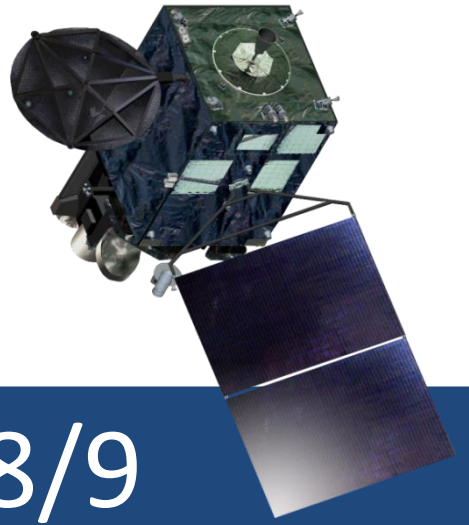
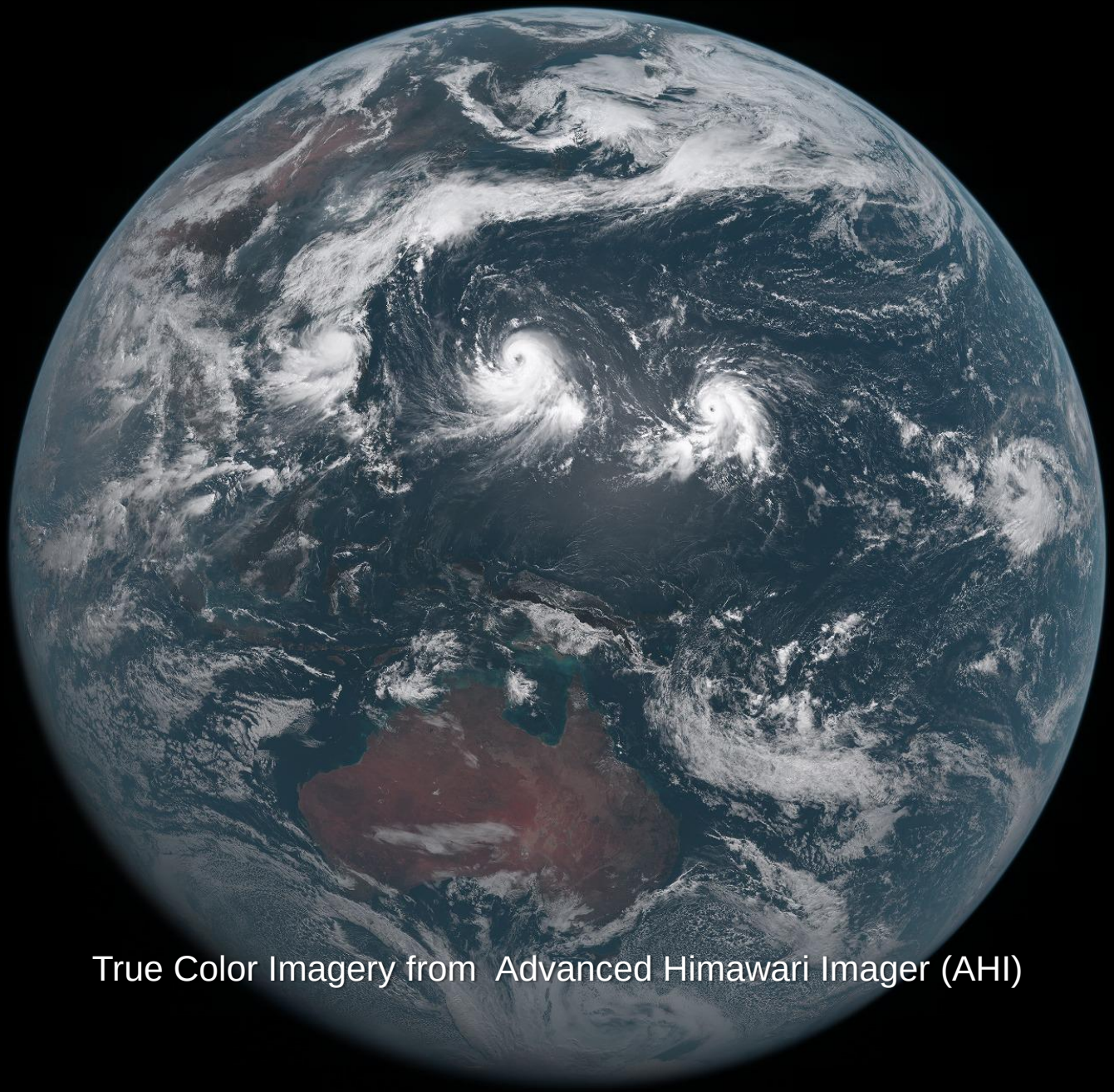


Overview of Himawari-8/9

Toshiyuki SAKURAI
Meteorological Satellite Center (MSC)
Japan Meteorological Agency (JMA)

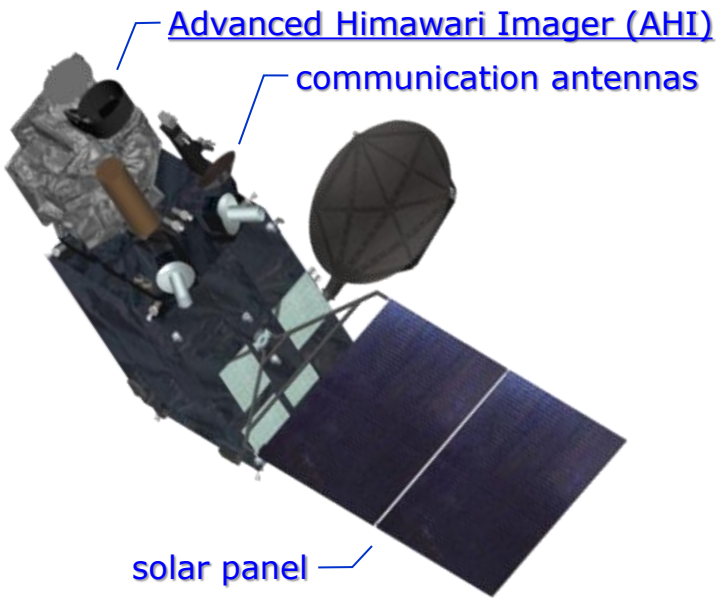
EUMeTrain Event Week on MTG-I Satellite 2016
Session2 - Himawari-8 and Data Applications
8 November 2016

Himawari-8 began operation at 02:00 UTC on 7th July 2015.



True Color Imagery from Advanced Himawari Imager (AHI)

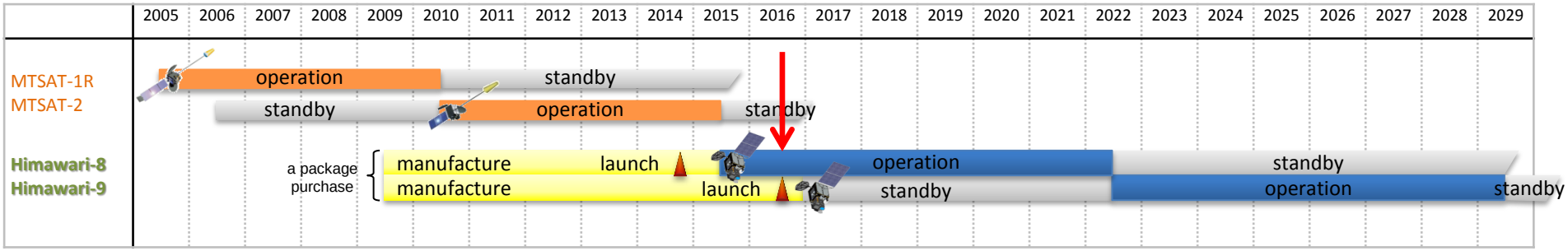
Himawari-8/9



Geostationary position	Around 140.7° E
Attitude control	3-axis attitude-controlled geostationary satellite
Communication	1) Raw observation data transmission Ka-band, 18.1 - 18.4 GHz (downlink)
	2) DCS International channel 402.0 - 402.1 MHz (uplink) Domestic channel 402.1 - 402.4 MHz (uplink) Transmission to ground segments Ka-band, 18.1 - 18.4 GHz (downlink)
	3) Telemetry and command Ku-band, 12.2 - 12.75 GHz (downlink) 13.75 - 14.5 GHz (uplink)

Himawari-8 began operation on 7 July 2015, replacing the previous MTSAT-2 operational satellite

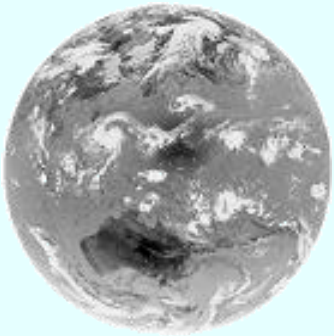
Himawari-9 was successfully launched using H-IIA Launch Vehicle No.31 on 2 November 2016 from the Tanegashima in Japan!



