The GPM Combined Radar-Radiometer Algorithm—V05 and Plans for V06

Bill Olson, Mircea Grecu, Joe Munchak, Ziad Haddad,
Sarah Ringerud, Kwo-Sen Kuo, Lin Tian,
Ben Johnson, Bart Kelley, Dave Bolvin, Liang Liao,
Walt Petersen, Todd Berendes, Ali Tokay, Pierre Kirstetter;
Gerry Heymsfield, Andy Heymsfield.....

with support from

the Radar and Radiometer Algorithm Teams, the GV Team,
WG's, and Precipitation Processing System Personnel

What we added in V05:

- impact of non-uniform beamfilling on simulated PIA_{Ka} included using empirical factor based on 3x3 distribution of Hitschfeld-Bordan PIA_{Ka}'s.

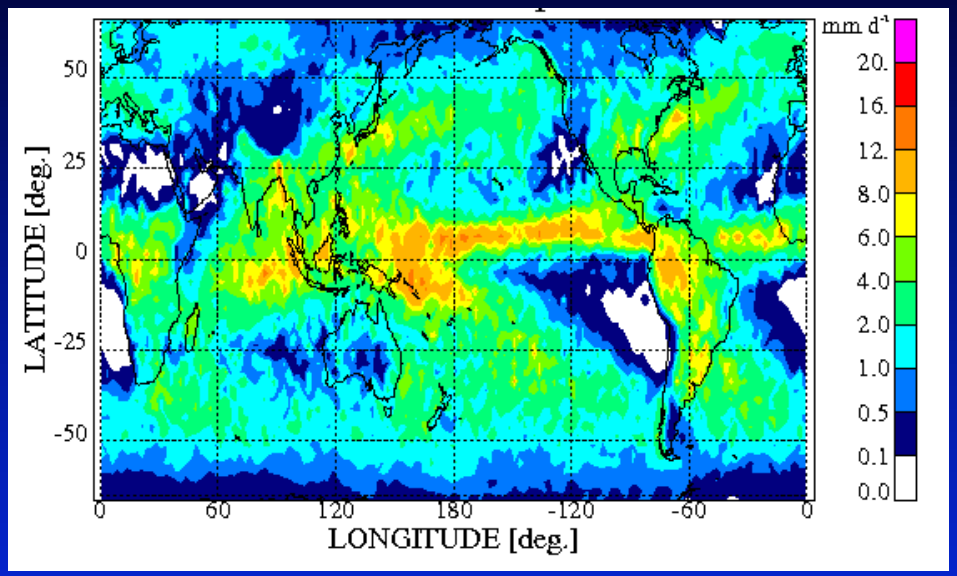
- more strongly constrain solutions with SRT PIA and Z_{Ka} data.
- constrain initial relationship between N_w and D_m.
- nonspherical ice particle properties now included in scattering tables.
- introduced σ^0 - emissivity model constraints.
- ATBD updated.

- completed since Houston

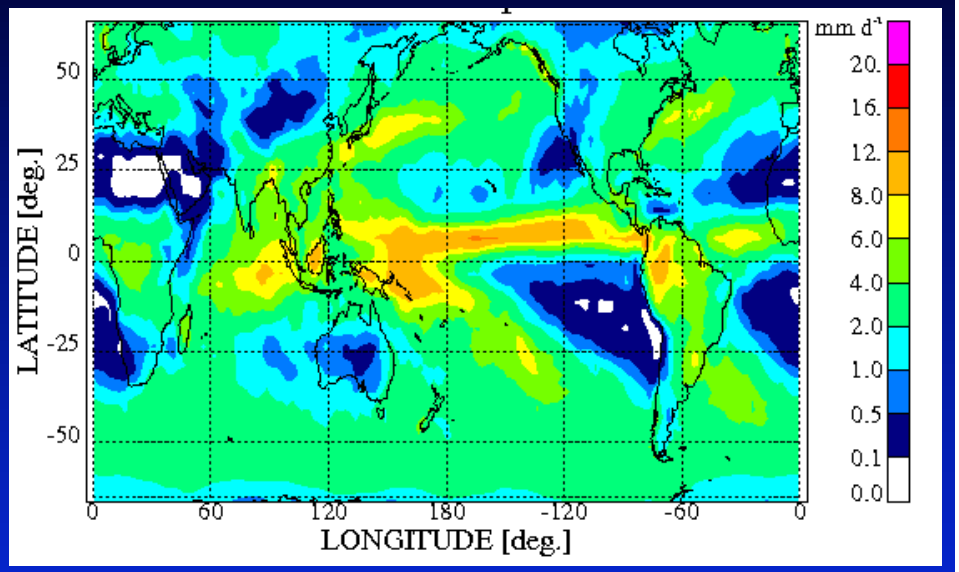
Comparison of V04 vs. GPCP Mean Precip. Sep. – Aug. 2014/2015

Dave Bolvin

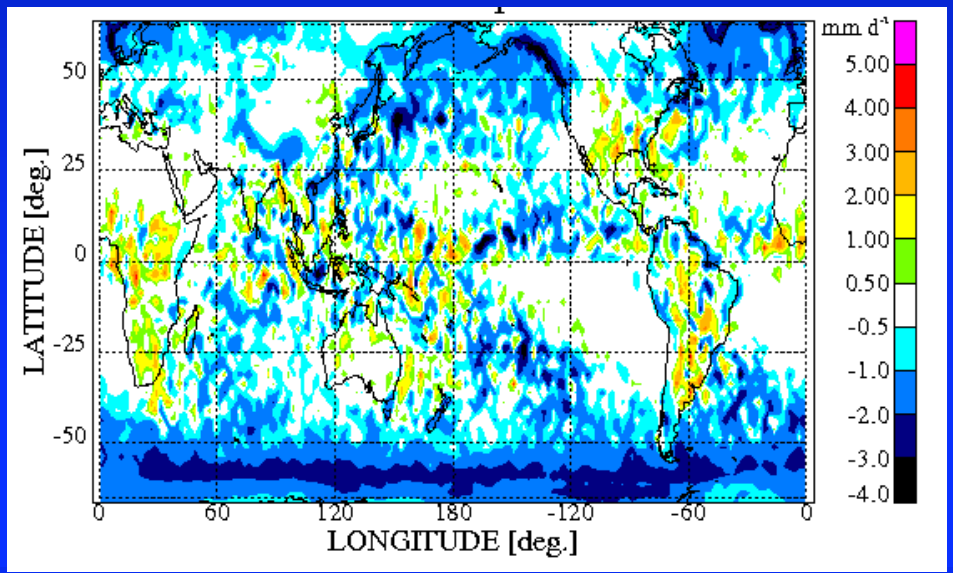
Combined V4 Ku+Ka+GMI



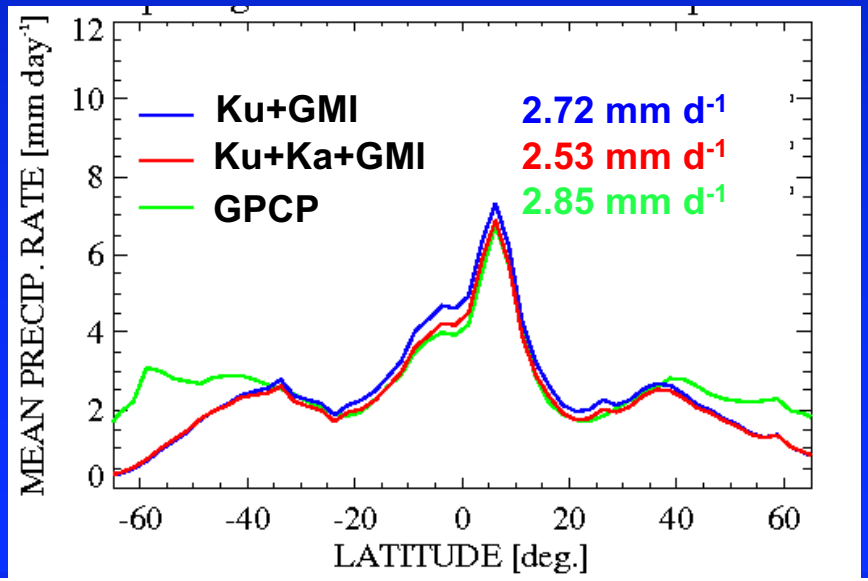
GPCP



V4 - GPCP



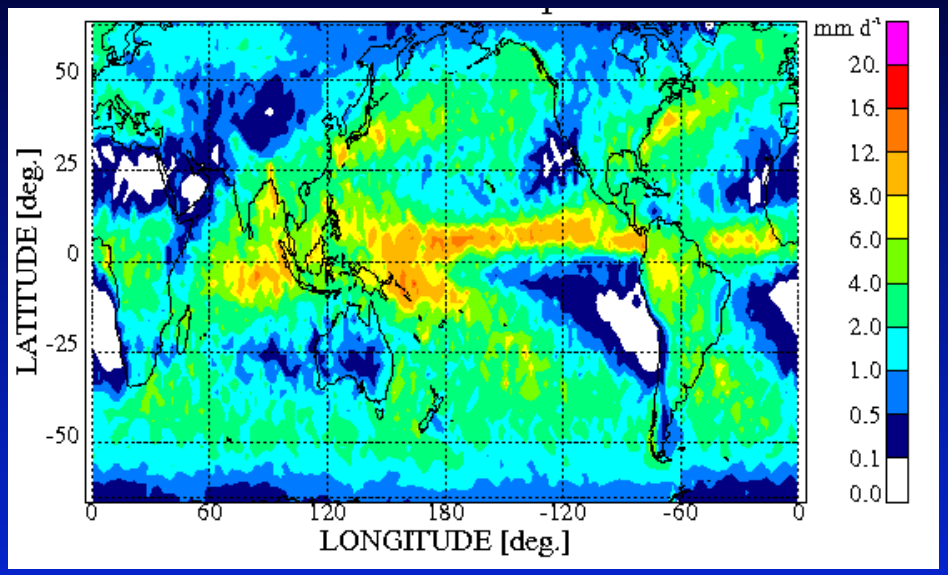
V4 and GPCP Zonals



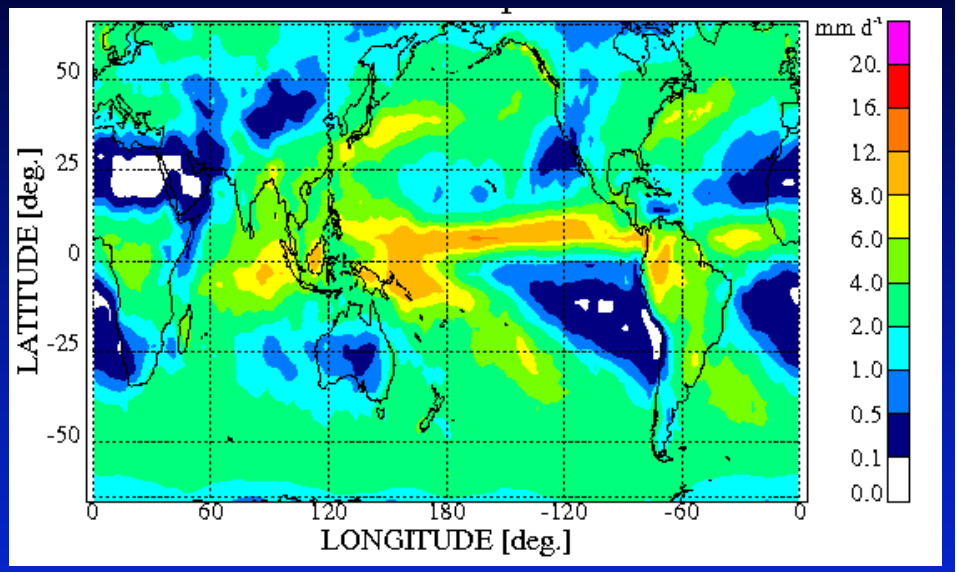
Comparison of V05 vs. GPCP Mean Precip. Sep. – Aug. 2014/2015

