

Review of “Field Observations Reveal Substantially Higher Scattering Refractive Index in Secondary Versus Primary Organic Aerosols” by Shen et al.

This work uses field measurements of aerosol size, composition, and optical properties to constrain estimates of the real part of the refractive index for organic aerosol. Based on statistical characterization of the organic spectra using PMF, the authors were able to identify organic aerosol types as having primary and secondary sources. Combined with this identification and direct DMA-SP2 measurements, the authors quantified contributions of the different aerosol types to the refractive index and recommended revised estimates of refractive index for POA and SOA. The analysis in this paper is cleverly carried out and thorough, providing fidelity to the arguments and new refractive index recommendations. The figures clearly illustrate discussions in the text. The paper is generally well written but there are a lot of grammatical errors and the sentence structure is at times difficult to follow. In some places I noted where these were and made suggestions, but the issues were far too numerous to point out each one. The authors should make a concerted effort to carefully re-read the paper to ensure its clarity. I believe this paper is appropriate for this journal but should only be accepted after the authors address the following minor comments.

1. Line 109-110: The authors should cite the manufacturer of the SP2 (Droplet Measurement Technologies).
2. Lines 105-115: The authors have not provided any discussion on the set up or quantified the inlet and loss properties of the instrument set up and sampling system. This information must be included. What altitude were the aerosol sampled from? Were the measurements continuous? Were the aerosol collected in a container using one main inlet? Was there an impactor or cyclone before sampling into the instruments? What was the main inlet flow and instrument flows? Have the authors quantified the sampling losses to the instruments? How were the aerosol dried? How was the relative humidity monitored?
3. Line 116: can the authors provide a citation for how this equation was derived?
4. Line 140: what type of nephelometer was used? Please provide the same information where relevant as in my second comment.
5. Line 166: no need to redefine PMF.
6. Figure S4 caption: revise text to, “[Comparison of] dry-state aerosol ...”
7. Figure S5 and S7: how is the relative deviation calculated? Please specify.
8. Line 302-304: The authors state that the chemical composition at mr1064,400 of 1.56 has higher MOOA content. Higher than what? The mr1064,400 at 1.48?

Please specify which mr1064,400 and MOOA content are being referenced in the text.

9. Figure 4: please specify that the red line in these panels is the 1:1 line in the caption.
10. Line 454: Grammar: "...increase mrc525 from 1.37 to 1.59 would [result?] in a ~60%..."
11. Line 474-477: This sentence is too long and confusion. It should be split into two sentences for clarity.
12. Data availability: In accordance with ACP guidelines (https://www.atmospheric-chemistry-and-physics.net/policies/data_policy.html) that "authors are required to provide a statement on how their underlying research data can be accessed", the authors must provide a resource that contains their deposited data to "guarantee the integrity, transparency, reuse, and reproducibility of scientific findings." If this is not possible, the authors need to clarify why their data is not being shared. This should be in the Data Availability section at the end of the manuscript.