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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Eddy covariance fluxes of acyl peroxy nitrates (PAN, PPN, and MPAN) above a Ponderosa pine forest" *by* G. M. Wolfe et al.

G. M. Wolfe et al.

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We thank the referee for taking the time to review and provide critical feedback on our manuscript. Our responses to the referee's questions and comments are outlined below.

Reviewer: "The method section is very informative and essential to give the details on these challenging measurements but think it is distracting from the main point to be made in this paper on the APN fluxes and role of controlling processes. Consequently, I would suggest to consider to move most of the details of the methodology section to a supplement section (if possible) and only describe in section 2 some of the key features."

Response: We agree that many of these details are important but not necessarily relevant to the message of this paper. We have moved most of these details to an Appendix and have shortened the methods section considerably.

Reviewer: "At page 17514 there is a discussion about how to appreciate the observed deposition rates of $>$ 0.5 cm s-1 compared to upward exchange rates of 0.7 cm s-1 by Farmer and Cohen at the same site. It is discussed that these differences might be due to different meteorological conditions and also having a more mature canopy structure resulting in a more efficient deposition and suppressed turbulent transport for the here presented data compared to those by Farmer and Cohen. It is difficult to conceive that these differences can have such a pronounced impact resulting in the canopy being an effective source turning into an effective sink. It appears that this could only be studied using explicit canopy exchanges models that include the processes as described in this paper. Reading the last sentence of the conclusions, this is indeed what the authors will further pursue and it would be useful to explicitly mention this already here."

Response: We agree that it is difficult to reconcile our 2007 measurements with previous summer observations at BFRS. During BEARPEX 2009, we hope to make a side-by-side comparison measurement of APN fluxes with the instrument used by Farmer and Cohen to help resolve this discrepancy. Furthermore, we are indeed currently constructing a 1-D chemistry-transport model to test some of our hypotheses. We have added a sentence mentioning this need to the end of the paragraph mentioned above.

Reviewer: "At page 17520 there is a discussion about the role of thermal decomposition in the fluxes mentioning that part of the downward flux of PAN could reflect the more efficient thermal decomposition (TD) at the surface compared to the air aloft. Calculation of the significance of the TD in explaining the fluxes compared to the role of surface deposition (stomatal uptake) raises the very interesting point about establishing the relative importance of chemistry versus turbulent transport. Turnispeed et al. (2006) did not consider the role of TD in effecting the PAN fluxes based on the fact that, using the commonly applied approach of comparing the turbulent and chemical

ACPD

8, S9657–S9659, 2008

timescale, the TD timescale is much slower than that of turbulence. Wolfe et al. state such as assessment should not use the average loss rate but vertical gradient in the loss rate, which for the presented measurements actually indicates an important role of TD in explaining the observed gradients (and fluxes). This discussion raises the issue about a chemical flux divergence versus chemistry explaining part of the flux. Reading over carefully the text it becomes clear that the authors (and Turnispeed et al.) do not aim at assessing the importance of a flux divergence (so a deviation from the log profile) but really focus on how much the chemistry explains the surface removal. This could be stressed more specifically in the text."

Response: We agree that there is a fine but important difference between TD flux divergence and the role of TD as a surface sink. We have added some text in this section to help clarify the goal of our analysis.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 17495, 2008.