Detection of Rapidly Developing Cumulus Areas from MTSAT-1R Short-Time Interval Images

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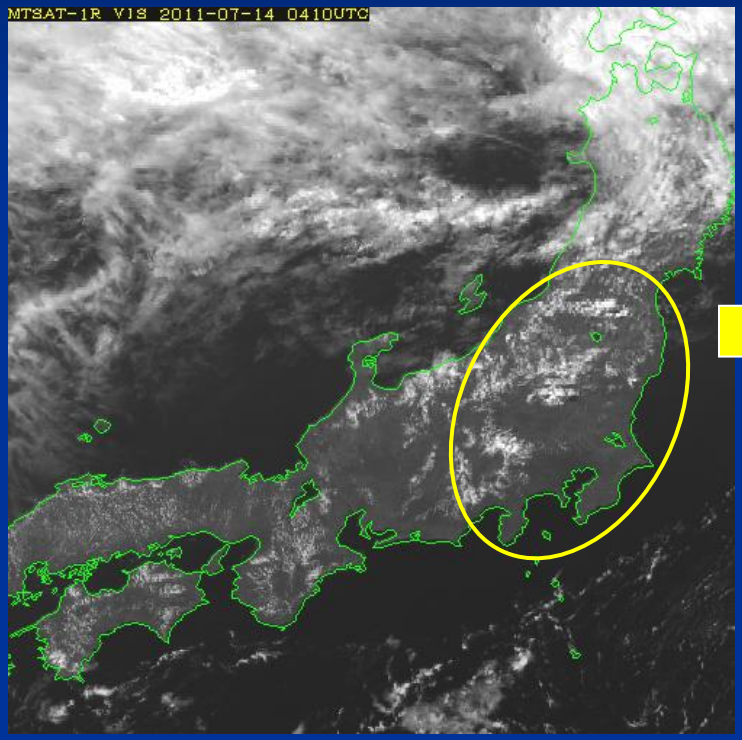
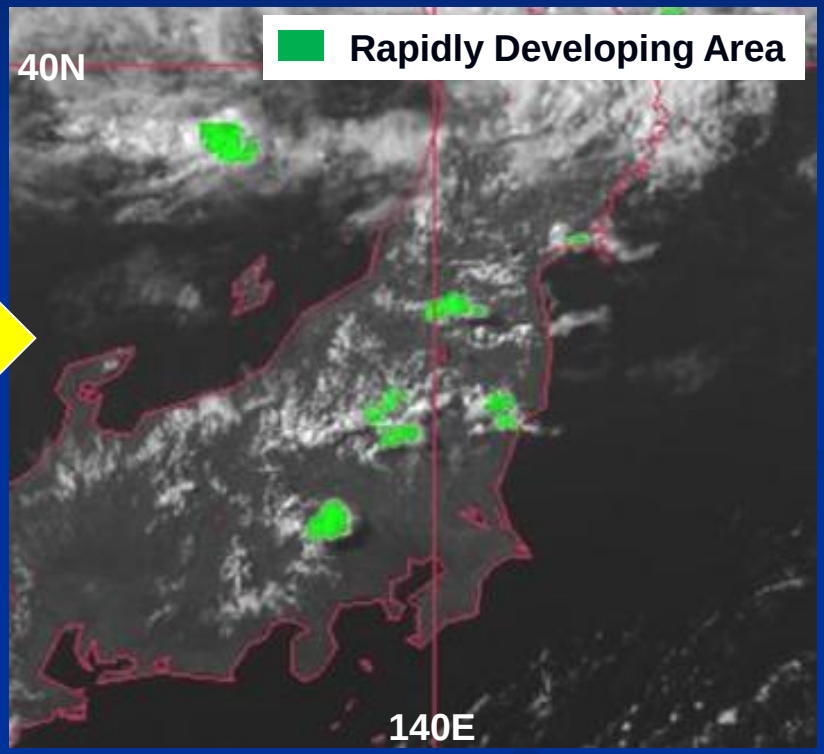
1. Introduction-1

Rapidly Developing Cumulus Areas (RDCA)





