Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC2
https://doi.org/10.5194/acp-2022-218-RC2, 2022

Comment on acp-2022-218

Anonymous Referee #2

Referee comment on "Strong light scattering of highly oxygenated organic aerosols impacts significantly on visibility degradation" by Li Liu et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-218-RC2, 2022

Liu et al. measured the chemical composition and light scattering coefficient of wintertime organic and inorganic components of ambient aerosols in Guangzhou, China, with an aerosol chemical speciation monitor and a tandem nephthelometer system. Positive matrix factorization was applied to the Q-ACSM data to extract primary and secondary organic aerosol factors. The dry mass scattering efficiency of the organic aerosol factors ranged from 2.1 m^2/g (hydrocarbon-like OA) to 9.9 m^2/g (MOOA), and the MSE of MOOA increased to 16 m^2/g at 90% RH. A hygroscopicity parameter of 0.23 was obtained for MOOA from light scattering enhancement factors measured under humidified conditions relative to dry conditions. Overall, MOOA contributed 54% of the ambient OA scattering and 20% of the ambient non-refractory aerosol scattering.

1. The authors claim that calculated k_{OA} values are not solubility-limited above RH ~ 80% (e.g. **L349**). To support this hypothesis, I think it would be useful to add a plot showing k_{OA} as a function of RH (over the range of conditions accessed in the humidified nephthelometer) for the LOOA and MOAA factors. This result could then be compared to humidity-dependent k_{OA} values measured in, for example, biogenic SOA that spans a range of phase state/viscosity (e.g. Pajunoja et al., 2015). Adding these details should also clarify the conditions that were used to calculate the k_{OA} values that are discussed in the text – for example, it is not clear to me from the text what humidity condition(s) were used to obtain k_{OA} = 0.23 for MOAA

2. L108-L109: Typo – "8-9 L" and "8 L" should presumably have units of L/min.

3. L146: Please state the range of composition-dependent ACSM collection efficiency values that were calculated.

3. Figure 2: In my opinion, the information shown in panels (a)-(d) would be more useful if summarized in a table. Figures 2e and 2f might be possible to move to the supplement.

4. Figure 3: Why does this figure need to be presented in the main paper? If I understand it correctly, it is a result obtained in a previous study (Tao et al., 2019), not in this one.

5. Figure 4: Please make the x-axis scale the same in panels (a) and (b). It would be useful to decrease the minimum f_{MOOA} and f_{POA} values to zero. Also, I would replace "f_{POA}" with "f_{HOA} + f_{COA}" (if that is what it represents) to directly relate it to the PMF factors.

6. Figure 5:

- The layout of this figure is confusing: the pie charts on top are labeled as panels (a), (b), and (d); it would make more sense to label these as panels (a), (b), and (c).
- In the "MSE vs RH plot" (Fig. 5c), please show MSE = 0 on the axis scale.
- In the "% Contribution vs Visibility (km)" plot (Fig. 5e), please show % Contribution = 0 on the plot.
- Fig 5e: I suggest changing the label "% Contribution" to "Fractional Aerosol Scattering " or something that more clearly explains what is being shown.
- Fig 5e: I don't understand what "Visibility (km)" means. I cannot find where this is discussed/explained in the manuscript. Please add a few sentences to the text to explain what this figure is showing.
- Fig 5e: What does the "SA" symbol mean?
- Fig 5e: I am confused about how to interpret the numerical values shown in this figure. If the fractional scattering contribution is shown, shouldn't the values add up to 100%? If not, why? It would be easier for me to understand this plot if it was normalized so that the fractional scattering contributions summed to 100% or 1.

References

Pajunoja, A. T. Lambe, J. Hakala, N. Rastak, M. J. Cummings, J. F. Brogan, L. Hao, M. Paramonov, J. Hong, J. Malila, S. Romakkaniemi, K. Lehtinen, A. Laaksonen, P. Massoli, T. B. Onasch, N. M. Donahue, I. Riipinen, P. Davidovits, D. R. Worsnop, T. Petäjä, A. Virtanen. Adsorptive uptake of water by semisolid secondary organic aerosols in the atmosphere. Geophys. Res. Lett., 42, doi: 10.1002/2015GL063142, 2015.