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Atmospheric Chemistry and Physics Discussions

Interactive comment on "3-D polarised simulations of space-borne passive mm/sub-mm midlatitude cirrus observations: a case study" *by* C. P. Davis et al.

Anonymous Referee #3

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The paper presents detailed simulation results obtained with a versatile Monte Carlo radiative transfer model which incorporates both 3D spherical geometry, particle non-sphericity, and polarization. The comparison between 1D and 3D radiative transfer modeling is especially interesting and important and will have serious implications for development/improvement and performance evaluation of existing and future passive retrieval algorithms. The paper is very well written; the main results are well articulated and substantiated. There are a few typos that will, undoubtedly, be corrected by the copy editor.

I have only two suggestions. The first one is to provide several general references

substantiating the facts stated by the authors in the second paragraph of section 1. Some of the statements are rather strong and need corroboration. For example, a good recent reference on passive mm/sub-mm remote-sensing techniques is the book

C. Matzler (Ed.), Thermal Miscrowave Radiation: Applications for Remote Sensing (IET Press, London, 2006).

An appropriate reference for radar remote sensing would be the book

G. L. Stephens, Remote Sensing of the Lower Atmosphere (Oxford University Press, New York, 1994).

A good demonstration of the effect of particle shape on the results of cirrus cloud retrievals in the visible is the paper

M. I. Mishchenko et al., Sensitivity of cirrus cloud albedo, bidirectional reflectance, and optical thickness retrieval to ice-particle shape, J. Geophys. Res. 101, 16973-16985 (1996).

The authors may have alternative/additional references in mind.

The second suggestion is to comment on how the scattering properties of real ice crystals are represented by idealized shapes such as spheroids, cylinders, and hexagonal columns and plates. I would simply say that when the particles are comparable to or smaller than the wavelength, their scattering and absorption properties are mostly determined by a simple shape parameter like the ratio of the largest to the smallest particle dimensions. This is in contrast to the situation in the visible spectral range, where even small-scale surface roughness can result in wavelgnth-high undulations and affects scattering quite strongly. I am sure the authors can find a reference substantiating this point.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 12701, 2006.