

Interactive comment on “Impact of convective transport and lightning NO_x production over North America: dependence on cumulus parameterizations” by C. Zhao et al.

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We thank the editor for a detailed review of the paper. To take advantage of the interactive nature of ACPD, we here provide some quick feedback on the main issues raised in the review. We would appreciate further comments from the editor and other reviewers.

The paper was in revision on and off in 2007 and 2008. Before sending it for publication, we should have reviewed more thoroughly the papers covering INTEX-A and ITCT-2004 and updated the references. NO was initially used in the analysis but was later dropped for reasons that I could not recall. If I guess, it is likely that I did not

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think that we should deal with the question if the measured NO and NO₂ are internally consistent since it's in the realm of the Science Team investigators. Ren et al. (2008) clearly answered that question; we should have been more diligent in making inquiries. What we do know is that the reason is not because adding NO in the analysis in any way made the comparison between model and observations worse. We did not include a direct comparison in Figure 5 because our result is similar to Hudman et al. (2007). We felt that showing observed NO_x in that figure is a distraction from the main point of that figure (i.e., we cannot tell the difference of NO_x profiles at the altitude of DC-8 observations). We will add that comparison in revision. Adding proper references to INTEX-A investigators' papers was another thing that somehow fell through the cracks. We thank the editor for bringing the point up and will correct the omissions during the revision. The NASA Tropospheric Chemistry Program has in the last two decades had much larger impacts on atmospheric chemistry than its budget would indicate not only because of the excellence of the Science Team investigators but also because the open and easy access to collected measurement data allowed non-Science-Team investigators to do interesting science. Giving proper credits to Science Team investigators is the least we can do.

I do have some reservation on the second point of the editor's comments. Hudman et al. (2007) has already done a comprehensive analysis of lightning NO_x impacts during INTEX-A and ITCT-2004. This paper was not meant to repeat the main objective of the Hudman et al. paper, i.e., modeling analysis of aircraft observations. As such, our figures and discussion focused on if and how INTEX-A and other observations during the same period that can be used to evaluate the difference of model simulated convective transport and lightning NO_x production based (largely) on two different cumulus convection schemes. We therefore made a conscious decision of not showing the figures already in the work by Hudman et al. (2007). We cannot ignore, of course, the question of how lightning contributes to upper tropospheric NO_x and O₃. On the O₃ front, our results are so similar to Hudman et al. (2007); it does not seem to warrant extended discussion. I have reservations on unconstrained model-model comparisons and what

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the comparisons would mean scientifically. Even under well constrained conditions, it is often difficult to pinpoint the model-model differences when model formulations are drastically different. Doing such comparisons based only on published papers will most likely lead to ambiguous statements on the reasons for model differences. If we limit the discussion to INTEX-A and ITCT-2004 period, there is little question that lightning NO_x makes significant impacts on upper tropospheric NO_x and O₃. We will revise the paper to make it more clear in light of previously published papers. However, I do not believe that this is the paper to make a general statement on upper tropospheric lightning impacts since it was not the objective of this paper and we did not simulate other periods as Cooper et al. (2009). If there is debate here on if a general statement should be made, it seems that the debate is less about the science content of the paper but more about the style of scientific writing.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 2289, 2009.

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