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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 #1

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This paper presents WRF-Chem simulation results for a winter haze event in 9-26 January 2014 in Beijing-Tianjing-Hebei area. The results highlights the important effects of HONO, glyoxal, and methylglyoxal on SOA formation. The simulation results after considering all these effects yield significant improvement in comparison with observed SOA, O3, HONO, HOA, BBOA, and CCOA. The results are significant and the presentation is in high quality. This reviewer only has a few minor concerns before recommending it for publication.

1. While the introduction provides a good literature review of SOA importance and recent advances in modeling SOA, it is a bit open ended because it didn't address why

this paper is needed and how this paper differs from past studies.

2. It might be interesting to look a the difference in simulated vertical profiles of SOA and O3. Early studies with field campaigns in ACE-Asia and TRACE-P showed the model's deficiency in simulating vertical profiles of SOAs. For this study, such analysis could be purely a model analysis because there was no observational counterpart to compare. But, still this can be an interesting and adds more 'meat' in the paper.

3. Finally, is there any systematic diurnal variation of SOA? if so, how well model can simulate it? Diurnal variation of PM2.5 has been of a high interest for air quality studies and such variation may differ by region. Recent studies show that in east Asia, WRF-Chem has deficiency to capture the observed diurnal variation (see citation below and references therein). It is worthy to add some analysis or discussion in the paper. To what extent the SOA simulation is improved as far as diurnal variation is concerned?

Lennartson, E. et al., 2018: Diurnal variation of aerosol optical depth and PM2.5 in south Korea: a synthesis from AERONET, satellite (GOCI), KORUS-AQ observation, and WRF-Chem model, Atmospheric Chemistry and Physics, 18, 15125–15144.

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