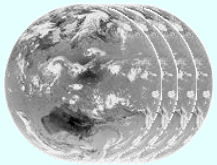
Improved Resolutions

Spectral

VIS 1 band



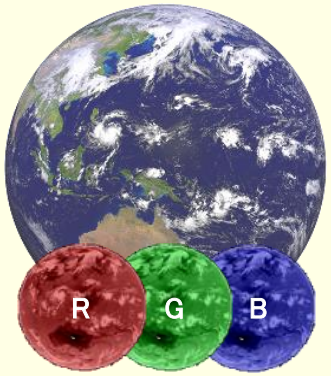
IR 4 bands



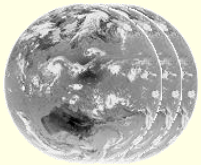
5 bands

MTSAT-1R/2

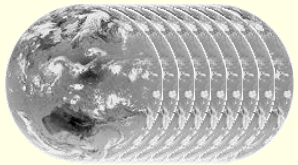
VIS 3 bands



NIR 3 bands



IR 10 bands



16 bands

Himawari-8/9

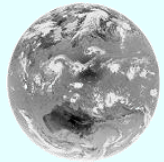
Spatial

At sub-satellite point

MTSAT-1R/2	Himawari-8/9
VIS 1 km	VIS 0.5/1 km
IR 4 km	IR 2 km

Temporal

Observation Frequency

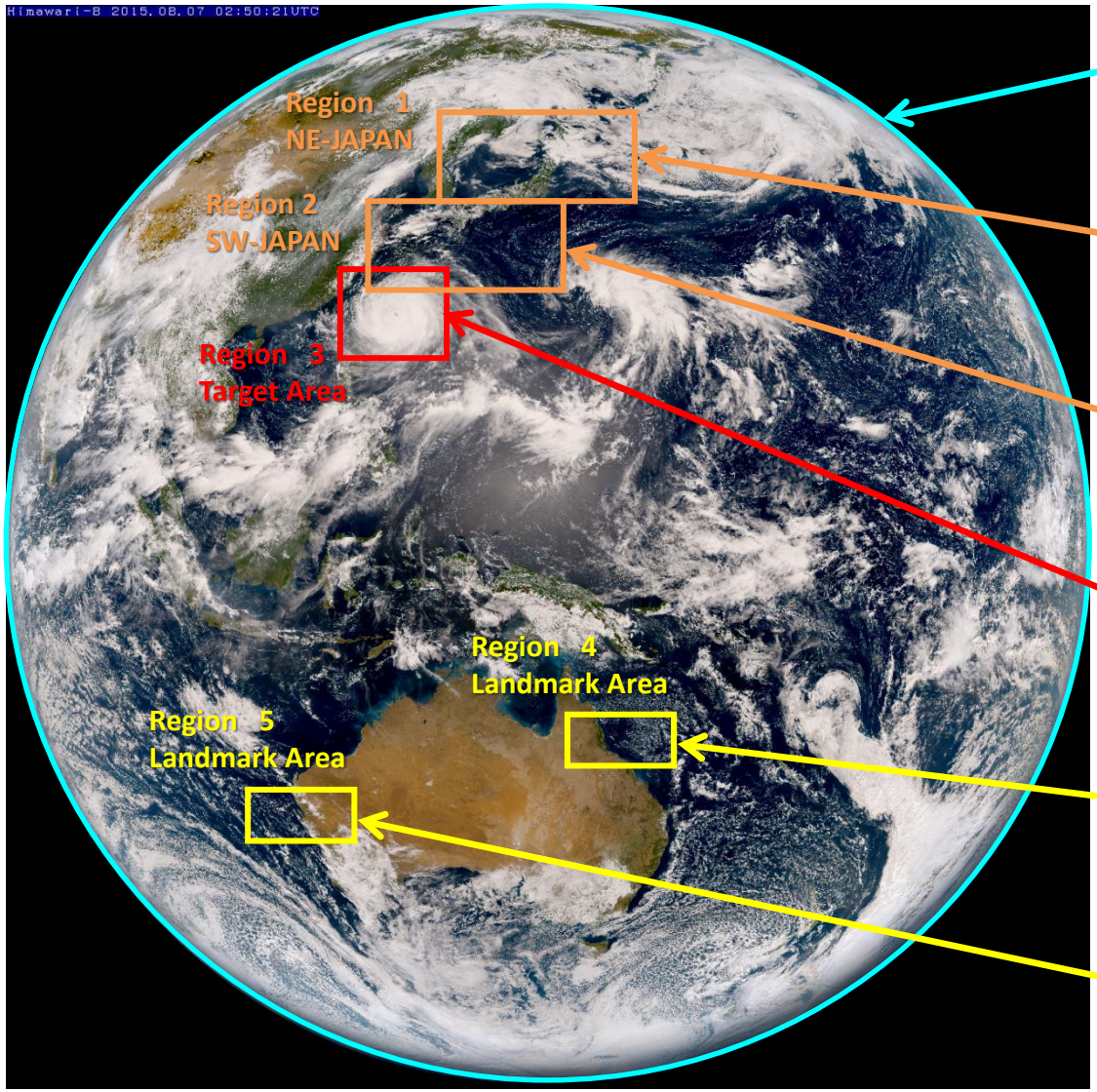


60min.
(full-disk obs.)

MTSAT-1R/2

Himawari-8/9

AHI Observation Modes



Full disk

Interval : **10 minutes** (6 times per hour)

Region 1 JAPAN (North-East)

Interval : **2.5 minutes** (4 times in 10 min)
Dimension : EW x NS: 2000 x 1000 km

Region 2 JAPAN (South-West)

Interval : **2.5 minutes** (4 times in 10 min)
Dimension : EW x NS: 2000 x 1000 km

Region 3 Target Area

Interval : **2.5 minutes** (4 times in 10 min)
Dimension : EW x NS: 1000 x 1000 km

Region 4 Landmark Area

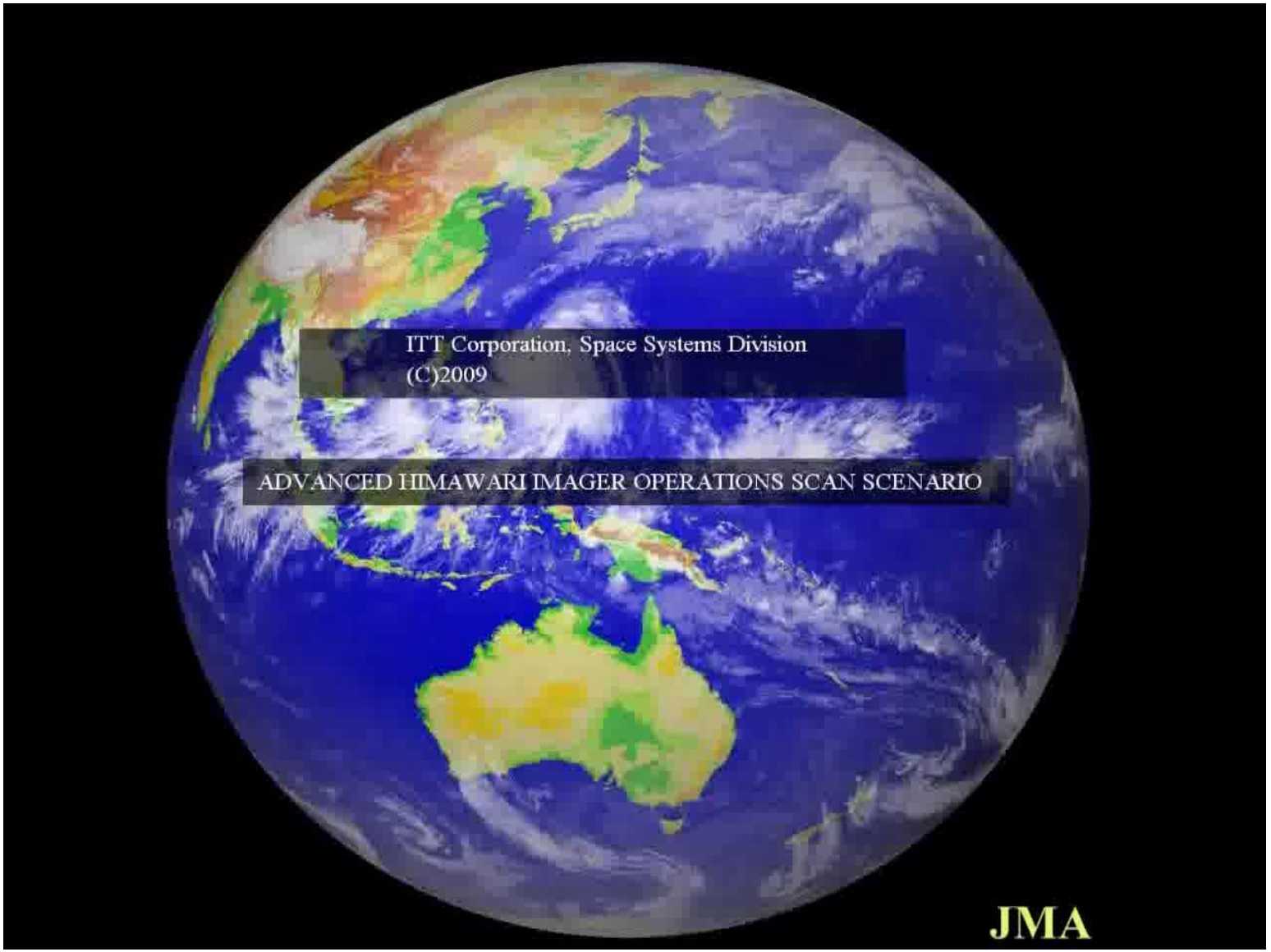
Interval : **0.5 minutes** (20 times in 10 min)
Dimension : EW x NS: 1000 x 500 km

Region 5 Landmark Area

Interval : **0.5 minutes** (20 times in 10 min)
Dimension : EW x NS: 1000 x 500 km

AHI Scan Scenario

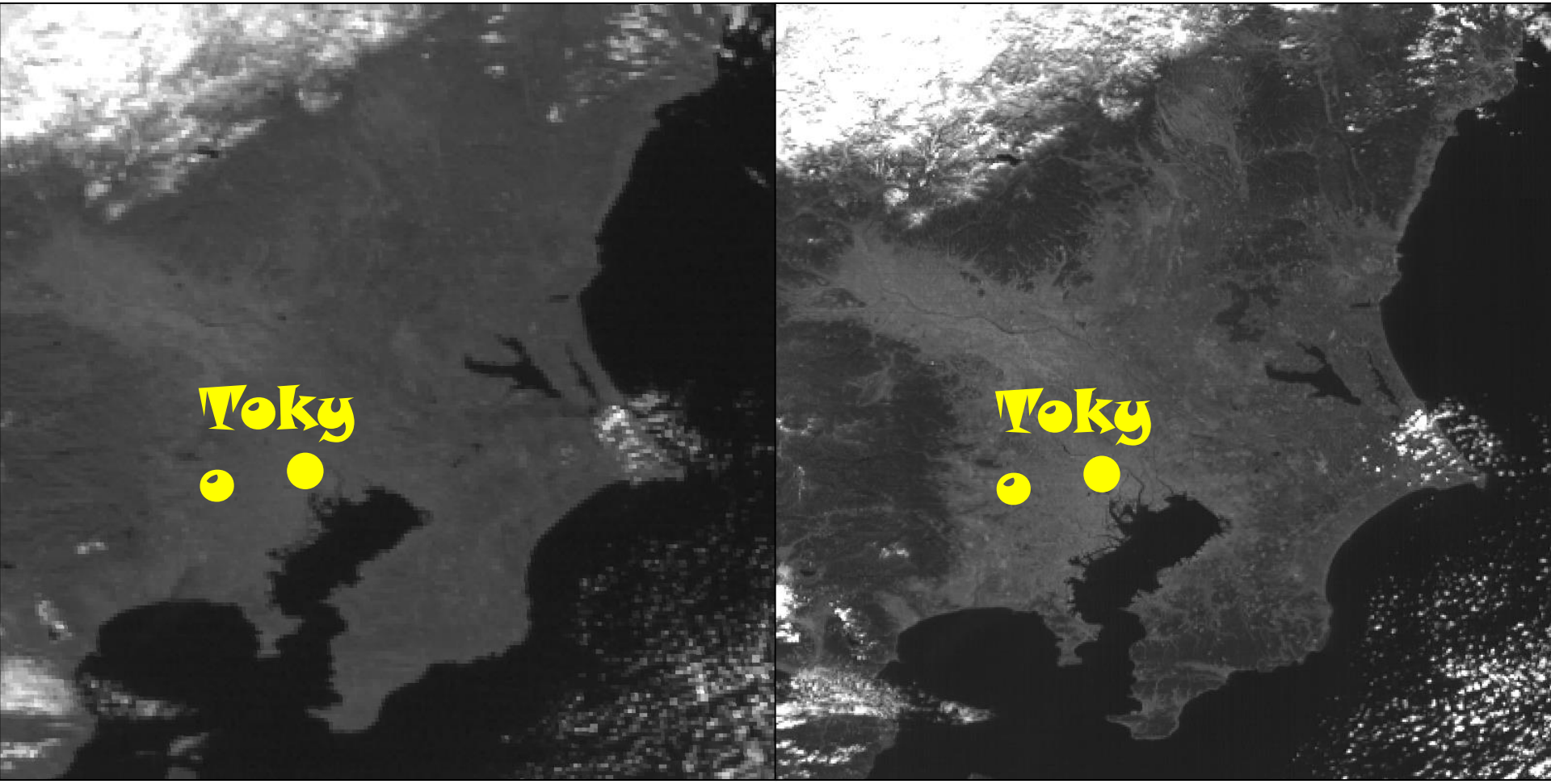
(MOVIE)



