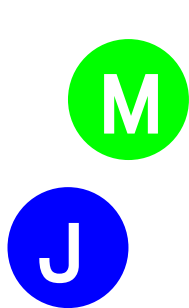


The Sixth Asia/Oceania Meteorological Satellite Users' Conference
9 – 13 November 2015, Tokyo/Japan



Introduction of JMA VLab Support Site on RGB Composite Imagery and tentative RGBs

Akihiro SHIMIZU

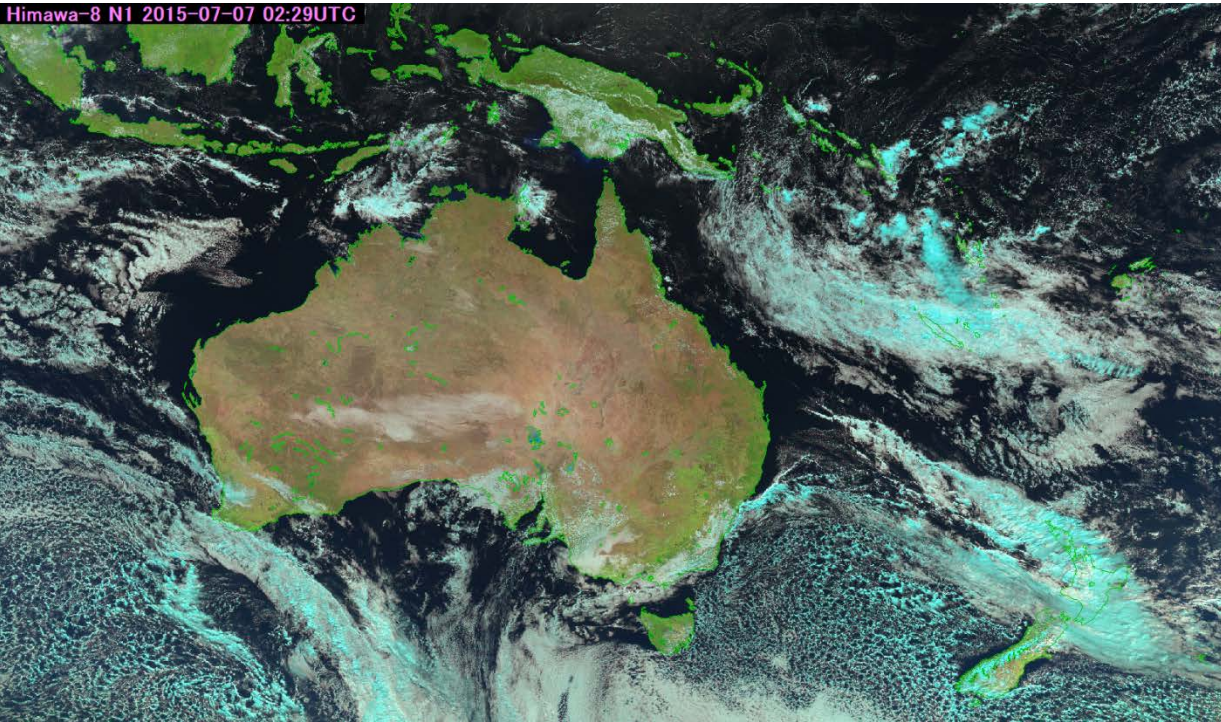
Analysis Division, Data Processing Department
Meteorological Satellite Center (MSC), JMA

metsat AT met.kishou.go.jp
(Satellite Program Division, Japan Meteorological Agency)

Contents

- VLab Support Site on RGB composite imagery
- Adjustment RGB recipes (tentative)
- Experimental RGBs by Himawari-8/AHI

Himawa-8 N1 2015-07-07 02:29UTC



VLab Support Site on
RGB composite imagery

Background of Opening of VLab Support Site on RGB composite imagery

- RGB composite technique is in the “spotlight” as an effective use of the AHI/Himawari-8 imagery data.
- The Himawari user community is not necessarily familiar with RGB composite imagery.
 - The basic RGB materials are necessary.

Virtual Laboratory for Training and Education in Satellite Meteorology (VLab)



- VLab is a global network of specialized training centres and meteorological satellite operators working together to improve the utilisation of data and products from meteorological and environmental satellites.
- Eight satellite operators are involved: CMA, CONAE, EUMETSAT, INPE, JMA, KMA, NOAA and ROSHYDROMET, and Thirteen training centres – called Centres of Excellence (CoEs) – located in Argentina (Buenos Aires and Cordoba), Australia (Melbourne), Barbados (Bridgetown), Brazil (Cachoeira Paulista), China (Beijing and Nanjing), Costa Rica (San Jose), Kenya (Nairobi), Morocco (Casablanca), Niger (Niamey), Oman (Muscat), Republic of Korea (Gwanghyewon), the Russian Federation (Moscow and St Petersburg) and South Africa (Pretoria). Three CoEs are linked to universities (Buenos Aires, St. Petersburg and Nanjing).

(extract) WMO-CGMS VLab website <http://www.wmo-sat.info/vlab/>



MSC/JMA website



Himawari Real-Time Image	
Himawari User's Guide	
Himawari-8 Operational Information	MTSAT Operational Information
Virtual Laboratory (VL)	Products and Library
Navigation Monitoring	Calibration Monitoring

JMA's VLab website

Spring and Autumn Equinox Operations of Himawari-8

- Observation images of Himawari-8 are affected by the sun avoidance function of the radiometer and the sun stray light in a spring and autumn equinox period.
Detailed information;[Himawari-8 Operation for Eclipse Periods](#) (10 August 2015)

Important Notice

- [Direct dissemination service via MTSAT-1R to be terminated on 4 December 2015.](#) (7 October 2015)

Information

Updated top page
of JMA VLab site



JMA Virtual Laboratory

*For Satellite Training and
Data Utilization*

[About us](#)[Aims of our Activities](#)[Virtual Resources](#)[SATAID](#)[RGB Training Library](#)

Contributions to the WMO/CGMS-VL

The Virtual Laboratory for Satellite Training and Data Utilization (VL) was established to maximize the use of satellite data around the world. It is a collaborative effort that connects the world's major satellite operators with WMO Centers Of Excellence in satellite meteorology. These centers serve as satellite-focused training resources for WMO Members.

JMA Virtual Laboratory users must note the [COPYRIGHT](#) information and [DISCLAIMER](#) below.

VL Resources

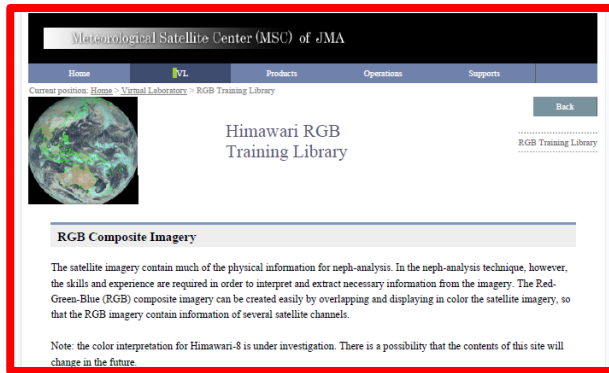
[Contents](#)

SATAID

[What is SATAID?](#)[SATAID Operation Manual \(PDF: 5,733 KB\)](#)

Link button to the
RGB training page
has been added
here!

