

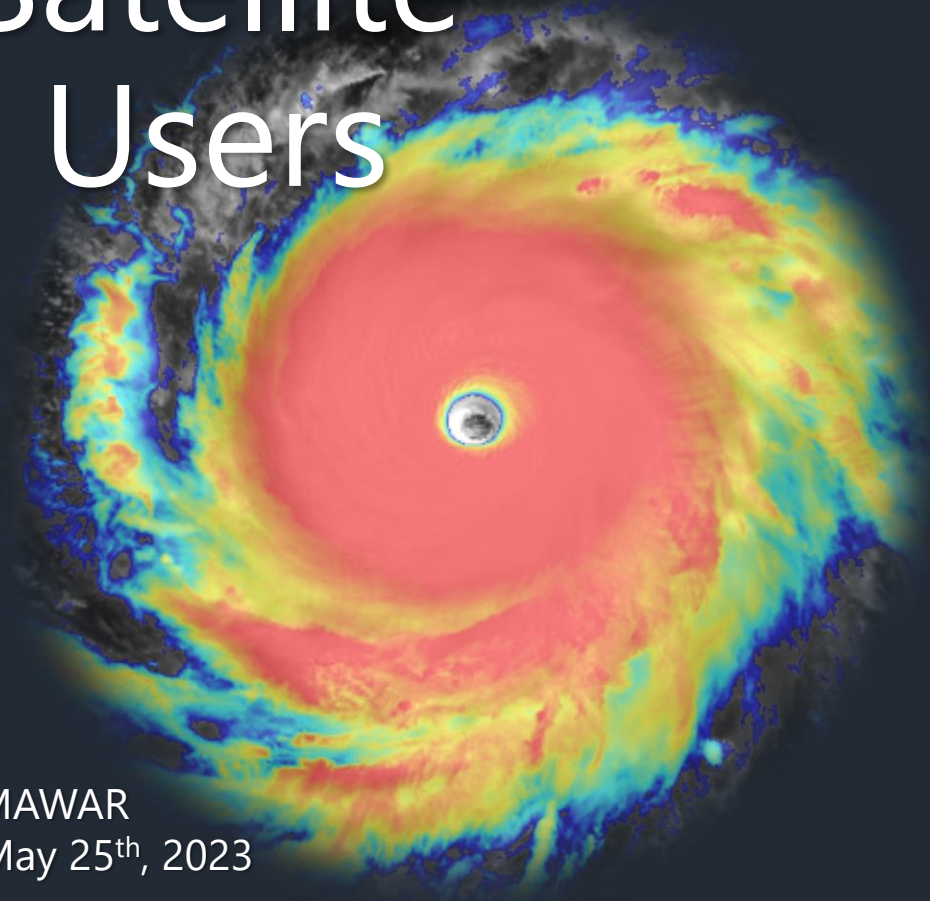
Hawaii-Pacific Aviation Weather Safety Workshop  
June 9-10, 2023

# JMA's Himawari-8/9 Satellite Products for Aviation Users

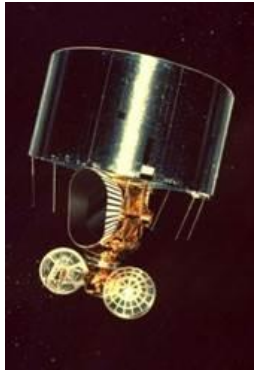
Tomohiro NOZAWA

Assistant Scientific Officer  
Office of Aviation Weather Forecasting  
Forecast Division, Atmosphere and Ocean Department  
Japan Meteorological Agency (JMA)

TC MAWAR  
on May 25<sup>th</sup>, 2023



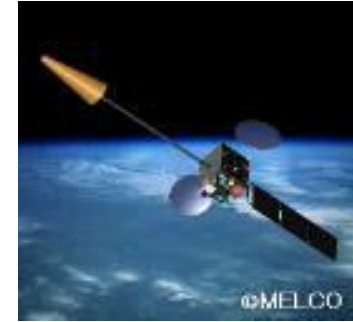
# History of Japanese Geostationary Met. Satellites



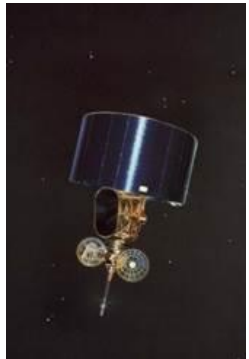
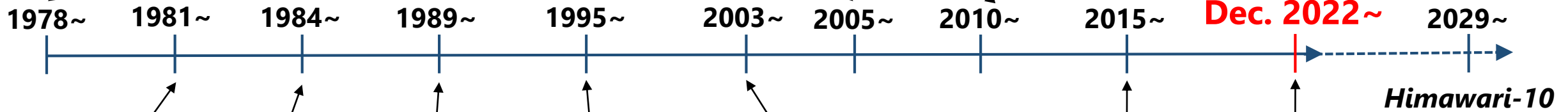
**GMS (Geostationary Meteorological Satellite)**  
nicknamed "Himawari"



