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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Characterization and source apportionment of aerosol light scattering in a typical polluted city in Yangtze River Delta, China" *by* Dong Chen et al.

Anonymous Referee #1

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The paper by Chen et al. systematically investigates the characteristics and sources of aerosol light scattering through measurements at three different functional sites in a typical polluted city in the Yangtze River Delta, China. Aerosol scattering is important for both visibility degradation and air pollution, and is also complex due to aerosol chemical composition and hygroscopic growth. In this study, the US IMPROVE formula for aerosol scattering calculation was optimized using online and offline measurements at different functional sites in Nanjing with complicated sources of air pollutants. The influence of aerosol size distributions and pollution levels on the aerosol scattering was quantitatively evaluated based on a comprehensive analysis of the size-specific chemical compositions of particles at various sites. In general, this manuscript is well

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Discussion paper

organized and easy to follow. I would recommend its acceptance after some necessary corrections suggested as follows:

1. Line 87: “NH4NO3 and (NH4)2SO4” need to be defined at their first mention in the manuscript. The manuscript has similar problems with other chemical species as well. Please go through the manuscript and change all of them.

2. Line 149: What is the mass fraction of the methanol soluble organic carbon in the total organic carbon mass? Did you try the water extraction?

3. Line 186: In the process of formula optimization, why did the authors subtract the scattering coefficients by sea salt, soil dust and coarse particles from the measured scattering coefficient? Does it mean that the light scattering of those species has little impact on the optimization of IMPROVE formula?

4. Line 201: Mie theory is very sensitive to the size distribution of aerosol chemical species. However, the size distribution data obtained from a high-flow MOUDI impactor can usually be influenced by the particle bounce. This is particularly concerned in case where filters, instead of metal foils with grease coating, are used as the substrate. I suggest the authors make an uncertainty evaluation upon the size distribution measurement in this study.

5. In Section 3.2, the US IMPROVE algorithm was optimized only within one city in the Yangtze River Delta with good performance. How did the authors consider the application of the optimized formula in typical regions such as cities in Beijing-Tianjin-Hebei or Pearl River Delta? Some discussions are recommended here.

6. Line 352: The study did not mention if the scattering coefficients used for the US IMPROVE estimation at the three sites were measured by CAPS or nephelometer? According to Section 2.3, the scattering coefficients at PAES and NUIST were measured by two integrating nephelometers. Need some clarification on this issue.

7. Line 447: Due to the varied chemical properties of particles in different regions, the

growth factors of particles (GF) can be different, and it would bring some uncertainty to the calculation of scattering coefficient in Section 3.3. It is recommended to measure and apply the local GF values in this work.

8. In Section 3.4, there was no clear description whether the scattering coefficients were estimated based on the assumption of dry or ambient conditions.

9. In Section 3.5, the assumption that the secondary components were proportional to the emissions of their precursors is subject to great uncertainty, as noted by the authors. Please be more specific on how to get better results with improved measurement or modeling methods.

Some minor comments:

Line 31: Define “IMPROVE” on first usage.

Line 32: "OC" should not be abbreviated when it is mentioned for the first time.

Line 160: What is the wavelength of the integrating nephelometer at the three sites used?

Line 246: The operational symbol was missing in Eq. (3).

Line 522: “Mien theory” should be “Mie theory”.

Line 562: “PME” should be “PMF”

Line 970: SIA in the legend did not exist in Figure 8.

Reference list: The format of references should be in accordance with the journal requirement.

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