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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effects of organic coating on the nitrate formation by suppressing the N_2O_5 heterogeneous hydrolysis: A case study during wintertime in Beijing-Tianjin-Hebei (BTH)" *by* Lang Liu et al.

Anonymous Referee #1

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In this study, the WRF-Chem model was used to understand the effects of organic coating on particles on N2O5 heterogeneous hydrolysis. The study has very good model performance on simulating air pollutants and shows that the coating of organic is important for nitrate formation. But more details are needed to show how the model was improved. As the model performance is really good, other researchers can learn and improve their simulations. Thus, I think a major revision is needed before publication.

Comments:

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Discussion paper

1. The writing can be improved by correcting unprofessional usages. Some examples in abstract: a. WRF-Chem not WRF-CHEM b. particulate matter not particulate matters c. Line 20, why “referred to as” is needed? d. Lines 22-23, “the” is not needed in front of every noun.

2. The model used is not clear at all to the readers, which make the model results unreliable. For example, the WRF-Chem was based on studies published in around 2010, have the new features of new versions of WRF-Chem been incorporated? It said that the CMAQ aerosol module was used, but what version, AERO5 or AERO6? Isorropia II has been out since 2007, why Isorropia 1.7 is still in use? What is the gas phase mechanism? SOA contributions from glyoxal and methylglyoxal were added, but how? Have the results been validated?

3. The emission is from Zhang et al 2009 (in table 1: SAPRC-99 chemical mechanism emissions), which is a much coarser resolution and have more than 5 years’ difference in time (published in 2009 and simulation in 2014). How did the emission is processed before running WRF-Chem? With the large uncertainties in the emission inventories for China, it is hard to believe that the nitrate concentration has MB of 0.1 ugm-3, so as other components. I encourage more details to be added.

4. The method is questionable. a. All inorganic components are assumed as core? This is not reasonable. SOA, nitrate, sulfate, and ammonia are all formed secondarily, it is not right to assume that SOA is the shell while others are the core. Also, primary OA should also lay in the center as the core, right? Why it is not? b. Line 130, why H2O concentration is not considered in the reaction rate? c. Line 137, ðİŻ¿2 is what? d. Lines 144-145, ðİŻ¿N2O5,core is calculated by Eq 4?

5. MFB and MFE are recommended by several studies for PM validation. I would like to see they are used to validate the model results.

6. For the meteorological parameters, there are studies suggesting benchmarks. It is subjective to say “reproduces” and “well consistent with”. Similar for air pollutants.

7. How the PM2.5 components were measured? What instruments? Any published results? The SOA performance with MB of -1.2 ugm-3 is really interesting as there is no model so far can capture such high SOA concentrations (>75 ugm-3). This is very important for the authors to show very detailed description of their SOA model.

8. Sulfate is most underpredicted in current models for as high as 150ug/m3. It is also not clear why this model predict even higher compared to observations, as you are using CMAQ module for that.

9. Nitrate results is perfect to has a MB of 0.1 ug/m3. But meteorological conditions have larger certainties, how can this not affect the nitrate performance at all?

10. As the results show that the organic coating is important. It is essential to show that the detailed values of the parameters involving in the processes. For example, the gamma values.

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