Atmospheric
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Discussions

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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 #3

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General comments: The chemical transport model is an important tool for the study of air pollution and emission control. The ability of the model to simulate aerosol and its components is an important standard to evaluate the model This manuscript evaluated the WRF-Chem performance on simulating inorganic aerosol components of PM2.5 during a haze-fog event in Nanjing, and investigate the possible reasons of simulating bias compared with the observations. It found that the strong sensitivity of SNA concentration to the cloud water provides an explanation for the bias of SNA simulation. The topic is of interest and the manuscript is generally well written. There are

several issues that need to be addressed before the manuscript can be accepted for publication.

Specific comments: 1. Because LWP is a vertically integrated quantity. Is the large of MODIS MWP possible due to the thickness of the fog is thicker? I think the effect of the vertical profile simulation can be compared. If there is no observation data, vertical sounding and simulation can be compared. 2. What data quality control did authors do to evaluate the model, especially for Himawari 8 and MODIS? 3. line 256: What is pH observation data used in this study? 4. Lines 348-350: What the influence of NH3 and ammonium concentration by changing pH and LWP? Could you provide more detail? 5. Lines 365-371: It seems that cloud water pH is important to the aqueous-phase reactions rates, and the model underestimated the cloud water pH in this study. Why the pH was change from 4.9 to 2.5 by modifying LWP? And the authors need to clarify how to modify the cloud water only in the aqueous chemistry module in this paper. 6. In my opinion, emissions, meteorological, and chemistry mechanisms are also main factors in air quality model. The author should make more discussion to prove the importance of they investigated: cloud water and pH. 7. Line 815: Describe " WS" twice, change "WS" to "WD". 8. Figure 6 should be re-plottedãĂĆ The circles in the figure could be drawn in larger sizes.