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Comment

Interactive comment on “Identifying the causes of differences in ozone production from the CB05 and CBMIV chemical mechanisms” by R. D. Saylor and A. F. Stein

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The authors thank Referee Mora-Ramirez for useful comments and feedback.

Major Comments

1. The authors agree with the Referee that a clearer explanation for the motivation leading to the study should be provided in the Introduction. This will be included in the revised manuscript at the end of the second paragraph in the Introduction section. However, we disagree with the Referee that mention of CB6 is relevant to the current manuscript. The focus of this work is solely to identify the causes for the observed O₃ differences between the CB05 and CBMIV versions of the NAQFC. The purpose of this

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manuscript is not to identify the causes of the summertime biases that are present in both NAQFC versions – that is the focus of ongoing work that will be reported in future publications elsewhere.

2. The authors believe that the Referee is confusing two issues here. As mentioned in (1.), this investigation is only concerned with identifying the mechanistic causes that result in higher O₃ values being produced by CB05 than are produced by CBMIV, given the same emissions and environmental conditions. This work is NOT addressing the broader issue illustrated in Figure 1 concerning the biases of both CB05 and CBMIV with respect to observations in June through December. This work focuses only on why the black line of Figure 1 (i.e., the NAQFC which uses CB05) is consistently higher than the red line (i.e., the NAQFC which uses CBMIV). In this context, we chose to focus the investigation on environmental conditions where the difference in O₃ production is largest between the two NAQFC versions, i.e., the warm season. A 10-day box model simulation period was determined to be sufficient to allow the two mechanisms to exhibit significant differences in O₃ production.

3. As noted in (1.) previously, there is no need to include any discussion of CB6 since the NAQFC does not use this mechanism. The suggestion to show the main differences between CBMIV and CB05 is, in fact, exactly what we do in Section 2.2. Each sensitivity test is focused on one major conceptual difference between the mechanisms. These differences are described in significant detail in each subsection of 2.2. Finally, the revised manuscript will contain a brief description of the differences between the NAQFC versions of these mechanisms and the originally published versions. To answer Referee Mora-Ramirez's point specifically, reactions 63 and 64 are indeed the same in both the NAQFC version of CB05 and the originally published version. There are actually only a few differences between the NAQFC versions and the originals – we mentioned this in the manuscript only to be completely forthcoming and honest in presenting our work.

4. Again, as noted in (2.), this work is not addressing the O₃ overestimation for June

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to October of BOTH mechanisms. That is the focus of other work that will be reported elsewhere. As already stated, this work has a narrower focus.

5. As is stated at the end of Section 2.1, the behavior of the box model results of the two mechanisms is consistent with the full 3-D NAQFC simulations, where most, but not necessarily all, environmental conditions result in higher O₃ concentrations from CB05. We certainly could delve into the details of why scenario s37 behaves somewhat differently, but it would not add substantially to our communication of the results we have obtained.

6. We disagree with the reviewer that these suggestions would improve the presentation of the results of this study.

7. Possibly we do not understand the point that is being made here, but our results are not inconsistent with the work of Yarwood et al., 2005.

Minor Comments

1. We do not think that the color differences pointed out by the reviewer will cause any confusion to readers of the manuscript, especially since we have taken great care in captioning each figure.

2. We are unable to locate exactly what the reviewer is referring to here, but believe they may be referring to reactions R116', R117', R118' and R119', which are revised (and hence denoted with a 'prime') from the original CB05 reactions R116, R117, R118 and R119.

Interactive comment on Geosci. Model Dev. Discuss., 4, 2687, 2011.

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