

Introduction to Himawari-8

Training on meteorological satellite data usage

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Meteorological Satellite Center (MSC)

Japan Meteorological Agency (JMA)

The Sixth Asia/Oceania Meteorological Satellite Users' Conference

Tokyo, Japan

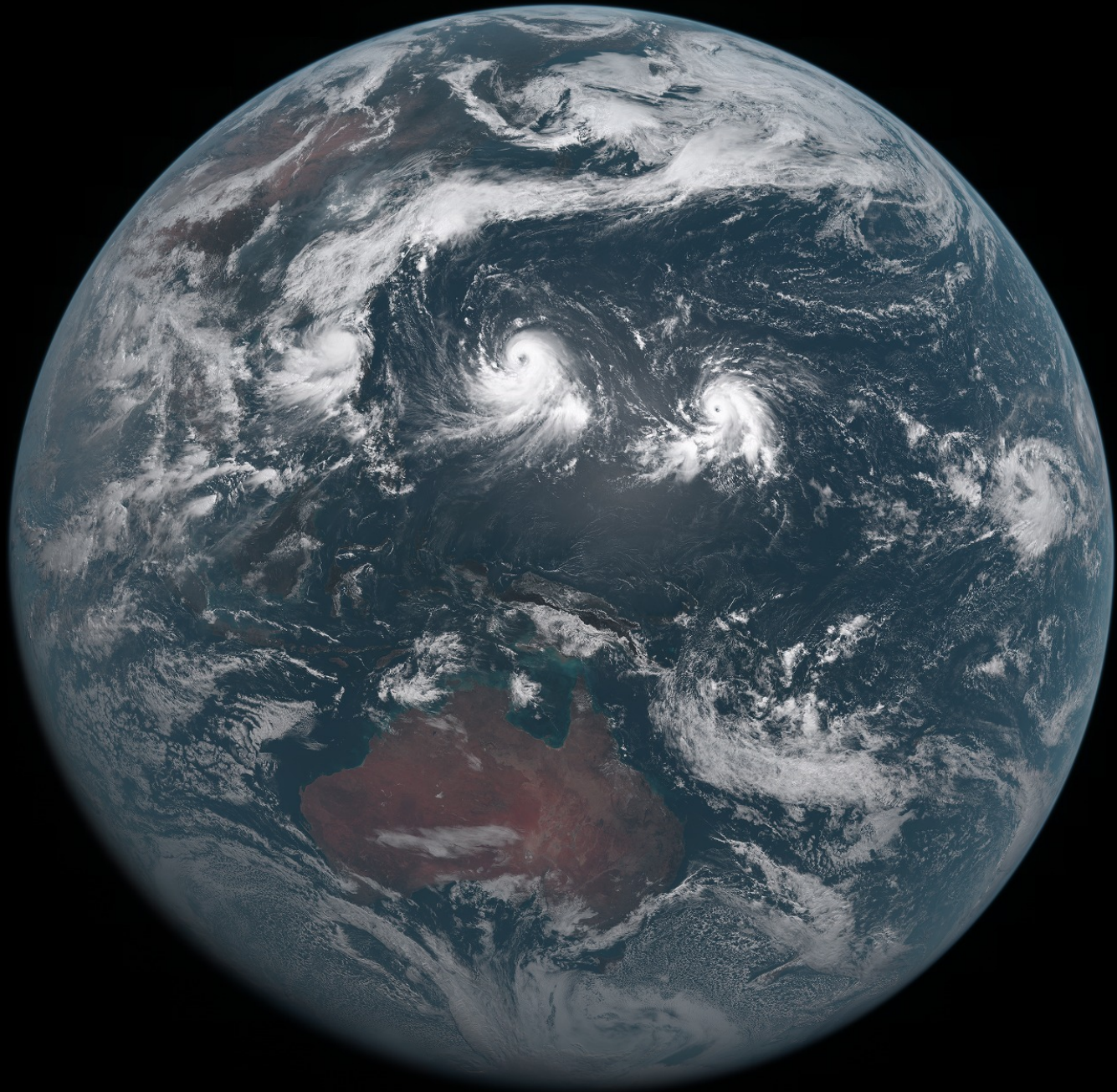
9 – 13 November 2015

Successful Launch of Himawari-8

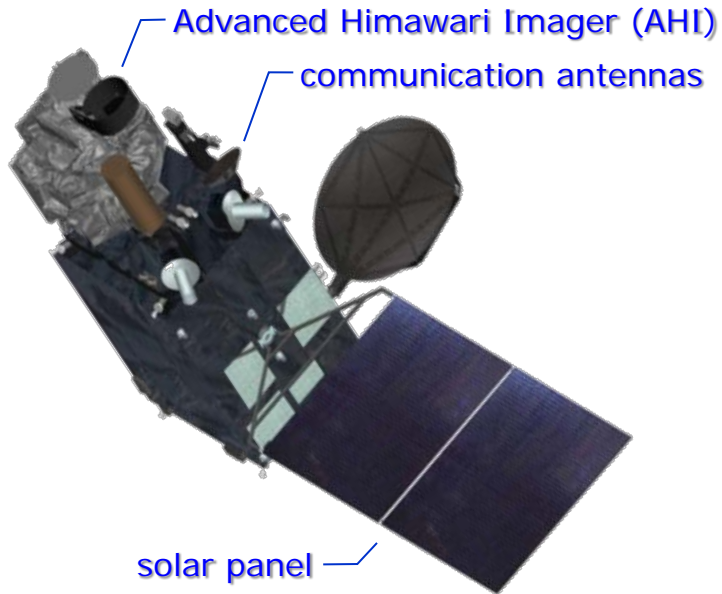


Himawari-8 was successfully launched using H-IIA Launch Vehicle # 25 on 7 October 2014 from the Tanegashima Space Center in Kagoshima, Japan

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

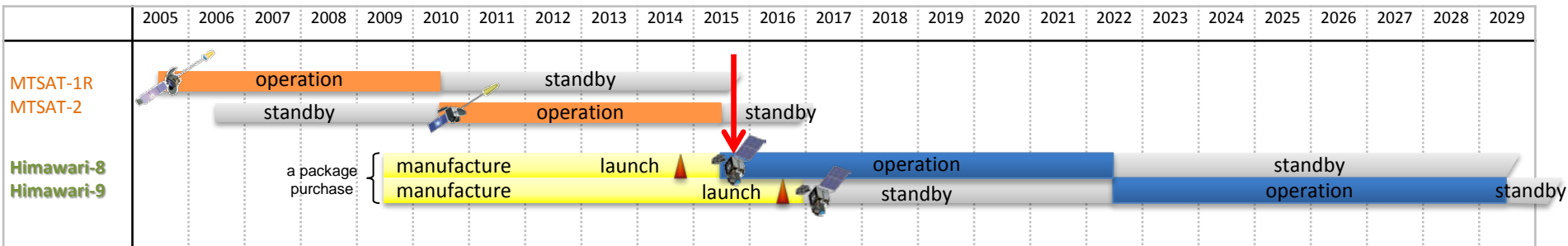


Outline of Himawari-8



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)

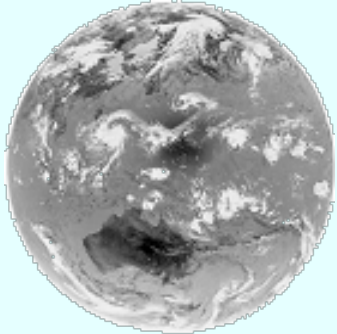
Himawari-8 began operation on 7 July 2015, replacing the previous MTSAT-2 operational satellite



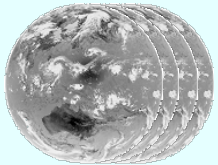
Improved Resolutions

Spectral

VIS 1 band



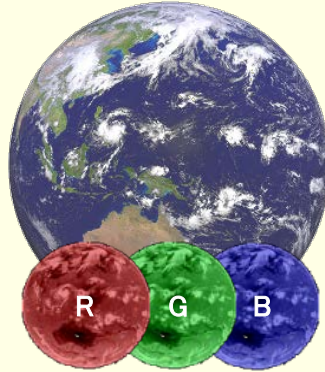
IR 4 bands



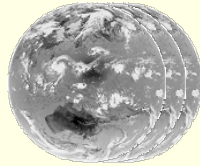
5 bands

MTSAT-1R/2

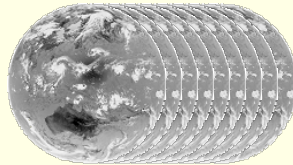
VIS 3 bands



NIR 3 bands



IR 10 bands



16 bands

Himawari-8/9

Spatial

At sub-satellite point

VIS 1 km
IR 4 km

MTSAT-1R/2

VIS 0.5/1 km
IR 2 km

Himawari-8/9

Temporal

Observation Frequency

60min.

(full-disk
obs.)

MTSAT-1R/2

10min.

10min.

10min.

10min.

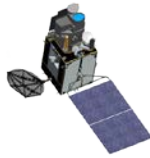
10min.

10min.

Himawari-8/9

Spectral Bands

Himawari-8/9 Imager (AHI)



Band		Spatial Resolution	Central Wavelength	Physical Properties
1	Visible	1 km	0.47 μm	vegetation, aerosol
2			0.51 μm	vegetation, aerosol
3		0.5 km	0.64 μm	Vegetation, low cloud, fog
4	Near Infrared	1 km	0.86 μm	vegetation, aerosol
5		2 km	1.6 μm	cloud phase
6			2.3 μm	particle size
7	Infrared	2 km	3.9 μm	low cloud, fog, forest fire
8			6.2 μm	mid- and upper-level moisture
9			6.9 μm	mid-level moisture
10			7.3 μm	mid- and lower-level moisture
11			8.6 μm	cloud phase, SO ₂
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

