DSD database for the GPM/DPR precipitation retrieval algorithm

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Rain Drop Size Distribution (DSD) has been and is being measured with disdrometers at many stations in the world. Parameterization of DSD is necessary for retrieving rain rates (R) from radar measurements. The relation between radar reflectivity factor (Z) and R (Z-R relation) is an example of DSD parameterization.
In the precipitation retrieval algorithm of the Dual-frequency Precipitation Radar (DPR) of the Global Precipitation Measurement (GPM) mission core satellite, the relation between the mass-weighted mean drop size (D_m) and R (R-D_m relation) is used. As both R and D_m are independent of radar frequency, R-D_m relation is useful in the dual-frequency algorithm and it may be extended for other radar measurements.
The standard R-D_m relation in the DPR algorithm was derived from Z-R relation which Kozu et al. (2009) proposed based on precipitation measurements in Tropics. It may not be appropriate and need to be modified for mid- and high-latitude precipitation within the DPR coverage.
In the DPR algorithm, at each pixel, R-D_m relation is modified by the Surface Reference Technique (SRT), while the SRT does not work well for light precipitation. However, dual-frequency measurements make it possible to adjust R-D_m relation for light precipitation.
The figure shows estimates of R and D_m for over-land convective precipitation cases by single-frequency (SF) algorithm (Fig. a) and dual-frequency (DF) algorithm (Fig. b) in the version-4 DPR algorithm. For weak precipitation, SF algorithm mostly follows the standard R-D_m relation, but DF algorithm gives larger D_m estimates.
Based on DF estimates, optical R-D_m relations are calculated for seasons and regions. They are summarized as DSD database. The new R-D_m relations are used for SF algorithm in the version-5 DPR algorithm (Fig. c). As a result, SF and DF algorithms give closer D_m for weak precipitation. As the next step, the DSD database needs to be validated and improved with ground-based measurements.

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