



Detection and analyses of hydrometeor properties from EarthCARE CPR/ATLID

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The paper introduces details of our hydrometeor-property retrieval (Level 2) algorithms aimed for EarthCARE Atmospheric backscatter Lidar (ATLID) and Dopplerized Cloud Profiling Radar (CPR). The algorithms are based on our current algorithm formulated for application to ice clouds detected from CloudSat/CALIPSO data. This CloudSat/CALIPSO cloud microphysics retrieval algorithm features the incorporation of particle-type discrimination before the microphysical retrieval, consistent theoretical treatment of ice particle mixtures in the radar and lidar forward models that could account for particle orientation and non-sphericity, and the combined use of three observables (the radar reflectivity, the lidar backscattering coefficient and the depolarization ratio). For the case of CloudSat/CALIPSO, the ratio of the region of cloud with radar-lidar overlap to all of the clouds observed from space is estimated to be about 70% at high altitudes, decreasing to 20% below 5 km. Since there is more confidence in the microphysical properties retrieved for the cloud region with radar-lidar overlap versus those obtained by either instrument according to the number of independent observables, the algorithm had uniquely reflected the information from the lidar-radar overlap region to assess the microphysical at single-instrument cloud region for each radar/lidar vertical profile to avoid the use of a prescribed parameterization among the observables and cloud microphysics. Performance of particle sizing and ice water content estimation achieved by the algorithm at cloud regions with insufficient numbers of observables were consistent with lidar-radar retrieval results within about 10% and 40% uncertainty on average despite the depth of the cloud layers, respectively. According to results obtained from further evaluation of the method conducted with CloudSat/CALIPSO data, extension and updates on the radar and lidar forward models are accomplished and discussed, which are required for the characterization of the global distribution of hydrometeor species including those other than cloud ice, for EarthCARE ATLID/CPR as well as for CloudSat/CALIPSO.