3 Visible Bands

Addition of NIR Bands

Increase of WV Bands

Increase of TIR Bands

cf. MTSAT-2 Bands



VIS
0.68 μm

IR4
3.7 μm

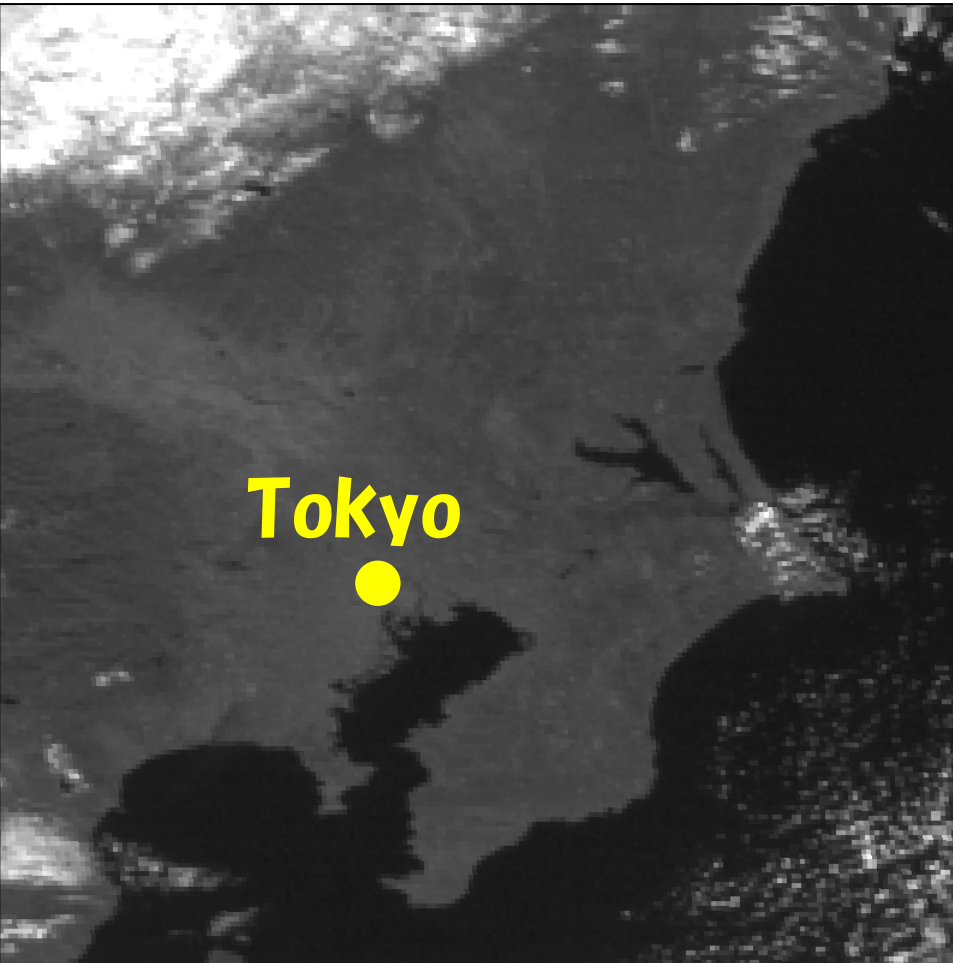
IR3
6.8 μm

IR1
10.8 μm

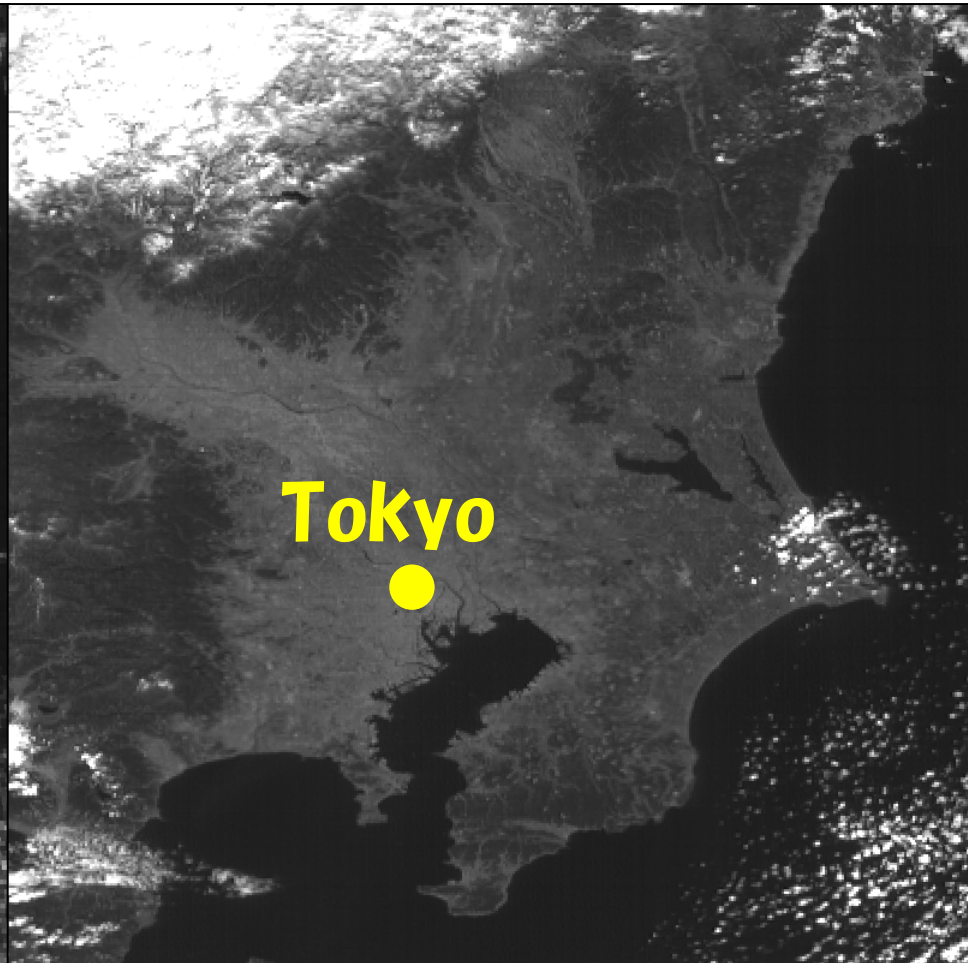
IR2
12.0 μm

Spatial Resolution

MTSAT-2 (VIS)
1km



Himawari-8 (B03)
0.5 km



03:00 UTC on 29 January 2015

Observation Frequency

MTSAT-2 (VIS)
Hourly in Monochrome

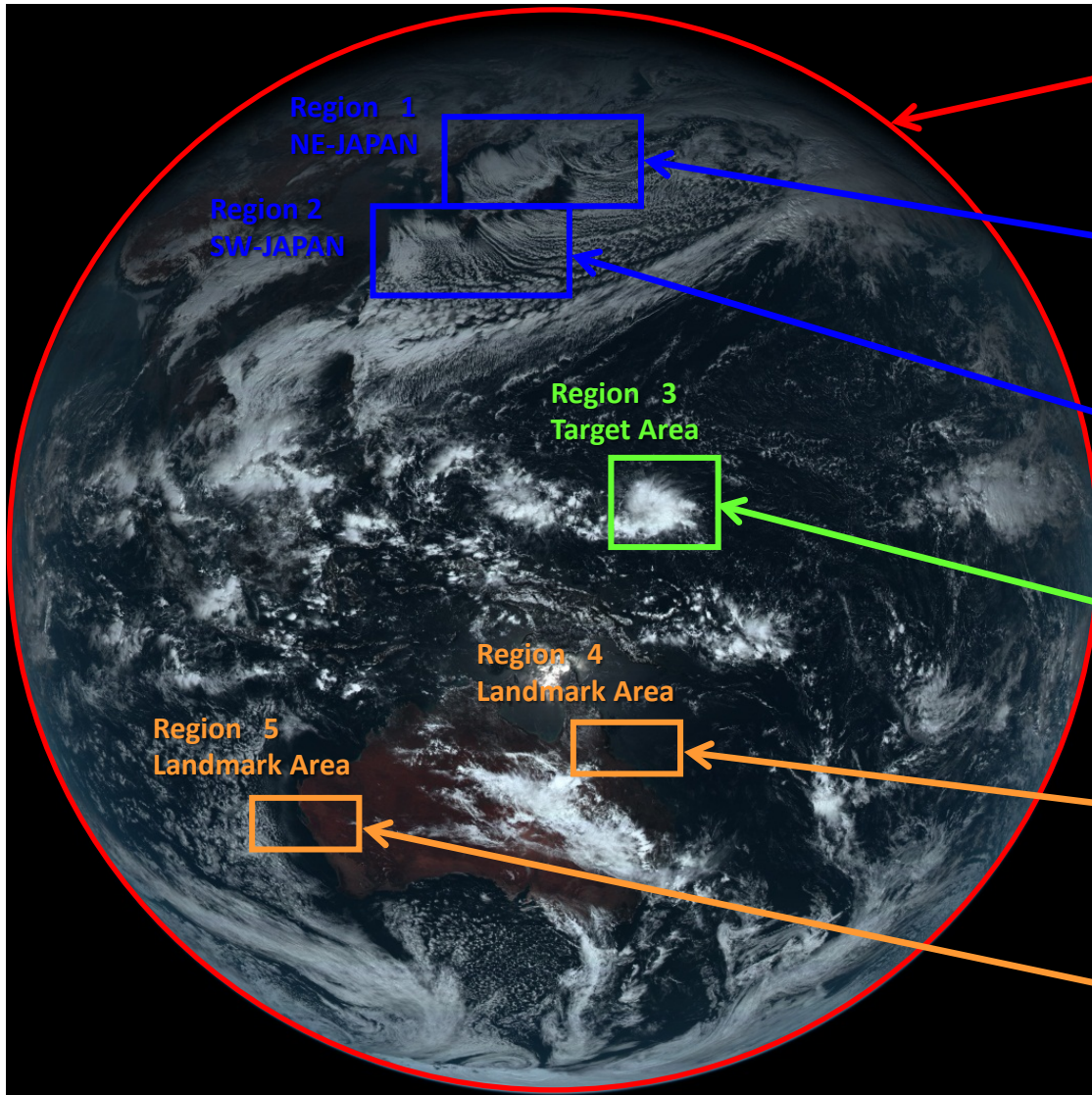
Himawari-8 (Band01-03)
Every 10 minutes in Full-Color

MTSAT-2 VIS 02, APR, 2015 16:00UTC

Himawari-8 02, APR, 2015 16:00UTC

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

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)

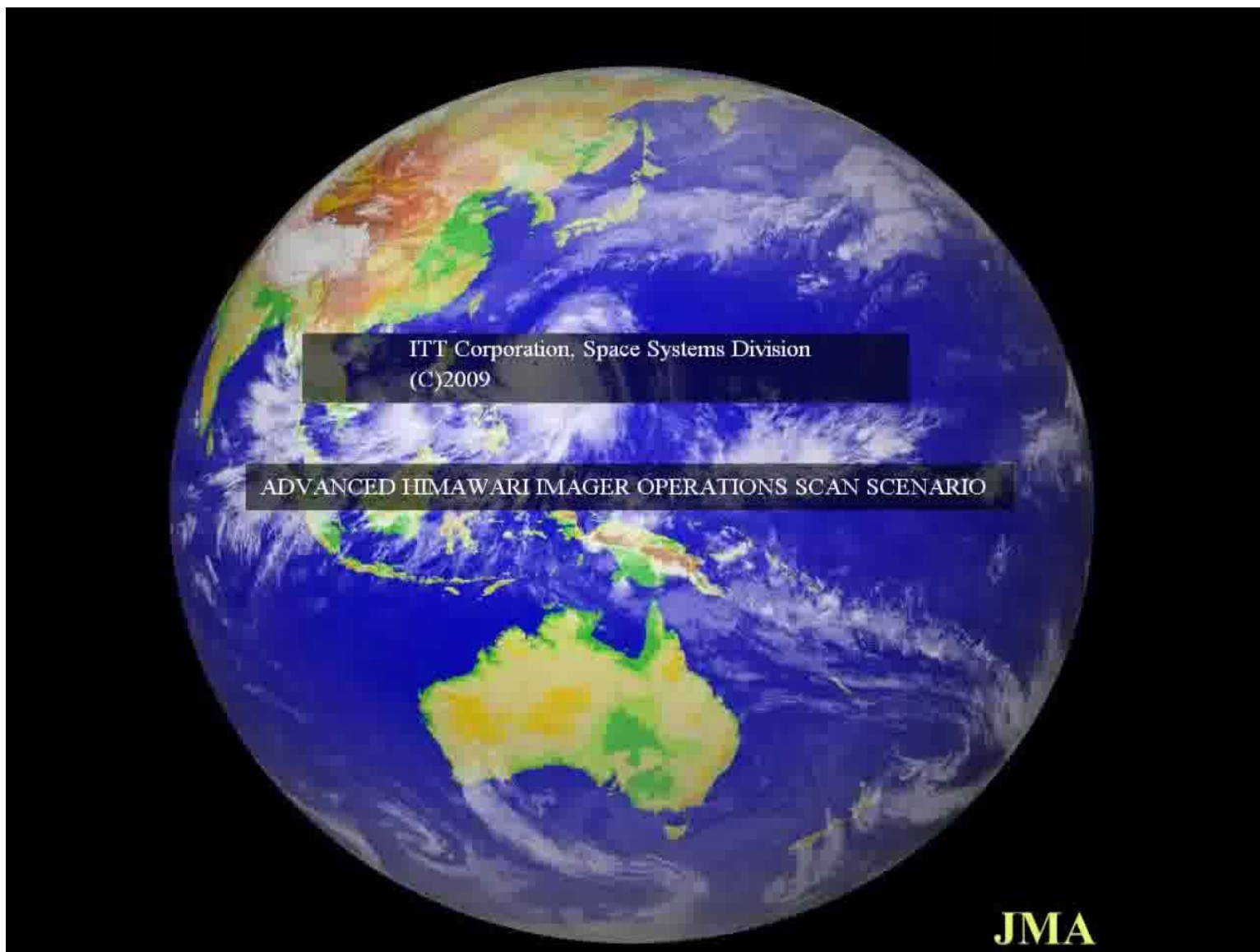
Dimension : EW x NS: 1000 x 500 km

Region 5 Landmark Area

Interval : **0.5 minutes** (20 times in 10 min)

Dimension : EW x NS: 1000 x 500 km

AHI Scan Scenario



Revolution of Advanced Himawari Imager

Upgrade of

- Number of bands
- Spatial resolutions
- Temporal resolutions

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

5 -> **16**

VIS: 1 km -> **0.5 or 1.0 km**

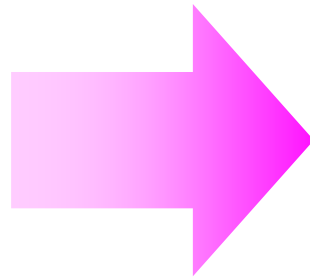
IR: 4.0 km -> **2.0 km**

30/60 min -> **10 min**

(Total data size: **50 times!!**)



B/W TV



HD TV

Himawari-8: Observation Area and Interval

in 10 minutes time frame

Visible band

RGB Composited True Color

Japan & Vicinity Obs.

Targeted Area obs.

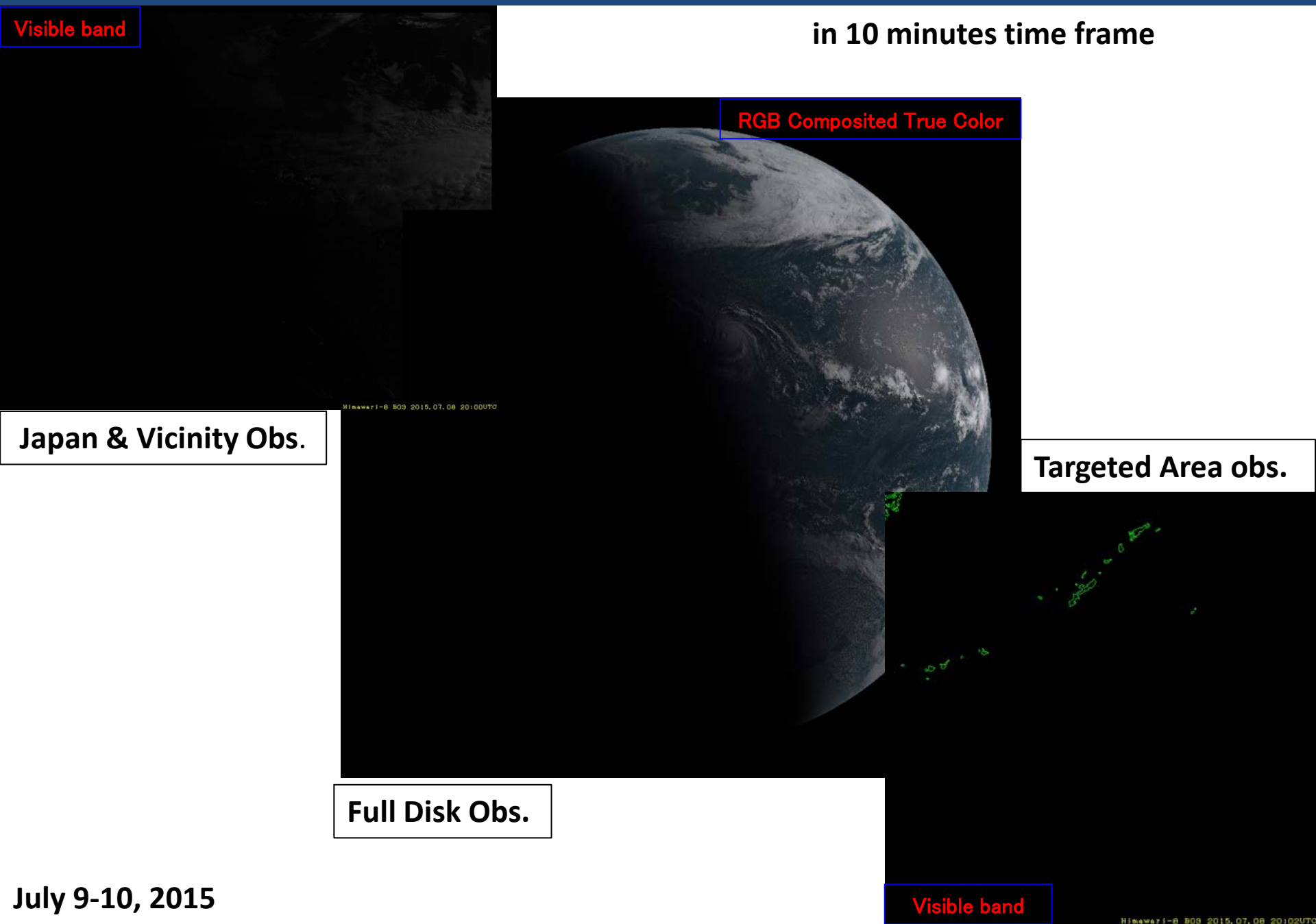
Full Disk Obs.

Visible band

July 9-10, 2015

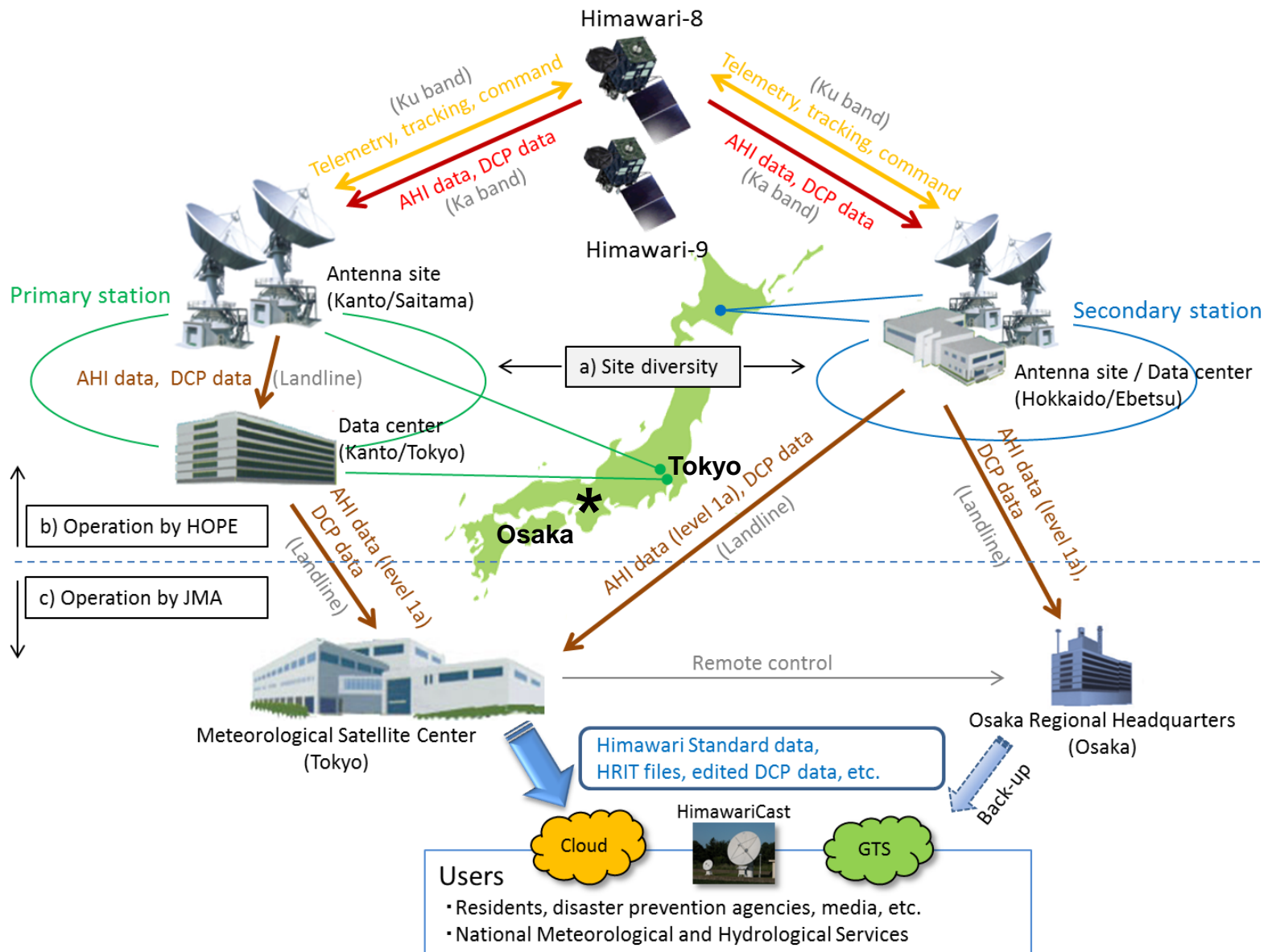
Himawari-8 B03 2015.07.08 20:00UTC

Himawari-8 B03 2015.07.08 20:02UTC



Himawari-8/9 Ground Segments

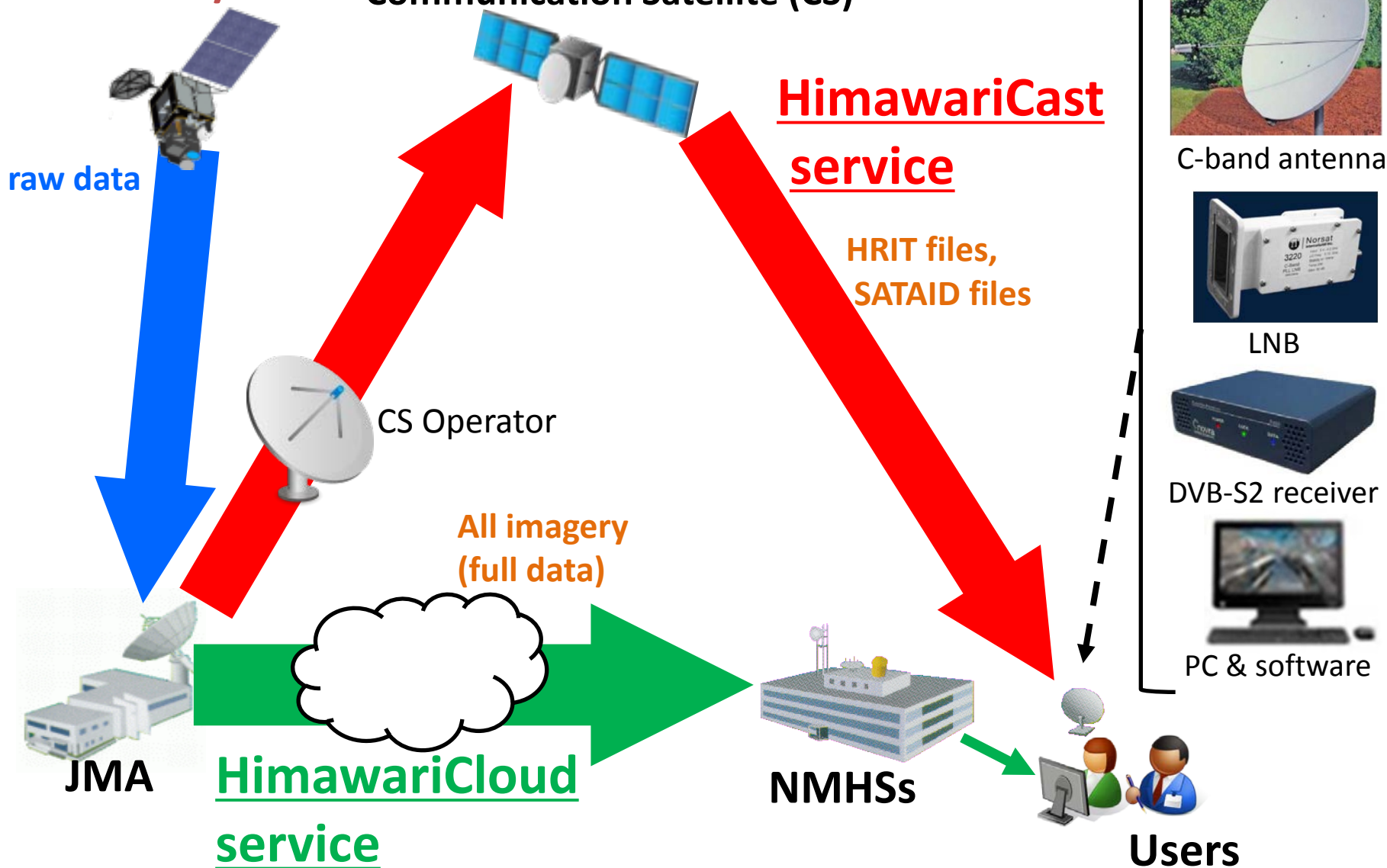
Himawari-8/9 Ground Segment and Operations



