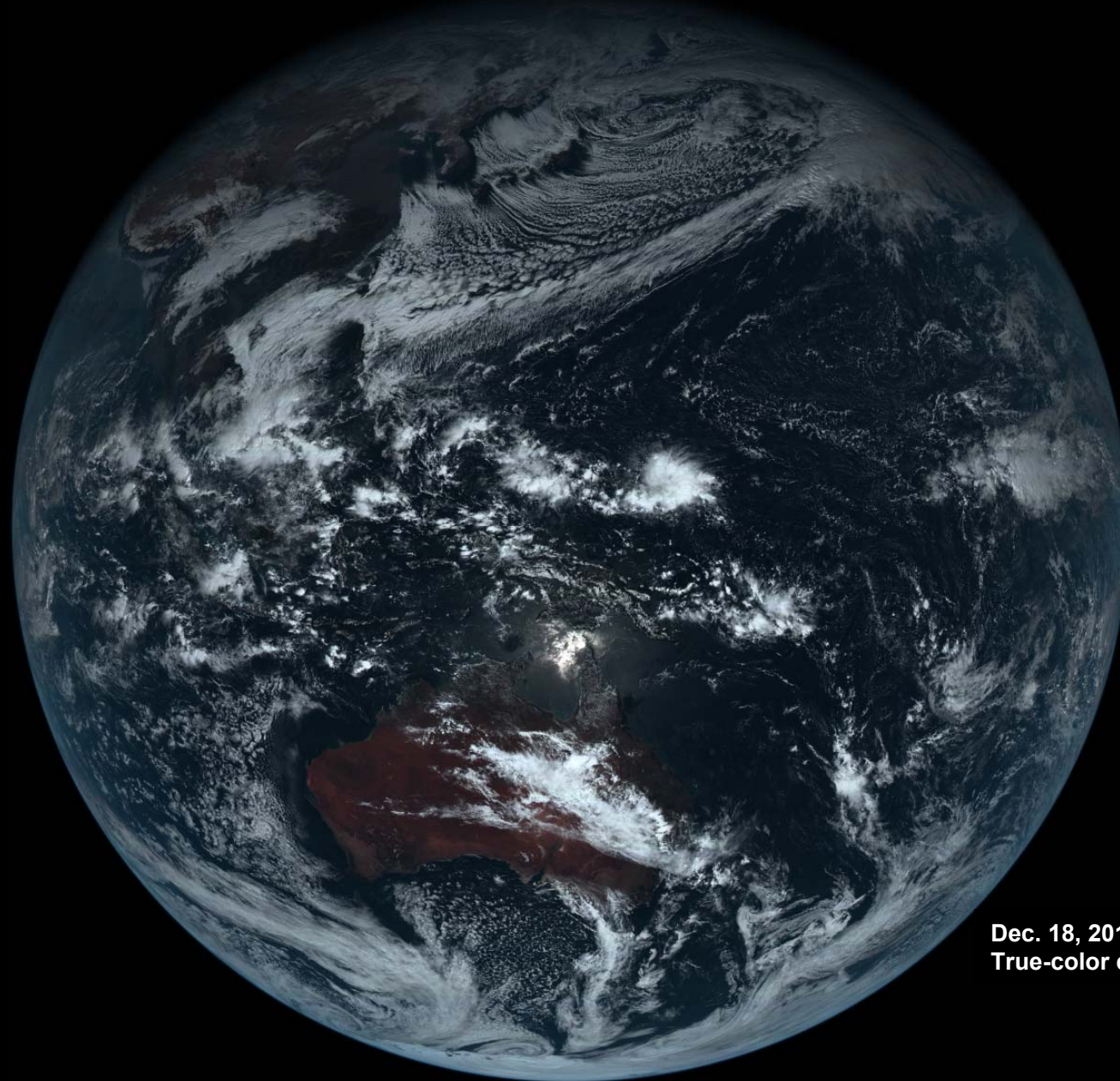# Dawn of a "New Era"

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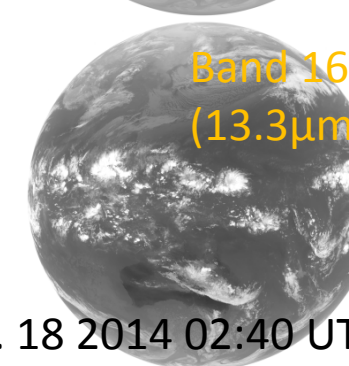
The First Image of Himawari-8

Dec. 18, 2014 02:40 UTC
True-color composite

The First Images of Himawari-8

Band 01 (0.47μm)

Band 02 (0.51μm)

Band 03 (0.64μm)

Band 04 (0.86μm)

Band 05 (1.6μm)

Band 06 (2.3μm)

Band 07 (3.9μm)

Band 08 (6.2μm)

Band 09 (6.9μm)

Band 10 (7.3μm)

Band 11 (8.6μm)

Band 12 (9.6μm)

Band 13 (10.4μm)

Band 14 (11.2μm)

Band 15 (12.0μm)