MTSAT-1R Rapid Scan observation

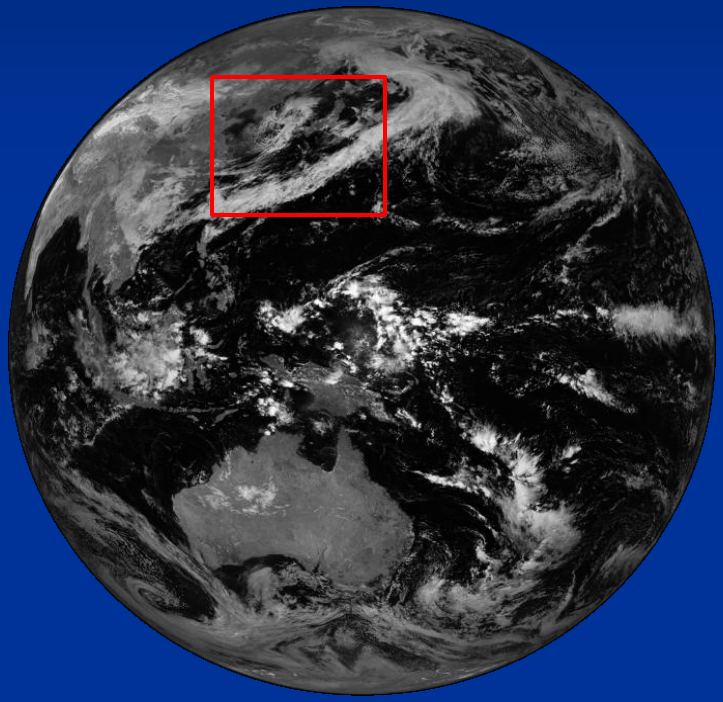
- 5-minute interval
- Available in daytime of summer

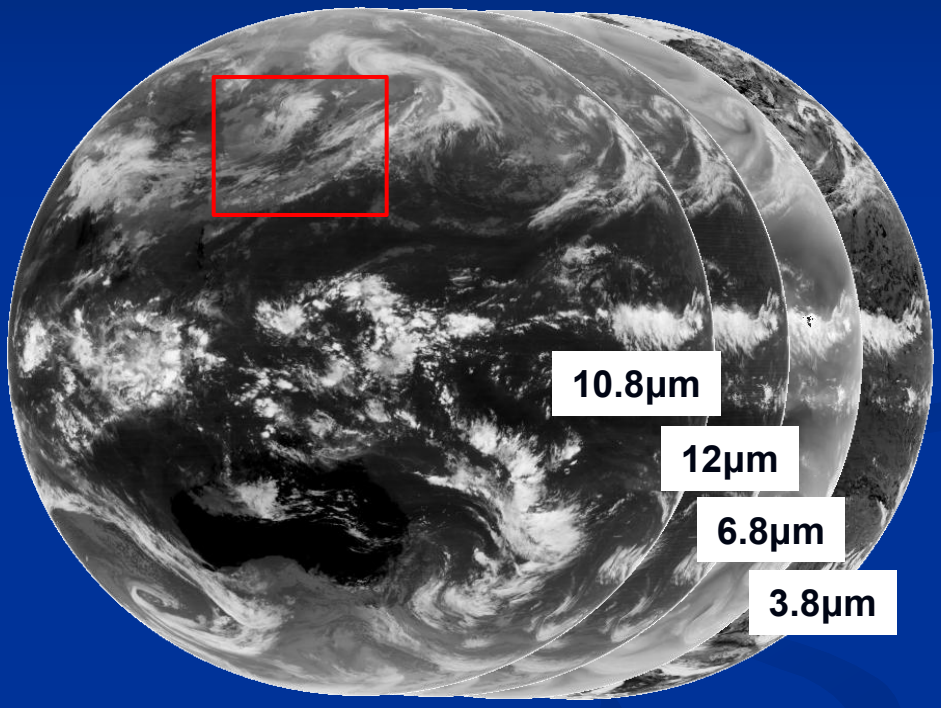
Example of RDCA (prototype)

- Mainly to capture airmass thunderstorms
- For aviation
- Service will start in 2012

2. Introduction-2

What does MTSAT-1R observe for nowcasting?