Two Ways of Data Dissemination/Distribution HimawariCast/HimawariCloud

Himawari-8/9

Communication Satellite (CS)



HimawariCast
service

HRIT files,
SATAID files

All imagery
(full data)

HimawariCloud
service



C-band antenna



LNB



DVB-S2 receiver



PC & software

Users

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

HimawariCast via Communication Satellite

- Service for Everyone
- No Pass Code for Receiving
- JMA's Baseline for Imagery Dissemination
- 14 bands (1 VIS and 13 IR) every 10 minutes for Full Disk
- Spatial Resolution is same as that of MTSAT HRIT compatible

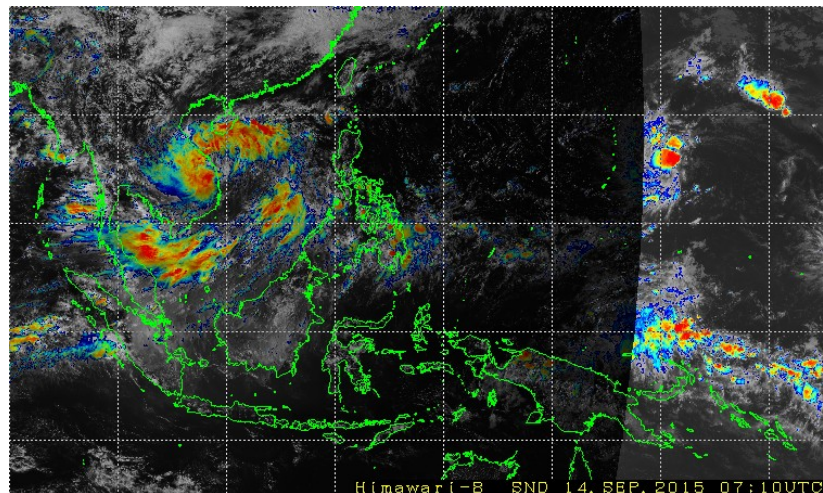
HimawariCloud via Internet Cloud

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

HimawariCast/HimawariCloud: Data spec.

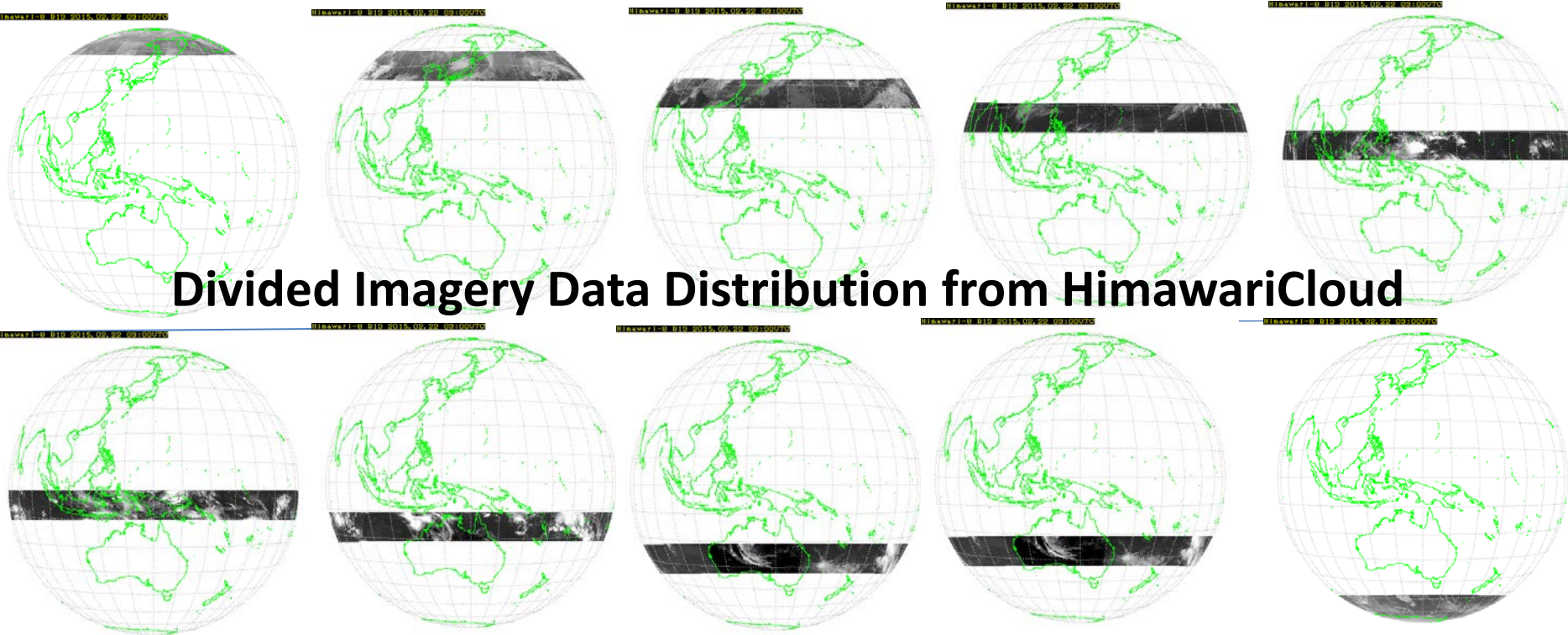
Service	Users	Format	Interval	Band	Resolution	Delivery
HimawariCloud (for advanced usage)	NMHS	HSD (Himawari Standard Data)	10 min	16	VIS: 0.5-1 km IR: 2 km	<u>High-speed Internet</u> (NTT Communication)
HimawariCast (for baseline usage)	All	HRIT files (MTSAT Compatible)	10 min	14	VIS: 1 km IR: 4 km	Communication Satellite (JCSAT-2A/2B)
Web-based Quick-Look	All	JPEG	10 min	4+	several km	

http://www.data.jma.go.jp/mscweb/data/himawari/sat_img.php?area=se1



Integrated Usage of HimawariCloud and HimawariCast

Divided Imagery Data Distribution from HimawariCloud



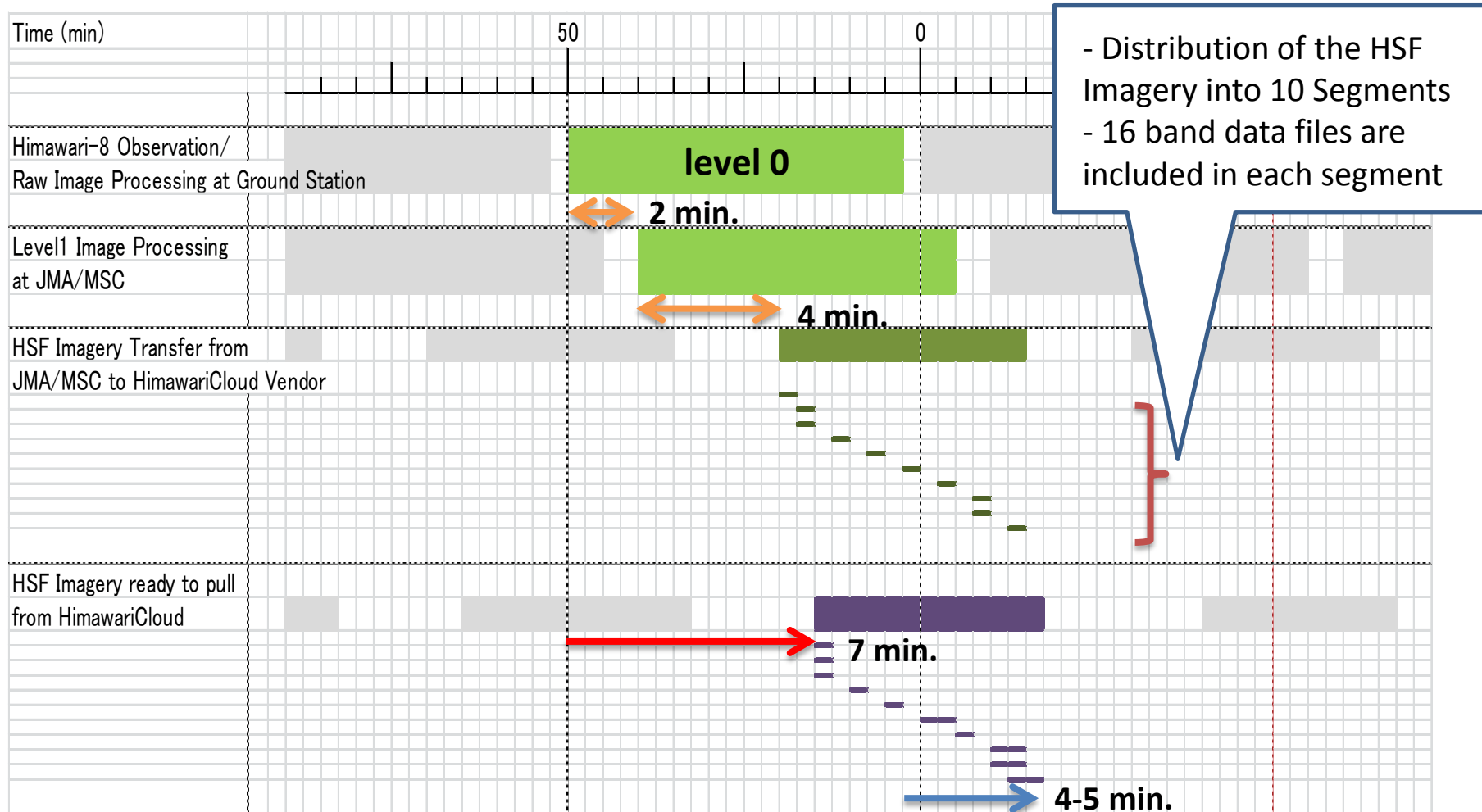
- Full Disk Imagery from HimawariCast
- The Specific Imagery in detail from HimawariCloud

Table. Segment number and approximate coverage in latitude

Segment #	North Edge (lat.)	South Edge (lat.)
1	--	47 deg.N
2	47 deg.N	32 deg.N
3	32 deg.N	21 deg.N
4	21 deg.N	10 deg.N
5	10 deg.N	Equator
6	Equator	10 deg.S
7	10 deg.S	21 deg.S
8	21 deg.S	32 deg.S
9	32 deg.S	47 deg.S
10	47 deg.S	---

Timeline of HimawariCloud HSF Imagery data Distribution

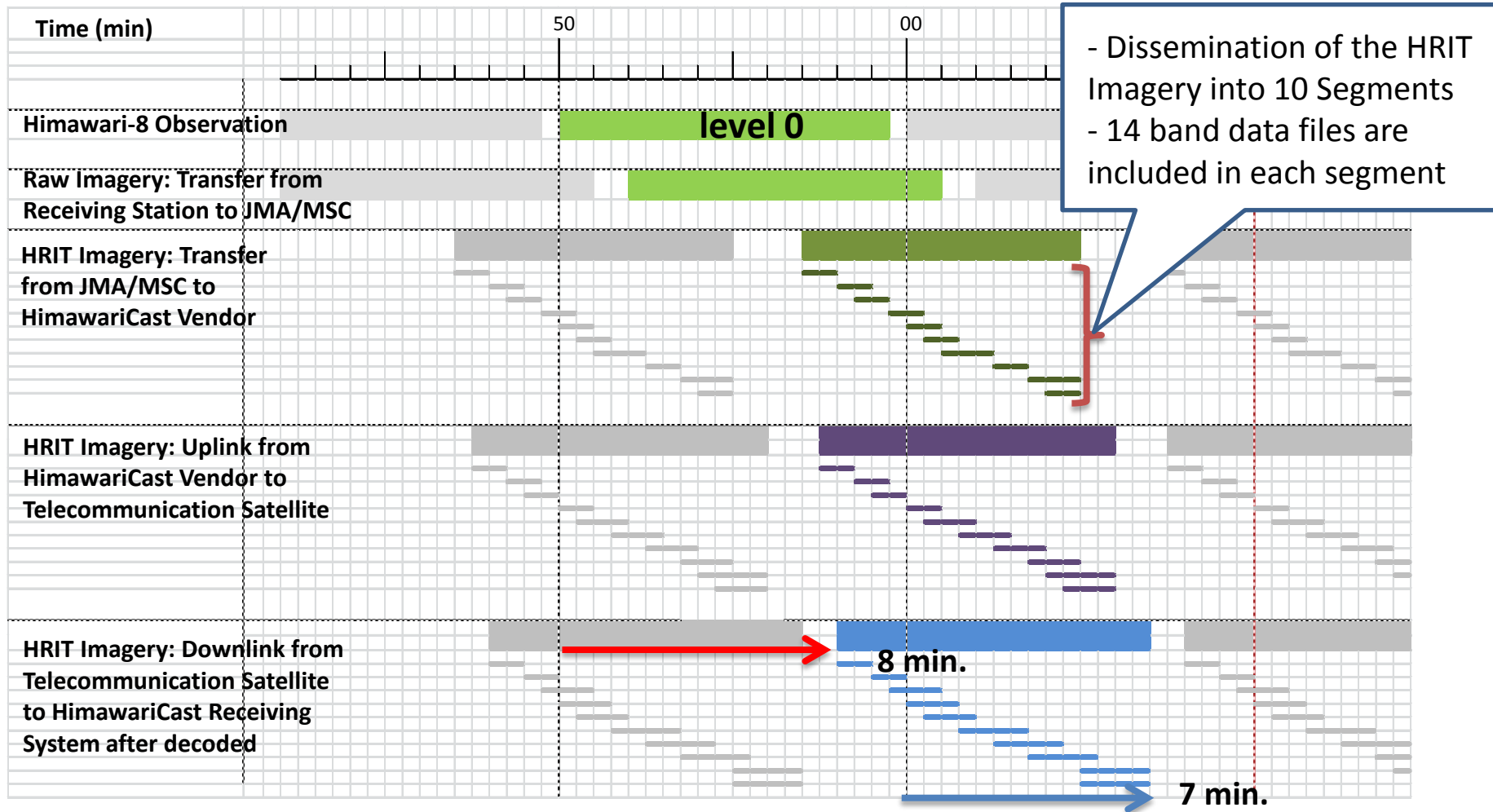
time is rounded in minutes based on the past record at "peak time" (local noon after spring equinox)



The first Segment Imagery Data will be ready to pull **within 7 min. after observation start time** (the last Segment within 4-5 min. after observation end time)

