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Atmospheric Measurement Techniques Discussions

Interactive comment on "Design and Field Campaign Validation of a Multirotor UAV and Optical Particle Counter" *by* Joseph Girdwood et al.

Anonymous Referee #1

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This is a well written and presented paper and the authors should be commended in tackling the topic of measurement uncertainty arising from particle sensors mounted on UAVs. The UAV platform is an important tool in the atmospheric observer's arsenal but the community has, in general, been lax in applying the same rigour to measurement uncertainty as is applied to sensors on large aircraft platforms.

1. The authors have performed extensive simulations to determine the effects of the propellers and flow through the particle measurement system on the resultant measured size distribution. Particle size is affected by changes in the temperature and humidity of the carrier phase and these parameters can be affected by the flow dynam-

ics. In addition to the ambient field measurements of temperature and humidity, ideally, these would also be measured at the point at which the particle size is measured. As this is difficult to do it is often advisable to model the dynamical effects on these fields in order to get a handle on a possible measurement uncertainty introduced.

2. The authors have been primarily concerned with droplet but there are applications for where the particles under consideration are dry: dust for example. Have the authors modelled the electric field around the particle sensor and considered how this may bias any measurements?

3. The reasoning around using fog and low cloud as the source of "calibrating" particle is sound as these can be assumed to be spherical water droplets (the previous point concerning particle growth due to dynamical effects on temperature and pressure is thus quite important). It is noted that a CAPS probe was used as the reference instrument and of the two optical sensing systems in this probe only the CAS is used (CIP:12.5 μm – 1.55 mm (standard), CAS: 0.51 μm to 50 μm). Given the conditions expected at the deployment site, a DMT FM-120 (ground-based fog monitor: 2 μm to 50 μm) or CDP-2 (cloud probe that can be used in ground-based applications without the need for artificial aspiration: 2 μm to 50 μm) would have been a better choice of probe type. Why was the CPAS selected?

4. When using what are essentially aircraft instruments such as CAPS in ground-based deployments it is standard practice to have the instruments automatically aligning so they always point into the wind. Probes such as these have a limited acceptance angle (when deployed on an aircraft they are always pointing directly into the wind by default) and measuremtns can be severely biased when the incident airflow is outside of this. What arrangements were taken to ensure that the ambient wind direction was within the acceptance angle of the CAPS probe?

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