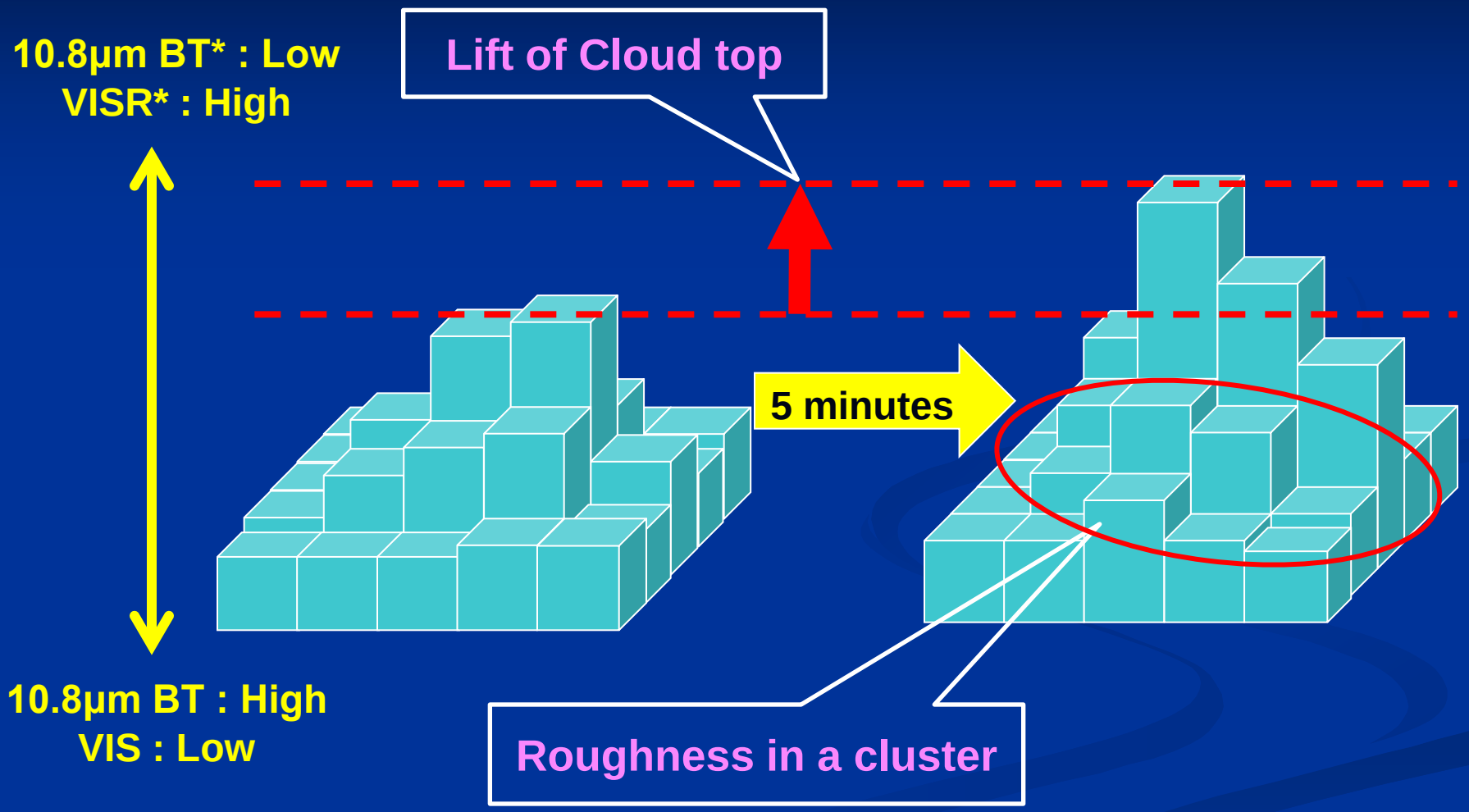
Visible (VIS)