Timeline of HimawariCast HRIT Imagery data Dissemination

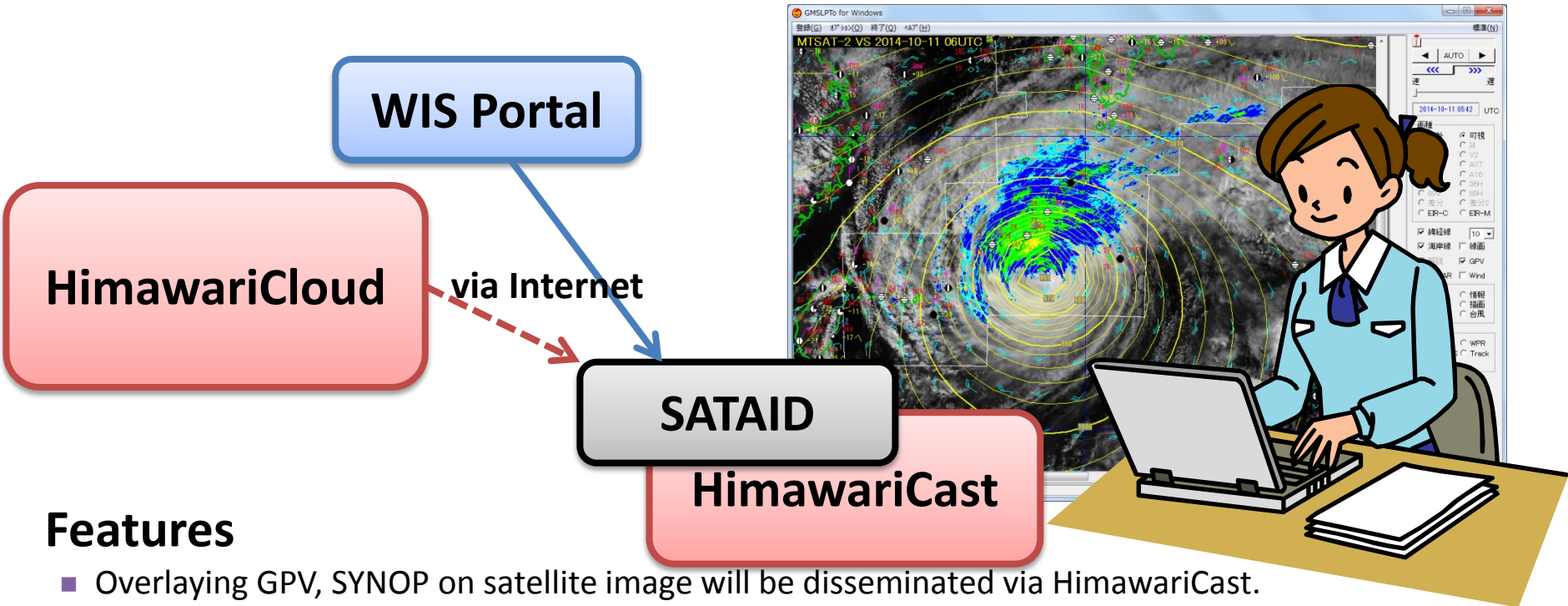
time is rounded in minutes based on the past record at "peak time" (local noon before spring equinox)



The first segment data is to be disseminated **within 8 min. after observation start time** (the last segment data within 7 min. after observation end time)

HimawariCast with SATAID

HimawariCast provides
an Integrated Environment for Satellite Cloud Imagery Analysis
with overlaying weather radar, GPV, SYNOP on SATAID system



Features

- Overlaying GPV, SYNOP on satellite image will be disseminated via HimawariCast.
- Satellite image in SATAID format can be downloaded from WIS Portal server, or you can convert from HRIT image data.
- SATAID System will be available from MSC Website with “Source Code”
- Image data format converter between HRIT and SATAID/NetCDF will be provided from MSC Website
- Handling Tools for reading Image Data in NetCDF format will also be provided from MSC Website for the further use in GIS applications.

Archived Servers

Operated by Japanese Science Group

The following Himawari Historical Data Servers are operated by Japanese Science Group on a voluntary basis for Non-Profit R&D Users

- **Chiba University Data Server**
CEReS (Center for Environmental Remote Sensing)
- **NICT Himawari-8 Real-time Web**
<http://himawari8.nict.go.jp/>
- **JAXA Himawari Monitor**
<http://www.eorc.jaxa.jp/ptree/index.html>
- **University of Tokyo**
DIAS (Data Integration and Analysis System)
(in preparation for operation)

HIMAWARI-8 Image Navigation & Calibration Status

Himawari-8 Image Navigation Estimated from "Coast Line" Analysis

Image Navigation
for band 13 (10.4 μ m)

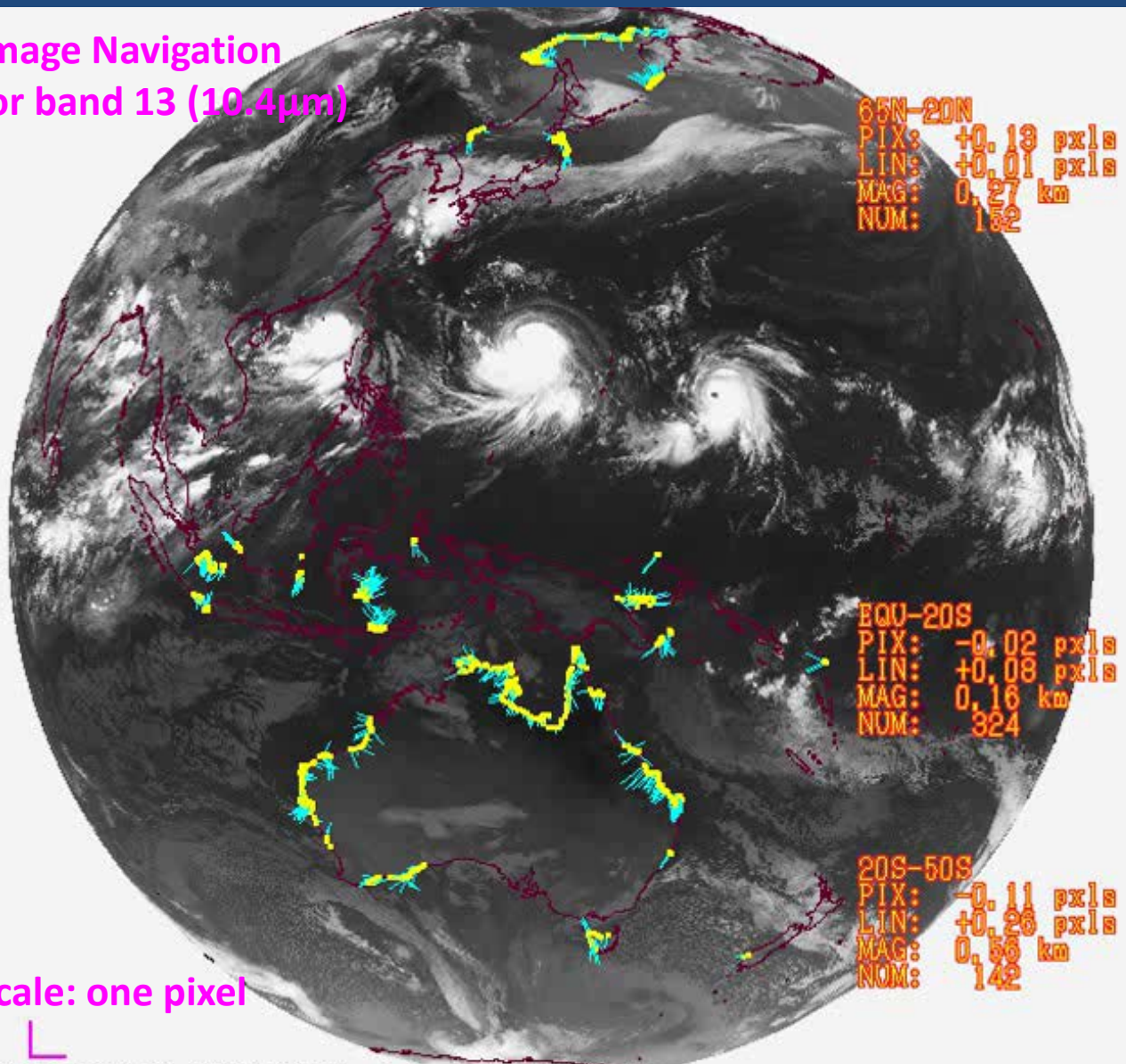


Image navigation
accuracy is mostly
less than 0.3 pixels

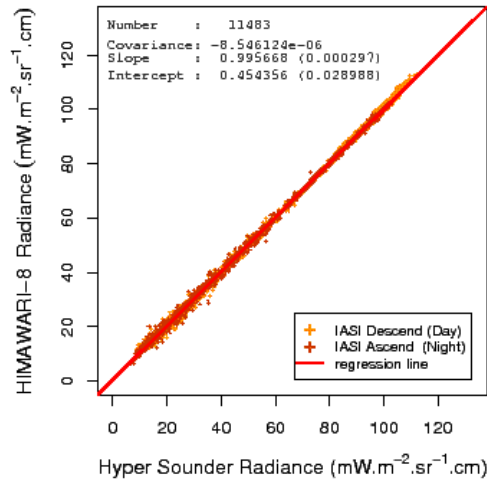
Scale: one pixel

MEAN OF VECTOR MAGNITUDES(pxls): 0.16(=0.3 km)
MEAN VECTOR(pxls): PIX -0.00, LIN +0.10, MAG 0.10(=0.2 km), # OF SAMPLES: 618

Validation of IR Bands Calibration based on GSICS inter-calibration

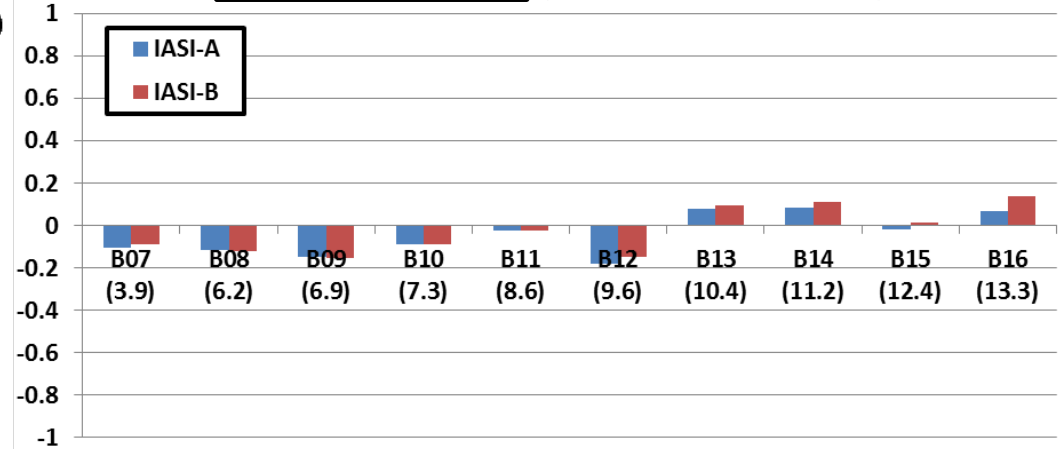
Radiance

HIMAWARI-8 BAND13 vs. METOP-A/IASI
27 Jul 2015 (Period: 13 Jul 2015 to 10 Aug 2015)



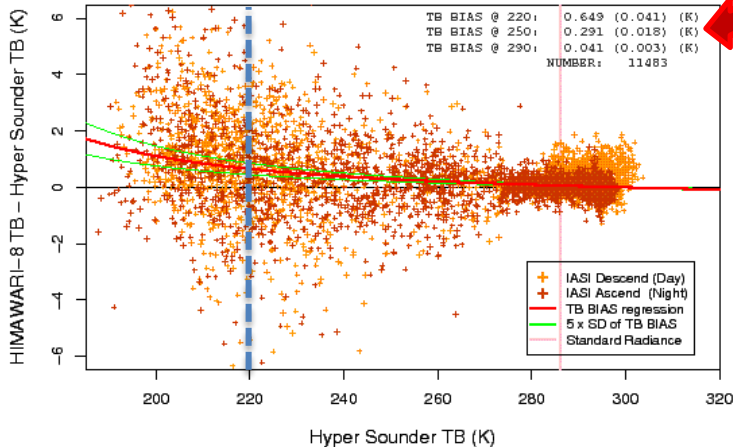
Tb Bias

(at standard radiance)



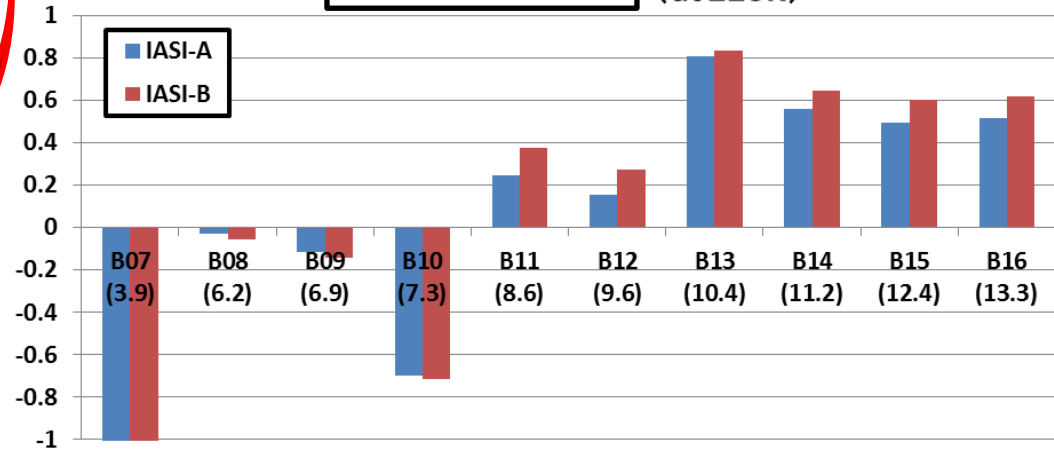
Brightness Temp. (Tb)

HIMAWARI-8 BAND13 vs. METOP-A/IASI
27 Jul 2015 (Period: 13 Jul 2015 to 10 Aug 2015)



Tb Bias

(at 220K)



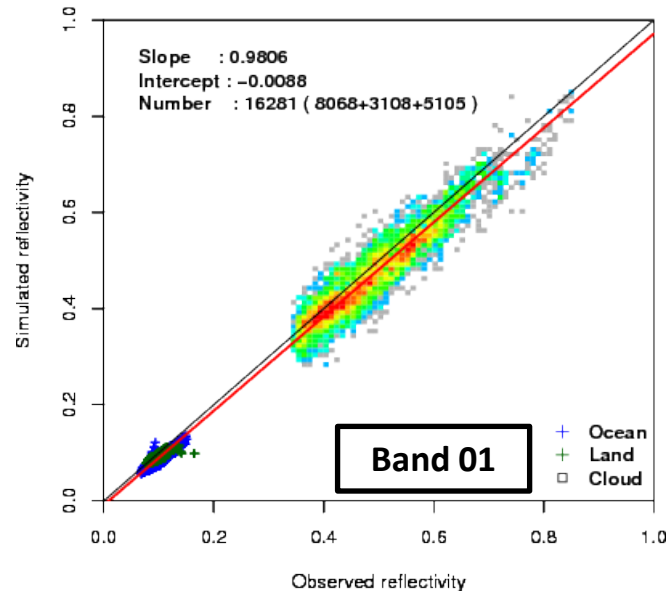
* Standard Radiance was calculated under clear sky condition over the ocean in nighttime by RTTOV 11.2 with US standard atmosphere (1976)

Validation of VIS/NIR Bands Calibration for Himawari-8 Imagery

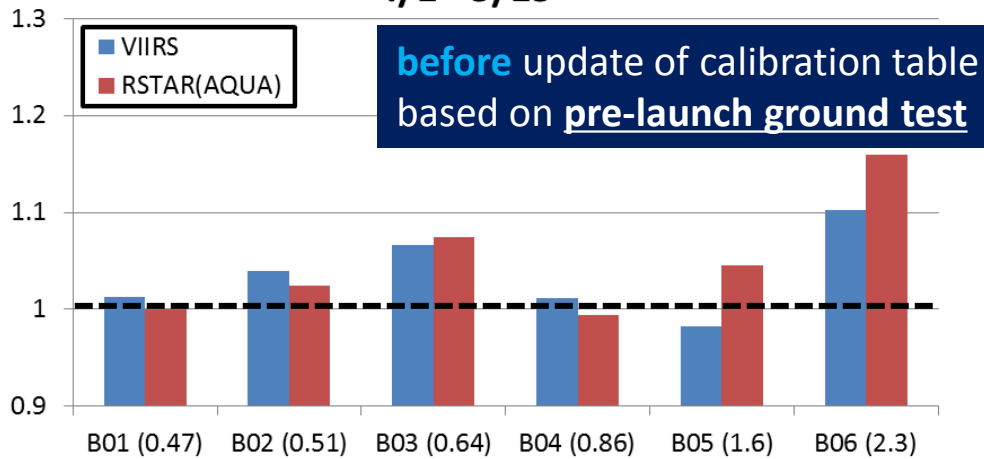
- Two ways of validation results are well agreed
- Ratio to observed AHI reflectivity are around 1.0 for all VIS/IR bands
- However, it differs in property between B01-04 and B05-06

