**Title:** Validation of GPM Precipitation Retrieval Algorithms across the Precipitation Continuum

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A large repository of ground validation (GV) field campaign and Validation Network (VN) polarimetric radar and supporting disdrometer observations have been developed to quantify the intrinsic characteristics of liquid and frozen precipitation such as intensity (rate), water content, gamma size distribution parameter behavior (e.g., Nw, , Dm/0; PSD), hydrometeor phase (e.g., liquid, frozen, mix) and precipitation type (e.g., convective/stratiform; C/S; snow habit/density), as related to DPR or GMI measurements in both the horizontal and vertical spatial dimensions. The large VN database, when matched to DPR and GMI pixels in GPM core-satellite overpasses (>45,000 coincident volumes matched) provides the means to identify statistically-meaningful discrepancies between the ground and GPM satellite-based retrievals and associated algorithms. Existing field campaign observations then enable more specific isolation and resolution of discrepancies found between ground-based VN comparisons and the satellite estimates (e.g., DSD, precipitation rate, column profile properties) as a function of the precipitation process. In our current research we have used the VN and field datasets to study decorrelation lengths in rain DSD, deficiencies in the formulation of the DSD for light rainfall, and are currently investigating apparent disagreements in DSD retrieval between GV, DPR, and combined retrieval algorithms that produce biases in estimation of convective rainfall rates.

The first task for the proposed research is focused on mining the vast VN database and parts of that database also including field campaign data. Here we will further cross-correlate discrepancies between DSD and precipitation rate characteristics found in DPR and combined algorithm retrievals at footprint scales as a function of precipitation type (convective/stratiform; C/S)/process along DPR rays (column) and across the DPR swath. Specific focus is/will be placed on DPR convective precipitation and combined algorithm C and S product DSD constraints, since they represent a base component of GPM radiometer and merged satellite algorithm retrieval databases. The resultant analysis will address components of retrieval algorithms sensitive to process, scale and sensor limitations; e.g., Dm vs. retrieved rain rate, PSD variability in C/S precipitation and coupling to correction of path integrated attenuation (PIA) and non-uniform beam filling.

The second task of the research extends to frozen precipitation- specifically focused on leveraging/continuing existing targeted case-study database building/satellite comparison collaborations with international PMM partners (e.g., Finland, Canada, and ICE-POP field campaign efforts in Korea). We will continue to develop optimal or “best” case-by-case GV distributed frozen precipitation rate estimates using field and national network datasets and subsequent comparison of those estimates with GPM data products. Specific focus will be placed on identifying and categorizing situations where the “best” GV estimates disagree substantially (e.g., using contingency statistics) with GPM satellite estimates in the context of both microphysical and meteorological regime, the latter being potentially identifiable in, and therefore correctable using, model analysis datasets.

It is envisioned that the aforementioned efforts will also be highly reliant on collaboration with other related but distinct projects awarded for participation on the PMM Science Team.