Geophysical Research Abstracts
Vol. 20, EGU2018-16139, 2018
EGU General Assembly 2018

Evaluation of the GPM DPR Single- and Double-Frequency Algorithms Over the Mediterranean Area

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The NASA/JAXA Global Precipitation Measurement (GPM) Core Observatory (CO) carries, for the first time, a dual-frequency Precipitation Radar (DPR). The DPR provides insights into the three-dimensional structure of precipitating clouds and intensity and is currently considered the main calibration instrument for radiometer derived global precipitation estimates. The DPR employs three scanning modes: Matched Scan (MS), Normal Scan (NS) and High Sensitivity scan (HS). The Ka- and Ku-band radar (MS) footprints of the inner swath consist of 25 angle bins with a vertical resolution of 125 m while the Ku-band radar (NS) covers the full swath with 49 angle bins with the same vertical resolution. The HS Ka-band radar footprints are interlaced with matched Ku/Ka-band footprints and consist of 24 angle bins with range sampling at 250 m. The swath widths of Ka- and Ku-band radars are 120 km and 245 km, respectively, while the diameter of both Ka- and Ku-band footprints at nadir is 5 km about.
While the precipitation retrieval algorithms of the Ka- and Ku-band radar Matched (MS) footprints provide a double-frequency based output, the Ku-band Normal Scan (NS) and Ka-band High Sensitivity scan (HS) precipitation estimates for same footprints, are single-frequency based.
The goal of the present works is to carry out an intercomparison of the single- and double-frequency DPR algorithms by considering the respective outputs over the Mediterranean area during rain events. A number of DPR related variables have been considered (i.e. measured and corrected reflectivity, surface rainfall rate, mean mass diameter, normalized intercept parameter, liquid and ice water content vertical profiles) to perform the analysis. The data have been categorized for surface type (land and sea) and precipitation type (stratiform and convective). The results show the differences in the performance of the single- and double-frequency algorithms as function of the surface and precipitation type. The vertical profiles of the single- and double-frequency based retrieved parameters are compared in order to assess their variability along the precipitating column.