Band 16 (13.3μm)
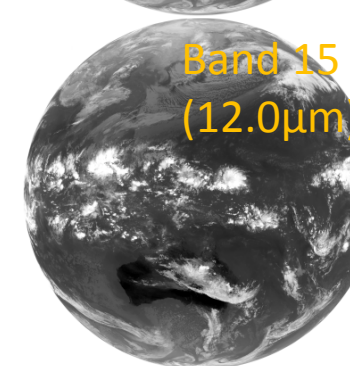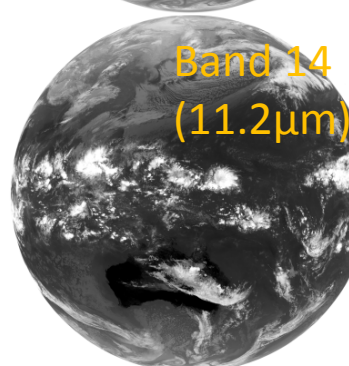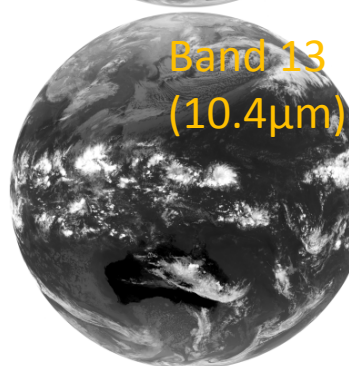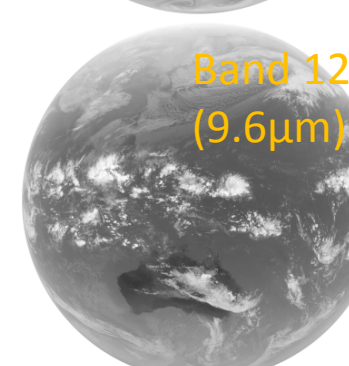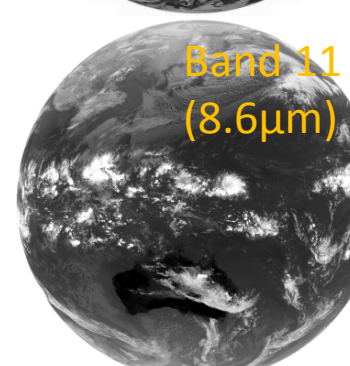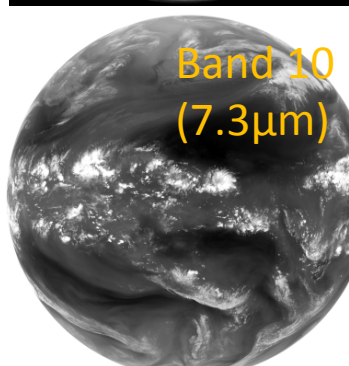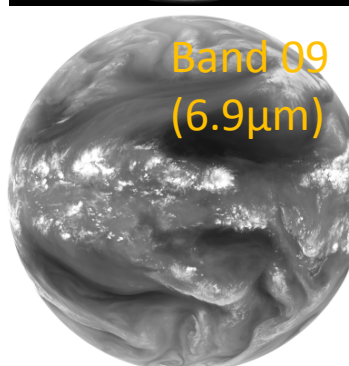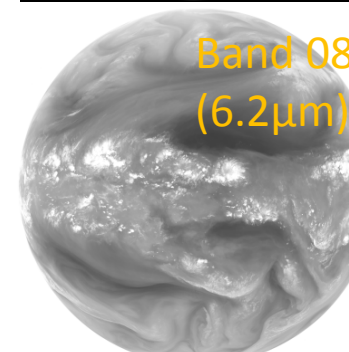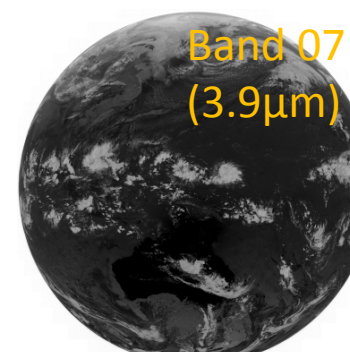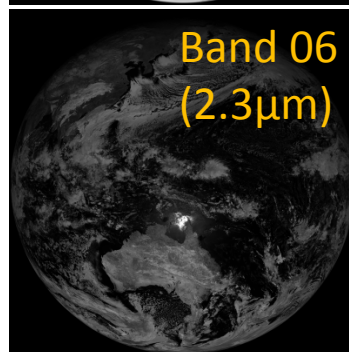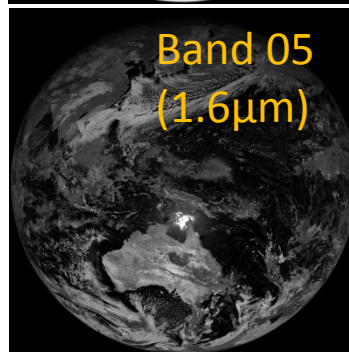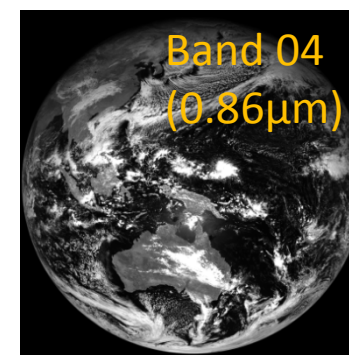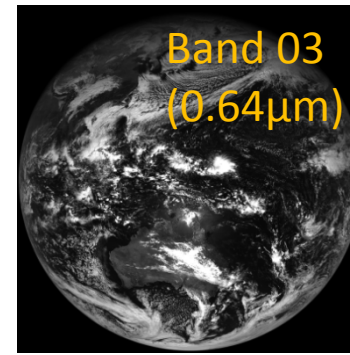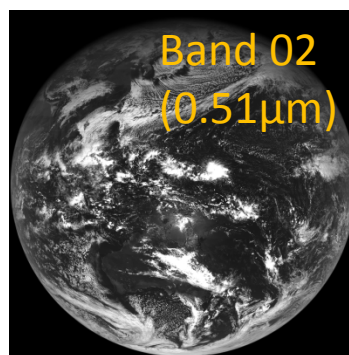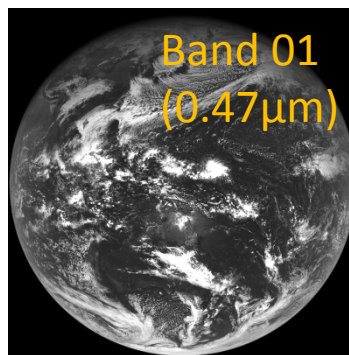
Dec. 18 2014 02:40 UTC