Introduction/outline



Meteorological Satellite Center (MSC) of JMA

Home VL Products Operations Supports

Current position: Home > Virtual Laboratory > RGB Training Library

Back

Himawari RGB Training Library

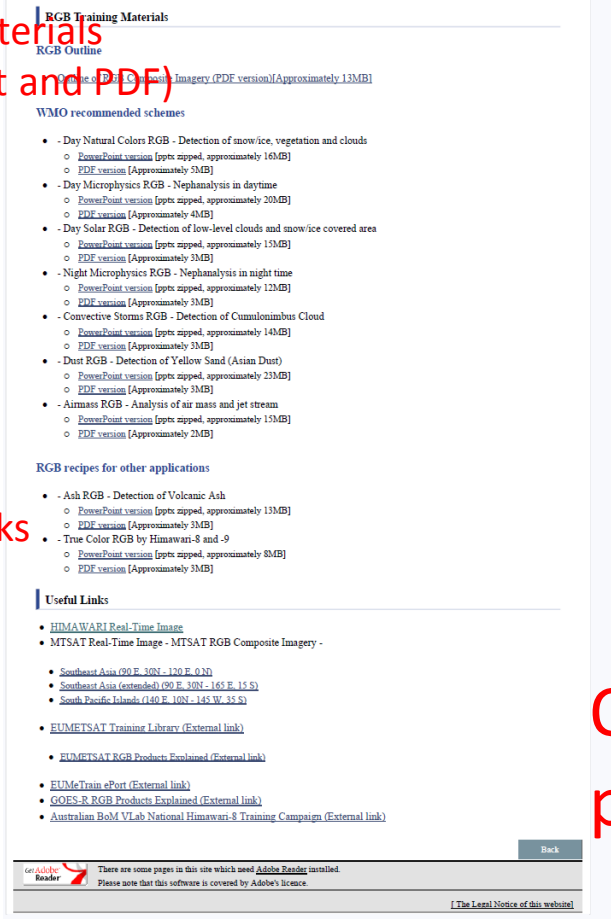
RGB Training Library

RGB Composite Imagery

The satellite imagery contain much of the physical information for neph-analysis. In the neph-analysis technique, however, the skills and experience are required in order to interpret and extract necessary information from the imagery. The Red-Green-Blue (RGB) composite imagery can be created easily by overlapping and displaying in color the satellite imagery, so that the RGB imagery contain information of several satellite channels.

Note: the color interpretation for Himawari-8 is under investigation. There is a possibility that the contents of this site will change in the future.

Training materials (PowerPoint and PDF)



RGB Training Materials

RGB Outline

[Outline of RGB Composite Imagery \(PDF version\) \[Approximately 13MB\]](#)

WMO recommended schemes

- Day Natural Colors RGB - Detection of snow/ice, vegetation and clouds
 - [PowerPoint version \[pptx zipped, approximately 160MB\]](#)
 - [PDF version \[Approximately 5MB\]](#)
- Day Microphysics RGB - Nephanalysis in daytime
 - [PowerPoint version \[pptx zipped, approximately 200MB\]](#)
 - [PDF version \[Approximately 4MB\]](#)
- Day Solar RGB - Detection of low-level clouds and snow/ice covered area
 - [PowerPoint version \[pptx zipped, approximately 150MB\]](#)
 - [PDF version \[Approximately 3MB\]](#)
- Night Microphysics RGB - Nephanalysis in night time
 - [PowerPoint version \[pptx zipped, approximately 120MB\]](#)
 - [PDF version \[Approximately 3MB\]](#)
- Convective Storms RGB - Detection of Cumulonimbus Cloud
 - [PowerPoint version \[pptx zipped, approximately 140MB\]](#)
 - [PDF version \[Approximately 3MB\]](#)
- Dust RGB - Detection of Yellow Sand (Asian Dust)
 - [PowerPoint version \[pptx zipped, approximately 230MB\]](#)
 - [PDF version \[Approximately 3MB\]](#)
- Airmass RGB - Analysis of air mass and jet stream
 - [PowerPoint version \[pptx zipped, approximately 150MB\]](#)
 - [PDF version \[Approximately 2MB\]](#)

RGB recipes for other applications

- Ash RGB - Detection of Volcanic Ash
 - [PowerPoint version \[pptx zipped, approximately 130MB\]](#)
 - [PDF version \[Approximately 3MB\]](#)
- True Color RGB by Himawari-8 and -9
 - [PowerPoint version \[pptx zipped, approximately 8MB\]](#)
 - [PDF version \[Approximately 3MB\]](#)

Useful Links

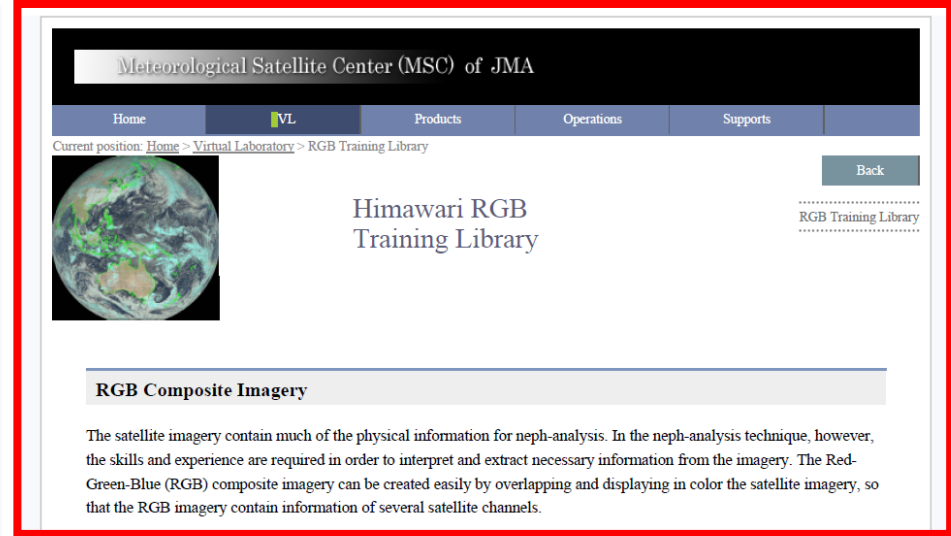
- [HIMAWARI Real-Time Image](#)
- [MTSAT Real-Time Image - MTSAT RGB Composite Imagery -](#)
 - [Southeast Asia \(90 E - 30N - 120 E - 0 N\)](#)
 - [Southeast Asia \(extended\) \(90 E - 30N - 165 E - 15 S\)](#)
 - [South Pacific Islands \(140 E - 10N - 145 W - 35 S\)](#)
- [EUMETSAT Training Library \(External link\)](#)
 - [EUMETSAT RGB Products Explained \(External link\)](#)
- [EUMeTrain ePort \(External link\)](#)
- [GOES-R RGB Products Explained \(External link\)](#)
- [Australian BoM VLab National Himawari-8 Training Campaign \(External link\)](#)

Back

There are some pages in this site which need Adobe Reader installed. Please note that this software is covered by Adobe's licence.

