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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Global combustion sources of organic aerosols: Model comparison with 84 AMS factor analysis data sets" *by* A. P. Tsimpidi et al.

Anonymous Referee #1

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Overall, the article is well written and provides a useful comparison of a global model to a very large AMS data set. The agreement between fresh OA and SV-OOA and aged OA and LV-OOA is an interesting result. I recommend publication after addressing these comments. My main comment is to include some caveats about how comparisons based on total mass (or even 3 components of mass: POA, LV-OOA, SV-OOA) may not be able to resolve source sectors or governing pathways very well. As an example, IEPOX-SOA has been shown to be a major contributor to ambient OA around the world via more recent AMS PMF analysis (Hu et al. 2015). This type of SOA is likely formed via processing of later generation isoprene products in aqueous acidic aerosol, a process not considered in the model used here. How does neglecting this type of

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Discussion paper

SOA bias comparisons? In addition, cooking aerosol (17% of total OA in Pasadena, Hayes et al. 2013) is not specifically evaluated. Is it included in your emission inventory? Should the model expect to reproduce observed OA if it is missing known pathways?

Minor comments:

1. This is a personal preference, but I encourage use of Tg C/yr instead of Tg/yr when referring to OC

2. Line 64: point out that the magnitude of missing IVOCs is likely source specific

3. Line 121: Heald et al. 2005 and de Gouw et al. 2005 were performed before isoprene was even considered a source of SOA via traditional semivolatile pathways (e.g. Henze and Seinfeld 2006). These outdated references should be replaced with more recent references to assert that global models currently underestimate OA.

4. Line 257: Do Aiken et al. 2008 OM/OC values need to be updated in light of new AMS calibrations by Canagaratna et al. 2015?

5. Lines 310-315: was cooking OA resolved in any data sets or is it likely part of HOA and BBOA?

6. How is deposition of SOA/SOG handled?

7. A table of the yield parameters for the traditional VOCs and IVOCs should be reproduced from Tsimpidi et al. 2014 in the supporting information (or in text)

8. Line 392 and thereafter: How much does the seasonality of emissions drive the higher POA in winter? Cold temperatures favor partitioning to the particle as indicated, but higher residential wood combustion could be expected as well.

9. Paragraph starting on line 408: The annual tropospheric burden vs year plot could be made more interesting by including regional trends. Do the emissions capture the expected increase in emissions from China vs decrease in the US?

10. Line 428: Clarify the IVOCs from biomass burning. Line 274 indicates IVOCs from biomass burning were not added to the existing POA, yet IVOCs account for 40% of the emissions?

11. Section 5.2.1: How do you separately diagnose errors in the magnitude of POA emissions from the volatility profile?

References

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Hayes, P. L., et al.: Organic aerosol composition and sources in Pasadena, California during the 2010 CalNex campaign, J. Geophys. Res.-Atmos., 118, 9233–9257, doi:10.1002/jgrd.50530, 2013.

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