**MTSAT-1R**  
**Himawari-6**



**MTSAT-2**  
**Himawari-7**



**GMS-2**  
**Himawari-2**



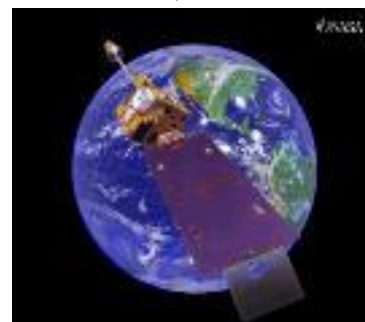
**GMS-3**  
**Himawari-3**



**GMS-4**  
**Himawari-4**



**GMS-5**  
**Himawari-5**



**GOES-9**  
**Pacific GOES**



**Himawari-8 Himawari-9**

**Himawari-10**



# Himawari-8/9 Specifications Overview



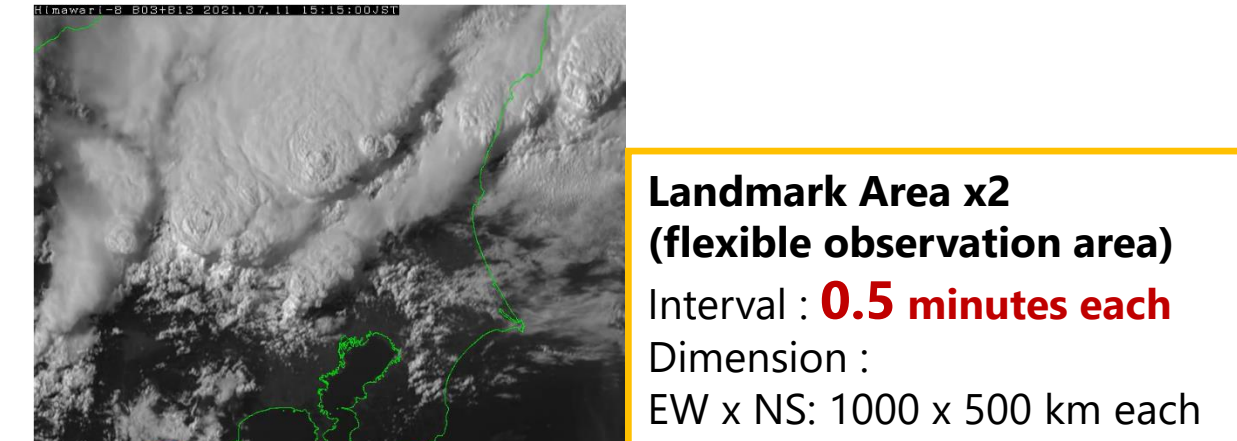
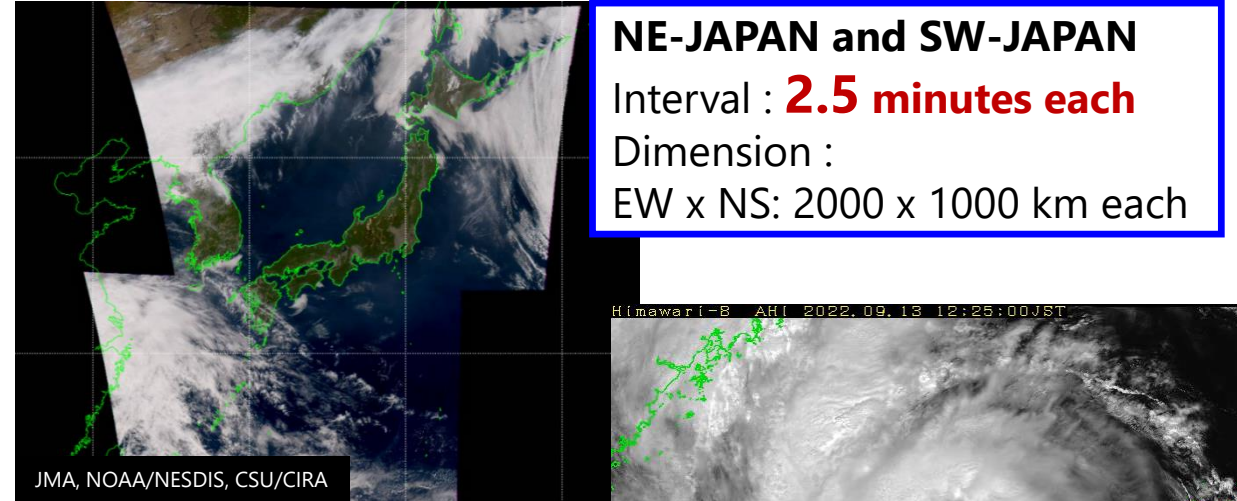
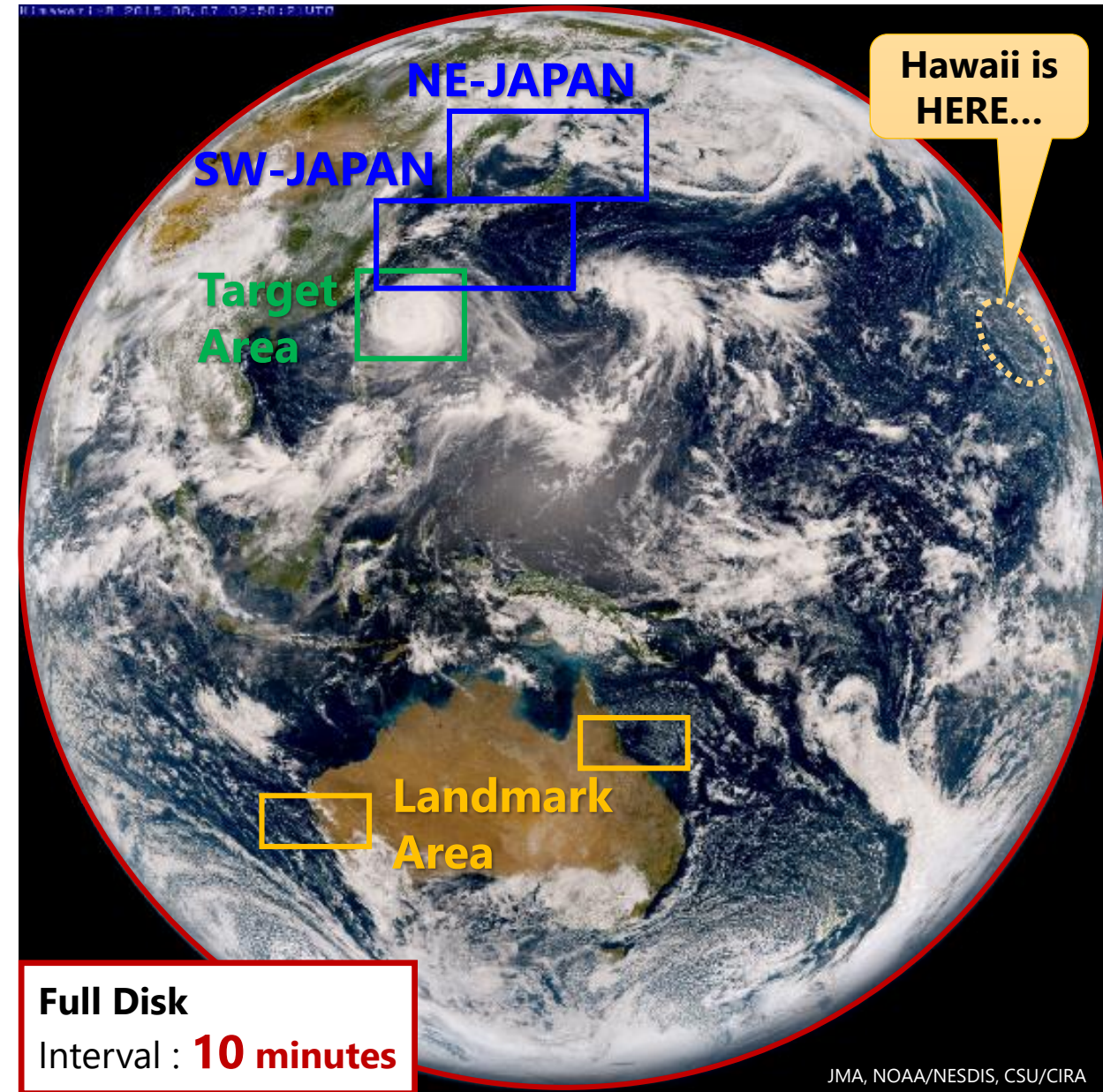
Position	Approx. 35,800 km high above the equator at 140.7° E
Design lifetime	Meteorological mission: 8+ years satellites: 15+ years
Size while in operation	Total length: approx. 8 m
Mass	Dry mass: approx. 1,300 kg At launch: approx. 3,500 kg

## Spectral Bands Configuration of AHI

Band	Spatial Resolution	Central Wavelength	Physical Properties
1	1 km	0.47 $\mu\text{m}$	vegetation, aerosol
2		0.51 $\mu\text{m}$	vegetation, aerosol
3		0.5 km	0.64 $\mu\text{m}$
4	1 km	0.86 $\mu\text{m}$	vegetation, aerosol
5	2 km	1.6 $\mu\text{m}$	cloud phase
6		2.3 $\mu\text{m}$	particle size
7	2 km	3.9 $\mu\text{m}$	low cloud, fog, forest fire
8		6.2 $\mu\text{m}$	mid- and upper-level moisture
9		6.9 $\mu\text{m}$	mid-level moisture
10		7.3 $\mu\text{m}$	mid- and lower-level moisture
11		8.6 $\mu\text{m}$	cloud phase, SO <sub>2</sub>
12		9.6 $\mu\text{m}$	ozone content
13		10.4 $\mu\text{m}$	cloud imagery, information of cloud top
14		11.2 $\mu\text{m}$	cloud imagery, sea surface temperature
15		12.4 $\mu\text{m}$	cloud imagery, sea surface temperature
16		13.3 $\mu\text{m}$	cloud top height, CO <sub>2</sub>



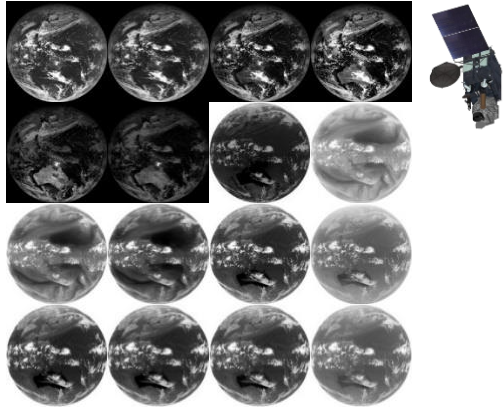
# AHI Observation Modes



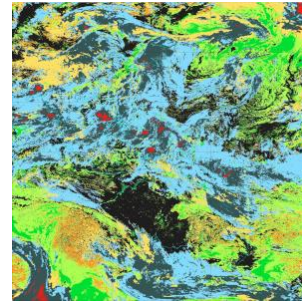


# Why Do We Need the "Multiple" Spectral Bands ?

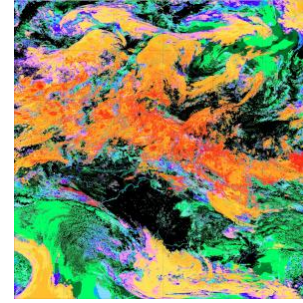
Combining images from multiple bands is useful for ...



