Triple oxygen isotopic compositions of atmospheric nitrate and sulfate in the Pacific Ocean boundary layer

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The oxidation reactions in the atmosphere play significant roles to influence the lifetimes and the abundances of atmospheric trace compounds (e.g., CH_4, CO). It is hence important to understand the abundances of atmospheric oxidants and the magnitudes of their contribution to oxidation processes, what is called “oxidative capacity“. Marine boundary layer has characteristic oxidative capacity induced by high solar radiation and humidity throughout the year which results in destruction of ozone [1]. However, the relative importance of the oxidation processes in the marine boundary layer are not fully understood [2]. In order to investigate the oxidative capacity, triple oxygen isotopic compositions ($\Delta^{17}O$) of atmospheric nitrate (NO_3^-) and sulfate (SO_4^{2-}) are used as unique tracers. The NO_3^- and SO_4^{2-} formed via O_3 oxidation possess high $\Delta^{17}O$ values, while the NO_3^- and SO_4^{2-} formed via other oxidants like HO_x possess low $\Delta^{17}O$ values. In this study, we measured $\Delta^{17}O(NO_3^-)$ and $\Delta^{17}O(SO_4^{2-})$ values of atmospheric aerosols collected in the Pacific Ocean from 31°S to 64°N during two cruises of R/V Hakuho Maru (KH-13-7 and KH-14-3).

The $\Delta^{17}O(NO_3^-)$ values were widely distributed in the range of 21-32‰ and the $\Delta^{17}O(NO_3^-)$ values in winter of the North Pacific Ocean were higher than the values in summer of the South Pacific Ocean, indicating that the contribution of O_3 and OH radical in oxidation processes were different between summer and winter. On the other hand, the $\Delta^{17}O(SO_4^{2-})$ insignificantly varied in the range of 0-1.5‰. Based on the results, we discuss the atmospheric oxidative capacity in the marine boundary layer over the Pacific Ocean.

[1] Read et al. (2008) *Nature* **453**, 1232–1235. [2] Savarino *et al*. (2013) *Proc. Natl. Acad. Sci.* **110**, 17668-17673.