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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Insight into winter haze formation mechanisms based on aerosol hygroscopicity and effective density measurements" *by* Yuanyuan Xie et al.

Anonymous Referee #1

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The authors presented comprehensive aerosol dataset observed from metropolitan city of Shanghai. The measurements and data are valuable to study nowadays severe haze in China. The authors conclude that the accumulation of local emissions under stagnant meteorological conditions as well as rapid particle growth by secondary processes are primarily responsible for the haze formation in Shanghai. The analysis of particles hygroscopisity and density variations during pollution events is very interesting although no specific mechanism, which is actually very complex in urban areas, is addressed in the study. And also, the authors may need to improve the language. In general, I think the paper is suitable for publication in this special issue after addressing some minor issues as follows,

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L36 remove “in heavily polluted areas” .

L88 no mechanisms are actually discussed in this paper.

Section 2.1, Besides the sampling sites information, the authors also present measurements and data information here.

L172 the authors think that the differences among the concentrations of PM1, PM2.5 and PM10 were insignificant. Is that true? According to the Fig. 2, on 26 Dec, they showed large differences in PM1, PM2.5 and PM10. L176 -177, you mentioned that the PM mass dropped sharply due to the atmospheric dilution or precipitation. Do you have such data to support this?

L182, is it 0.28, or 0?

L202, it seems particles with Dp>300 nm are with lower kappa, why? Some explanations are needed here.

L217ïijŽ The interpretation “. . .strong formation of sulfate and nitrate” looks contrary with the section 3.2, the section 3.2 shown that SNA (sulfate, nitrate, ammonium) only accounts for 28% of PM1.0.

L235-238: The reviewer is confused that why the number fraction of the lower density group increased as the concentration of NO increase. Did the authors analyze the relationship of them? or any reference?

Section 3.3, you talk about Kappa in the first part of this section, but you used GF in the second part. It’d better to use one parameter.

Fig.3 the authors may look the mass fraction of SIA, but not the mass concentrations. It is of course that the mass of each component will increase with the increase of PM.

Fig.5 and L259-261, it seems it’s difficult to see the characteristics you described here. You may replot the figure to make it more clearly to reviewers.

L342-344, is the first banana shape a NPF event? Because you said the other two are not.

L360-371: The science of the analyzing method is weak. Anytime the number fraction and GF of the more-hygroscopic group always increase with particle size (Figure 6). It's hard to say that the hygroscopicity difference in size was caused by the particle growth. The density difference has also the similar problem.

Section 3.6, it's very interesting to look at the particles hygroscopisity and density evolutions during the particle growth. The authors have investigated the particles with different Dp (40 nm, 100 nm and 220 nm). But to my understand, it may be more reasonable to look the GF and density with same Dp during different stage. For example, how do the GF and density of 100 nm particles changed from initial stage to growth stage?

And also, according to Fig. 7, it seems, during the period 2 and period 3, the concentrations for both the Nitrate and sulfate didn't increase and remain flat trends. How can you say that the secondary sulfate and nitrate was major contributors to particle growth during haze events?

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