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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Contributions of foreign, domestic and natural emissions to US ozone estimated using the path-integral method in CAMx nested within GEOS-Chem" *by* Alan M. Dunker et al.

Anonymous Referee #1

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This manuscript applies a relatively new technique, the path-integral method, to characterize contributions to ozone over the United States. It applies two widely used models, CAMx nested within GEOS-Chem, to conduct its analysis. The main focus is on characterizing background and base ozone conditions, which have received heightened interest as the U.S. has moved to tighter ozone standards.

The manuscript is clearly written and its methods are sound. Model performance and results are in line with previous studies.

What is relatively novel here is the use of the path-integral method. As such, additional explanation and illustration should be provided in the final paper. Specifically, in Figure 2, it would be helpful to illustrate what happens in the "PIM" box. Also, a bit more explanation would be helpful regarding Equation 1. In particular, it is unclear to me what is happening along the 4 steps – is each source being reduced 1/4 at a time?

Moreover, it is unclear to me that PIM has a "unique capability to allocate the difference in O3 between two simulations..." (p. 2, lines 27-28). Don't zero-out and tracer methods also do so? Given the nonlinearities of ozone response to emissions, there is no uniquely correct answer to apportionment. Better clarity on how to interpret PIM relative to other methods would be useful.

Soil NOx, lightning NOx, biogenic VOC, and wildfire emissions are all very important to background O3. It should be clarified how soil NOx was estimated, and whether each of these sources was modeled consistently between GEOS-Chem and CAMx.

Finally, the authors could consider discussing the implications of their findings for the setting of ambient standards for O3, which is an urgent topic in the US now. That so many sites have base T10 concentrations above 60 ppb suggests certain limits under consideration may be unattainable in some regions. US NAAQS are formulated based on 4th highest O3 at the most polluted monitor in a region. Given that this study looks at T10 rather than 4th highest, at a single monitor rather than worst, with models that tend to underpredict peak O3, and with the impossibility of removing all anthropogenic emissions globally all suggests attainment of NAAQS below 70 ppb may be unrealistic.

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