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Atmospheric Measurement Techniques Discussions

Interactive comment on "The Universal Cloud and Aerosol Sounding System (UCASS): a low-cost miniature optical particle counter for use in dropsonde or balloon-borne sounding systems" *by* Helen R. Smith et al.

Anonymous Referee #2

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Review of "The Universal Cloud and Aerosol Sounding System (UCASS): a low-cost miniature optical particle counter for use in dropsonde or balloon-borne sounding systems" by Smith et al.

This manuscript describes a low-cost miniature optical particle counter for relatively large particles. The design of the counter seems to be sound and unique. The manuscript is well written but there are a few issues that need to be addressed. I recommend significant revision before it can be accepted for this Journal. Detailed comments and suggestions are listed below.

Major comments:

1) Calibration process is incomplete. The described calibrations using particles of known diameters can only determine the sensitivities of the instrument, but not counting efficiencies (as a function of particle diameter). This is especially important for small particles (near the lower detection limit of 0.4 μm). Note that the inter-comparison results shown in Figs 16 and 17 are not sufficient to validate the UCASS. This is because the particle mass concentration or liquid water content is only sensitive to large particles. The authors need to demonstrate the counting efficiency by comparing the UCASS to a proven OPC or CN instrument.

2) It is a bit disturbing to see the wide (up to 1 order of magnitude) and inconsistent (between the low- and high-gain channels and between various sizes – note especially peaks of 0.753 and 3 μm PSLs and 11.58 μm soda lime) spreads of the instrument responses to PSL and other particles (Fig. 8). The authors seem to attribute it to calibration particles. But it is hard to believe the PSLs have such large spreads. If it is due to the real PSL spread, the authors ought to be able to reduce the spreads by using a DMA (at least for particles < 1 μm) and redo the calibration. If not due to the calibration material problem, then the authors need to provide an explanation.

3) If the large spreads shown in Fig. 8 are due to an instrument problem (such as the imperfection of sensing area definition/particle rejection as described in Fig. 4), then the size resolution of the instrument is not great. Detailed analysis is needed to show the true size resolution.

4) The description of the optical assembly is very difficult to understand. A better Fig. 2 should help.

Minor comments:

1) Fig. 1 is not well done. Appears to be hand drawn?

2) Fig. 16 needs to be improved.

3) It is hard to get a clear understanding of the electronics design. A circuit diagram should help (such as Fig 4. In Hill et al., J. of Atmos. And Ocean Tech., 2008).

4) A quick search for Alphasense mirror and First Sensor detector didn't yield any useful results. Please add web links or state that they special orders.

5) "f(x)" is not defined in Fig. 8.

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