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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Glyoxal yield from isoprene oxidation and relation to formaldehyde: chemical mechanism, constraints from SENEX aircraft observations, and interpretation of OMI satellite data" *by* Christopher Chan Miller et al.

Anonymous Referee #1

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General Comments:

The authors present a studying using GEOS-Chem and box model simulations to understand and interpret observations of glyoxal and formaldehyde from the SENEX aircraft campaign over the Eastern US. In addition, they compare results to satellite-derived formaldehyde and glyoxal columns to determine if there is separate information about isoprene emissions that can be obtained from each species (which they do not find). The manuscript is well written and should be published after addressing the following minor comments.

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Discussion paper

Specific Comments:

1. Beta vs delta isoprene RO2 isomers: Can you clarify the yield of beta vs delta RIO2 isomers separately from the RIO2+NO ISOPN yield from each isomer? Table S1 indicates the authors recommend an update to the RIO2+NO → ISOPNB and ISOPND yields. I wonder how much of that update is due to the different isomer distribution and how much is due to the yield of ISOPN from each isomer. Note that in older versions of the isoprene chemistry, the yield of beta-RIO2+NO to produce ISOPNB and delta-RIO2+NO to produce ISOPND were different. Fisher et al., 2016 updated them to both be 9%. The 10% yield of delta isomers indicated in Figure 1 is higher than MCM (3.4%, page 5 line 29).

2. The Li et al. paper is only cited twice despite using a very similar data set and working on a similar issue. More synthesis of results in the context of Li et al. would be helpful. For example, do both models agree in terms of the role of RO2 isomerization and its contribution to glyoxal? Comparing Figure 1 of Li et al. to Figure 1 in this paper indicates Li et al. predict a much larger role for RO2+HO2 relative to isomerization in producing glyoxal (but the figures are not directly comparable, so it is not clear).

3. Page 5, line 6-7. How was it determined that the model was not sensitive to aerosol reactive uptake? Was that through a simulation or estimated lifetime against uptake? The authors note that a background/free tropospheric source of glyoxal may be missing from the model. Have the authors considered whether or not reversible uptake of glyoxal, particularly if it is formed in the boundary layer and repartitions to glyoxal in the free troposphere, may provide this missing source?

4. Page 8, near line 5 and Figure 7: The model shows a population of points with R(GF) < 0.01 while observations do not indicate such low R(GF) at any time. Do you know the cause of these low modeled R(GF)?

5. Page 9, line 26-27 indicates finer scale, more temporally resolved data may provide valuable glyoxal data from satellite? Are the authors hypothesizing that R(GF)s may

be more variable? Can GEOS-Chem predictions be used to test that theory?

6. Figure 6: Is the influence of NOx due to the effect on RO2 branching or OH?

Technical Corrections:

7. Second sentence of abstract could be reworded as it is not clear if HCHO is also measureable from space via the same technique as glyoxal or not.

8. Page 3, line 12: “is in better agreement” than Vrekoussis?

9. Page 4, line 15: delta "vs beta" branching ratio

10. Page 4, line 15: forms as "a" second-generation

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