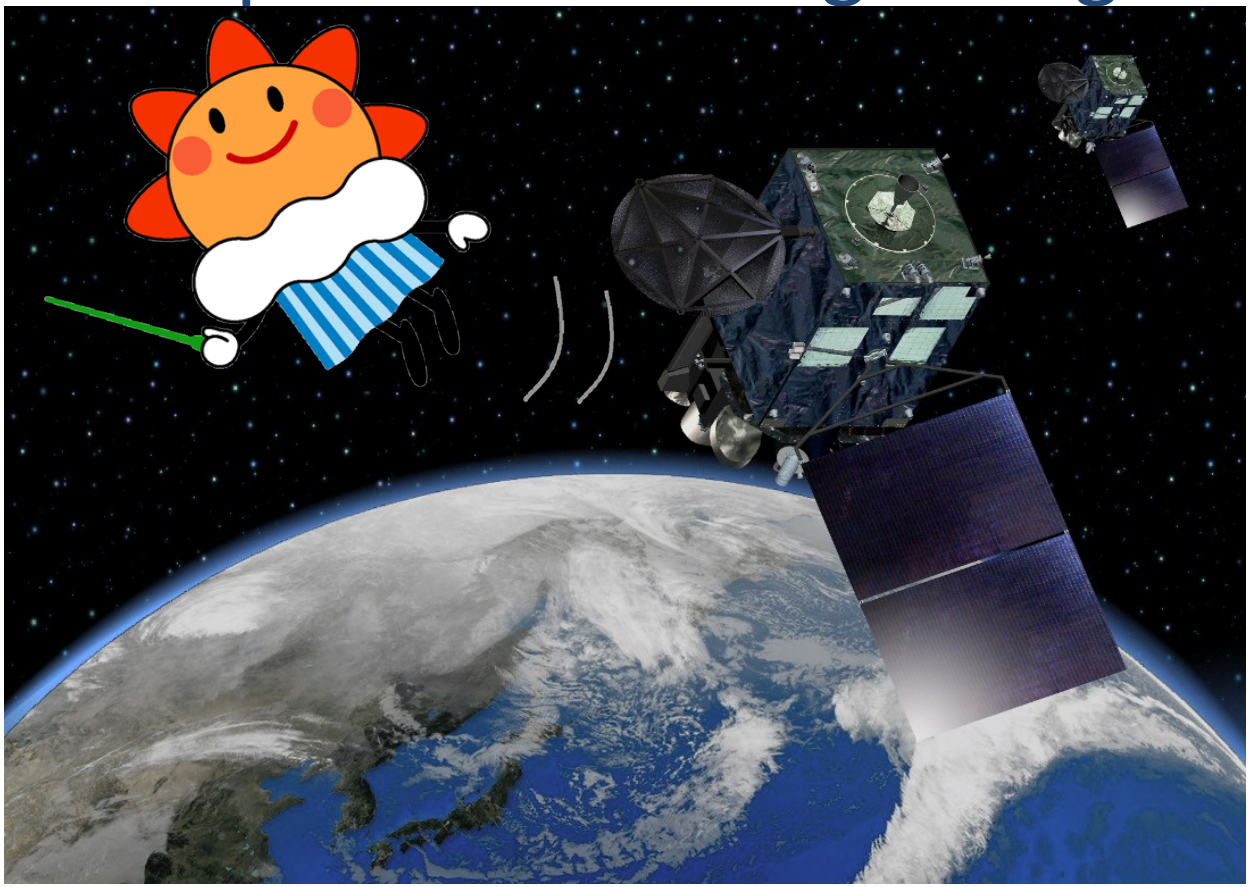
Status of Current and Future Satellite Programs of Japan Meteorological Agency



Masanori OBAYASHI, Satellite Program Division

Contents

1. History and Current Status

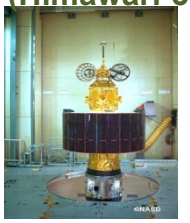
History of Japanese Geostationary Meteorological Satellites "Himawari"

GMS (Geostationary Meteorological Satellite)

GMS (Himawari) — Jul 1977

GMS-2 (Himawari-2) — Aug 1981

GMS-3 (Himawari-3) — Aug 1984



GMS-4 (Himawari-4) — Sep 1989

GMS-5 (Himawari-5) — Mar 1995

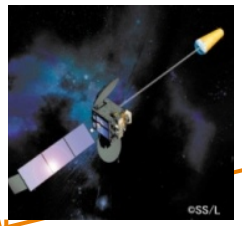
A Ranging Station for GMS was operated by Australian Bureau of Meteorology

(GOES-9)

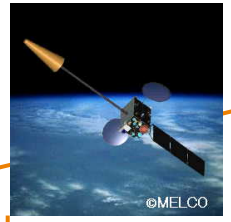
Back-up operation of GMS-5 with GOES-9 by NOAA/NESDIS from May 22, 2003 to June 28, 2005

MTSAT (Multi-functional Transport SATellite)

MTSAT-1R (Himawari-6) — Feb 2005

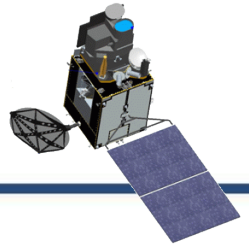


MTSAT-2 (Himawari-7) — Feb 2006

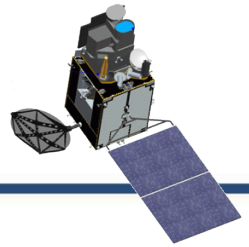


Himawari

Himawari-8 — 2014



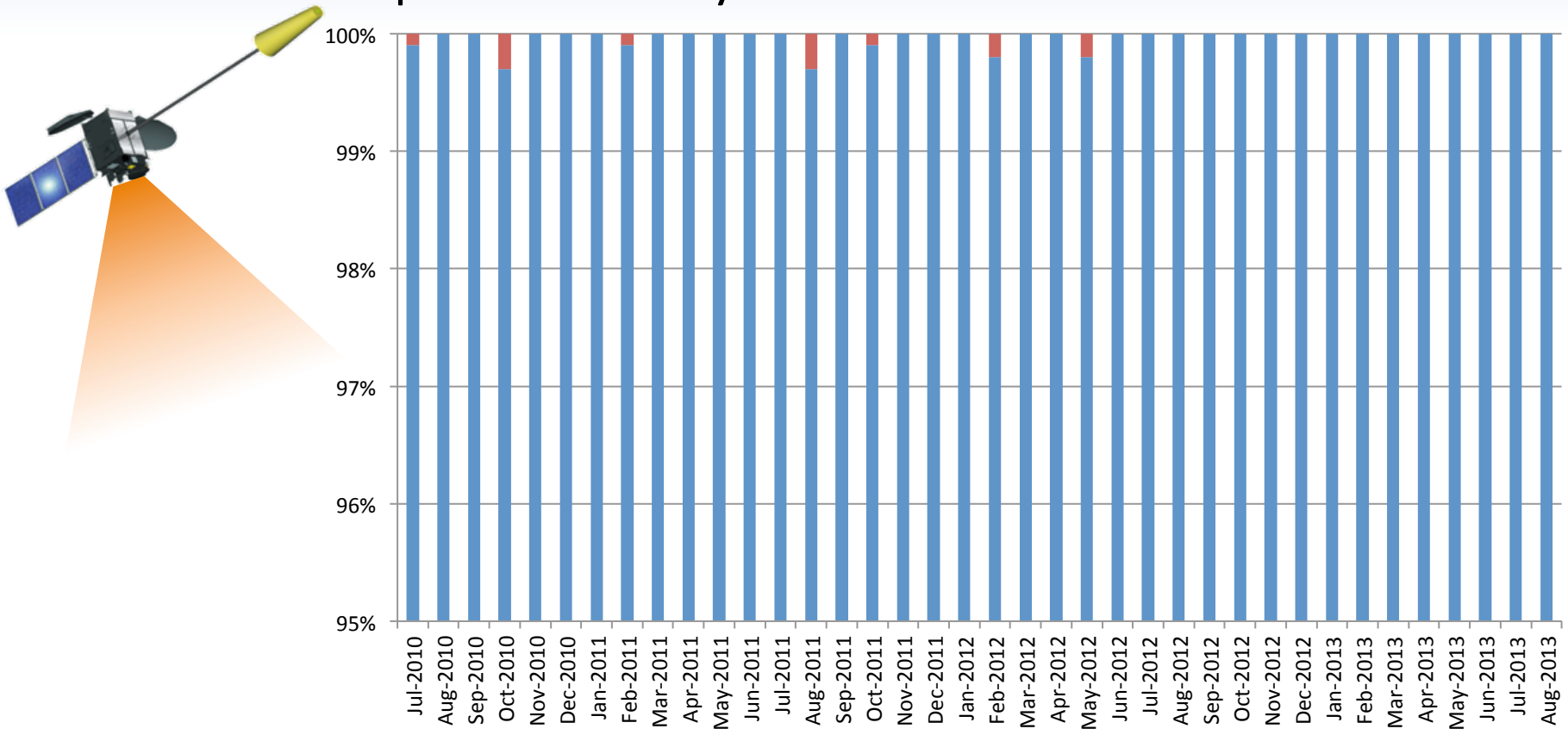
Himawari-9 — 2016



Satellite	Observation period
GMS	1977 – 1981
GMS-2	1981 – 1984
GMS-3	1984 – 1989
GMS-4	1989 – 1995
GMS-5	1995 – 2003
GOES-9	2003 – 2005
MTSAT-1R	2005 – 2010
MTSAT-2	2010 –
Himawari-8	Launch in 2014
Himawari-9	Launch in 2016

Operation of the Current Satellite, MTSAT-2

- Operation of **MTSAT-2** is extremely **stable** after **MTSAT-2** started its operation in July 2010.



