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Atmospheric Measurement Techniques Discussions

Interactive comment on "Laboratory evaluation of particle size-selectivity of optical low-cost particulate matter sensors" *by* J. Kuula et al.

Anonymous Referee #2

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General Comments This manuscript describes the development of a system to provide a flow of monodisperse particles, and the authors then use this system to evaluate several common low-cost sensors. The description and evaluation of the new system (VOAG-GP50) are clearly described. Although their conclusion that low-cost sensors mis-classify particle sizes is not new, the systematic evaluation of size selectivity in low-cost sensors is a valuable contribution to the field. However, the paper would be stronger if the authors improved the clarity of the data-processing section, address a few questions regarding sample flow rate, and polish the language.

Specific comments:

The data processing section needs some clarification. The authors discuss dividing the data into 30 size bins, but in line 146 they discuss 10 steps to produce different

particle sizes. The authors need to clarify how 10 steps can yield 30 different size bins. In Lines 175 to 180, the authors base their discussion of valid detection ranges on a detection efficiency curve, but I could not find a discussion of how they define a detection efficiency curve. I would suggest providing an example in the supplementary material and illustrating how the upper $\frac{1}{2}$ of this curve is defined.

I have some concerns regarding the effect of sample flowrate on the low-cost sensors. In the experimental setup, a pump draws the monodisperse particles into the sensor housing at a flow rate of 1 lpm. Figure S2 shows the sensor housing and placement of the low-cost sensors with the flow directed at the sensor inlet (mostly). The authors should consider whether this setup may be skewing their results. This is particularly important for sensors with fans that are designed to operate at a specific flowrate. It is possible that pushing a flowrate that differs from the design flow rate could alter the results. For example the PMS sensor has a volumetric flowrate of approximately 0.1 lpm (which is 10x lower than the volumetric flowrate into the sensor housing). Granted not all of the 1 lpm would flow into the sensor, but this is worth considering.

The manuscript needs a thorough review and edit by a native English speaker. The language is awkward and sometimes confusing. I am including a few examples from the abstract, but this list is not comprehensive: - "due to their prostective nature regarding spatial extension of measurement coverage". Vague and awkward wording. - "sensors can be useful in achieving this goal". No goal is mentioned previously. - "it is often reminded that the risk of sensor misuse". Improper usage.

Technical corrections:

Line 121. Do the authors mean stable particle size distribution rather than particle size gradient? If they mean particle size gradient, this needs to be explained.

Line 185. The authors should clarify what the response curves are for. The 10-step (30-bin) generation of monodisperse particle sizes?

Line 203. The authors should provide the standard deviations of the CMDs. In Figure 2, the text says “The GSD of the size distribution remains below 1.2, but line 113 says that the VOAG has relative standard deviation of less than 3 %.”

The authors mention the size limitation of the APS as being a limiting factor in the analysis (Figure 2), but in line 119 they mention that the VOAG cannot reliably generate particles smaller than 0.55 um. This limitation should be mentioned in Figure 2 in addition to the APS limitation. It would also be worth mentioning this important limitation in the abstract.

Figure 1 – The GRIMM is not shown. Where does the GRIMM draw its sample? How are the flows distributed symmetrically between the APS and GRIMM since the GRIMM’s flow is 1.2 lpm whereas the GRIMM is 1 lpm?

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