Dave Bolvin

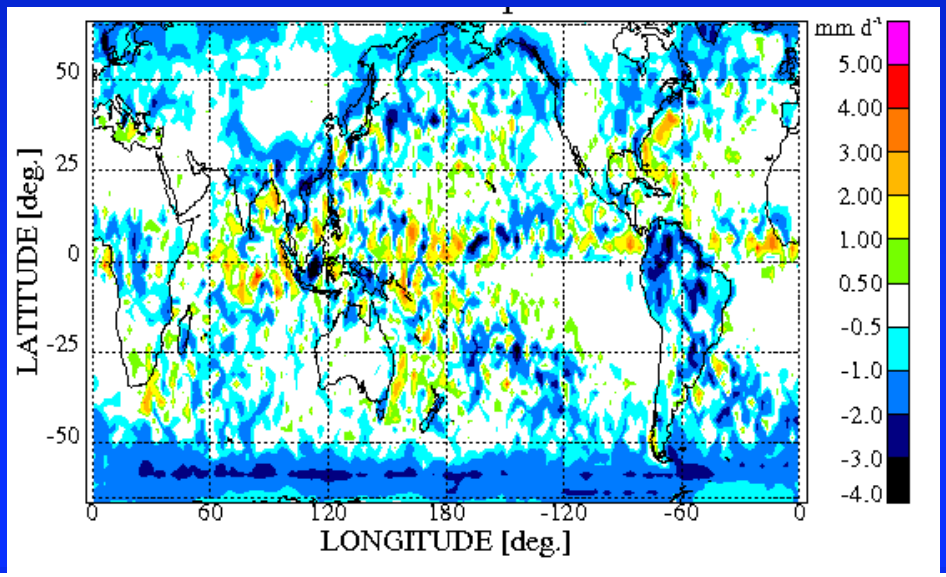
Combined V5 Ku+Ka+GMI



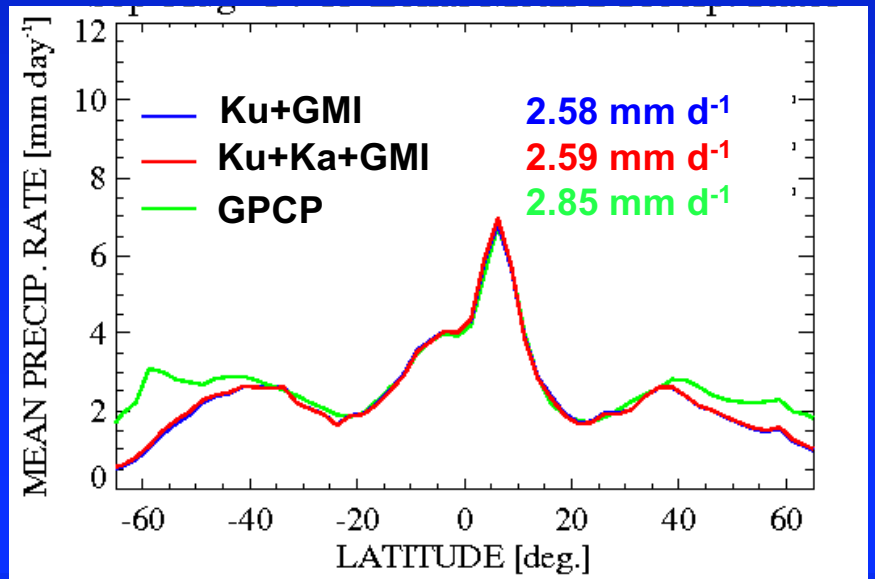
GPCP



V5 - GPCP

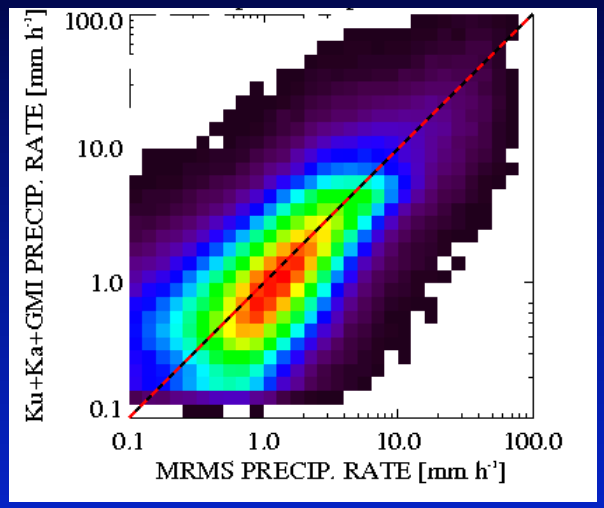


V5 and GPCP Zonals

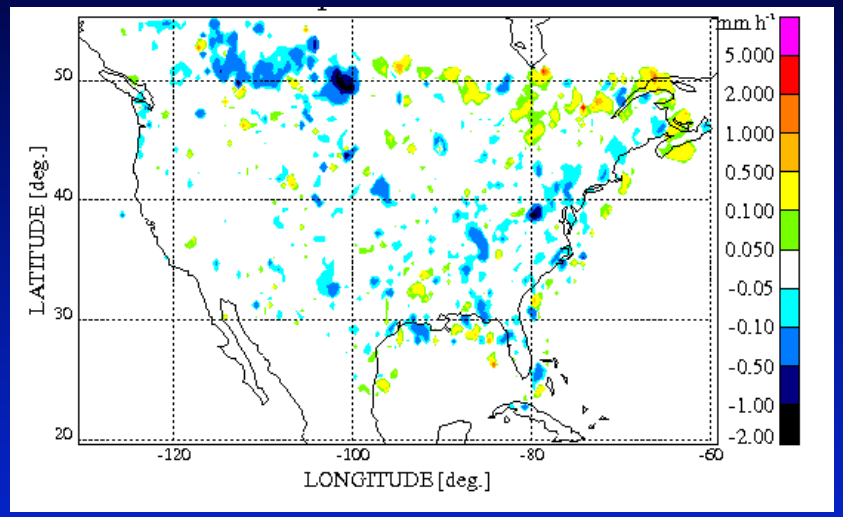


Comparison of Ku+Ka+GMI V05 vs. MRMS Sep. - Aug. 2014/2015

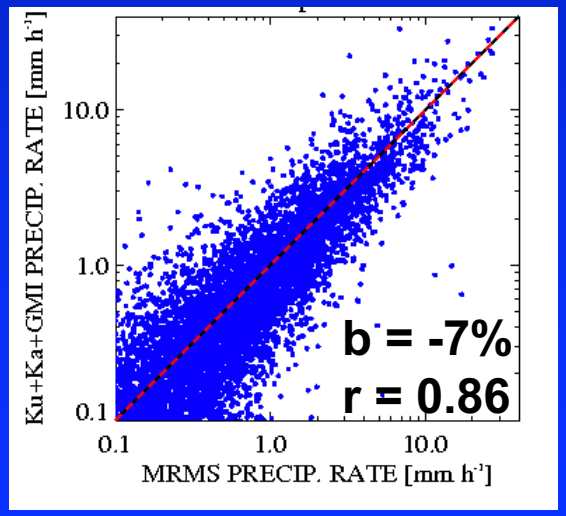
V05 vs. MRMS at footprint



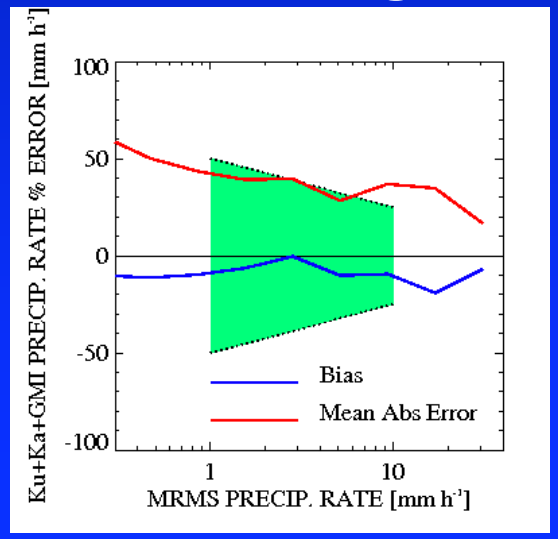
V05 - MRMS



V05 vs. MRMS at 0.5 deg

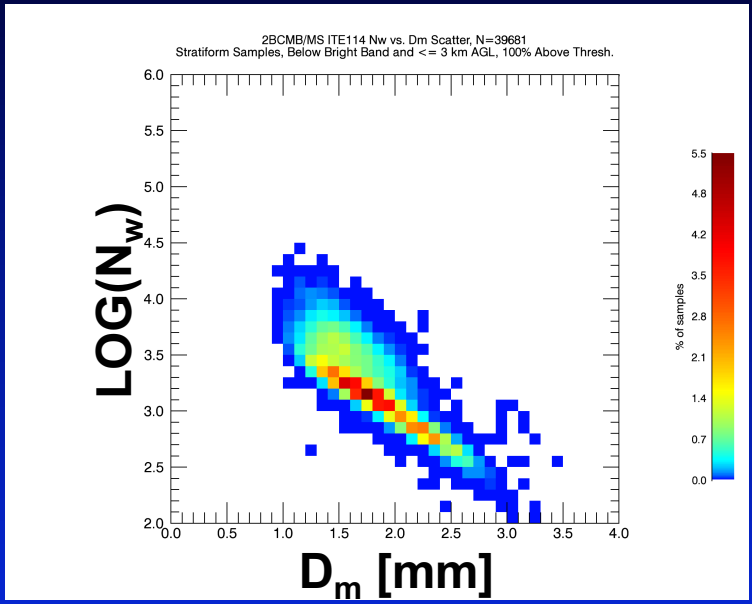
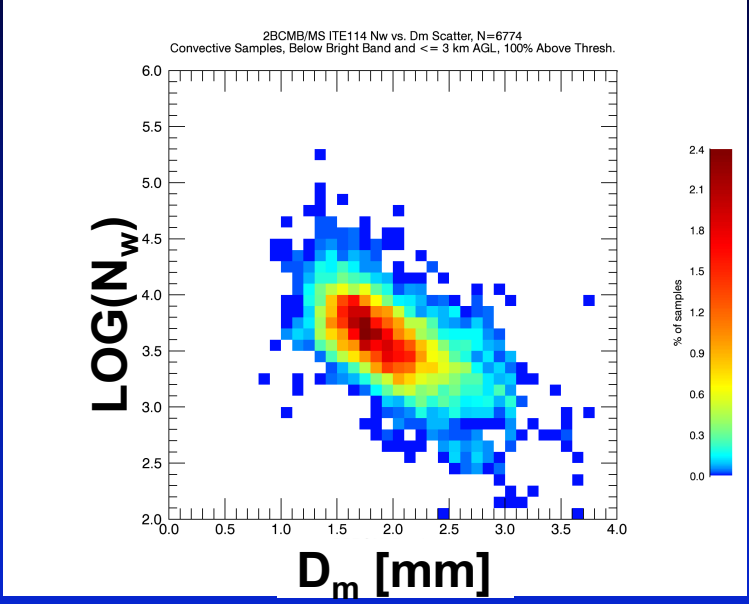
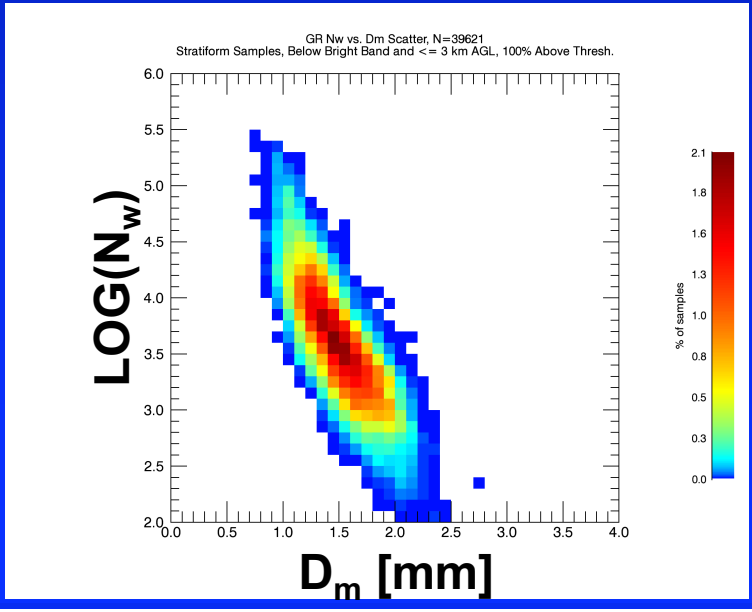
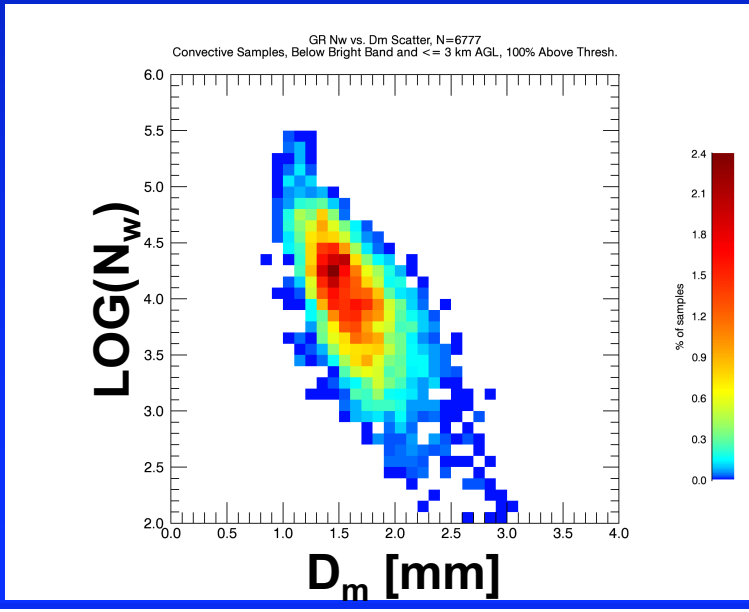