[The Latest Notice of this website]

Useful links



Meteorological Satellite Center (MSC) of JMA

Home VL Products Operations Supports

Current position: Home > Virtual Laboratory > RGB Training Library

Back

Himawari RGB Training Library

RGB Training Library

RGB Composite Imagery

The satellite imagery contain much of the physical information for neph-analysis. In the neph-analysis technique, however, the skills and experience are required in order to interpret and extract necessary information from the imagery. The Red-Green-Blue (RGB) composite imagery can be created easily by overlapping and displaying in color the satellite imagery, so that the RGB imagery contain information of several satellite channels.

Introduction/outline of RGB composite imagery

Overview of the training library page of RGB composite imagery

RGB Training Materials

Outline of RGB composite imagery based on EUMETSAT's technique

RGB Outline

- [Outline of RGB Composite Imagery \(PDF version\)](#) [Approximately 13MB]

WMO recommended schemes

Materials for seven WMO recommended schemes

- - Natural Color RGB - Detection of snow/ice, vegetation and clouds
 - [PowerPoint version](#) [pptx zipped, approximately 16MB]
 - [PDF version](#) [Approximately 5MB]
- - Day Microphysics RGB - Nephanalysis in daytime
 - [PowerPoint version](#) [pptx zipped, approximately 20MB]
 - [PDF version](#) [Approximately 4MB]
- - Day Snow-Fog RGB - Detection of low-level clouds and snow/ice covered area
 - [PowerPoint version](#) [pptx zipped, approximately 15MB]
 - [PDF version](#) [Approximately 3MB]
- - Night Microphysics RGB - Nephanalysis in night time
 - [PowerPoint version](#) [pptx zipped, approximately 12MB]
 - [PDF version](#) [Approximately 3MB]
- - Day Convective Storm RGB - Detection of Cumulonimbus Cloud
 - [PowerPoint version](#) [pptx zipped, approximately 14MB]
 - [PDF version](#) [Approximately 3MB]
- - Dust RGB - Detection of Yellow Sand (Asian Dust)
 - [PowerPoint version](#) [pptx zipped, approximately 23MB]
 - [PDF version](#) [Approximately 3MB]
- - Airmass RGB - Analysis of air mass and jet stream
 - [PowerPoint version](#) [pptx zipped, approximately 15MB]
 - [PDF version](#) [Approximately 2MB]

Almost all imagery are derived from Himawari-8.

As for detailed case studies (e.g. Visibility obstruction by fog 2015/XX/XX/XX UTC), they will be prepared and open at the stage when knowledge still more deepened.

RGB recipes for other applications

Materials except for WMO recommended schemes

- - Ash RGB - Detection of Volcanic Ash
 - [PowerPoint version](#) [pptx zipped, approximately 13MB]
 - [PDF version](#) [Approximately 3MB]
- - True Color RGB by Himawari-8 and -9
 - [PowerPoint version](#) [pptx zipped, approximately 8MB]
 - [PDF version](#) [Approximately 3MB]

JMA's True Color RGB material is here!

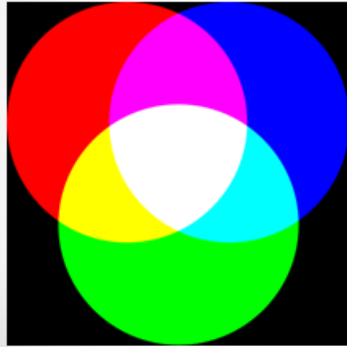
Example of materials

Outline material on RGB composite imagery

Outline of RGB Composite Imagery

Data Processing Division, Data Processing Department
 Meteorological Satellite Center (MSC)
 JMA
 Akihiro SHIMIZU
 29 September, 2014
 Updated 18 May, 2015

What's RGB composite imagery?



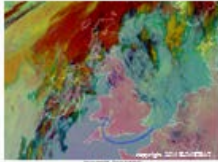
- Red (R), green (G) and blue (B) which are the three primary colors of light constitute color space expressing additive color composite
- The RGB composite imagery is a technique to display a color using this property of the three primary colors of light

What's RGB composite imagery?

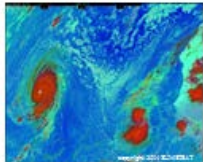
Channel	Himawari-8/ -9	MTSAT-1R/-2	MSG	Physical Properties	
1	0.46 μm			vegetation, aerosol	Visible
2	0.51 μm			vegetation, aerosol	
3	0.64 μm	0.68 μm	0.635 μm	low cloud, fog	
4	0.86 μm		0.81 μm	vegetation, aerosol	Near Infrared
5	1.6 μm		1.64 μm	cloud phase	
6	2.3 μm			particle size	
7	3.9 μm	3.7 μm	3.52 μm	low cloud, fog, forest fire	Infrared
8	6.2 μm	6.8 μm	6.25 μm	mid- and upper level moisture	
9	6.9 μm			mid- level moisture	
10	7.3 μm		7.35 μm	mid- and lower level moisture	Infrared
11	8.6 μm		8.70 μm	cloud phase, SO ₂	
12	9.6 μm		9.66 μm	ozone content	
13	10.4 μm	10.8 μm	10.8 μm	cloud imagery, information of cloud top	Infrared
14	11.2 μm			cloud imagery, sea surface temperature	
15	12.4 μm	12.0 μm	12.0 μm	cloud imagery, sea surface temperature	
16	13.3 μm		13.4 μm	cloud top height	

There are different properties in each channel, as shown in the left figure.

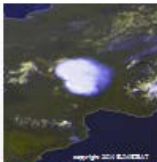
RGB composite imagery which are possible to create by MTSAT satellites



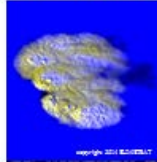
Night Microphysics



Day Microphysics




Clouds Convection



Severe Storms

Example of materials

Natural Color RGB



Natural Color RGB
Detection of snow/ice, vegetation and clouds

Meteorological Satellite Center, JMA

Ver. 20130424

This material reproduces the EUMETSAT/MSG recipe by using "Himawari8/AHI" imagery.

Characteristics and Basis of Three Components

- Reflection characteristic of 805 depends on the phase and size of cloud particles
- Reflectivity is small for large cloud particles
- Ice cloud particles absorb light beams, and reflectivity is small
- High-level clouds consisting of ice particles, snow/ice and sea ice are displayed in darker color

R : 805(N2 1.6) Range: 0~100 (%) Gamma : 1.0

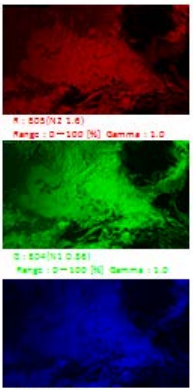
- 805 has, in general, high reflectivity for snow/ice covered area and clouds
- Land surface looks relatively darker, sea surface looks darkest
- Reflection by clouds depends on optical thickness and density of cloud particles
- Low-level clouds and land/sea surface can be seen through thin high-level clouds
- Clouds can be distinguished by their "texture", i.e. stratiform clouds of smooth texture or convective clouds of rough texture

G : 804(N1 0.36) Range: 0~100 (%) Gamma : 1.0

- 804 as well as 805, has high reflectivity for snow/ice covered area and clouds
- Land surface looks relatively darker, sea surface looks darkest
- Vegetation distribution can be derived because of high reflectivity by "chlorophyll" in plant bodies
- On MSG imagery, high-level clouds consisting of ice particles, snow/ice and sea ice, which are low reflectivity on red 805, are displayed in cyan (i.e. green 804 + blue 803) color
- Low-level clouds (water clouds) which are high reflectivity on the three colored images, are displayed in whitish color
- Vegetation area appears in greenish color

B : 803(N3 0.64) Range: 0~100 (%) Gamma : 1.0

What's Natural Color RGB?



