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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Impact of particle number and mass size distributions of major chemical components on particle mass scattering efficiency in urban Guangzhou of South China" *by* Jun Tao et al.

**Anonymous Referee #2**

Received and published: 22 March 2019

General

The paper presents calculations of mass scattering efficiencies (MSE) in Guangzhou, a polluted region in south China. The work is based on size-segregated measurements of aerosols with a multi-stage impactor, filter sampling, size distributions measured with an SMPS and an APS and scattering measured with a nephelometer. The main goal was to obtain new MSEs to be used in polluted air instead of those in the IMPROVE equation. That makes sense since the IMPROVE equation was derived from data collected in very different areas, mainly US national parks. The paper is traditional



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Discussion paper

aerosol science, there are no especially significant new findings but it is important to get these new MSEs published since they are a piece in improving air quality. The paper was easy to read, I did not find any major mistakes so I can recommend publishing it in ACP after making some small additions and corrections.

One thing that I recommend doing is to calculate your MSEs also by using multiple linear regression (MLR). Now you calculated them with a Mie model. That is fine and scientifically justified but it also has its uncertainties, for instance related to refractive indices etc. Your data is good for MLR and that would give another estimate for the MSEs. MLR is quick and easy to do – even with Excel – and that is also actually inversely the way air quality data would be used for estimating visibility from PM2.5 filter data. Doing that you would have an additional uncertainty estimate and a closure of MSEs.

Having done that I suggest you make an additional scatter plot and linear regressions of scattering coefficient calculated with the Mie-derived MSEs, with the MLR-derived MSEs and with IMPROVE MSEs vs. measured scattering coefficient. Now you have written in the text new MSEs and written how they differ from the IMPROVE MSEs but the full comparison for the Guanzhou air is missing, that would be the linear regressions I suggested. How well do the different MSEs predict the observed scattering?

Another thing I miss is equations. For example equations of how you calculated MSE, the mean diameters you are using and also chemistry: Did you dry the sampling air for the impactor? If not the particles are larger and get collected on the upper stages which affects the inverted size distributions and ultimately the Mie-modeled scattering. At least some discussion of this would be good.

Detailed comments L131 " ... geometric diameter (Dg) ..." The widely used meaning of Dg is the geometric mean diameter of a particle number size distribution. So use Dp. for the aerodynamic diameter use Da.

L137-138. Nephelometer: did yu calibrate it?

L197: expain the Mie model in a bit more detail

L201, define MMAD and give the formula L206 "limit of detection" is wrong here, that expression is related to concentration measurements

L248 "As expected" – why would you expect this?

L266 "NO3 mainly exists in the form of ammonium nitrate..." you have data on the inorganic ion concentrations but how did you calculate concentration of ammonium sulfate and ammonium nitrate? Give a couple of formulas.

L385 "NMAD" – give formula

L574 "mass median geometric diameter (MMGD)" I have never heard of. Define. Consider using some other descriptive diameter that has been presented in literature.

Fig. 4. Are the diameters of the ASMPS data and the APS data both aerodynamic or what? The gap is huge, try to explain it.

Fig 5. The numbers in the x and y axes cannot be true. In Guangzhou number concentrations are in the range of thousands, now the max concentration is about 400 /cc.

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