V05 percentage error



Looking toward V06:

V5 (Ku+Ka+GMI) Nw vs. Dm Relationships vs. Dual-Pol. Radar

	Stratiform	Convective
V5		
Ground Radar *from Todd Berendes & Walt Petersen*		

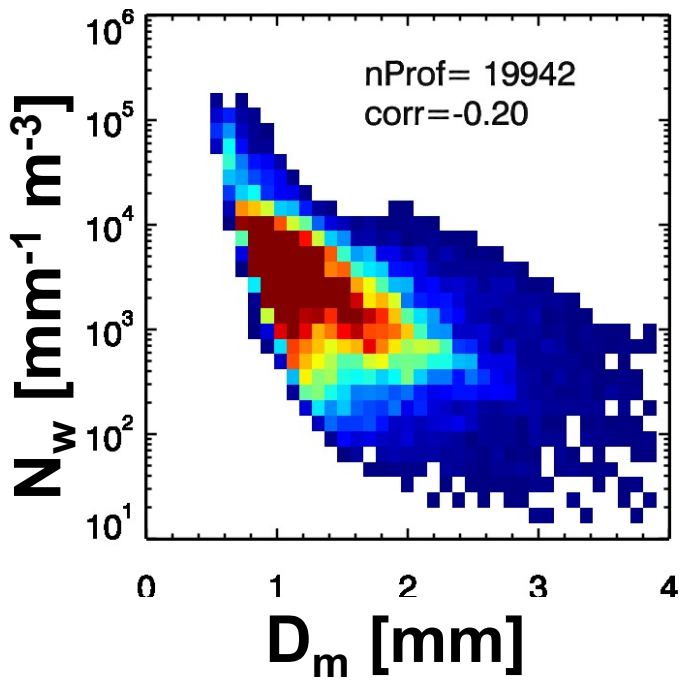
Simulating Drop-Size Parameter Retrievals

from Liang Liao

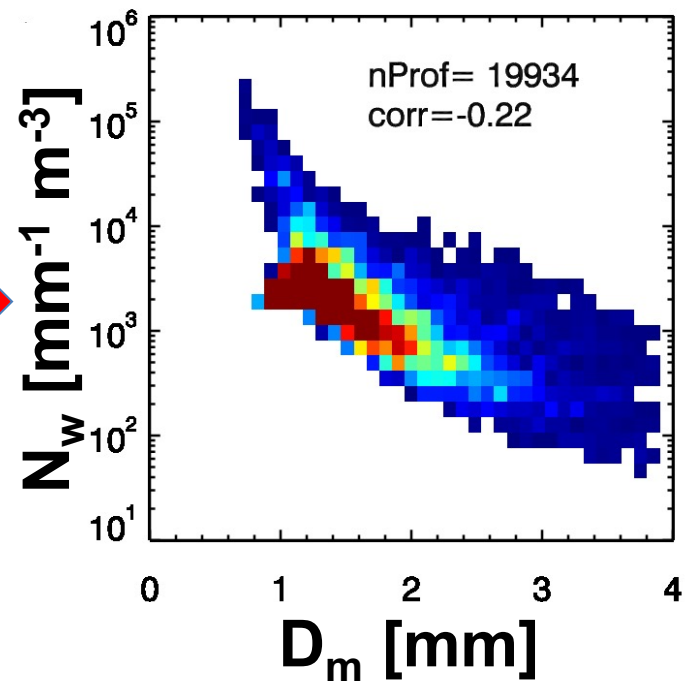
DSD's from disdrometers → Simulate reflectivity, attenuation profiles + noise → Estimate DSD

?

Original DSD's



Estimated DSD's



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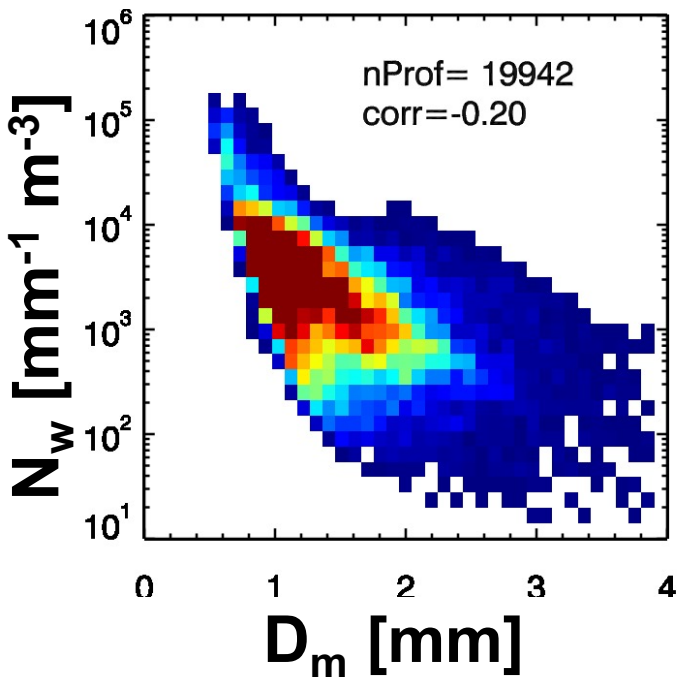
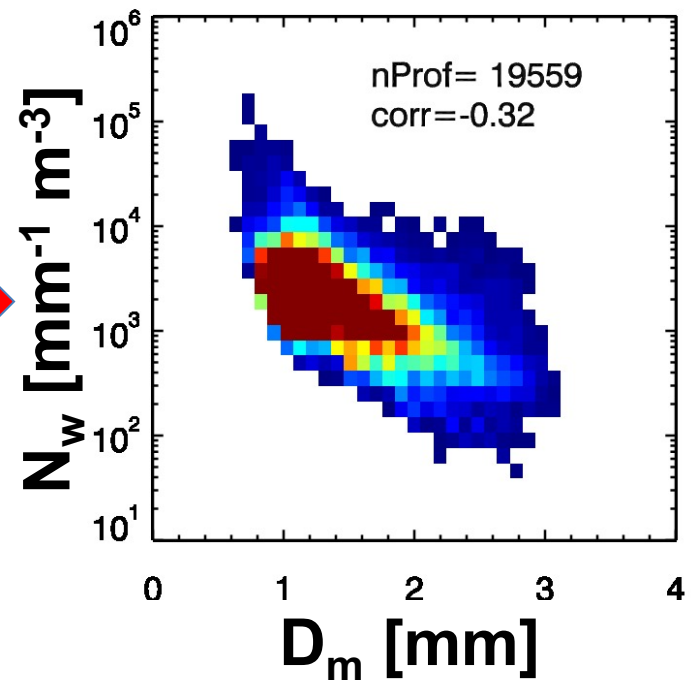
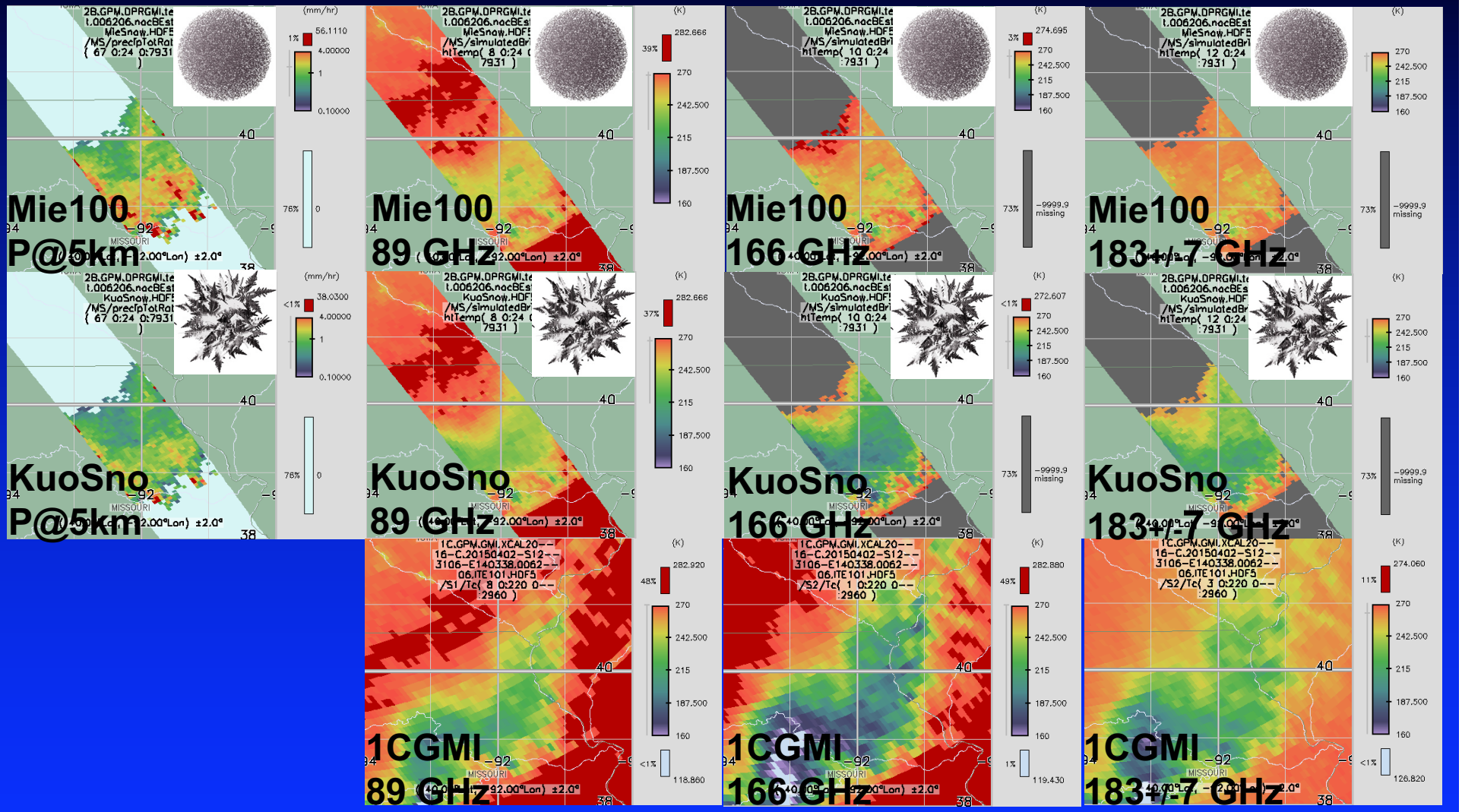


Estimated DSD's



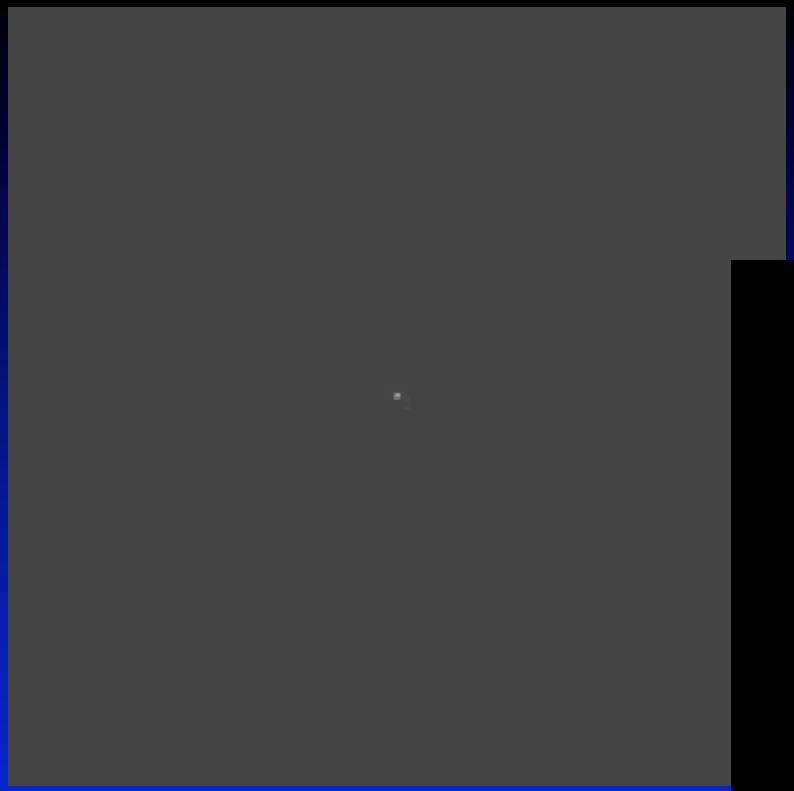
Nonspherical Ice Scattering Table Tests (orbit #6206)



