Preparation for Himawari-8

Japan Meteorological Agency
Meteorological Satellite Center
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Introduction

• Background
  – The Japan Meteorological Agency (JMA) plans to start the operation of next-generation Himawari-8 and -9 satellites in 2015 and 2017, respectively, as a replacement for current MTSAT-2 (Himawari-7).
  – Himawari-8 and -9 will carry the Advanced Himawari Imager (AHI), a new Visible/near-infrared/Infrared Imager

• For user preparation, JMA provides information about Himawari-8/9 on its website.
• JMA is developing the AHI products
Specification of Himawari-8/9 Imager (AHI)

<table>
<thead>
<tr>
<th>Band</th>
<th>Wavelength [μm]</th>
<th>Spatial Resolution</th>
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<td>0.51</td>
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<tr>
<td>16</td>
<td>13.3</td>
<td>2Km</td>
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Similar to ABI for GOES-R

- **RGB band Composited**
- **0.51 μm (Band 2) instead of ABI’s 1.38 μm**

- **Water vapor**
- **SO₂, O₃**
- **Atmospheric Windows**
- **CO₂**

**Products**
- Cloud Product (mask, type, height)
- Atmospheric Motion Vector
- Clear Sky Radiance
- Volcanic Ash
- Yellow Sands (Asian Dust)
- Typhoon Analysis
- Sea Surface Temperature
- Snow and Ice Coverage
- Global Instability Index
- ...

MTSAT-1R/2

VIS

IR4

IR3

IR1

IR2

True Color Image

A true color earth image is published by the JMA Earth Observation

3/18
AHI will scan all sectors within 10 minutes

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

**Region 1 JAPAN (North-East)**
Interval: **2.5 minutes** (4 times in 10 minutes)
Dimension: EW x NS: 2000 x 1000 km
2 swath

**Region 2 JAPAN (South-West)**
Interval: **2.5 minutes** (4 times in 10 minutes)
Dimension: EW x NS: 2000 x 1000 km
2 swath

**Region 3 Typhoon (Target area)**
Interval: **2.5 minutes** (4 times in 10 minutes)
Dimension: EW x NS: 1000 x 1000 km
2 swath

**Region 4 Land mark**
Interval: **0.5 minutes** (20 times in 10 minutes)
Dimension: EW x NS: 1000 x 500 km
1 swath

**Region 5 Land mark**
Interval: **0.5 minutes** (20 times in 10 minutes)
Dimension: EW x NS: 1000 x 500 km
1 swath
JMA/MSC (Meteorological Satellite Center) website top page
http://mscweb.kishou.go.jp/
(note: going to new URL in September)

The Japan Meteorological Agency (JMA) has operated the GMS and MTSAT series of satellites at around 140 degrees east to cover the East Asia and Western Pacific regions since 1977, and makes related contributions to the WMO's World Weather Watch (WWW) Programme. As a follow-on to the MTSAT series, the Agency plans to operate next-generation satellites called Himawari-8 and Himawari-9 (Himawari means “sunflower” in Japanese).

Overview of satellite observations

The functions and specifications are notably improved from those of the on-board imager of MTSAT, and enable better nowcasting, improved numerical weather prediction accuracy and enhanced environmental monitoring.

Satellite operation plan for Himawari-8/9

- Enhanced spatial resolutions
- More spectral bands
- More frequent observations
  - Full disk observation with 10-minute intervals
  - Rapid scan observation
    - Every 2.5 minutes around Japan

MTSAT-1R/2

- 1 band (1km, VIS)
- 4 bands (IR, NIR)
- 16 bands

Himawari-8/9

- 3 bands (color image)
- 5 bands
- 10 bands
- 16 bands
Himawari-8/9: Technical Information

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

- Estimated Spectral Response Functions (SRFs) of AHI are available on JMA website.
- NWP based proxy data using a Radiative Transfer Model are available on JMA website.

