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Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "Impact of relative humidity and particles size distribution on aerosol light extinction in urban area of Guangzhou" *by* Z. J. Lin et al.

**Anonymous Referee #1**

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The manuscript by Lin et al. describes the impact of relative humidity and particle size distribution on aerosol light scattering, absorption, and extinction from 2009 to 2010 in Guangzhou urban site. The authors estimate optical characteristics of aerosols by Mie Model with inputs of measured chemical species of PM and relevant parameters from literature, and then evaluate the estimations by observed results from Nephelometer measurement. The manuscript contains some new materials and has the potential to be of interest to readers of Atmospheric Chemistry and Physics. But, the manuscript gives rather weak arguments related to the link among aerosol size distribution, water uptake and chemical compositions. The measurement uncertainties of instruments as well as the uncertainties of modeling in this study should be addressed. It is also



suggested that the authors compare the results of this study with those reported in literature, particularly the results in Guangzhou or China. The quality of English writing is not satisfactory, and further language polished is necessary. Overall, I recommend to accept it for publication after major revisions concerning its scientific content and language quality.

Specific comments:

1. In this study, PM2.5 was sampled by quartz filter, which might react with water-soluble ions of PM. Furthermore, all quartz filters have artifacts and the blank might also be high. How are artifacts handled in this study and what are the blank for major water-soluble ions in the quartz filter?

2. The uncertainties of all measurements were not reported in the manuscript although it is very important for modeling aerosol optical properties based on measurements. It would be nice for the authors to add one table to list all uncertainties of individual measurement techniques. The authors are also encouraged to discuss the uncertainties of model results as consequence of all measurement uncertainties.

3. The RH inside the Nephelometer was monitored. What is the measured result? In line 22 of page 15650, it seems that the authors considered the aerosol to be completely dried out, probably this is rarely the case. Typically, the RH inside the Nephelometer will be smaller than the ambient RH. How do the authors convert the RH inside the Nephelometer to the ambient RH under which bsp, bap, bep, and b$\omega$0 were discussed?

4. The fg,j values for each species is from the literature. Figure 4 showed that some sorts of assumption had to be made concerning a smoothing of the hysteresis curves. What decisions are made concerning using the deliquescent or crystallization branch of the hysteresis curves ?

5. Line 3 in page 15647, "Since POM, EC, and other unidentified components were

considered to have no hygroscopic growth, . . .. . .", what is the literature for reference of this statement ? Generally, water soluble organic carbon accounts for 50% of the total organic carbon although its hygroscopic ability is smaller than inorganic salt. It would be nice to take the hygroscopic growth of POM into consideration in the model.

6. The mass of uptake water was estimated by Eq.(1). Please give the reference literature for Eq.(1).

7. Is water included in the j-th component in Eq.(2) and (3) ? If so, what is the value of fgj for water component ? How does the number concentration of water determined in Eq.(5) ?

8. Line 6 in page 15650, "it is able to estimate bsp, pm0.5-2.5 by the Mie model based on the EORI, EGF of PM2.5 and Nj,pm0.5-2.5 from APS measurement." This statement is based on the assumption that the chemical components and their mass fraction of PM0.5-2.5 are entirely consistent with that of PM2.5. But, the size distribution of chemical components vary greatly, especially for ultra-fine particles and fine particles. Furthermore, the chemical species was measured with low resolution (23.5 h). But, the modeling is with high resolution of 1 hour. How do the authors handle the dataset from low resolution to high resolution? The uncertainties of the assumption in this study should be evaluated.

9. Line 18 in page 15651, "Regardless of the difference in chemical composition, . . .. . .". As the question (7), the estimation of bap,pm2.5-20 (bsp,pm2.5-20) should take the size distribution of elemental carbon (sulfate, nitrate, ammonium,. . .. . .) into consideration.

10. Line 24 in page 15653, the number of 0.87 should be 0.86 according to figure 5 .

11. Line 9 in page 15654, "hbap,pm0.5-2.5 fluctuated around 1 when RH increased from 37% to 66%, and then began to drop." When the aerosol is assumed to be internal mixing, the “focus effect” of light absorption increases with the RH increasing and the



hbap,pm0.5-2.5 should also increase, but the value of hbap,pm0.5-2.5 began to drop with the RH increasing in this study.

12. It would be nice to add a figure illustrating the temporal series of mass concentrations for each species and each size bins based on PM2.5 data.

13. In figure 5, it should illustrate the value of the measured and modeled bsp, not the standardized bsp.

14. In figure 7, the title of y axis should be "fraction of scattering coefficient" and " fraction of absorption coefficient".

15. How to estimate the optical properties of PM1.0 ? The method could not be found in the manuscript, but the result was illustrated in figure 7.

16. The optical parameters of possible chemical components were listed in table 2, but, which components are used in the Mie model ? For example, what is the chemical form of sulfate in the calculation of bsp. If the chemical form of sulfate is (NH4)2SO4, the reason for this argument should be clarified.

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 15639, 2012.