- Cloud optical thickness

Infrared

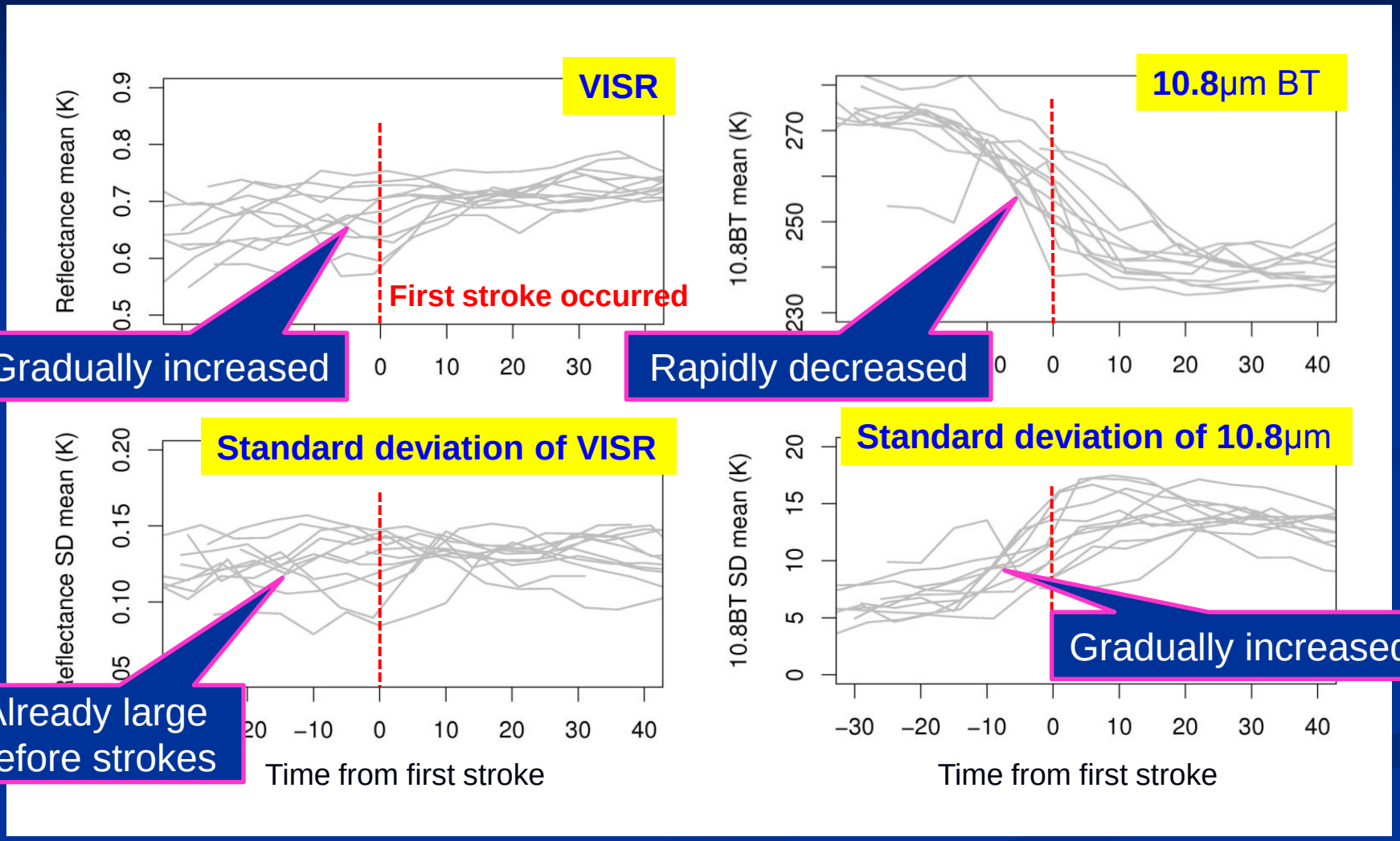
- Cloud top temperature (10.8μm)
- Water vapor on upper level (6.8μm)
- Solar radiation reflected by cloud (3.8μm)

3. Concept of RDCA



* BT : Brightness Temperature VISR : Reflectance

4. Time sequence of some parameters



12 convective clusters with lightening strokes (9 to 12 July 2011)