Radiative Transfer Simulation with RSTAR

29 May 2015 to 21 Jun 2015

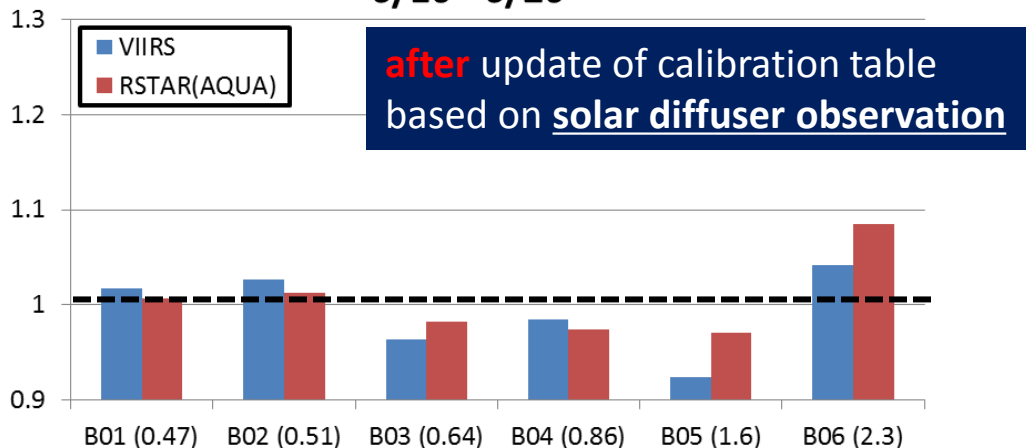


4/1 - 5/15

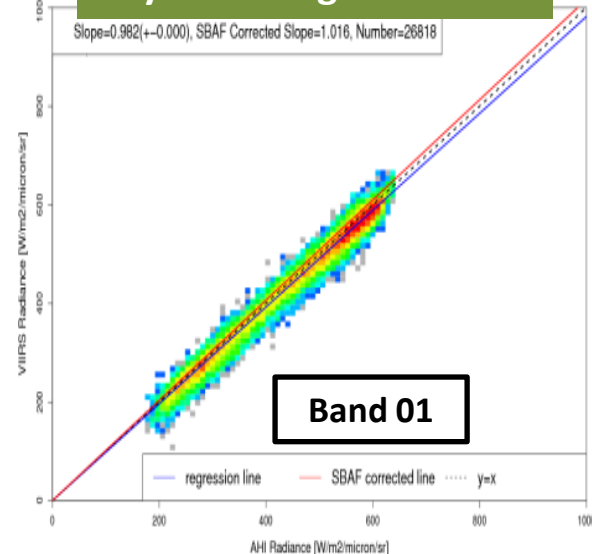


Updating calibration coefficients on 8 June, 2015

6/10 - 6/20



Ray-matching with VIIRS



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

Himawari-8 Operation Status

ATTENTION

- This website renewed with Himawari-8 operation starting on 7 July, 2015.

Information

- The Sixth Asia/Oceania Meteorological Satellite Users' Conference (AOMSUC-6) Venue decided (8 June 2015)
- Himawari-8 is scheduled to start operation at 02 UTC on 7 July 2015 (27 May 2015)
- Collection of images captured by Himawari-8 (1 May 2015)
- The Sixth Asia/Oceania Meteorological Satellite Users' Conference (AOMSUC-6) First Announcement (12 March 2015)
- Test dissemination of Himawari-8 imagery via the HimawariCast service. (12 March 2015)
- Detailed information on utilization of HimawariCloud service (11 March 2015)

Imagery Calibration

HIMAWARI-8 Infrared Band

- Band07 (3.9 μm)
- Band08 (6.2 μm)
- Band09 (6.9 μm)
- Band10 (7.3 μm)
- Band11 (8.6 μm)
- Band12 (9.6 μm)
- Band13 (10.4 μm)
- Band14 (11.2 μm)
- Band15 (12.4 μm)
- Band16 (13.3 μm)

LEO Data

- AIRS (all)
- IASI-A (all)
- IASI-B (all)
- CRIS (all)
- AIRS (asc, 1:30pm)
- AIRS (des, 1:30am)
- IASI-A (des, 9:30am)
- IASI-A (asc, 9:30pm)
- IASI-B (des, 9:30am)
- IASI-B (asc, 9:30pm)
- CRIS (asc, 1:30pm)
- CRIS (des, 1:30am)

Time Sequence

- TB difference
- Regression coef.

Statistics for GSICS Correction

- Scatter plot (DN)
- Scatter plot (Rad)

Imagery Navigation

Now Selected: 0040, 14 Aug. 2015

BAND: B07 B13

Image:

0000	1200
0010	1210
0020	1220
0030	1230
0040	1240
0050	1250
0100	1300
0110	1310
0120	1320
0130	1330
0140	1340
0150	1350
0200	1400
0210	1410
0220	1420
0230	1430
0240	1440
0250	1450
0300	1500

2016:Aug.

Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

2016:Aug.

Su	Mo	Tu	We	Th	Fr	Sa
						1
3	4	5	6	7	8	
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

MEAN OF VECTOR MAGNITUDES (pix): 0.21(+0.4 ka)
MEAN VECTOR (pix): PIX 40, 11; LIN 40, 11; MAG 0, 20(+0.4 ka), # OF SAMPLES: 733

This landmark analysis image is posted about 10 minutes after the end of its observation. [In Image]

Yellow point: Landmark point

Cyan line: B13 vs. landmark

Green line: B07 vs. landmark

Purple line: B03 vs. landmark

Orange line: The others band vs. landmark

[At left bottom outside image]

Purple line: Reference vector showing one pixel length at that band.

Cyan line: Averaged displacement vector, whose component values are printed at the left bottom.

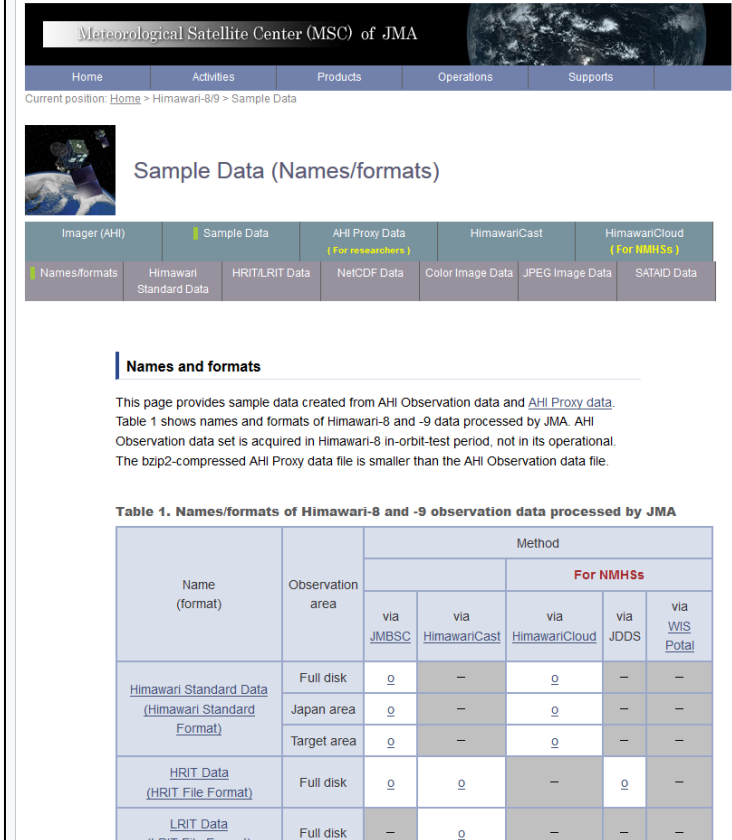
<http://www.jma-net.go.jp/msc/en/index.html>

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



Meteorological Satellite Center (MSC) of JMA

Home Activities Products Operations Supports

Current position: Home > Himawari-8/9 > Sample Data

Sample Data (Names/formats)

Imager (AHI)	Sample Data	AHI Proxy Data (For researchers)	HimawariCast	HimawariCloud (For NMHSs)		
Names/formats	Himawari Standard Data	HRIT/LRIT Data	NetCDF Data	Color Image Data	JPEG Image Data	SATAID Data

Names and formats

This page provides sample data created from AHI Observation data and [AHI Proxy data](#). Table 1 shows names and formats of Himawari-8 and -9 data processed by JMA. AHI Observation data set is acquired in Himawari-8 in-orbit-test period, not in its operational. The bzip2-compressed AHI Proxy data file is smaller than the AHI Observation data file.

Table 1. Names/formats of Himawari-8 and -9 observation data processed by JMA

Name (format)	Observation area	Method				
		For NMHSs				
		via JMBSC	via HimawariCast	via HimawariCloud	via JDDS	via WIS Portal
Himawari Standard Data (Himawari Standard Format)	Full disk	o	—	o	—	—
	Japan area	o	—	o	—	—
	Target area	o	—	o	—	—
HRIT Data (HRIT File Format)	Full disk	o	o	—	o	—
LRIT Data (LRIT File Format)	Full disk	—	o	—	—	—

Feel free to contact:

Satellite Program Division, Japan Meteorological Agency

metsat@met.kishou.go.jp

Enhancement in HIMAWARI-8 Level-2 Products

Development of L2 Products from Himawari-8/9 AHI

Increased Observation Spectral Bands

VIS: 1 --> 3

NIR/IR : 4 --> 13

with Higher Resolution

Spatial:

1km --> 0.5km for a VIS channel

4km --> 2 km for IR channels

Temporal:

1 hr --> 10 min for a full disk scan

2.5min for limited areas

Development of Baseline Products, focusing on

- Atmospheric Motion Vectors (AMVs)
- Cloud Properties (incl. Rapidly Developed Convective Clouds)
- Aerosol (incl. Asian Dust) / Volcanic Ash

Numerical Prediction

Severe Weather
Monitoring

Environmental Monitoring

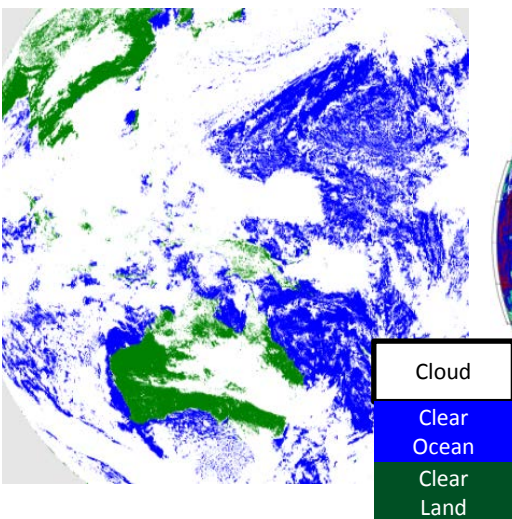
Cloud Products from Himawari-8/9 AH1

- **Extracted Parameters: Cloud Mask, Type, Phase, and Top Height**
- **Algorithm is based on NWC-SAF*¹ and NOAA/NESDIS*²**

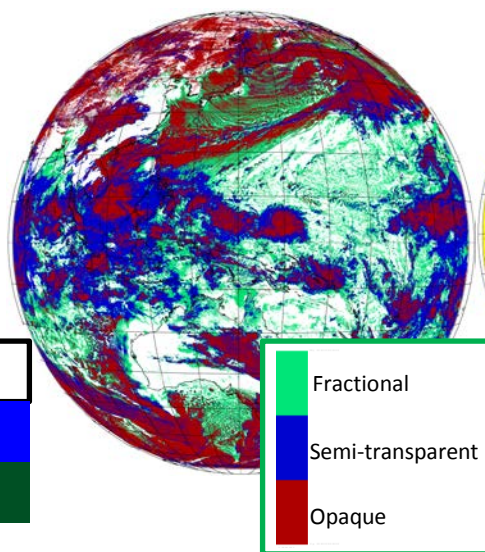
(*1) Meteo-France 2012: Algorithm Theoretical Basis Document for “Cloud Products” (CMa-PGE01v3.2, CT-PGE02 v2.2 & CTHH-PGE03 v2.2)
<http://www.nwcsaf.org/HD/MainNS.jsp>

(*2) Andrew Heidinger, 2011: ABI Cloud Mask, NOAA NESDIS CENTER for SATELLITE APPLICATIONS and RESEARCH ATBD
<http://www.goes-r.gov/products/baseline.html>

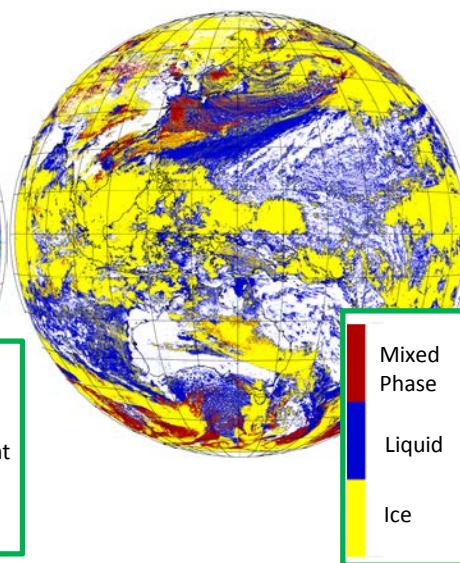
Cloud Mask



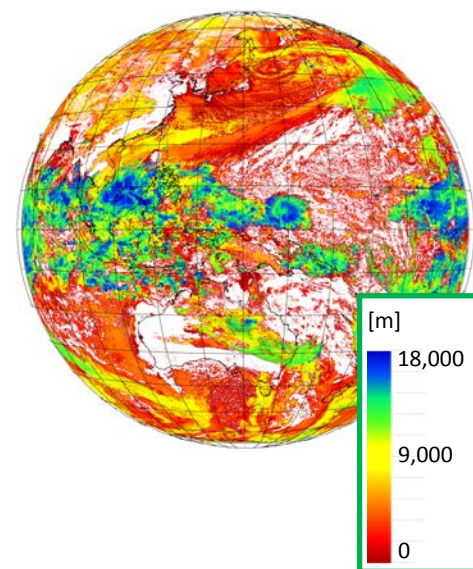
Type



Phase



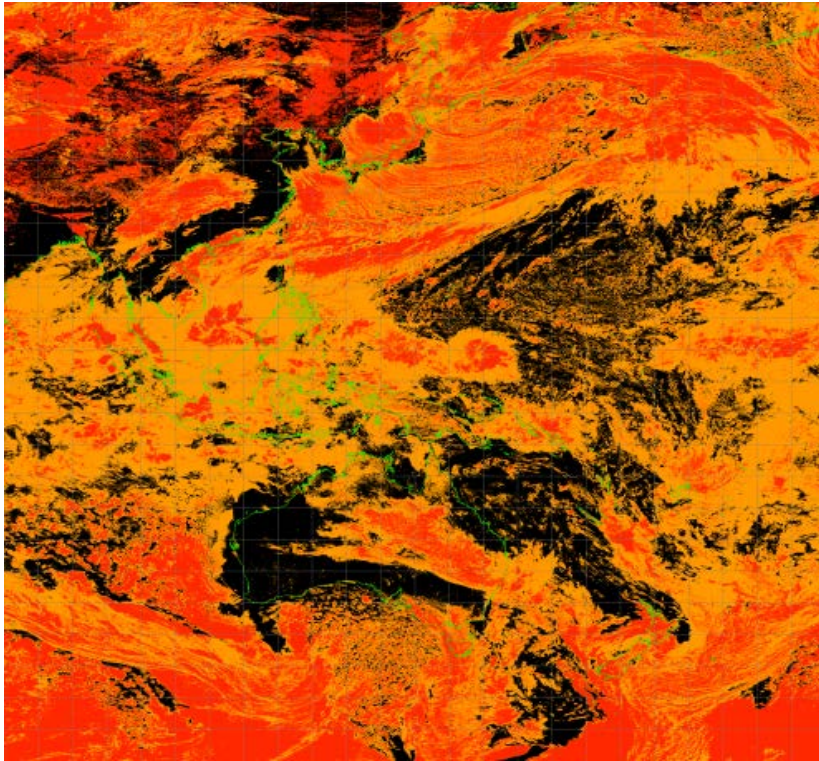
Cloud Top Height



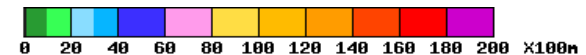
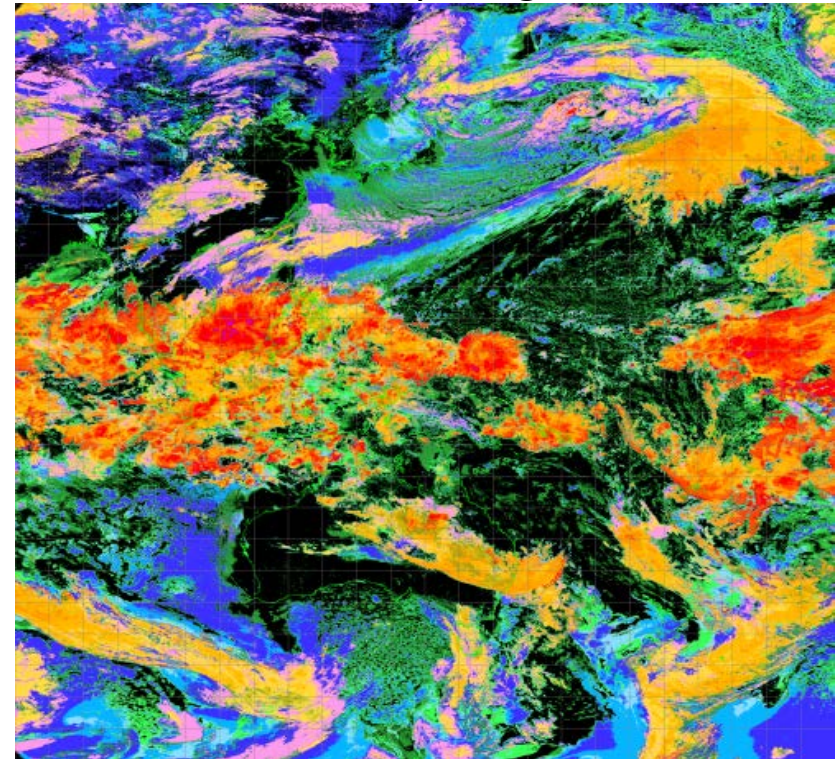
Objective Cloud Analysis Information (OCAI)

- Basic cloud product with latitude-longitude grid in 0.05 degree.
 - cloud mask, cloud type and cloud top height
- Be produced hourly
- Started to provide to NMHSs, e.g. Indonesia and Myanmar, in response to requests.

