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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The Chemistry of Atmosphere-Forest Exchange (CAFE) Model – Part 2: Application to BEARPEX-2007 observations" *by* G. M. Wolfe et al.

G. M. Wolfe et al.

zlonewolfe@gmail.com

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We thank Dr. Karl for providing his insight on the complex issues surrounding the modeling of trace gas fluxes in a forested environment. We appreciate the reference to the 2005 ACP work detailing the relationship between ozone uptake and oVOC emission, we will reference it in the introduction and discussion.

Our rather standard treatment of turbulent transport undeniably imparts some uncertainty to our estimates of forest-atmosphere exchange of trace gases; however, as Dr. Karl points out, a lack of in-canopy micrometeorological measurements limits our ability to further constrain in-canopy diffusion for the current study. Our choices for

near-surface diffusivity are tied to measurements via comparison with above-canopy scalar flux-gradient relationships, measured in-canopy gradients in VOC, and previous estimates of in-canopy residence time. We more fully discuss the diffusion parameterization and the model sensitivity to it in the companion paper, which we will more clearly reference in this manuscript.

We do not mean to imply that the 20% difference between modeled and measured ozone fluxes is strictly evidence of a chemical effect on ozone fluxes. In retrospect, our statement in the abstract about this point is likely too strong and we will modify our text in the final manuscript to note other possibilities. As an additional point, we note here and in the manuscript that this apparent agreement depends strongly on our resistance-based estimate of non-stomatal deposition, which comprises 40 – 50% of the modeled ozone flux in the current study. As we have no observational constraints for the non-stomatal deposition of ozone, the agreement to within 20% of observed flux is likely an artifact and in reality we are likely unable to explain a larger fraction of the observed flux. For example, in the Karl et al. (2005) ACP study, ozone fumigation measurements showed a negligible non-stomatal surface ozone loss on Loblolly pine, suggesting that our non-stomatal conductances are too high and thus we are likely missing an explanation for more than 20% of the observed ozone flux.

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