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Atmospheric Measurement Techniques Discussions

Interactive comment on "Facility for generation of ambient-like model aerosols in the laboratory: application in the intercomparison of automated PM monitors with the reference gravimetric method" *by* Stefan Horender et al.

Anonymous Referee #1

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Designing an aerosol generator to simulate ambient-like aerosols is a complex task especially because most ambient chemical reactions are hard to characterize. However, they are extremely important for instrument detection abilities. The authors have thoroughly explained the setup, its advantages and its limitations. There are a few improvements that can be made to the outputs of this setup, but this work is important to get out which can then be further developed. Calibrating instruments based on the conditions in which they are used and with relevant aerosol characteristics is very important, especially as we start to understand the importance of particle coatings, ag-

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gregation, etc. on human health and climate interactions. This type of device will also be important as wearable technology and supersites become more common. An over or under estimation of the particle concentration could prevent health alerts from going out if underestimated or could cause unnecessary concern if there is a consistent over estimation of PM. This is a useful proof of concept paper and provides a useful path forward in developing this device, and its uses, further.

Specific comments: Are there studies that look at each of the instrument's reaction to the ambient chemical on their own and not aggregated into a standardized aerosol? Line 367 alludes that this needs to be done and is an evidence gap in the literature. Is this true?

This device seems like a nice way to incorporate more ambient aerosols into calibrating instruments, but there seems to be relatively large unknowns such as needing to understand each component's influence on the instrument separately and how particle density influences instrumentation response. Will this presumably expensive aerosol generator have improvements to the aerosol modelling field even with these unknowns? Can this be corrected for during post-processing?

What is the lowest sample flow that this device can adhere to?

Would this type of system require knowledge about the ambient chemical composition in order to tailor the device to a calibration setting relevant to the geographical area? If so, to what degree is required for accurate results?

Can the designed device be taken out into the field for calibration outside of the lab? Or does it require a built-in power source, lots of set up or a highly stable environment (such as a study platform, etc.). In figure 6b, there are two different injection tubing types (L-shape and a bent elbow shape). What was the reason for the difference in this design? Does the L-shape influence the incoming primary aerosols differently than the turbulent air jet?

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Most of these parts are custom made and look very expensive. I assume that this device is going to be patented and sold, but in the case that it is not, how will other researchers be able to recreate these results? Will it be obtainable for using in a low-cost setting?

Technical Corrections: Line 37 – "most important metric to monitor", should be changed to "regulated pollutant" or something similar, as health studies are not conclusive about what particle characteristic is the most damaging to human health (PM, particle number, surface area, surface chemical composition, etc.). PM2.5 and PM10 is significantly easier to measure than surface area or PN for fine particles. Line 47 – Could the authors give a quick description of what the references found in regards to the limitations of measuring PM due to the volatile component of particles?

Throughout – "PM mass" is redundant, as PM stands for particulate mass.

Line 49 – Is this last sentence saying that PM has a 25% uncertainty with the measurement techniques? This sentence could be structured differently to avoid confusion to the reader. Line 60 – would the standard to which instruments need to be standardized be different depending on where/when/how PM is being measured? What about the influence of elevation in this standardization process? Line 87 – Add "detailed below" after "aerosol generator system" so it reads: Apart from the aerosol generator system (detailed below), . . . Line 87- Refers to a "new setup". Is there an old setup that precedes this setup that should be referenced? Line 105 – roman numeral should be iii) at the end of the line. Line 111 – was there a specific reason for choosing GMD of 90 nm? Line 113 – Was the aggregated particle size actually measured or is this an assumption based off of particle growth theories? Line 119 – Is this mixing protocol to adhere gaseous particles to the soot particles? A brief sentence about this would be helpful.

Figure 1 is very nice. It would be helpful to emphasize the intake air. How it is currently makes it look like a closed loop system rather than drawing air into the system. Is the

recycled water from the aerosol mixture chamber just used for cooling, is it cleaned for reuse, or is that unnecessary?

Line 272 – what is the purpose of the charring correction? Line 285 – Missing “an” before “example” Line 306 – Here would be a good place to include the uncertainty of these PM calculation technique (+/- 20%?). Line 332 – Is there any possibility the fresh soot was aggregating which caused a decrease in PN? Or was this variable accounted for in the design? Line 369-371 – is this sentence out of place? It seems relevant to include it with the previous paragraph.

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