History of Japanese Geostationary Meteorological Satellites "Himawari"

GMS (Geostationary Meteorological Satellite)
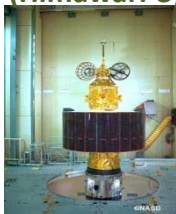
GMS (Himawari)	GMS-2 (Himawari-2)	GMS-3 (Himawari-3)	GMS-4 (Himawari-4)	GMS-5 (Himawari-5)
Jul 1977	Aug 1981	Aug 1984	Sep 1989	Mar 1995

(GOES-9)

Back-up operation of GMS-5 with GOES-9 by NOAA/NESDIS May 2003 - June 2005

MTSAT (Multi-functional Transport SATellite)

MTSAT-1R (Himawari-6)	MTSAT-2 (Himawari-7)
Feb 2005	Feb 2006

Himawari

Himawari-8	Himawari-9
2014	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	Operation in 2015
Himawari-9	Launch in 2016

5

Specification of Himawari-8/9 Imager (AHI)

MTSAT-1R/2

	Band	Wavelength [μm]	Spatial Resolution
VIS	1	0.47	1Km
	2	0.51	1Km
	3	0.64	0.5Km
	4	0.86	1Km
	5	1.6	2Km
	6	2.3	2Km
IR4	7	3.9	2Km
IR3	8	6.2	2Km
	9	7.0	2Km
	10	7.3	2Km
	11	8.6	2Km
	12	9.6	2Km
IR1	13	10.4	2Km
	14	11.2	2Km
IR2	15	12.3	2Km
	16	13.3	2Km

Similar to ABI for GOES-R

RGB band Composited

True Color Image

A true color earth image is published by the NASA Earth Observatory.
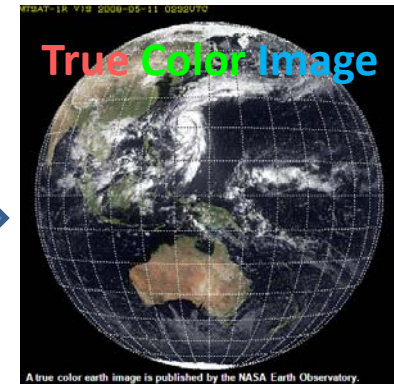
0.51 μm (Band 2) instead of ABI's 1.38 μm

RGB band → Water vapor (Bands 8, 9, 10)

SO_2
O_3

Atmospheric Windows

CO_2
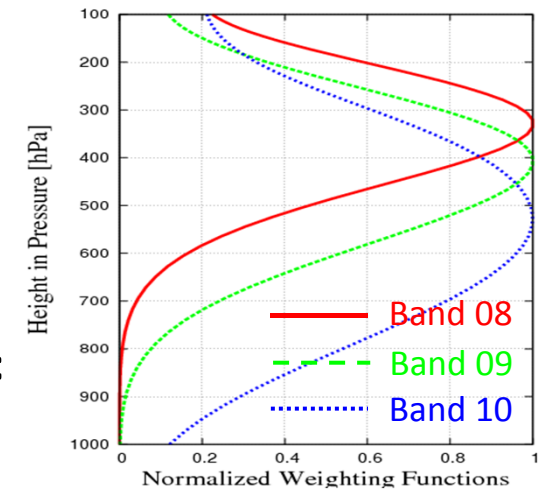
WV bands Weighting Function (US-Standard Atmosphere)