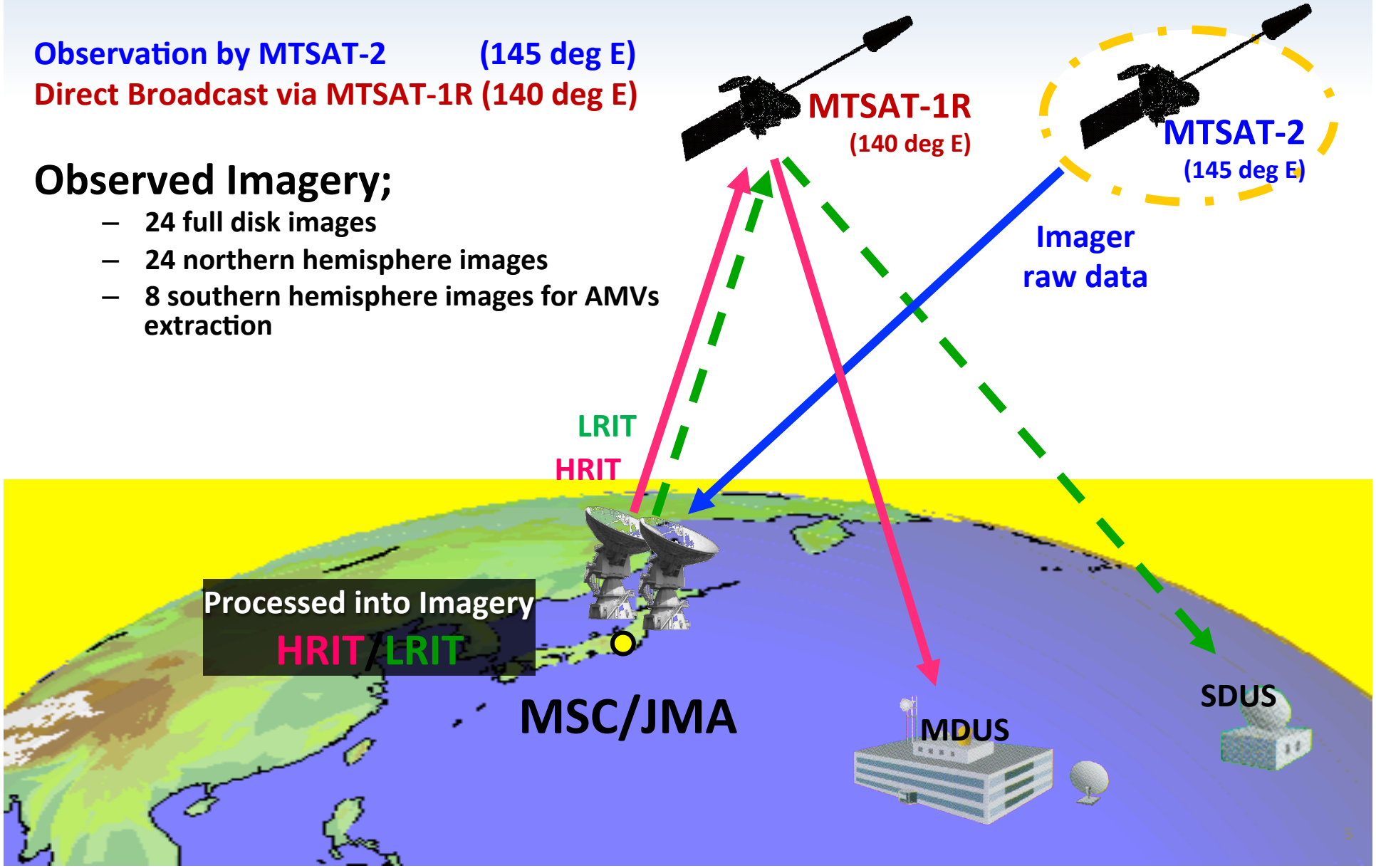
HRIT availability from July 2010 to August 2013

Observation/Direct Broadcast Configurations by MTSAT-1R/2

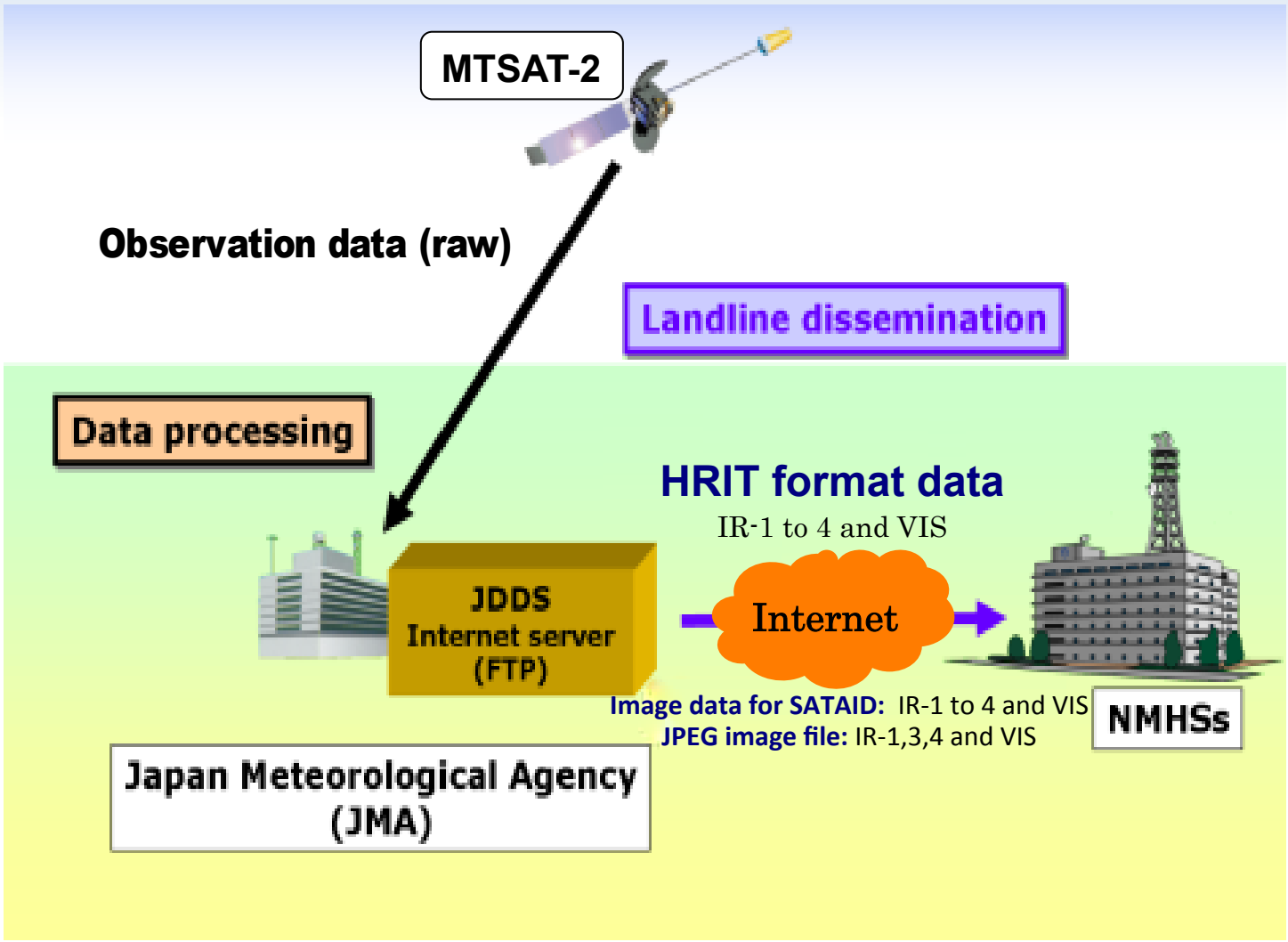
Observation by MTSAT-2 (145 deg E)
Direct Broadcast via MTSAT-1R (140 deg E)

Observed Imagery;

