

# ***Interactive comment on “Are BVOC exchanges in agricultural ecosystems overestimated? Insights from fluxes measured in a maize field over a whole growing season” by A. Bachy et al.***

**Anonymous Referee #2**

Received and published: 26 February 2016

## **1 General comments**

This study reports new measurements of BVOC fluxes over a maize field in Belgium using eddy covariance. The authors are the first (to their knowledge) to observe a full growing season, and also the first to measure at a European site, making this data set a valuable addition to the extremely limited database of BVOC flux observations in maize fields. Compared to past cropland studies, including two American-based maize studies, they observed similar BVOC composition – methanol (dominant), acetic acid, acetone, acetaldehyde, terpenes – but concentrations were significantly lower in the present study. The emission factors prescribed for crops, as used in BVOC

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emission models, were higher than those estimated from the field measurements in this study. From these results, the authors conclude that BVOC exchanges from maize vary regionally around the world, and that emission factors in models should account for this variability. The emission factors estimated in this study are recommended as representative of C4 crops in north-western Europe. With data for the full growing season, the authors were able to quantify the relative contributions of soil and plant to BVOC fluxes, finding that the soil (bare soil in particular) contributed about as much as vegetation.

This study, appropriate for ACP, makes a substantial contribution to the sorely limited observational record of BVOC fluxes in the ever-growing maize landscape. The purpose and goal is well articulated with strong motivating support. The methods are complete and clearly described. The conclusions drawn from the results follow logically, though may be overstated given still limited data and large uncertainties. Overall, the manuscript is well-written and merits publication in ACP provided the following comments are considered.

## 2 Specific comments

- Pg 2, Lns 13-17: What is the relative contribution from crops relative to other biogenic VOC sources (e.g., forests)? Any estimates on maize specifically? Though corn covers a large landscape, are emission rates large enough to significantly contribute to the global VOC budget?
- Pg 2, Lns 13-19: What did Das et al. and Graus et al. find? (i.e. the baseline knowledge going into this study)
- Pg 2, Ln 25: define "standard"
- Pg 3, Ln 26: Replace "a few" with a numeric range, if possible.

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- Pg 7, Ln 3: Combine with previous paragraph.
- Pg 8, Ln 26 and 28: What are "normal" (line 26) and "natural" (line 28) weather conditions for this area?
- Pg 9, Ln 22: Do plants take up monoterpenes? Are they not primarily emitted? Perhaps downward flux doesn't necessarily signify uptake in this case?
- Pg 9, Ln 23-26: Consider revising these paragraph breaks.
- Pg 9, Ln 27 - Pg 10, Ln 4: These lines seem to belong in Sec 3.5.1.
- Pg 11, Ln 1-2: The maize field area seems relatively small (155 x 255 m, Pg 3, Ln 4) and makes me wonder about the possibility of advection bringing in low-VOC air, thus resulting in lower VOC than other studies. Are the field sites of Das et al. and Graus et al. much larger and thus less influenced by outside air? Any correlations with wind direction that suggest advective influences? How does the flux footprint at the measurement heights on Pg 3, Lns 17-18 compare with size of the field (185 x 255 m) on Pg 3, Ln 4? Of course, if there is an advective signal, this puts into the question the validity of the horizontal homogeneity assumption and challenges whether this is representative of north-western Europe or "ecosystem-scale."
- Pg 12, Ln 27: What are the "default values" and what are they based on?
- Pg 13, Ln 1-2: Are you comfortable advising modelers to use these SEFs given all the uncertainties? Given the limited data, and the large discrepancies with the two studies cited here, I feel more data is needed to validate the SEFs found here before they are deemed a reliable representation of C4 crops in NW Europe. Instead, you might advise modelers to be wary that current SEFs may be overestimates and advise them to include that potential caveat in their studies.

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- Pg 13, Ln 24: Again, are you confident enough in your SEFs to say they "should" be used to represent C4 crop PFT?
- Sec 4 (Conclusions): Can you draw any new conclusions about the evolution of BVOC fluxes from maize fields throughout the growing season now that you have this new data set that didn't exist before? For instance, can you comment on the variability throughout the season in Figure 1 and how the "plant phenology" dependence of modeled emissions (Pg 12, Ln 15) captures that variability?

### 3 Technical corrections

- Pg 1, Ln 16: "as" → "on the"?
- Pg 1, Ln 17: "developped" → "developed"
- Pg 1, Ln 22: extra "in this"
- Pg 1, Ln 28: "affect" → "effect"
- Pg 2, Ln 1: add "the" before "formation"
- Pg 2, Ln 11: add "a" before "few"
- Pg 2, Ln 15: spell out FAOSTATS
- Pg 4, Ln 9: "There is more ... (2009)." → "See Aubinet et al. (2009) for more ... set-up."
- Pg 7, Ln 25: "2h" → "2 h"
- Pg 8, Ln 10: spell out BBCH, and define

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- Pg 10, Ln 11: "reporded" → "reported"
- Pg 12, Ln 21: "model" → "models"
- Pg 13, Ln 7: "signifcant" → "significant"

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Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2015-1034, 2016.

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