PROFILE CLASSIFICATION ALGORITHM FOR GPM-DPR

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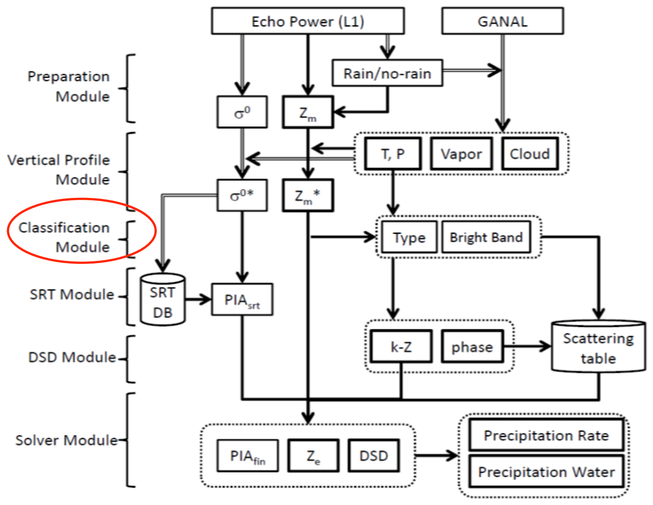
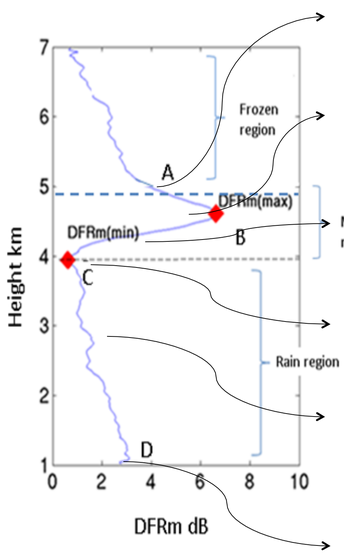
Basic structure of GPM-DPR level algorithm (Iguchi et al. 2013)



Classification module:

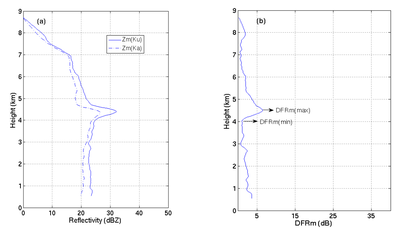
- Separate stratiform, convective and other rain types.
- Detect melting layer for each profile.

Measured dual-frequency ratio (DFR_m): $DFR_m = DFR + \delta PIA$

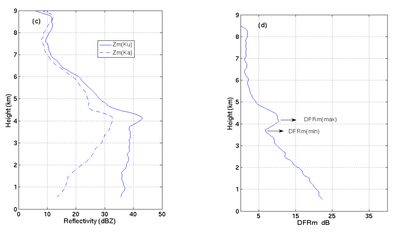


- DFRm slope maximum value at A
- DFRm maximum value at B
- DFRm slope between maximum and local minimum value (B,C slope)
- DFRm local minimum value at C
- DFRm slope between local minimum value and near surface value (C, D slope)
- DFRm value near surface at D

Stratiform



Convective



Precipitation type classification model (PCM)

A set of *DFRm* indices are defined. Let V1 be

$$V1 = DFR_m(max) - DFR_m(min) / DFR_m(max) + DFR_m(min) \quad (1)$$

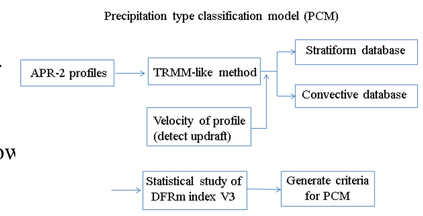
Let V2 be the absolute value of the mean slope of *DFRm* below the local min point.

$$V2 = abs(mean(DFR_m\ slope)) \quad (2)$$

In order to further enlarge the difference, a third *DFRm* index V3 is defined as

$$V3 = V1/V2 \quad (3)$$

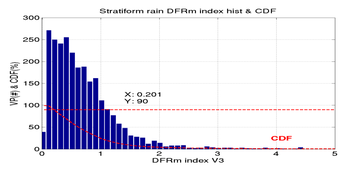
The DFRm index V3 can be an effective parameter to perform profile classification.