5. Parameter list on RDCA

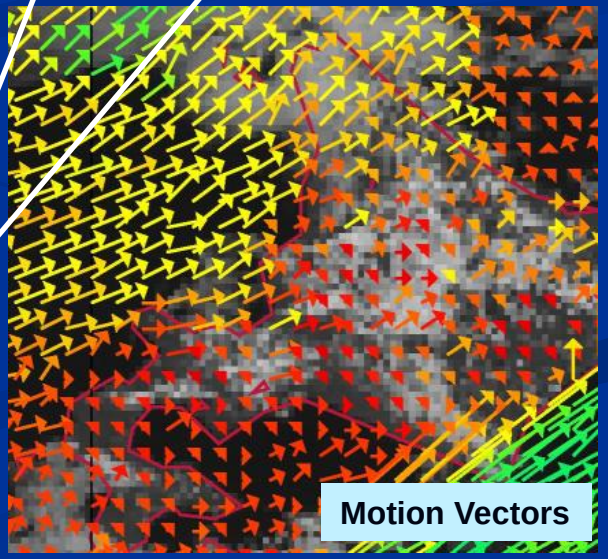
No.	Parameters	Main objective
1	VISR	To detect optical thick cloud (mainly for *Pre-detection)
2	Difference between maximum and minimum of VISR	To detect a roughness in developing cloud
3	Standard deviation of VISR	
4	Difference between maximum and minimum of 10.8μm BT	
5	Standard deviation of 10.8μm BT	
6	Difference between 10.8μm and 12μm BT	To exclude optically thin cloud (cirrus) (mainly for Pre-detection)
7	Difference between 6.8μm and 10.8μm BT	To detect the potential to develop
8	Slope index (relation between 10.8μm BT and effective radius of cloud top estimated from 3.8μm)	To evaluate cloud microphysical structure
9	Time differential of maximum of VISR	To evaluate vertically developing trend of developing cloud
10	Time differential of averaged VISR	
11	Time differential of minimum of 10.8μm BT	
12	Time differential of averaged 10.8μm BT	
13	Pinpoint fall down of 10.8μm BT	

Non-time-trend parameters

- Diagnostic parameters based on a single image

Time-trend parameters

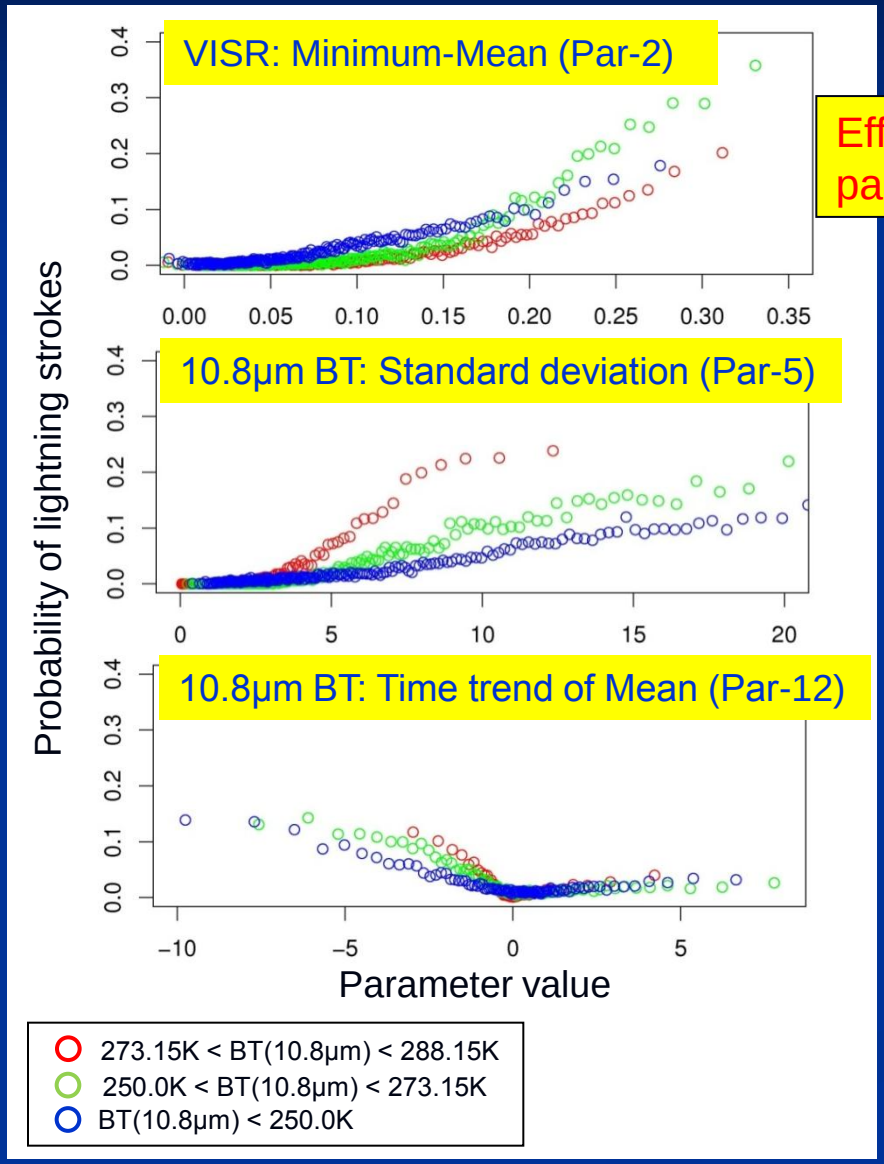
- Variance in 5 minutes
- Cloud motion is considered