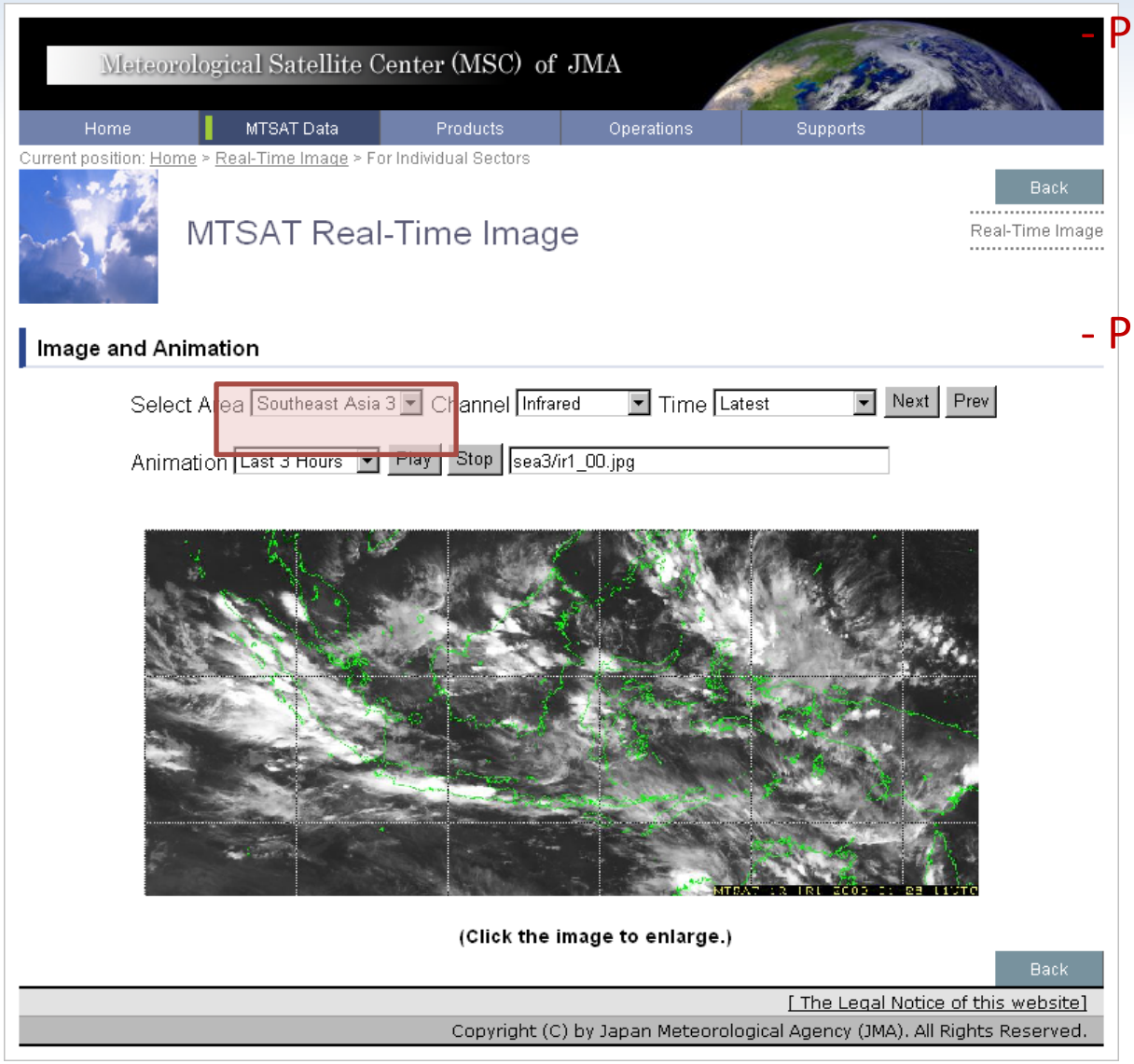
- 24 full disk images
- 24 northern hemisphere images
- 8 southern hemisphere images for AMVs extraction



Landline dissemination service via Internet (JDDS: JMA Data Dissemination System)



Real-time JPEG Imagery Service on JMA/MSC Website



- Providing imagery on MSCweb

easy access to MTSAT imagery especially for NMHSs with limited Internet bandwidth (data size: 64~128kbytes)

- Processed into sectored images in JPEG format for;

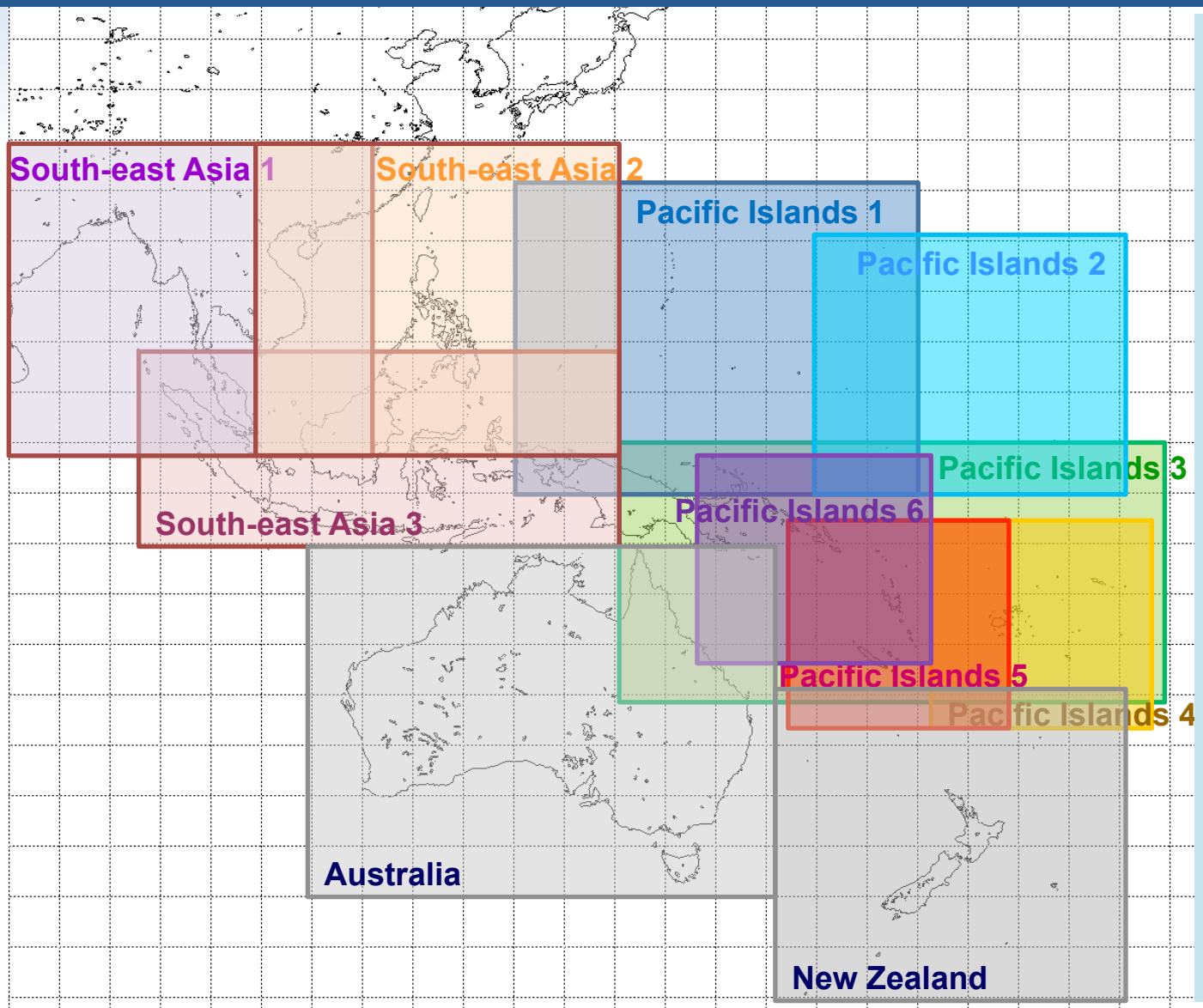
- Australia
- Central Asia
- New Zealand
- Pacific Islands
- Southeast Asia

and more....

