Geophysical Research Abstracts
Vol. 18, EGU2016-4478-1, 2016
EGU General Assembly 2016

Eddy covariance carbonyl sulfide flux measurements with a quantum cascade laser absorption spectrometer

Katharina Gerdel, Felix M. Spielmann, Albin Hammerle, and Georg Wohlfahrt

University of Innsbruck, Institute of Ecology, Research Group Biometeorology, Innsbruck, Austria (katharina.gerdel@student.uibk.ac.at)

Carbonyl sulfide (COS) is the most abundant sulfur containing trace gas present in the troposphere at concentrations of around 500 ppt. Recent interest in COS by the ecosystem-physiological community has been sparked by the fact that COS co-diffuses into plant leaves pretty much the same way as carbon dioxide (CO_2) does, but in contrast to CO_2, COS is not known to be emitted by plants. Thus uptake of COS by vegetation has the potential to be used as a tracer for canopy gross photosynthesis, which cannot be measured directly, however represents a key term in the global carbon cycle.

Since a few years, quantum cascade laser absorption spectrometers (QCLAS) are commercially available with the precision, sensitivity and time response suitable for eddy covariance (EC) flux measurements. While there exist a handful of published reports on EC flux measurements in the recent literature, no rigorous investigation of the applicability of QCLAS for EC COS flux measurements has been carried out so far, nor have been EC processing and QA/QC steps developed for carbon dioxide and water vapor flux measurements within FLUXNET been assessed for COS. The aim of this study is to close this knowledge gap, to discuss critical steps in the post-processing chain of COS EC flux measurements and to devise best-practice guidelines for COS EC flux data processing.

To this end we collected EC COS (and CO_2, H_2O and CO) flux measurements above a temperate mountain grassland in Austria over the vegetation period 2015 with a commercially available QCLAS. We discuss various aspects of EC data post-processing, in particular issues with the time-lag estimation between sonic anemometer and QCLAS signals and QCLAS time series detrending, as well as QA/QC, in particular flux detection limits, random flux uncertainty, the interaction of various processing steps with common EC QA/QC filters (e.g. detrending and stationarity tests), u*-filtering, etc.