Next steps: Other Habits/Polar. and Melting

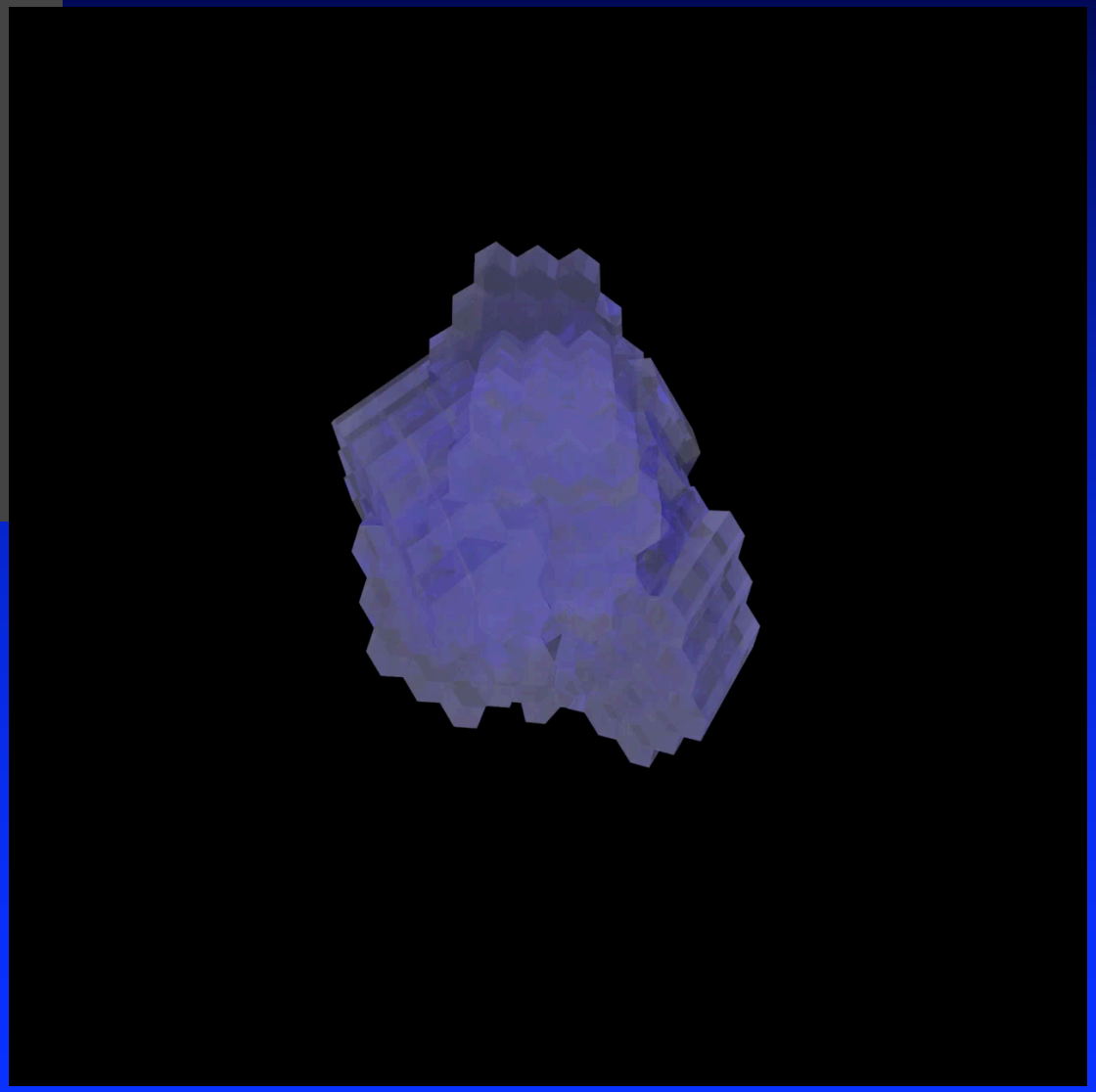
View toward V06:

- improvement of the representations of non-uniform beamfilling and multiple scattering.
- improvement of ice and mixed-phase transition modeling.
- further study of sensitivity of algorithm to *a priori* information.
- full physical retrieval of parameters in non-precipitating regions and transition regions.
- high-latitude estimates from radiometer-centric algorithm.
- focus on evaluation of regional/seasonal (regime) biases and snow validation.



Capped Column

Bullet Rosette

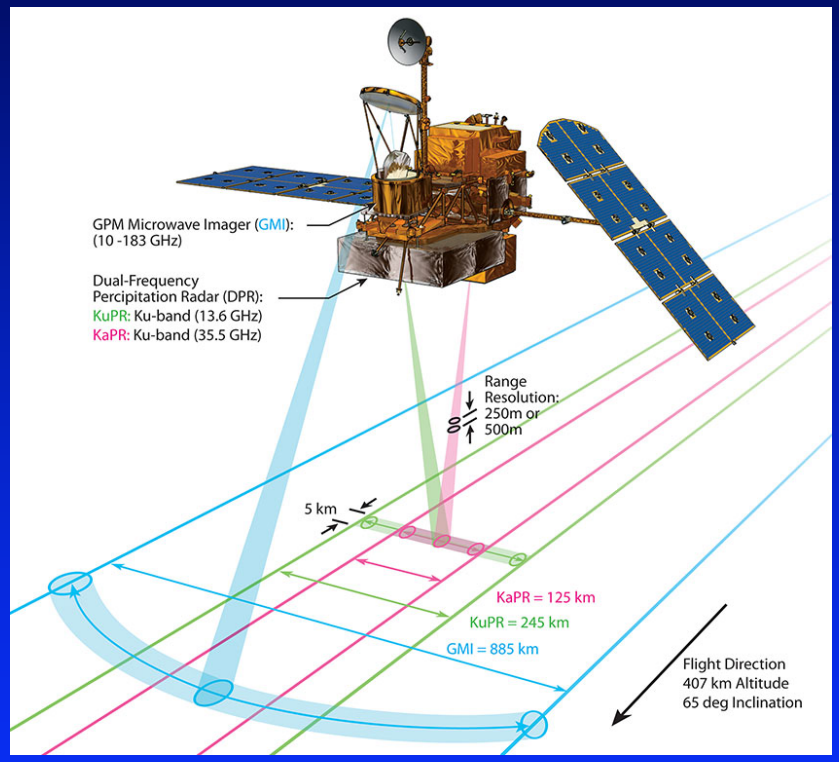


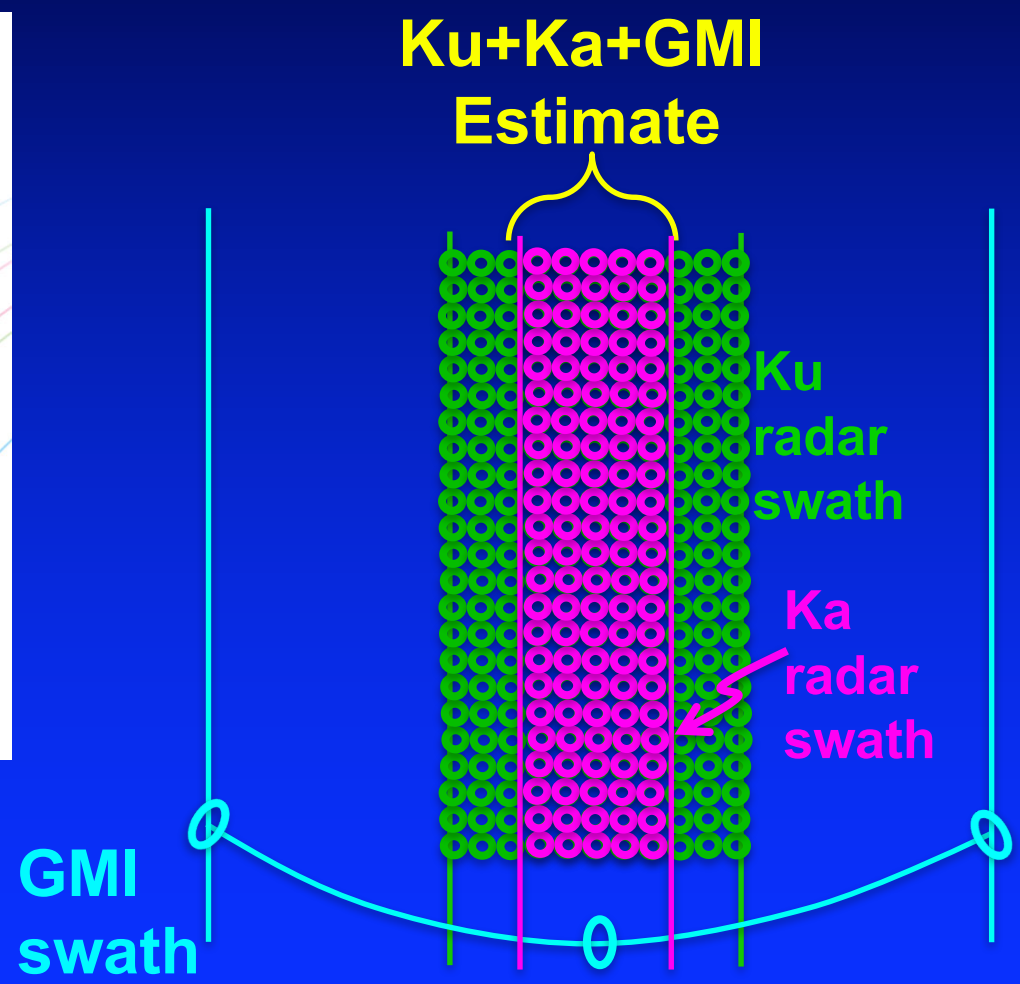
from Kwo-Sen Kuo and Tom Clune

extras

Combined Radar-Radiometer Algorithm Input

- Dual-Frequency Precipitation Radar (DPR); Ku & Ka bands
- GPM Microwave Imager (GMI); 10 – 183 GHz.