* Pre-Detection : To extract candidates of cloud

6. Parameter's sensitivity and index

Parameter value and probability of strokes



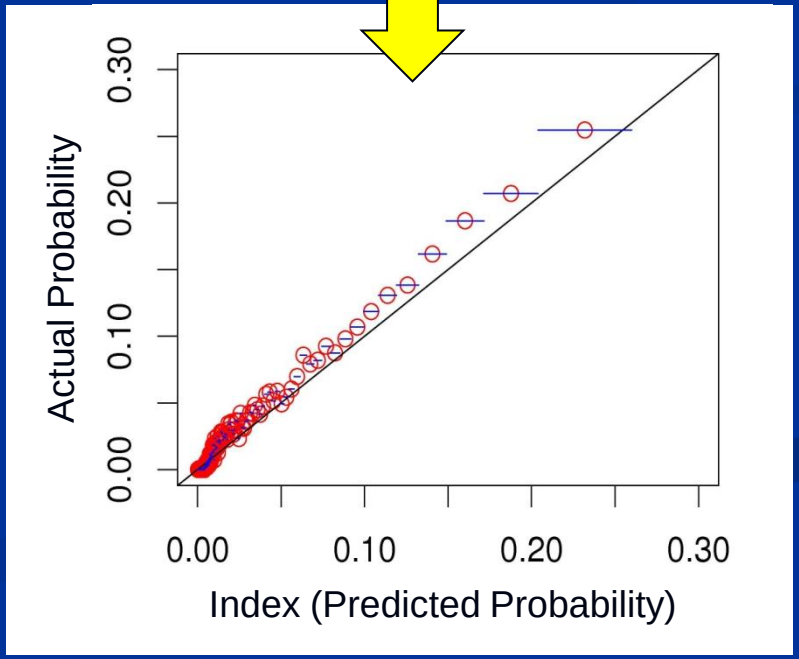
Effective parameters

Logistic regression model

$$p = \frac{1}{1+\exp\left\{-\left(a_0 + \sum_i a_i x_i\right)\right\}}$$

X_i : Effective parameter values

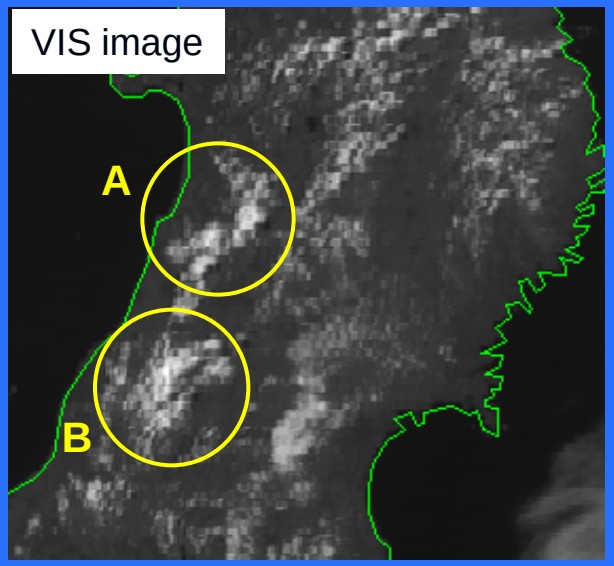
► **New Index (Predicted Probability)**

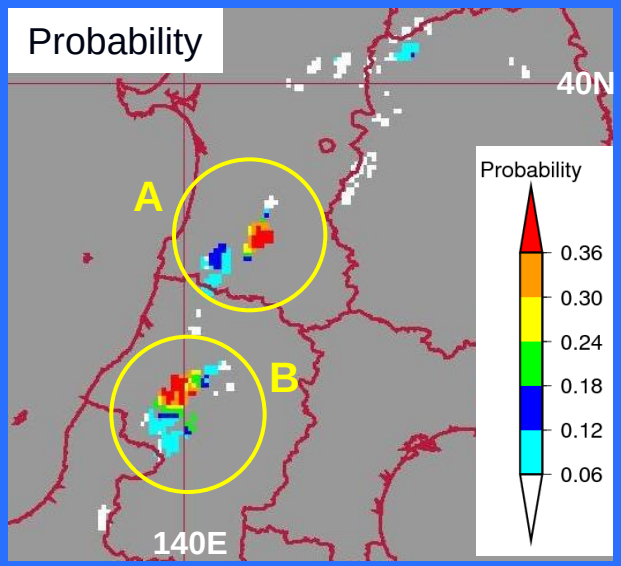


Comparison with actual probability

7. Example of RDCA

MTSAT-1R image and probability at 13:20 JST, 11 July 2011

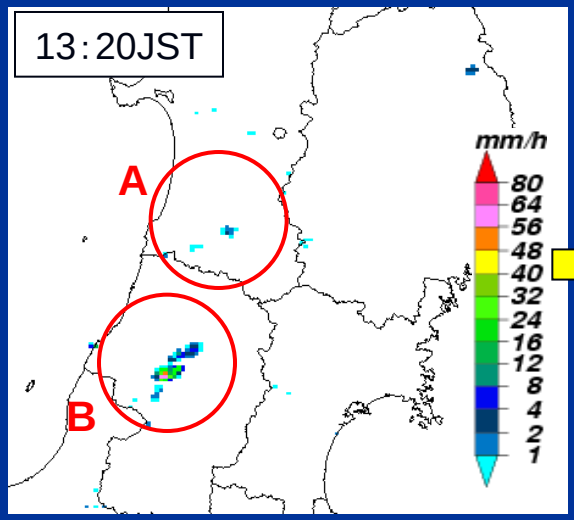


