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Sulfur and carbon isotope measurements of carbonyl sulfide (COS) from small air samples using GC-IRMS

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Carbonyl sulfide (COS) is the most abundant sulfur-containing trace gas in the atmosphere, with an average mixing ratio of 500 parts per trillion (ppt). It has a relatively long lifetime of about 2 years, which permits it to travel into the stratosphere. There, it likely plays an important role in the formation of stratospheric sulfur aerosols (SSA), which have a cooling effect on the Earth's climate. Furthermore, during photosynthetic uptake by plants, COS follows essentially the same pathway as CO_2, and therefore COS could be used to estimate gross primary production (GPP). Unfortunately, significant uncertainties still exist in the sources, sinks and global cycling of COS, which need to be overcome. Isotopic measurements of COS could be a promising tool for constraining the COS budget, as well as for investigating its role in the formation of stratospheric sulfur aerosols.

Within the framework of the COS-OCS project, we developed a measurement system at Utrecht University using GC-IRMS that can measure $\delta^{33}S$ and $\delta^{34}S$ from S^+ fragment ions of COS from small air samples of 2 to 5 L. This system was recently expanded to also measure $\delta^{13}C$ from the CO^+ fragment ions of COS, which has never been measured before. We will present the preliminary results from a plant chamber experiment conducted at Wageningen University, in which one of the goals was to quantify the COS uptake and isotopic fractionation factors of different C3 and C4 plants.