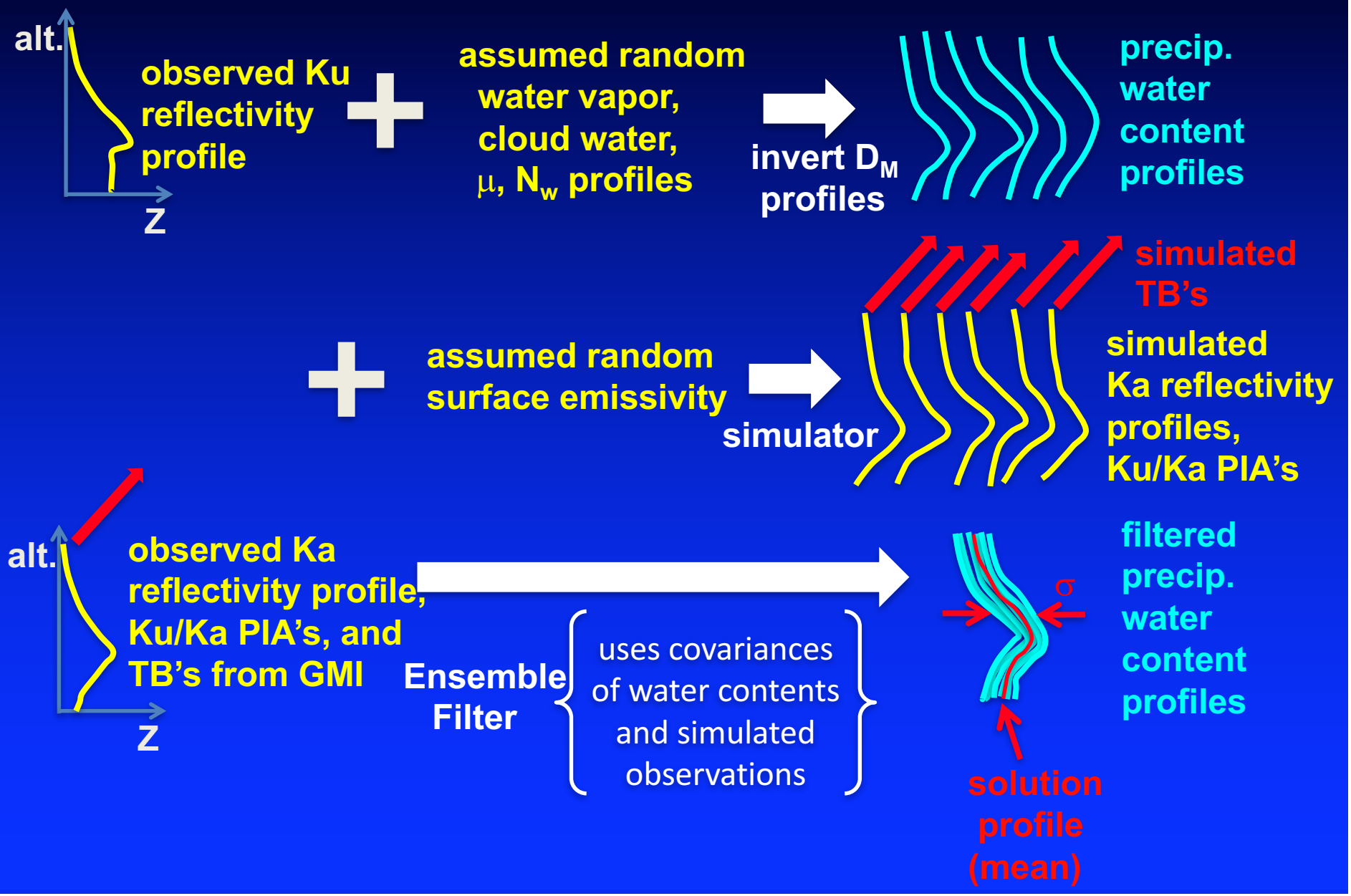




Algorithm "Concept" --- Ensemble Filter

Input

Ensemble Solution



Executive Summary

- Generally pleased with GPM V05 performance at this stage; need to validate snow estimates.
- TRMM V08 should be ready by Dec. 5.
- We will continue to work on new algorithm physical and parameterizations, *a priori* assumptions, and general validation of estimates leading to GPM V06.

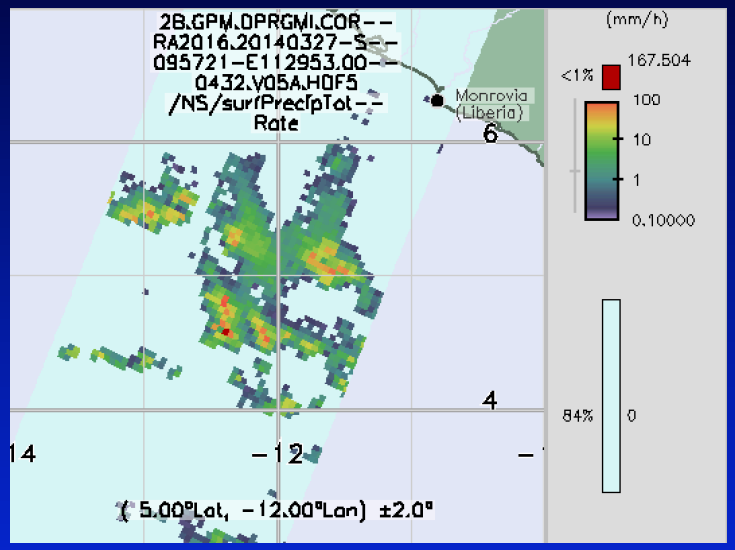
Adaptation of GPM V05 to TRMM V08:

