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Atmospheric Chemistry and Physics Discussions

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Interactive Comment

Interactive comment on "The Response of surface ozone to climate change over the Eastern United States" *by* P. N. Racherla and P. J. Adams

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RESPONSE TO ANONYMOUS REFEREE 1

Specific comments

#1 The choice of the 4-hour averaging period is dictated by the time step of the chemical transport model. The choice of 4h vs. 8h averaging period had a negligible effect on the number of O_3 episodes. We now clarify these issues in the revised version (Section 2.4).

#2 Yes, the distribution of "O_3 episodes" does not mirror an average O_3 distribution in that an arbitrary threshold of, say, 80 ppbv is utilized. Figure 3a, which shows the present-day MDA8-O_3 spatial distribution, however, gives one a better picture of the surface O_3 over the eastern US. Since the GEOS-CHEM model (*Bey et al.*, 2002) and

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the “unified" model that we utilize share a common heritage, we do not present here a detailed analysis of the present-day O_3 distributions; instead, we cite earlier studies, which have focused on that issue. Please see Section 3.1 of the revised version.

#3 We were making a general point that our analysis of the summertime sea level pressure (SLP) distributions didn't reveal a systematic trend; we therefore presented SLP distributions for several (randomly selected) cells over the eastern US. We have now replaced the 3x3 multipanel plot with one illustrative panel for a cell in the midwestern US. The reasons for the disagreement with the cited earlier work are somewhat unclear yet.

#4 We now present updated, detailed analysis of the residual 50% of the increase in O_3 episodes (please see Section 3.2). We explain how the increased O_3 chemical production is due to a combination of increases in: 1) natural isoprene emissions; 2) HO_2 concentrations resulting from increased water vapor concentrations; and, 3) NO_x concentrations resulting from reduced PAN. We have not investigated the role of the changes in boundary layer.

#5 The surface ozone budget (Table 2) shows that the shorter ozone lifetime during all seasons in the FC simulation occurs through a combination of changes in the dry deposition removal rates, total chemical loss rates, and net transport. Note that because the burdens are different in the PC and FC simulations in each season, it is important that the contribution of each loss mechanism to the overall lifetime change is considered rather than the absolute change in the loss itself. It can then be seen that, with the exception of the summer months (Jun/Jul/Aug), increased dry deposition loss rates contribute most to the shorter ozone lifetime. During the summer months, however, increased chemical loss rates and net transport contribute to the overall shorter ozone lifetime, while dry deposition loss rates remain nearly unchanged. We discuss these points in Section 3.2.

#6 This figure (Fig. 6 in the revised version) is meant to illustrate a more general point

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about climate change lengthening the O_3 season over the eastern US; we choose "grid normalized" O_3 exceedances of 80 ppbv as the metric here. Spatial information is provided in subsequent figures (eg. Figures 7/8 in the revised version) and discussion.

#7 In a way, this goes back in a way to comment #2. We have addressed this too in Section 3.1 now.

Minor editorial comments

#1 We have reworded the abstract.

#2 We choose to retain Table 1 as is, because we want to show the issue of variability (standard deviation column) in the model.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 9867, 2007.