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Atmospheric Chemistry and Physics Discussions

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

Anonymous Referee #1

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General comment – This manuscript seems to be a natural extension of the Rinne et al. (2007) using a stochastic Lagrangian transport model to estimate flux loss due to chemical reactions during transport. The results shown here are quite similar to those of Rinne et al. (2007), except that they are presented in a much more generalized form that should be more usable by the community as a whole. There are no real surprises here and the results are presented in a logical and understandable fashion. 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 phenomenona (e.g., secondary wind maximas within canopies); thus mixing time-scales may not be strictly valid as presented here. However, this work does

provide us with a blueprint of estimating flux loss due to chemical processing within canopies as we continue to further our understanding of within-canopy transport processes. The manuscript should be published with a few minor considerations.

Specific Comments: 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 b-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 a-pinene and other monoterpenes (for example: longifolene, a-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.

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.

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 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 b-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.

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

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Interactive Comment