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Atmospheric Measurement Techniques Discussions

Interactive comment on "Evolution of DARDAR-CLOUD ice cloud cloud retrieval: new parameters and impacts on the retrieved microphysical properties" *by* Quitterie Cazenave et al.

Anonymous Referee #2

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This paper presents results of microphysical ice properties from the radar and lidar on board the A-train in view of the latest refinements to the DARDAR cloud product, namely: 1. apriori information on the lidar ratio; 2. an improved particle size distribution for the ice particles; 3. An improved N'o and 4. A new mass-diameter relationship. The A-train data set currently provide our best estimate of the global climatology of ice clouds, so improving this data set is clearly a valuable step forward, and so the results are worthy of publication, subject to clarification of some issues.

Major Points

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Discussion paper

1. The abstract should be more informative and provide a more precise summary of the findings. At present the statements are too vague. Currently it says IWC can be 'up to 50% with, globally, a reduction'. 50% is a large change. What is the global average reduction? Effective radius increases between 5% and 40%, with the largest difference in clouds between -20C and 0C. The new lidar ratio of 35 +/10 sr for cold clouds is quite a reduction on the previous values. Line one of the introduction stresses the importance of ice clouds on the radiation budget, but this aspect does not seem to be directly addressed in the rest of the paper. Do changes in effective radius for the warmer ice clouds lead to changes in the radiation budget? Perhaps not, as such clouds are already optically thick? Do changes in the lidar ration affect the radiative properties of the thin cold ice clouds? If so by approximately by how much? Although only a few days were analyzed, this should be sufficient to make some more definitive statements. The purpose of the abstract is to give the reader a more quantitative summary of the findings and impact of the new results.

2. The paper is quite long, but the justification for the four changes in the DARDAR product are not discussed, instead, there is a list of references. Since these changes are of vital importance, a couple of sentences in each case summarising the evidence would be helpful to the reader. For example, on page 6, line 18, four references are quoted to justify reducing the max value of S (the lidar ratio) from 120 sr to 50 sr, and hence changing the coefficient alpha (lnS) by a factor of three from 0.0237 to 0.008 (page 7,line 9). What sort of observations were used? Were they Raman or HSRL lidar – ground-based or airborne? How comprehensive? How confident are we of any implied change in the radiative properties of thin cold ice clouds?

3. Figure 2 shows the change in the PSD. It would seem that this is crucial to the increase in the IWC, because the longer tail of larger particles with the normalised size above 2.8, will lead to large changes in Z, but smaller changes in IWC, hence a given Z will now correspond to a lower IWC. Is this effect dominant, or is the change in m-d of equal importance? Is the reduction in the concentration of particles with normalised

size below 0.2 of any significance? It would help the reader if these aspects were discussed.

4. The figures are of very poor quality and are scarcely legible.

5. Finally, there are quite a few typos.

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