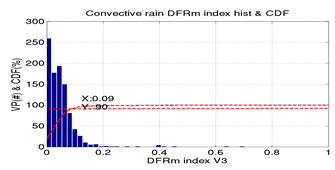


TRMM-like	Velocity	decision
'S'	'U'	'C'
'C'	'U'	'C'
'S'	'no'	'S'
'C'	'no'	'C'

The CDF or (1-CDF)(cumulative density function) of V3 is calculated and the 90% confidence line gives:

Convective: V3<C1;
Stratiform: V3>C2;
Transition: C1<=V3<=C2





APR-2 data resolution

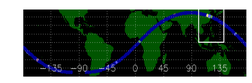
90% CDF	NAMMA	GRIP	Wakasa Bay
C1	0.09	0.120	0.101
C2	0.201	0.216	0.192

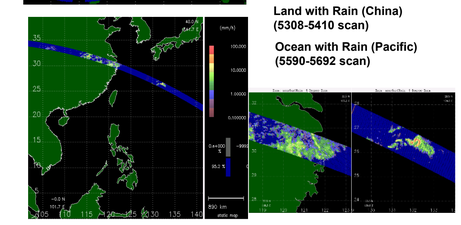
DPR horizontal resolution

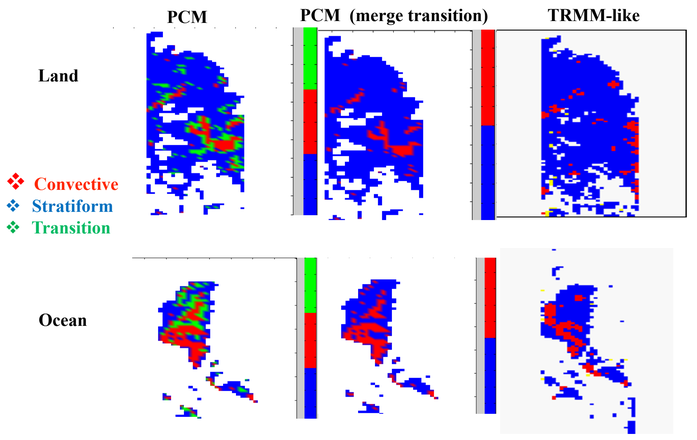
90% CDF	NAMMA	GRIP	Wakasa Bay
C1	0.09	0.112	0.10
C2	0.194	0.201	0.17

DPR vertical resolution

90% CDF	NAMMA (resample to 250m)	NAMMA (resample to 125m)	GRIP (resample to 250m)	GRIP (resample to 125m)
C1	0.093	0.092	0.13	0.13
C2	0.210	0.20	0.20	0.199



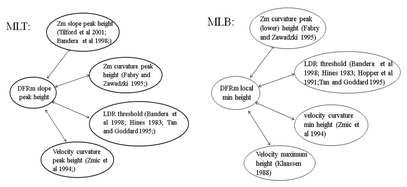




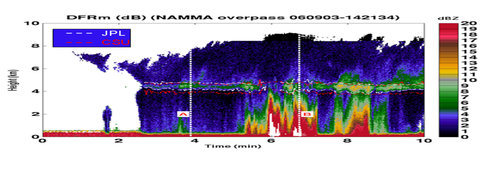
Hydrometeor profile characterization (HPC) model

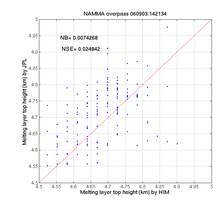
Melting layer top: height at which *DFRm* gradient has maximum value.

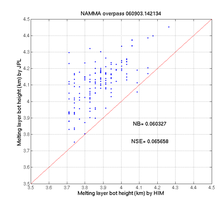
Melting layer bottom: height at which *DFRm* has a local minimum value.