on real-time basis with animation in the last 24 hours

http://mscweb.kishou.go.jp/sat_dat/img/reg/sat_img.htm

Real-time JPEG Imagery Service through JMA/MSC Website for Asia-Oceania Region



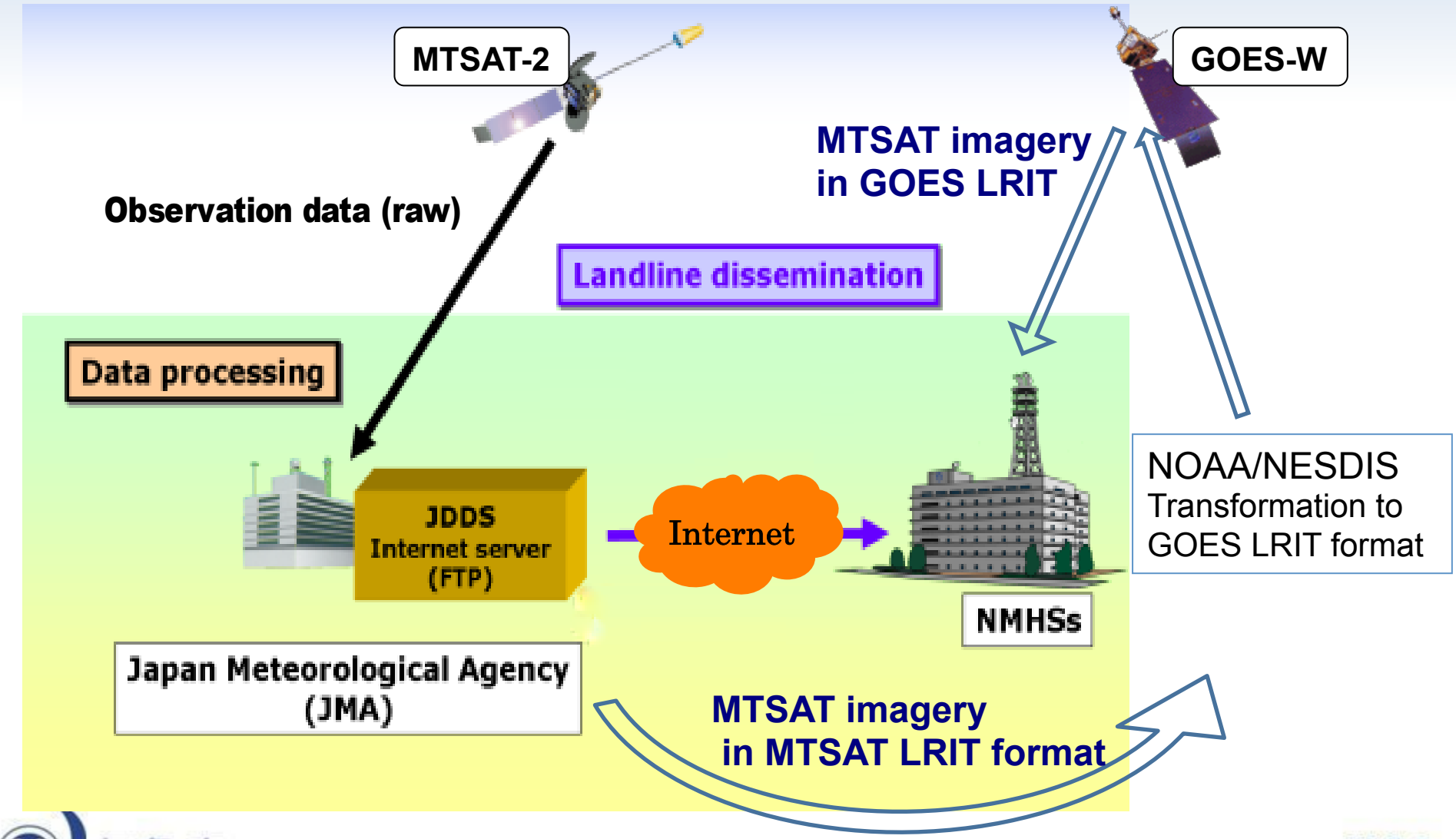
Access statistics
(Apr 2012-Mar 2013)

1 USA	63GB
2 Japan	56GB
3 Thailand	50GB
4 Indonesia	49GB
5 Unknown	18GB
6 China	14GB
7 New Zealand	12GB
8 Fiji	9GB
9 Australia	8GB
10 Viet Nam	5GB
11 Tonga	5GB
12 Philippines	4GB
13 Germany	4GB
14 Solomon Islands	4GB
15 Malaysia	4GB
16 Singapore	3GB
…	
22 Kiribati	0.8GB
24 Niue	0.5GB
25 Tuvalu	0.4GB

LDC and SIDS
SIDS

JMA will consider providing other sectored JPEG Imagery on request !!

MTSAT imagery dissemination via GOES-W LRIT
(Collaboration with NOAA/NESDIS for Pacific islands)



Satellite-related Activities

WMO Activities

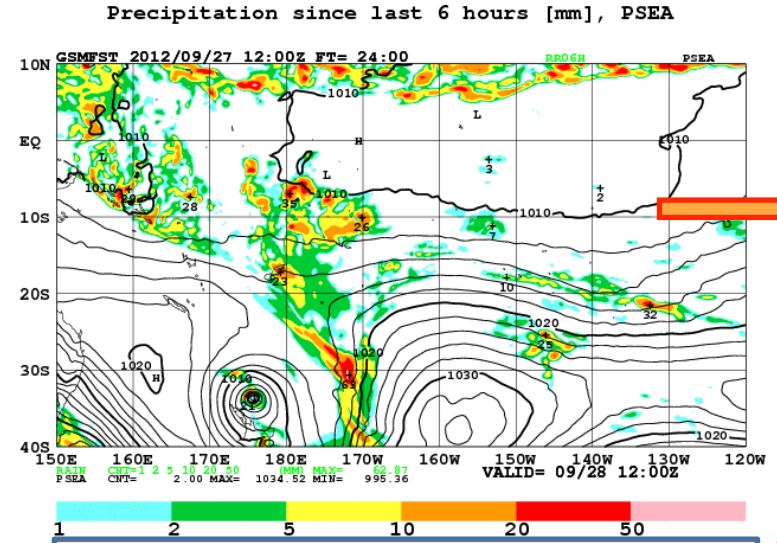
- DCPC of WIS
- GSICS
- SCOPE-CM
- DCS

Training Activities

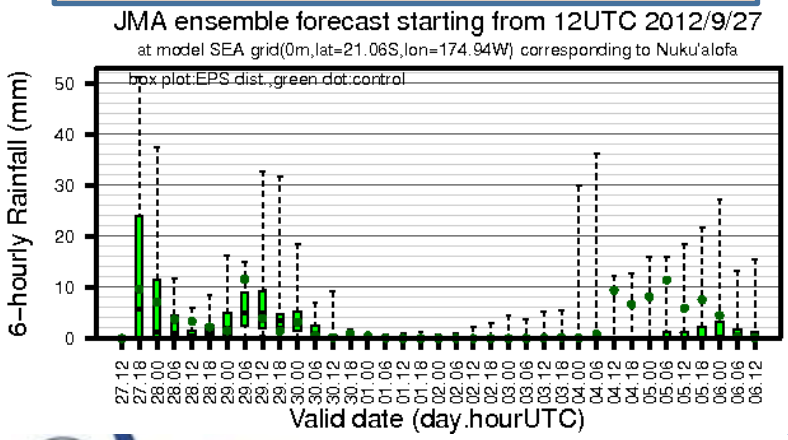
- JICA Group Training Course in Reinforcement of Meteorological Services
- Virtual Resource Library (VRL) on MSC website
  (http://mscweb.kishou.go.jp/VRL/index.htm)
- SWFDP in Southeast Asia (RA II) and South Pacific Islands (RA V)

