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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Wintertime secondary organic aerosol formation in Beijing-Tianjin-Hebei (BTH): Contributions of HONO sources and heterogeneous reactions" *by* Li Xing et al.

Anonymous Referee #2

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LiXing et al. present a modeling study of SOA formation pathways and contribution of heterogeneous HONO sources in the BTH region focusing on wintertime haze. This is an important study. I have several suggestions for strengthening the Manuscript, and I recommend that the following points need to be addressed before publication:

1. Introduction line 43: Please clarify if biogenic POA refers to POA from biomass burning and/or biological particles like bacteria, fungi etc.?

2. Line 46: In addition to Robinson and Hallquist, suggest citing the recent review paper on SOA by Shrivastava et al. 2017 (1)

3. Line 85: Also cite the global modeling paper using VBS by Shrivastava et al. 2015

(2)

4. Line 100: The difference between the 2-product model and VBS is also because the VBS accounts for semi-volatile and intermediate volatility organics emitted from fossil fuel and biomass burning sources in addition to traditional SOA 3. This needs to be mentioned here.

5. Line 115: Please mention the different SOA sources being represented by VBS: e.g., anthropogenic, biomass burning, biogenic. Also, was gas-phase fragmentation of organic vapors included during multigenerational aging of organic vapors in the VBS? Please see the following papers for reference: (References 2,4,5 listed below)

6. Section 3.1. POA simulations and Figure 2: It is confusing why POA and HOA are on separate panels. POA is generally compared against the HOA factor derived from PMF analysis of HR-Tof-AMS data. Please clarify what is model POA being compared to in panel 2(a) and what is PMF AMS HOA being compared to in panel 2(b)? Also I do not see a comparison for PMF OOA and model SOA.

7. Also, can the authors compare their glyoxal and methylglyoxal to some of the AMS factors? If not, can AMS total organic signal – (sum of HOA+BBOA+CCOA+COA) be used as an estimate of glyoxal/methylgloxal? If not, please explain. For example, are there any distinct AMS makers for glyoxal/methylgloxal SOA or aqueous SOA formed during Haze? What was the overall O:C ratio of AMS organic aerosol?

8. Section 3.3: The authors include glyoxal SOA, but seems they do not include isoprene epoxydiol (IEPOX SOA) which is also formed by aqueous chemistry. Is the IEPOX-SOA contribution expected to be insignificant?

9. Line 270-275: What sources contribute to residential living? Are these biofuel burning? Also, could glyoxal and methylglyoxal also be emitted from wildfires and agricultural waste burning?

10. Figure 3: In addition to observed average diurnal cycle, also include modeled

diurnal cycle average for O3 and HONO. For HONO please include both the base and HOMO cases from Figure 4.

References:

1 Shrivastava, M. et al. Recent advances in understanding secondary organic aerosol: Implications for global climate forcing. Rev. Geophys. 55, 509-559, doi:10.1002/2016RG000540 (2017).

2 Shrivastava, M. et al. Global transformation and fate of SOA: Implications of low-volatility SOA and gas-phase fragmentation reactions. J. Geophys. Res.-Atmos. 120, 4169-4195, doi:10.1002/2014jd022563 (2015).

3 Shrivastava, M., Lane, T. E., Donahue, N. M., Pandis, S. N. & Robinson, A. L. Effects of gas particle partitioning and aging of primary emissions on urban and regional organic aerosol concentrations. J. Geophys. Res.-Atmos. 113, doi:D18301 10.1029/2007jd009735 (2008).

4 Shrivastava, M. et al. Implications of low volatility SOA and gas-phase fragmentation reactions on SOA loadings and their spatial and temporal evolution in the atmosphere. J. Geophys. Res.-Atmos. 118, 3328-3342, doi:10.1002/jgrd.50160 (2013).

5 Shrivastava, M. et al. Sensitivity analysis of simulated SOA loadings using a variance-based statistical approach. Journal of Advances in Modeling Earth Systems 8, 499-519, doi:10.1002/2015ms000554 (2016).

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