



Using Carbonyl Sulfide column measurements and a Chemical Transport Model to investigate variability in biospheric CO₂ fluxes

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Understanding the CO₂ processes on land is of great importance, because the terrestrial exchange drives the seasonal and interannual variability of CO₂ in the atmosphere. Atmospheric inversions based on CO₂ concentration measurements alone can only determine net biosphere fluxes, but not differentiate between photosynthesis (uptake) and respiration (production). Carbonyl sulfide (OCS) could provide an important additional constraint: it is also taken up by plants during photosynthesis but not emitted during respiration, and therefore is a potential means to differentiate between these processes. Solar absorption Fourier Transform InfraRed (FTIR) spectrometry allows for the retrieval of the atmospheric concentrations of both CO₂ and OCS. Here, we investigate co-located and nearly simultaneous measurements of OCS and CO₂ measured at 3 sites via FTIR spectrometers. These northern-hemispheric sites span a wide range of latitudes and all have multiple year time-series. The sites include Ny-Alesund (79°N), Bremen (53°N) and Paramaribo (6°N). We compare these measurements to simulations of OCS and CO₂ using the GEOS-Chem model. The simulations are driven by different land biospheric fluxes of OCS and CO₂ to match the seasonality of the measurements. The simple biosphere model (SiB-COS) are used in the study because it simultaneously calculates the biospheric fluxes of both OCS and CO₂. The CO₂ simulation with SiB fluxes agrees with the measurements better than a simulation using CASA. Comparison of the OCS simulations with different fluxes indicates that the latitudinal distribution of the OCS fluxes within SiB needs to be adjusted.