## **DPR V4 Algorithm**

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### GPM/DPR rain profiling algorithm flow



## Major Improvements

- Preparation module
  - Range bin mismatch between Ku and Ka channels
  - Rain detection threshold in KaMS and KaHS
- Classification module
  - Rain type classification improved
- SRT module
  - Introduction of the temporal reference data in V4
- Solver module
  - Introduction of  $R-D_m$  relationship
  - $\delta\text{PIA}$  by DSRT is directly used in SLV module
  - Non-uniform beam filling correction implemented

#### D<sub>m</sub> in convective rain with 1<R(mm/h)<3.2 1998\_2013/00\_00, LSF=0-1 rainType(TRMM)=2-2, Utsumi%99=0-15 Dm 1.00rainRate= 3.16 PR -180° -150° -120° -90 -30 0 30° 60 90 120 150° 180° -60 40 40° 30 30° 20 20° 10 10° 0° 0 -10 –10° -20 -20° -30 -30° -40° -40' -180 -150° -120° -90 -60° -30° 0° 30° 60° 90° 120° 150° 180 2.5 0.5 1.5 2.0 3.0 1.0 Dual-freq.rainType=2-2, rainRate= NS1 KuPR NS2 2014/04\_2015/03, LSF=0-1 2014/04\_2015/03, LSF=0-1 rainType=2-2, rainRate= 1.00- 3.16 1.00- 3.16 Dm Dm V04 0000 V04\_0000 -180° -150° 180 -180° -150° -120° 150 -90' 150 90° 90° 60° 60' 30° 30 0° 0 -30°-30 -60°-60 -90°-90'

150

180

3.0

-180°

0.5

-150

-120°

1.0

-90

-60°

-30

1.5

120

2.5

30

2.0

60°

90

0

90°

60

30

0'

-30

-60

-90°

-180°

0.5

-150°

-120°

1.0

-90

-60°

-30

1.5

180

90

60°

30

0°

-30°

-60

-90

180

3.0

30

2.0

0°

60°

90°

120°

2.5

150°

### Comparison of DPR 04 (ITE 049) with 03B

Estimated Surface Rain in V4

Ku

#### DPR

GPMCore DPR precipRateESurface (2014/03-2015/08)



GPMCore KaMS precipRateESurface (2014/03-2015/08)



GPMCore KuNS precipRateESurface (2014/03-2015/08)

(Prepared by K. Kanemaru)



GPMCore KaHS precipRateESurface (2014/03-2015/08)



#### Comparison of DPR 04 (ITE 049) with 03B

(Prepared by K. Kanemaru)

Absolute change (V4-V3)

Ku

#### DPR

GPMCore DPR precipRateESurface (2014/03-2015/08)



GPMCore KaMS precipRateESurface (2014/03-2015/08)



GPMCore KuNS precipRateESurface (2014/03-2015/08)



GPMCore KaHS precipRateESurface (2014/03-2015/08)



#### Comparison of DPR 04 (ITE 049) with 03B (Prepared by K. Kanemaru) Relative change (V4-V3)/V3

DPR

GPMCore DPR precipRateESurface (2014/03-2015/08)



GPMCore KaMS precipRateESurface (2014/03-2015/08)



Ku GPMCore KuNS precipRateESurface (2014/03-2015/08)



GPMCore KaHS precipRateESurface (2014/03-2015/08)





# **V03B** current version rain @ 2km

TRMM Area 35S-35N

↔ KuNS = 65.9

↔ KaMS = 32.5

↔ KaHS = 33.0

• PR = 74.0

20

40

60

• DPRNS = 57.6





# V04C new (V6.20150706) rain @ 2km

40

60

# Comparisons in zonal means



Ku(NS) Ka(MS) Ka(HS) **DPR(MS)** Ku(MS) **GMI** PR

# Comparison of GPM V3 (public) and V4 (ITE057) algorithms Zonal Global Mean Comparison.

Solid symbols are V4 (ITE057)

Open symbols are V3 (Public)

Agreement in zonal mean does not imply regional agreement between estimates.



YYMM

#### GPCP V2.2 Accumulation



### Annual Accumulations Sept. 2014 – Aug. 2015

GPCP V2.2 and DPR (MS)

#### DPR (MS) V4 - GPCP V2.2 Relative Differences in Percent



(DPR - GPCP)/GPCP

### Comparison with NSSL's Multi-Radar/Multi-Sensor (MRMS) data

**DPR - MRMS** 

MRMS

Priod: April 2014-March 2015 Data: Only satellite overpass time 871 1 deg x 1 deg boxes 1-deg. zonal means



(N. Kawamoto)

## Summary

- Several improvements have been introduced into the DPR algorithm since V3.
  - Sidelobe clutter is now reasonably well removed.
  - New classification module with DFRm method works well.
  - DF Solver module adopts conservative method in V04.
  - Rain estimates from KaPR have been improved substantially.
- ready to propose current algorithm as V4.
- There are future issues and possible improvements.
  - ✓ Absolute calibration of radar
  - ✓ Effect of NUBF and multiple scattering
  - ✓ Regional and seasonal characteristics of the  $R-D_m$  relationship
  - $\checkmark$  Increase the reliability of PIA estimates with SRT
  - ✓ snow/rain separation using information from DFRm, Z(Ku) and other infomation (ex. storm depth)
    - DFRm and calibration are important components.