

Seasonal variations of triple oxygen isotopes of atmospheric nitrate and sulfate at Noto Peninsula, Japan

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Anthropogenic activities have increased emissions of nitrogen and sulfur from land to the atmosphere. By recent increase of the anthropogenic pollutants in the atmosphere, atmospheric oxidative capacity can be changed in the east Asia. An understanding of changes in the oxidizing capacity of the atmosphere is also relevant for air quality managers, but it is not easy because of oxidant's instability and multiple competing effects. The magnitude of ¹⁷O enrichment ($\Delta^{17}\text{O}$) in atmospheric nitrate and sulfate are unique tracers for the apportionment of different oxidation pathways [1]. Thus, based on $\Delta^{17}\text{O}$ in atmospheric nitrate and sulfate, it is possible to predict oxidizing capacity (i.e. relative importance of oxidants) in the atmosphere. In this study, we present seasonal variations of $\Delta^{17}\text{O}$ values in atmospheric nitrate and sulfate collected at at NOTO Ground-based Research Observatory (NOTOGRO) (37.5°N, 137.4°E) located at the north coast of Noto Peninsula, Japan.

The $\Delta^{17}\text{O}$ values of nitrate showed the clear seasonal variations with summer minimum and winter maximum. This trend is resulted from the seasonal changes in the O_3/HO_x ratios decreasing in summer by ozone destruction and HO_x production (e.g. OH, HO_2 radicals) via UV irradiance. For the $\Delta^{17}\text{O}$ values of sulfate, on the other hand, did not show clear seasonal variation and ranged around 0.7 to 1.5‰, being slightly higher than those observed in Wuhan, central China [2]. This small seasonality indicates that SO_2 oxidation by O_2 catalyzed by transition metal ions is dominant pathway producing sulfate, but higher $\Delta^{17}\text{O}$ values of sulfate indicates the relative importance of oxidation process via O_3 in long transportation from the continent. Additionally, the drop of $\Delta^{17}\text{O}$ values of sulfate was observed at the period of the tropospheric volcanic eruption occurred in Kyushu area.

[1] Alexander and Mickley (2015) *Curr. Pollution Rep.* **1**, 57–69. [2] Li *et al.* (2013) *Atmos. Environ.* **81**, 591-599.