Comment on amt-2021-318
Anonymous Referee #2

Referee comment on "Horizontal geometry of trade-wind cumuli – aircraft observations from shortwave infrared imager versus radar profiler" by Henning Dorff et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-318-RC2, 2022

Excellent paper, great summary and illustration of the limitations of 1D transects / chords lengths for characterizing cloud size distributions. Good follow on from Barron (2020) which they cite multiple times. I have only minor comments, detailed below. I have a suggestion which is not necessary for the authors to perform, but I wonder why they did not show at the end a joint-frequency distribution of cloud size and eccentricity? Should we expect some trend in eccentricity with cloud size? Perhaps eliminate figure 9 whose purpose is unclear, and add such a joint-pdf plot? Or leave that for your next work. There are other possible follow-up studies, which just illustrates why this is a good piece of technical foundation.

Line 25 “limitedly understood” is strange phrasing, consider “only partially understood”

Line 50 “barely” should be “rarely”

Line 72 “precedent” doesn’t make sense here, maybe “The conclusions consider the abilities of a prospective flight campaign to answer new research questions.”

Line 74 “We consider” change to “we analyze”?

Line 78 “… in a 2D image.”

Line 85 “… the profiling radar enables”

Line 96 Why choose the SWIR band instead of VNIR? Just one short sentence to explain. Something about sun-glint perhaps?

Line 127 I wonder if the window freezing issue should be mentioned again at the end in the recommendations.

Line 164 “following aspects” should be “the following aspects”

Line 174 consider “limited” instead of “dammed” which sounds too much like “damned”
This is a very important and difficult aspect of this analysis, I have experience with this issue. I believe you made the best choice to reduce bias and error of counting a section of a large cloud as a small cloud. However, this does not eliminate bias, but shifts the bias to larger size clouds (which are now systematically undersampled), so that is ideal for this analysis focused on smaller scales, but maybe a note about this should be included in the discussion in the beginning of section 3.4 to warn future users of this analysis technique. The larger clouds are indeed more rare, but will also be undersampled as the cloud length scale approaches the typical image scale.

A “scale-break” might also be a sign that a power law is the wrong choice, because, for example, a scatter-plot of frequency vs length scale data on a log-log axis plot that looks like two power-laws with a scale break in between could instead be considered as a single exponential distribution, with the “scale-break” location being the bend in the exponential on a log-log plot. Since 1 function is less complex than 2 functions, the principle of parsimony would suggest considering an exponential distribution instead of a power-law. I don’t expect you to change this for this paper, or change the power-law obsession everyone seems to have, but I do suggest that you consider the exponential instead of a “scale-break” in future work.

Unclear “this pronounces”?

“contrarily” is not clear, something more like “This affects the distributions in the opposite direction.

Caption of Figure 5 Remove “exemplary”

The point of Figure 9 is unclear... are you trying to show clouds that don’t make it into the analysis at all? Maybe draw some lines on Figure 9 to indicate which clouds in that image are included (if any?)

“constraint” should be “constrained” and “This pronounces” doesn’t make sense, maybe “This results”

“regardless of the resolution”

Not clear, maybe change to “Using only the radar resolution and statistical methods, e.g., considering circular assumptions (Romps and Vogelmann 2017), or as in Barron et al. (2020), such methods will fail to reproduce the actual double power-laws (not shown). Cloud shapes being rather more elliptical than circular...”

“arises” should be “raises”