

***Interactive comment on* “Global and regional effects of the photochemistry of $\text{CH}_3\text{O}_2\text{NO}_2$: evidence from ARCTAS” by E. C. Browne et al.**

Anonymous Referee #2

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This paper makes use of measurements from the ARCTAS campaign along with various models to assess the role of methyl peroxy nitrate in measurements of NO_2 and in the chemistry of cold regions of the troposphere. The work appropriately references and builds on previous work related to this (and related) species, and adds to the body of knowledge of its role as a HOx and NOx reservoir. All of this raises an important caution to making and interpreting NO_2 measurements in the middle to upper troposphere when peroxy nitrates are present. It is pointed out, appropriately, that the impacts are maximized when there is enhanced photochemical activity and/or HOx precursors leading to elevated peroxy radical levels (such as the biomass burning plumes in the modeling of the Tropics), highlighting the importance of understanding this chemistry in other situations besides those encountered during ARCTAS.

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The only aspect of the paper that I would like the authors to revisit and perhaps expand is the steady state modeling. While my suggestion may not make a large difference to the conclusions of this modeling (such as those in Fig. 2), it seems that some important reactions have not been included. I take it that the primary production of OH from ozone photolysis in the UV-B is not necessary because the model is constrained by observed OH and HO₂. If so, this should be stated. An alternative approach would be to let OH and HO₂ also be calculated, and to assess the degree of agreement between the measurements and the model values (perhaps beyond the scope of this paper, but also a partial test of the mechanism). Perhaps that is also why other HO_x sources such as CH₂O, H₂O₂, and HO₂NO₂ photolysis were omitted. Maybe this entire issue can be addressed with a sentence or two in the model description.

Have you performed laboratory experiments with a methyl peroxyxynitrate source and varying inlet sample times to address the impacts of uncertainties in the instrument residence time on the calculations mentioned in line 8, page 2241?

On page 2241, there are a mixture of the plus/minus symbol and the keyboard version: +/-.

On page 2246, line 18, I think you mean "...in the inlet of NO₂ instruments..." rather than "... NO₂ measurements...".

It is the authors' choice, but personally I prefer symbols with error bars for binned values such as in Figs. 1 and 3. They show the range of values and bin width clearly.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 2233, 2011.

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