Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2017-407-RC2, 2017
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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Canopy uptake dominates nighttime carbonyl sulfide fluxes in a boreal forest" *by* Linda M. J. et al.

Anonymous Referee #2

Received and published: 29 June 2017

In the article "Canopy uptake dominates nighttime carbonyl sulfide fluxes in a boreal forest" Kooijmans and co-authors present a season of nighttime fluxes of COS and CO2 derived at a height of 8m in a boreal forest with a dominant canopy height of 17 m. Fluxes are derived by eddy covariance, but recognizing the limitations of eddy covariance under placid nighttime conditions, the authors derive fluxes by gradient-flux similarity methods to Radon 222, which is emitted at consistent rates from soil. The authors find evidence for significant nocturnal uptake of COS by the canopy, suggesting a greater role of vegetation than soils in atmospheric COS uptake both during the day and night at this site. The measurement methods and analysis are thorough, and the results provide much needed data to the field including independent measurements of stomatal conductance for comparison with COS fluxes. This is a valuable contribution

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to understanding the behavior of COS in ecosystems for more precise application as a carbon cycle tracer. General and specific comments follow.

General comments:

The manuscript discusses the possibility that under still conditions, when eddy covariance techniques are not applied due to low u*, COS may be depleted at the leaf surface and slow uptake rates. This is discussed in relation to the suitability of u* filtering. However, a similar phenomenon could occur at the soil-atmosphere interface under still conditions where COS uptake rates are limited by COS availability in depleted layers low in the profile. Under those conditions, emissions of CO2 and 222Rn would however not be limited given that they are production reactions. How would concentration-depletion at the soil-atmosphere interface affect interpretation of the data in this paper (for example the interpretation of Figure 3)?

It would be useful to discuss the uncertainty in scaling up soil flux measurements from the chamber measurements. How much variation was there between chambers? Given the large difference in footprint between tower-based and chamber measurements, how could spatial heterogeneity affect your estimations of the role of nocturnal canopy uptake of COS?

No significant trend of F_Rn derived from NEE was reported with SWC, but was there a trend over the season? I would find a time series of F_Rn (perhaps in Fig S1) informative for reference in the sections evaluating the potential contributions of variations in F_Rn to Rn-derived COS fluxes.

Specific comments:

P6L26: Do the footprints of the flux tower for the EC system overlap with the nearby tall tower? Is it possible that differences arise due to spatial heterogeneity and not any kind of estimation? There could be heterogeneity that affects some gases more than others.

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P8L14: Clarify the time period of NEE data using to derive F_Rn

P13L15: Consider citing also Commane et al., Figure 2D

Supplement: Text spacing looks strange

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