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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Remote sensing of ice crystal asymmetry parameter using multi-directional polarization measurements – Part 2: Application to the Research Scanning Polarimeter" *by* B. van Diedenhoven et al.

Anonymous Referee #1

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Review of

Remote sensing of ice crystal asymmetry parameter using multi-directional polarization measurements – Part 2: Application to the Research Scanning Polarimeter by B. van Diedenhoven, B. Cairns, A. M. Fridlind, A. S. Ackerman, and T. J. Garrett

The authors present a valuable and extensive analysis of a large and expensive data set from the CRYSTAL-FACE campaign in 2002! Four interesting flights have been investigated. The manuscript is well written. The findings of cloud asymmetry parameter

and aspect ratio are quite important for future studies on cloud microphysics observation and modelling. A few comments below might be worth considering in the revised paper.

1) As in several other papers on this topic the term roughness and “microscale distortion” is wrongly used. The “distortion” is realized by random tilts of the (physically infinitely extended) plane crystal facets. That corresponds to an ensemble of columns or plates, which deviate from a perfect macroscopic hexagonal crystal structure. This is not a microscale property.

2) It might be worth to briefly note where the polarization information is used in the retrieval to distinguish between particle shapes? Plates and columns have rather different polarizations in the range of scattering angles, I assume.

3) The main concept of the RSP retrieval is the use of aspect ratio and “distortion” of hexagonal columns or plates as free parameters. That might be OK if the crystals mostly consist of this general hexagonal geometry. However, Fig. 4 for example shows that the majority of the ice particles are irregular. I assume one could to the same exercise with spheroids (to vary aspect ratio) and air bubble inclusions (to vary inhomogeneneity), for example. So, some words to justify the approach might be in order.

4) . . .71, 20-25: Please provide some arguments why the (existing) correction of cloud top heights due to transmissivity and multiple scattering is not applied. Cirrus clouds are optically thin and the assumption of opaque clouds may not be approriate. And for optically thicker clouds, multiple scattering gets more important, of course. So, it seems that there is always a strong need for that correction.

5) Figs. 3b and 3c: Is the RSP retrieved extinction the mean value for the cloud column? If so, comparison with in-situ extinction at the flight lag is problematic. Same for RSP retrieved g near cloud top and in-situ g at a certain flight altitude. Both g do not seem to show any correlation. So, extensive discussion of the differences may not be

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required.

6) General: Given the small radiometer field of view and the strong cloud inhomogeneity I assume that 3d-effects may play a role. I understand that this is beyond the scope of the present study, but could get mentioned in the conclusions.

7) Conclusion: First three paragraphs are merely summary. Please remove or move to previous section.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 32063, 2012.

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Interactive Comment