Band 08
Band 09
Band 10

Specification of Himawari-8/9
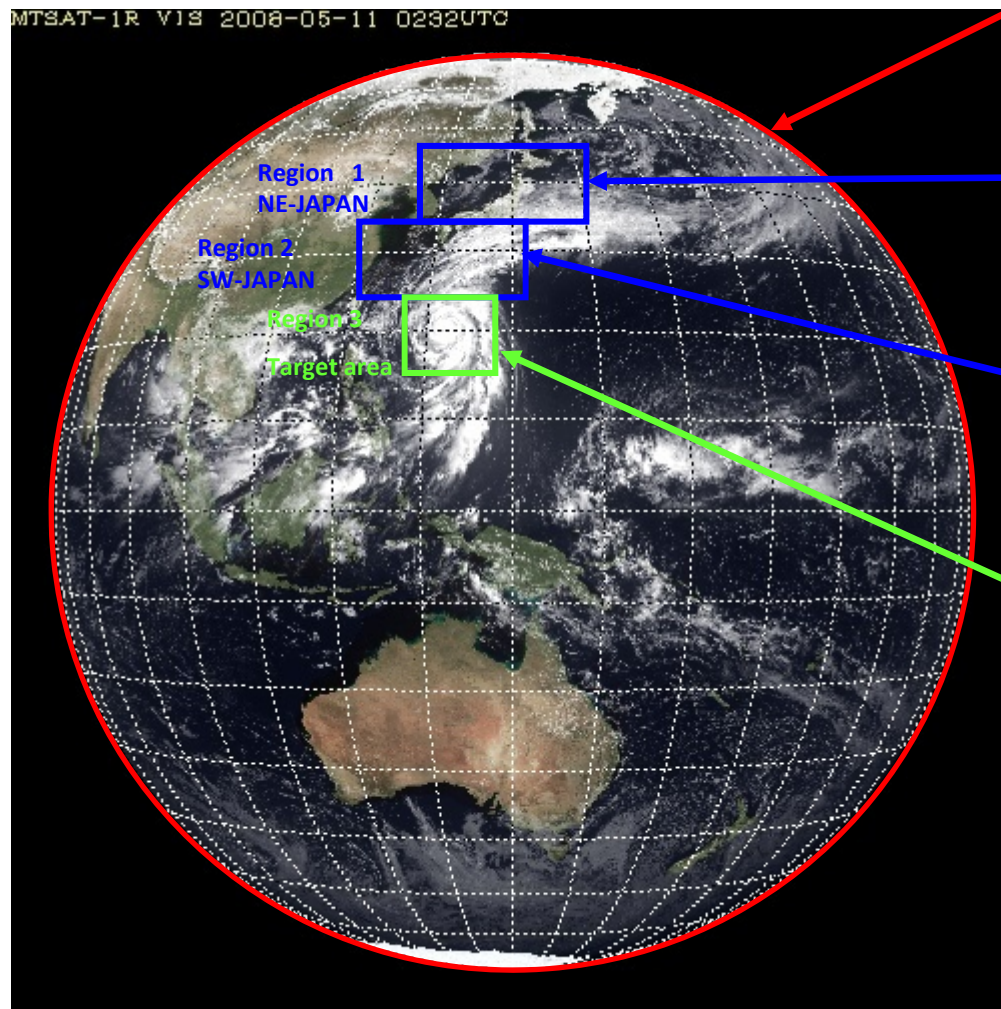
Full disk

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

Himawari-8/9: Data Distribution/Dissemination

Himawari-8/9

raw data

Communication Satellite (CS)

CS Operator

C-band (4 GHz)
DVB-S2

HimawariCast service (data are thinned)

(c)

HRIT files, SATAID files

New equipment needs to be installed.

C-band antenna

LNB

DVB-S2 receiver

PC & software

SATAID files

(d) WIS Portal

(e) JDDS HRIT files

All imagery (full data)

Cloud Service (HimawariCloud)

Internet / NRENs

(a)

Archive Server

Operated by Japanese Science Group

(b)

JMA

NMHSs

Researchers

Main Users
(a) **Cloud Service**: NMHSs (1 agency / nation)
(b) **Archive Server**: Universities and Researchers
(c) **HimawariCast**: Every users
(d) **WIS Portal and (e) JDDS**: NMHSs

For more info. please check:

http://www.data.jma.go.jp/mscweb/en/himawari89/himawari_cast/himawari_cast.html

http://www.data.jma.go.jp/mscweb/en/himawari89/cloud_service/cloud_service.html

Schedule of launch and imagery data dissemination

Japanese FY	2014	2015	2016
Operation of Satellites			
MTSAT-1R Meteorological Mission	In-orbit standby		
MTSAT-2 Meteorological Mission	Operational	In-orbit standby	
Himawari-8	Launch	Operational	
Himawari-9	Manufacturing		Launch
Data Dissemination			
via MTSAT (direct)	Operational (MTSAT-2 imagery)	(MTSAT-2 imagery)	
via a cloud service (HimawariCloud)		Test (Himawari-8 imagery)	Operational (Himawari-8 imagery)
via HimawariCast		Operational (MTSAT-2 imagery)	Operational (Himawari-8 imagery)

Parallel Dissemination
for users' smooth transition

Planned Product Developing for Himawari-8/9

- Atmospheric Motion Vector (AMV)
- Clear-Sky Radiance
- Cloud Products
  - Cloud Mask,
  - Cloud Type/Phase,
  - Cloud Top Height
- Aerosol (Asian Dust)
- Volcanic Ash
- Sea Surface Temperature
- Downward Short-wave Flux
- Convective Cloud Invormation

