

Interactive comment on “First correlated measurements of the shape and scattering properties of cloud particles using the new Particle Habit Imaging and Polar Scattering (PHIPS) probe” by A. Abdelmonem et al.

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This paper is a detailed analysis that thoroughly describes the physical and theoretical operation of an interesting instrument that will potentially offer new measurements that relate ice crystal morphology to phase function, a critical property of cloud particles that determines how they alter radiative fluxes.

Given that the title advertises "correlations" between cloud particle shape and the scat-

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tering properties (I assumed that this refers to visible light-maybe the title should also have "light scattering"?), I anticipated a more quantitative paper that would show more than a single comparison between the shapes and phase functions. Although I realize that the focus of AMT is on technology and not science, I think that the title is misleading as there are no correlations between the shapes and scattering properties. In fact, there are only two comparisons: 1) a phase function of a water droplet and 2) a phase function of a crystal plate. Why not take all of the measurements from the columns shown in Figure 12, calculate their maximum diameters and aspect ratios and show how the measured phase function changes with aspect ratio? The whole phase function would not need to be shown, but something derived like hemispheric back scatter and asymmetry factor, two parameters very important for radiative transfer calculations. I personally would also be very interested to see how much these values change as a function of the alpha and beta for a constant size. This seems to me to be the power of the PHIPPS that makes it unique to other measurement techniques.

If a more comprehensive set of data is not going to be shown, then I would recommend that the authors remove the phrase "correlated measurements".

Page 11, line 10 - "probably dependent on size", doesn't optical theory dictate that it has to be dependent on size?

Page 11, line 14 - Should "path" be "pass"?

Page 12, Figure 4 - I think it might be useful in this figure to replace the theoretical curve with one that is averaged over the same intervals as measured by the PHIPS and add another curve that is the ratio of PHIPS to this average. It appears from the figure that the agreement is quite good in the 0-90 angles but there seems to be a shift or bias in the 90-180, particularly 100-130. Is this a misalignment or possibly a polarization issue?

Page 12, Line 10 - What is the meaning of "flake"?

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Page 13, Line 23 This sentence needs some re-writing as it doesn't read well. Perhaps, "In the case of small particles they are faint and produce a flat, broad distribution. In the case of out-of-focus particles the histogram method fails since the peak in the histogram, corresponding to the particle is masked by the histogram background."?

Page 14, line 6 I think instead of "involuntary", the better word might be "automatically" or "unconsciously".

Page 14, line 7 "Flip" in this case might be ambiguous. Does this means when the trend goes from positive to negative, or negative to positive?

Page 16, Line 21 "All threshold values are arbitrary values selected carefully...". I would remove the word "arbitrary" because I think this implies the opposite of careful selection.

Page 24, line 3 Are the length to width ratios large enough to classify these as needles rather than columns?

Page 24, line 19 Are these averages over all alpha and beta angles?

Page 25, line 13 Sect. 0?

Page 26, line 7 "During this growth period compact columnar ice particles were detected by PHIPS as depicted in Fig. 15." How does this figure show columnar ice crystals? There seem to be a range of habits. What are the red and yellow lines?

Page 27, line 11 "The color code marks the particle number concentration while the black color is reserved for PHIPS data." I think that a comparison between the PHIPS and CAPS, that would be easier to interpret, would be to calculate the average of median volume diameter from the CAPS, in the size range of the PHIPS, to compare with the PHIPS. If comparing with the CAS, this measures an optical diameter whereas PHIPS is measuring some other size parameter. If comparing with the CIP, you could compare area equivalent diameters.

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