

Author Response to Reviewer #1

Joseph Girdwood

We thank the reviewer for their comments and welcome their extensive experience with OPCs, and input into the manuscript.

Response to general comments:

We agree that more work would have to be done in order to characterise aerosol distributions with the UCASS instrument. The evaluation presented here was conducted with cloud droplets, since the underlying Mie assumptions used to compute a size are more valid, and the evaluation here is more focused on the integration of the instrument with the platform as opposed to more instrument specific parameters, like the response to various aerosols—which may be non-spherical, non-homogeneous, or be highly absorbing. As you correctly point out, this is only mentioned briefly in Sect. 4.1, therefore the manuscript has now been changed to emphasise this more strongly in the abstract. UCASS has been utilised and evaluated for the measurement of aerosol—specifically Saharan dust—in Smith *et al.* (2019) and Kezoudi *et al.* (2021), however this is ongoing research.

The aim of the CFD-LPT simulations was to define a series of UAV operating conditions, with particular focus on airspeed and AoA, in which UCASS can measure with reasonable tolerance. This has been stated in Sect. 3.1.

To provide campaign context, number concentration profiles through the cloud are presented in Fig. 8. Each profile now has an ID number which is consistent throughout the manuscript.

Since several of the authors are responsible for the initial and continued development of the UCASS instrument, future work relating to this project will be largely focused on a design overhaul of the UCASS instrument to deal with the mechanical stresses encountered during an intensive UAV field campaign. The updated UCASS will also include an extended size range, and particle-by-particle data as opposed to bins. Future work will also be conducted into evaluating the new UCASS for aerosol measurements. The conclusion has been amended to state this.

Response to minor comments in order:

- The sentence structure here has been revised to include revisions based on a previous comment.
- The elliptical mirror is positioned with a lens angle of 60° and has a half angle of 45° . This range of scattering angles was selected as a compromise between monotonicity of the instrument response with respect to particle optical diameter—where 90° scattering is preferable—and refractive index dependency—where forward scattering is preferable. The laser operates at 650nm, which was selected based on a size parameter for a Mie scattering regime within the size range of the instrument. Section 2.1 has been amended to reflect this.
- Figure 5 has been altered to include the aft simulation in a second panel. The text and caption have also been altered to explain this in more detail.
- The correlation coefficient is now included on both Figure 14 and 15.

References

Smith, H. R., Ulanowski, Z., Kaye, P. H., Hirst, E., Stanley, W., Kaye, R., Wieser, A., Stopford, C., Kezoudi, M., Girdwood, J., Greenaway, R., and Mackenzie, R.: *The Universal Cloud and Aerosol Sounding System (UCASS): a low-cost miniature optical particle counter for use in dropsonde or balloon-borne sounding systems*, *Atmos. Meas. Tech.*, 12, 6579–6599, <https://doi.org/10.5194/amt-12-6579-2019>, 2019.

Kezoudi, M., Tesche, M., Smith, H., Tsekeri, A., Baars, H., Dollner, M., Estellés, V., Bühl, J., Weinzierl, B., Ulanowski, Z., Müller, D., and Amiridis, V.: *Measurement report: Balloon-borne in situ profiling of Saharan dust over Cyprus with the UCASS optical particle counter*, *Atmos. Chem. Phys.*, 21, 6781–6797, <https://doi.org/10.5194/acp-21-6781-2021>, 2021.