Cloud Phase

Cloud Mask

L ratio: 0.49

Water Mixed Unknown Ice

Cloud Top Height

0.00 3.60 7.20 10.80 14.40 18.00
cloud top height / km
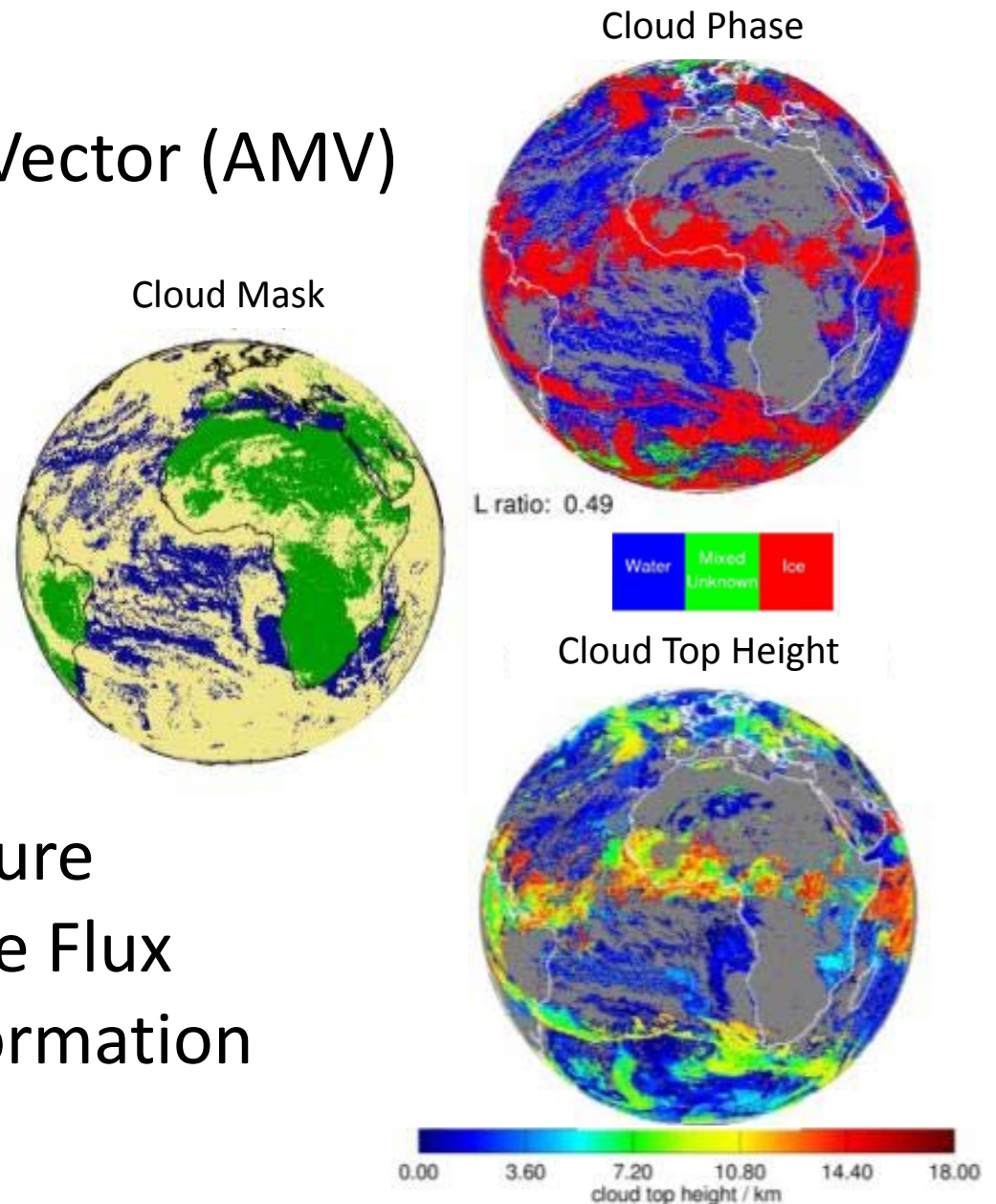
Data Assimilation (DA) of Himawari-8

- Assimilate AMVs and CSRs (Clear Sky Radiances) in the operational DA of JMA and other NWP centers
  - AMVs and CSRs from current geostationary satellites have improved winds and humidity analyses and forecasts
  - Greater impacts are expected from advanced Himawari imagers

- *Himawari-8 AMV and CSR data is planned to be disseminated from Spring of 2015 for user rediness*