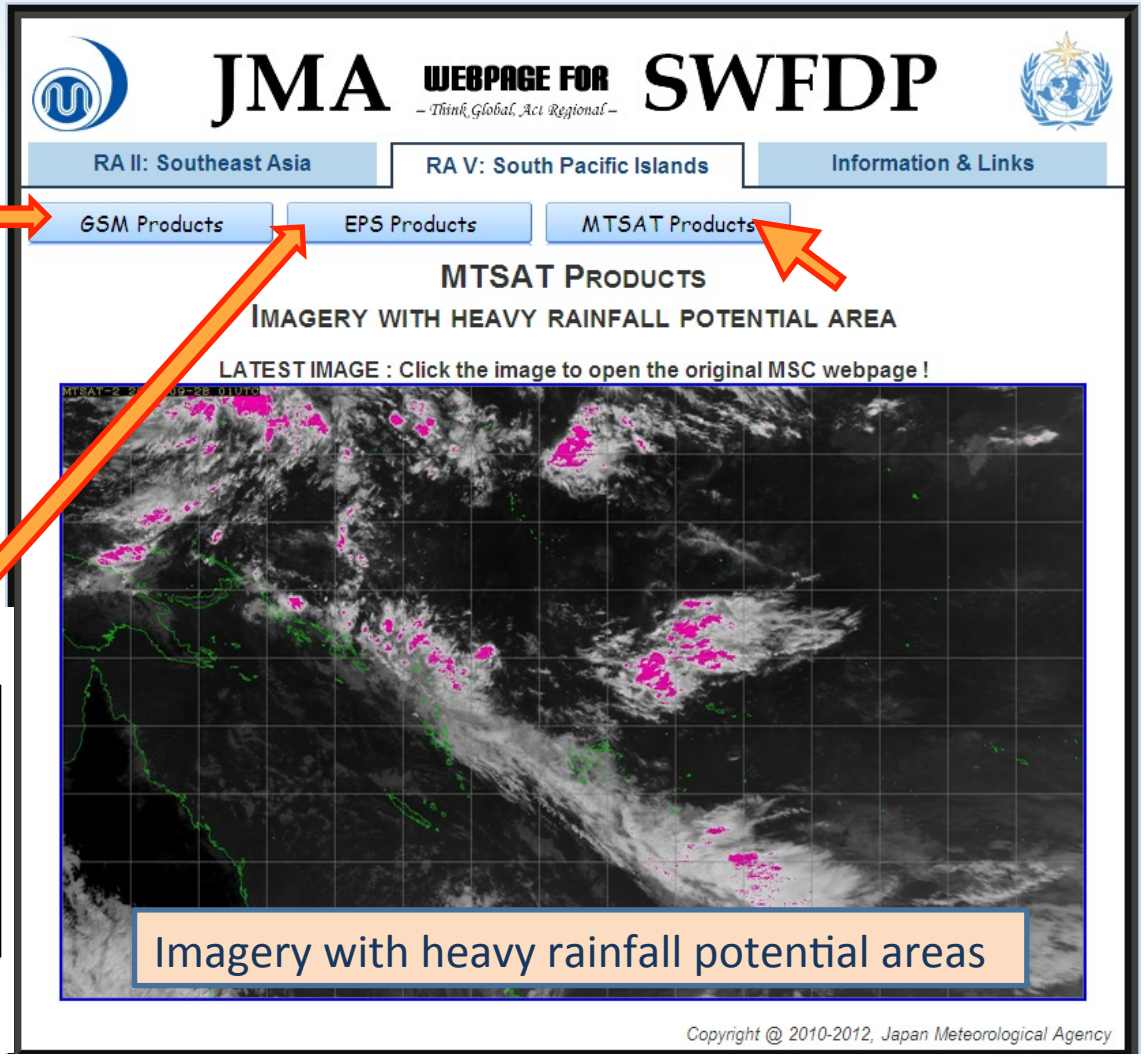
JMA SWFDP Webpage

Forecast charts of GSM/JMA



Ensemble Forecast products





http://www.wis-jma.go.jp/swfdp/ra5_swfddp_spi.html

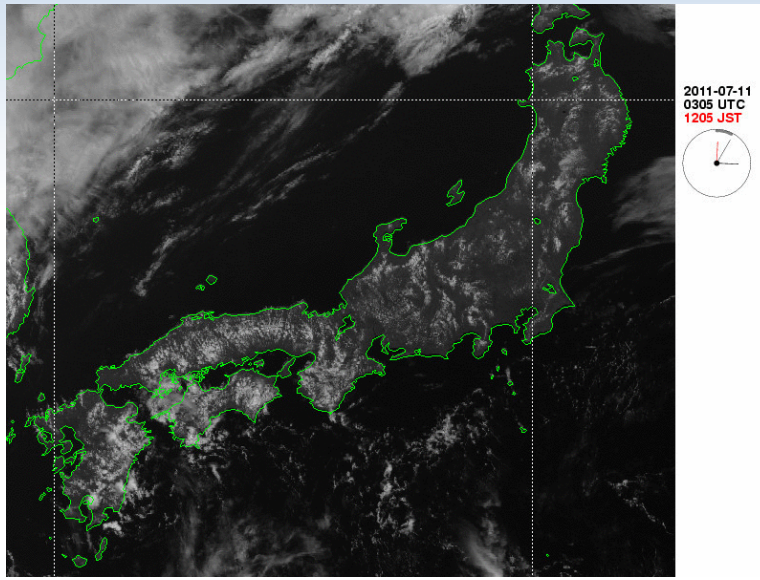
Utilizing of the Backup Satellite, MTSAT-1R

Special Observations

Rapid Scan Observation

Period: June – September
00 UTC – 09 UTC (daytime)
Interval: 5 minutes
Area: around Japan

Aviation user

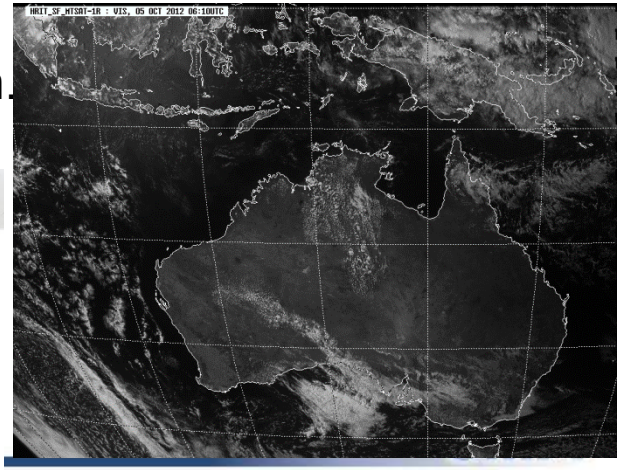


High Ice Water Content (HIWC) Study in Darwin, Australia

- HIWC Study: Study on phenomena of jet-engine power-loss by ice crystals.
- JMA will support the HIWC Study field campaign by conducting **MTSAT-1R rapid scan observation**.

Period: January – March 2014
Interval: 10 minutes
Area: around Australia

NASA



CGMS: Coordination Group for Meteorological Satellites

- **CGMS-41** was successfully held in Tsukuba, Japan from 8 to 12 July 2013, hosted by **JMA** and JAXA.

Objectives

- **Exchange of technical information** among satellite operators and WMO

  e.g. future plans, algorithms, products

- **Harmonizing of satellite mission parameters**

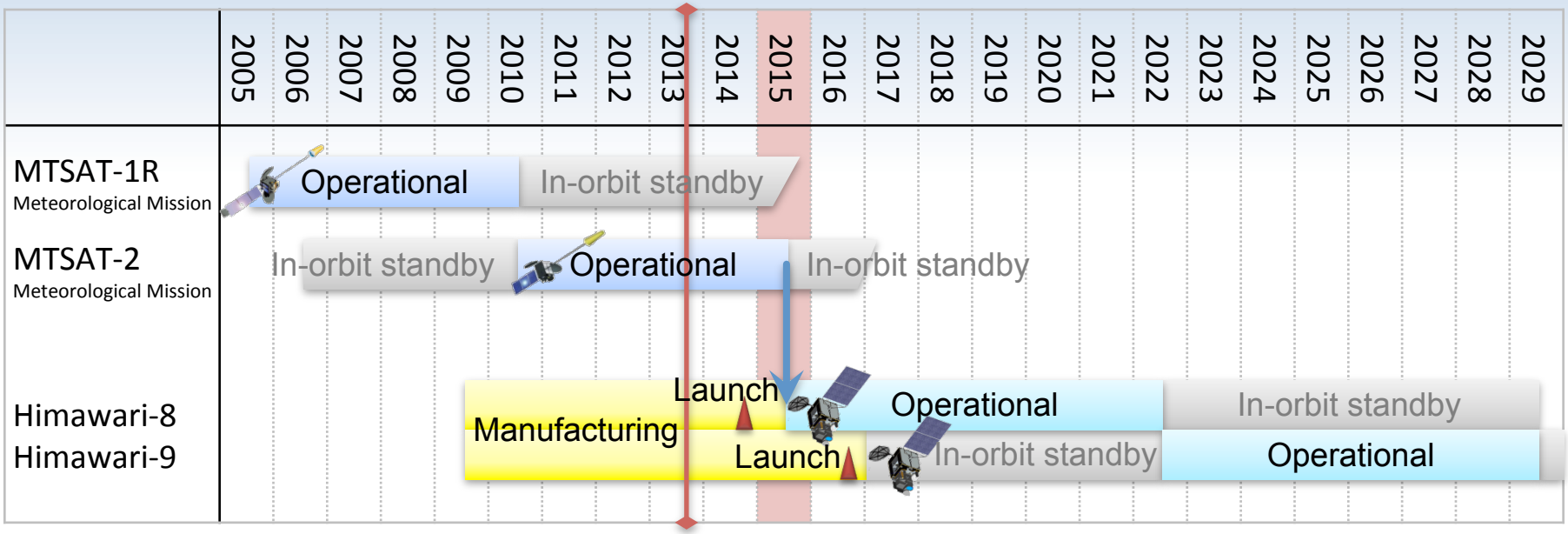
  e.g. orbits, data formats

(See http://www.cgms-info.org/)

- **CGMS** members agreed to promote the preparedness of users for new generation of satellites such as **Himawari-8**.

