Current State of GPM Precipitation Profiles from DPR and Combined; Comparisons with TRMM PR.

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Introduction The Global Precipitation Measurement (GPM) mission core spacecraft was launched in Feb. 2014 and includes the Dual-Frequency Precipitation Radar (DPR) which consists of two radars: one operating at Ku-band (much like TRMM PR) and the other at Ka-band. The Tropical Rainfall Measurement Mission (TRMM) Precipitation Radar (PR) has provided a precipitation data record extending back to Dec. 1997. The PR retrieval algorithms that provide these precipitation estimates have undergone extensive testing and validation over the life of TRMM. Having both TRMM PR and GPM DPR operational at the same time results in increased sampling for Ku-based precipitation measurements and a unique opportunity for analysis and improvements of retrieval algorithms. ***This work extends the usefulness and enhances the sampling of the TRMM PR precipitation record into the GPM era by allowing the TRMM retrieval algorithms to be used on DPR Ku-band data and will contribute to eventually using the GPM era algorithms on the entire spaceborne precipitation radar data set, back to 1997.***

TRMM PR, GPM DPR and Combined Average Profiles

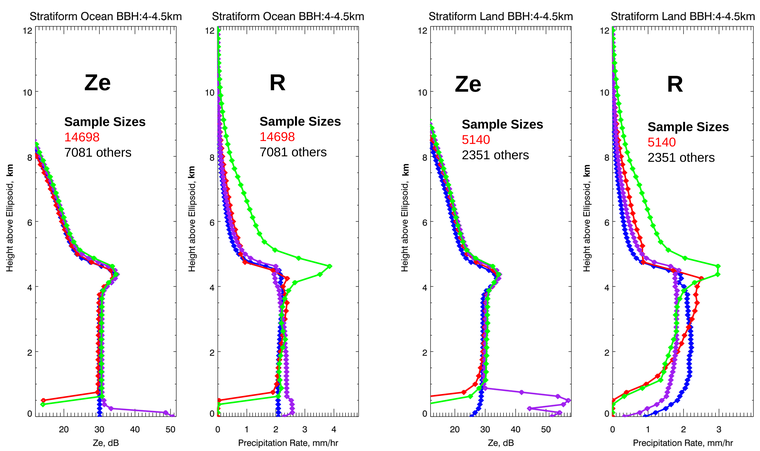
During June 2014 both TRMM PR and GPM Core collected data. Average Corrected Reflectivity (Ze) and Precipitiaton Rate (R) profiles were computed from the Production Research Products for TRMM PR, GPM DPR and GPM Combined Level-2 retrieval algorithms. (TRMM V7, GPM V03). Average profiles are computed for all 49 angles, at each radar slant range gate for the two main precipitation classes: Stratiform and Convective. Only those cases where a clear Bright Band is detected are included in the Stratiform case. The profiles are further categorized into 14 levels; in the case of Stratiform the Height of the Brightband is used, for Convective cases the detected Storm Height is used.

Average Profiles of Corrected Reflectivity and Precipitation Rate June 2014

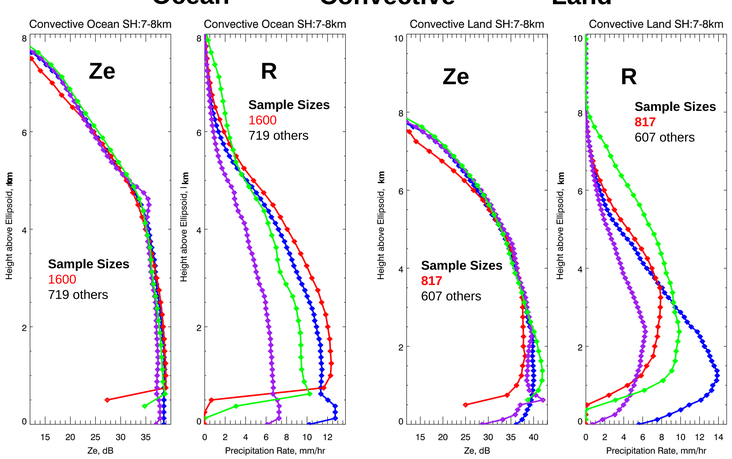
June 2014. Limited to TRMM coverage area of +/37deg Latitude.
Nadir Profiles are shown.
TRMM Version 7 and GPM Version 3 data.

TRMM PR (2A25)
DPR Ku (2AKu)
DPR (2ADPR NS-swath)
Combined (2BCMB NS-swath)

Ocean Stratiform Land



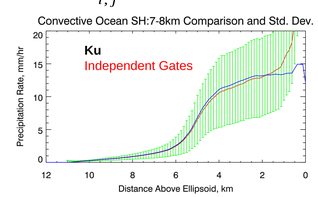
Ocean Convective Land



Aside : Profile Averaging.

