Atmospheric Measurement Techniques Discussions

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Comment on amt-2021-275

Anonymous Referee #2

Referee comment on "Simulation and field campaign evaluation of an optical particle counter on a fixed-wing UAV" by Joseph Girdwood et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-275-RC1, 2021

This is a review of "Simulation and Field Campaign Evaluation of an Optical Particle Counter on a Fixed-Wing UAV" by Girdwood et al. The authors describe an evaluation of the UCASS OPC where they use airflow simulations of airspeed and angle of attack to filter real airborne campaign data. As someone that has used optical particle counters extensively and is interested in deploying them on airborne platforms in the future, I found this study useful. I think others would as well and think it merits publication in AMT. The writing is good. I have some thoughts and suggestions regarding the narrative of the manuscript as well as some minor comments which I think should be addressed prior to publication.

General comments:

This study focuses on using the UCASS to measure cloud droplet number concentrations and size distributions which should be mention in the title, or more strongly in the abstract. More work would need to be done for aerosol number size distributions with the UCASS (e.g. in smoke plumes).

It is a little difficult to follow the narrative from section 3 (Computational Fluid Dynamics with Lagrangian Particle Tracking) to section 4 (Field Campaign Testing and Validation). It's hard to see how the CFD work was used to either inform and/or correct for the field campaign design and data analysis. I don't think any major needs to be done, but maybe right at the beginning of section three the aims of the CFD could be stated in the context of how and why it is useful to do.

The choice of figures included in manuscript make it a bit challenging for the reader to visualise what was done for the field campaign component. There's a photo of the UCASS on the Talon, as well as another photo of the stationary UCASS mounted on the station,

but nothing showing any information about the flights. For example, I think a panel of plots showing the altitude vs flight time with coloured points indicating things like cloud droplet number concentration/temperature/wind speed/wind direction (like what is summarised in lines 251-253) would be useful for the reader to visualise the experimental part of this work. Even a map showing where the station was and the flight coordinates would be good and could be incorporated into Figure 8.

In the conclusions section I'd be very interested to know what the next steps are. Are the CFD simulations essential for data filtering? Will the authors try different OPCs or in different environments with different aerosol/cloud? Where their some limitations in this study that the authors would like to address in future work?

Minor comments:

- Line 12. "flew past through stratus cloud". It should be "through" only.
- In section 2.1 I think the authors should mention the laser wavelength and the scattering angle. Both are relevant for determining the sizing of the 16 size bins. The sizing accuracy will depend on the type of aerosol (or cloud) being sampled. In this study only clouds are considered which is fine but the situation would be more complex with aerosol, especially if it's absorbing. It is mentioned later on but does belong in the instrument description.
- Can the results from both the fore and aft simulations be shown in Figure 5?
- Can the correlation coefficient also be included for Figure 15? I think it would be useful to know how much of the variance in number concentration difference is explained by the relationship with PRY