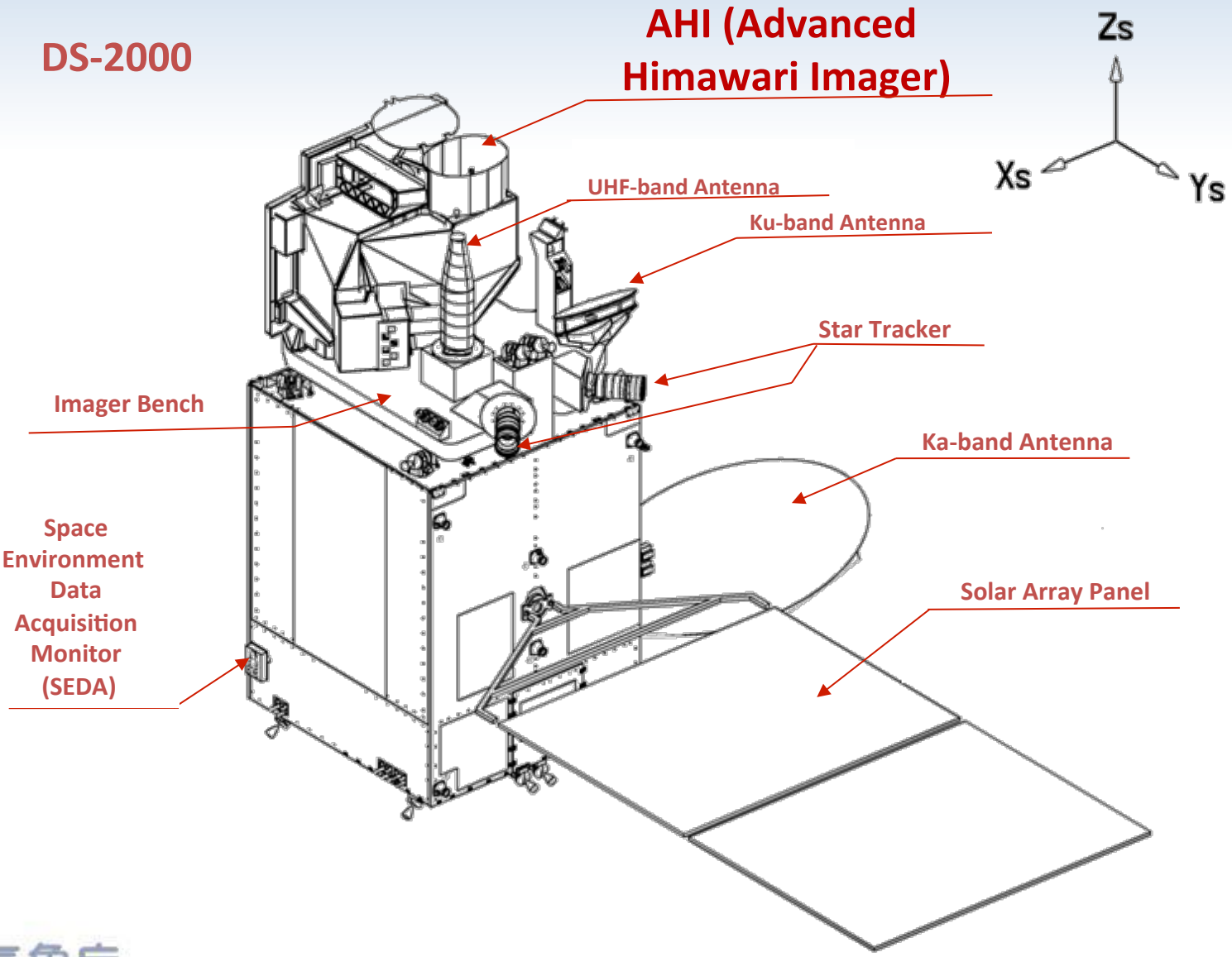
2. Future Plan

Transition of Operational Satellites



- JMA plans to launch **Himawari-8** in **2014** and begin its operation in **2015**.
- The launch of **Himawari-9** for in-orbit standby is scheduled in **2016**.
- **Himawari-8/9** will be in operation around **140 degrees East** covering the East Asia and Western Pacific regions for 15 years.

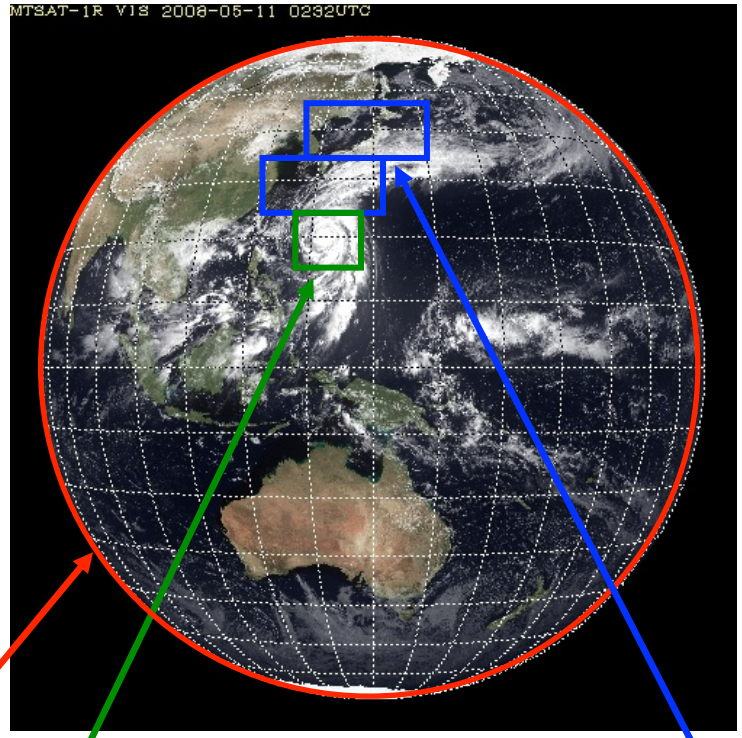
Appearance of Himawari-8/9



Himawari-8/9: Specification of Observation

Channels of the Advanced Himawari Imager (AHI)

Channel	Central Wavelength [μm]	Spatial Resolution	
1	0.43 – 0.48	1 km	RGB Composited True Color Image
2	0.50 – 0.52	1 km	
3	0.63 – 0.66	0.5 km	
4	0.85 – 0.87	1 km	
5	1.60 – 1.62	2 km	
6	2.25 – 2.27	2 km	
7	3.74 – 3.96	2 km	
8	6.06 – 6.43	2 km	Water Vapor
9	6.89 – 7.01	2 km	
10	7.26 – 7.43	2 km	
11	8.44 – 8.76	2 km	SO_2
12	9.54 – 9.72	2 km	O_3
13	10.3 – 10.6	2 km	Atmospheric Windows
14	11.1 – 11.3	2 km	
15	12.2 – 12.5	2 km	
16	13.2 – 13.4	2 km	CO_2



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

Region: Japan
Interval: **2.5 minutes** (4 times in 10 minutes)
Dimension: EW x NS: 2000 x 1000 km x 2

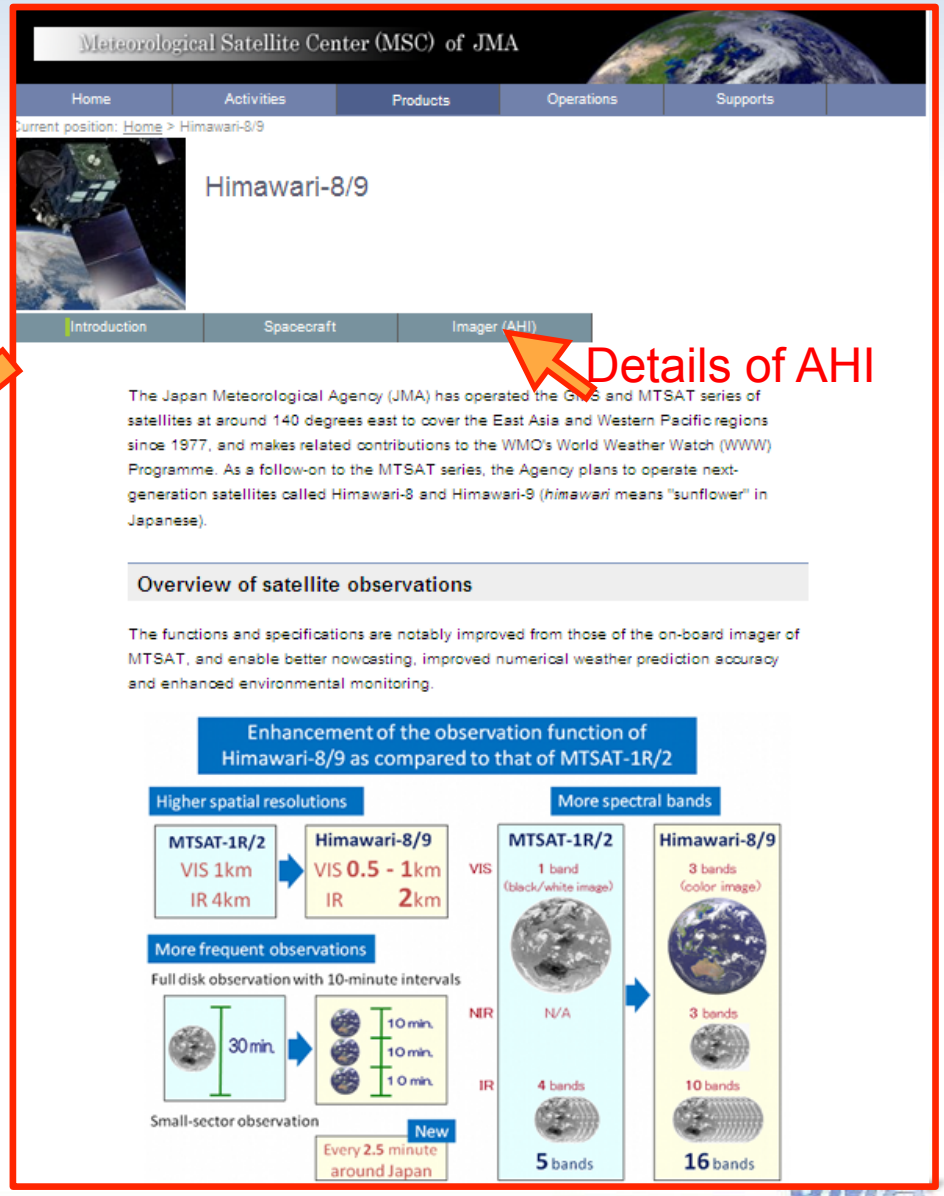
Region: Typhoon
Interval: **2.5 minutes** (4 times in 10 minutes)
Dimension: EW x NS: 1000 x 1000 km

Number of Channels: 5 ⇨ 16

Interval: 30/60 min. ⇨ 10min.

