Full review of Schnaiter et al., AMT 2017 (based on the manuscript version of 30 August 2017)

General comments

The manuscript „PHIPS-HALO: the airborne Particle Habit Imaging and Polar Scattering probe – Part 2: Characterization and first results“ is the second part of a study presenting a novel aircraft optical cloud probe. This part is focusing on the characterization and the first measurements from the PHIPS-HALO instrument.

The unique part of the PHIPS-HALO is the combination of a polar nephelometer and a stereo imager. Both components together allow for measurements of the microphysical properties and the appropriate angular light scattering function of single particles.

In this manuscript, the authors characterize the main components of the instrument (light scattering detection system, imaging system, electronics) and present some first results from two research campaigns.
For example, the authors explain very clearly why and how they redesigned the fiber-to-MAPMT coupler inside the polar nephelometer in order to avoid optical crosstalk between adjacent channels of the MAPMT, which is an important factor for obtaining reliable measurements. For the imaging system, they introduce a correction method, which is used to correct the oversizing of smaller cloud particles in order to get adequate results.

All in all, the manuscript is very well written and has a clear structure. I would suggest the manuscript to be published after minor revision. This should address the following points:

Major comments

Page 9, Line 26 – 33: You mention that the instrument was used during four aircraft missions. I am wondering how the measurements from the PHIPS-HALO agree with particle measurements from other imaging instruments or another polar nephelometer. I think this is the biggest weakness of the manuscript, because the authors show results from only a single instrument. It would be a beneficial to know if the measurements of the angular scattering function are similar to measurements from another polar nephelometer. The comparison could be done by using homogenous cloud sections. If other instruments were not available on the aircraft, it might be possible to use cloud chamber studies for an instrument intercomparison.

Page 10, Line 12 – 28: You point out the advantages of the stereo imager very clearly, but the advantages of the whole PHIPS-HALO instrument in comparison to other instruments is neglected. It would be nice to have a table or a paragraph which summarizes the advantages of this novel cloud probe in comparison with other instruments (FSSP's, Cloud Imaging Probes, holography instruments, etc.).

Page 8, Line 29 -31: You mention a new data acquisition software, but do you use analysis software to identify different kind of particles (plates, columns, etc.)? Do you analyze and sort the particles by hand or do you use some sort of algorithm?

Minor comments

Page 1, Line 12: change “form” to “from”

Page 2, Line 22: Here, you use a headline followed by another headline. It looks strange when there is a headline with no following content.

Page 2, Line 23: The paragraph about the “Trigger detector” is included in the subsection “Light scattering detection system”. Do you think it is the right place? You should consider putting it before this subsection, because the Trigger also starts the image acquisition (see Page 7, Line 28-29). It means that the Trigger detector initiates the light scattering system and the imaging system.

Page 3, Line 8: Is “sensing area” similar to “sample volume”? If it is, change it.

Page 3, Line 9: “roughly” Can you deliver an uncertainty of these droplet diameters?

Page 3, Line 28: You might answer it in Part 1, but are the mirrors heated to avoid condensation?

Page 3, Line 31: You should mention in this sentence for what reason it is not feasible.

Page 4, Line 17 – 18: You show in Figure 2 the redesigned fiber-to-MAPMT coupler and the simulated irradiation. If you additionally show the simulations here before the redesign it would help to explain why you needed a redesign.

Page 8, Line 25: “several kHz” Be more specific.

Page 8, Line 31: “QuickUSB library and the library that comes with the camera” Give a reference.

Page 9, Line 42: “at least for cirrus cases” What is the typical particle distance between cirrus particles. Does it mean that you can not exclude shattering for liquid clouds?

Page 9, Line 27: You should cite the BAMS paper here concerning ML-CIRRUS
http://journals.ametsoc.org/doi/abs/10.1175/BAMS-D-15-00213.1

Page 11, Line 5: Change “The two imaged droplets with…” to “The two imaged droplets in Figure 12 with…”

Page 12, Line 11: Change “In a first analysis, bullet-rosettes were…” to “In a first analysis, bullet-rosettes (see Figure 14) were…”

Page 14, Line 1 – 6: As mentioned before, I think it is time for an intercomparison with other instruments.

Figure 2b: Legend is too small
Caption Figure 2: “nephelometer” not “nephlometer”, ….the the …..

Figure 3: The numbers on the axes are too small

Figure 3 and 4: Stay consistent with the Figures. For Figure 2 you use “a” for the left and “b” for the right figure. Here you talk about “left”, “right”, “upper” and “lower” panel.

Figure 4: Left and right figure are inconsistent. Labels are different. Brackets around the units are different. Label size is different. Ticks for y-axis are different. The illustrations of the electrical crosstalk levels are different too.

Figure 16: Mark the images with numbers or letters. Then you can add these number to the lines of the angular scattering functions. Like in Figure 13.

All Figures: Stay consistent. Keep [unit] or (unit).