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- [Volumes and Issues](#)
- Special Issues
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- Title and Author Search

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Review

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[Volumes and Issues](#) [Contents of Issue 3](#)

Atmos. Chem. Phys., 2, 171-181, 2002
www.atmos-chem-phys.net/2/171/2002/

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The flux of carbonyl sulfide and carbon disulfide between the atmosphere and a spruce forest

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Abstract. Turbulent fluxes of carbonyl sulfide (COS) and carbon disulfide (CS₂) were measured over a spruce forest in Central Germany using the relaxed eddy accumulation (REA) technique. A REA sampler was developed and validated using simultaneous measurements of CO₂ fluxes by REA and by eddy correlation. REA measurements were conducted during six campaigns covering spring, summer, and fall between 1997 and 1999. Both uptake and emission of COS and CS₂ by the forest were observed, with deposition occurring mainly during the sunlit period and emission mainly during the dark period. On the average, however, the forest acts as a sink for both gases. The average fluxes for COS and CS₂ are -93 ± 11.7 pmol m⁻² s⁻¹ and -18 ± 7.6 pmol m⁻² s⁻¹, respectively. The fluxes of both gases appear to be correlated to photosynthetically active radiation and to the CO₂ and H₂O fluxes, supporting the idea that the air-vegetation exchange of both gases is controlled by stomata. An uptake ratio COS/CO₂ of 10 ± 1.7 pmol μmol⁻¹ has been derived from the regression line for the correlation between the COS and CO₂ fluxes. This uptake ratio, if representative for the global terrestrial net primary production, would correspond to a sink of 2.3 ± 0.5 Tg COS yr⁻¹.

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Citation: Xu, X., Bingemer, H. G., and Schmidt, U.: The flux of carbonyl sulfide and carbon disulfide between the atmosphere and a spruce forest, Atmos. Chem. Phys., 2, 171-181, 2002. [Bibtex](#) [EndNote](#) [Reference Manager](#)

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