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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Cloud condensation nuclei in polluted air and biomass burning smoke near the mega-city Guangzhou, China – Part 2: Size-resolved aerosol chemical composition, diurnal cycles, and externally mixed CCN-inactive soot particles" *by* D. Rose et al.

Anonymous Referee #2

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General comments:

This paper presents a result of CCN closure study conducted at a sub-urban site in China. The data analysis incorporating both AMS and VTDMA data allowed the authors to investigate dependence of CCN activity on chemical composition and mixing state. This study would be a good example in demonstrating our current ability to predict CCN number concentration. The authors will be able to improve the quality of the

manuscript by describing underlying assumptions in their data analysis in more detail. In particular, I would require the authors to pay further attentions in comparing different instruments. Different instruments use different principles, and they are operated at different conditions in most of cases. It will also be possible to discuss the result in more detail by adding few more (relatively easy) data analysis. In addition, I believe that the authors will be able demonstrate the novelty of the present manuscript more clearly if they compare their result with several recent studies. The detailed comments are listed below.

Specific comments

P26843L9

What κa,p, κorg etc. mean? Abbreviations should be used following their definition.

P26845L8

I suggest authors to add a paragraph that summarizes (1) what has been already done to reveal the relationships between CCN activity and chemical composition, mixing state etc, and (2) what kind of questions are unanswered. Some studies have already investigated the relationships between CCN data with AMS (e.g., Cubison et al., 2008) and VTDMA data (e.g., Kuwata and Kondo, 2008). What kind of novel knowledge the authors are going to add? This paragraph will be useful in clarifying the scientific role of the paper.

P26847L2

I am concerning about the potential influence of water in particles. RH = 33% is almost equivalent to efflorescence relative humidity of (NH4)2SO4. This means that sampled particles potentially contained significant amount of water. Please discuss how it affects the data reported in the manuscript as well as the discussion (i.e., I do not think that it is possible to derive κ values precisely when particles contain water). RHs for CCN measuring instrument, DMPS, VTDMA, and AMS were the same? If not, how it

affects the data analysis?

P26848L24

I have concerns on this paragraph regarding (1) actual value of density, and (2) potential size-dependence in density. 1.7 g cm-3 is almost equal to the density of (NH4)2SO4. Considering that observed particles contained significant fraction of organic compounds, the real density would be lower than this value. The authors refer Cheng et al. (2006) and Zhang et al. (2006) as references for the value. However, Zhang et al. (2009) investigated optical properties of particles observed at Beijing, which is located thousands kilometers away from PRD region. Cheng et al. (2006) assumed density as 1.7 g cm-3. Figure 2 clearly demonstrates size-dependence in chemical composition. This indicates density is also size-dependent. It may be difficult to derive size-dependent particle density; however, it would be possible to discuss how assumptions in density affect the data interpretation.

P26849L13

It seems that the authors (implicitly) assume soot particles do not contain organic compounds. However, laboratory studies and atmospheric observations have showed that they are coated by primary organic matters. This means that the present data analysis is possibly over-estimating the fraction of organic compounds included in non-soot particles. Please describe the assumptions on mixing state, and how they affect the data interpretation.

P26853L8

I am not sure if the assumption is acceptable or not. Density of POA (e.g., n-alkanes) would be around 0.8 g cm-3, which is so much different from 1.7 g cm-3 for inorganic compounds. Do the authors have any additional comments regarding this point?

P26854L2

I am wondering the significance of the statement. If the authors observed significant

influence of primary organic matters (e.g., biomass burning, transportation from megacities located at the vicinity of the observation site), it does not make any sense to compare the value with those of SOA. κorg for SOA can be higher than 0.1 if significant fraction of water-insoluble primary organic matters were present. It would be useful if the authors can add some statements on the data scattering shown in Figure 3. Is it from the noise in the original data, or does it indicates potential fluctuation in κorg?

P26855L26

Figure 5 shows (1-MAFf) vs Da relationship. Is it appropriate to use Da as x-axis? Particles larger than Da determines (1-MAFf). It would be more appropriate to use other parameters e.g., Da + 3 σ

P26857L20

It seems that the same equation has already been used by other studies (e.g., Kuwata et al., 2007). The authors will be able to demonstrate appropriateness of the definition by referring some of the previous studies.

L26857L24

Is it really due to the uncertainty of the measurement? What happens if the assumptions in deriving the equation (2) are not correct?

Figures 3 and 4

At which supersaturation authors measured the data shown in the figure?

Figure 12

This figure contains too many panels, which makes it difficult to focus on each panel. Can the authors select important panels?

References

Cheng, Y. F.,Eichler, H.,Wiedensohler, A., et al.: Mixing state of elemental carbon

and non-light-absorbing aerosol components derived from in situ particle optical properties at Xinken in Pearl River Delta of China, Journal of Geophysical Research-Atmospheres, 111(D20), doi: 10.1029/2005jd006929, 2006

Cubison, M. J.,Ervens, B.,Feingold, G.,Docherty, K. S.,Ulbrich, I. M.,Shields, L.,Prather, K.,Hering, S. and Jimenez, J. L.: The influence of chemical composition and mixing state of Los Angeles urban aerosol on CCN number and cloud properties, Atmospheric Chemistry and Physics, 8(18), 5649-5667, 2008

Kuwata, M.,Kondo, Y.,Mochida, M.,Takegawa, N. and Kawamura, K.: Dependence of CCN activity of less volatile particles on the amount of coating observed in Tokyo, Journal of Geophysical Research-Atmospheres, 112(D11), doi: 10.1029/2006jd007758, 2007

Kuwata, M. and Kondo, Y.: Dependence of size-resolved CCN spectra on the mixing state of nonvolatile cores observed in Tokyo, Journal of Geophysical Research-Atmospheres, 113(D19), doi: 10.1029/2007jd009761, 2008

Zhang, Q.,Ma, X. C.,Tie, X. X.,Huang, M. Y. and Zhao, C. S.: Vertical distributions of aerosols under different weather conditions: Analysis of in-situ aircraft measurements in Beijing, China, Atmospheric Environment, 43(34), 5526-5535, doi: 10.1016/j.atmosenv.2009.05.037, 2009

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 26841, 2010.