

Development of a large volume sampling system for measuring stable isotope analysis of carbonyl sulfide and field observation

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Carbonyl sulfide (OCS) is the most abundant sulfur-containing gas in the ambient atmosphere, with an average mixing ratio of 500 parts per trillion (ppt) by volume in the troposphere. OCS is suggested as a sulfur source of the stratospheric sulfate aerosols (SSA) which plays an important role for Earth of radiation budget and for ozone depletion. Moreover, since leaves consume OCS whenever they are assimilating CO₂ with same process but plant does not emit OCS to atmosphere by respiration, OCS provides a means to partition net ecosystem exchange into gross primary production (GPP) and respiration on land. Nevertheless, current figures for tropospheric OCS sources and sinks carry large uncertainties.

Isotope analysis is a useful tool to trace sources and transformations of trace gases. Very recently, Angert et al. (2019 Sci. Rep.) reported d³⁴S value at Israel and Canary Island for tropospheric OCS using a gas chromatograph (GC)/multi collector-inductively coupled plasma mass spectrometer (MC-ICP-MS). For the measurement of sulfur isotope ratios of OCS in our laboratory, an online method measuring on a GC/isotope ratio (IR)-MS using S⁺ fragmentation ions had been developed (Hattori et al., 2015). This method supports simple analysis of sulfur isotopic compositions of OCS over 8 nmol. However, application this method for atmospheric samples has yet to be done by this GC/IR-MS method, because of the large sample amounts that are necessary (i.e. 500 L of 500 pmol mol⁻¹ OCS). Therefore, we developed a large volume air sampling system to apply S⁺ IR-MS method for atmospheric samples and we observed d³⁴S value in Suzukakedai campus at Yokohama (Kamezaki et al., 2019 Atmos. Meas. Tech.).

We will discuss the difference between the result of Angert et al. (2019) and our observation. Additionally, we also report the result in field campaign using our developed method.

Keywords: Carbonyl sulfide, Sulfur isotope, atmospheric trace components