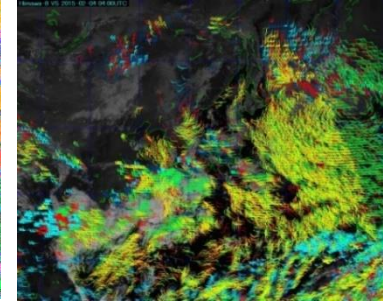
Developing new analytical (quantified) products.



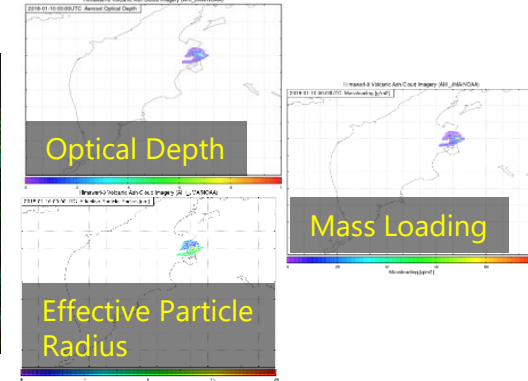
Cloud Type



Cloud Top Height

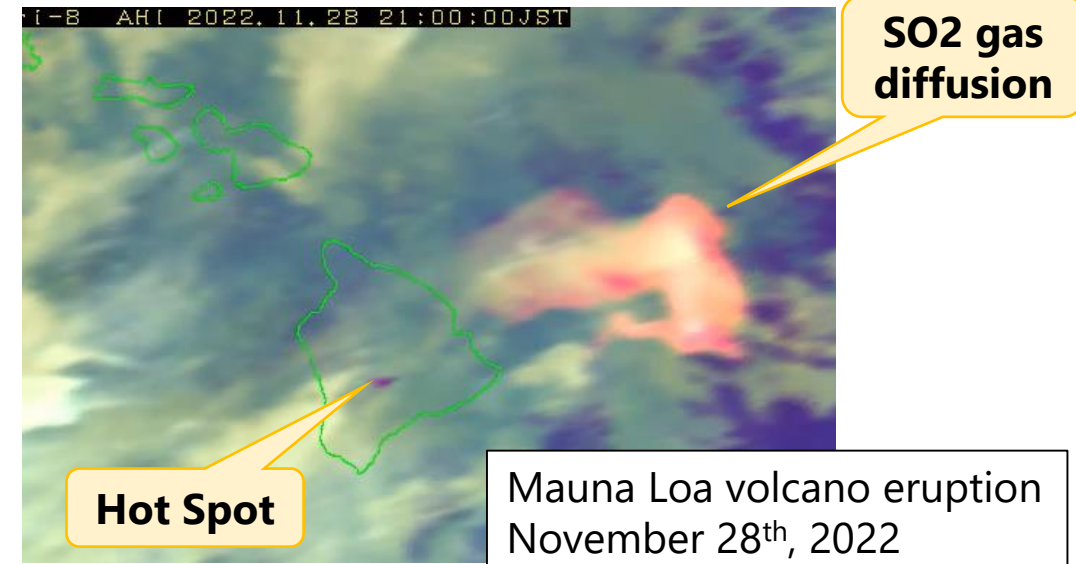
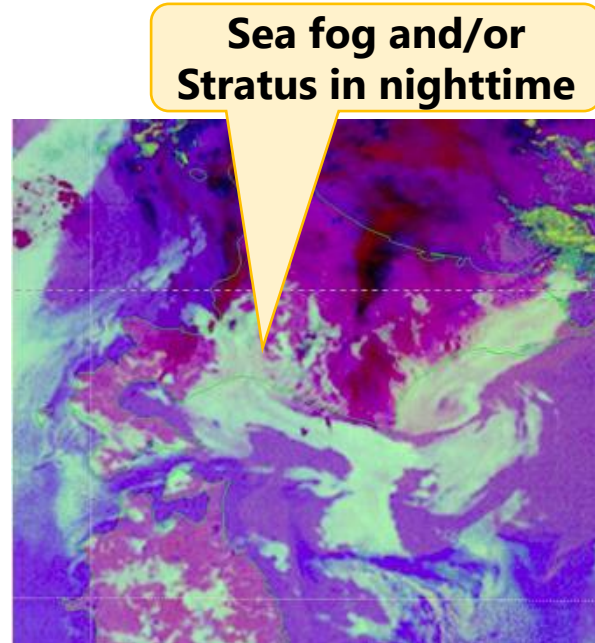
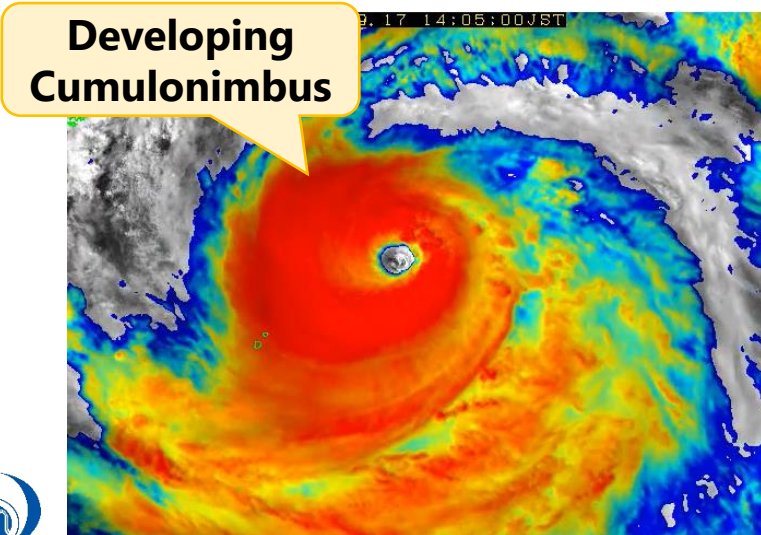


Atmospheric Motion Vector



Volcanic Ash Analysis

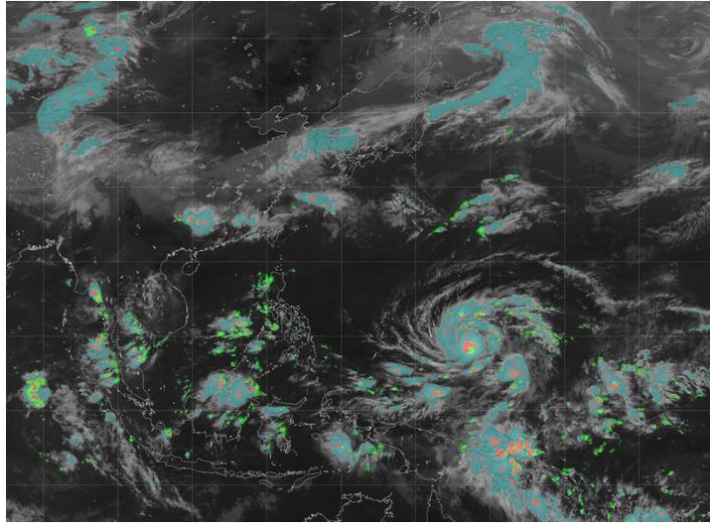
Monitoring various phenomena.