Cloud Mask



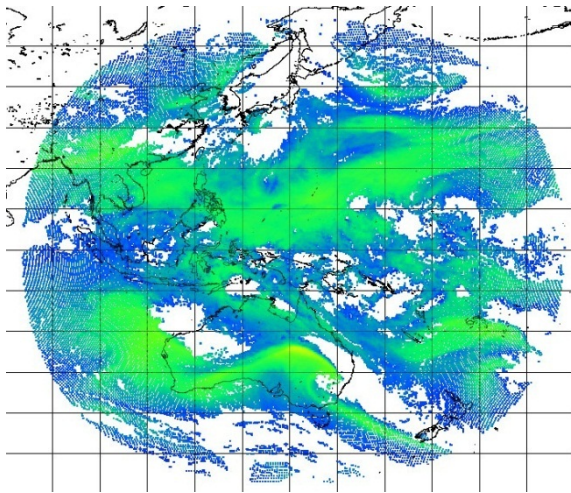
Cloud Top Height



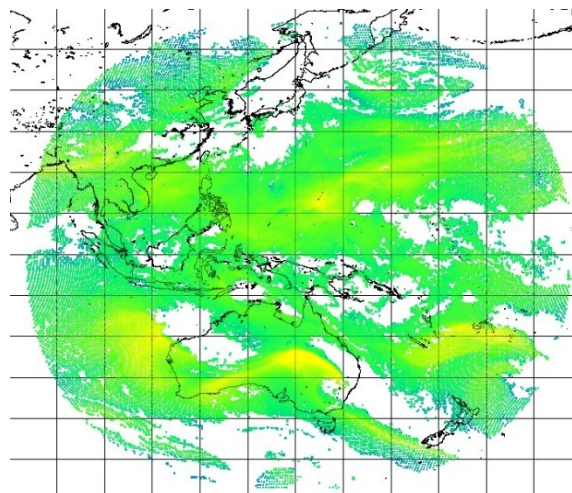
Clear Sky Radiances (CSRs)

- Area averaged clear sky radiance and brightness temperature.
- Specifications:
 - All IR bands (3.9, 6.2, 6.9, 7.3, 8.6, 9.6, 10.4, 11.2, 12.4, 13.3 μm)
 - Full disk, Hourly produced
 - Spatial resolution (size of area for averaging): 16 x 16 pixel (IR) (32 x 32 km @SSP)

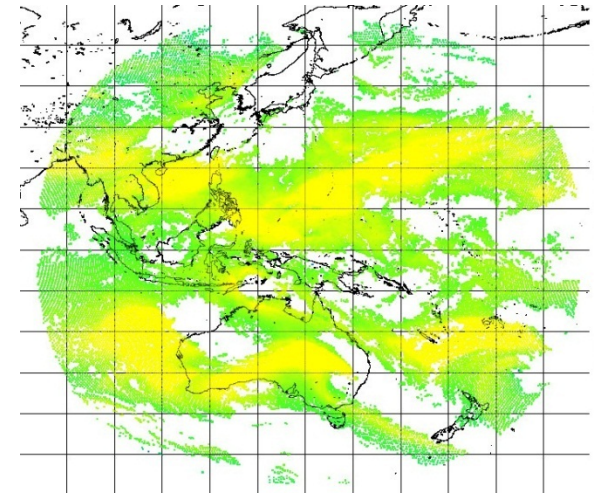
Band #8 (6.2 μm)



Band #9 (6.9 μm)



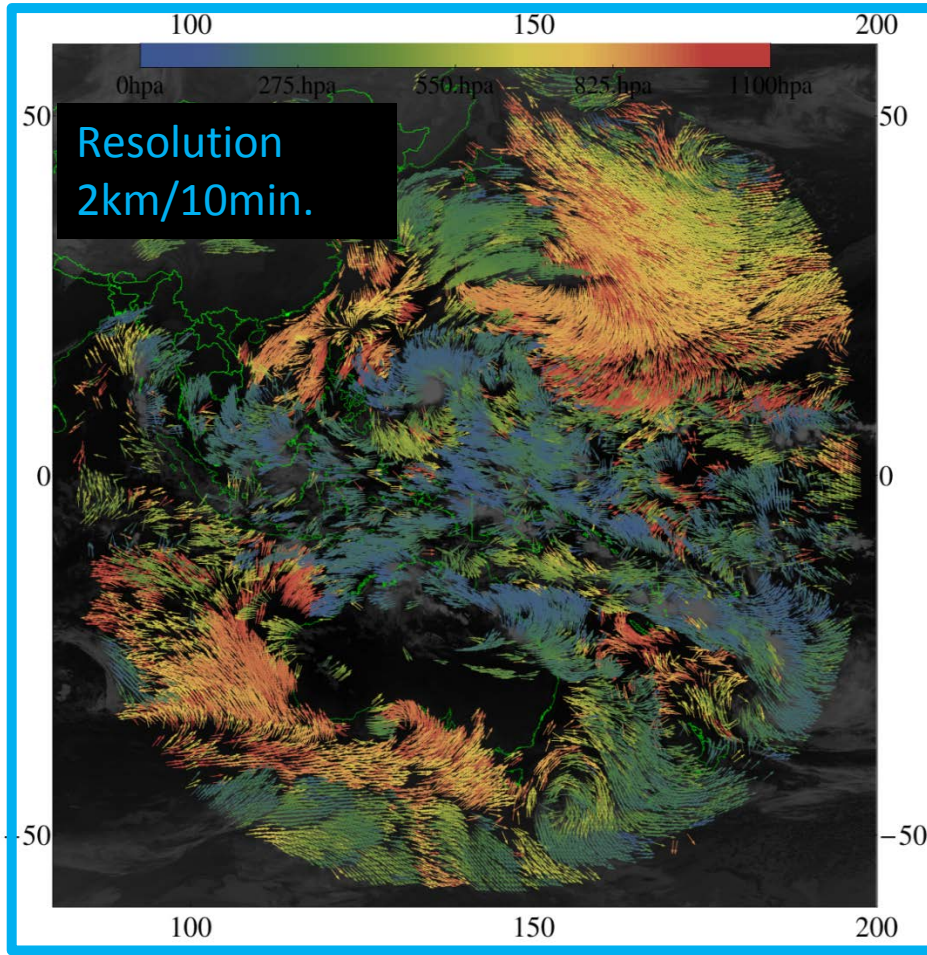
Band #10 (7.3 μm)



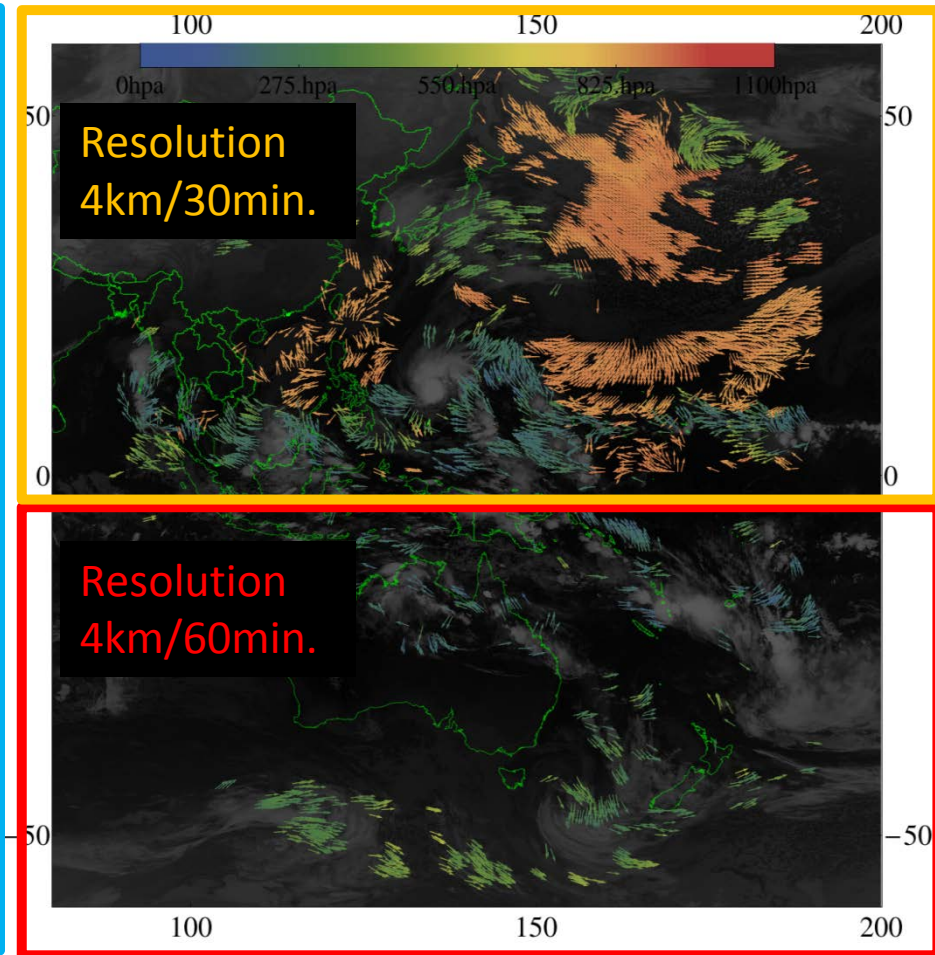
03 UTC 20 April 2015

Improvement in Atmospheric Motion Vectors (AMVs) Retrieval

Himawari-8 AMVs derived from Himawari-8 imagery with new algorithm



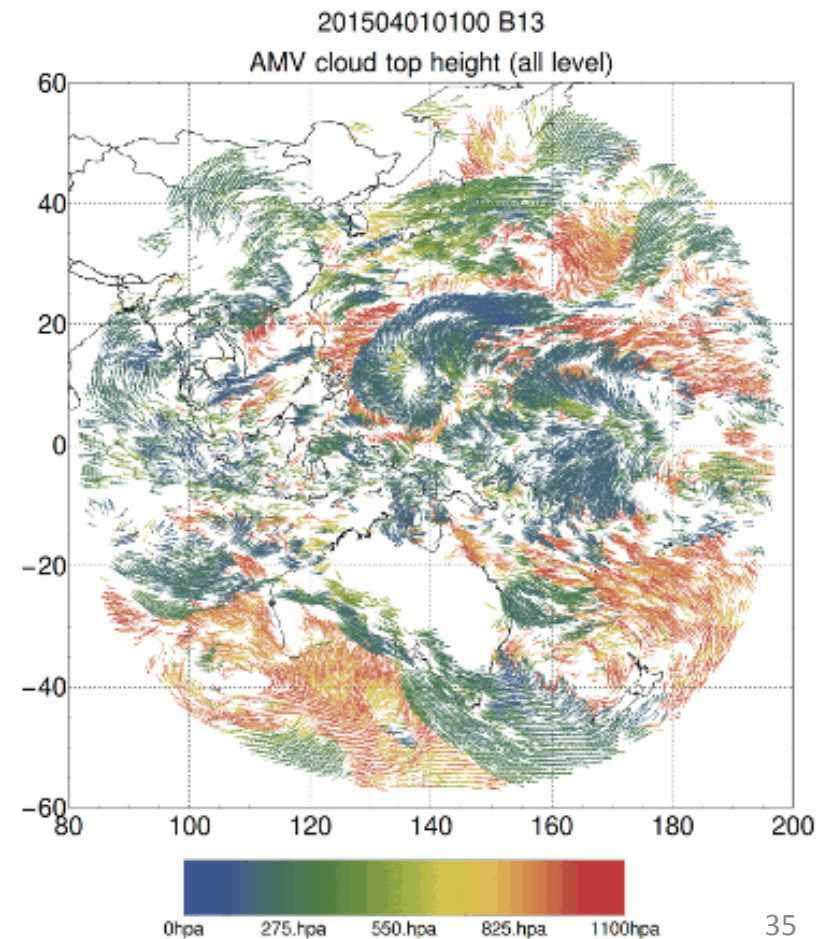
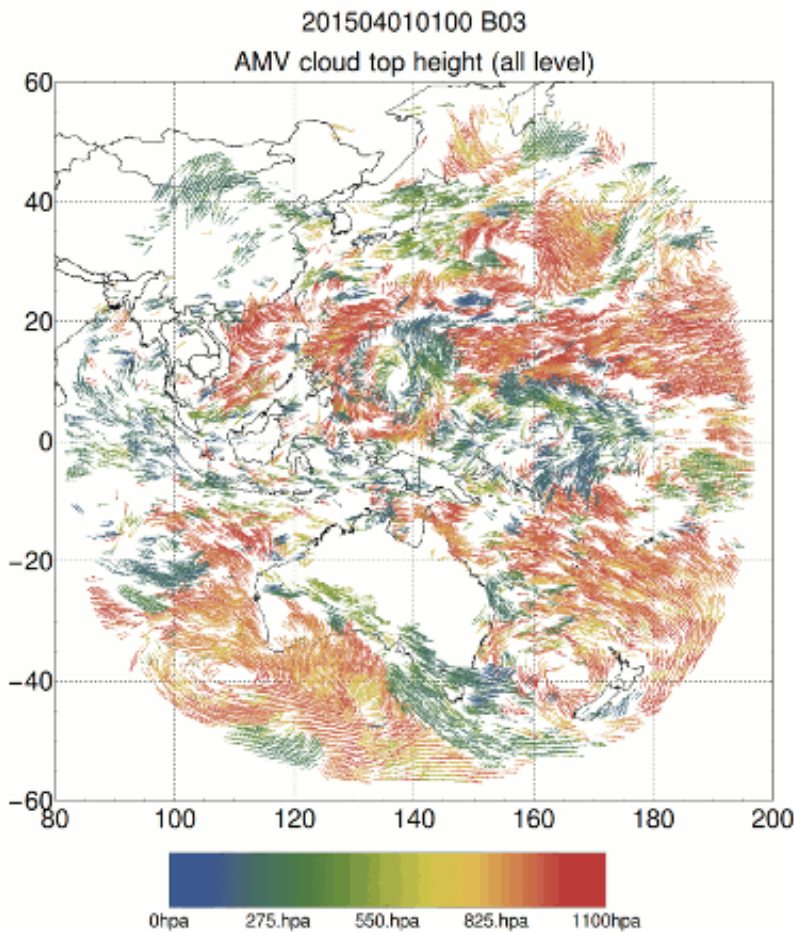
MTSAT-2 AMVs derived from MTSAT-2 imagery and heritage algorithm



Himawari-8 and MTSAT-2 IR AMV (QI>60, 2015 01 14 1700UTC)

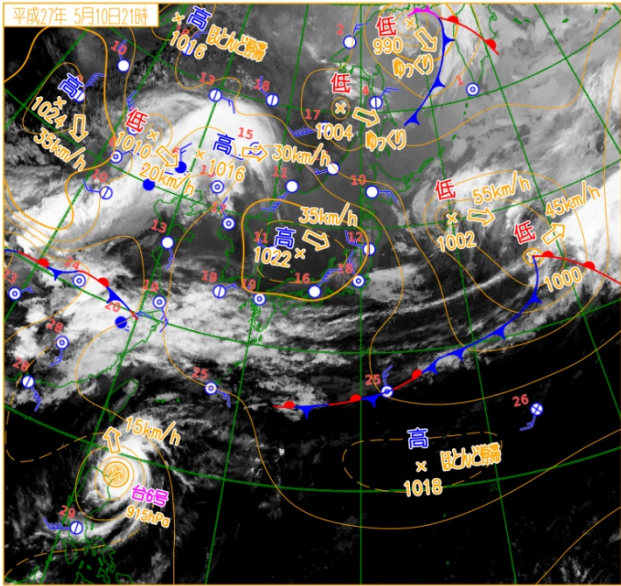
Atmospheric Motion Vectors (AMVs)

