10.7 EVALUATIONS OF RAIN MICROPHYSICS RETRIEVAL USING GPM DPR THROUGH COMPARISON WITH A SELF-CONSISTENT NUMERICAL METHOD

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The NASA/JAXA Global Precipitation Measurement (GPM) mission aims at providing 4-D measurements of precipitation at a global scale to support efforts in understanding the governing mechanisms underlying the formation of precipitation. Its Core Observatory (CO) has been equipped with a dual-frequency precipitation radar (DPR) based on two weather radars operating at two frequencies of Ku (13.6 GHz) and Ka band (35.5 GHz), respectively. In the beam-matching mode, the two radars are operated to sample the same precipitation volume, in order to fully exploit dual-frequency observation capability. One of the goal of DPR is to achieve, from space, more accurate information on microphysical properties of precipitation with respect to the single Ku band frequency radar of the predecessor NASA/JAXA Tropical Rainfall Measuring Mission. The primary objective of the study is to evaluate the accuracy of rain drop size distribution retrievals using the DPR. Direct comparison with measurements provided by ground based instrumentation might answer the question, but, unfortunately, this is task is not easy and can result in largely unmeasurable uncertainty. In this study, a self-consistent numerical method (SNM) was used to estimate microphysical parameters along rain profiles from DPR measurements. It has been preliminarily evaluated using known rain and radar profiles. Such profiles were obtained from the D3R measurements. In particular, by choosing the reflectivity measurements collected in RHI mode, the Ku-band differential phase shift was used to evaluate the corresponding specific attenuation of reflectivity from which to obtain the specific attenuation at Ka band. The correction procedure utilized algorithms found by simulation using as input a large dataset of measurements from the 2DVDs deployed for the IFloodS GPM Ground Validation campaign. Under fixed conditions, vertical reflectivity profiles were obtained by the composition of reconstructed radar cells from RHIs at Ku and Ka band, each 450 m wide and 75 m high. The SNM was applied to these profiles to estimate the corresponding profiles of microphysical parameters. The good SNM performance, characterized in the presence of a fixed μ (μ=3) and measurement errors, was pointed out by a normalized standard error in the order of 10% and 15% for D_m and $\log_{10}N_w$, respectively. Subsequently, the SNM was applied to the data collected by the DPR and its results compared to thoseobtained by GPM algorithms. The entire version 4 of the GPM DPR precipitation products obtained with data collected from September 1, 2014, to February 28, 2017 was used. In the presence of bright-band features, the rain region of matched scans, was employed to retrieve DSD parameters with SNM and GPM algorithms. In particular, the comparison between the microphysical parameters showed a difference in terms of normalized standard error, while a negative sign of normalized bias indicates that both D_m and dBN_w computed with SNM are underestimated with respect to the corresponding values obtained with DPR algorithms.