R : 805(N2 1.6) Range: 0~100 (%) Gamma : 1.0

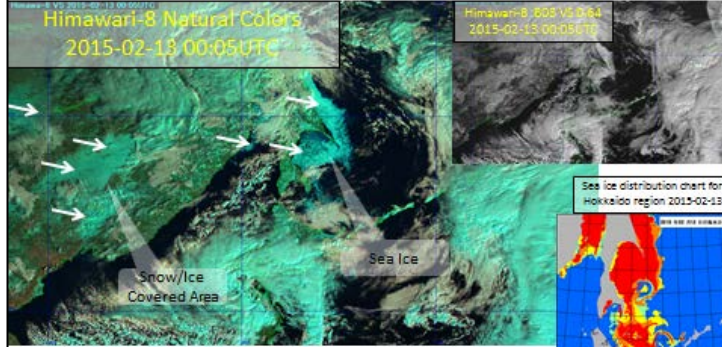
G : 804(N1 0.36) Range: 0~100 (%) Gamma : 1.0

B : 803(N3 0.64) Range: 0~100 (%) Gamma : 1.0

Example of Natural Color RGB
Sea Ice and Snow/Ice Covered Area

Himawari-8 Natural Colors
 2015-02-13 00:05UTC

Himawari-8 805-V3 0.64
 2015-02-13 00:05UTC



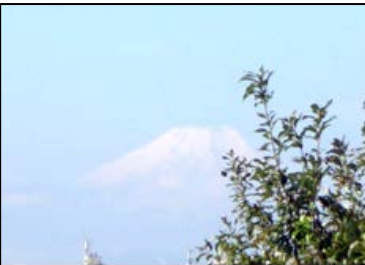
Sea ice distribution chart for Hokkaido region 2015-02-13

Sea ice and snow/ice covered area appear in cyan color!

Example of materials

This scheme is Himawari's own recipe!

True Color RGB

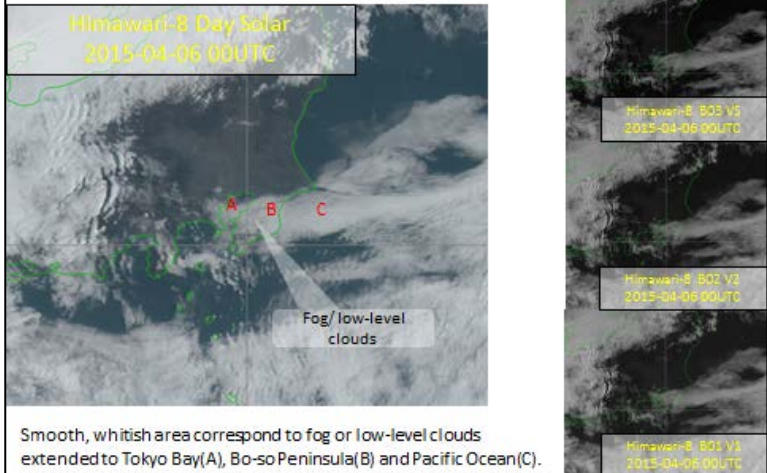


**Himawari-8
True Color RGB**

Meteorological Satellite Center, JMA

Ver. 20130019

Example of True Color RGB
Fog/low-clouds after the rainfall in Kanto Plain, Japan



Himawari-8 Day Salar
2015-04-06 00UTC

Himawari-8 B03 V3
2015-04-06 00UTC

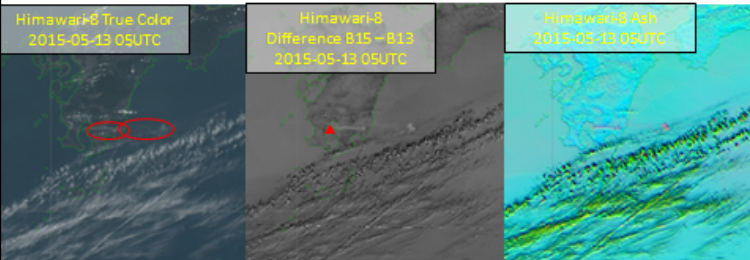
Himawari-8 B02 V3
2015-04-06 00UTC

Himawari-8 B01 V3
2015-04-06 00UTC

Fog/low-level clouds

Smooth, whitish area correspond to fog or low-level clouds extended to Tokyo Bay(A), Bo-so Peninsula(B) and Pacific Ocean(C).

Example of True Color RGB
Volcanic ash of Sakurajima, Japan



Ash
(RGB:R12-R13/R13-R11/R13)


Himawari-8 True Color
2015-05-13 09UTC

Himawari-8
Difference B15 - B13
2015-05-13 09UTC

Himawari-8 Ash
2015-05-13 09UTC

The drifting volcanic ash (from west to east) can be seen in true color RGB image and difference image (B15 - B13), however, the distinction between ash and upper layer cloud is not easy.

Ash RGB (specific RGB adapted to monitor and track volcanic ash and gas) appears to be better colorization (reddish area).



Sakurajima, Japan

© 2015 Google

**True Color RGB
Summary**

This RGB scheme will be...

- available to display "true colored" image that is nearly visible with the naked eye, by composition of "three visible images" corresponding to red, green and blue colors with human's naked eye
- easy to use for traditional "single band" imagery user and RGB beginner
- available day time only
- "second-best" compared with other specific RGB scheme in the specific case such as nephelometry and volcanic ash

Useful links

Useful Links

- [HIMAWARI Real-Time Image](#) ← Links to Himawari real-time image including the RGB composite imagery
- MTSAT Real-Time Image - MTSAT RGB Composite Imagery -
 - [Southeast Asia \(90 E, 30N - 120 E, 0 N\)](#) ← Links to MTSAT real-time image including the RGB composite imagery
 - [Southeast Asia \(extended\) \(90 E, 30N - 165 E, 15 S\)](#)
 - [South Pacific Islands \(140 E, 10N - 145 W, 35 S\)](#)
- [EUMETSAT Training Library \(External link\)](#) ← EUMETSAT Training Library
- [EUMETSAT RGB Products Explained \(External link\)](#)
- [EUMeTrain ePort \(External link\)](#) ← EUMeTrain ePort
- [GOES-R RGB Products Explained \(External link\)](#) ← NOAA GOES-R RGB Products Explained website
- [Australian BoM VLab National Himawari-8 Training Campaign \(External link\)](#)

Australian BoM VLab National Himawari-8 Training Campaign website

Suitable links will be added here.

