Objective: Verify and Improve GPM Drop Size Distribution Retrievals and GG model for complete DSD spectrum

- Drop size distributions (DSD: $D_m$, $N_p$) are critical to GPM DPR-based rainfall retrievals.
- Examine physical consistency between GV, algorithms, and within and between algorithms.
- Comparisons with GV suggest DPR $D_m$ bias in convective rain is correlated to underestimation of rain rate. What is the source?
- Light rain/small DSDs are a challenge: Should a generalized gamma (GG) approach be used to model the full DSD spectrum?

Continental to Site Specific GV and DPR studies

Sample and collocate coincident GV radar and DPR DSDs for O[50-300] raining overpass volumes per radar site within VN radar network

Focus on Convective spectrum and large $D_m$

Convective Z below ML similar to GV regardless of $D_m$; Convective Z increases aloft with large $D_m$

Focus on Small $D_m$ and GG model for complete DSD spectrum

The GG Model

$$N(x) = N^*_m \exp\left(-\frac{x}{\alpha}\right)$$

where $N^*_m = \frac{M}{\Gamma(M)} \alpha^M$ and $D_m = \frac{4\alpha}{\pi}$

- $\Gamma$ = gamma function
- $\alpha$ = scale parameter
- $M$ = shape parameter

4. Summary

GPM DSD retrievals exhibit inconsistencies between GV, DPR and Combined algorithm retrievals. Development of positive bias in convective $D_m$ rain DSD noted, and strongest in KuPR Z. Associated epsilons are too low and result in markedly reduced convective rain rates (a current issue in the retrievals). Source may be NUBF. Issues with the large end of the DSD not withstanding, on the small end of the DSD, combined MPS and 2DVD measurements fit with generalized gamma functions exhibit strong potential for representing the entire spectrum of the DSD and subsequently the whole rain rate spectrum.

Acknowledgements: NASA PMM and GPM Program funding; NASA GV Team. Prof. K. Knupp, UAH for access to XPR data.