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Soil emission and uptake of carbonyl sulfide at a temperate mountain grassland

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Introduction

The measurement of carbonyl sulfide (COS) , a trace gas with a mean concentration of about 500 pptv in the troposphere, is a promising new approach to partition net ecosystem-scale CO_2 fluxes into photosynthesis and respiration. The utility of COS for flux partitioning on the ecosystem scale depends critically on the understanding of non-leaf sources and sinks of COS. Especially the role of soils, which have been shown to act both as sources and sinks for COS, needs to be clarified.

We conducted measurements

- to assess the contribution of the soil to ecosystem-scale COS fluxes under simulated drought conditions
- to quantify soil fluxes during the season 2015

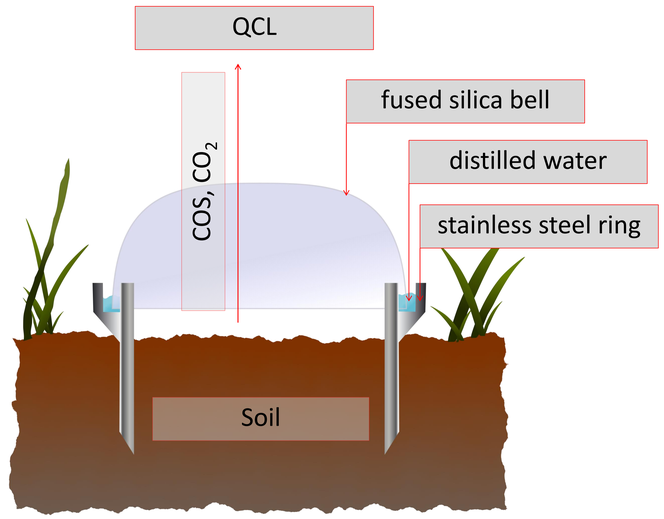
at a temperate mountain grassland in the Central Alps.

Study site

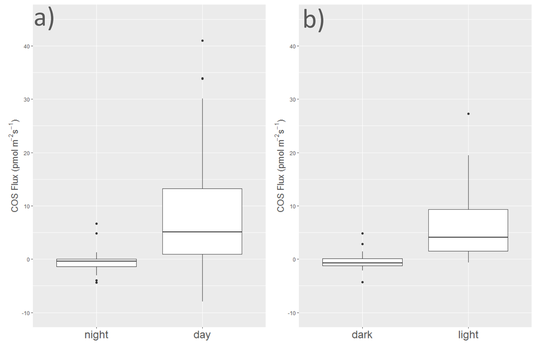
The study site (47°7’ N, 11°18’ O), a temperate mountain grassland, is located near Neustift in the Central Alps at an elevation of 994 m above sea level. The soil was classified as a Fluvisol with an estimated depth of 1 m, the bulk of the roots was located within the first 10 cm.

Methods

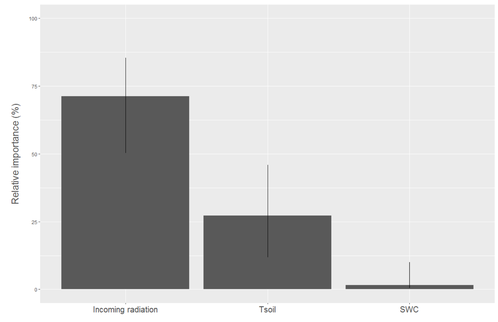
Transparent flow-through soil chambers (see sketch) were used together with a QCL (Aerodyne Research) to quantify soil COS and CO_2 fluxes . A drought was simulated with rain out shelters from the 11-Jun-2015 to the 05-Aug-2015.



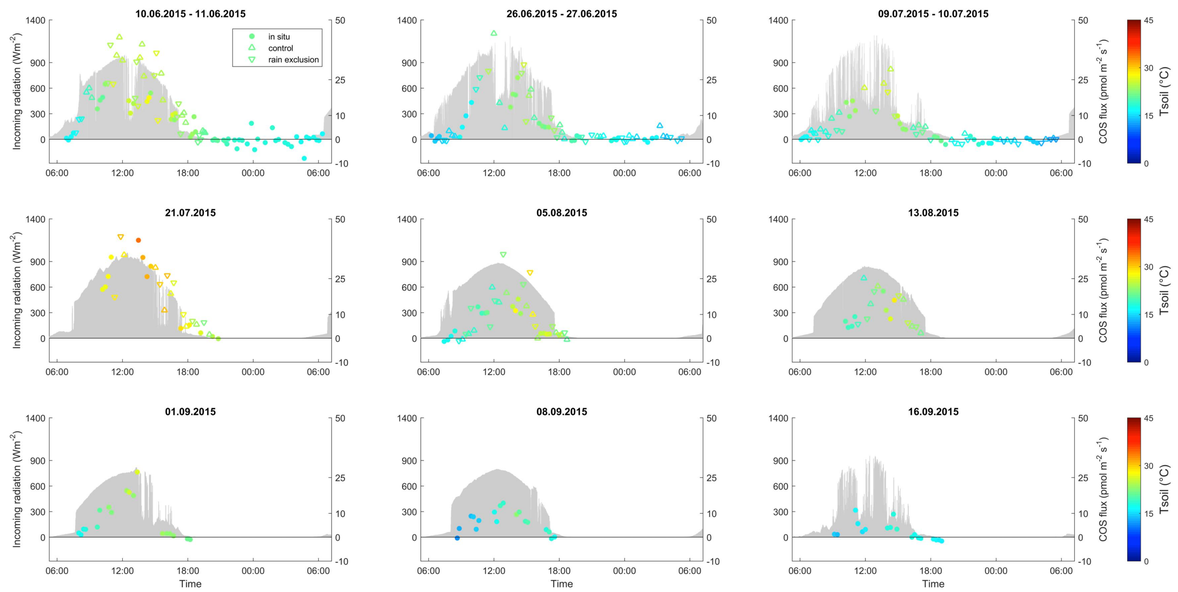
Results & Conclusion



a) Nighttime versus daytime soil COS fluxes (sig. different, Kruskal-Wallis, $p < 0.05$)
b) Soil COS fluxes measured under dark (chamber covered with aluminum foil) versus light (uncovered) conditions (sig. different, Kruskal-Wallis, $p < 0.05$)



Relative importance of the predictors for log(COS flux) with 95% confidence intervals and normalized to the R^2 (70.39%) of the linear regression
The R package relaimpo and the method LMG was used.



Soil COS fluxes (symbols) before (10.06.), during (26.06. – 05.08.) and after (13.08. – 16.09.) the simulated drought. Grey bars indicate the incoming solar radiation.

- CO_2 fluxes decreased slightly, compared to the control treatment, as the soil water content decreased (to a minimum of 5%), on the contrary COS fluxes remained unaffected
- Soil temperature had a moderate influence on soil COS fluxes
- Incoming radiation had the largest influence on soil COS fluxes – hence nighttime and daytime fluxes differed strongly

- **We conclude that soil COS fluxes at our study site are mainly driven by abiotic drivers and among them incoming solar radiation is dominant**

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FWF Der Wissenschaftsfonds. Gefördert von tirol