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First Odin sub-mm retrievals in the tropical upper troposphere: ice cloud properties

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Abstract. More accurate global measurements of the amount of ice in thicker clouds are needed to validate atmospheric models and sub-mm radiometry can be an important component in this respect. A cloud ice retrieval scheme for the first such instrument in space, Odin-SMR, is presented here. Several advantages of sub-mm observations are shown, such as low influence of particle shape and orientation, and a high dynamic range of the retrievals. In the case of Odin-SMR, only cloud ice above ≈12.5 km can be measured. The present retrieval scheme gives a detection threshold of about 4 g/m^2 above 12.5 km and does not saturate even for thickest observed clouds (>500 g/m^2). The main retrieval uncertainties are the assumed particle size distribution and cloud inhomogeneity effects. The overall retrieval accuracy is estimated to be ~75%. The retrieval error is judged to have large random components and to be significantly lower than this value for averaged results, but high fixed errors can not be excluded. However, a firm lower value can always be provided. Initial results are found to be consistent with similar Aura MLS retrievals, but show important differences to corresponding data from atmospheric models. This first retrieval algorithm is limited to lowermost Odin-SMR tangent altitudes, and further development should improve the detection threshold and the vertical resolution. It should also be possible to decrease the retrieval uncertainty associated with cloud inhomogeneities by detailed analysis of other data sets.

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