MSC Web Page for Himawari-8/9 Information

MSC website top page
http://mscweb.kishou.go.jp/

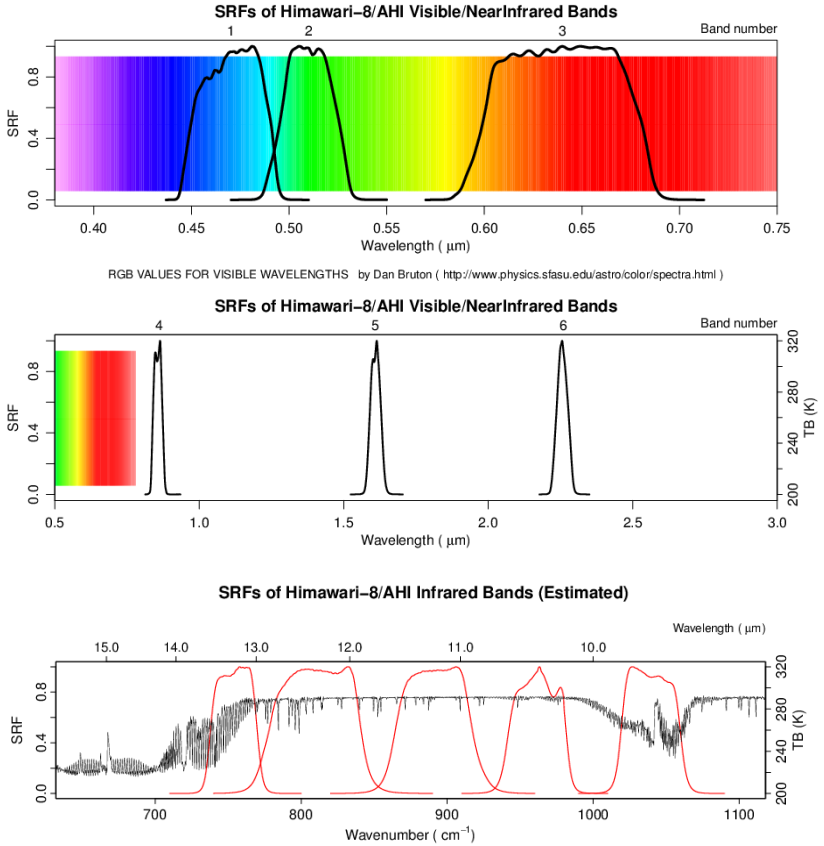


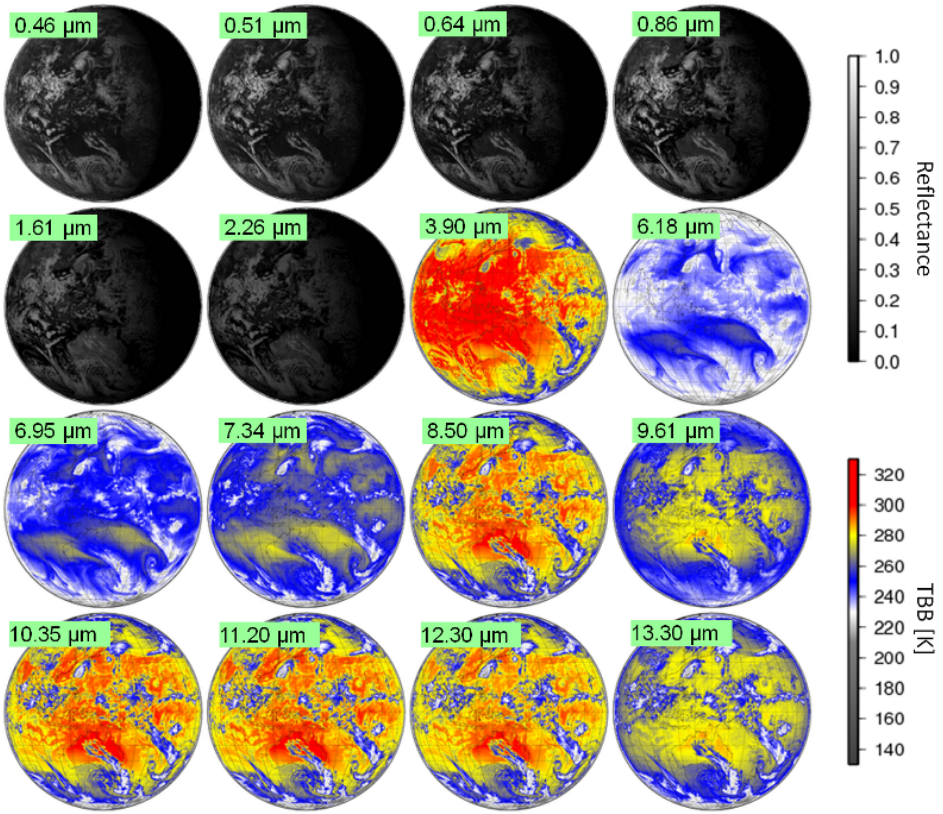
Himawari-8/9: Technical Information

To support research and development of products based on **Himawari-8/9**,

- Estimated Spectral Response Functions (**SRF**s) of **AHI** are **available** on JMA website.
- **Simulation data** generated using a radiative transfer model are also **available** on JMA website.

http://mscweb.kishou.go.jp/himawari89/





Development of products of Himawari-8/9 AHI

Higher resolution

Horizontal:
- 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

Increased observation channels

VIS: 1 -> 3 bands

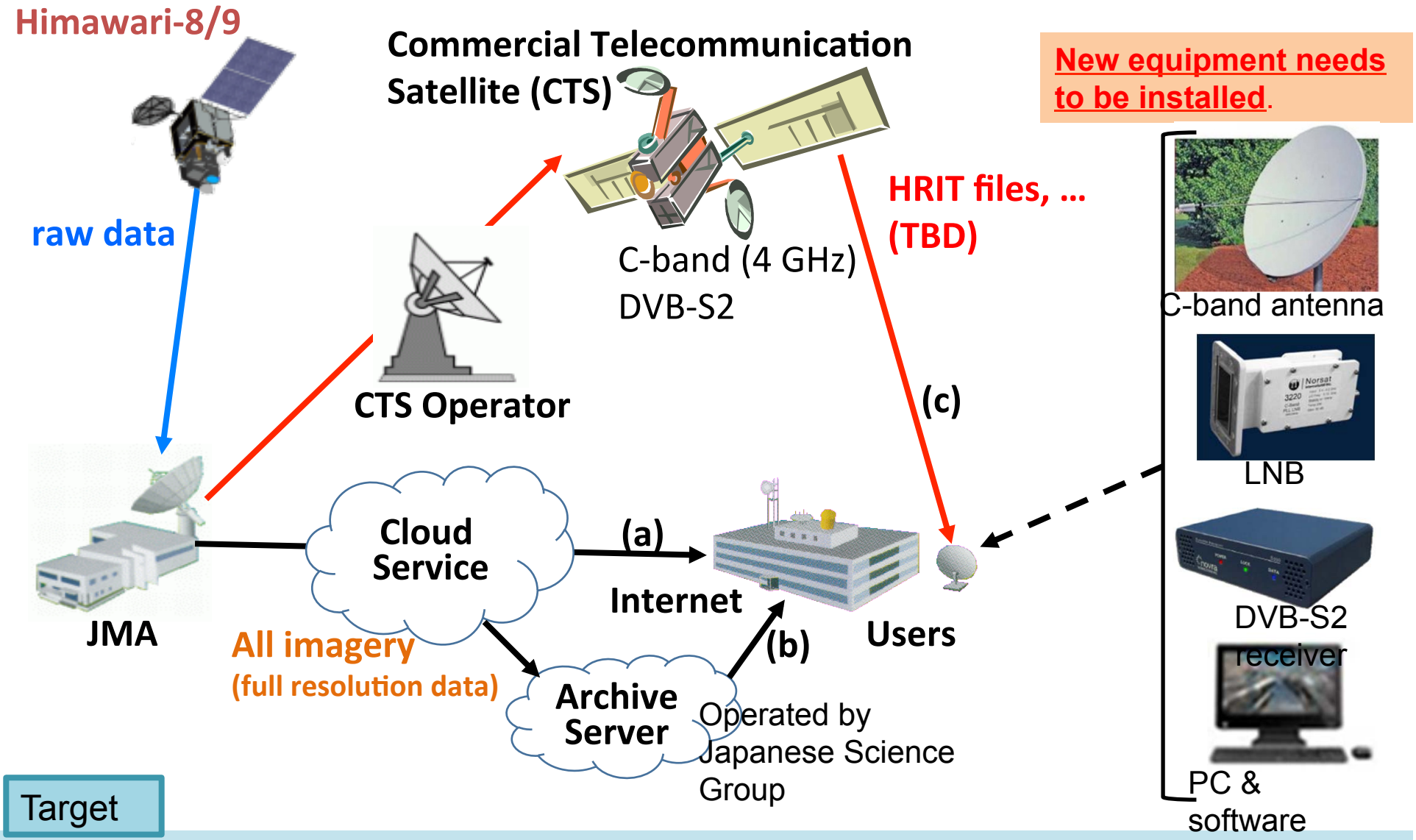
IR : 4 -> 13 bands

Examples of expected new/enhanced products

- Atmospheric Motion Vectors (AMVs)
- Volcanic Ash (VA) / Aerosol
- Global Instability Index

- Severe weather monitoring/ nowcasting
- Climate change monitoring
- Volcano eruption Ash area detection
- Numerical prediction
- Yellow sand/ dust storm
- Solar energy monitoring