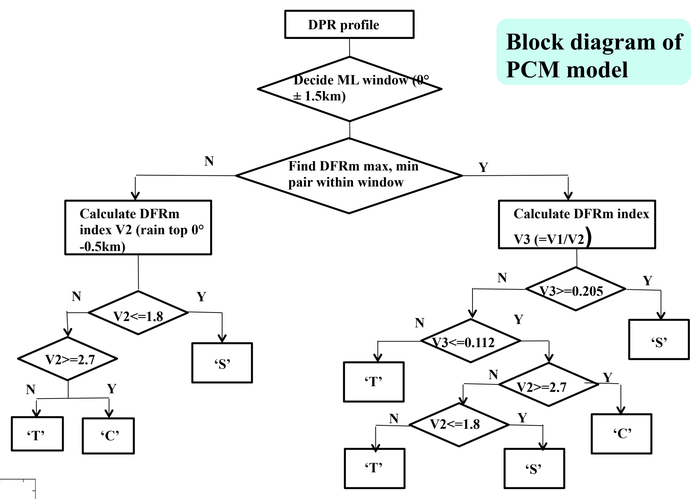


	Criteria	DFRm slope max (NAMMA)	DFRm slope max (GRIP)	DFRm slope max (Wakasa Bay)
Melting layer top comparisons	Zm slope max	NB= -0.026; NSE=0.036;	NB= -0.025; NSE=0.036;	NB= -0.049; NSE=0.066;
	Zm curvature max	NB= 0.016; NSE=0.033;	NB= 0.015; NSE=0.030;	NB= 0.028; NSE=0.052;
	LDR	NB= -0.028; NSE=0.045;	NB= -0.033; NSE=0.042;	NB= -0.06; NSE=0.072;
	* Velocity curvature max	NB= -0.013; NSE=0.036;	NB= -0.014; NSE=0.037;	NB= -0.019; NSE=0.056;
		DFRm local min (NAMMA)	DFRm local min (GRIP)	DFRm local min (Wakasa Bay)
Melting layer bottom comparisons	Zm curvature max	NB= 0.043; NSE= 0.055;	NB= 0.037; NSE=0.050;	NB= 0.043; NSE=0.069;
	LDR	NB= 0.045; NSE= 0.059;	NB= 0.040; NSE=0.054;	NB= 0.054; NSE=0.112;
	*Velocity curvature min	NB= 0.022; NSE= 0.049;	NB= 0.017; NSE=0.044;	NB= -0.0008; NSE=0.07;
	*Velocity max	NB= 0.016; NSE= 0.059;	NB= 0.019; NSE=0.043;	NB= -0.026; NSE=0.139;

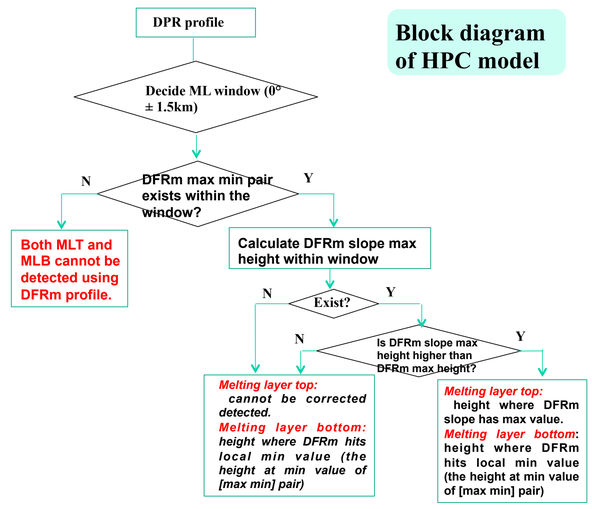




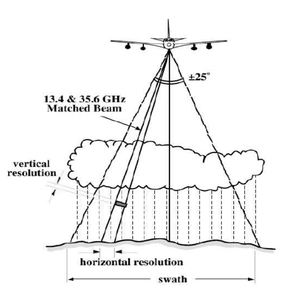




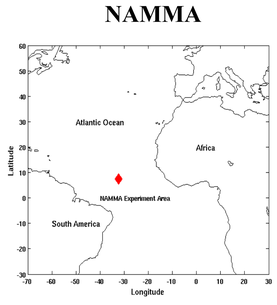
Block diagram of PCM model



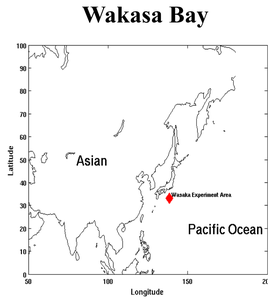
Block diagram of HPC model



NAMMA



Wakasa Bay



GRIP

SUMMARY

- Profile classification method for GPM-DPR is presented.
- Precipitation type classification model (PCM) and hydrometeor profile characterization (HPC) model are developed and implemented to GPM-DPR level-2 day 1 algorithm.
- Algorithms are undergoing testing and showing reasonable comparisons with TRMM-like methods.

This work is supported by the GPM PMM program.

Acknowledgements: The authors sincerely thank Dr. Simone Tanelli for providing the APR2 data used in this analysis.

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