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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Evaluation of radar multiple scattering effects in Cloudsat configuration" *by* A. Battaglia et al.

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High LDR values can certainly be due to non-spherical particles. However (see discussion and reference Wolde-Vali at page 12) the frequency of occurence of $LDR > -10\,dB$ is very rare, especially at nadir view. On the other hand we predict such large values of LDR as soon as MS is relevant (and in particular increasing more and more going deep within the medium). In this sense we believe this as a peculiar feature of MS. Note that the introduction of non-spherical particle scattering properties is not believed to change this LDR signature in a significative way just because this strong depolarization comes from the contribution of higher than 1 order of scattering. A paper including profiles with non-spherical particles is now under preparation.

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1. Obviously the longer time is taken into account. Practically the MonteCarlo code solves the time-dependent radiative transfer equation.

2. In the GCE-CRM six hydrometeors are considered including uniform size cloud droplets (radius $10\mu m$) and ice crystals (radius $10\mu m$), raindrops, graupel (density $0.4\,g/cm^3$) and snow (density $0.1\,g/cm^3$) with the latter three hydrometeor classes having exponential size distribution with a fixed intercept parameter N_0. While for rain this intercept is always equal to $1.6\times10^4 m^{-3}mm^{-1}$, for graupel and snow this parameter is equal to 1.6×10^4 and $3.2\times10^4 m^{-3}mm^{-1}$ respectively. Mixed-phase hydrometeors are not included.

3. The surface is always considered as a black surface. However this is not relevant because only ranges shorter than the surface-range itself are considered in the paper. A consistent surface model is necessary only when the return from ranges longer than the surface-range are seeked. Do not be scared by a reflectivity enhancement by 70-80 dB. It may also be infinite, e.g. in the case when there is a finite cloud and the MS produces a signal for ranges longer than the bottom of the layer (from where one would expect no signal at all). The key thing is that the signal we see from a certain range may actually be produced completely in an upper level. Therefore the signal from a certain range can be totally decoupled by what is actually present at that range.

4. Yes it is certainly true that high LDR are found in correspondence of low signal (because of strong attenuation). According to a suggestion from the people who performed the Wakasa Bay experiment we used a cut off at -40 dBZ for the cross polar reflectivities. We also are concerned with the interpretation of these measurements which where not thought to investigate MS effects (so there was not particular care in the LDR product). Our message here is that even in airborne configuration MS should be detectable, but it requires high quality measurements since it manifest itself in region of high attenuation (thus where signal

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is very low). Cloudsat is not equipped with LDR capabilities but we recommend future airborne campaigns to perform ad hoc studies on this topic.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 8125, 2006.