http://mscweb.kishou.go.jp/himawari89/
## Himawari-8 sample data

<table>
<thead>
<tr>
<th>band</th>
<th>Central wavelength [µm]</th>
<th>Original spatial resolution [km]</th>
<th>Himawari Standard Data</th>
<th>NetCDF</th>
<th>Color Image Data (png)</th>
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<tr>
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<td></td>
<td></td>
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<td>target area</td>
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*True Color Images available on: [http://mscweb.kishou.go.jp/himawari89/space_segment/spsg_sample.html](http://mscweb.kishou.go.jp/himawari89/space_segment/spsg_sample.html)
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
NetCDF Data

• NetCDF format on latitude/longitude grids.
• Only for Regional Observation
  – Target area
• General input/output format for many GIS applications
• bzip2-compressed

Sample data of Japan area (from MTSAT-2)
Color Image Data (PNG 24bit)

- Visible bands true color composition
  - blue: 0.46µm, green: 0.51µm, red: 0.64µm
- Easy to check, easy to understand
- Useful for identification/monitoring of Dust, Volcanic Ash, Fire Smoke, etc.

Sample data of Japan area (NWP based proxy data)
Sample data of Full Disk (NWP based proxy data)
Status of Product Development for Himawari-8/9

- Cloud Products
  - Cloud Mask,
  - Cloud Type/Phase,
  - Cloud Top Height

- Atmospheric Motion Vector (AMV)

- Volcanic Ash Product

- Aerosol Product (Asian Dust)
Cloud Product

- Elements: cloud mask, Cloud type/phase, Cloud top height
- User: L2 product (used in subsequent processing)
- Algorithm: based on NWC-SAF and NOAA/NESDIS
- Status: Prototypes testing (MSG), tuning for Himawari-8/9

1200UTC 13th Jun. 2008

Figures for CREW comparison
Changes of AMV derivation software for Himawari-8

Changes

- Motion tracking algorithm using multiple imagery and different size of target box
- Cloud height assignment method based on maximum likelihood estimation

MTSAT IR AMV computed by operational software (QI>80) for 00UTC 02 March 2014
MTSAT IR AMV computed by Himawari-8 AMV software (QI>80) for 00UTC 02 March 2014

Changes of AMV derivation software for Himawari-8

Changes

- Motion tracking algorithm using multiple imagery and different size of target box
- Cloud height assignment method based on maximum likelihood estimation
Volcanic Ash Products

- JMA has been developing volcanic ash products for aviation use.

**Introduced Algorithms**

- **JMA+EUMETSAT algorithm**
  - JMA developed ash detection algorithm
  - (similar way to NOAA/NESDIS algorithm)
  - Retrieval algorithm is provided from EUMETSAT.

- **NOAA/NESDIS algorithm**
  - JMA introduced volcanic ash retrieval software developed by NOAA/NESDIS.

**JMA will establish a test-bed for inter-comparison of multiple algorithms.**

- JMA performed a preliminary comparison of two algorithms.
  - note: Input datasets (NWP, SST) are different in each algorithm.
  - JMA+EUMETSAT: GSM, MGDSST (JMA)
  - NOAA/NESDIS: GFS, SST from AVHRR

Note: NOAA/NESDIS will be providing JMA with a software update in June 2014 and that all results are extremely preliminary until the update has been installed.
Preliminary intercomparison of NOAA/NESDIS and EUMETSAT algoirism

Ash Top Height

Note: NOAA/NESDIS will be providing JMA with a software update in June 2014 and that all results are extremely preliminary until the update has been installed.

Note: Input datasets (NWP, SST) are different in each algorithm.
Dust Product (Aerosol Optical Depth)

Prototype (from Terra/MODIS)

Current product (MTSAT-2)

Available over Land (NEW)

Optical depth estimated from Terra/MODIS data (corresponding to Himawari/AHI channels) using a new algorithm (without cloud mask)

Optical depth estimated from MTSAT-2 data (with cloud mask)