Spatial Resolution

MTSAT-2 (VIS)
1km

Himawari-8 (B03)
0.5 km



03:00 UTC on 29 January 2015

Observation Frequency

(MOVIE)

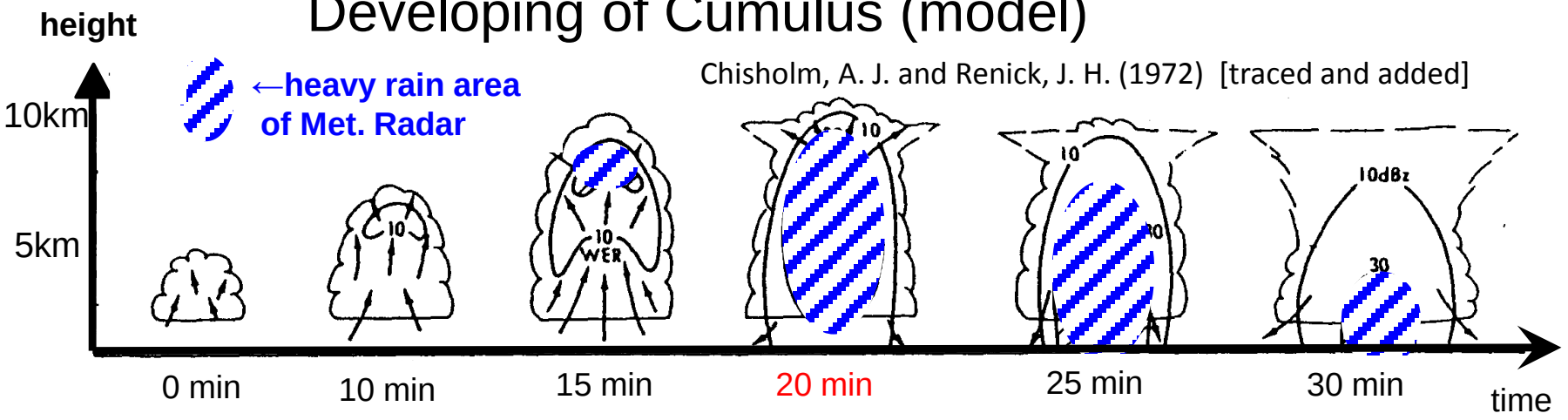
MTSAT-2 (VIS)
Hourly in Monochrome

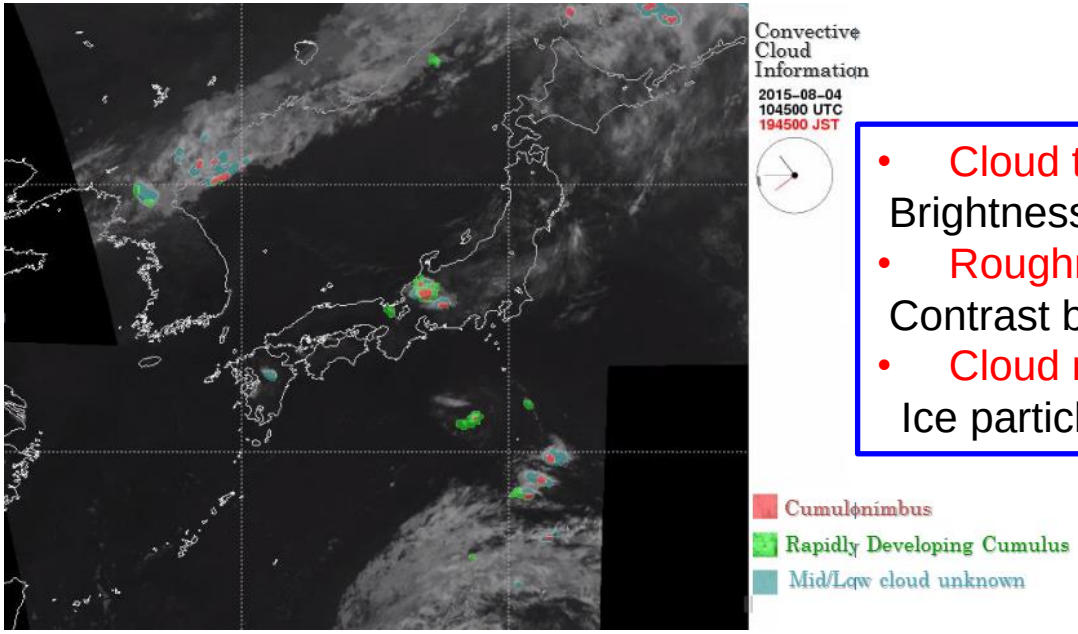
Himawari-8 (Band01-03)
Every 10 minutes in Full-Color

16 UTC on 2nd to 13 UTC on 3rd, April 2015

Rapidly Developing Cumulus Area Detection

Developing of Cumulus (model)

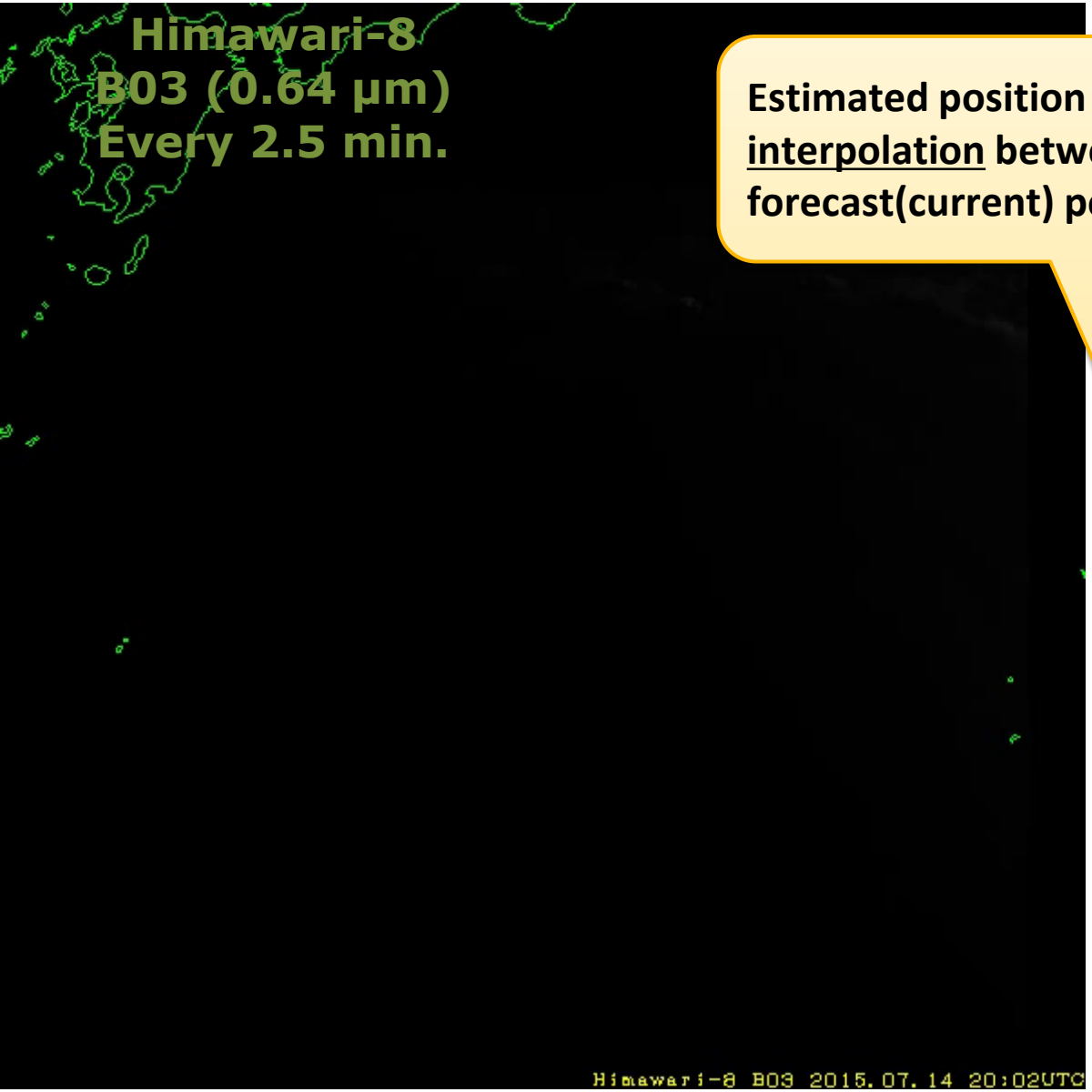




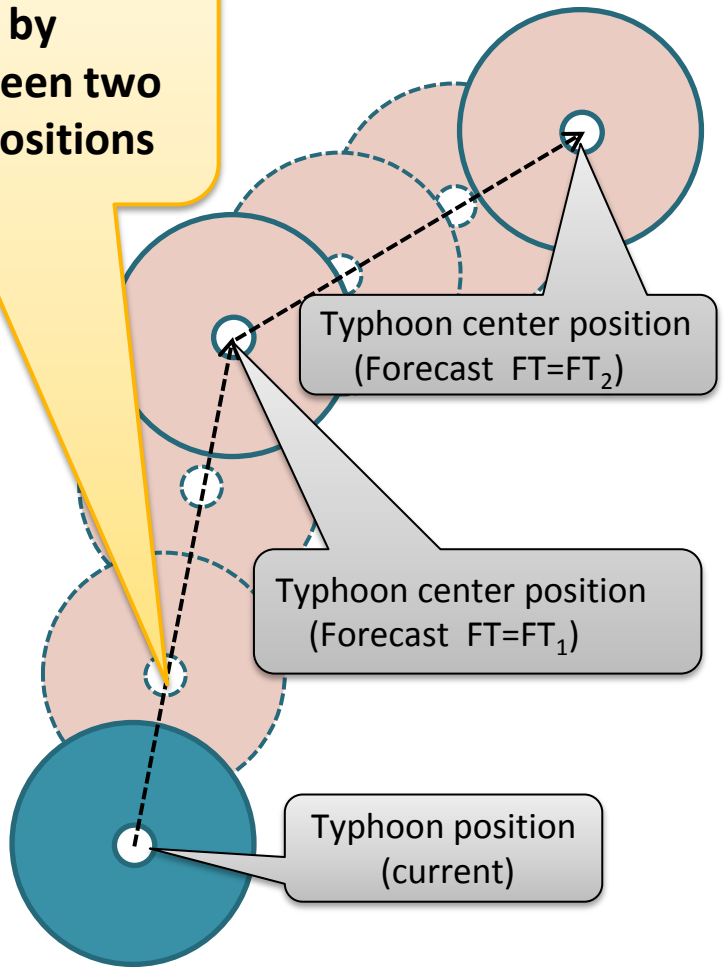
- Cloud top is higher
  Brightness temperature is getting low.
- Roughness of cloud top increases
  Contrast between light and dark is getting clear.
- Cloud microphysical parameters change
  Ice particles are produced near cloud top

