Atmos. Chem. Phys. Discuss.,
doi:10.5194/acp-2016-525-RC1, 2016

Atmospheric Chemistry and Physics Discussions

Interactive comment on "A top-down approach of surface carbonyl sulfide exchange by a Mediterranean oak forest ecosystem in Southern France" *by* S. Belviso et al.

Anonymous Referee #2

Received and published: 8 July 2016

Overview

I read this manuscript on carbonyl sulfide with great interest because the data provide several advances over related studies including continuous observations, multiple tracers, and multiple sample heights. I agree with the conclusions in this study but have several comments that may clarify the role of this field site within the broader context of carbon cycle science. In particular, the variation in LRU needs to be better framed to note that this variation is critical for canopy-scale studies but it is less critical than other uncertainties for regional-scale studies.

Specific Comments

Printer-friendly version

Discussion paper

1) "However, there is evidence that the Leaf Relative Uptake of OCS and of CO2 (LRU), ... following Eq. (1) (Campbell et al., 2008; Asaf et al., 2013),..." The introduction begins with a discussion of LRU variability that should be revised to clarify a key distinction with respect to spatial scales. In particular, the impact of LRU variability for the regional-scale analysis in Campbell et al. (2008) is very different from the impact of LRU variability on canopy-scale analysis. At the regional scale, the effect of LRU variability is less significant because the regional spatial uncertainty in GPP is much larger than the LRU uncertainty. This is demonstrated in Hilton et al. (Tellus B, 2015) by showing that the mechanistic simulation of COS plant flux by SiB and a constant LRU implementation of COS plant flux in SiB have small differences in comparison to the large differences between multiple ecosystem models (SiB, CASA, CLM, etc.). However, at the canopy-scale the temporal variation in LRU becomes much more significant when trying to infer daily or even hourly GPP fluxes use COS observations. The reader should be reminded of this distinction again later in the paper where the authors write "However, the assessment of GPP from measured OCS fluxes remains tributary of our poor knowledge of the magnitude of the LRU diel variations which requires further examination."

Hilton, T.W., Kulkarni, S., Zumkehr A., Berry, J.A., Campbell, J.E. (2015) Large variability in ecosystem models explains a critical parameter for quantifying GPP with atmospheric carbonyl sulfide, Tellus B, v16, http://dx.doi.org/10.3402/tellusb.v67.26329.

2) The discussion could be expanded to note paths forward for addressing diel LRU variation for canopy scale analysis. For example, some field studies are now making canopy flux and leaf chamber measurements simultaneously and using leaf chambers to estaimte LRU and then using canopy measurements to estiamte GPP.

3) Further discussion of the high mixing ratios observed in 2013 could be added. These observations coincide with back trajectories to the Rhône Valley. The gridded anthropogenic inventory of Kettle et al. (2002) does not show significant emissions in this region. However the Kettle inventory used a coarse spatial proxy that is not specific

to the COS source industries. A more recent inventory developed by Campbell et al. (2015) uses industry-specific data and finds that the primary anthropogenic source is the indirect source from industrial CS2 emissions. These industry data show that Adisseo France in the Rhône Valley is the largest producer of carbon disulfide in Western European.

4) It would be interesting to expand figure 4 to plot the COS/CO2 ratio for the multiple years and sample heights. This ratio is of interest because it also appears in equation 1 and is being used by multiple modeling groups to scale GPP.

5) The authors report that their ERU of 4.3 is similar to Harvard Forest values. They may also want to expand the comparison to note similarities to more spatially diverse data including a range of 2-8 reported for North American NOAA airborne data (Montzka et al., 2007) and 5.7 +- 0.6 reported for North American NASA airborne data (Campbell et al., 2008).

6) The soils were not a net sink which contrasted with field measurements from Sun et al. which show a soil sink in the Stunt Ranch oak field site. However, recent laboratory incubations using soil samples from Stunt Ranch have found that Stunt Ranch soils could also result in no net sink (or even a small net source) under certain temperature and soil moisture conditions (Whelan et al., 2016).

Whelan M.E., Hilton T.W., Berry J.A., Berkelhammer M., Desai A.R., Campbell J.E. (2016) Carbonyl sulfide exchange in soils for better estimates of ecosystem carbon uptake. Atmos. Chem. Phys. 16, 3711-3726, doi:10.5194/acp-16-3711-2016..

7) The night/day shading in many of the figures is a great visual cue and could be added to Figure 3 also.

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-525, 2016.