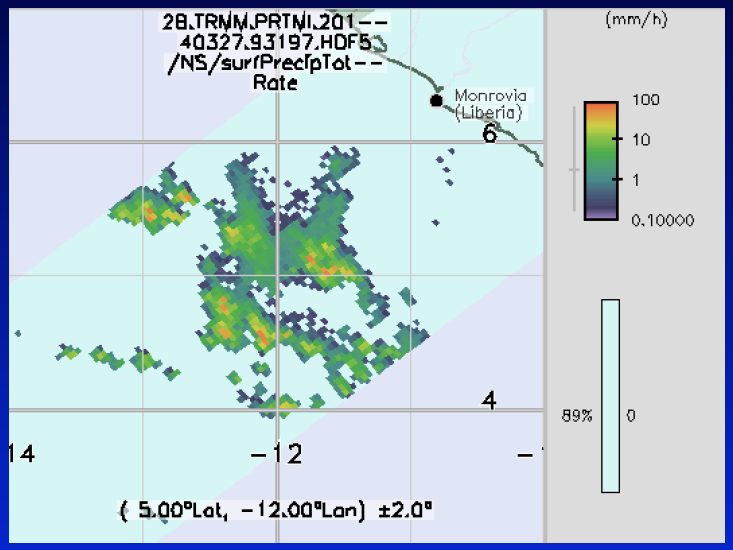
Comparisons of 93 Overlapping Swaths

overlaps courtesy Prof. Seto

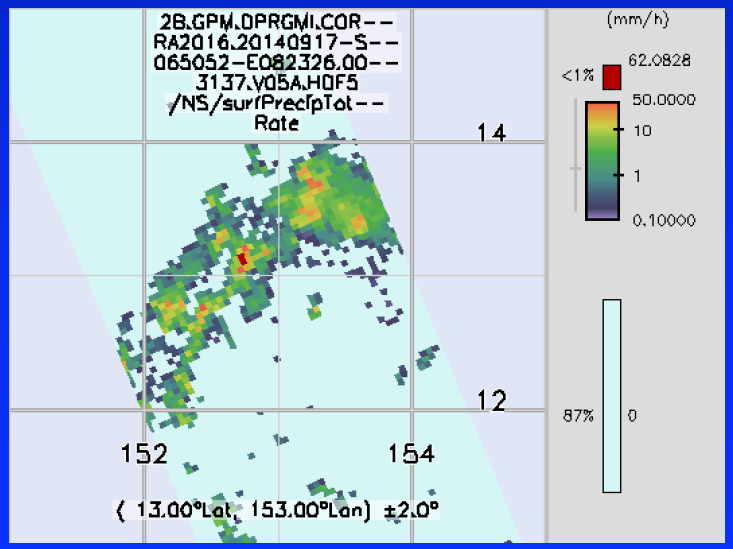
GPM V05 | TRMM V08

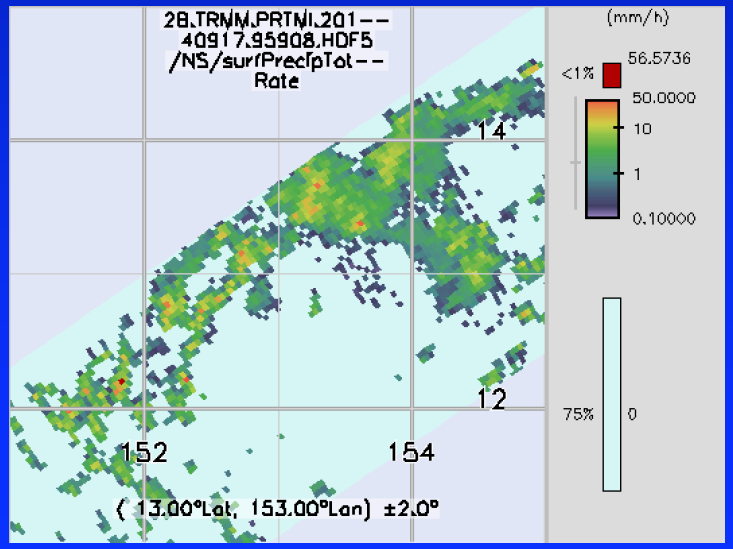
03/27 2014





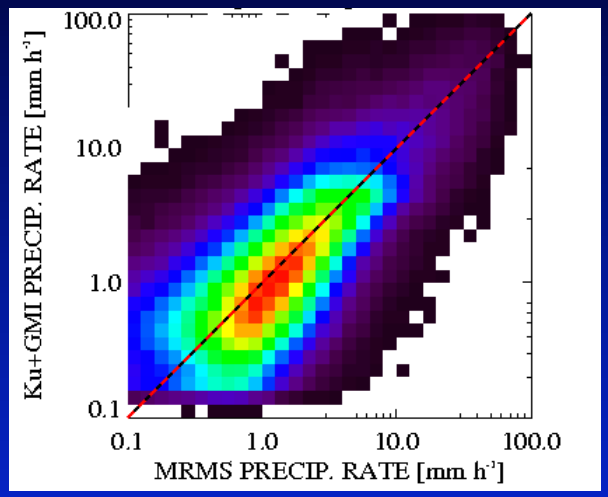
09/17 2014



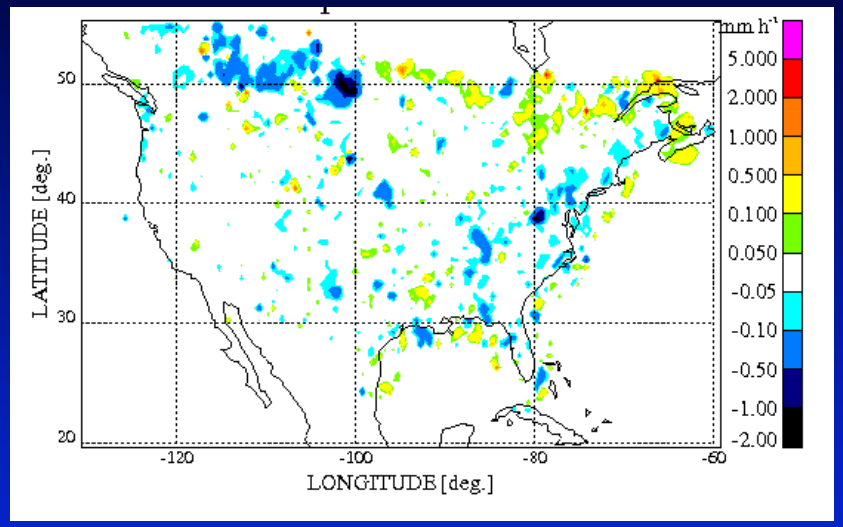


Comparison of Ku+GMI V05 vs. MRMS Sep. - Aug. 2014/2015

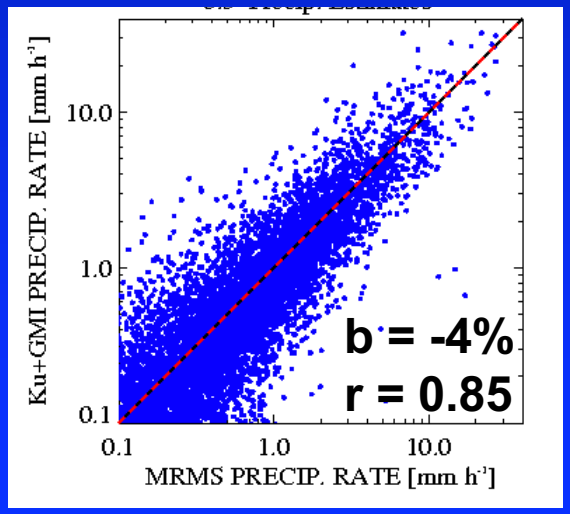
V05 vs. MRMS at footprint



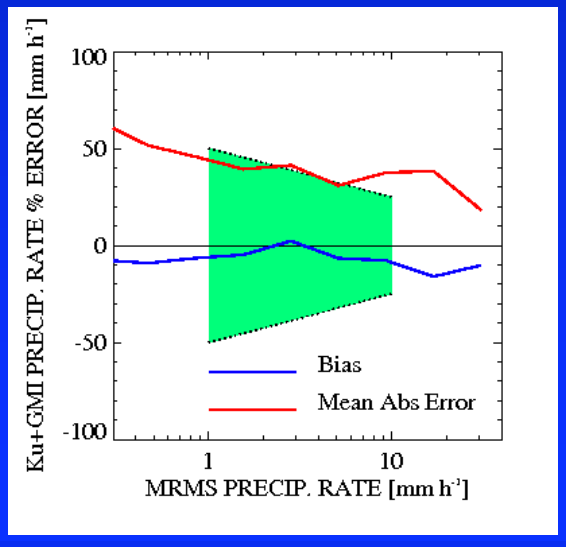
V05 - MRMS



V05 vs. MRMS at 0.5 deg

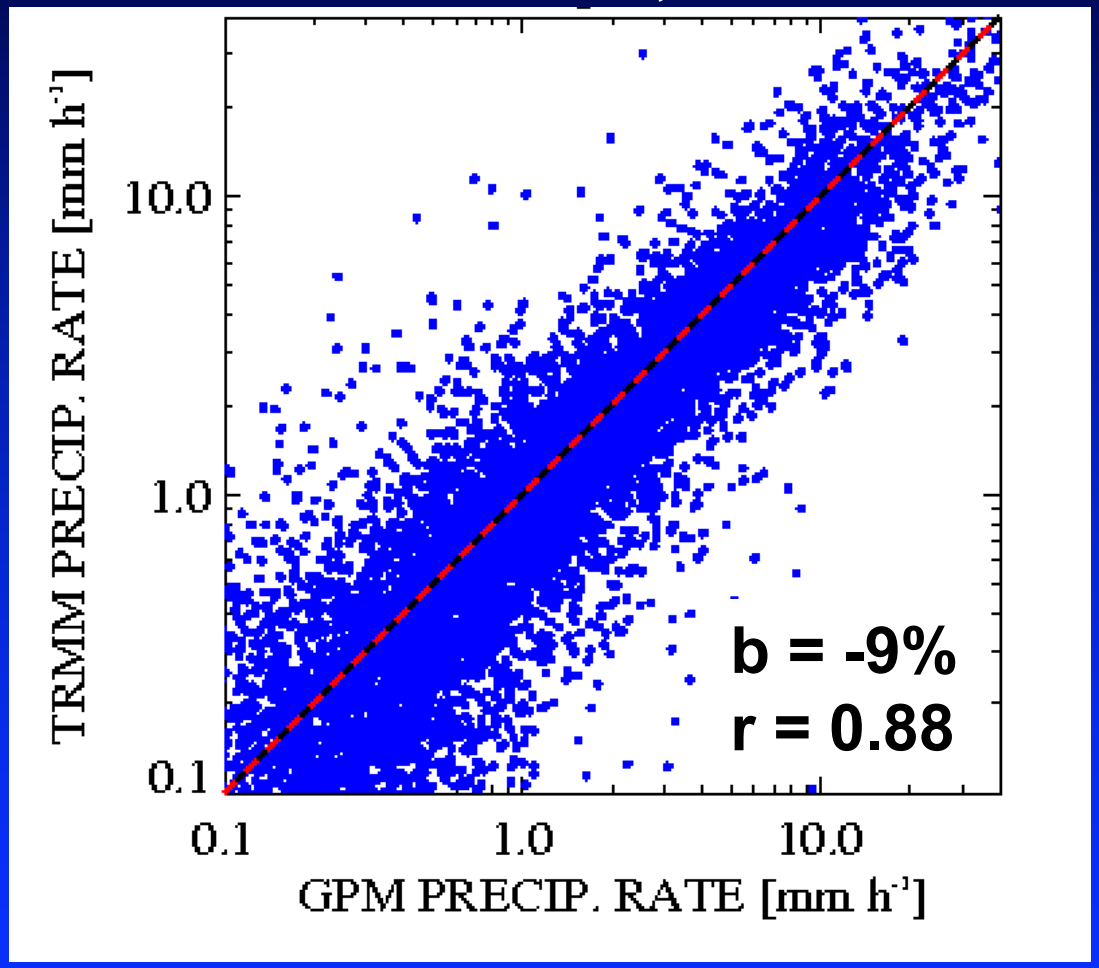


V05 percentage error

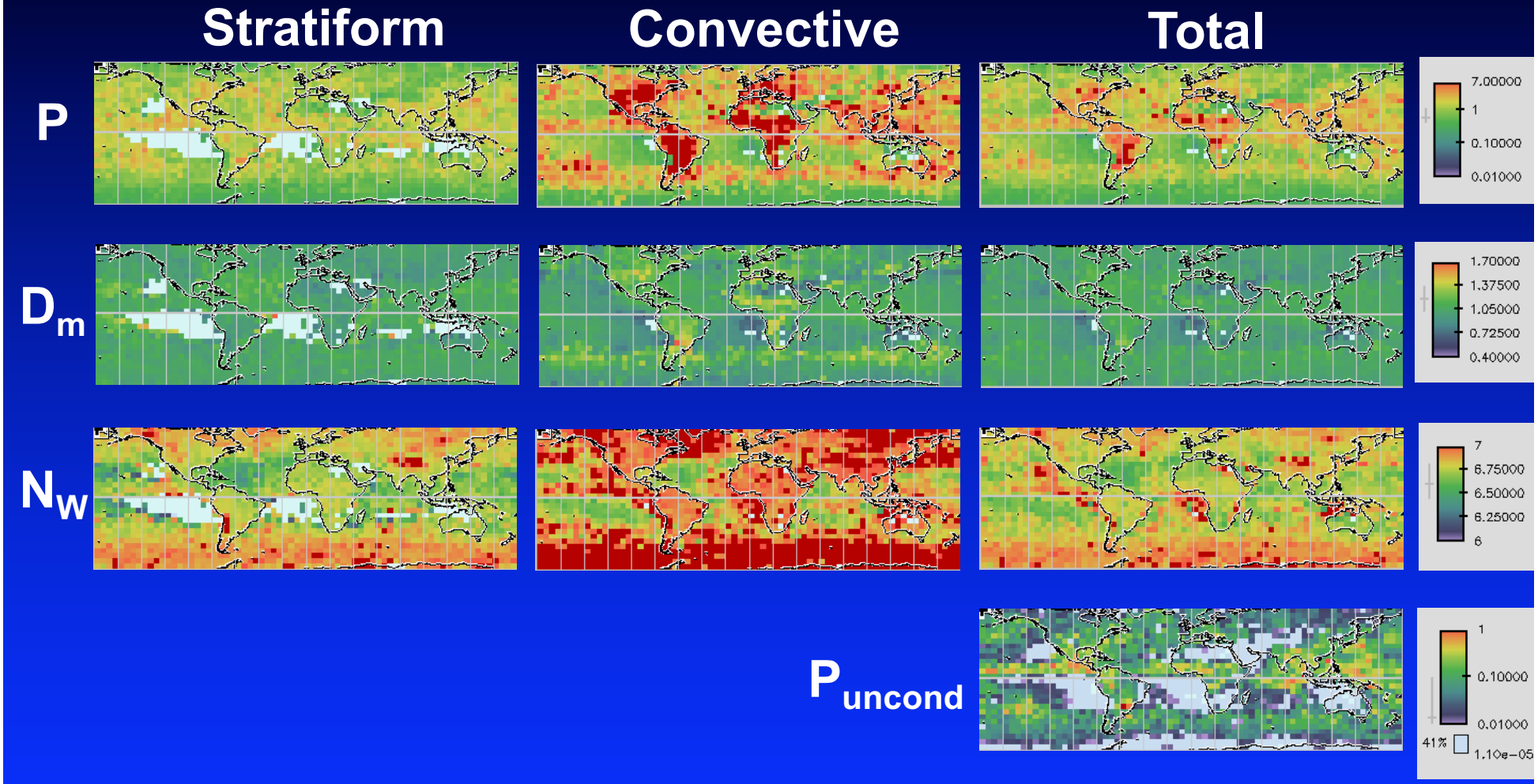


Comparisons from 93 Overlapping Swaths

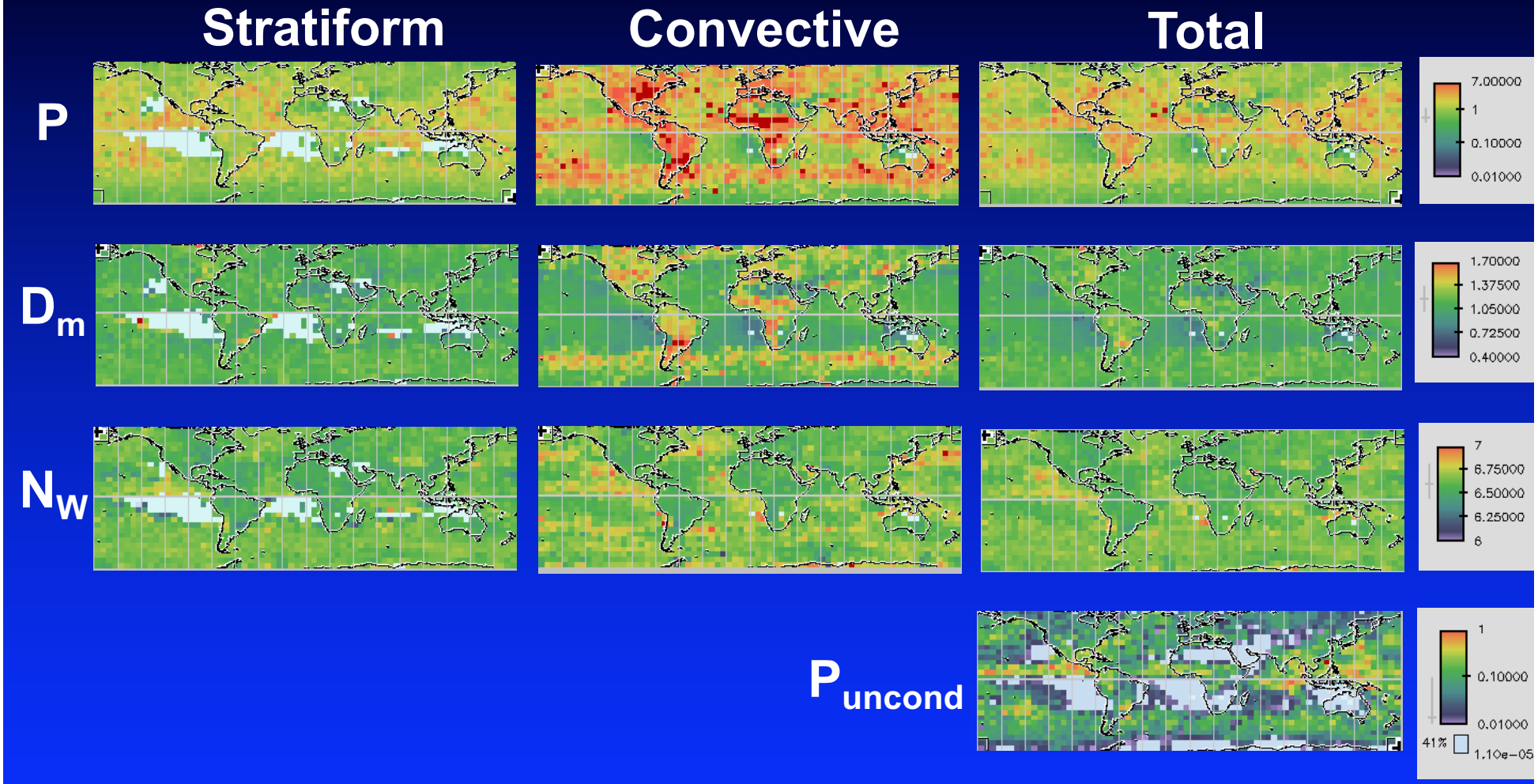
0.1° Matched Data; within 5 min.