MTSAT-2 AMV by *current algorithm*　　　MTSAT-2 AMV by *algorithm for Himawari-8*

MTSAT IR AMVs (QI>80) for March 2nd 2014 00 UTC
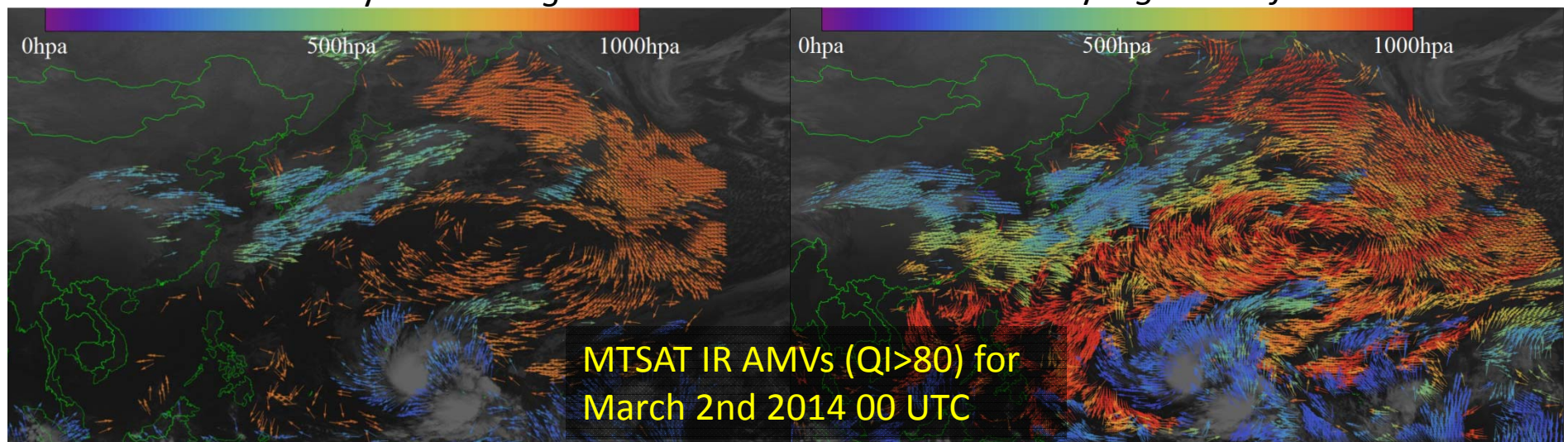
"Big Data Assimilation" project

- Aim to predict unexpectedly strong rain
  - Lead by Dr. Miyoshi, Riken research institute, funded by CREST (2013~2018)
- Exploit high-performance model, DA system, supercomputer, observation of Japan
  - High performance and high resolution model
  - Super rapid DA cycle with Local Ensemble Transform Kalman Filter (LETKF)
  - 10-Peta-Flops K computer
  - Phased array radars and Himawari-8
- Capture the developing convection and rain particles every 30-sec by super-rapid DA cycles and make 30-min forecasts

RIKEN data assimilation team website:
http://data-assimilation.jp/index_e.html

Big Data Assimilation:
Revolutionary super-rapid 30-sec. cycle

Phased Array Radar
1GB/30sec/2 radars

Himawari
500MB/2.5min

A-1. Quality Control
A-2. Data Processing

B-1. Quality Control
B-2. Data Processing

①30-sec Ensemble Forecast Simulations
2 PFLOP

②Ensemble Data Assimilation
2 PFLOP

Analysis Data
2GB

Ensemble Forecasts
200GB

Ensemble Analyses
200GB

③30-min Forecast Simulation
1.2 PFLOP

Repeat every 30 sec.

30-min Forecast
2GB

Summary

- Himawari-8/9 will provide significantly improved temporal/spatial/spectral information
- Preparation of the data dissemination is going well
- Different imagery data are available via HimawariCloud (cloud service) and HimawariCast depending on what you need and your infrastructure
- Improved and new products are being developed and evaluated
  - Cloud property, AMV, CSR, volcanic ash and aerosol
- Need to advanced assimilation development to make the most of Himawari-8/9 data

Revolution of Himawari-8/9

Upgrade of   MTSAT -> Himawari

➢ Number of channels   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
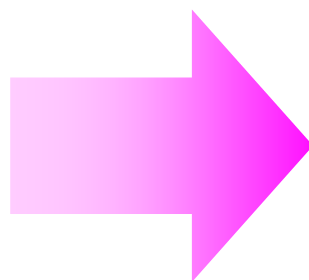
http://www.data.jma.go.jp/mscweb/en/himawari89/index.html

Data Dissemination

Communication Satellite (CS)

Himawari

CS Operator

C-band (4 GHz) DVB-S2

HimawariCast Service
- HRIT
- SATAID (GPV etc.)

Raw data

(c)

(d), (e)

(c)

NMHS
(National meteorological and Hydrological Service)

Cloud Service

(a)

All imagery (full data)