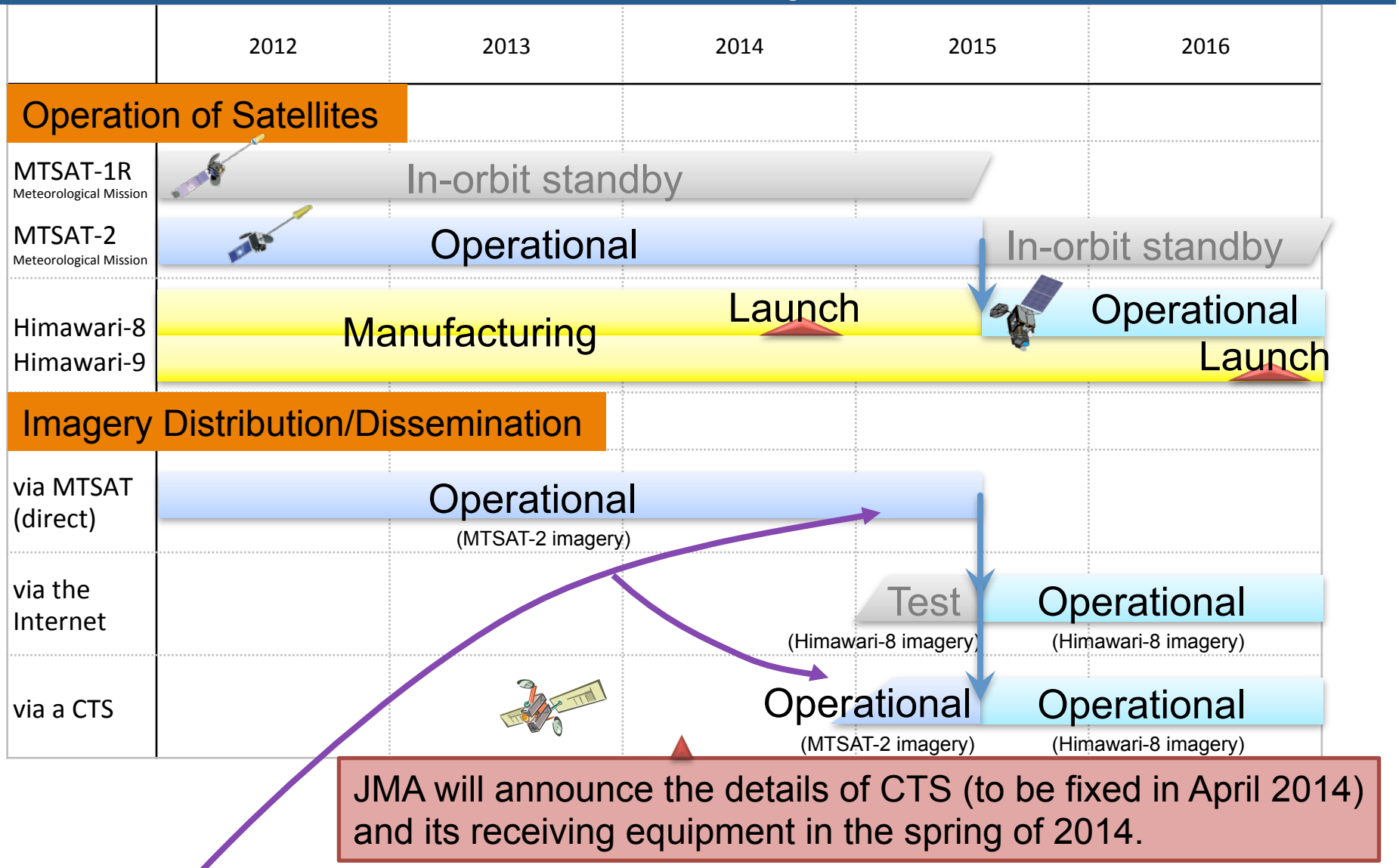
Himawari-8/9: Data Distribution/Dissemination



Target

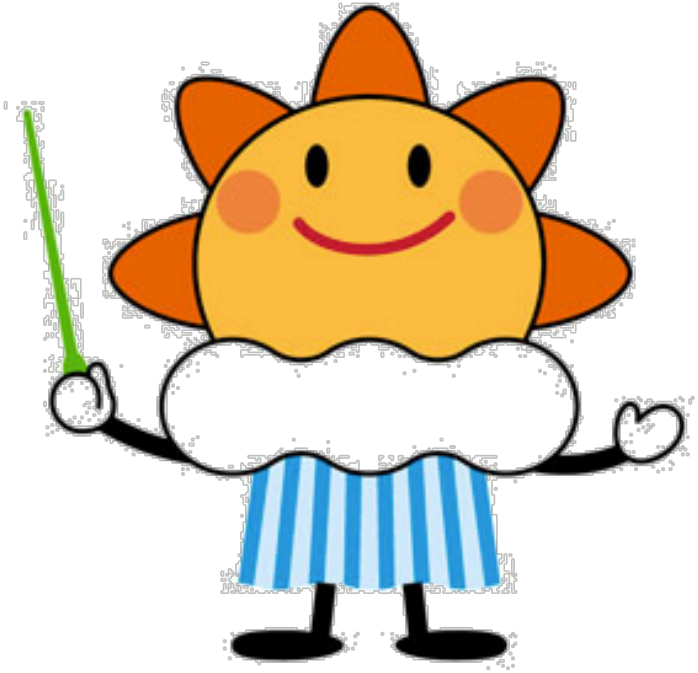
(a) **Cloud Service**: National Meteorological and Hydrological Services
(b) **Archive Server**: Researchers
(c) **CTS**: Everyone in the East Asia and Western Pacific regions

Schedule of Distribution/Dissemination



- **Parallel dissemination** is planned for **<u>users' smooth transitions</u>** to the receipt of imagery via a CTS.

Thank You.



Appendix

Imagery via the Internet

	Name	Interval	Channel & Resolution	Size
Full disc observation	TBD	10 min	All (16) channels #3: 0.5 km #1, 2, 4: 1 km #5-16: 2 km	329 GB (1 day) #3: 930 MB (10 min) #1, 2, 4: 230 MB (10 min) #5-16: 60MB (10 min)
	PNG	10 min	Composite (#1-3) 1 km	49 GB (1 day) 350 MB (10 min)
	HRIT (same as MTSAT)	10 min	5 channels Vis: 1 km IR: 4 km	41 GB (1 day) Vis: 230 MB, IR: 15 MB (10 min)
	LRIT (same as MTSAT)	10 min	3 channels 5 km	432 MB (1 day) each: 1 MB (10 min)
Regional observation (Typhoon)	TBD & netCDF	2.5 min	All (16) channels #3: 0.5 km #1, 2, 4: 1 km #5-16: 2 km	12 GB (1 day) #3: 8 MB (2.5 min) #1, 2, 4: 2 MB (2.5 min) #5-16: 0.5 MB (2.5 min)
Cut-out (several regions)	PNG JPEG	10 min	TBD	Not so large

Imagery via a CTS

	Name	Interval	Channel & Resolution	Size
Full disc observation	TBD	10 min	All (16) channels #3: 0.5 km #1, 2, 4: 1 km #5-16: 2 km	329 GB (1 day) #3: 930 MB (10 min) #1, 2, 4: 230 MB (10 min) #5-16: 60MB (10 min)
	PNG	10 min	Composite (#1-3) 1 km	49 GB (1 day) 350 MB (10 min)
	HRIT (same as MTSAT)	10 min (TBD)	5 channels Vis: 1 km IR: 4 km	41 GB (1 day) Vis: 230 MB, IR: 15 MB (10 min)
	LRIT (same as MTSAT)	10 min (TBD)	3 channels 5 km	432 MB (1 day) each: 1 MB (10 min)
Regional observation (Typhoon)	TBD & netCDF	2.5 min	All (16) channels #3: 0.5 km #1, 2, 4: 1 km #5-16: 2 km	12 GB (1 day) #3: 8 MB (2.5 min) #1, 2, 4: 2 MB (2.5 min) #5-16: 0.5 MB (2.5 min)
Cut-out (several regions)	PNG JPEG	10 min	TBD	Not so large

Equipment to receive imagery via a CTS

Tentative

Needed equipment

C-band antenna

LNB

DVB-S2

PC & software

	Required/recommended specifications	Estimated cost (US$)
C-band antenna	Dish type with a diameter of 1.2 – 2.4 m	1,500 – 9,000
Low-noise block (LNB)	Standard-performance type	600 or less
DVB-S2* receiver	Standard-performance type such as Novra S300, Comtech EF DATA CMR-5975 or Advantech S4020	1,500 – 3,000
Software for DVB acquisition and processing	KenCast Fazzt standard software	900 or less

* DVB-S2: Digital Video Broadcasting – Satellite – Second Generation (a digital video broadcast standard)

Notes

• HRIT imagery can be displayed on a PC using a set of software modules for data processing and visualization.
• Construction of dish antenna foundations and wiring work for antenna-PC connection are required for installation of the above equipment.
• The diameter of a dish antenna depends on its geographical location and the footprint of the commercial telecommunication satellite to be used by JMA.