Pre-Industrial Carbonyl Sulphide studied by 1-D photochemical model, future implications

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Carbonyl sulfide (OCS) has a large lifetime for tropospheric consitions making it the most abundant reduced sulfur compound in the atmosphere. Stratospheric oxidation of OCS produces a sulfate aerosol layer between 17 and 30 km. This stratosppheric sulfur aerosol (SSA) also known as the Junge Layer affects the planet's Albedo and catalysis the hydrolysis of N_2O_5, promiting mid-latitude ozone deplition. While volcanic eruptions are an important source of stratospheric sulfate they are sporadic. Recent studies have extended the isotopic database and hte kinetic data related to this compound. Ice core studies show that pre-industrial tropospheric levels of OCS were 372 ppt while current levels are 500 ppt. In this study, we create a 1-D photochemical model that includes stable isotopes has an additional tool for model calibrations and consider the historical variation of anthropogenic emissions of OCS and its tropospheric precursor CS_2.

In orer to calculate the OCS atmospheric vertical profile, we developed a one-dimensional photochemical model that takes into account chemistry, transport, deposition, stable isotopes, and high-resultion UV absorption spectrum. This last feature is important since the main isotopic imprint if the stratospheric oxidation pathway of produced by photo-dissociation. The combinationod the updated kinetic isotopic data with different emission scenarios presents a new hypotheis that challenges the current understanting of the stratospheric sulfur aerosol. Our fidings show that 34% of today's SSA is anthropogenic. Furthemore, the anthrpogenic contribution to SSA means that an estimate of -0.16 Wm^2 of radiative forcing should be accounted in pre-industrial pollution-free models.

Keywords: SSA, Pre-Industrial

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