Average profile (weighted sum) vs independent average at each bin. $i = \text{Ray} \quad j = \text{Gate/Bin}$

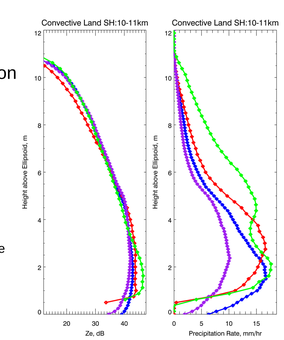
$$\langle R_{i,j} \rangle = \frac{\sum_{i,j} R_{i,j}}{N_{i,j}} \qquad \langle R_{i,j} \rangle = \frac{\sum_{i,j} R_{i,j}}{N_i}$$



Use as a potential algorithm diagnostic tool.

- Corrected reflectivity profiles generally look very good however there are some issues near the Surface.
- Near-surface precipitation rates with GPM Ku are generally higher then TRMM PR.
- All angles available as IDL save set.
- V04 algorithms are being tested now.

Deeper Convection over Land

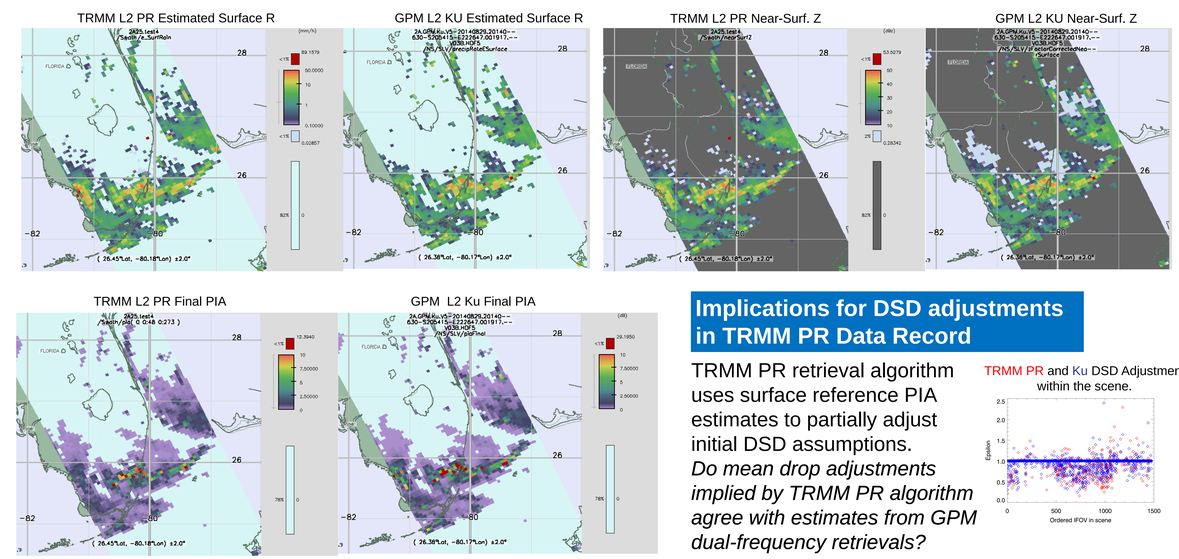


Clutter
- TRMM PR data is not available in profiles into the clutter region.
- GPM products have estimated data into clutter region.

Retrievals with TRMM PR Algorithms on GPM DPR Ku Data

TRMM algorithms modified to accept DPR Ku-band data as input.
- Opportunity for retrievals from both GPM DPR and TRMM algorithms on the same data.
- Identify potential deficiencies for both GPM DPR and TRMM algorithms.
- Implications to 16+ year TRMM PR precipitation record.
- Comparisons not restricted to TRMM/GPM satellite coincidence data.
- Ease transition to processing entire 1997+ spaceborne radar data set with GPM DPR algorithms.

Example Case Study of TRMM PR 2A25 Retrievals on GPM Ku Data June 30, 2014 GPM DPR Ku V03B

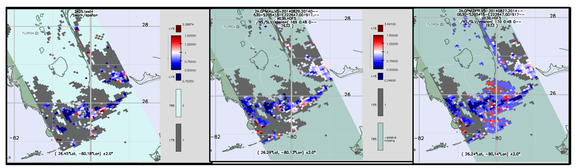


Implications for DSD adjustments in TRMM PR Data Record

TRMM PR retrieval algorithm uses surface reference PIA estimates to partially adjust initial DSD assumptions. *Do mean drop adjustments implied by TRMM PR algorithm agree with estimates from GPM dual-frequency retrievals?*

TRMM PR and Ku DSD Adjustment within the scene.

Choices
- In these examples the major precipitation classification was chosen from the DPR Ku algorithm.
- Measured reflectivity from DPR Ku was sampled at 250m for the TRMM 2A25 algorithm.
- DPR Ku has no temporal reference file for SRT in V03.



GPM V04 Testing at NASA Goddard / PPS

Integration and Test Environment (ITE) at PPS.
- Assist in testing modifications to GPM algorithms
- 90 node Beowulf Cluster.
  - 32 CPUs, 256GB per node.
- Test data made available to algorithm teams by online FTP.

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