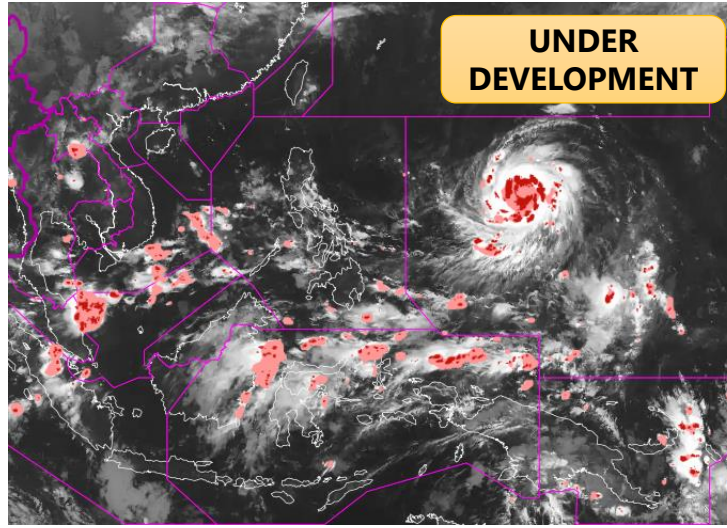


# JMA's Himawari Products for Aviation Users

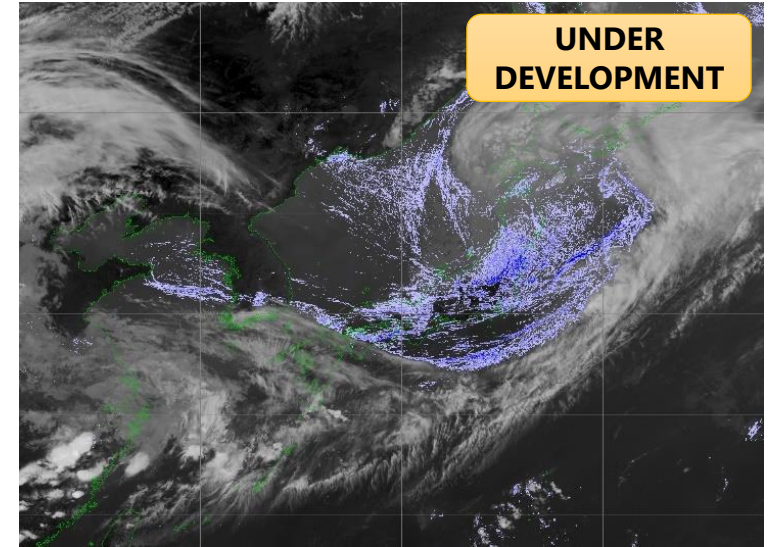
## Convective Cloud Information



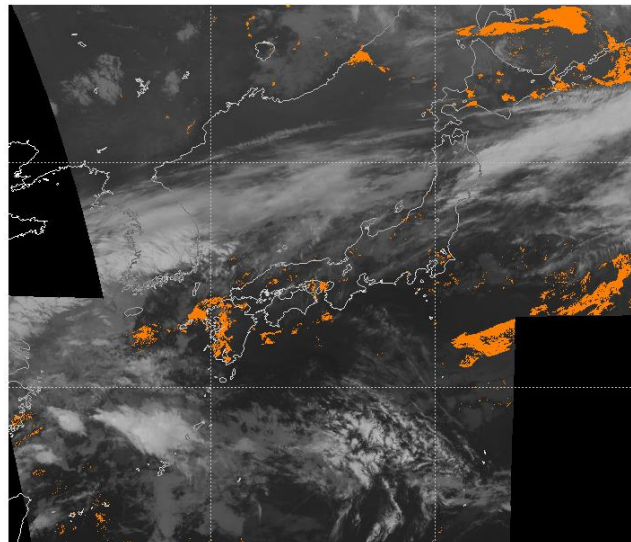
## CB Nowcast



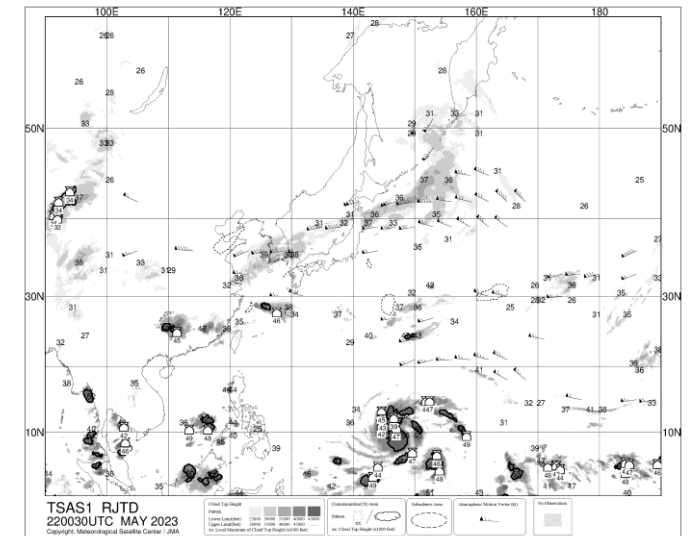
## Clear Air Turbulence Potential Analysis



## Fog Detection



## Satellite Cloud Information Chart



# Convective Cloud Information (CCI) Product

## ◆ Overview

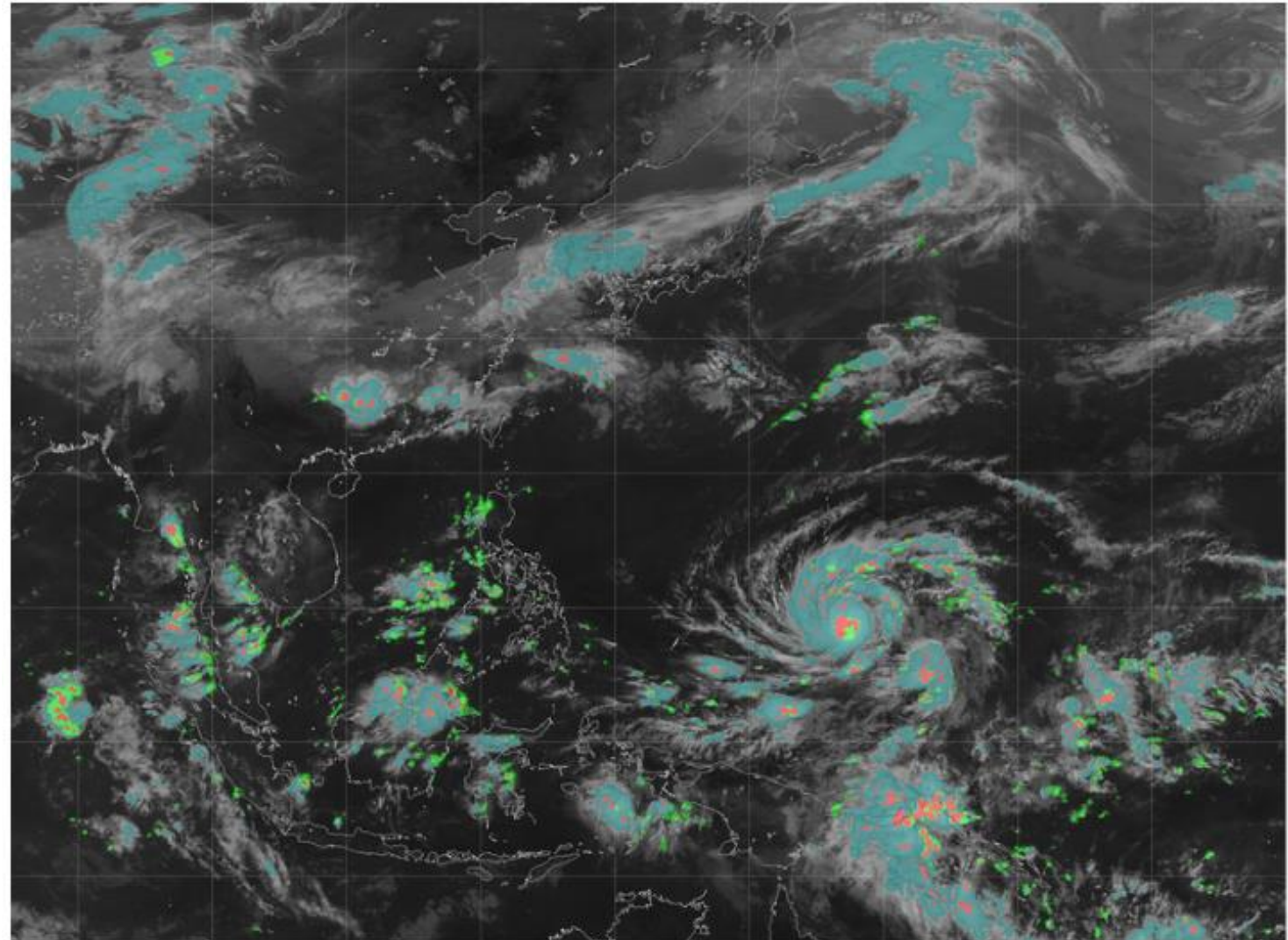
- Early detection of signs of rapid development of cumulus clouds by high-frequency satellite cloud observations.

