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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Thunderstorms and upper troposphere chemistry during the early stages of the 2006 North American Monsoon" *by* M. C. Barth et al.

Anonymous Referee #1

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Thunderstorms and upper troposphere chemistry during the early stages of the 2006 North American Monsoon

M. C. Barth et al.

The processes responsible for enhanced upper tropospheric ozone over the United States during the summer are examined using a 4-km WRF-Chem simulation with explicitly resolved convection. Regions where convective transport and chemical production occur are identified. Rate of chemical production and precursors involved are investigated. Relative importance of stratosphere-troposphere exchange and chemical production are discussed.

ABSTRACT:

P16408L11-14: Because ozone mixing ratios agree well with these same satellite data, it suggests that chemical production of O3 in the model is overpredicted and compensates for the excess convective lofting of BL air. Be more clear with your reasoning. Ignoring biases in STE, if chemical production of ozone is accurately captured, would you expect to see a low-bias in UT ozone due to the lofting of relatively clean BL air? i.e., are you assuming a (relatively) clean BL?

Emphasize what is new here. Has WRF-CHEM ever been run at this high resolution (with explicit convection), for this large of a domain, for this long of a time period to study this type of problem?

16410L14: there is concern as to the possibility of substantial –> there are substantial

16418L6-10: You seem to imply that the use of explicit convection contributes to the poor simulation of unorganized shallow convection? Would you expect to do a bit better with a convective parameterization or are you implying that you need an even finer resolution? Be clear.

16418L20-30: Within the discussion section, you should comment on the impact of this three hour bias on the amount and time evolution of the chemical production of ozone.

16420: Section 3.2.1 doesn't add much to the paper and could be shortened.

16422: L21-25: However, the TES frequency ... This sentence is confusing. CO mixing ratios are not 25% lower. It is the frequency of high-CO amounts that is overestimated. Rephrase.

16423: You do not discuss the Huntsville profile.

Section 3.22 & 3.23. Perhaps combine into one shorter section.

16424L20-25: STE caveat probably needs to be added to abstract.

16426L23-27: Do you have any thoughts on why ozone production is suppressed when stratospheric air is in the region?

16429L24-26: For point (c), I'd suggest listing which "other VOCs" are important regionally but not necessarily domain-wide.

164321L4-8, These interesting differences between inside and outside of the anticyclone could be highlighted a bit more in the discussion/summary.

16433L14-16: The statement that WRF-Chem has a high-bias in UT ozone is inconsistent with what you say at other locations in the text including the abstract.

16433L24-27: Perhaps state that estimate for organic peroxides may be an upper bound due to model chemistry.

Acknowledgements: A little more information on how much these simulations cost and how much time they took would be useful. Quite an impressive computational feat.

Figures: While (perhaps) obvious make sure to add units to Figures 1 and 2. Figure 3 does not show up well. Make larger.

Figure 4. Should we be at all concerned about the overestimation of very weak convection?

Figure 5. Captions are too small.

Figure 9 is harder to read than Figure 8.

Figure 10. This plot is too small. Use entire page.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 16407, 2012.