

Atmos. Meas. Tech. Discuss., referee comment RC1
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Comment on amt-2020-495

Anonymous Referee #1

Referee comment on "Characterizing the performance of a POPS miniaturized optical particle counter when operated on a quadcopter drone" by Zixia Liu et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2020-495-RC1>, 2021

Overall Comments:

The authors present a ground-based comparison of a POPS measurement and SMPS in an environment heavily influenced by biomass burning aerosol. The authors then compare POPS measurements on a UAS in flight to its measurements on the ground and suggest that these differences are due primarily to the UAS flight.

Although comparing an SMPS to the POPS is not particularly novel, this study does verify that the agreement holds in an environment influenced by biomass burning and where a different index of refraction has been assumed.

The authors suggest that the POPS is adversely affected in this particularly sampling position on a small rotary UAS. Yet the authors note that no attempts were made to sample from other locations on the multi-rotor aircraft, or to modify the inlet for in-flight aerosol measurements. Potential perturbation to instrument flow are not directly addressed. These should perhaps be pursued. At the very least, the authors must tailor the scope of their claim to say that simplistic measurements from the POPS instrument are ill advised and quad copter aerosol sampling requires careful evaluation and consideration.

The flight tests do not involve an in-flight inter-comparison, which we suggest the authors also pursue, if possible. As noted, real differences in aerosol distributions and particle concentration number with time could have obscured perceived UAS aerosol sampling bias.

Specific Comments:

The abstract should be shortened.

L31 – L33 An odd comment; remove from the abstract. Begin with, “we compared the Portable Optical Particle Spectrometer, a small light-weight and high sensitivity optical particle counter...”

L37 Awkward. Rephrase. “This is the first such documented...”

L38 Word choice – you don’t “investigate” the RMSE or MAD - you report it.

L50 – 52 Be specific about differences in coarse mode to what other instrument – SMPS does not measure particles > 1.0 micron. This is particularly confusing...

L62-74 This section could be much more concise.

L88 Awkward phrasing.

L106 – 113 This section could be shortened and only details particularly relevant to this study should be mentioned (this overall description is covered in Gao et al. 2013 and 2016).

L117 Did this study include a POPS?

L119 Comparisons to tower measurements – what instruments were compared and were they compared only at one height? Was temporal averaging applied?

L131-132 It is still not clear what was entailed in the in-flight UAS POPS comparison. Please be more specific.

L132-134. This sentence should be removed. It is not helpful.

L153-155 Was the adjustment to account for a difference in the index of refraction done to binned data or per particle data? Doing this to binned data could introduce an additional (likely small) source of error.

L178-180 Can the authors comment on how the sampling tube might be optimized for drone sampling? This seems like a very important point considering the comparison/ test.

L205 Was this date of the wing-mounted PCASP instrument a day that the POPS sampled (on the UAS or on the ground)? What altitudes were sampled to provide these size distributions?

If not, perhaps shorten this section and specify that the PCASP size distribution is simply provided for reference.

L235-240 For an instrument comparison, the size range of the SMPS and POPS should only be compared in the range where measurements overlap. The full SMPS and POPS size ranges should only be used to characterize atmospheric aerosol distributions more fully.

L258 – 290. Since no in-flight comparison to another instrument was done, the authors need to demonstrate that they did not observe any systematic differences in the PSD at 10 m compared with at the ground.

L285-287 not needed.

L301-303. This is a good point. The POPS flow (used to calculate PC in each bin size) needs to be monitored in each of the different flight positions.

L313 – 316. Again what is the flow in each POPS case? Are the counting statistics much poorer during FLY than when on the ground?

L331-333 Unfortunately, this point undermines this entire study. If there are real differences that might be confused with instrument performance in flight, the study ideally should address this.

L336-337 This does not make sense. Two additional stages of G_NR are suggested?

L356- end Tailor sweeping claims as suggested.