Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2018-437-RC2, 2019

Atmospheric Measurement Techniques Discussions

Interactive comment on "Study of the diffraction pattern of cloud particles and respective response of Optical Array Probes" *by* Thibault Vaillant de Guélis et al.

Anonymous Referee #2

Received and published: 21 February 2019

This manuscripts presents a series of diffraction simulations and laboratory calibrations designed to test the ability of optical array probes to accurately measure the size and shape of non-spherical ice particles. This topic is of interest to the community of OAP users and the work here is relevant and important to extending our understanding of probe response characteristics in ice. In my view, the most important findings are how differently the same particle can appear at different Z positions, which has implications for habit identification using OAPs (particularly in cirrus), and how particle size changes as a function of Z, which will affect the accuracy of size distributions due to uncertainties in both size and DoF. The writing, logic, and data presentation are all very good, and I do not have any serious reservations about this manuscript being published in AMT. A

few minor considerations and comments are listed below.

P3, line 9: Spherical particles act as a lens which makes them largely opaque. Ice particles, however, often have flat surfaces that will allow significant light transmission through the particle. I think the assumption of opaqueness is OK for this manuscript, but it should be stated here that it will not always apply to real ice particles, and thus the simulations/calibrations and resulting measurements (such as D_eq) will have additional sources of error that are not captured in this experiment.

P5, line 7: Was the divergence of the beam tested? OAP lasers are not perfectly collimated, which will affect the diffraction pattern and how it changes through the depth of field. Some other simulation-based experiments have considered this, e.g. Hayman et al. (JTECH 2016).

P6, line 8: "perfectly seen" should be rephrased, smaller features will still be distorted in real-life situations.

P12, line 24: Defining the DoF limit in terms of D_eq or D_max here seems tricky. In practice, the measured diameter will be used to define DoF, rather than the actual diameter of the underlying particle, as is implied here. Even though D_eq may give a better DoF estimate in this case, I suspect that the DoF limit is highly shape-dependent. Did the authors attempt to test non-spherical DoF for a wider variety shapes?

P12, line 29: I'm not sure I understand what this sentence is referring to. The original diameter definition used to compute DoF can be found in Knollenberg 1970 (JAM).

P13, line 9: What was the equivalent air speed of the spinning disk? Was there any attempt to try the experiment at different speeds in order to test the effects of electronic response time?

P14, line 35: I think this is already done in some software packages, e.g. 'reacceptance' in McFarquhar et al 2017.

Appendix A, line 20: What type of filter was applied to the image?

Appendix C: I think this appendix is unnecessary. The minimum circle problem is well known and there are much more modern approaches to the problem (Welzl, etc.). It is also discussed in the context of OAP images in Wu and McFarquhar (JTECH, 2016).

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2018-437, 2018.