Geophysical Research Abstracts, Vol. 8, 06913, 2006
SRef-ID: 1607-7962/gra/EGU06-A-06913

Exchange of Carbonyl sulfide (COS) between soils and the atmosphere depends on diffusivity dominated by water filled pore space

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Carbonyl sulfide (COS) is an important atmospheric trace gas involved in stratospheric aerosol production and the ozone cycle. Sinks and sources seem to be well balanced but obviously poorly understood. In addition to the vegetation, soils are now regarded as an important sink. Soil samples are investigated for their exchange of Carbonyl Sulfide (COS) with the atmosphere under controlled ambient conditions. The measurements are performed with two dynamic enclosures (cuvettes), one enclosing the soil sample and the other serving as an empty reference. The results are obtained in high time resolution with a fully automatic Sulfur Gas Analyzer (SUGAR) performing an analysis every 15 minutes. COS is fully automatically sampled by cryogenic trapping and analyzed on a gas chromatograph equipped with a flame photometric detector. The exchange is investigated for different arable soils from China, Siberia, South America, Germany and Finland to be parameterized in relation to the ambient COS concentration, temperature and soil water content. Based on our data exhibiting a clear and sharp optimum for COS-uptake, we discuss the soil water content as an important biological and physical parameter to characterize the exchange of COS between soil and the atmosphere. Different COS uptake optima related to the soil water content of different soil types, which were analyzed, disappear when the uptake is related to the water-filled pore space (WFPS), a parameter depending on soil water content and structure.