## ◆ Elements (refer to the next slide)

- **Rapidly Developing Cumulus Area (RDCA)**
- **Cumulonimbus Area (CBA)**
- **Mid/Low Cloud Unknown Area (MLUA)**

## ◆ Interval and Area

- 55N-15S, 85E-180E every 10 minutes.



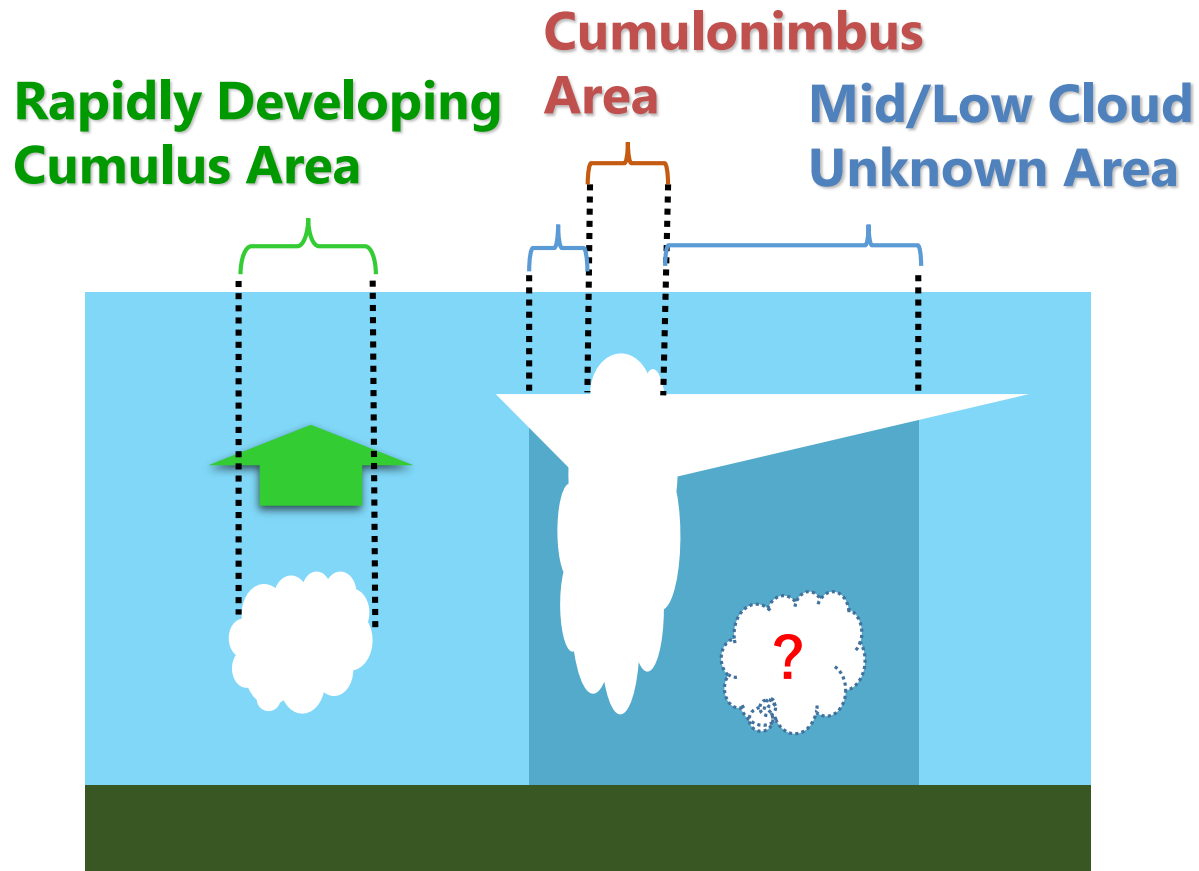
Technical Note URL : <https://www.data.jma.go.jp/mscweb/technotes/msctechrep62-2.pdf>





# Elements of CCI Product

- **RDCA** could potentially evolve into thunderstorm within an hour.
- **CBA** is vertically developing thick clouds area that seems to be overshooting.
- **MLUA** is an area covered by high clouds and satellite cannot see below.





## ◆ Overview

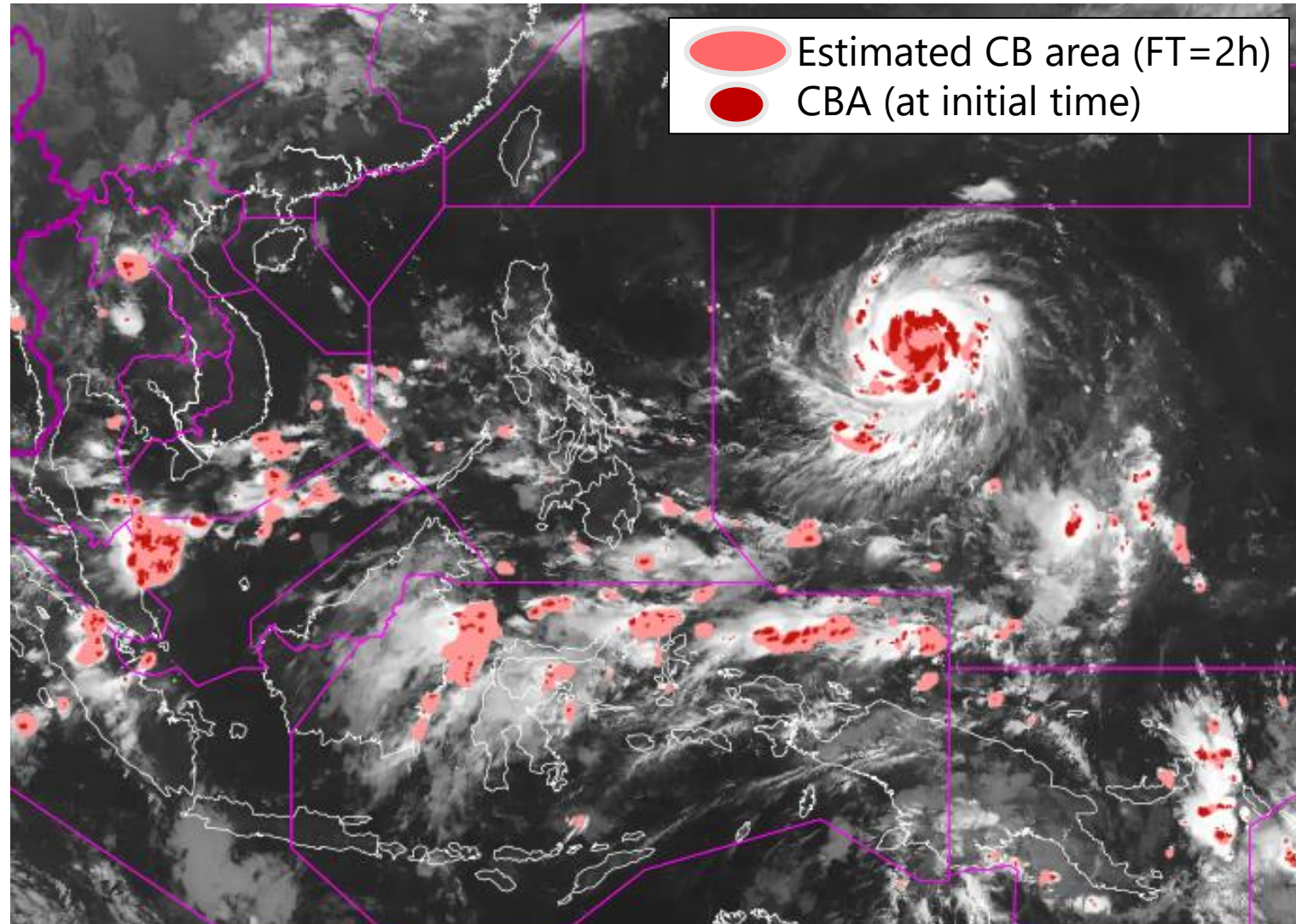
- Estimate future CB area up to 4 hours ahead from the distributions of each elements of CCI product.