Useful links: HIMAWARI Real-Time Image

MSC/JMA website

Meteorological Satellite Center (MSC) of JMA

Home Activities Products Operations Supports

About us Aims Japanese

Monitoring the earth from space

Spring and Autumn Equinox Operations of Himawari-8

- Observation images of Himawari-8 are affected by the sun avoidance function of the radiometer and the sun stray light in a spring and autumn equinox period.
Detailed information: [Himawari-8 Operation for Eclipse Periods](#) (10 August 2015)

Important Notice

- Direct dissemination service via MTSAT-1R to be terminated on 4

Himawari Real-Time Image

Himawari User's Guide

Himawari-8 Operational Information

MTSAT Operational Information

Virtual Laboratory (VL)

Products and Library

Navigation Monitoring

Calibration Monitoring

HIMAWARI Real-Time Image

Useful links: HIMAWARI Real-Time Image

Meteorological Satellite Center (MSC) of JMA

Home **Himawari Image** Products Operations

Current position: [Home](#) > Real-Time Image



Himawari
Real-Time Image

Full Disk, Quadrant, etc. Individual Sectors

Contents

Information

- This page was created at 03:00 UTC on 3 July 2015 (3 July 2015).
- JMA will provide [MTSAT Real-Time Imagery](#) in the event of a Himawari-8 or Himawari-9 enters stand-by orbit (3 July 2015).

Real-Time Image

- [MTSAT Real-Time Image](#)
- [Full Disk, Northern Hemisphere, Quadrant and/or East Asia. \(JMA website\)](#)
- [Full disk, Australia, Central Asia, New Zealand, Pacific Island, Southeast Asia, Resolution Asia.](#)
- Imagery with heavy rainfall potential areas
 - [Southeast Asia, South Pacific Islands](#)

HIMAWARI Real-Time Image

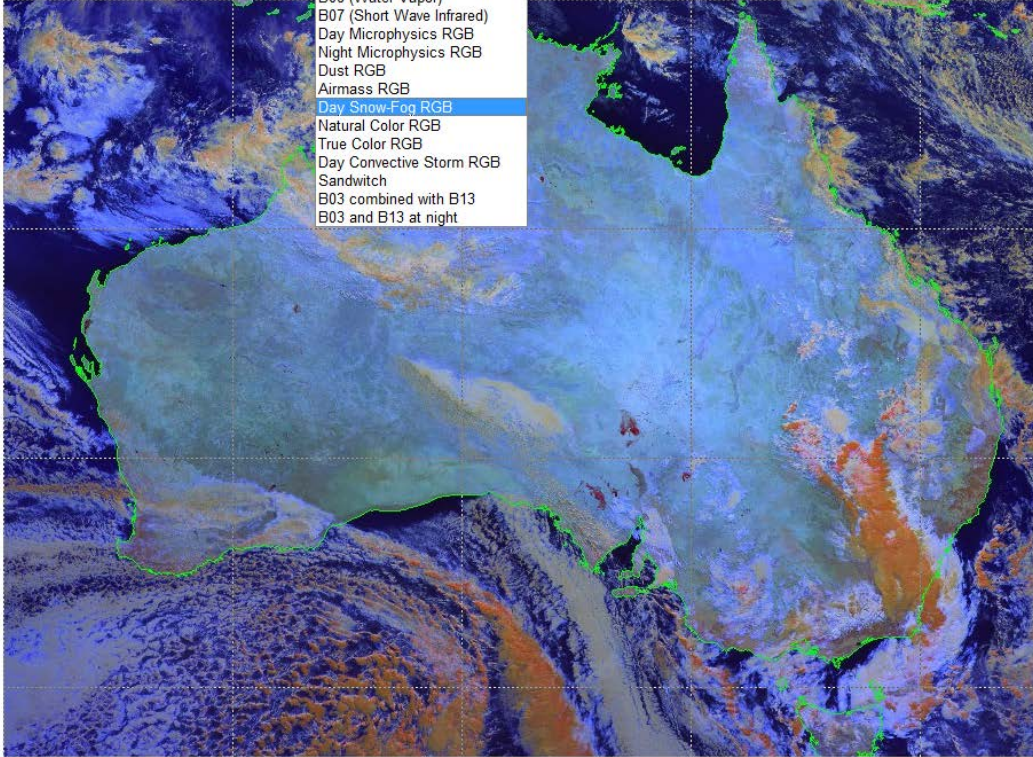
Select your favorite RGB!

The RGB composite imagery is produced by composing satellite images colored in red, green and blue.
[User's Guide to RGB composite imagery \(Himawari RGB Training Library\)](#)


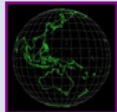
Select Area: Band:

Time: 02:00 UTC 10 July 2015

- B13 (Infrared)
- B03 (Visible)
- B08 (Water Vapor)
- B07 (Short Wave Infrared)
- Day Microphysics RGB
- Night Microphysics RGB
- Dust RGB
- Airmass RGB
- Day Snow-Fog RGB**
- Natural Color RGB
- True Color RGB
- Day Convective Storm RGB
- Sandwich
- B03 combined with B13
- B03 and B13 at night



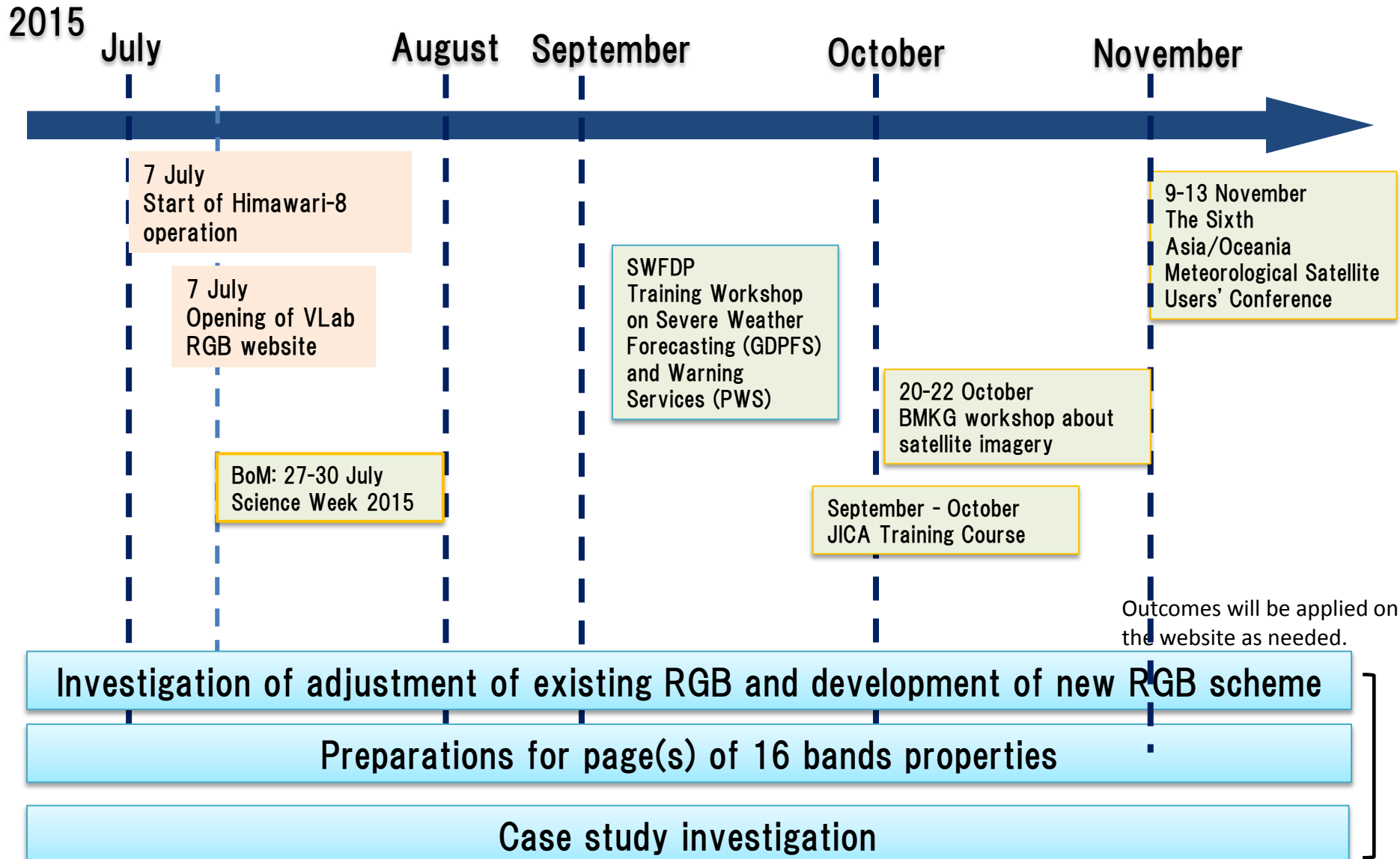
Click your favorite region!

