

Interactive comment on “A tethered-balloon PTRMS sampling approach for rapid surveying of landscape-scale biogenic VOC fluxes” by J. P. Greenberg et al.

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Reviewer #1:

General comments: needs more description of methods and discussion of results

- a. We have added a more detailed description of the 4 sites, including information on vegetation species distribution
- b. An revision of the surface layer gradient has been inserted
- c. We have expanded the discussion to include the effects of non-uniform vegetation

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distribution and complex terrain on results

Surface layer gradient estimates need some corrections

- a. Were all measurements within the constant flux layer: our calculations indicate that all of the measurements were made in the surface (constant flux) layer
- b. Lowest measurement level (5 m) should not be used in the calculations when they may be below the height of the canopy, as in the Prades site: While the Prades site had a canopy height of approximately 15 m, the balloon was launched in a grassy clearing, not within the forest canopy. Nonetheless, to avoid any canopy effects, we have limited our analysis to the measurements at 20 m and above for all sites. Above this altitude, and considering the height of the canopy at the sites, the displacement height made at most a minor contribution to surface layer gradient calculation and, consequently, was neglected. This is added to the text.
- c. How large was the clearing at Montseny: The launch site for Montseny was in a large meadow surrounded by forest. We have included the dimensions of the launch site for all sites: Garraf, Monegros= \sim 25 m diameter gravel area, Prades= \sim 10m x 25m grassy terrace, Montseny \sim 200 m x 100m meadow.
- d. Eddy diffusivity.

The reviewer suggests that using the simple expression of our original eddy diffusivity calculation only applied to neutral stability conditions and that we should use the more inclusive expression he suggests for the calculation in all stability conditions: we have identified the stability conditions during each measurement period from the results of the WRF model and have applied the suggested calculation for the measurements made during the different stability conditions. This resulted in the revision of figures 3a, 3b and 4 and Table 1.

- e. How were fluxes calculated in the surface layer gradient method:

the confusion related to this question was resolved in the new analysis suggested by

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the reviewer.

Some questions regarding the discussion and conclusions:

a. The mixed layer variance technique only gives the absolute value of the flux and not the sign:

This is correct. The sign of the flux (emission or deposition) was determined from the gradient measurements that alternated with the variance measurements. This has been stated now explicitly in the text.

b. More discussion is needed for the results presented in figures 3a, 3b, and 4: We have expanded the discussion of the results to include the limitations of the individual techniques and possible biases. Negative fluxes (deposition) were indeed indicated in some measurements and these are reflected in the figures. However, the figures are only for isoprene, monoterpenes and methanol, where emissions from the surface were expected. For the other VOCs listed in Table 1, the direction of the flux was determined from the profiles in the surface layer gradient technique. Fluxes for individual VOCs were positive (emission) or negative (deposition) during different periods at the 4 sites. We list only daytime measurements in Table 1, since most measurements were made during daytime and we did not want to suggest that the results might also apply for nighttime periods.

c. Why do methanol fluxes appear to be mostly negative?:

The recalculation of methanol fluxes, suggested by the reviewer, resulted in positive and negative fluxes. A daytime emission flux was suggested.

d. Why do monoterpenes emissions vary so much between sites?

We have added some site description and references which explain that the vegetation composition varied considerably among the sites and resulted in different magnitudes of isoprene, monoterpene and other VOC fluxes. Negative values for isoprene and monoterpenes fluxes were indicated in the inter-quartile ranges of Table 1; it was

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most often found at all sites that, on the few occasions when deposition of isoprene or monoterpene was observed, both isoprene and terpene fluxes were simultaneously deposited during the profiles. The magnitude of the deposition fluxes was larger than the uncertainty assigned to the determinations. This has been included in the text.

e. Some errors in Table 1: these have been corrected.

f. Error analysis needs more clarification:

We have detailed many of the uncertainties in each of the 3 techniques used. While the uncertainties were estimated to be approximately of the same magnitude for the techniques, the origin of contributors to these errors were peculiar to the individual techniques. Consequently, a tabular comparison, suggested by the reviewer, was not made. We have, however, added some remarks to summarize the magnitude of the uncertainties and their application to a comparison of the techniques.

Which method is preferred?

We have added some discussion of the limitations of the surface layer gradient and inventory techniques and suggested that the mixed layer variance technique may be the most practical application.

Specific comments and technical corrections: we have made the corrected suggestions or added the required comments and citations.

Reviewer #2.

The source of the electric power for the experiments at the different sites, namely the local electric power grid, has now been included in the text.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 979, 2014.

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