## ◆ Elements

- High probability area of CB
- CB top height (under planning)

## ◆ Next plan

- Provide CB Nowcast to several neighboring MWOs on a dedicated website on a trial basis.



# Satellite Cloud Information Chart

## ◆ Overview

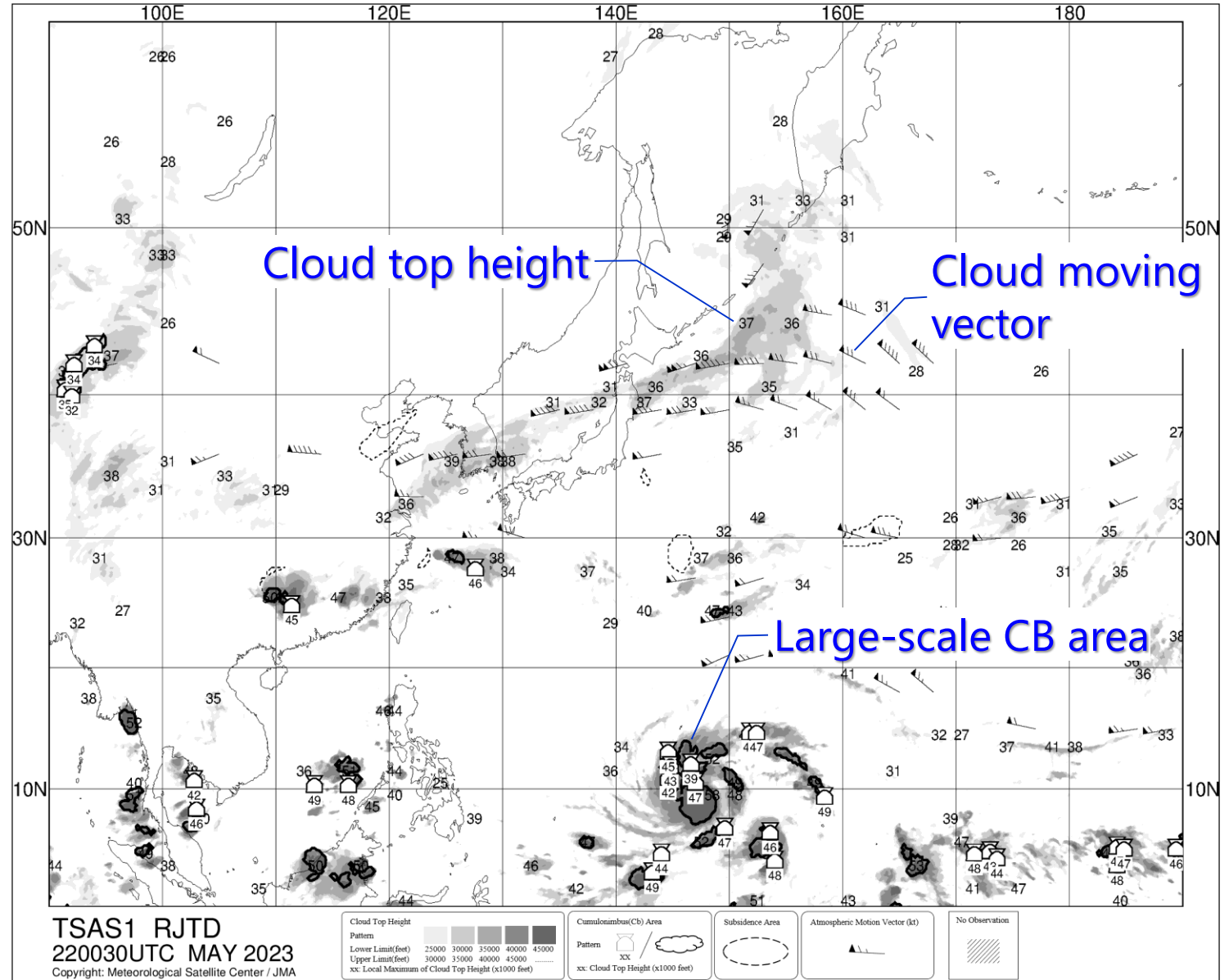
- Various analysis values from Himawari observation drawn together in a single figure.
- It has been provided since 1995.

## ◆ Elements

- Large-scale CB area with its maximum cloud top heights
- Cloud top height and moving vector of upper clouds

## ◆ Interval and Area

- Every 30 minutes each of the Northern half and the Southern half of the Himawari observation area.





# Fog Detection Product

## ◆ Overview

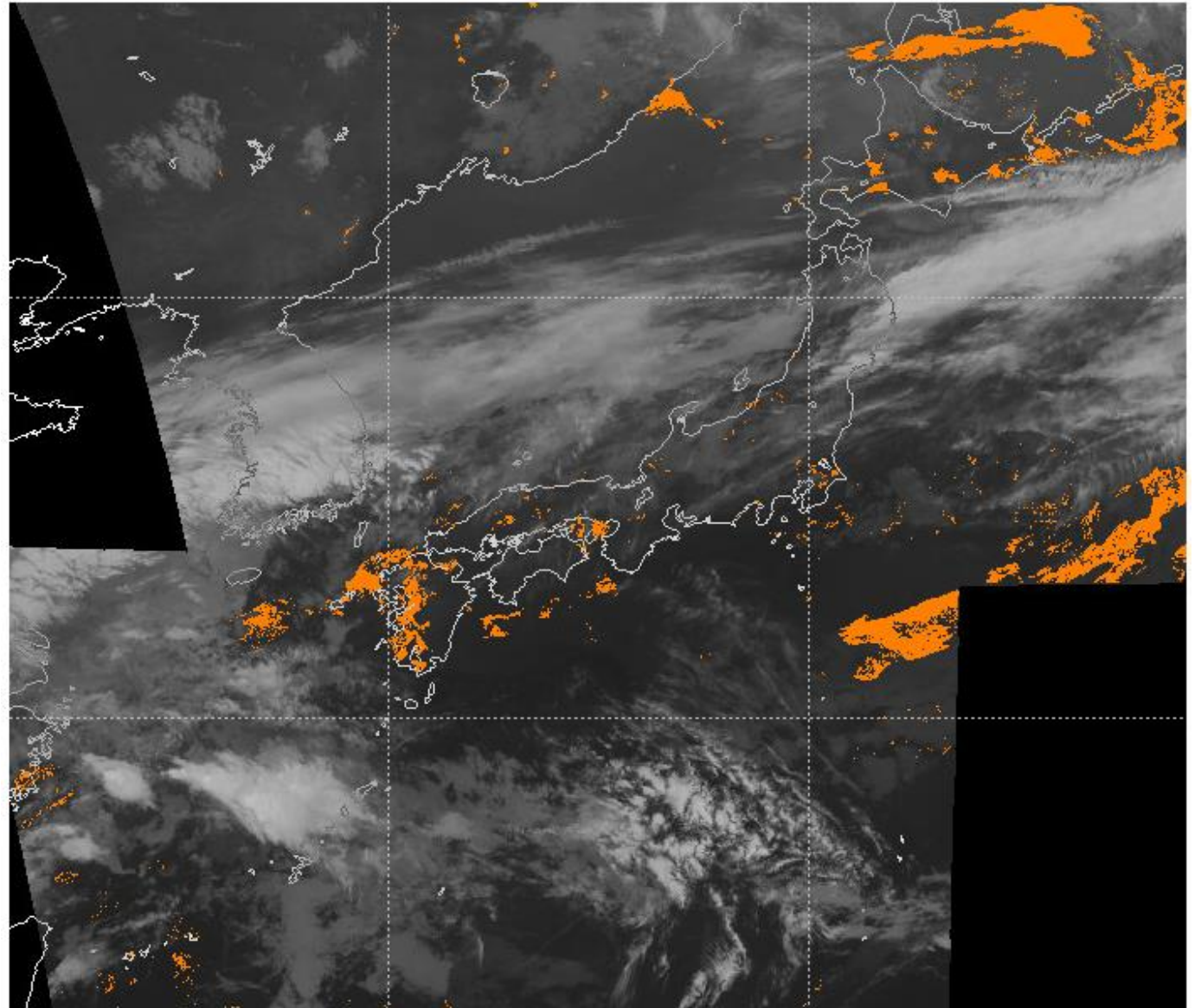
- Detect the surface fog distribution day and night.
- To distinguish fog and low clouds, it uses not only Himawari observations but also numerical weather prediction data.