JMA

Internet

Archive Server

(b)
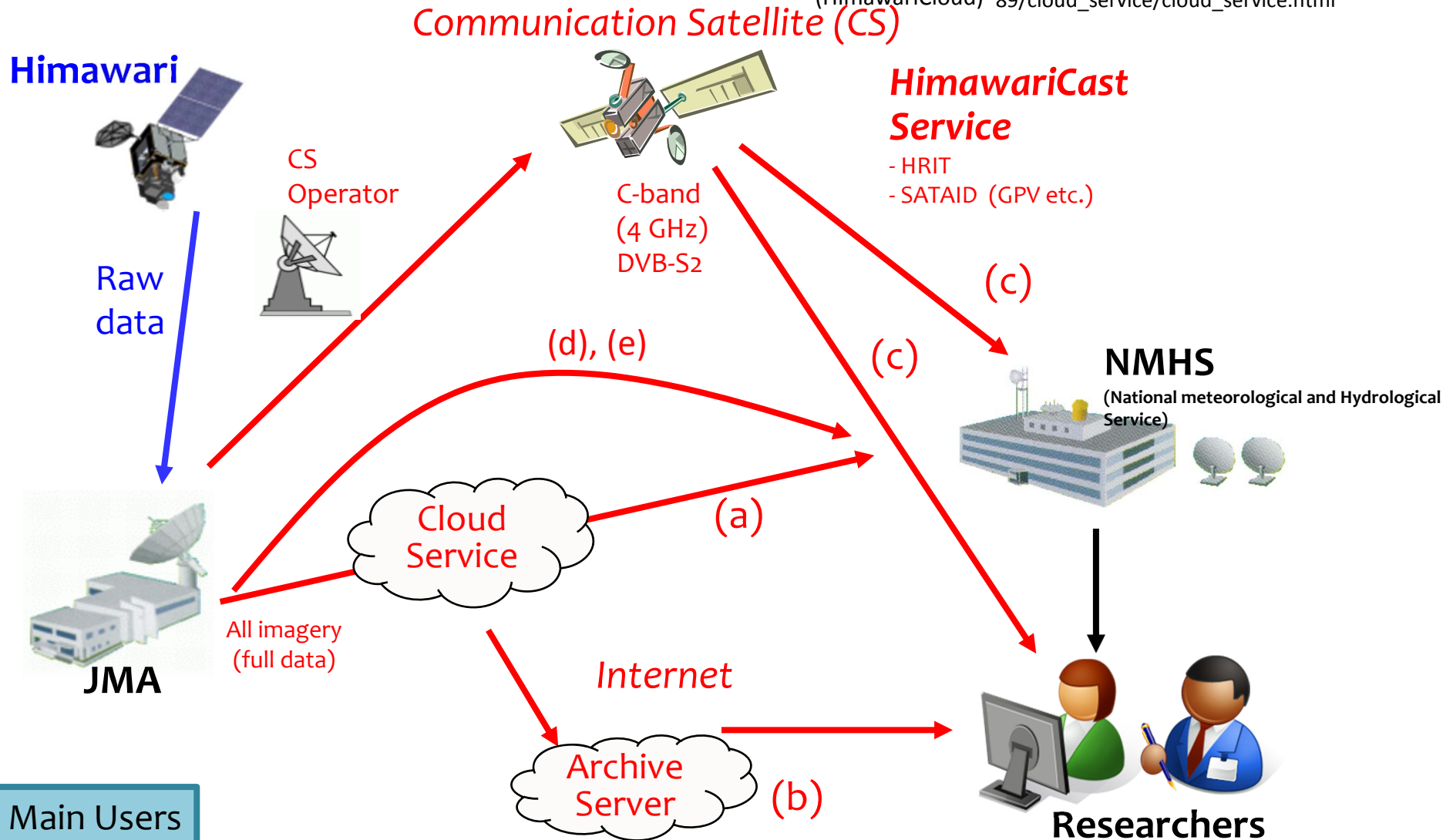
Researchers

Main Users

(a) Cloud Service: NMHS (1 Agency / Country)
(b) Archive Server: Universities and Researchers
(e) JDDS (JMA Data Dissemination System)

(c) HimawariCast: Every users
(d) WIS portal

Internet Cloud Service: HimawariCloud

- HimawariCloud is currently under the construction process.
- JMA plans to start the service in **March 2015**.

- Each NMHS will be provided one account for accessing HimawariCloud from JMA on request.
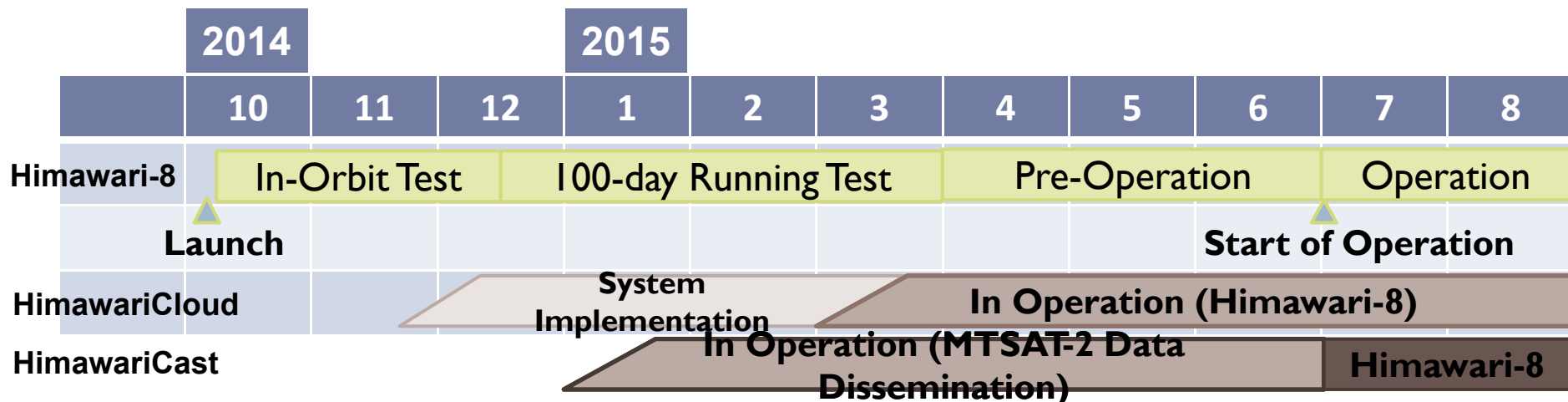
- Users can select the bands and the segments they want to get.
- If users want to get full set of data, they need to prepare connection line its bandwidth is more than **25 Mbps**, and **concurrent download** must be implemented to achieve practical download speed.

