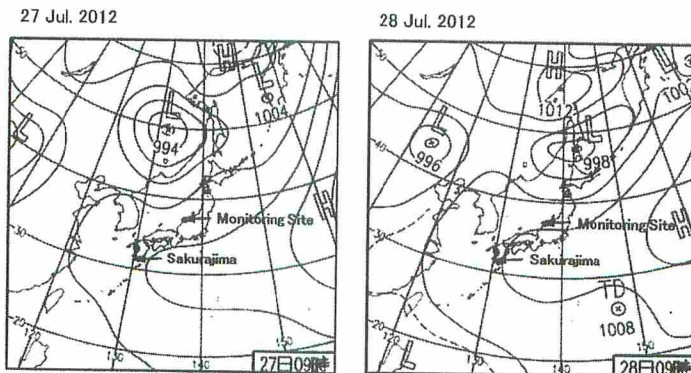


Fig.4 Surface weather charts at 09 JST (00 UTC) on 27 July (left panel) and 28 July (right panel) in 2012.

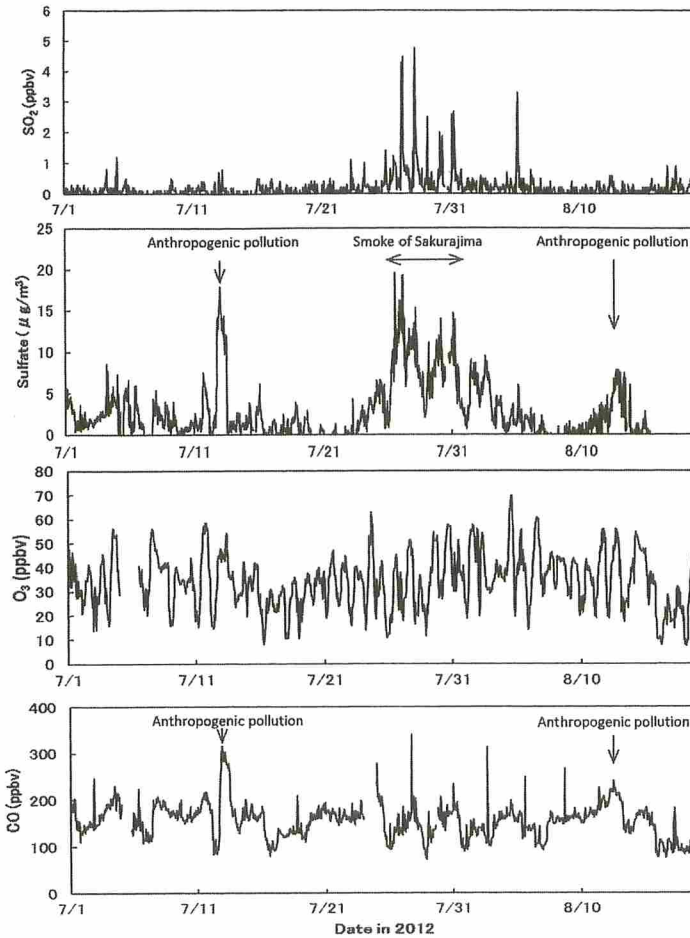


Fig.3 Time series of SO₂, sulfate, O₃ and CO concentrations in Suzu City in the summer (July and August) of 2012. Hourly data of SO₂, O₃ and CO concentrations and 30 minute data of sulfate concentrations were plotted. Measurements of sulfate particles were performed until 15 August.

