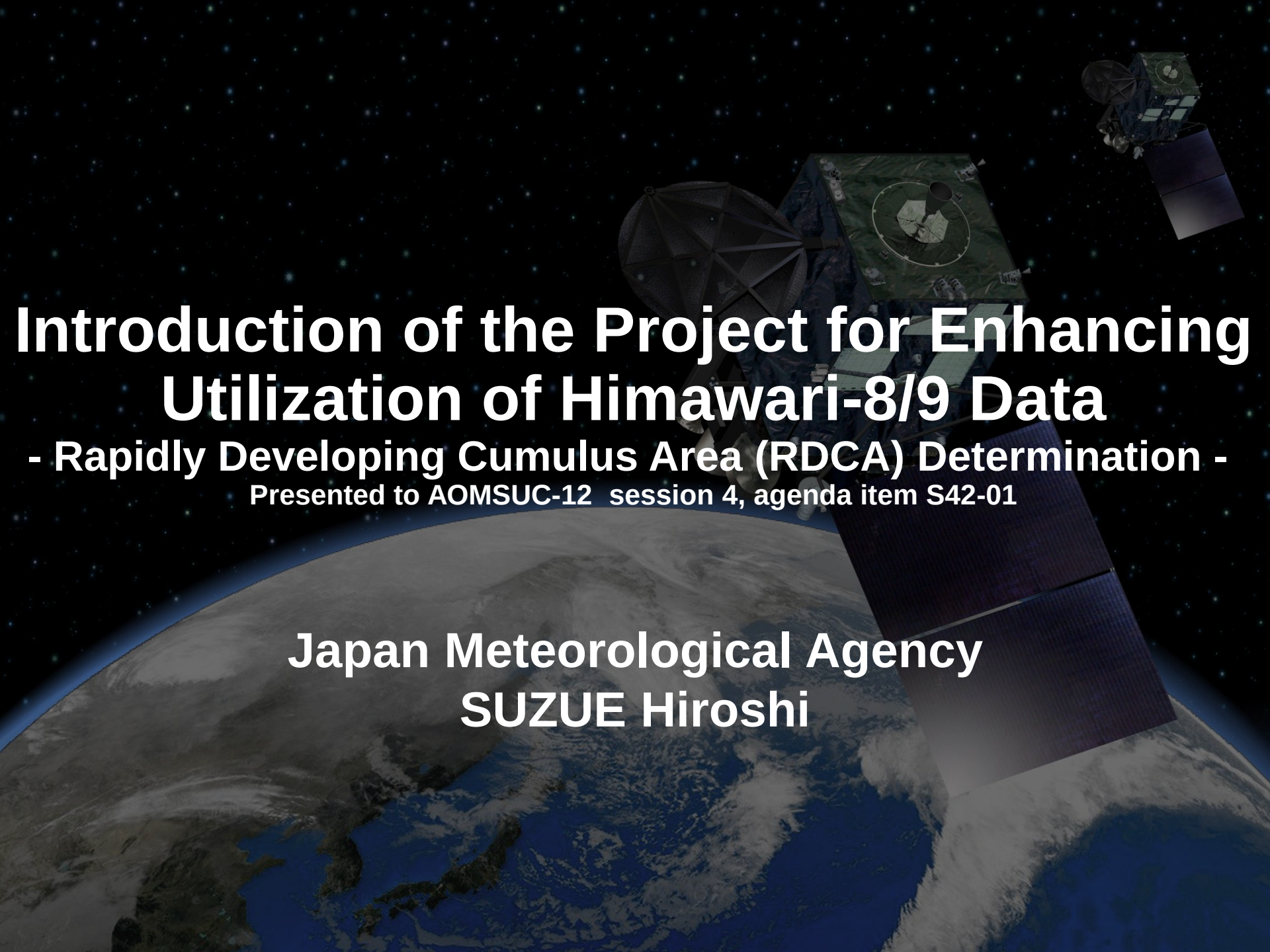


Introduction of the Project for Enhancing Utilization of Himawari-8/9 Data

- Rapidly Developing Cumulus Area (RDCA) Determination -

Presented to AOMSUC-12 session 4, agenda item S42-01

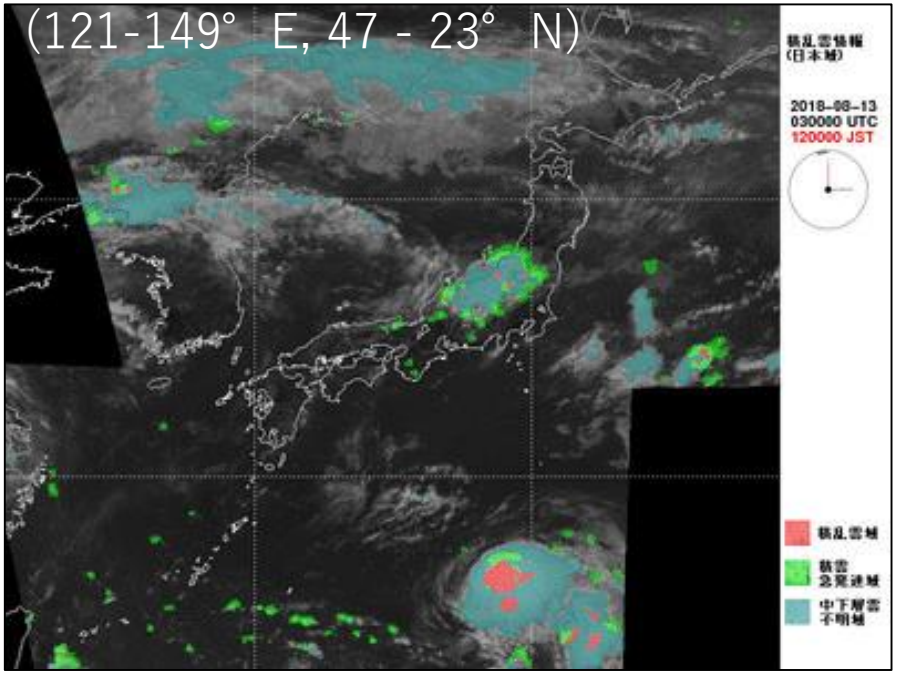
Japan Meteorological Agency

SUZUE Hiroshi

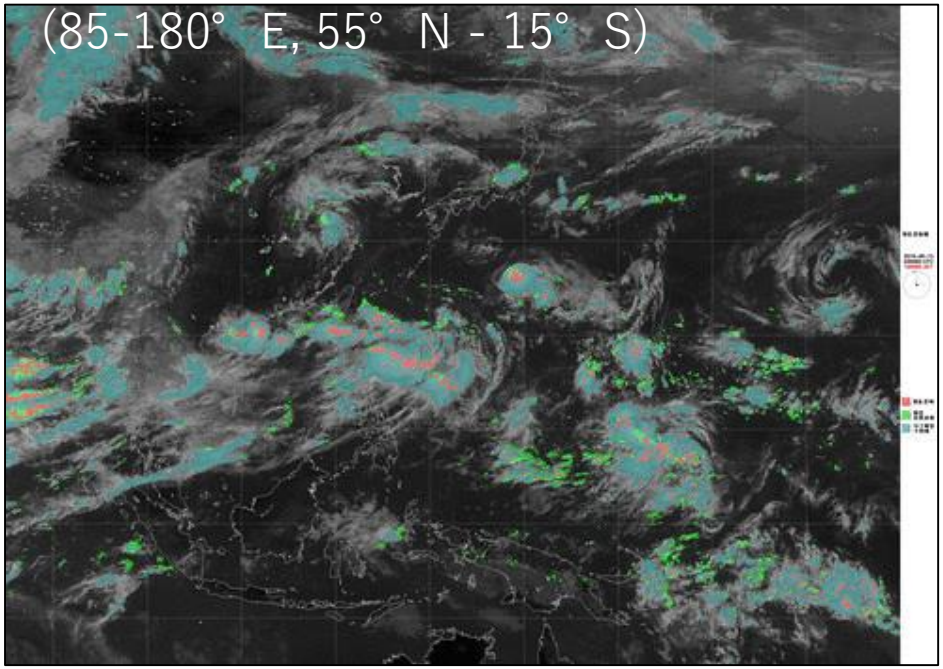
Convective Cloud Information (CCI)

- JMA has provided a Japan-area version (left) of CCI and an Asia and Western Pacific version (right) for aviation safety and air traffic control.

Japan-area version



Asia and Western Pacific version



Cumulonimbus

Rapidly Developing Cumulus

Mid/Low cloud unknown

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RDCA Determination Flow

Calculation of Logistic Regression Coefficients (off-line)

Lightning Observation (CC*1/CG*2)