V04 (Ku+Ka+GMI) Low-Level Parameters for Sep. 2014

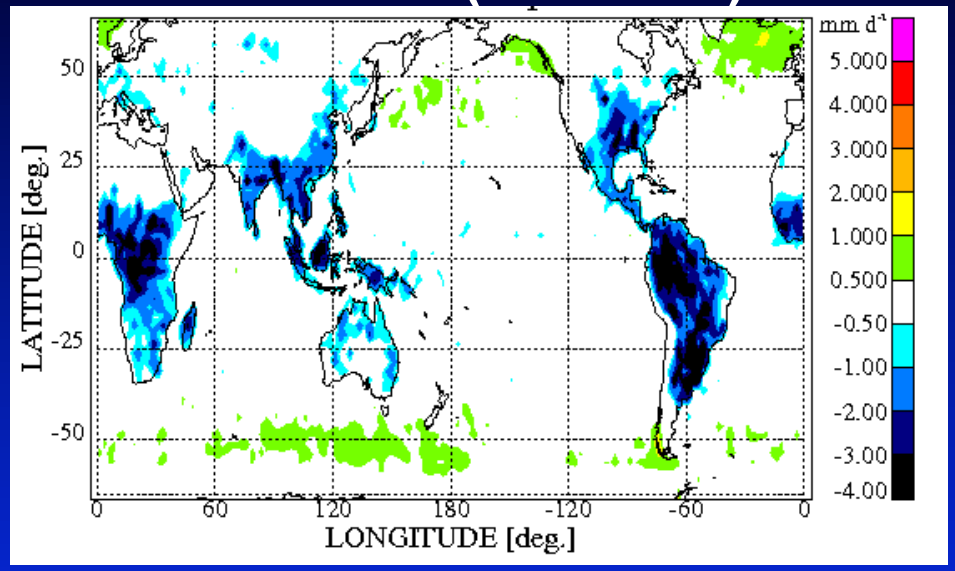


V05 (Ku+Ka+GMI) Low-Level Parameters for Sep. 2014

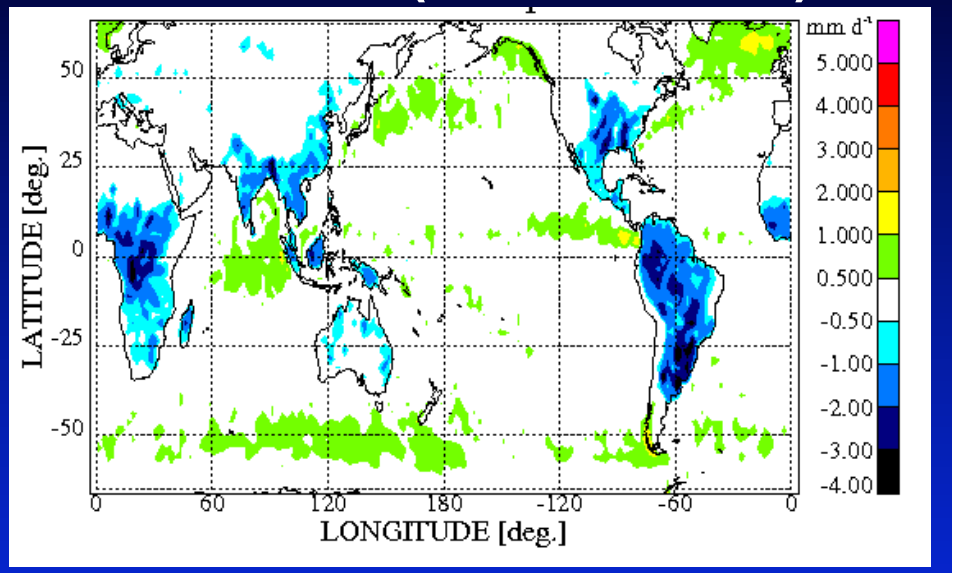


Comparison of V05 vs. V04 Mean Precip. Sep. – Aug. 2014/2015

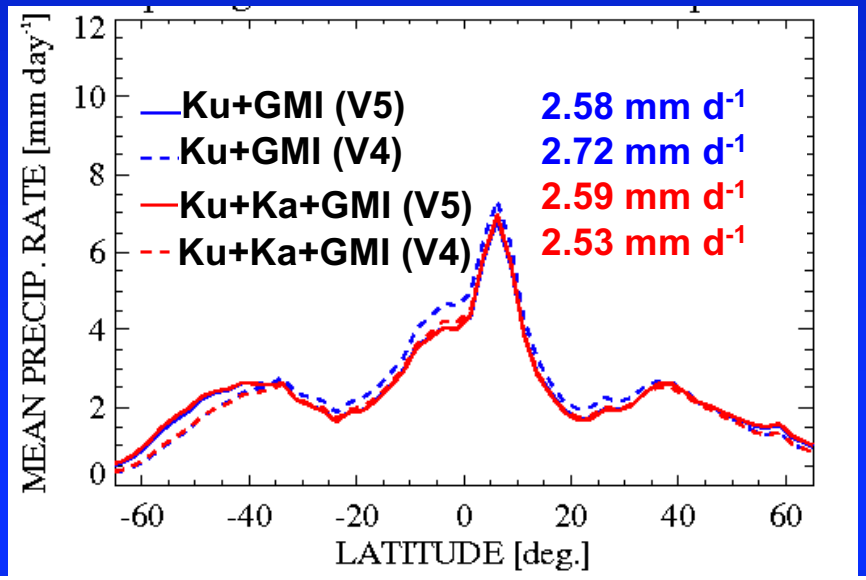
V5 – V4 (Ku+GMI)



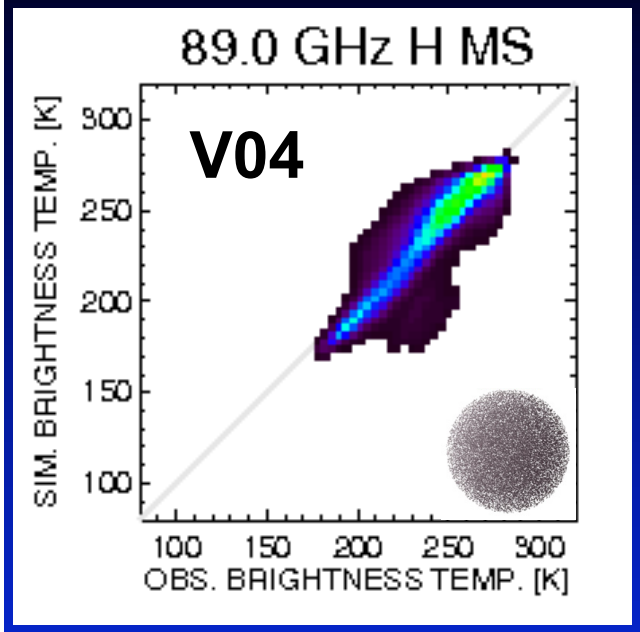
V5 – V4 (Ku+Ka+GMI)

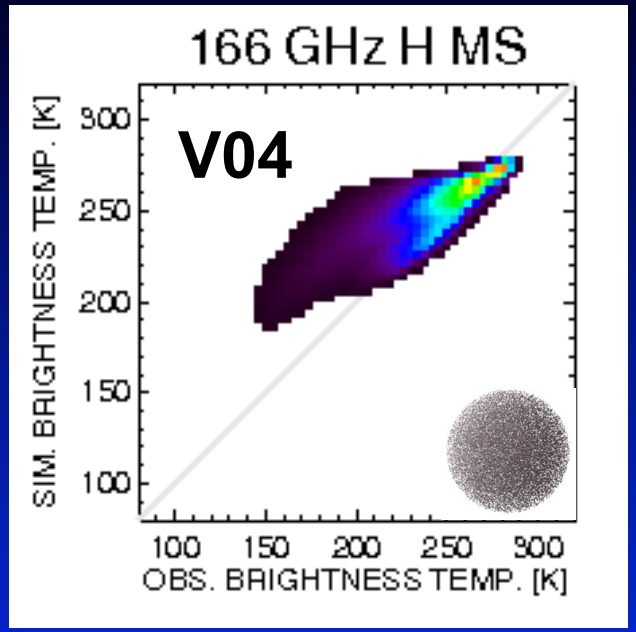


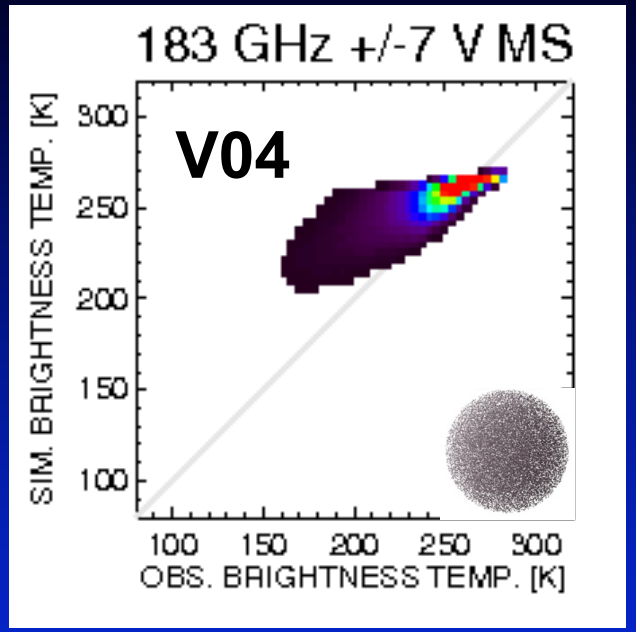
V5 and V4 Zonals

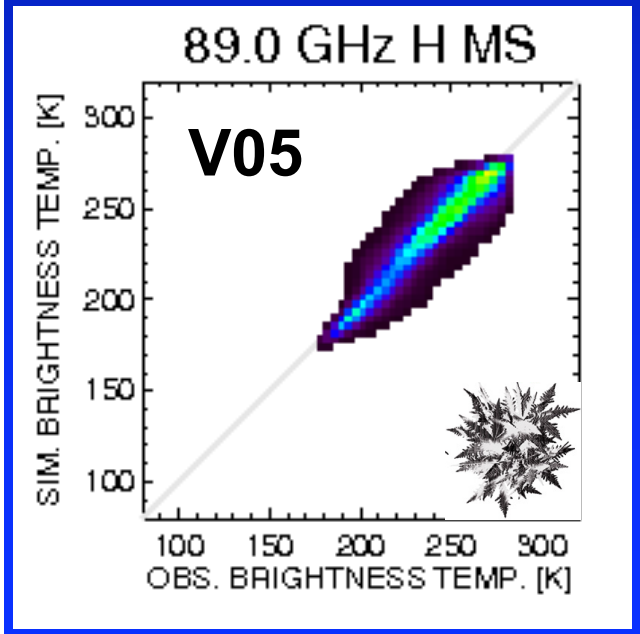


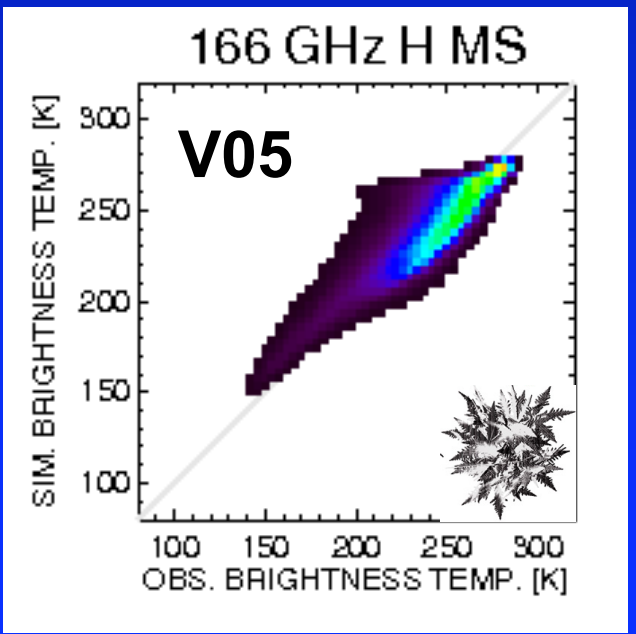
Simulated vs. Observed Radiances at Higher Freq's.

