



The influence of water vapor on atmospheric exchange measurements with an ICOS* based Laser absorption analyzer

Rüdiger Bunk (1), Zhi Quan (1,3), Matthias Wandel (2), Zhigang Yi (1,4), Heiko Bozem (2), and Jürgen Kesselmeier (1)

(1) Max-Planck-Institut für Chemie, Abt. Biogeochemie, Mainz, Germany (r.bunk@mpic.de), (2) Johannes Gutenberg Universität, Institut für Physik der Atmosphäre, Mainz, Germany (mwandel@students.uni-mainz.de), (3) Institute of Applied Ecology, Chinese Academy of Sciences, Shenyang, China (bawang20001996@126.com), (4) College of Resources and Environment, Fujian Agriculture and Forestry University, Fuzhou, China (zhigang.yi@mpic.de)

Carbonyl sulfide and carbon monoxide are both atmospheric trace gases of high interest. Recent advances in the field of spectroscopy have enabled instruments that measure the concentration of the above and other trace gases very fast and with good precision. Increasing the effective path length by reflecting the light between two mirrors in a cavity, these instruments reach impressive sensitivities. Often it is possible to measure the concentration of more than one trace gas at the same time.

The OCS/CO₂ Analyzer by LGR (Los Gatos Research, Inc.) measures the concentration of water vapor [H₂O], carbonyl sulfide [COS], carbon dioxide [CO₂] and carbon monoxide [CO] simultaneously. For that the cavity is saturated with light, than the attenuation of light is measured as in standard absorption spectroscopy. The instrument proved to be very fast with good precision and to be able to detect even very low concentrations, especially for COS (as low as 30ppt in the case of COS).

However, we observed a rather strong cross sensitivity to water vapor. Altering the water vapor content of the sampled air with two different methods led to a change in the perceived concentration of COS, CO and CO₂. This proved especially problematic for enclosure (cuvette) measurements, where the concentrations of one of the above species in an empty cuvette are compared to the concentration of another cuvette containing a plant whose exchange of trace gases with the atmosphere is of interest. There, the plants transpiration leads to a large difference in water vapor content between the cuvettes and that in turn produces artifacts in the concentration differences between the cuvettes for the other above mentioned trace gases.

For CO, simultaneous measurement with a UV-Emission Analyzer (AL 5002, Aerolaser) and the COS/CO Analyzer showed good agreement of perceived concentrations as long as the sample gas was dry and an increasing difference in perceived concentration when the sample gas was humidified. The difference in perceived CO concentration showed a clear correlation to the water vapor content in the sample air.

For COS we could show that changes in water vapor also impacted on the perceived COS concentrations; the raise of the water vapor concentration would lead to an increasing underestimation of the COS concentration.

Drying the air using a Nafion Dryer before entering the COS/CO Analyzer eliminated any water vapor induced artifacts and showed no adverse effects on the quality of the conducted measurements.

*Integrated cavity output spectroscopy