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Isotopic Measurements of Carbonyl Sulfide: The First Results from Semi-continuous Outside Air Measurements in the Netherlands

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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 new measurement system at Utrecht University, that can measure $d^{33}S$ and $d^{34}S$ from COS from small air samples of 2 to 5 L. The aim of the project is to perform a global-scale characterization of COS isotopes by measuring seasonal, latitudinal and altitudinal variations in the troposphere and stratosphere. We will present the newest results from a series of semi-continuous outside air measurements in the Netherlands during the fall and early winter of 2020/2021. The measurement results are interpreted with the help of backward trajectory analyses to characterize the influence of different wind directions and air origins on the COS concentration and isotopic composition.