

Interactive comment on “Comparison between the first Odin-SMR, Aura MLS and CloudSat retrievals of cloud ice mass in the upper tropical troposphere” by P. Eriksson et al.

Anonymous Referee #2

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This paper presents a preliminary comparison between IWP derived from passive and active microwave and submillimeter measurements from three satellites. The information presented here is useful as an interim result and the paper should be published. However, revisions are required to the present manuscript.

While the overall presentation of information is reasonable, there are many grammatical errors that need to be corrected.

My major criticisms are as follows:

The statement on page 12046 that the cloudsat algorithm will always retrieve a smaller

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ice mass is speculation without some sort of demonstrated calculation. What is a "perfect" retrieval in this sense? The authors assume that for a given cloud volume, the radar reflectivity and the passive measurements will provide some sort of equivalent information irrespective of different scattering and emission effects. This seems unlikely. Second, it is not necessarily obvious that the unimodal retrieval of cloudsat will always be equivalent to the large mode of the bimodal PSD assumed for the passive measurements. This depends on the relative particle sizes and number concentrations of the two modes. A unimodal retrieval can approximate a bimodal distribution and actually obtain a higher ice mass depending on the relative properties of the two modes of the PSD. Furthermore, what is the basis for assuming that all PSD's look like Heymsfield and McFarquhar?

The conclusion reached by the authors that the agreement in the mean values of the retrievals make them suitable for model validation seems fundamentally premature. Each of the retrieval algorithms considered in this paper relies on many more a priori assumptions than the authors consider. In addition to the assumption of particle size distribution shape, there are assumptions regarding the mass and area dimensional relationships that have a large influence on the relationships between the measurements and the retrieved ice masses for a given PSD assumption. That the mean pIWP value can change by a factor of 2 for the MLS retrieval for a relatively slight change in cloud height is evidence for the instability of the algorithms. It may be that the agreement in the algorithms is due to a common set of compensating errors. Before such conclusions can be made, additional independent validation is needed.

The PDF plots show that the distribution of IWP is highly non-Gaussian. Therefore, the use of a grand mean as a point of comparison seems particularly unsuitable. The authors should also compare the median values of the distributions or some other statistic that is more suitable to the functional form of the IWP distributions.

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