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Interactive comment on "Secondary Organic Aerosol (SOA) formation from the β-pinene $+$ NO$_3$ system: effect of humidity and peroxy radical fate" by C. M. Boyd et al.

Anonymous Referee #2

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The authors present a laboratory study conducted at the Georgia Tech Environmental Chamber of secondary organic aerosol formation from beta-pinene+NO3 reactions. The laboratory generated SOA is compared to SOA observed during the 2013 SOAS field study as well as used to generate parameters that would allow their information to be included in regional models. Overall, the study is well written, provides significant information on the beta-pinene+NO3 system, is relevant to ACP, and should be suitable for publication.

I have two major comments:

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1. The authors present significant detail in terms of the identification of gas-phase organic nitrates in the system and some information on particle-phase composition such as the fact that 45-74% of the aerosol is likely organic nitrates. The information provided in the form of an Odum 2-product or VBS fit allows for an easy, but incremental, update to existing monoterpene+NO3 SOA pathways in models. As organic nitrates are being increasingly recognized for their importance in recycling or removing NOx from the atmosphere, contributing to nitrogen deposition in sensitive ecosystems, etc. they are being included in greater detail in models. Given the significant contribution of organic nitrates to aerosol, can modeling of monoterpene+NO3 aerosol be further advanced to allow for a greater consistency between gas and aerosol-phase mechanisms? With aerosol yields on the order of 27 to 104%, adding an Odum 2-product SOA yield on top of a gas-phase mechanism could lead to substantial double counting. Is there a later generation product (such as an organic nitrate) or rate limiting step beyond the initial monoterpene+NO3 that models could base SOA formation on?

2. Can the laboratory AMS spectra be tied more quantitatively to the field LO-OOA? The critical link seems to focus on m/z 67 and 91. Given that those peaks are only a portion of the spectrum, how to you attribute the majority of the spectrum to monoterpene+NO3 reactions?

Other minor comments:

1. Is beta-pinene likely a good surrogate for all monoterpene+NO3 SOA formation behavior in the southeast US? How likely is the abundance of species like alpha-pinene likely to bring down the overall monoterpene+NO3 effective yield?

2. Page 2691, in adjusting the yield curve for density other than 1, both the yield and loading should be multiplied by the density shifting the entire curve up and to the right. It's not clear if both the loading and Y values were adjusted or just the Y.

3. Figure 8: The description of "RO2+HO2" and "RO2+NO3" dominant regimes is used throughout the text. Is there a way to highlight how Figure 8 is different under those two

regimes in a simple way? In terms of relative abundance of species or major reaction pathways?

4. Page 2698 line 20-29, page 2699: Is all the data from Griffin et al. 1999 shown in figure 3 (just 2 points)? Discussing the mass loadings of those points more clearly demonstrates the shortcomings of previous work than discussing the previous Odum fit. Also note that on line 12 on page 2698, the Griffin fit is referred to as an Odum 2-product, while only one product was successfully fit in Table 2.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 2679, 2015.

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