Region		File Index
Full Disk		Filelist
		

Future Plan of VLab Support Site on RGB composite imagery

- First phase: materials based on “EUMETSAT” recipe
- Second phase: materials on the imagery specifications of AHI’s sixteen bands
- Third phase: materials of the tuned or optimized (color matching) and “new” RGB recipe
- Continuously: enhance the contents of RGB case studies

Related activities of VLab Support Site on RGB composite imagery





Adjustment RGB recipes (tentative)

Background and method of adjustment RGB recipes

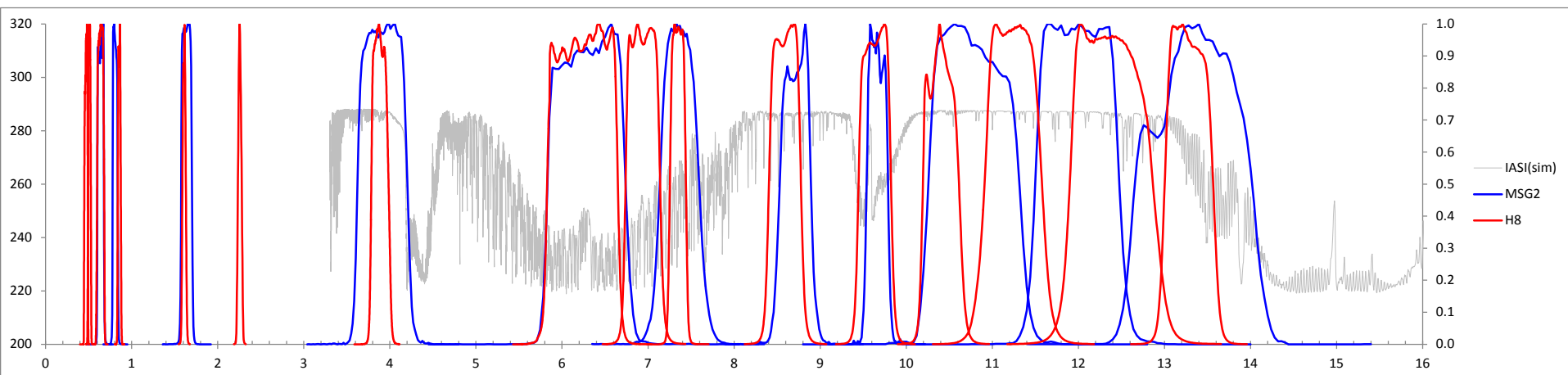
- Imager difference between Himawari and Meteosat (MSG)
 - Basic RGB recipes are based on MSG data
- Necessity of proper enhancements or adjustments of individual color beams
- Investigation of correlation between Himawari-8 and MSG-2, by simulated data (by H. Murata)
- Possibility to adjust MSG recipe to Himawari RGB by regression coefficient derived from the investigation

Assumption of the simulation

- Both of Meteosat-9 and Himawari-8 are on 140 degree east longitude
- Data: 06UTC (FT=0), 28th September 2012

#	MSG/SEVIRI	Himawari-8/ AHI	MTSAT-2/IMAGER
1		0.47	
2		0.51	
3	0.635	0.64	0.68
4	0.81	0.86	
5	1.64	1.6	
6		2.3	
7	3.92	3.9	3.7
8	6.25	6.2	6.8
9		6.9	
10	7.35	7.3	
11	8.70	8.6	
12	9.66	9.6	
13	10.8	10.4	10.8
14		11.2	
15	12.0	12.4	12.0
16	13.4	13.3	

Bands (channels) and response function



Correlation of Bands of Himawari-8/AHI and MSG/SEVIRI

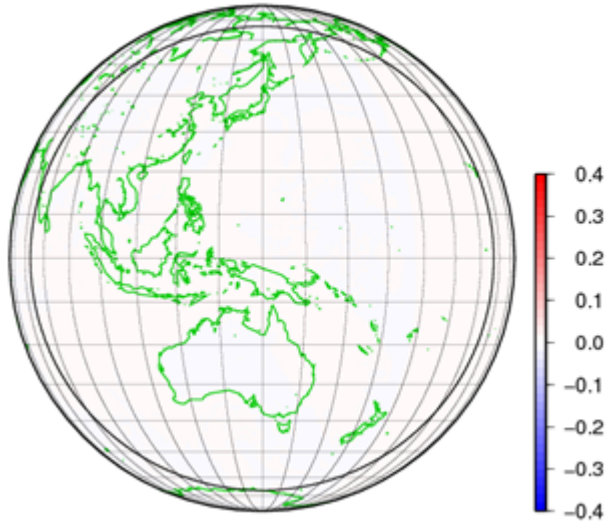
#	Himawari-8/ AHI	MSG/SEVIRI
1	0.47	
2	0.51	
3	0.64	0.6
4	0.86	0.8
5	1.6	1.6
6	2.3	
7	3.9	3.9
8	6.2	6.2
9	6.9	
10	7.3	7.3
11	8.6	8.7
12	9.6	9.7
13	10.4	10.8
14	11.2	
15	12.4	12.0
16	13.3	13.4

