

Interactive comment on “Effect of chemical degradation on fluxes of reactive compounds” by J. Rinne et al.

J. Rinne et al.

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We thank the referee for the informed and constructive comments and for suggestions to improve the paper. Below we answer these comments, and give indication how these will be taken into account in the revised manuscript.

R#1: It is likely that how useful this work is towards understanding chemical observations and fluxes within canopies will ultimately depend upon how well one can model the turbulence within a variety of plant canopies. Certainly, that is a difficult problem as wind and turbulence models (including those used here) do not always capture many observed phenomena (e.g., secondary wind maximas within canopies); thus mixing time-scales may not be strictly valid as presented here.

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A: We will discuss shortly on the model's performance in the revised manuscript as compared to the data on below canopy turbulence published at our measurement site.

R#1: Page 31821. Line 9 (and maybe a few other places). The authors put forth the example that sesquiterpenes are typical compounds with reactive lifetimes similar to that of the mixing time scale (mainly due to rapid ozone reaction). Certainly this is true for β -caryophellene which they use as their example compound later. However, this is a bit of an over-generalization – there are many common SQTs that have similar reactivity to α -pinene and other monoterpenes (for example: longifolene, α -cedrene). Conversely there are also some rather reactive monoterpenes. I think it is a bit of a misconception in the field that if a compound is a SQT, it will be highly reactive towards ozone and will have a short lifetime.

A: The referee is correct in this statement and we will modify the manuscript in a way that sesquiterpenes as a group are not given as an example of highly reactive compounds.

R#1: Section 4.3. The authors suggest that the main effect of stability is likely through its effect on u^* . However, the stability here is computed from above-canopy variables. For sufficiently dense canopies, the stability within the canopy is often quite different (and opposite sign) of that above, which could have a more significant impact on the transport time (and therefore the flux reduction). Certainly this would have a more significant effect on emissions originating from the soil surface.

A: This is a relevant point. In the below canopy airspace the stability can indeed be even opposite to that above the canopy. However this this does not change the result that the direct effect of stability is not so large. We will add discussion on this issue in the revised manuscript.

R#1: Section 4.4 and Figure 8. Certainly the main focus of this manuscript lies in understanding flux loss with respect to chemical reaction; however, the authors do bring up an interesting point that the relationship between emission flux and its driving variables

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will be affected by varying chemistry. It would be interesting to see a figure showing how much these relationships can be affected for a compound like β -caryophellene. It seems that it would be simple to apply a typical temperature-dependency (or light) to the emission flux and then recompute the observed diurnal above-canopy flux and see how that emission/driving variable relationship changes.

A: This is a very good point. We will add a section and on how the functional relationships between flux and the driving variables of emission are affected by the chemistry.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 31819, 2011.

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