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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Large estragole fluxes from oil palms in Borneo" *by* P. K. Misztal et al.

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We thank the referee for all their helpful comments. Please find our responses below:

General Comments

This study is a nice representation of coupling the above-canopy fluxes with leaf/flower enclosures. The science is bolstered with very nice contextual history of oil palm pollination.

Standards: The in-situ measurements are understandably performed without a

specific estragole standard, but why wasn't one used in the laboratory experiments? Did the authors use a standard on the identical instruments when they returned from the field to ensure the peak identification and quantification procedure? This comment is particularly directed towards the use of m/z 77 response to that of the a-pinene standard (page 1529). In doing so, the authors assume that estragole has a similar response to the adsorbent and column as a monoterpene even though estragole is clearly more polar. The lack of standard used with the GC and PTR-MS seems at odds with the "nebulised estragole" used with the HR-ToF-AMS (page 1538).

It is true that the polarity of estragole will likely lead to different behaviour on the GC column. In fact, because we did not detect any quantifiable peaks in the leaf cuvette samples, any "quantification" we undertook using the m/z 77 of α-pinene turned out to be redundant and was not actually used in the results. We have therefore removed this redundant detail from the methods. Quantification by PTR-MS was performed as described in Section 2.2, but yes, a calibration using vaporised estragole standard (Sigma Aldrich, 98%) was done afterwards in a lab under the identical drift-tube conditions and the calibration curves were compared to yield sensitivity to estragole; this was well within 30% of the value obtained from the relative transmission approach used for estragole at the field. This information has been added to the manuscript.

Deposition modeling: I agree with the previous reviewer's comments regarding the uncertainty of the deposition modeling. Moreover, I don't believe that it is necessary to the argument of the paper if more information is provided in terms of light and temperature dependence parameters.

As addressed in the response to the other reviewer, we have removed deposition from the modelling of estragole flux, although we discuss the relative importance of deposition at the end of Section 3.6 in the revised paper.

G06 algorithm: Explain the “G06” algorithm and how it was used in this parameterization. Some places in the text it is referred to as “G06” and in others it is the “Guenthertype.” What are the best-fit temperature and light dependent parameters used here? This will provide comparisons to other studies.

We have now substantially revised Section 2.5 so it more thoroughly explains the G06 algorithm; the large equation (previously equation 3) has been rearranged and grouped into components analogously to the presentation in Guenther et al. 2006. In addition, the comparison between empirical constants in the original G06 algorithm for isoprene and the modified G06 for estragole has been provided in Table 3 of the revised manuscript. This clarifies which parameters were amended and may be helpful for comparison in future studies. “Guenther-type” has been changed to “G06” throughout for consistency.

Specific/Technical Comments

Page 1524, line 6: Specify the type and/or vendor of the heating tape.

The information: “Omega, UK type SRF3-2C self regulating heat cable” has now been inserted.

Page 1525, line 20: “Kim et al., 2008” is noted in the text, but “Kim et al., 2009” is in the references.

Now corrected.

Page 1528, lines 13-17: Clarify this long sentence. It seems as if there are multiple

thoughts.

The sentence about GC detection limits has been simplified and clarified.

Page 1529, line 5: Delete the period after “NY)”

Done.

Page 1533, lines 5-8: Clarify this statement. Again, it seems like two sentences have been blended together.

The sentence about biogenic aromatic compounds has been rephrased for clarity.

Page 1534, line 9: Do the authors have evidence to support the claim that “insects avoid tropical heat”?

This seems logical for many insects but apart from observational studies (and grey literature) this claim cannot be supported. Therefore, we have deleted this part of the sentence, and restructured the rest of the statement. In fact, avoiding tropical heat may not be directly related to the pollination, as insects could still fly in the shaded areas below canopies and be able to pollinate.

Page 1537, lines 4-6: Explain how the “approximate 50% free air-space” was estimated and taken into account in the calculations.

The volume of enclosure bag was estimated by eye. This was a very robust sampling approach with the aim to confirm flowers as a source.

Page 1537, lines 27-29: What is the basis for the assumptions of vegetation density used to scale up the measurements?

The emission calculations from bag samples were as follows:

Ei = Total estragole emitted from inflorescence (ug inflorescence^{-1}) = concentration in sample (ug L^{-1}) x volume of air in bag into which the compound was emitted (L; estimated by fraction occupied by inflorescence x total bag volume)

Erate = Emission rate of estragole (ug estragole inflorescence^{-1} h^{-1}) = Ei/Accumulation time (h)

Etree=Total oil-palm tree emission (ug tree^{-1} h^{-1}) = Erate x average# inflorescence per tree (=150^{a})

Total emissions from plantation (mg ha^{-1} h^{-1})=(Etree/1000) x #trees per ha (=113^{b})

Table 1: If the canopy values are what is shown, then only use the corresponding reference in the table (Bouvier-Brown et al., 2009b)

This has now been amended.

Figure 6: make the flux line thicker so that a reader can clearly see the PAR coloration.

The flux line has been made thicker.

References:

^{a} **http://www.palmplantations.com.au/oil-palm-trees.htm**

^{b}**Sabahmas; mean value for the whole plantation (including roads and residential areas)**