## ◆ Elements

- High probability area of fog

## ◆ Interval and Area

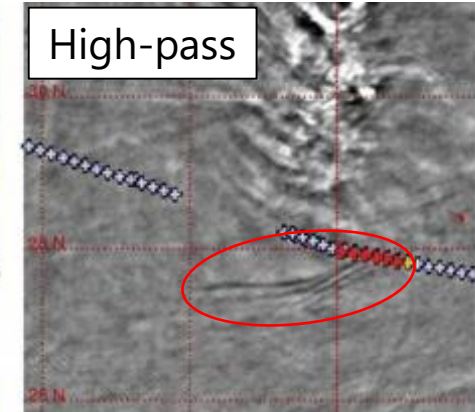
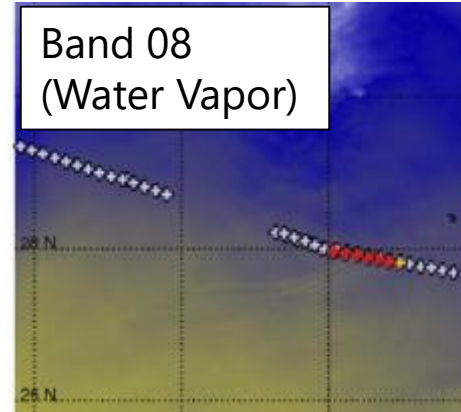
- Every 5 minutes around Japan.



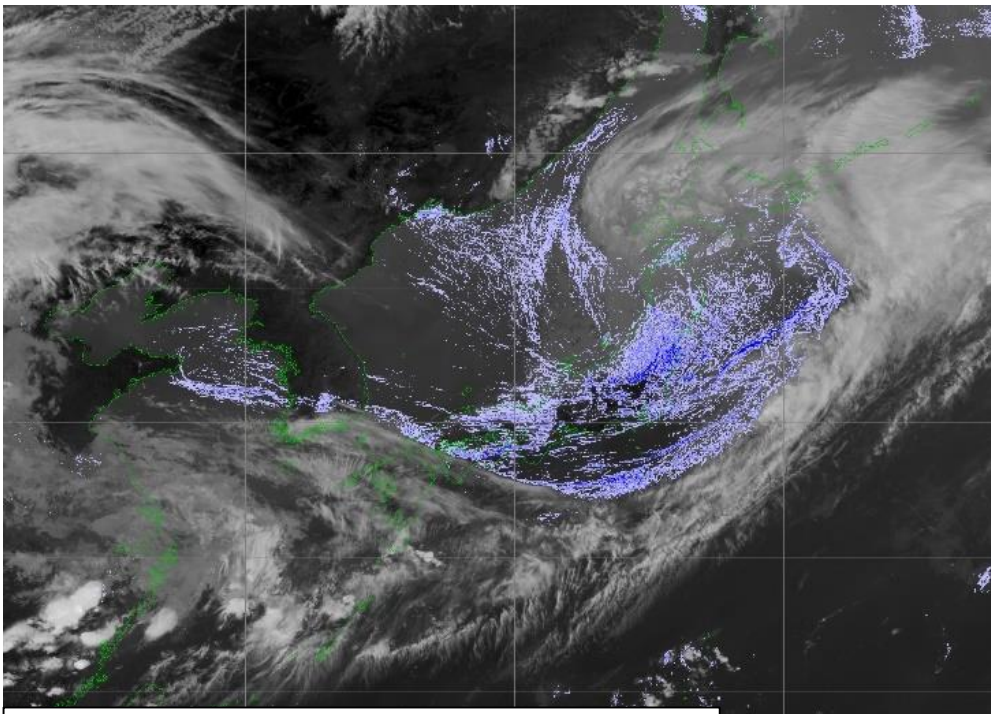
# Clear Air Turbulence Potential Analysis

UNDER DEVELOPMENT

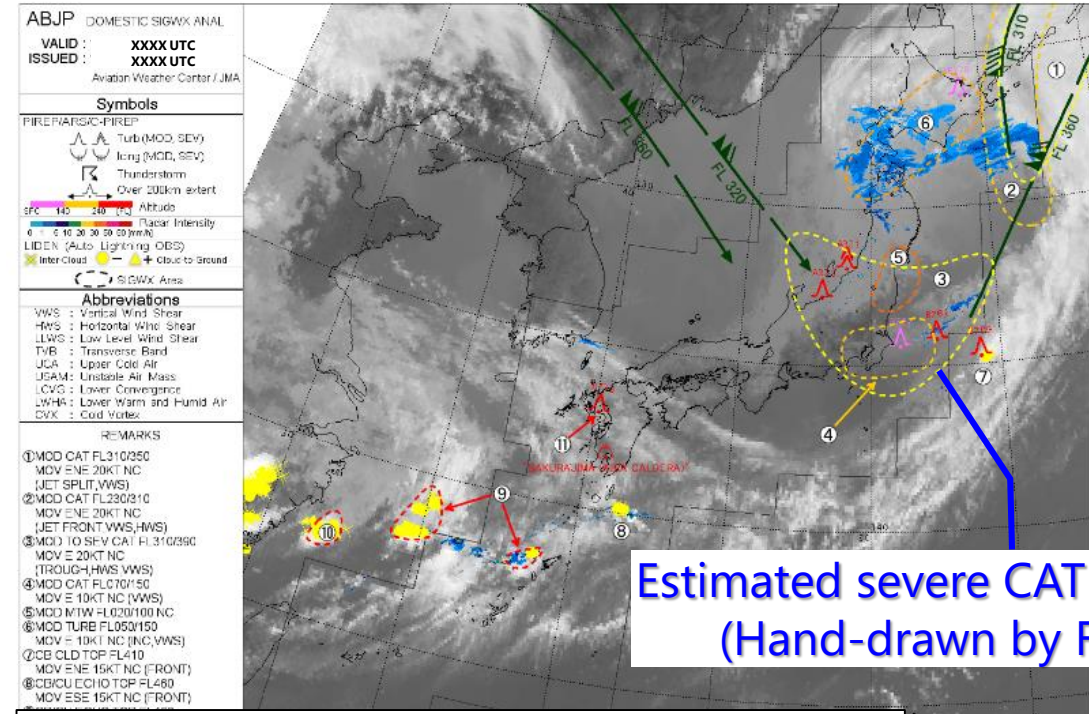
- Applying a high-pass filter to the water vapor image, some gravity waves in the upper troposphere can be seen (Wimmers *et al.* 2018).
- We are trying to estimate the probability of Clear Air Turbulence (CAT) from Himawari images using Neural Network.