*1 Cloud to Cloud
*2 Cloud to Ground

Occurrence of lightning each grid within an hour

Logistic Regression Analysis

Logistic Regression Coefficients: a_i

Detection Indicators: x_i

Trace cloud movement within an hour

Detection of RDCA

Logistic Regression Equation

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

Probability of Lightning: p

$p > Threshold$

RDCA

Himawari-8/9 Observation

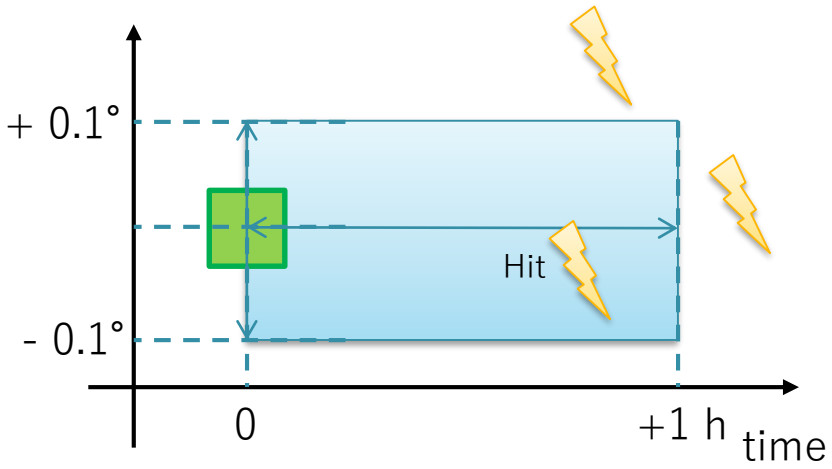
Detection Indicators: x_i

RDCA Determination Contingency Table

		Lightning		TOTAL
		YES	NO	
RDCA	YES	a or aa : *HIT*	b : *FALSE*	a + b : *Number of RDCA*
	NO	c : *MISS*		
TOTAL		aa + c : *Number of Lightning*		

a: Lightning is observed within an hour in ±1 grid (0.1 degree) of RDCA after RDCA was determined.

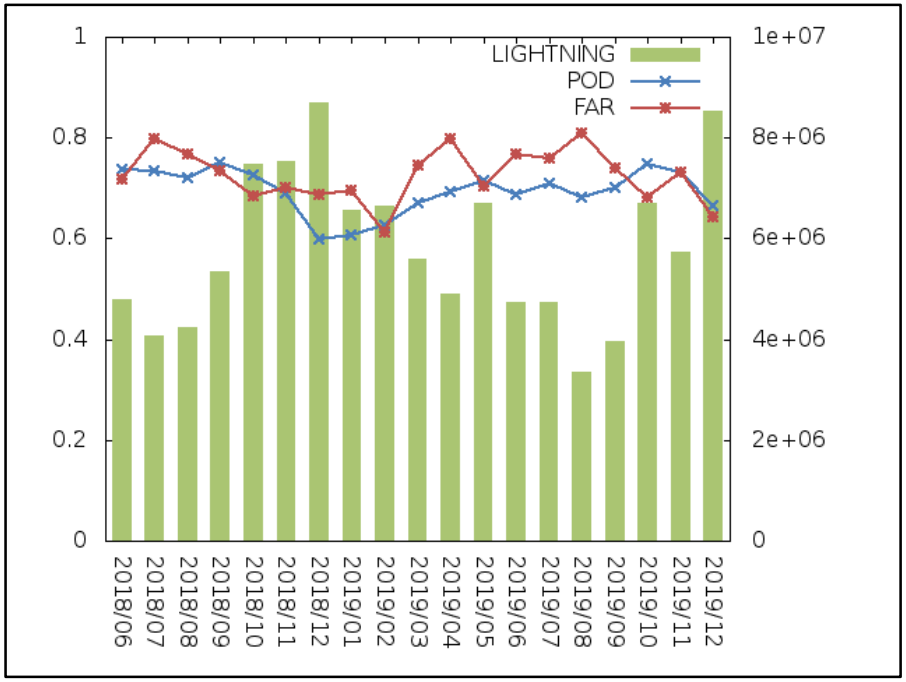
aa: RDCA was determined within an hour in ±1 grid of lightning before lightning is observed.



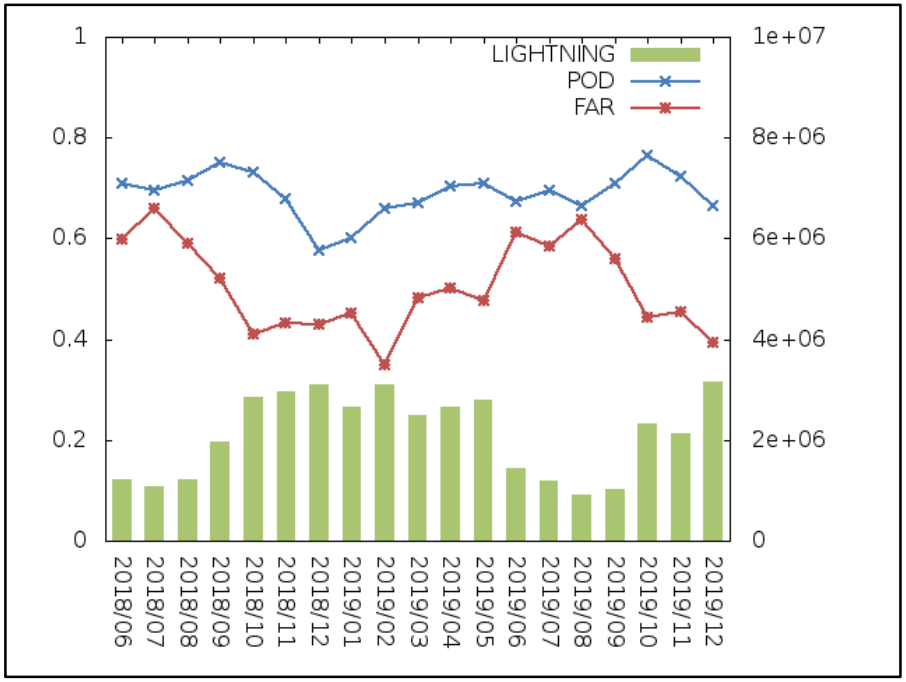
POD = aa / (aa + c)
FAR = b / (a + b)

