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Using disdrometers data to evaluate GPM-DPR products over Italy

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Remote sensing measurements provided by satellite-borne radars play a fundamental role in estimating precipitation distribution worldwide. However, they are subjected to a variety of potential errors and need continuous validation with ground-based measurements. Validating satellite products using measurements collected by sensors at the ground has been addressed in the literature, but it is still challenging due to intrinsic differences in the measuring principle and viewing geometries of the instrument being compared each other. To date, the Dual-frequency Precipitation Radar (DPR) aboard the Core Satellite of the Global Precipitation Measurement (GPM) mission is the only active sensor able to provide, at the global scale, vertical profiles of rainfall rate, radar reflectivity, and Drop Size Distribution (DSD) parameters from space. After the launch of the GPM Core Satellite, on February 2014, an extensive Ground Validation (GV) program was established with the aim of evaluating the performance of the retrieval algorithms, over long periods and in different climatic regions across the world. Since the free availability of GPM data, many studies have been conducted to compare and validate the available version of satellite precipitation products with data collected by ground-based instrumentations such as radars and rain gauges, however very few published studies used networked disdrometers data on national scale.

For the first time, we used disdrometers to evaluate near surface GPM-DPR products (Version V06A) against long time series of measurements collected by seven laser disdrometers dislocated

along the Italian peninsula and networked thanks to a cooperation effort of seven institutions (including research centers, universities and environmental regional agencies). The comparison was made in terms of rainfall and DSD parameters: rainfall rate, radar reflectivity, mass-weighted mean diameter (D_m), and normalized gamma DSD intercept (N_w). The comparison showed limited differences between single- or dual-frequency GPM algorithms, although the former presents better performance in most cases. The conclusions suggest that the agreement was good for rain rate, reflectivity factor, and D_m, while N_w satellite estimates need to be improved. Same method is used for evaluating current V07A of precipitation products.

Given the collaborative nature that has allowed the validation analysis presented, this study also represents an opportunity to consolidate cooperation between Institutions managing disdrometers in Italy and set the stage for future plans aimed at improving the use of disdrometer data in Italy.