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Comparison between early Odin-SMR, Aura MLS and CloudSat retrievals of cloud ice mass in the upper tropical troposphere

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Abstract. Emerging microwave satellite techniques are expected to provide improved global measurements of cloud ice mass. CloudSat, Aura MLS and Odin-SMR fall into this category and early cloud ice retrievals from these instruments are compared. The comparison follows the SMR retrieval product and is made for partial ice water columns above 12 km. None of the retrievals shows a significant degree of false cloud detections, the ratio between local mean values from the instruments is fairly constant and a consistent view of the geographical distribution of cloud ice is obtained. However, important differences on the absolute levels exist, where the overall mean is 9.6, 4.2 and 3.7 g m⁻² for CloudSat, SMR and MLS, respectively. Assumptions about the particle size distribution (PSD) are a consideration for all three instruments and constitute the dominating retrieval uncertainty for CloudSat. The mean for CloudSat when applying the same PSD as for MLS and SMR was estimated to 6.3 g m⁻². A second main consideration for MLS and SMR are the effects caused by the poorer spatial resolution: a possible vertical misplacement of retrieved values and an impact of cloud inhomogeneities. The latter effect was found to be the dominating retrieval uncertainty for SMR, giving a possible mean value range of 2.3–8.9 g m⁻². The comparison indicates a common retrieval accuracy in the order of 70%. Already this number should suffice for improved validations of cloud ice parametrisation schemes in atmospheric models, but a substantially better consistency between the datasets should be attainable through an increased understanding of main retrieval error sources.

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