- JMA/MSC has developed a new algorithm for Himawari-8 AMVs based on an optimal estimation method for full exploitation of satellite data (Shimoji 2014).
- Validation results are informed to NWP users (IWW mailing list)



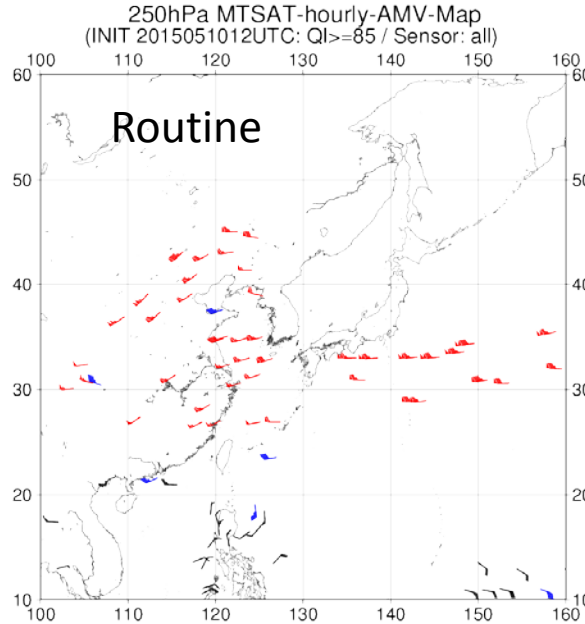
Case Study on Impact of Himawari-8 AMVs using JMA's global NWP system

A sample of the assimilated data distribution (12 UTC, 10 May 2015)

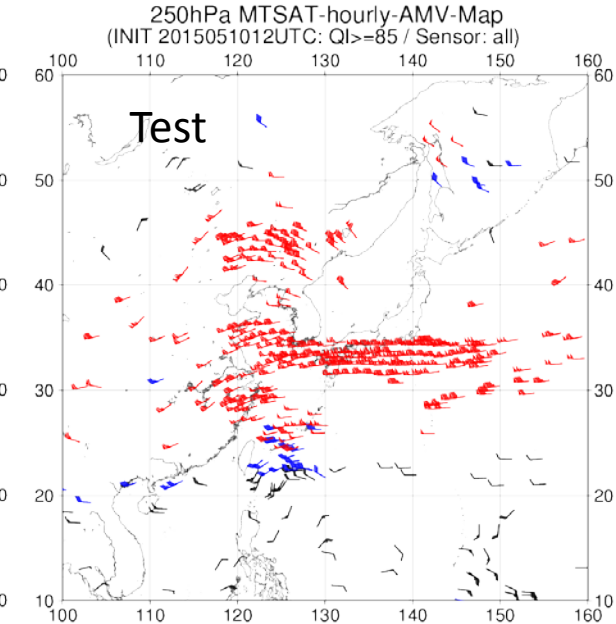


Weather chart with MTSAT-2 infrared satellite image

Red:	≥ 50 kt
Blue:	≥ 30 kt
Black:	< 30 kt



MTSAT-2 AMVs on 250 hPa in vicinity of Japan, which were assimilated into the routine system



Himawari-8 AMVs on 250 hPa in vicinity of Japan, which were assimilated into the test system

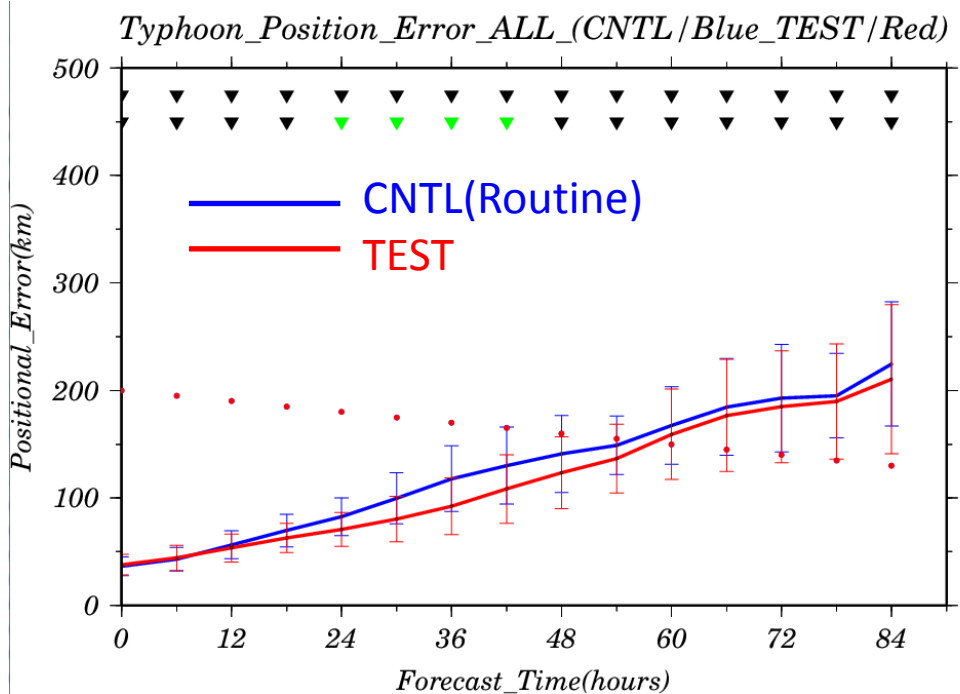
Himawari-8 AMVs were derived from three sequential satellite images with 10-minute time interval by a new retrieval method based on maximum likelihood estimation.

MTSAT-2 AMVs were derived from three sequential satellite images with 15- or 30-minute time interval.

(Himawari-8 and MTSAT-2 AMVs used for this study were produced by Meteorological Satellite Center of JMA.)

Typhoon track forecasts using Himawari-8 AMVs

Impact of Himawari-8 AMVs compared to routine



Typhoon track forecast errors averaged for NOUL (T1506)

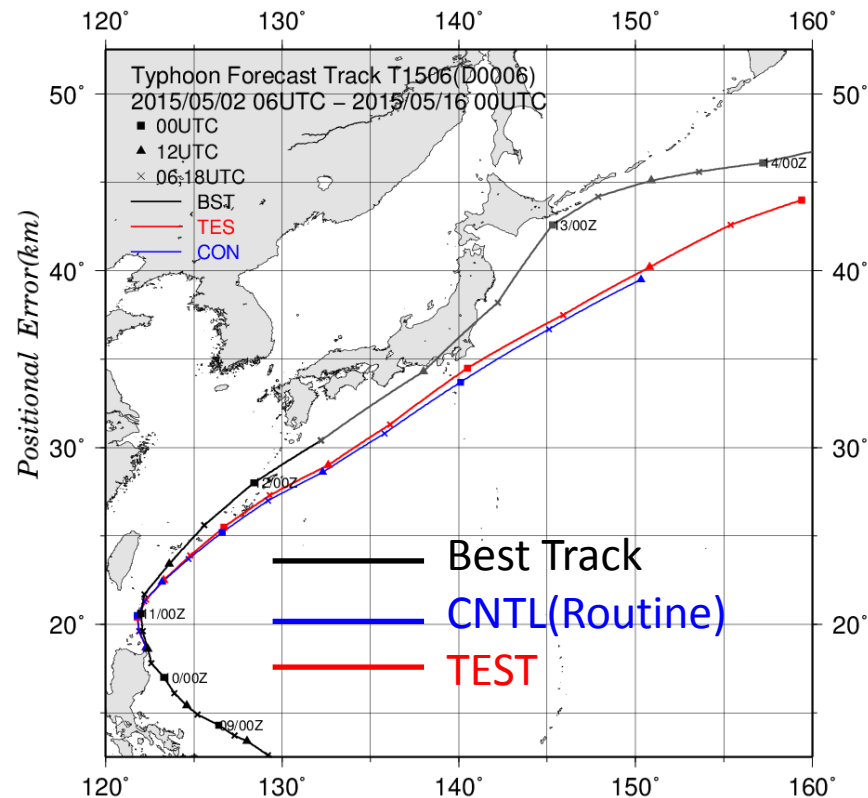
CNTL(Routine): Result by assimilating MTSAT-2 AMVs

TEST: Result by assimilating Himawari-8 AMVs

Period:

Assimilation : From 1 to 24 May 2015

Forecast : From 2 to 12 May 2015

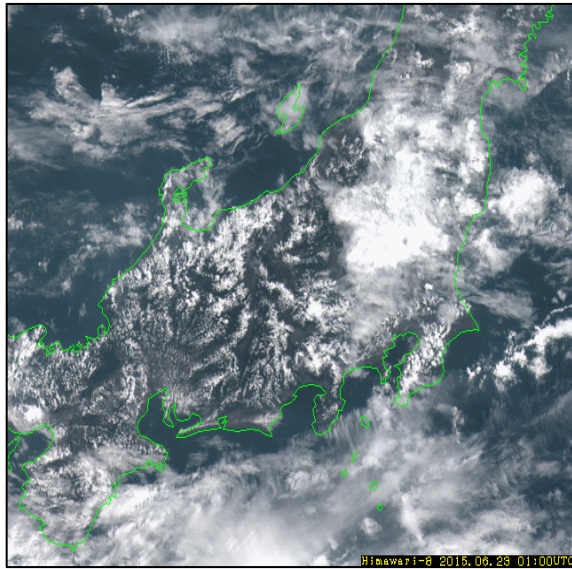


Typhoon track forecast of NOUL (T1506) initialized at 12 UTC on 10 May 2015.

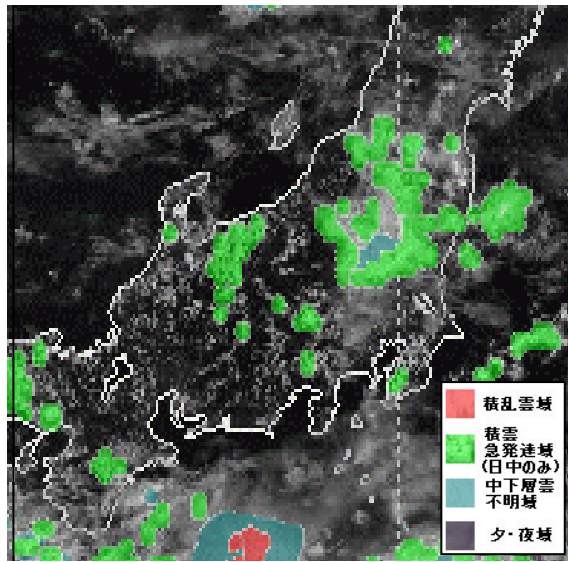
Black is the best track. **CNTL(Routine)** and **TEST** are same to the left panel.

Detection of Rapidly Developed Convective Clouds

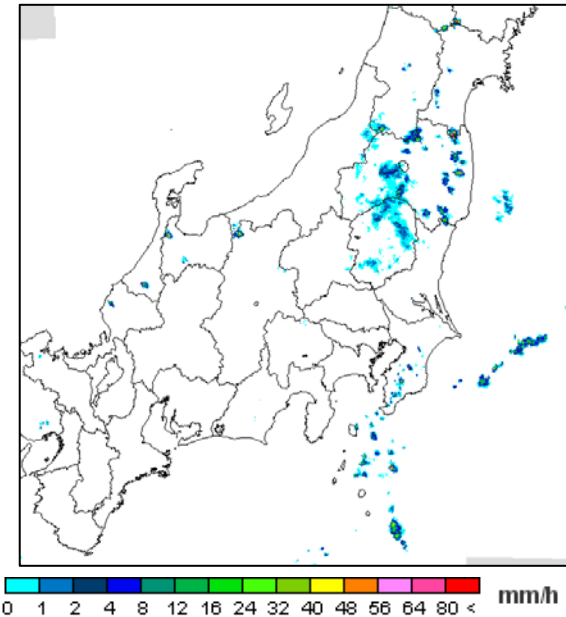
Himawari-8 Imagery



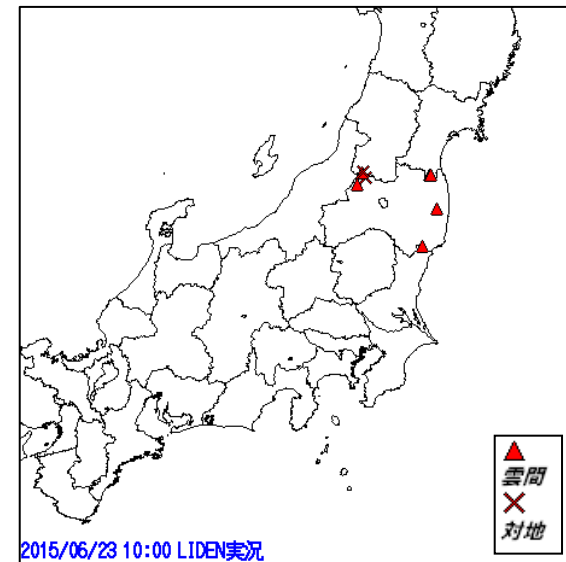
Information on Potential Area for Rapidly Developed Convective Cloud Area



JMA's Weather Radar System

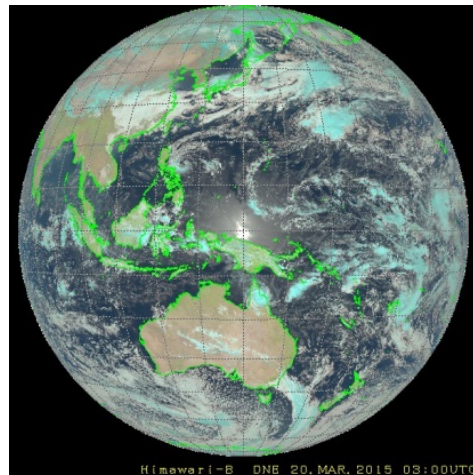


JMA's Lightning Detection System (LIDEN)