	2014			2015							
	10	11	12	1	2	3	4	5	6	7	8
Himawari-8	In-Orbit Test			100-day Running Test			Pre-Operation			Operation	
	Launch									Start of Operation	
HimawariCloud			System Implementation				In Operation (Himawari-8)				
HimawariCast				In Operation (MTSAT-2 Data Dissemination)						Himawari-8	

- The technical information on the **HimawariCloud** service has been released on JMA's website.
  - http://www.data.jma.go.jp/mscweb/en/himawari89/cloud_service/cloud_service.html

Internet Cloud Service (HimawariCloud)

Format	Area	Data size	Remarks
Himawari Standard Data (HSD)	Full disk Target area	329 GB (1 day) #3: 930 MB (10 min) #1, 2, 4: 230 MB (10 min) #5-16: 60MB (10 min)	- Full disk: every 10 minutes - Target area: every 2.5 minutes - 16 bands - Finest-spatial-resolution data
PNG	Full disk Target area	49 GB (1 day) 350 MB (10 min)	- True color image (composites of 3 visible bands) - Full disk: every 10 minutes - Target area: every 2.5 minutes - Same spatial resolution as HSD
NetCDF	Target area	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)	- Every 2.5 minutes - 16 bands - Same spatial resolution as HSD

Features
- NMHS can get data using HTTP 1.1 client such as Web browser or Wget.
- NMHS choice of data (HSD is created separately for each band, and divided into 10 segments.) i.e. 16 bands x 10 segments = 160 files / 10 minutes

Notes
- Basically one download per one country
- Account registration is required
- High speed Internet access (25 Mbps) is required to download all HSD

Archive Server: Candidates

- Following two systems volunteered to act as a server for providing all Himawari-8 data to researchers
- They have big storage device more than several petabytes
- Voluntary and best effort service
- Details are undecided
- Further news will be uploaded in JMA/MSC website

DIAS   Data Integration and Analysis System

http://www.editoria.u-tokyo.ac.jp/projects/dias/?locale=en

- Managed by University of Tokyo

NICT Science Cloud

http://sc-web.nict.go.jp/

- Managed by National Institute of Information and Communications Technology (NICT)

HimawariCast Service

| Data type	Format/size	Remarks
Himawari-8/9 imagery (Full Disk)	**HRIT files** 41 GB (1 day) Vis: 230 MB (10 min) IR: 15 MB (10 min) **LRIT files** 432 MB (1 day) each: 1 MB (10 min)	- Compatible with current MTSAT HRIT & LRIT - Every 10 minutes - HRIT: 5 bands; LRIT: 3 bands - Coarser spatial resolution than HSD
NWP Products(GPV)	SATAID format 10 MB (6hour)	- JMA's Global Spectral Model (GSM) products - Every 6 hours
In-situ Observations (Surface, upper-air, ships)	SATAID format less than 1 MB (1 hour)	- Observation data collected from the East Asia and Western Pacific regions
ASCAT Ocean Surface Wind	SATAID format 5 MB (1 hour)	- Originally provided by EUMETSAT OSI SAF and converted into SATAID format by JMA

Features
- With SATAID, you can overlay GPV, SYNOP etc. on satellite image.
- Satellite image in SATAID format can be downloaded from WIS server (or you can convert from HRIT)

Notes
- Receiving and processing system is required
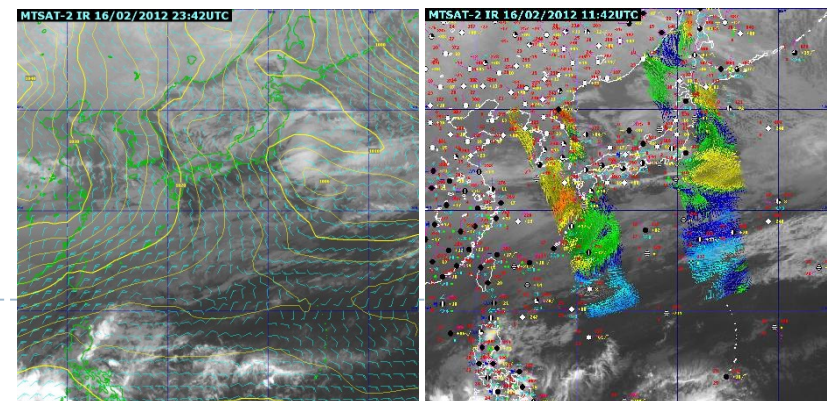
Himawari Standard Data

- The AHI data are processed into
  - "Himawari Standard Data" in

    "Himawari Standard Format"
  - JMA original format
  - similar to HRIT data, but additional metadata in the header records (e.g. Satellite ID, Quality flags, GSICS coefficients, etc.)
- Himawari Standard Data User's Guide
  - http://mscweb.kishou.go.jp/himawari89/space_segment/hsd_sample/HS_D_users_guide_en.pdf