Probability of Detection (POD):
Lightning, with a prior detection of RDCA
False Alarm Rate (FAR):
No lightning, though RDCA was detected

Evaluation



Land and Sea Area



Land Area Only

In the tropics, 85-180° E and 20°N-15° S,

no significant seasonal variations in accuracy are observed, and there are fewer false alarms over land than over sea.

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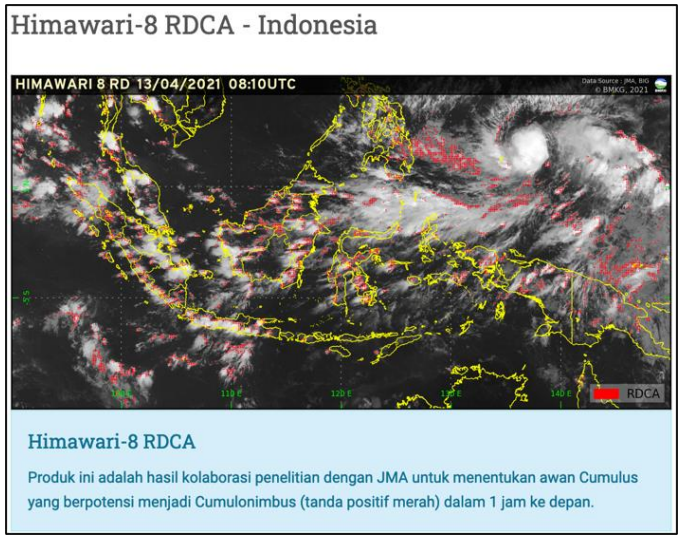
Technical Expertise Transfer for RDCA Determination

- Past Activities
  - ✓To promote the application of Himawari-8/9 observation data, JMA provides the data to various countries via channels such as HimawariCloud and HimawariCast.
  - ✓In 2016, JMA began efforts for bilateral cooperation with Indonesia (BMKG) to provide source code for RDCA determination and transfer related expertise.



BMKG website:
https://www.bmkg.go.id/satelit/satelit.bmkg?Sat=4&id=0

Technical Expertise Transfer for RDCA Determination

- Past Activities
  - ✓In 2017, JMA also began efforts for bilateral cooperation with Malaysia (MMD).
  - ✓In 2018, an ESCAP/WMO Typhoon Committee Project was launched to promote the use of Himawari-8/9 observation data based on technical cooperation in RDCA determination.
    - ➢Malaysia (MMD), Singapore (MSS), Thailand (TMD) and Vietnam (VNMHA) contribute to the project.

Technical Expertise Transfer for RDCA Determination

- Issue and solution
  - ➢Himawari-8/9 observation data are provided online via HimawariCloud.
  - ➢However, issues relating to the large file size, especially visible band, involved can hinder regular downloads.
  - ✓The related program was modified to enable RDCA determination using only limited observation data.

Technical Expertise Transfer for RDCA Determination

- Current and Future Activities
  - ➢For 2022 and 2023, JMA plans to deal with issues individually and to use feedback and discussion on the transfer of technical expertise to individual countries toward improved RDCA product precision.
    - Plans for 2022
      - Begin trial operation of RDCA product in individual countries using JMA's parameters for Japan area in summer.
    - Plans for 2023
      - Consider the need for tuning work such as recreation of regression coefficients.
      - Consider setting of ground truth data in validation and tuning.

Summary

- JMA has provided Convective Cloud Information, including RDCA, for aviation customers.
- RDCA is determined using only Himawari-8/9 observation data.
- JMA has cooperated with Indonesia (BMKG), Malaysia (MMD), Singapore (MSS), Thailand (TMD) and Viet Nam(VNMHA) as a bilateral cooperation or an ESCAP/WMO Typhoon Committee Project.
- Although there are issues with downloading Himawari-8/9 observation data, we are working to make it operational in individual country with some ingenuity.