

Interactive comment on “Urban Aerosol Size Distributions: A Global Perspective” by Tianren Wu and Brandon E. Boor

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Dear Colleagues,

Please take the following comments from Anonymous Referee #2 into account when revising the manuscript.

Many thanks and best wishes, Uli Pöschl (handling editor)

Comments on Wu and Boor (2020), submitted to ACP

I commend the authors for attempting this expansive review, which will be very helpful to the aerosol community. I apologize for not submitting a review in time, and even now my work is incomplete. Normally, I spend a couple of hours on a review; I have spent

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well over that on this manuscript and I am still less than a third of the way through it. Some of that is apparently because of ACP's format requirements - with 25 figures at the end, reading and relating discussions to figures becomes very difficult. For what it's worth, the comments I have so far are mostly grammatical or ways to frame it better.

Some general comments:

1. This review attempts to not only review worldwide PSDs, but also applications in exposure and filtration. The latter two are fields in their own right for good reason and should perhaps be separated as a companion paper(or papers) that can be reviewed by experts in those fields. 2. Perhaps this expansive work is better as a monograph that can be fact-checked, verified, and copy-edited by paid staff, or at least split into three or four papers, with measurement experts, atmospheric chemists, inhalation modelers, and building/indoor air quality experts reviewing the different parts. The latter might also make it easier for an individual reviewer to spend a few hours and do a satisfactory job within their expertise. 3. One of my comments was whether 1 nm species can even be called aerosol particles, and that seems a definitional rabbit hole. If one were to focus on urban air quality and exposure/HVAC applications, the sub-10 nm aerosols may not even be practically relevant or can be left for another paper.

Specific comments: Abstract, line 3: replace "enable for characterization" with "enable characterization"

Introduction, line 2/para 1: "spanning in size from a single nanometer to tens of micrometers" - can 1 nm actually be considered an aerosol particle? Seems like an issue of definition - has previous work established a lower size limit for the transition from molecules to aerosol particles? (The authors limit their own review to aerosol sizes above 3 nm.)

Introduction, para 2: "Measurement of urban aerosol PSDs provides..." and "UFPs...are associated with various deleterious human health outcomes." These statements should be backed up by references to epidemiological and toxicological studies,

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especially as the paragraph criticizes current air quality standards that are based on PM mass (and which have been quite effective at improving human health). A problem could very well be (as the authors state) that most PSD measurements are not long-term, which is necessary for epidemiological studies; but that surely is the end product of the current manuscript (e.g. “we recommend more long-term studies”) rather than a declarative statement at the outset. Toxicological studies do not require long-term studies; the authors should be able to cite studies that back up their claims.

Introduction/last paragraph: replace “enables for identification of gaps” with “enables identification of gaps” (Please check the manuscript for similar language corrections, I will stop now.) Also, the authors should probably state in the introduction that their 3 nm to 10 micron size range refers to electrical mobility diameter.

Methodology: What is the time duration of an individual PSD? Typical SMPS scans are 2 minutes; optical sizing can be at 1 Hz. Or do they mean 793 measurement campaigns or days of data?

Abbreviations for geographical regions: I had a hard time remembering what each stood for, e.g. CSSA or WA. Suggest the use of Africa, EAsia, WAsia, CSSAsia, etc. Why is the EU separated from North America/Australia/New Zealand - these are all OECD regions with greater similarities in emissions control regimes compared to Asia or Africa.

Figure 9 is introduced and discussed before Figure 2. Suggest re-ordering the figures in the order they are discussed.

Section 3.4: what did Rissler et al. report as density for soot aggregates - that seems relevant for group C (traffic environments) if EC can be a quarter of particle mass. A statement about the material density of soot appears at the end of the first paragraph of Sec 3.5 - which is supposed to be about coarse particles that likely don't have a lot of EC. Perhaps that should be moved to Sec 3.4. The last sentence seems unclear - if both soot particles and denser(?) components can exist in the 400-1000 nm size

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range, why pick one over the other unless one component dominates the mass?

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