Wimmers *et al.* 2018



CAT potential analysis (sample)



Domestic Significant WX Analysis Chart

Estimated severe CAT potential area  
(Hand-drawn by Forecaster)





# Aviation Weather Info. Provision System (MetAir)

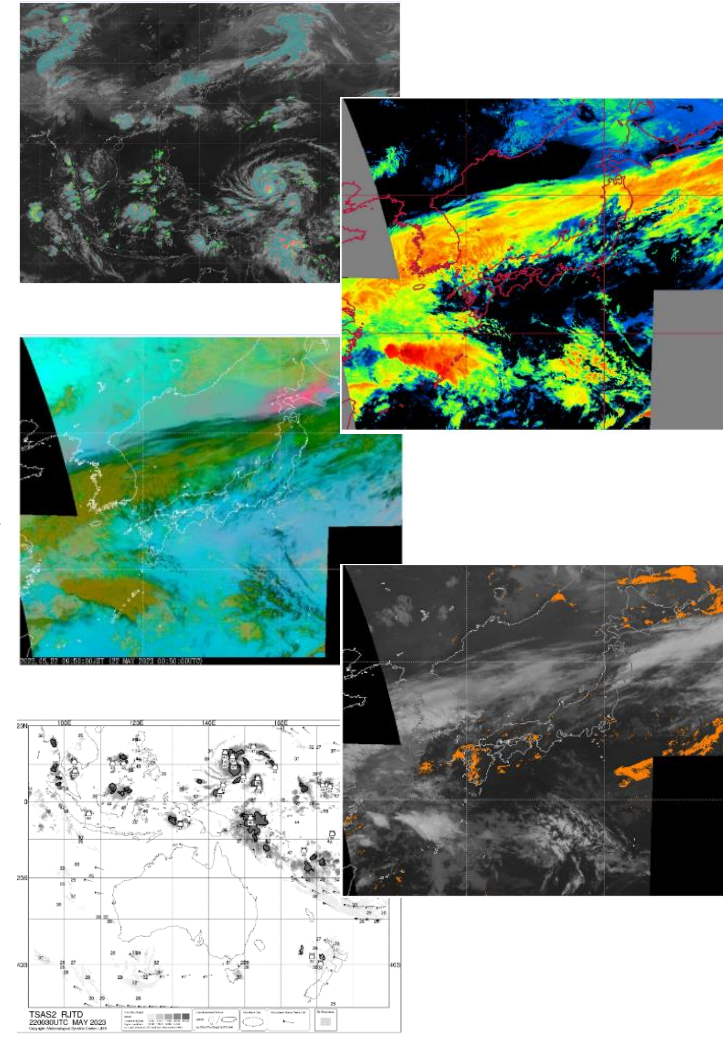
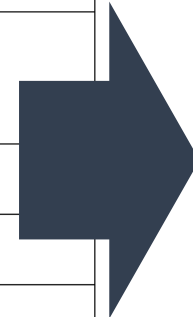
- Domestic aviation users can access **VARIOUS** weather products provided by JMA from this website named MetAir.



Logout

Main Menu	Top Page	Aerodrome Info	Airspace Info	Graphical Products	Observation Data	Disaster Prevention Info	Data Search	ATMetC Info	Self Briefing
<a href="#">&gt; Self Briefing</a>									
<a href="#">Japanese</a> <a href="#">English</a>									

PROG Chart	FBJP	Low Level SIGWX	APP-Area SIGWX	FBJP112	FXJP106/112				
OBS/ANAL Chart	ABJP	Atmosphere Analysis (FL)	Atmosphere Analysis (CS)	AXJP130/140	Terminal Area SIGWX	Airspace SIGWX	Aerodrome SIGWX		
	TSAS1	Satellite Imagery	Radar Echo Intensity	Radar Echo-Top Height	Wind Profiler	Aerodrome WX Live Camera	Thunder OBS Chart		
METAR/TAF	Chubu/Koshin Hokuriku	Kanto	Tohoku	Hokkaido	SIGMET				
	Okinawa	Southern Kyushu/Amami	Northern Kyushu	Chugoku/Shikoku	Kinki				
Surface Analysis Chart	SPAS	ASAS	FSAS24	FSAS48	FEFE19				
Upper analysis / Emagram	Emagram Region1 (E140)	Emagram Region2 (E130)	Emagram Region3	Emagram Region4	AUPA20	AUPA25	AUPN30		
Aviation WX Commentary	National (Aerodrome)	National (FUKUOKA_FIR)	National (Domestic)						
	Hokkaido	Tohoku	Kanto/Chubu	Kinki/Chugoku Shikoku	Kyushu	Okinawa			
Upper WX Charts	AUPQ35	AXFE578	FXFE502	FXFE504	FXFE507	FUPA252	FUPA302		
	AUPQ78	FXJP854	FXFE5782	FXFE5784	FXFE577	FUPA402	FUPA502		
Volcanic Info	Volcanic Ash Fall Forecast (Scheduled)	Volcanic Ash Fall Forecast (Preliminary)	Volcanic Ash Fall Forecast (Detailed)	Volcanic Information (Text)					
	Volcanic Ash Advisory	VAG	VAGI						



# Support Website for SIGMET Coordination with NWS

- **JMA provides the support website to some MWOs including HFO, for collaborative SIGMET issuance with neighboring FIRs.**
- In addition to Himawari images, CCI products and numerical weather prediction products can be monitored, and overlaid with SIGMET polygons.
- JMA and HFO sometimes communicate each other about SIGMET issuance on the online chat board.

***JMA will continue to make efforts for aviation safety over the Pacific Ocean!***

The screenshot displays the 'Collaborative SIGMET Issuance Support Website' interface. At the top, there is a navigation bar with 'Collaborative SIGMET Issuance Support Website' and a 'PAST DATA' button. Below this, there are tabs for 'WS', 'WC', and 'WV', and a 'Your ID: JMA / Your FIR: Fukuoka' dropdown. The main content area is divided into two sections: 'OBS' and 'FCST'. The 'OBS' section has tabs for 'TS Info.', 'Lightning #', 'Satellite Analysis', 'CBA', 'MLUA', 'RDCA', and 'CB TOP'. The 'FCST' section has tabs for 'TB Info.', 'TB Index', 'IC Info.', and 'IC Index'. The central part of the interface is a map showing a satellite image of the Pacific Ocean with various colored polygons overlaid, representing SIGMET areas. The map is titled '2023-05-26 08:30 UTC' and has a zoom control on the left. At the bottom of the map, it says 'SIGMET VALID: 2023-05-26 08:39 UTC' and 'N2216 W13521 Leaflet | Himawari-8/9'. On the right side, there is a 'SIGMET Message Editor' and a 'Chat' section. The chat section shows a list of messages with timestamps and recipients. The messages are:

- AWC** 2023-05-26 02:48:47Z  
To: JMA  
Thank you JMA!
- JMA** 2023-05-26 02:46:49Z  
To: Anchorage, Honolulu, KansasCity  
Hi NWS,  
Attached is SIGWX Summary in Fukuoka FIR.
- JMA** 2023-05-26 02:46:22Z  
To: PAGASA  
Dear PAGASA,  
Attached is SIGWX Summary.
- JMA** 2023-05-26 02:45:56Z  
To: PAGASA, VATM, LDMH, TMD, MDMH  
Dear CSI members,  
JMA has just uploaded Forecast Outlook.
- AAWU** 2023-05-25 21:57:34Z  
To: Honolulu, KansasCity, JMA  
Noted, thanks.







*Thank you for listening!*  
*Any questions?*

## References

- Maruyama, T., et al. (2022), Himawari-8 Fog Detection Product Development. *Meteorological Satellite Center Technical Note No.66 October 2022.*
- Sumida, Y., et al. (2017), Convective Cloud Information derived from Himawari-8 data. *Meteorological Satellite Center Technical Note No.62 March 2017.*
- Wimmers, A., et al. (2018), Observations of Gravity Waves with High-Pass Filtering in the New Generation of Geostationary Imagers and Their Relation to Aircraft Turbulence. *Wea. Forecasting.* **33**, 139-144.

Cherry trees at the entrance of  
Meteorological Satellite Center of JMA