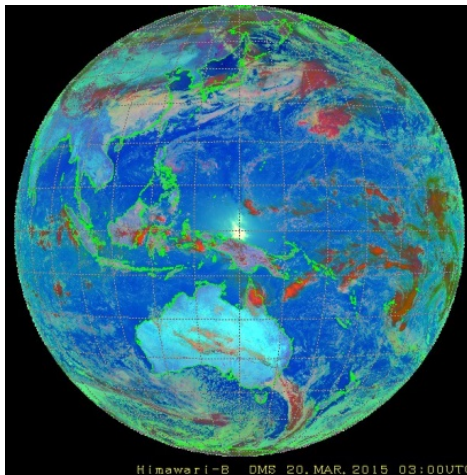


▲ Cloud - Cloud
 × 対地 Cloud - Ground

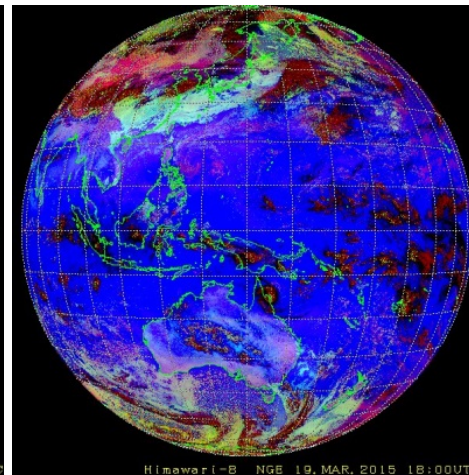
WMO/EUMETSAT RGBs Recipe



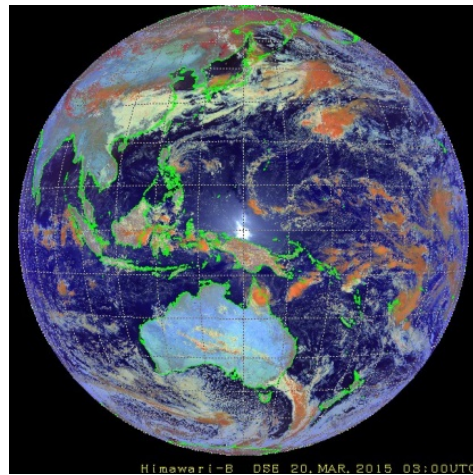
Day Natural Colors



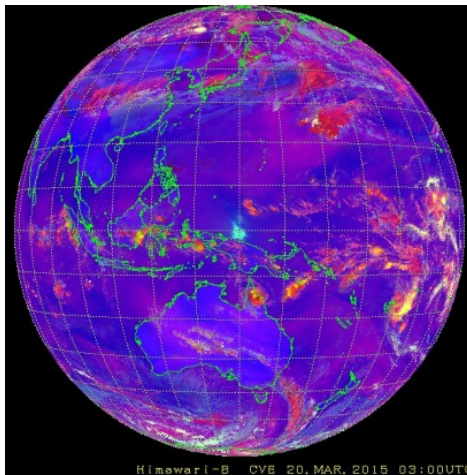
Day Microphysics



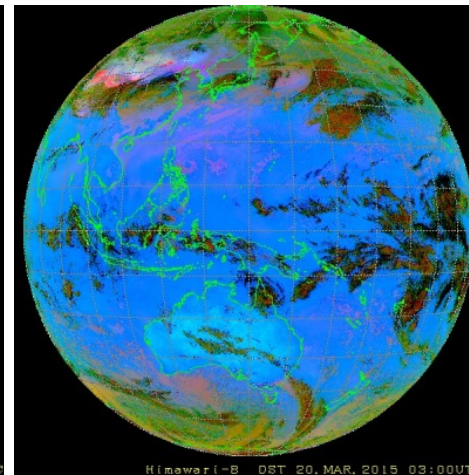
Night Microphysics



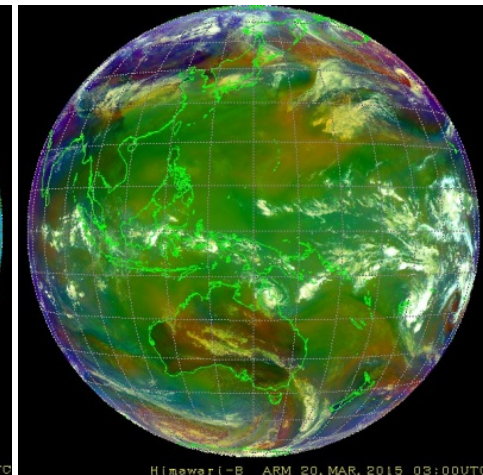
Day Solar



Convective Storms



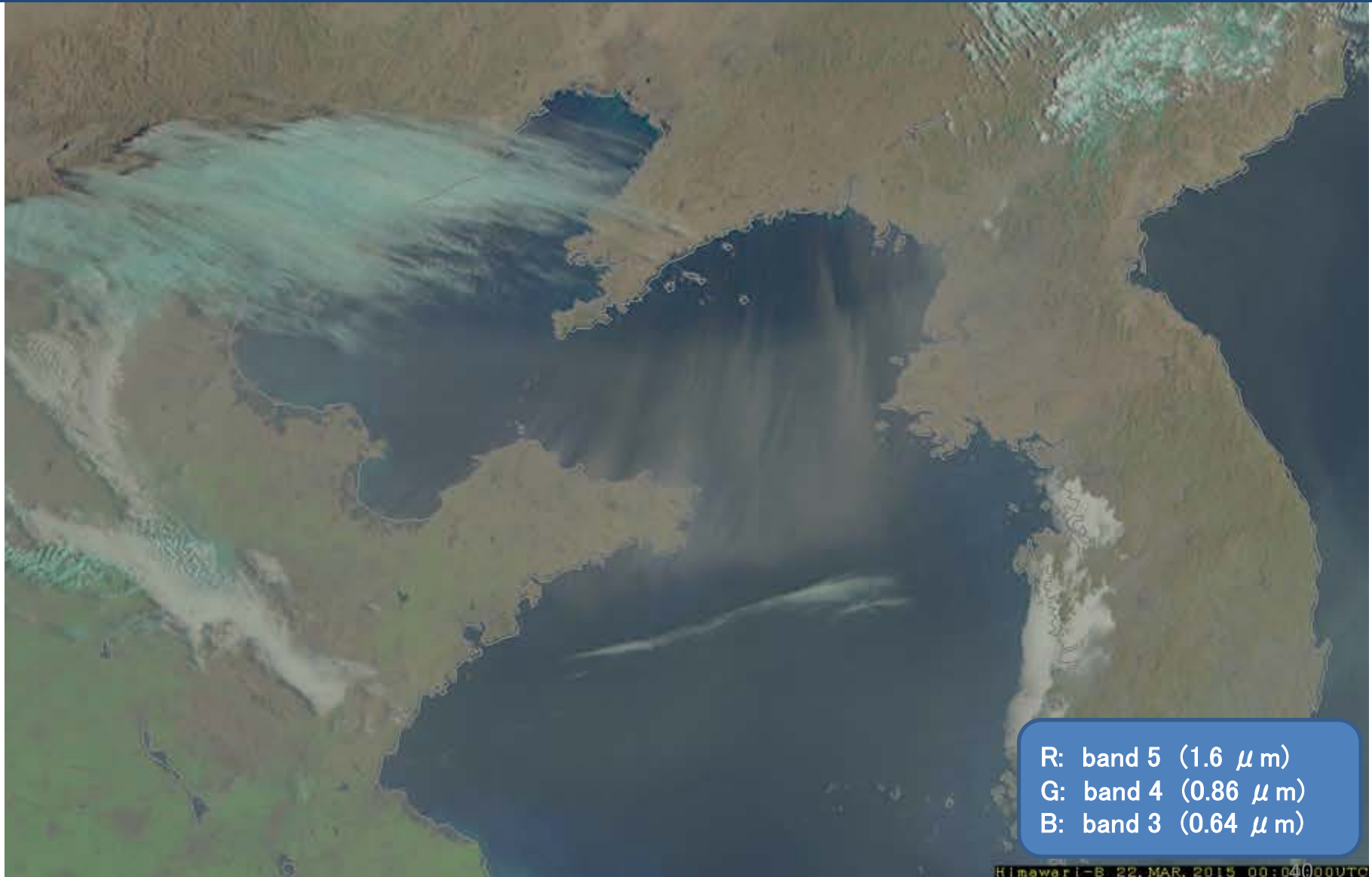
Dust



Airmass

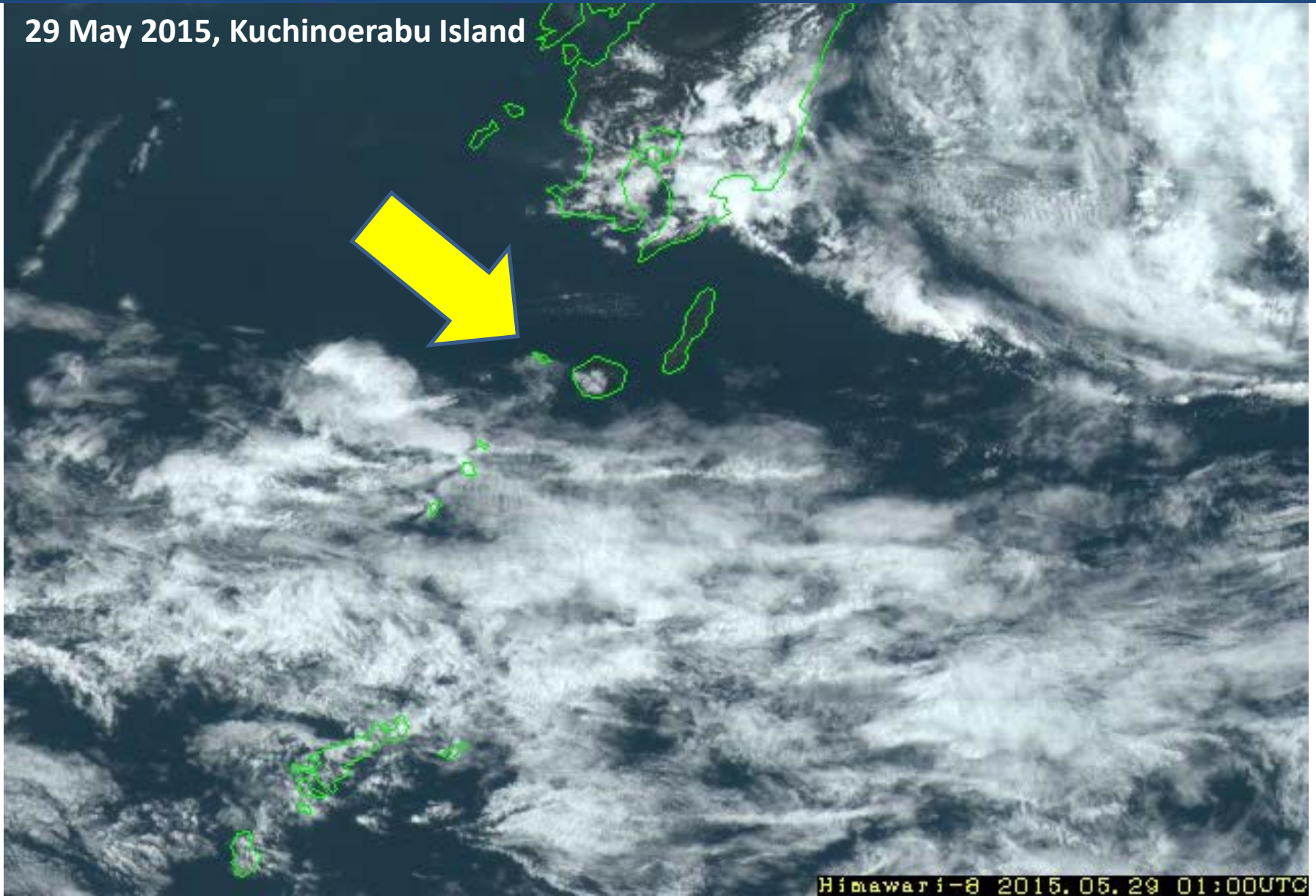
<http://oiswww.eumetsat.org/IPPS/html/MSG/RGB/>

Utilization of RGB Imagery: Visible and Near Infrared Detection of Aerosol (Asian Dust)



Utilization of RGB Imagery: Visible True Color Detection of Volcanic Ash and Gas from Volcano Eruption

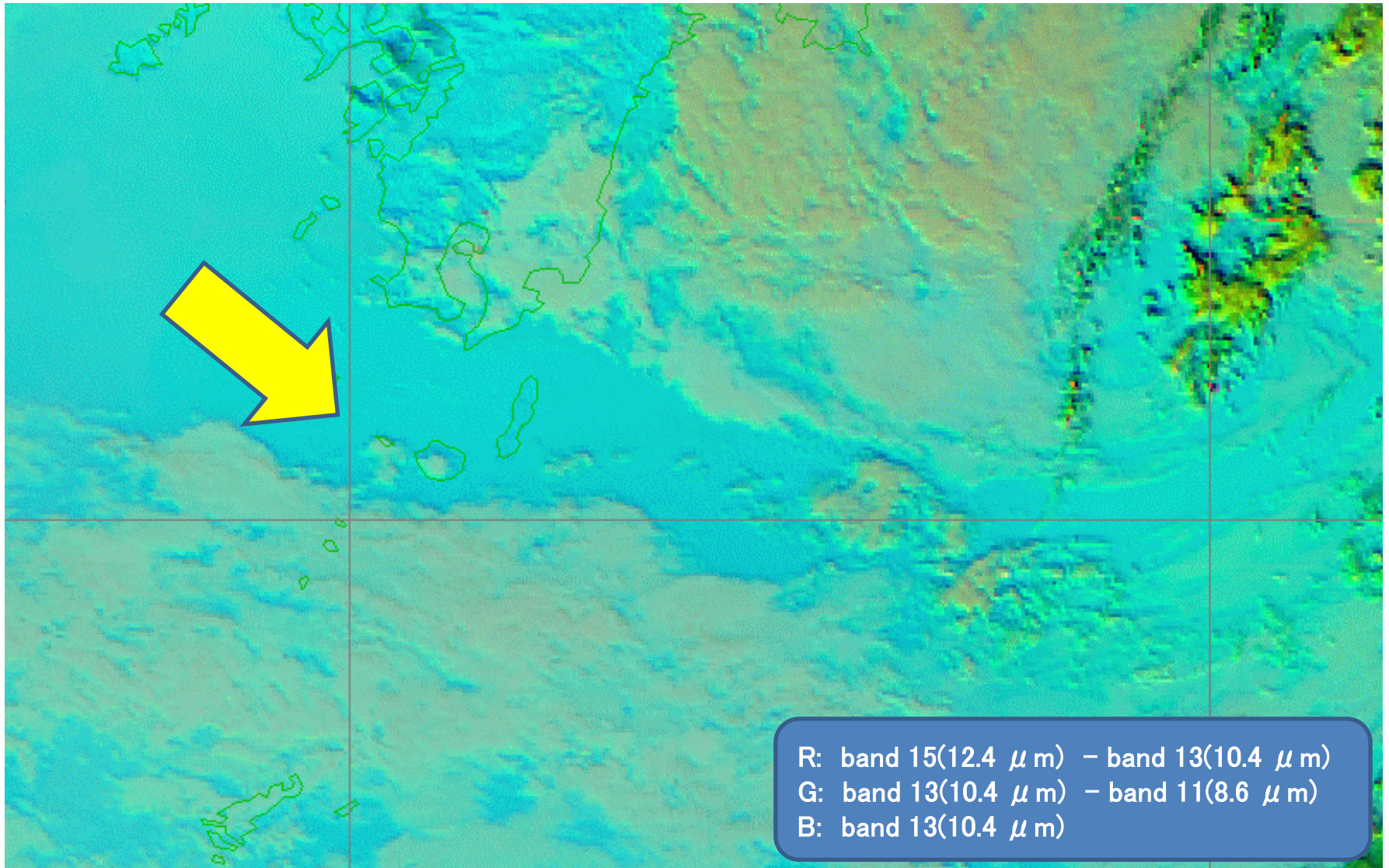
29 May 2015, Kuchinoerabu Island



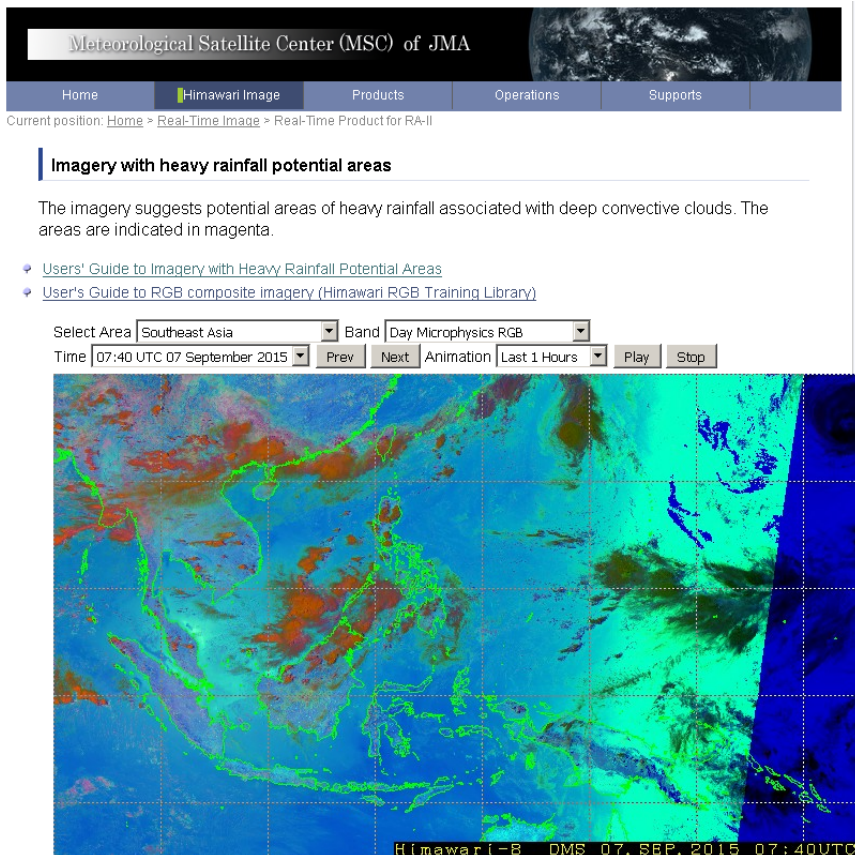
Utilization of RGB Imagery: SO₂ Band (8.6 μm)

Detection of Volcanic Ash and Gas from Volcano Eruption

29 May 2015, Kuchinoerabu Island



JMA real-time RGB Website for supporting SWFDP in RA II and SWFDDP in RA V



Meteorological Satellite Center (MSC) of JMA

Home | Himawari Image | Products | Operations | Supports

Current position: Home > Real-Time Image > Real-Time Product for RA-II

Imagery with heavy rainfall potential areas

The imagery suggests potential areas of heavy rainfall associated with deep convective clouds. The areas are indicated in magenta.

- Users' Guide to Imagery with Heavy Rainfall Potential Areas
- User's Guide to RGB composite imagery (Himawari RGB Training Library)

Select Area: Southeast Asia | Band: Day Microphysics RGB

Time: 07:40 UTC 07 September 2015 | Prev | Next | Animation | Last 1 Hours | Play | Stop

Himawari-8 DMS 07, SEP, 2015 07:40UTC

Day Microphysics RGB

JMA provides the Web site and the User's Guide documentation.

- RGB composite imagery based on the WMO standard recipe are produced from Himawari-8 imagery.

e.g. Day Microphysics, Night Microphysics.

- Products are provided for supporting SWFDP in RA II/RA V region.
- IR(10.8um), IR(3.9um), WV(6.8um), VIS(0.68um), and **Sandwich Imagery** are also provided.

Future plan

- Development of new RGB imagery or "localization" for typical weather phenomena in Asia/Oceania regions.

RGB Imagery are available from:

http://www.data.jma.go.jp/mscweb/data/himawari/sat_hrp.php?area=r2s

http://www.data.jma.go.jp/mscweb/data/himawari/sat_hrp.php?area=r5s

Thank you !!



Eruption of Mt. Shiveluch in Kamchatka
March 25, 2015
Footage from Himawari-8 Test Observation (Band-3 (0.64 μm), 2.5 min.)

Himawari-8 B03 25.MAR.2015 22:02:30UTC