Target Area Observation (Typhoon)

(MOVIE)



Estimated position by <u>interpolation</u> between two forecast(current) positions

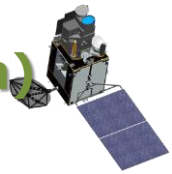


Comparison of Observation Frequency (MOVIE)

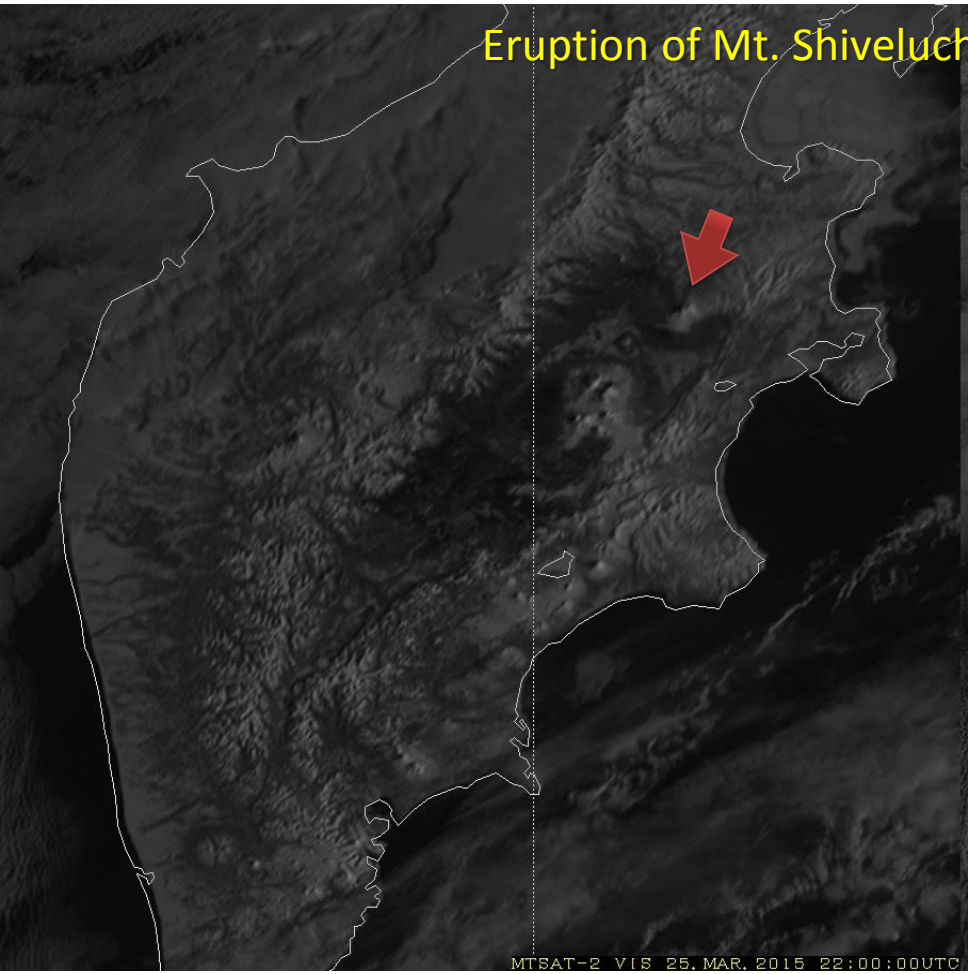
Target Area Observation (Volcano)

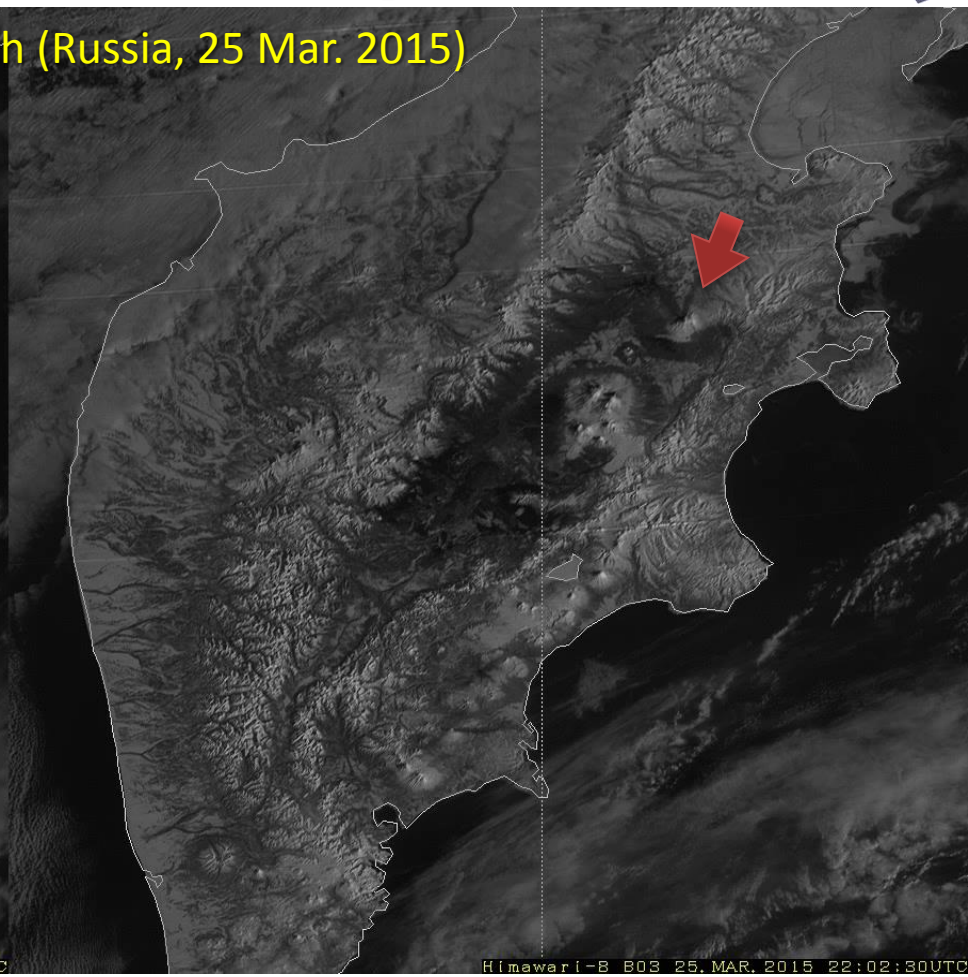
MTSAT-2 VIS (0.68 μm)
Every 30 min.

Himawari-8 B03 (0.64 μm)
Every 2.5 min.



Eruption of Mt. Shiveluch (Russia, 25 Mar. 2015)





Spectral Bands

cf. MTSAT-2 Bands

VIS 0.68 μm

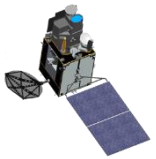
IR4 3.7 μm

IR3 6.8 μm

IR1 10.8 μm

IR2 12.0 μm

Himawari-8/9 Imager (AHI; Advanced Himawari Imager)



Band		Spatial Resolution	Central Wavelength	Physical Properties	
1	Visible (VIS)	1 km	0.47 μm	aerosol	3 Visible Bands
2			0.51 μm	aerosol	
3		0.5 km	0.64 μm	low cloud, fog	
4	Near Infrared (NIR)	1 km	0.86 μm	vegetation, aerosol	Addition of NIR Bands
5		2 km	1.6 μm	cloud phase/particle size	
6			2.3 μm	cloud particle size	
7	Infrared (IR)	2 km	3.9 μm	low cloud, fog, forest fire	
8			6.2 μm	upper-level moisture	Increase of WV Bands
9			6.9 μm	mid- to upper-level moisture	
10			7.3 μm	mid-level moisture	
11			8.6 μm	cloud phase, SO_2	Increase of TIR Bands
12			9.6 μm	ozone content	
13			10.4 μm	cloud imagery, information of cloud top	
14			11.2 μm	cloud imagery, sea surface temperature	
15			12.4 μm	cloud imagery, sea surface temperature	
16			13.3 μm	cloud top height	

Comparison of imagers

https://www.wmo-sat.info/oscar/

*Resolution depends on imaging mode

Himawari-8 AHI

Central Wavelength (μm)	Spatial Res. (km)
0.47063	1
0.51000	
0.63914	0.5
0.85670	1
-	2
-	
1.6101	
2.2568	
3.8853	
6.2429	
6.9410	
7.3467	
8.5926	
9.6372	
10.4073	
11.2395	
12.3806	
13.2807	

GOES-R ABI

Central Wavelength (μm)	Spatial Res. (km)
0.47	1
-	-
0.64	0.5
0.86	1
-	-
1.38	2
1.61	1
2.26	2
3.90	
6.15	
7.00	
7.40	
8.50	
9.70	
10.3	
11.2	
12.3	
13.3	

MSG SEVIRI

Central Wavelength (μm)	Spatial Res. (km)
N/A(broad bandwidth channel)	1.6 km IFOV, 1 km sampling for broad VIS channel / 4.8 km IFOV, 3 km sampling for narrow channels
0.635	
0.81	
-	
-	
1.64	
-	
3.92	
6.25	
-	
7.35	
8.70	
9.66	
10.8	
-	
12.0	
13.4	