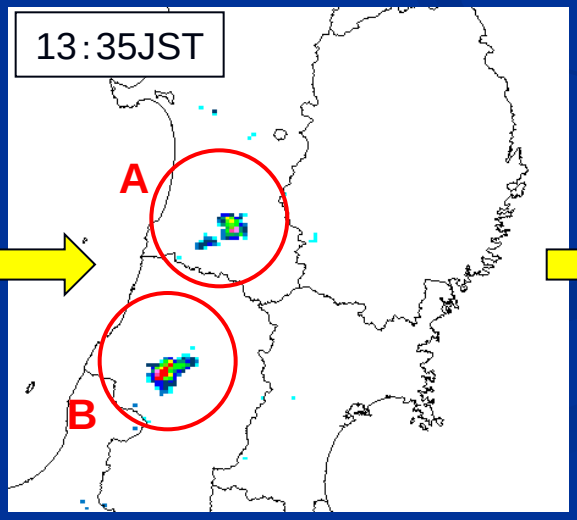


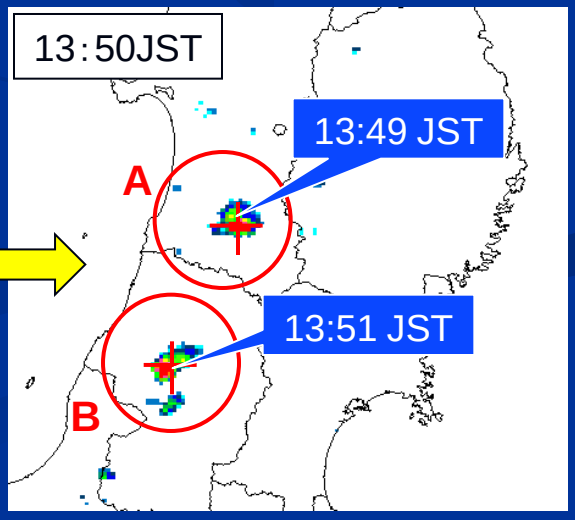
Effective for RDCA

Rain Radar charts

Lightening strokes







8. Summary and issues

- Introduction of detection parameters using MTSAT-1R Visible and Infrared channels.
- Parameters have sensitivity for thunderstorms.
- Index based on detection parameters is effective to capture clouds at early developing stage.

Issues in the future

- Introduction of other effective parameters
- Investigation of method to treat parameters
- Consideration of method to validate
- Preparation for next generation satellite

Thank you for your attention.