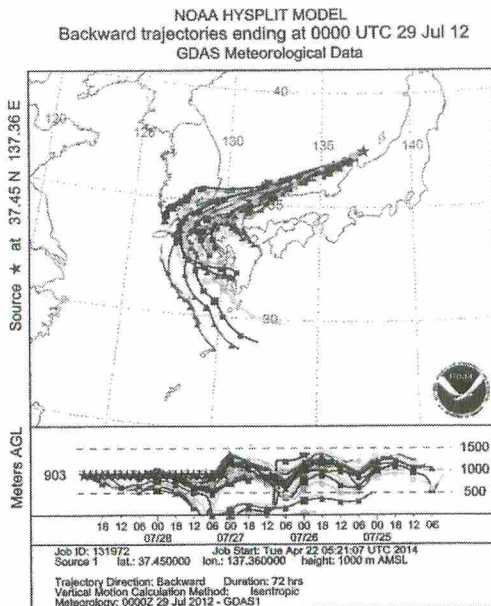
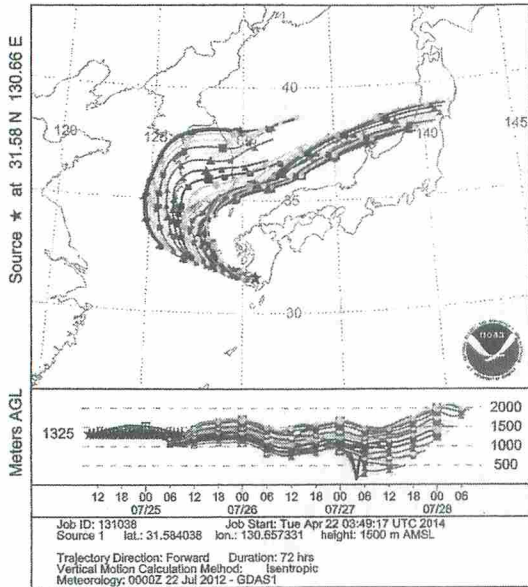


Fig.5 Results of 3-day backward trajectory analyses; the starting times are 09 JST (00 UTC) on 27 July- 09 JST (00 UTC) on 29 July (every 2 hour) in 2012.

NOAA HYSPLIT MODEL
Forward trajectories starting at 1000 UTC 24 Jul 12
GDAS Meteorological Data



NOAA HYSPLIT MODEL
Forward trajectories starting at 1000 UTC 24 Jul 12
GDAS Meteorological Data

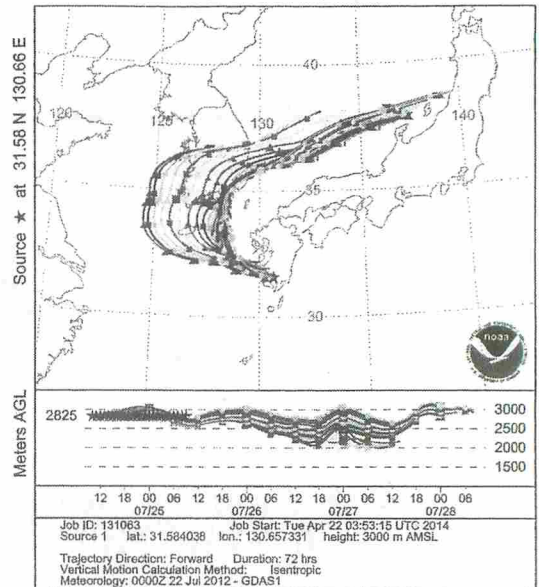
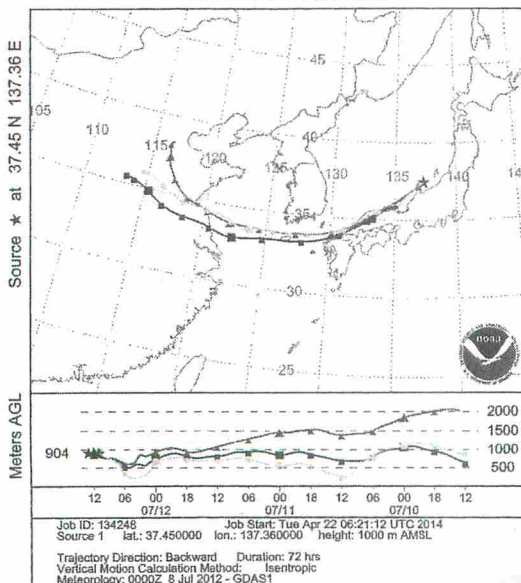


Fig.6 Results of 3-day forward trajectory analyses; the starting times are 19 JST (10 UTC) on 24 July- 18 JST (09 UTC) on 25 July (every 1 hour) in 2012. The starting heights are 1500 m a.s.l. (left panel) and 3000 m a.s.l. (right panel).