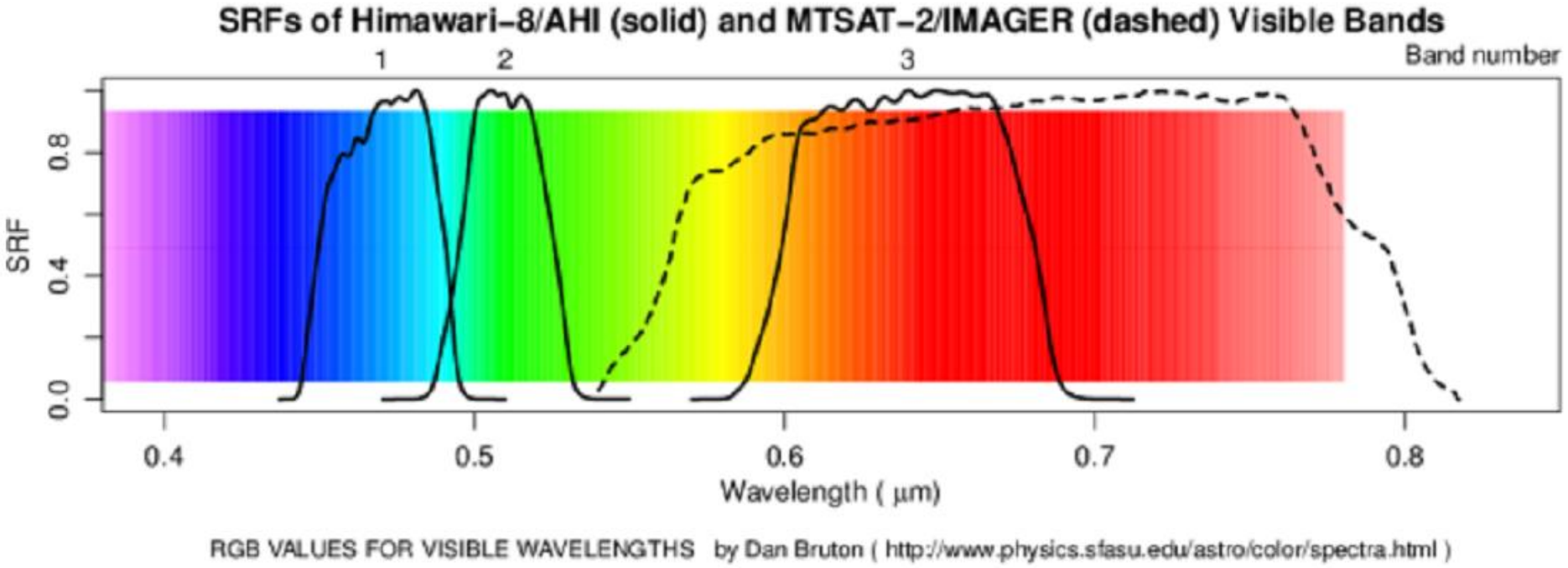
MTG FCI

Central Wavelength (μm)	Spatial Res. (km)
0.444	1
0.510	
0.640	1/0.5※
0.865	1
0.914	
1.380	
1.610	
2.250	1/0.5※
3.80	2/1※
6.30	2
-	
7.35	
8.70	
9.66	
10.50	2/1※
-	-
12.30	2
13.30	

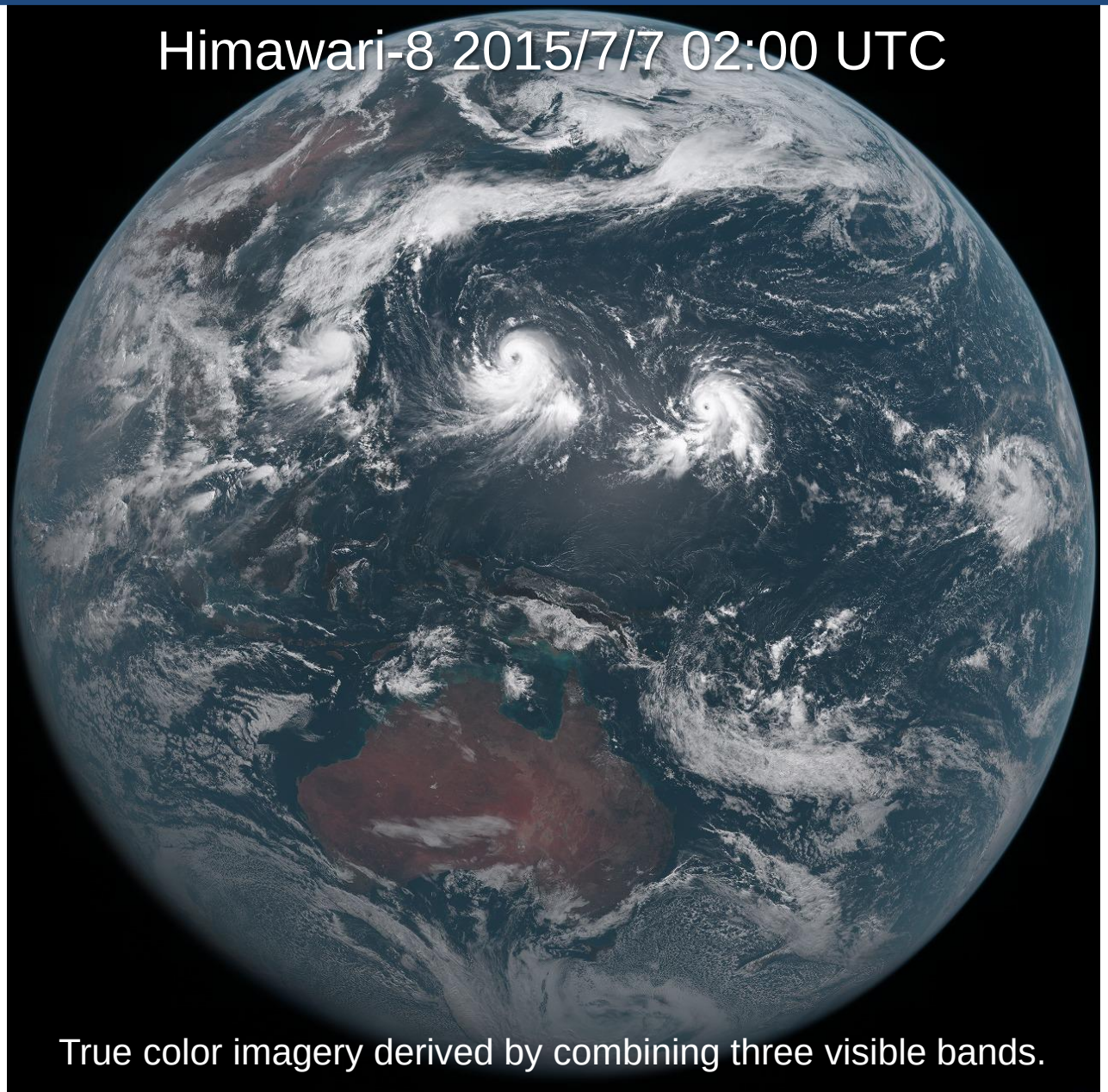
Visible bands

Band 1	0.47micron	Blue	1 km
Band 2	0.51micron	Green	1 km
Band 3	0.64micron	Red	0.5km

For True Color Image.

