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Carbon monoxide fluxes over a managed mountain meadow

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Carbon monoxide (CO) is a toxic trace gas with an atmospheric lifetime of 1-3 months and an average atmospheric concentration of 100 ppb. CO mole fractions exhibit a pronounced seasonal cycle with lows in summer and highs in winter. Carbon monoxide has an indirect global warming potential by increasing the lifetime of methane (CH4), as the main sink of CO is the reaction with the hydroxyl (OH) radical, which in turn is also the main sink for CH4. Regarding the warming potential, it is estimated that 100 kg CO are equivalent to an emission of 5 kg CH4. In addition, carbon monoxide interferes with the building and destruction of ozone. Emission into and uptake from the atmosphere of CO are thus relevant for global climate and regional air quality. Sources and sinks of CO on a global scale are still highly uncertain, mainly due to general scarcity of empirical data and the lack of ecosystem-scale CO exchange measurements, i.e. CO flux data that encompass all sources and sinks within an ecosystem.

Here we present eddy covariance CO fluxes over a managed temperate mountain grassland near Neustift, Austria, whereby volume mixing ratios of CO were quantified by a dual-laser mid-infrared quantum cascade laser (QCL). First analyses of fluxes captured in April 2013 showed that the QCL is well able to capture CO fluxes at the study site during springtime. During the same time period, both significant net uptake and deposition of CO were observed, with high emission and deposition fluxes on the order of +/- 5 nmol m-2 s-1, respectively. In addition, CO fluxes exhibited a clear diurnal cycle during certain time periods, indicating a continuous release or uptake of the compound with peak flux rates around noon.

In this presentation, we will analyze 12 months of carbon monoxide fluxes between January and December 2013 with regard to possible abiotic and biotic drivers of CO exchange. As an additional step towards a full understanding of the greenhouse gas exchange of the meadow, we will relate observed CO fluxes to concurrently measured CO_2, CH4 and N2O exchange rates in terms of CO_2-equivalents and – where applicable – carbon.