Difference images

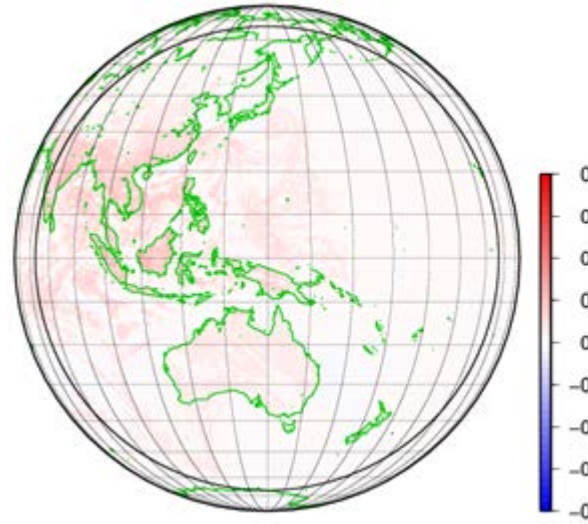
#	Himawari-8	MSG/SEVIRI
13-15	10.4-12.4	10.8-12.0
14-15	11.2-12.4	
7-13	3.9-10.4	3.9-10.8
7-14	3.9-11.2	
8-10	6.2-7.3	6.2-7.3
13-11	10.4-8.6	10.8-8.7
14-11	11.2-8.6	
13-12	10.4-9.6	10.8-9.7
14-12	11.2-9.6	

MSG vs H8@Visible and near IR

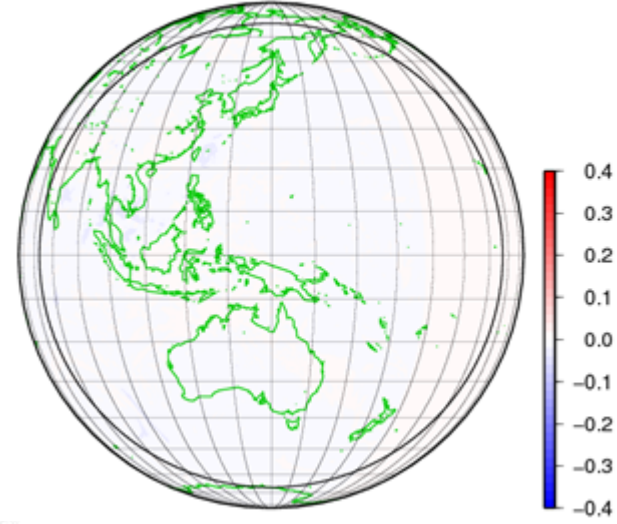
Himawari8/0.64μm – METEOSAT9/0.6μm



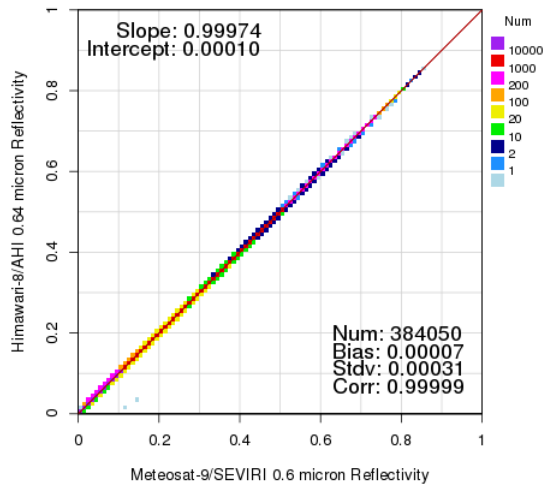
Himawari8/0.86μm – METEOSAT9/0.8μm



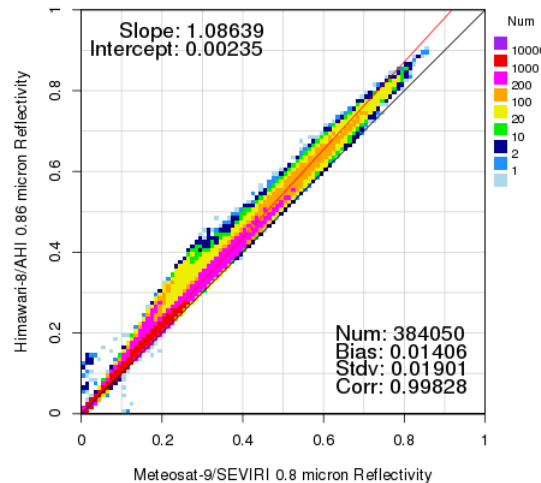
Himawari8/1.6μm – METEOSAT9/1.6μm



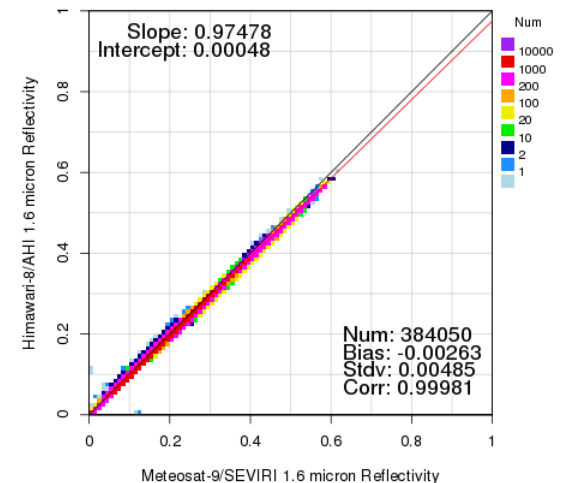
Comparison of simulated satellite observation



Comparison of simulated satellite observation



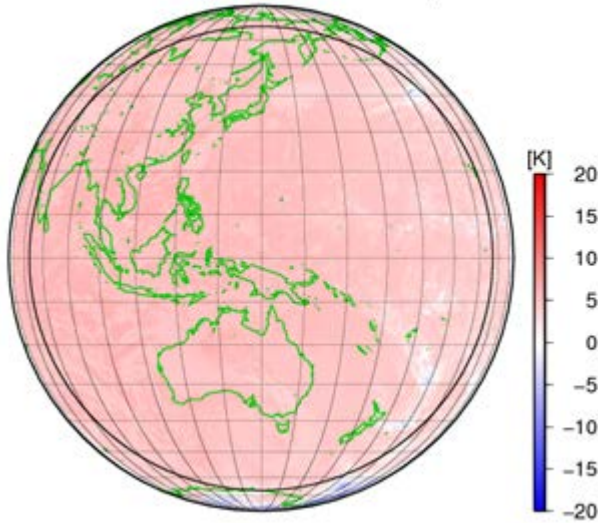
Comparison of simulated satellite observation



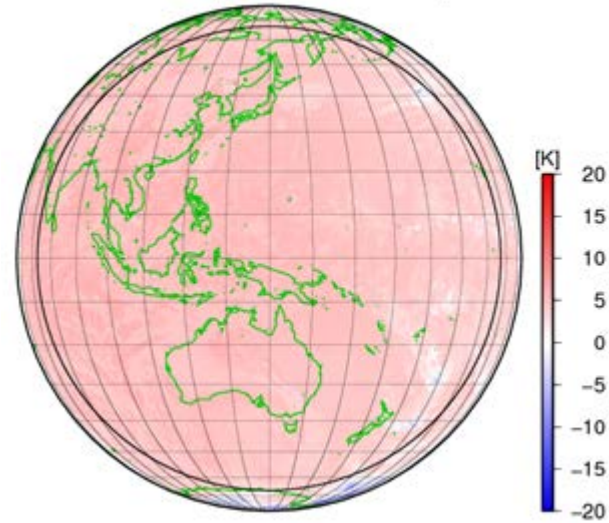
MSG vs H8@Infrared (3.9 micron)