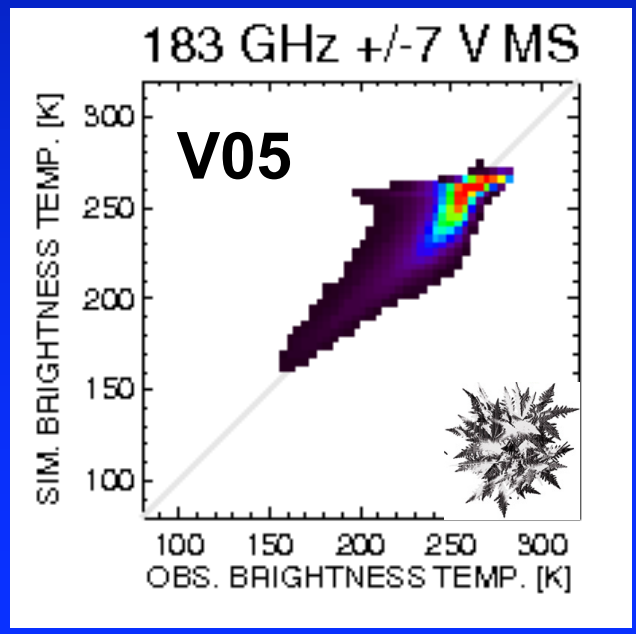






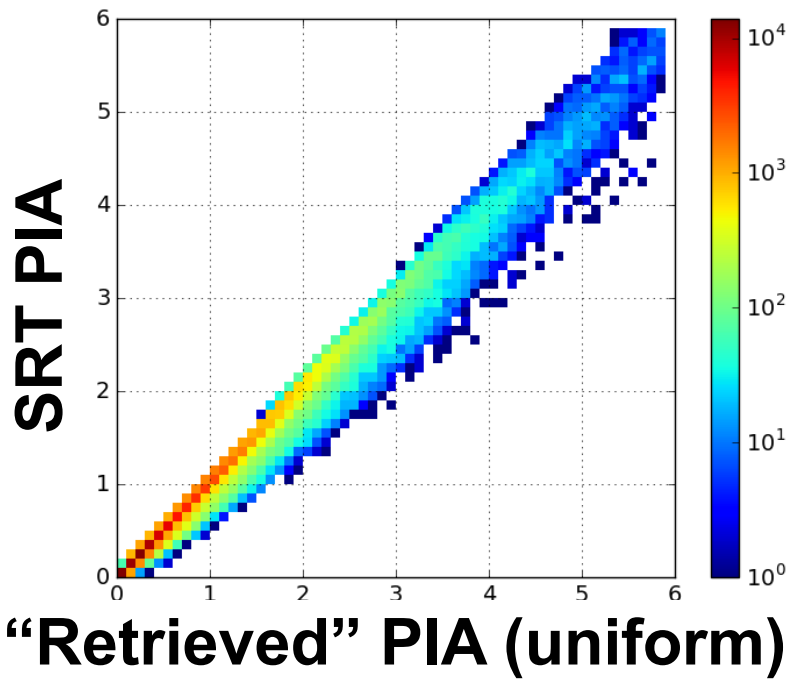




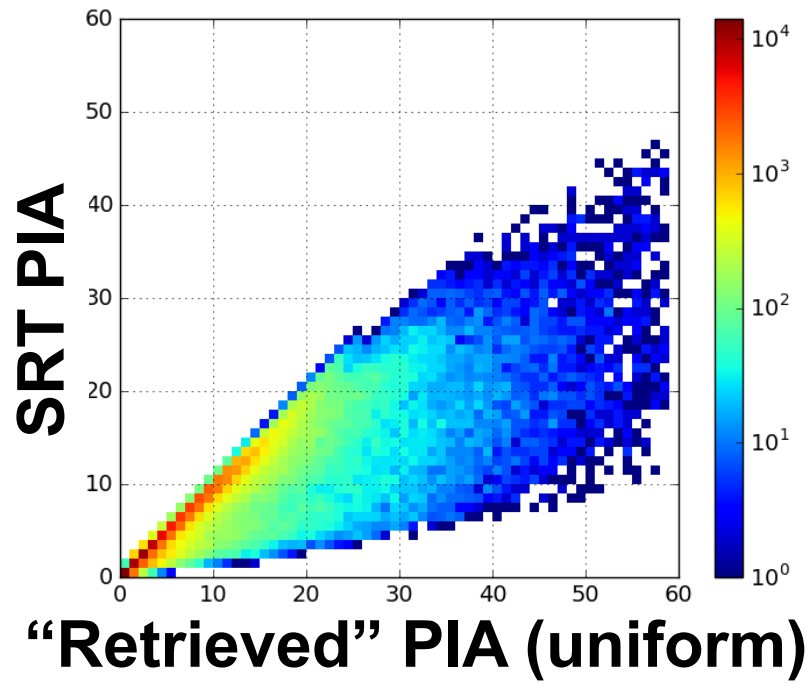


Radar-Based Simulations of Beamfilling-Affected Path Integrated Attenuation

PIA at Ku Band



PIA at Ka Band

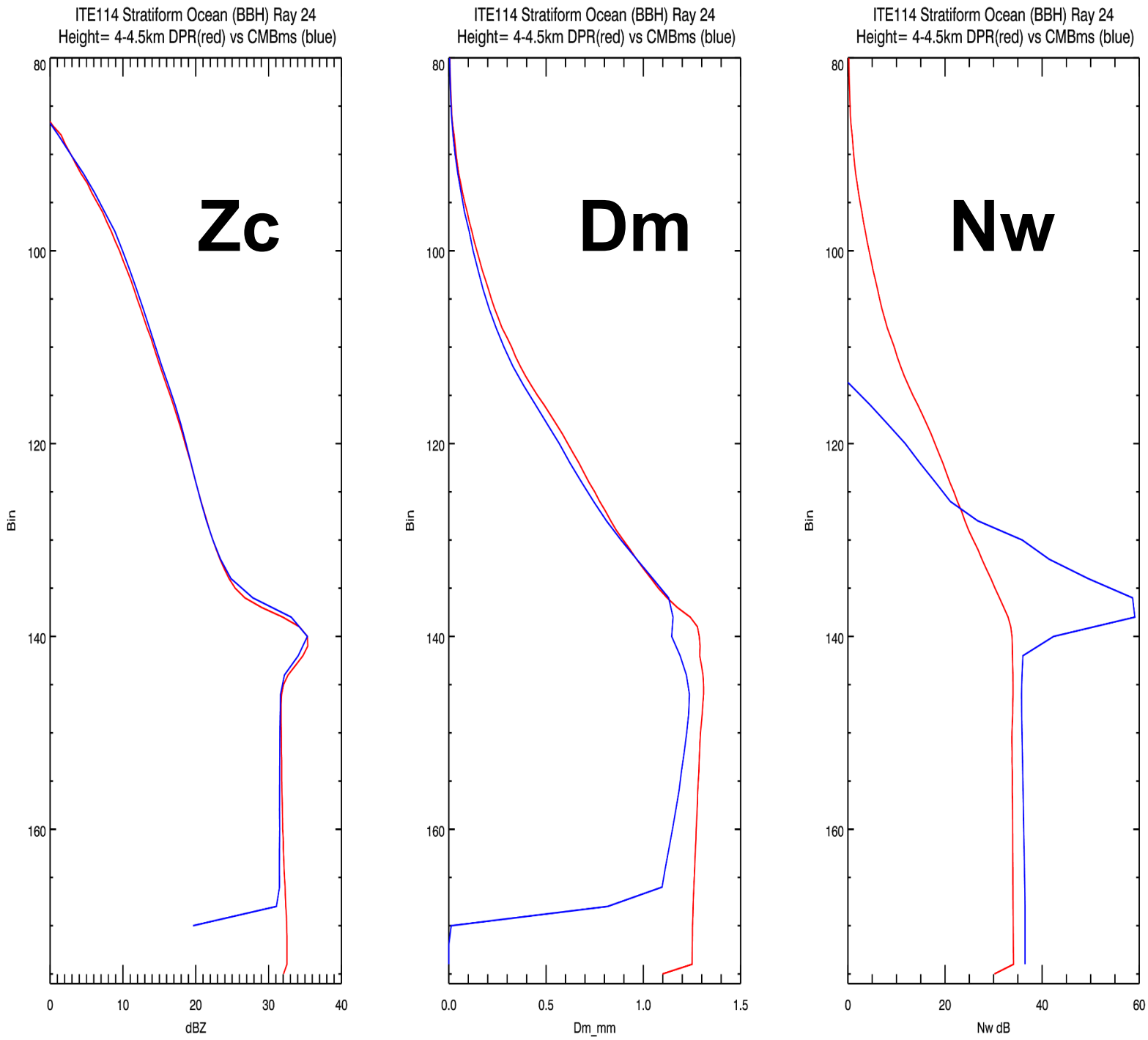


- $SRT_PIA(Ka)_{param} = PIA(Ka) * factor$

from Mircea Grecu

factor = -10.*log10(<10.**(-0.1*PIA(Ka))>)/<PIA(Ka)>

where PIA(Ka) is from "uniform" HB, and < > are 3 x 3 footprint averages.



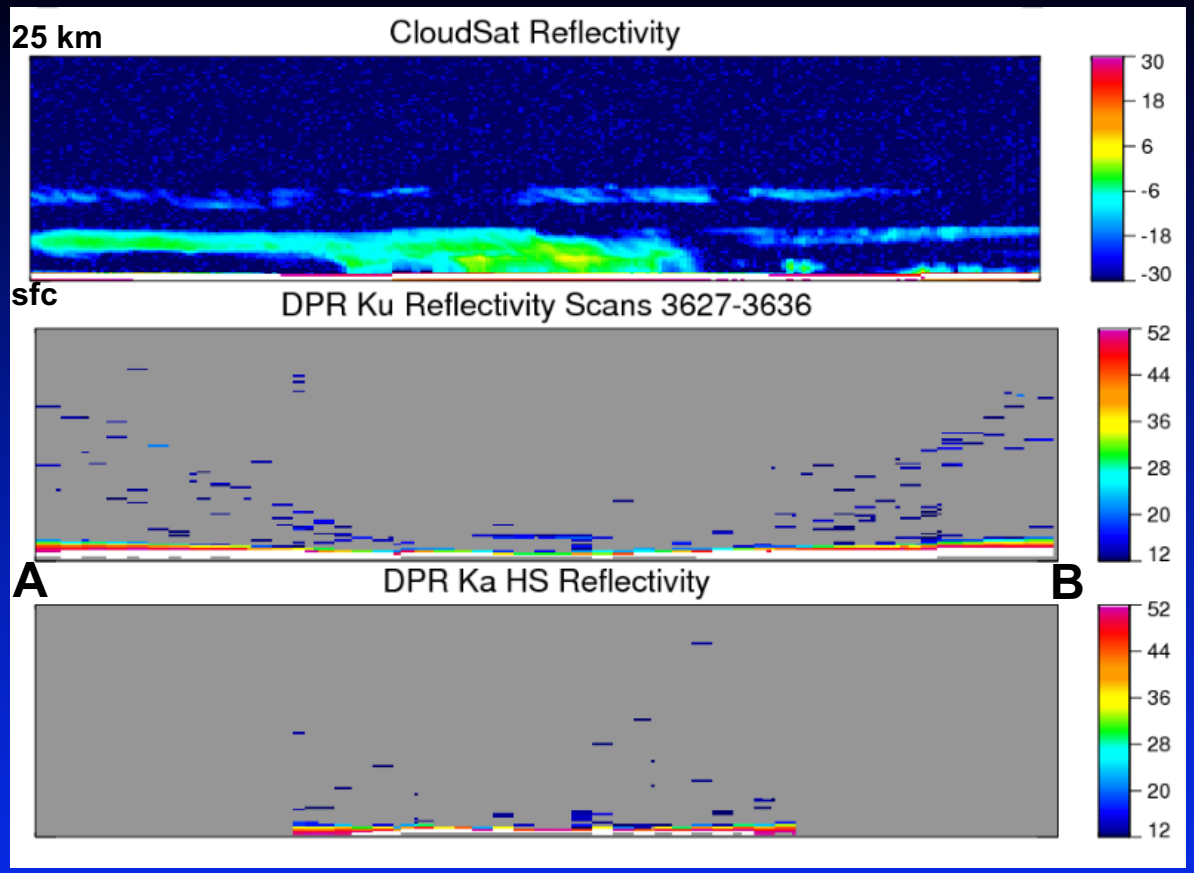
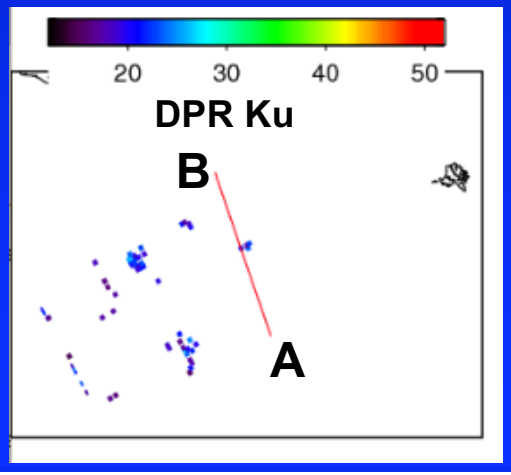
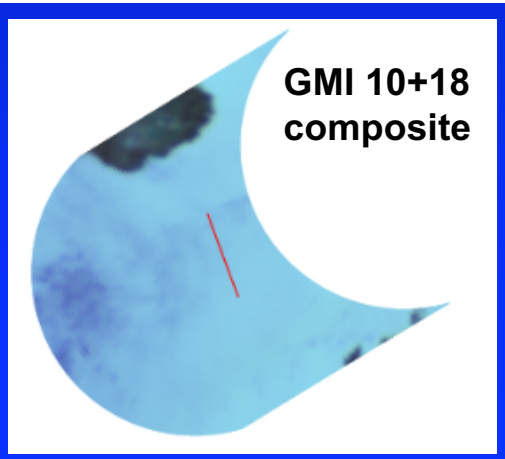
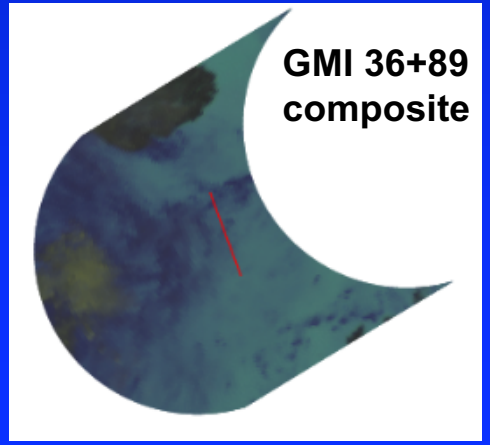
Strat. Ocean

DPR

CMBms

from John Kwiatkowsk

High-Latitude Precipitation



Joe Munchak