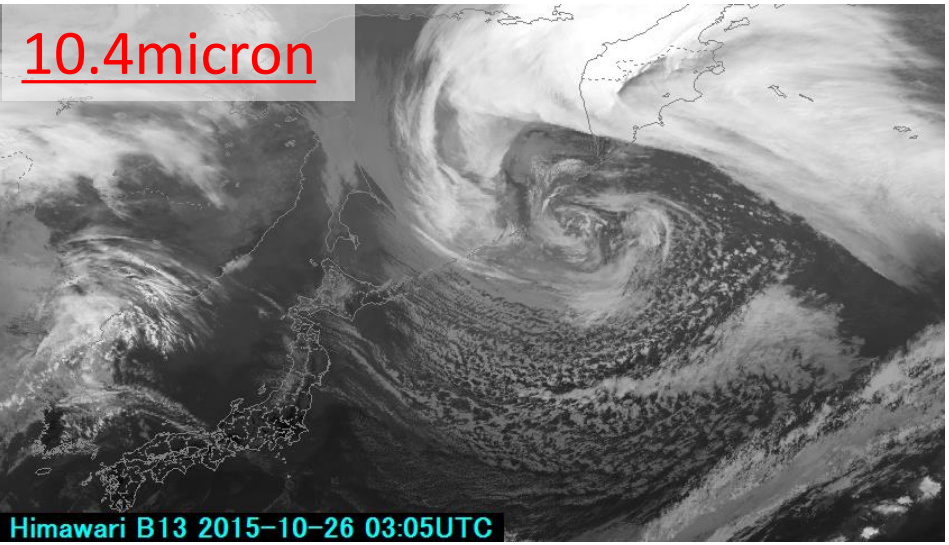


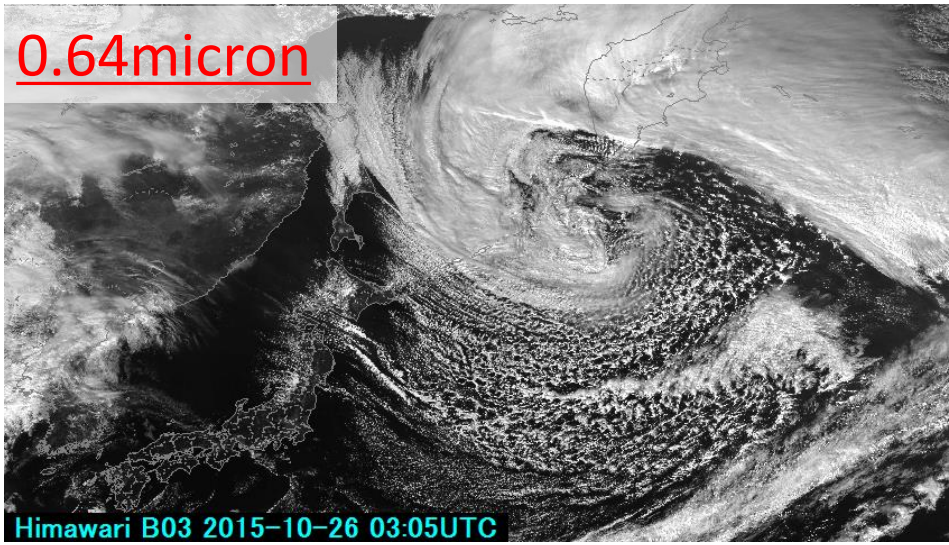
True Color Imagery

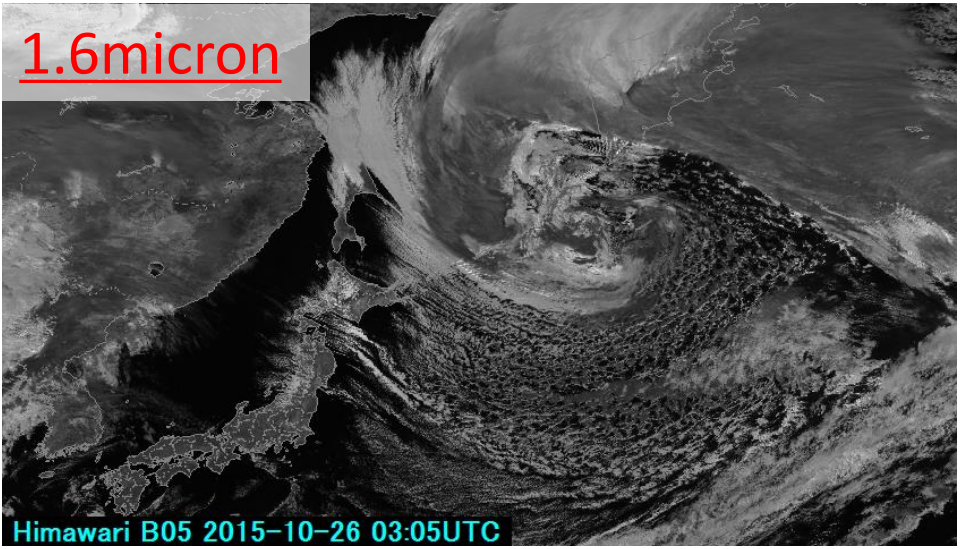


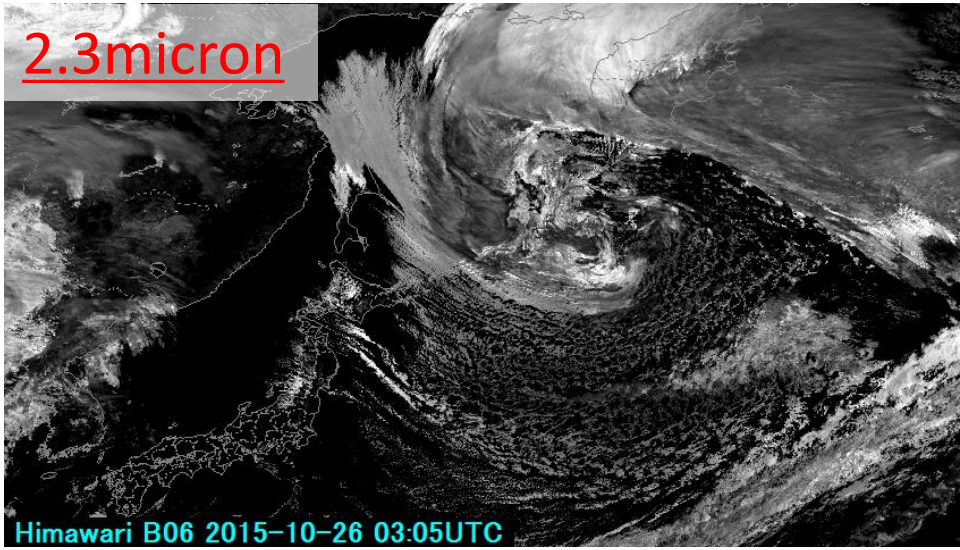
True color imagery derived by combining three visible bands.

1.6micron band (B05) and 2.3micron band (B06)

