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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Improvement of inorganic aerosol component in $PM_{2.5}$ by constraining aqueous-phase formation of sulfate in cloud with satellite retrievals: WRF-Chem simulations" *by* Tong Sha et al.

**Anonymous Referee #2**

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General comments: East Asian countries and regions are always suffered from serious air pollutions with rapid economic growth in recent decades. And high level emissions of air pollutants in East Asia could further affect regional air qualities, human health, traffic safeties as well as regional or global climate changes. Observations have revealed that severe and persistent haze pollutions occurred frequently in China during recent years. Although the numerical models could capture the loading levels and temporal-spatial variations of the total PM, most of them could not well simulate their chemical components, especially in heavy pollution episodes. Thus, accurately pre-



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Discussion paper

dicting the concentrations and chemical components of particulate matter are still very challenging for climate and air quality models. In this study, influence of aqueous-phase chemistry on the formation of near surface sulfate as well as the concentrations of total ammonium is carried out to investigate the importance of this process in some polluted episodes, based on observations and numerical evolutions. Therefore, the topic of this study is interesting and novel to some degrees and the paper has a potential for publication in the journal.

Speicfic comments: 1. Both Abstract and Conclusions should be more concise, instead of only repeating the results. 2. Were the aerosol or trace gases from biomass burning taken into account in the simulations? What is the resolution of the emission inventory (MEIC)? Why the emissions in 2016 were used to assess the pollution episode in 2018? 3. What is the resolution of the Himawari-8 and MODIS data? Is the MODIS resolution accurate enough to evaluate the model? 4. It seems that the simulated ammonium (NH4+) has little improvement when simulated the corrected LWC is used. Why? 5. Was the VIS calculated based on the aerosol and trace gases in the model? If so, then the overestimated VIS in the model could not be used to illustrate the reason why simulated LWC is underestimated. 6. Results in this study states that aqueous-phase chemistry plays a very important role in resulting in sever haze pollution. However, there have many polluted episodes in which inorganic aerosols are also growth sharply in the absent of fogs. The authors should make a brief comparison or statement on these two types of pollutions in Results. 7. Fig. 6 is needed to be re-plotted. The circles in the figure could be drawn in larger sizes. 8. English should be corrected throughout the whole manuscript.

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