Objective: Verify and Improve GPM Drop Size Distribution Retrievals

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- Drop size distributions (DSD; D_m, N_m) 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?

2. Continental to Site Specific GV and DPR studies

Sample and collocate coincident GV radar and DPR DSDs for 0[50-300] raining overpass volumes per radar site within VN radar network

3. Focus on Convective spectrum and large D_m

Above: Positive bias in convective D_m (top) increases with D_m > 2 mm (red-dash line). N_m (bottom) inconsistent across algorithms, over-compensates negative bias in KuPR D_m.

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

4. Focus on Small D_m and GG model for complete DSD spectrum

Top: XPR Observations of TS Nate during weak bright band period and shallow warm rain. Bottom: DSDs as indicated. GG approach represents varying spectra in light rain very well. Collectively, the GG approach seems robust; how might we might implement the approach in future GPM algorithms?

Overall Assessment

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 retrieval. 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.

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Greeley CO (left) and Huntsville AL sites (right): 2DVD and Meteorological Particle Spectrometer (MPS) enable studies of the full DSD spectrum.