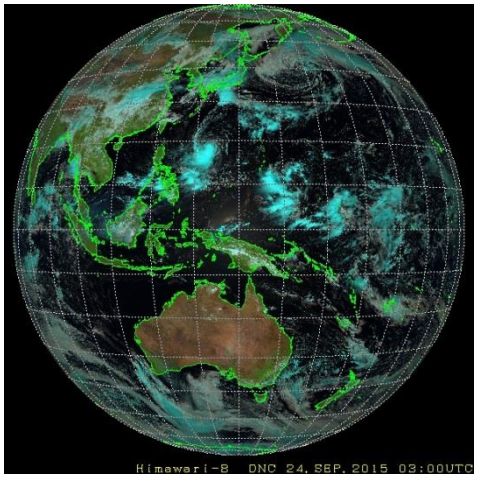




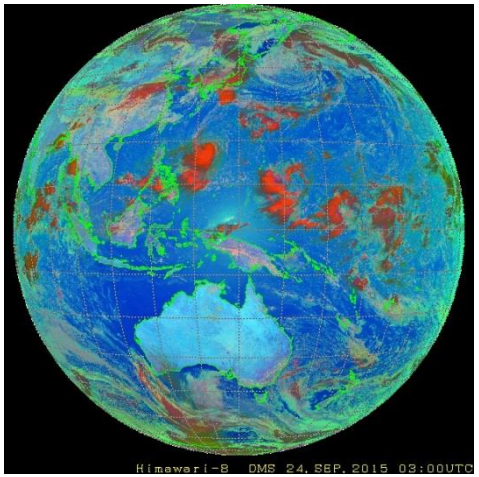




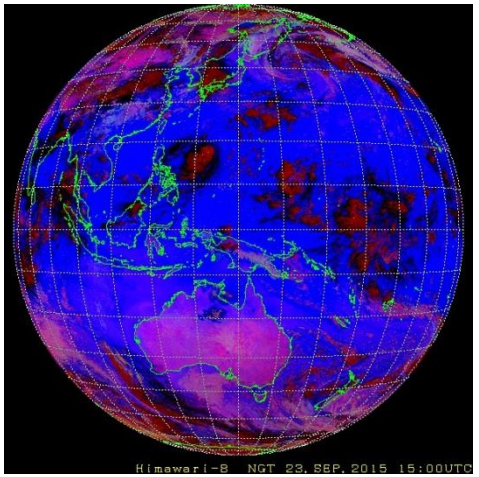
RGBs from Himawari-8



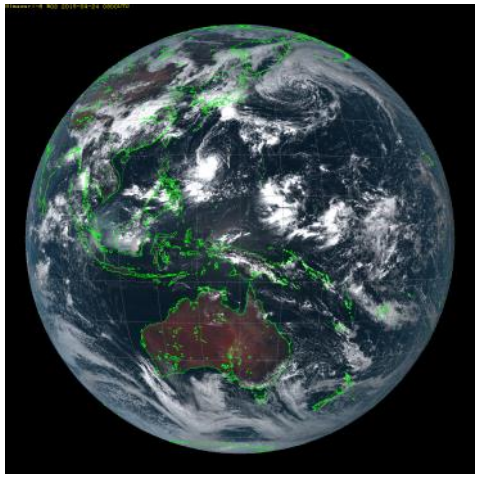
Natural Color



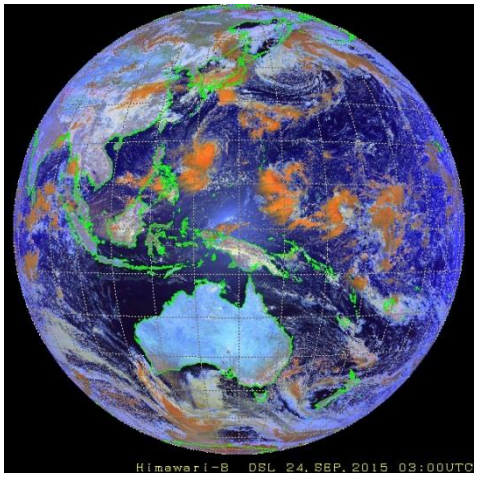
Day Microphysics



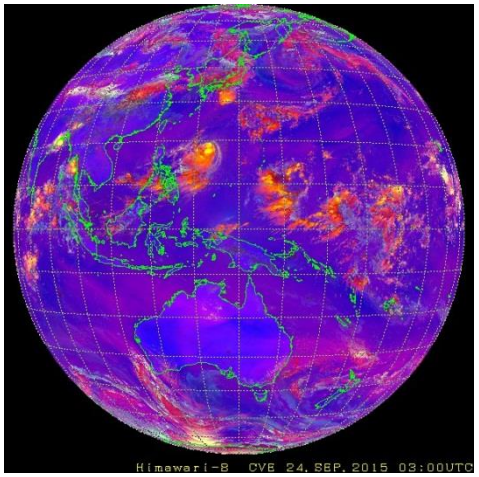
Night Microphysics



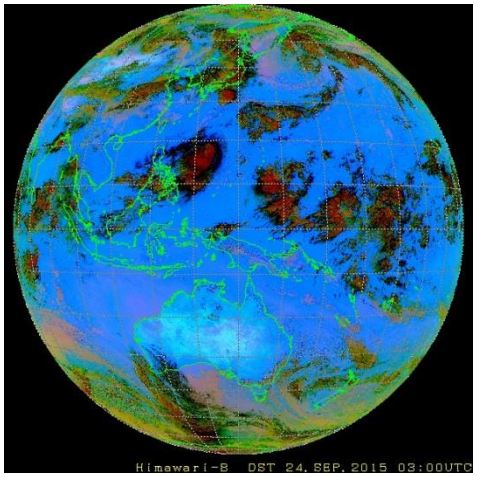
True Color



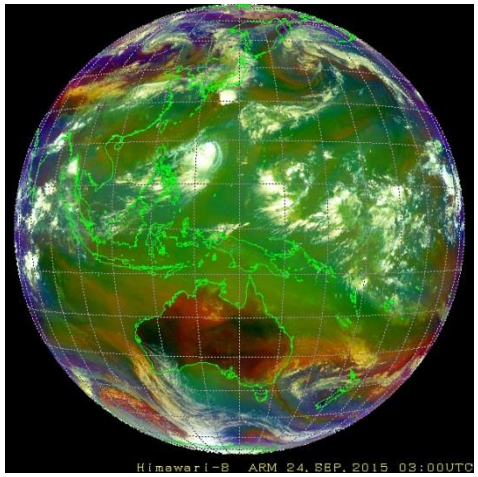
Day Snow-Fog



Day Convective Storm



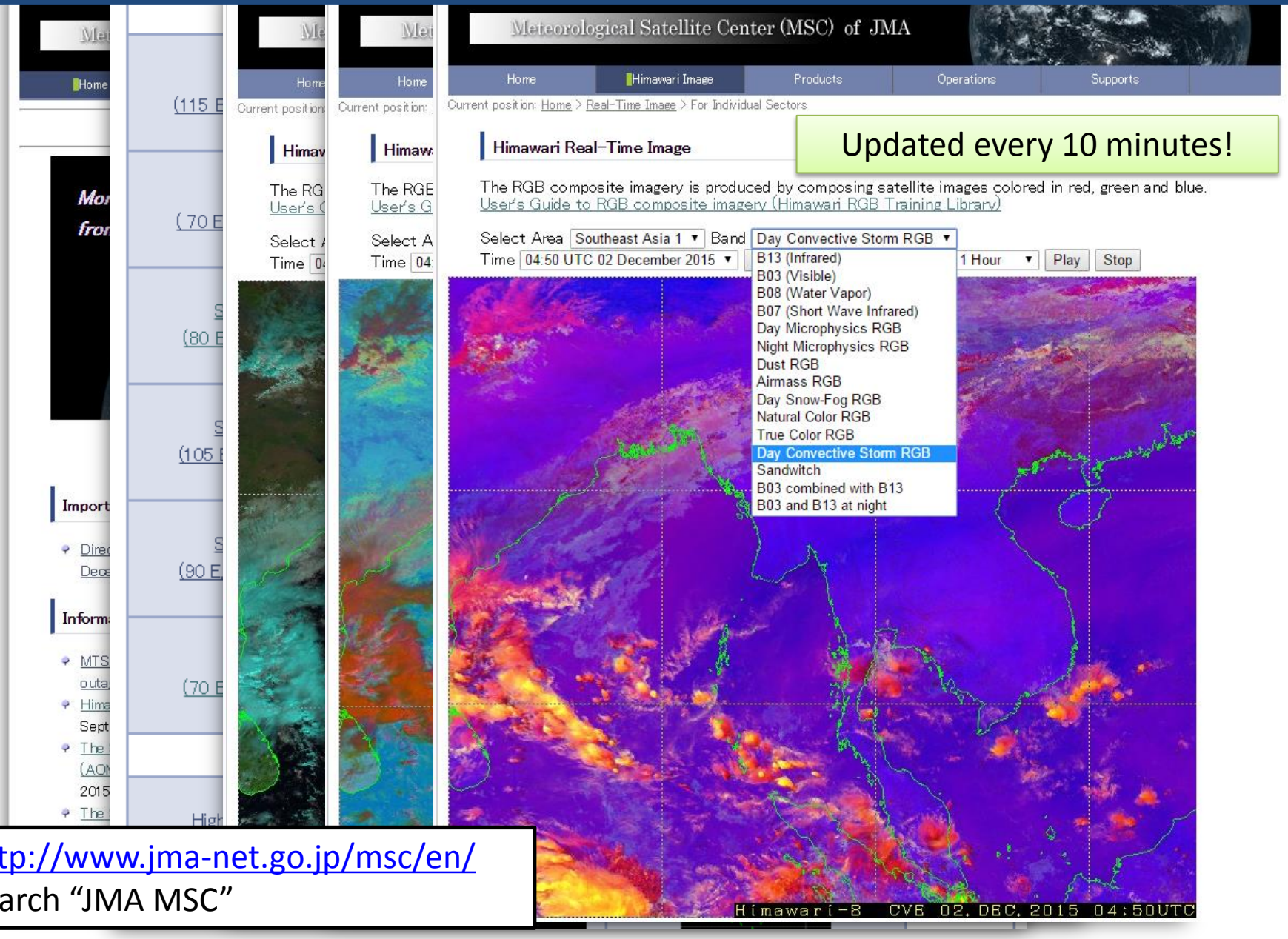
Dust



Airmass

http://www.data.jma.go.jp/mscweb/data/himawari/sat_img.php?area=fd_

Real Time RGB Images on MSC/JMA Website



http://www.jma-net.go.jp/msc/en/
search “JMA MSC”

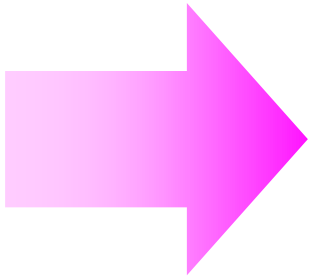
Revolution of Advanced Himawari Imager

Upgrade of **MTSAT -> Himawari-8/9**

- **Number of bands** **5 -> 16**
- **Spatial resolutions** **VIS: 1 km -> 0.5 or 1.0 km**
  IR: 4.0 km -> 2.0 km
- **Temporal resolutions** **30/60 min -> 10 min**

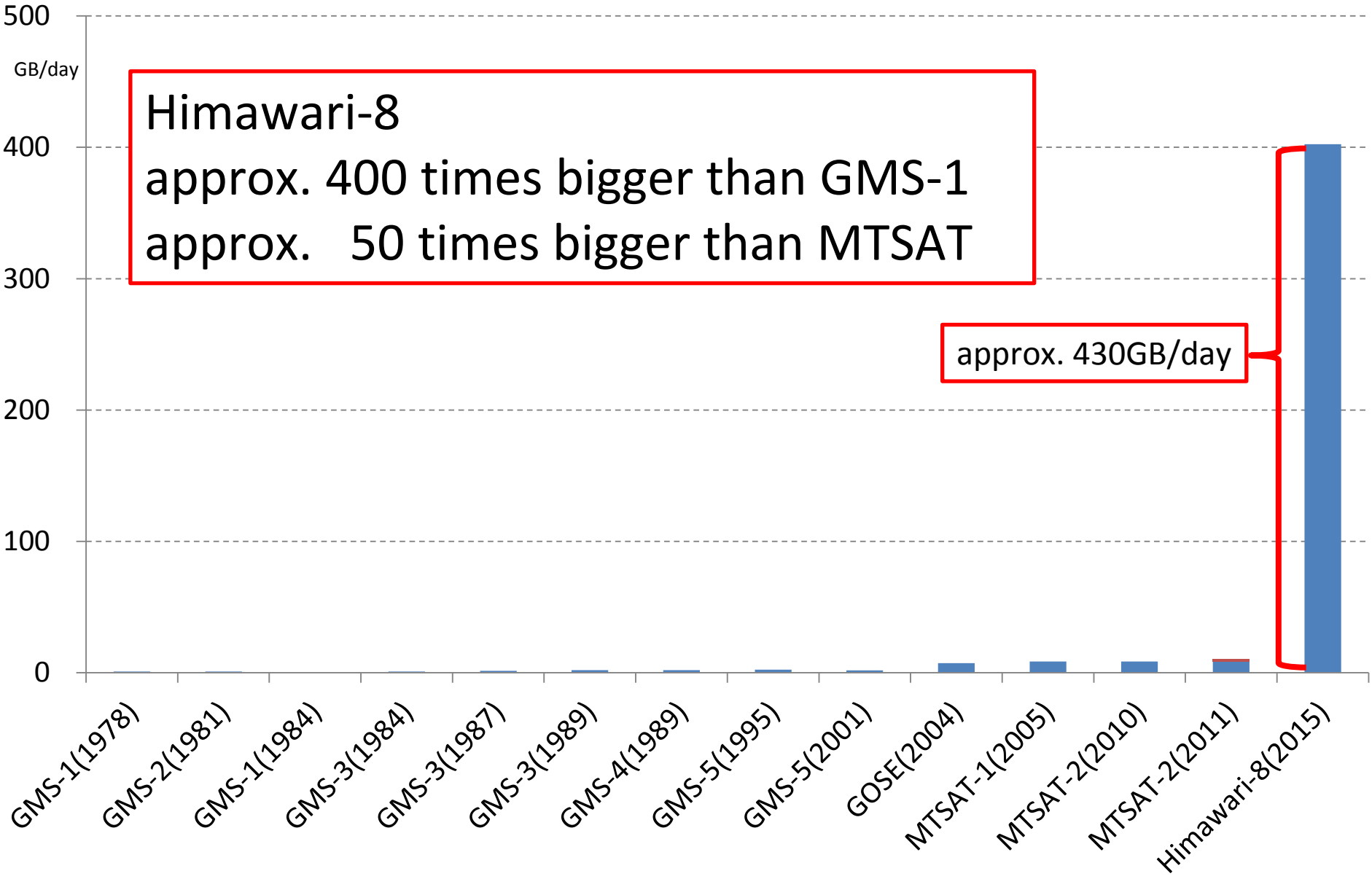
(Total data size: 50 times!!)

B/W TV

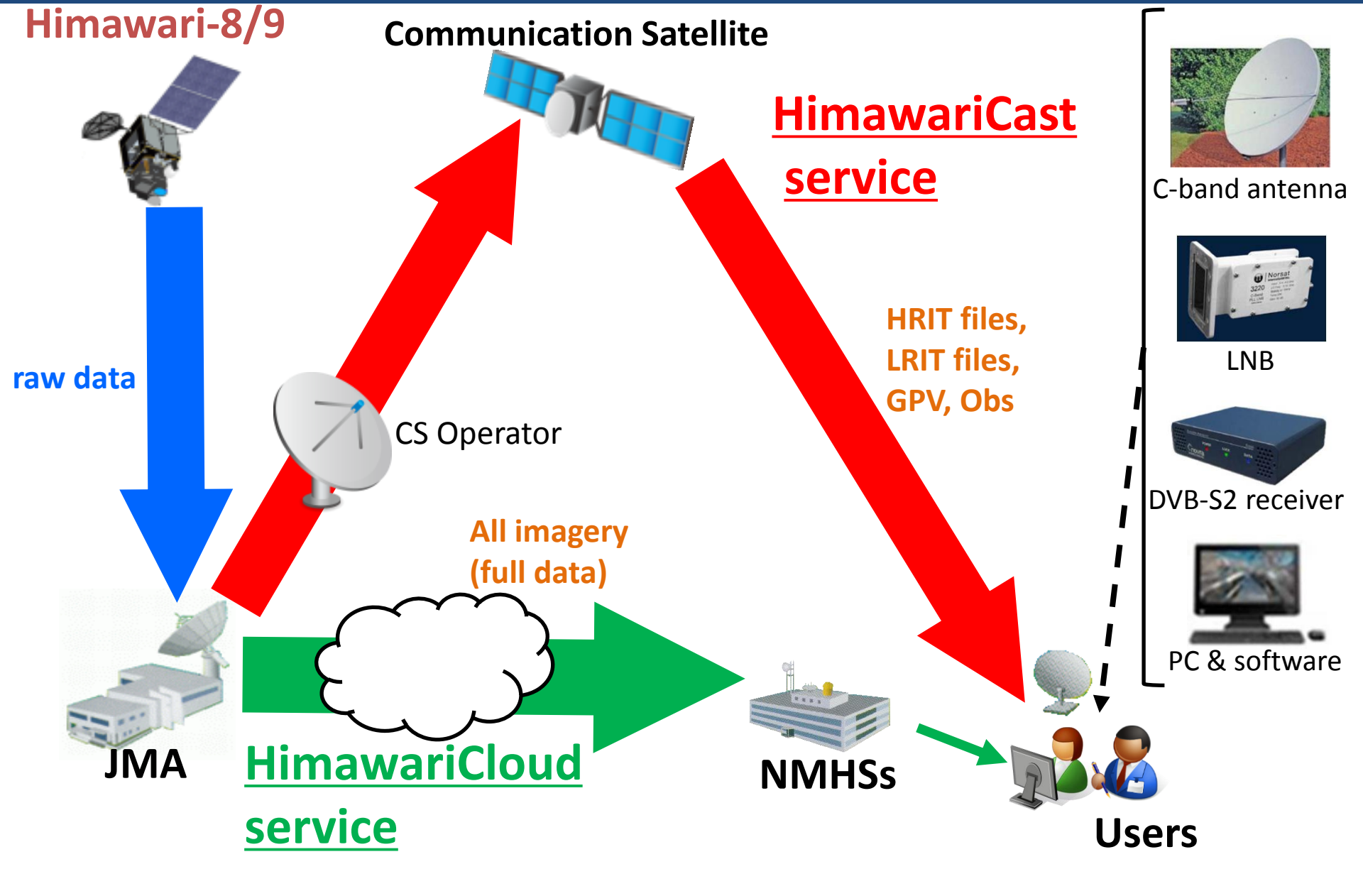


HD TV

Data amount of Himawari series



Two Ways of Data Dissemination/Distribution HimawariCast/HimawariCloud



Data distribution/dissemination methods

Two Ways of Himawari-8/9 Imagery Dissemination/Distribution

HimawariCast via Communication Satellite

- Service for **Everyone**
- **No Pass Code** for Receiving
- **14 bands** (1 VIS and 13 NIR/IR) every **10 minutes** for Full Disk
- Spatial resolution is same as that of MTSAT **HRIT compatible**

HimawariCloud via Internet Cloud

- Service for **NMHSs** with high-speed Internet access
- All **16 bands** (3 VIS and 13 NIR/IR)
- **Full Specification** (temporal and spatial) of Imagery

Data Services Operated by Japanese Science Group

Himawari-8 Data Service are operated by Japanese Science Group on a voluntary basis for Non-Profit R&D Users.

