3.040 Carbonyl Sulfide: new ways of Observing the Climate System.

Presenting Author:

Maarten Krol, Meteorology and Air Quality, Wageningen University, Netherlands, , maarten.krol@wur.nl

Co-Authors:

Kazuki Kamazaki, Tokyo Institute of Technology, Tokyo, Japan

Shohei Hattori, Tokyo Institute of Technology, Tokyo, Japan

Naohiro Yoshida, Tokyo Institute of Technology, Tokyo, Japan

Elena Popa, Institute for Marine and Atmospheric Research, Utrecht University, Netherlands

Linda Kooijmans, Centre for Isotope Research, University of Groningen, Netherlands

Huilin Chen, Centre for Isotope Research, University of Groningen, Netherlands

Abstract:

The future climate of our planet strongly depends on the capacity of the biosphere to sequester atmospheric CO_2, and on the abundance of stratospheric sulfate aerosols (SSA). These aerosols form a layer that resides at about 16 km altitude that, contrary to CO_2, has a cooling effect on climate. These two climate-regulating mechanisms are intricately linked to the atmospheric trace gas carbonyl sulfide (COS).
COS is the most abundant sulfur compound in our atmosphere. The dominant COS source is biogenic activity in the ocean, while uptake by the terrestrial biosphere, and a small amount of destruction in the stratosphere, contribute to its removal. The COS loss to the biosphere could potentially be used to quantify photosynthetic CO_2 uptake, while its stratospheric destruction is an important precursor for the formation of SSA. A deeper understanding of atmospheric COS variations would therefore signal a major step forward in our ability to diagnose CO_2 uptake and SSA formation.
We recently started an ERC-funded research program (COS-OCS) to fundamentally improve our limited understanding of the COS budget. The program will combine innovative modelling and measurements, including air core and highly challenging analyses of COS isotopologues. In this overview, recent scientific insights will be presented concerning the exchange of COS with the biosphere. These insights include evidence of night-time uptake by vegetation, bidirectional COS exchange from soils, and isotopic fractionation during COS uptake by bacteria. Subsequently, I will highlight the main uncertainties in the COS budget, and prospects for combined modelling and measurement activities to reduce these uncertainties.