Geophysical Research Abstracts
Vol. 18, EGU2016-13974, 2016
EGU General Assembly 2016

Using NDACC column measurements of carbonyl sulfide to estimate its sources and sinks

Yuting Wang (1), Julia Marshall (2), Mathias Palm (1), Nicholas Deutscher (1,3), Christian Roedenbeck (2), Thorsten Warneke (1), Justus Notholt (1), Ian Baker (4), Joe Berry (5), Parvadha Suntharalingam (6), Nicholas Jones (3), Emmanuel Mahieu (7), Bernard Lejeune (7), James Hannigan (8), Stephanie Conway (9), Kimberly Strong (9), Elliott Campbell (10), Adam Wolf (11), and Stefanie Kremser (12)

(1) Institute of Environmental Physics, University of Bremen, (2) Max-Planck-Institut für Biogeochemie, (3) Centre for Atmospheric Chemistry, School of Chemistry, University of Wollongong, (4) Colorado State University, (5) Carnegie Institute of Washington, (6) University of East Anglia, (7) Institute of Astrophysics and Geophysics, University of Liège, (8) National Center for Atmospheric Research, (9) Department of Physics, University of Toronto, (10) University of California, (11) Princeton University, (12) Bodeker Scientific

Carbonyl sulfide (OCS) is taken up by plants during photosynthesis through a similar pathway as carbon dioxide (CO_2), but is not emitted by respiration, and thus holds great promise as an additional constraint on the carbon cycle. It might act as a sort of tracer of photosynthesis, a way to separate gross primary productivity (GPP) from the net ecosystem exchange (NEE) that is typically derived from flux modeling. However the estimates of OCS sources and sinks still have significant uncertainties, which make it difficult to use OCS as a photosynthetic tracer, and the existing long-term surface-based measurements are sparse.
The NDACC-IRWG measures the absorption of OCS in the atmosphere, and provides a potential long-term database of OCS total/partial columns, which can be used to evaluate OCS fluxes. We have retrieved OCS columns from several NDACC sites around the globe, and compared them to model simulation with OCS land fluxes based on the simple biosphere model (SiB). The disagreement between the measurements and the forward simulations indicates that (1) the OCS land fluxes from SiB are too low in the northern boreal region; (2) the ocean fluxes need to be optimized.
A statistical linear flux model describing OCS is developed in the TM3 inversion system, and is used to estimate the OCS fluxes. We performed flux inversions using only NOAA OCS surface measurements as an observational constraint and with both surface and NDACC OCS column measurements, and assessed the differences. The posterior uncertainties of the inverted OCS fluxes decreased with the inclusion of NDACC data comparing to those using surface data only, and could be further reduced if more NDACC sites were included.