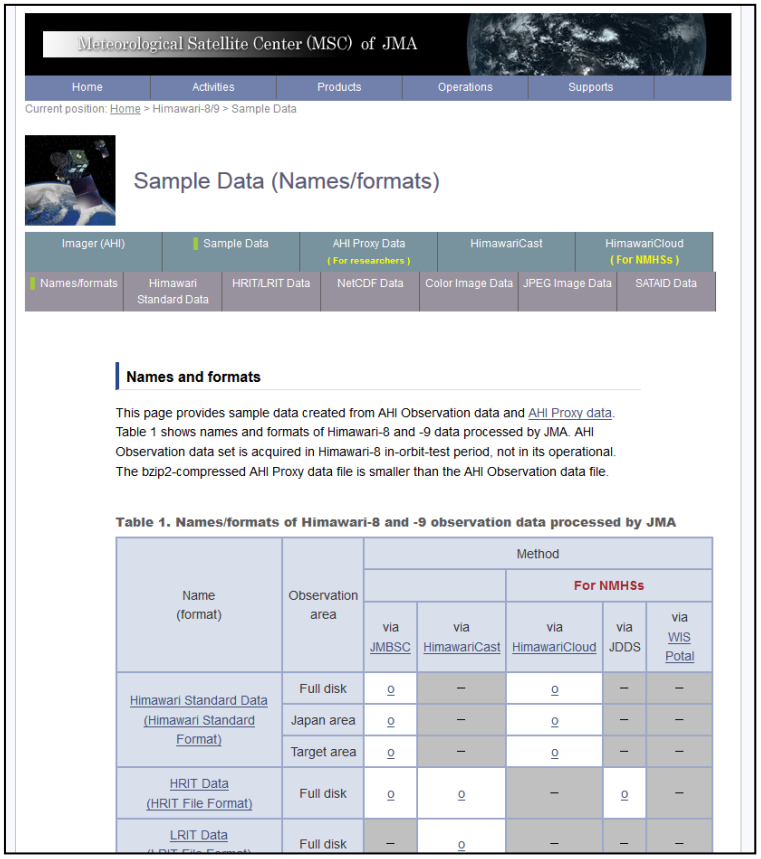
- **JAXA Himawari Monitor**
  http://www.eorc.jaxa.jp/ptree/index.html
- **NICT (National Institute of information and Communications Technology) Science Cloud**
  http://sc-web.nict.go.jp/himawari/multi-language/
- **Chiba University Data Server**
  CEReS (Center for Environmental Remote Sensing)
- **University of Tokyo**
  DIAS (Data Integration and Analysis System)
  In preparation for operation

Himawari-8/9 Users Support Information

http://www.jma-net.go.jp/msc/en/support/

Contents:

- Overview of satellite observation
- Overview of data dissemination
- Imager (AHI) specifications
- Operational status
- Sample data
- Sample source code to read Himawari-8 data and convert into other formats

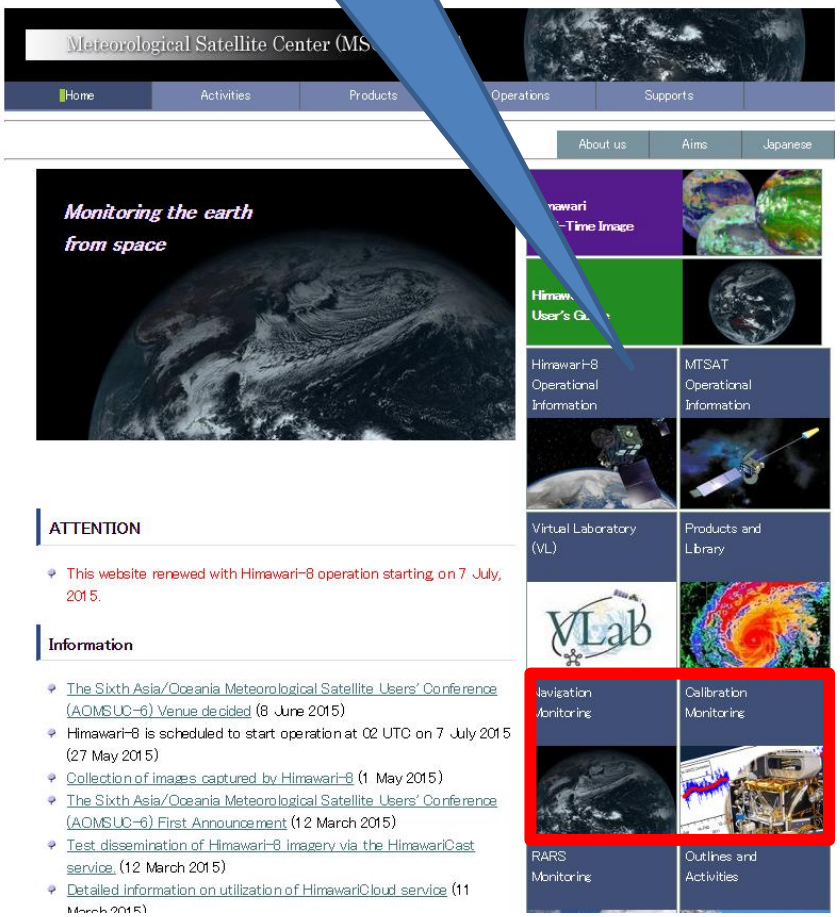


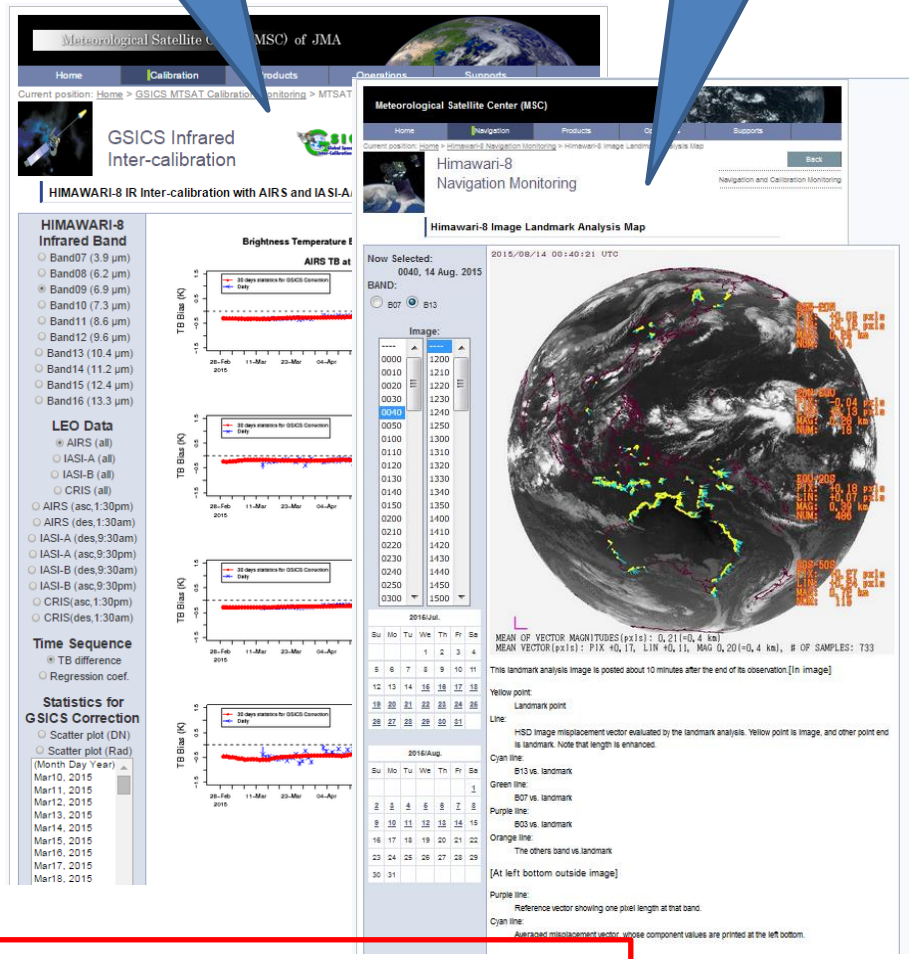
Himawari Operation Status and Imagery Calibration/Navigation Monitoring from MSC Web

Himawari-8 Operation Status

Imagery Calibration

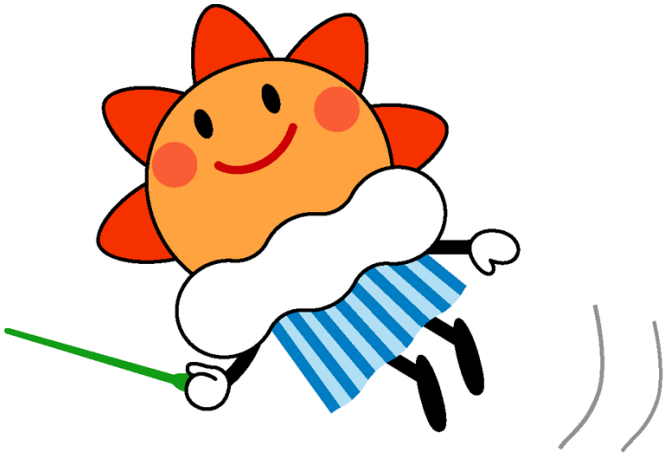
Imagery Navigation





http://www.jma-net.go.jp/msc/en/index.html

Thank you for your kind attention!



JMA mascot character
“Harerun”