NOAA HYSPLIT MODEL
Backward trajectories ending at 1300 UTC 12 Jul 12
GDAS Meteorological Data



NOAA HYSPLIT MODEL
Backward trajectories ending at 1500 UTC 12 Aug 12
GDAS Meteorological Data

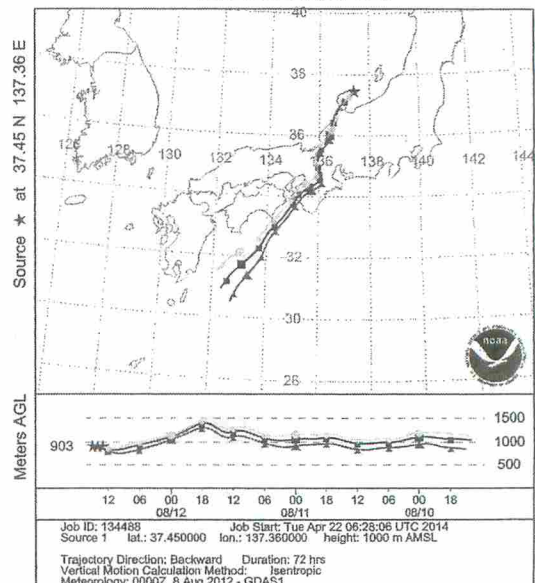


Fig.7 Results of 3-day backward trajectory analyses; the starting times are 20 JST (11 UTC) - 22 JST (13 UTC) on 12 July (left panel) and 22 JST (13 UTC) - 24 JST (15 UTC) on 12 August (right panel) in 2012.

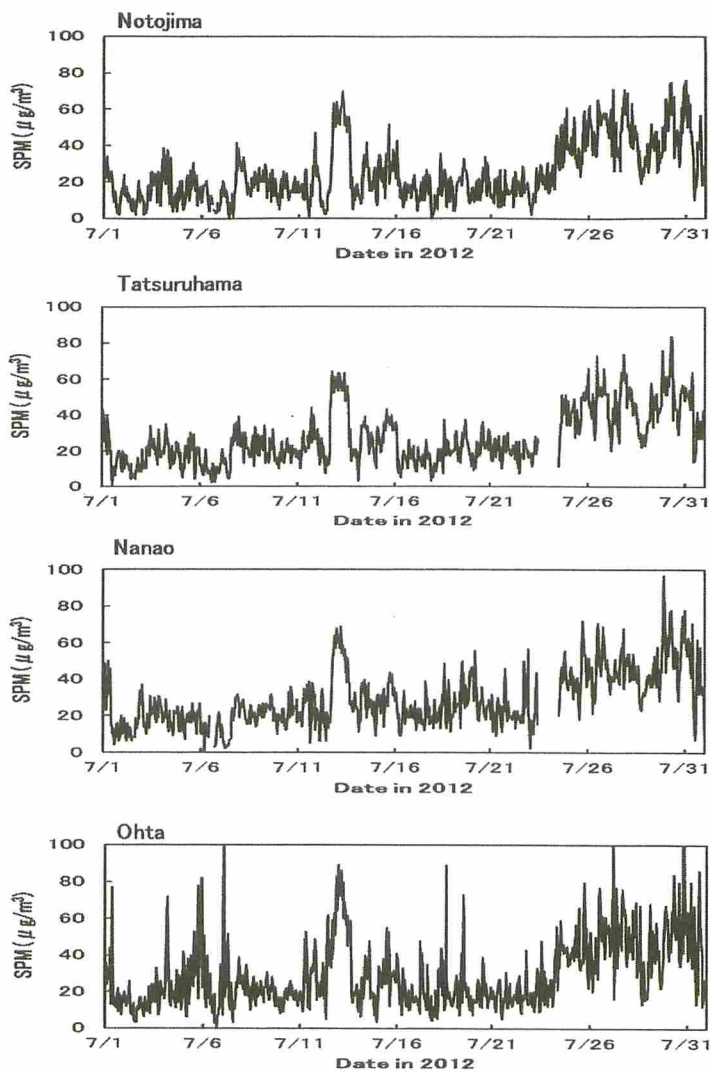


Fig.8 Time series of SPM concentrations in Nanao City (Notojima, Tatsuruhama, Nanao and Ohta) in July 2012. Hourly data were plotted.

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