Nighttime only

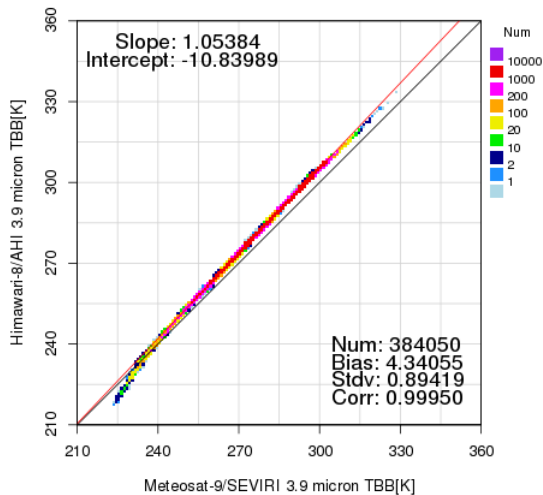
Himawari8/3.9 μ m - METEOSAT9/3.9 μ m



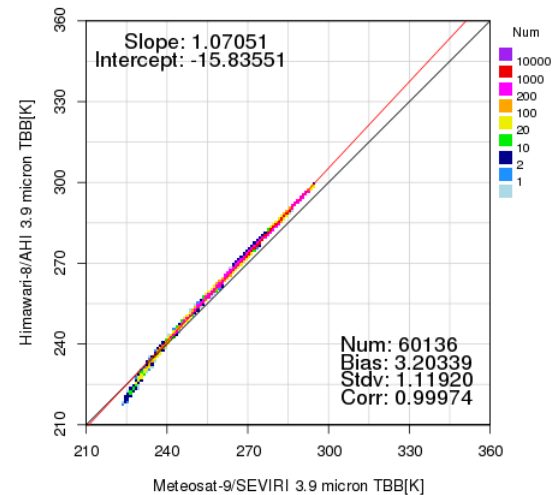
Himawari8/3.9 μ m - METEOSAT9/3.9 μ m



Comparison of simulated satellite observation

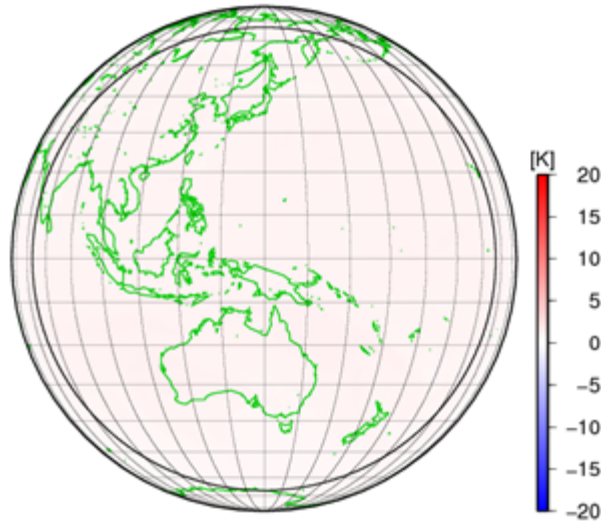


Comparison of simulated satellite observation

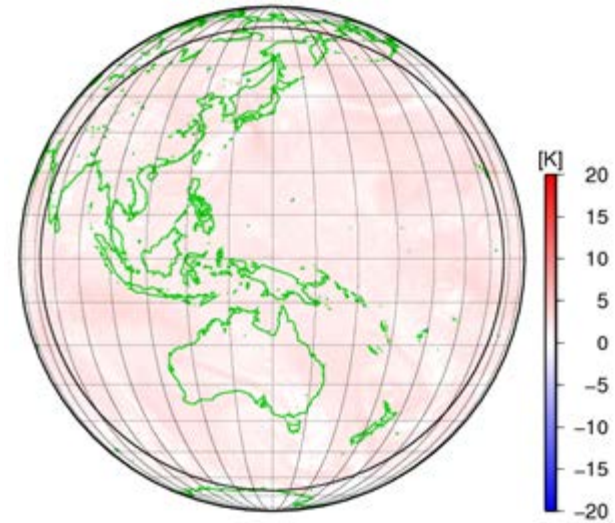


MSG vs H8@Infrared (water vapor)

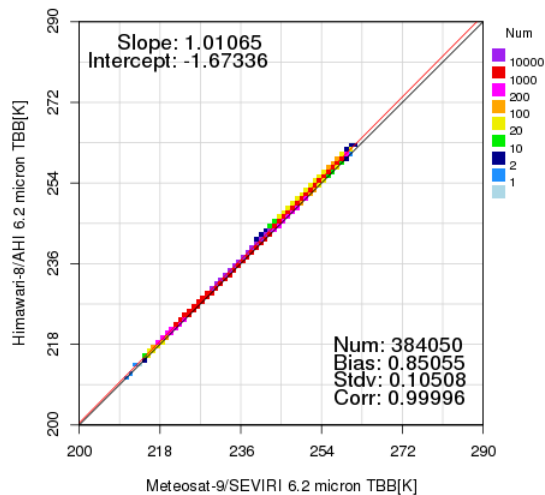
Himawari8/6.2 μ m – METEOSAT9/6.2 μ m



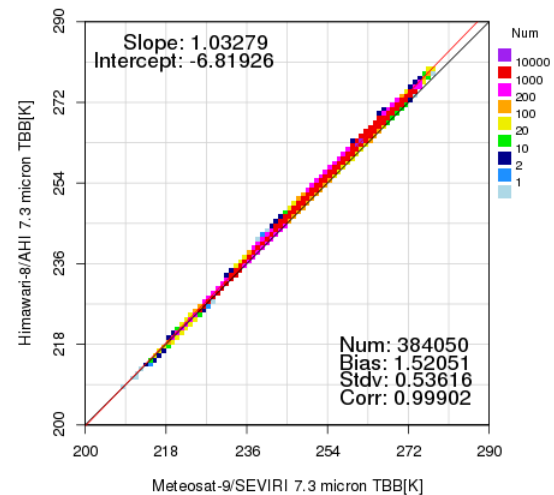
Himawari8/7.3 μ m – METEOSAT9/7.3 μ m



Comparison of simulated satellite observation

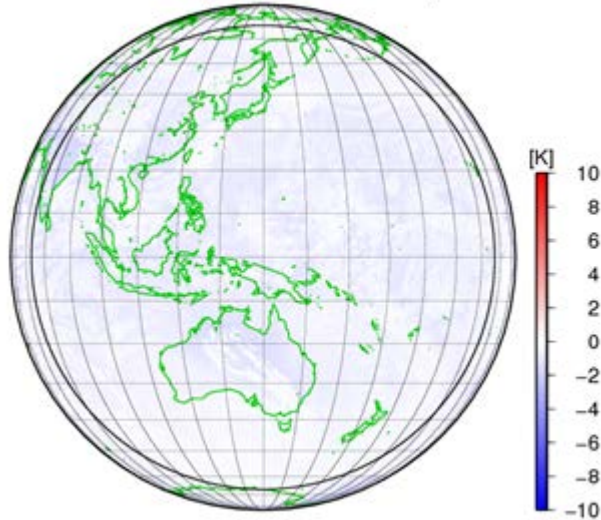


Comparison of simulated satellite observation

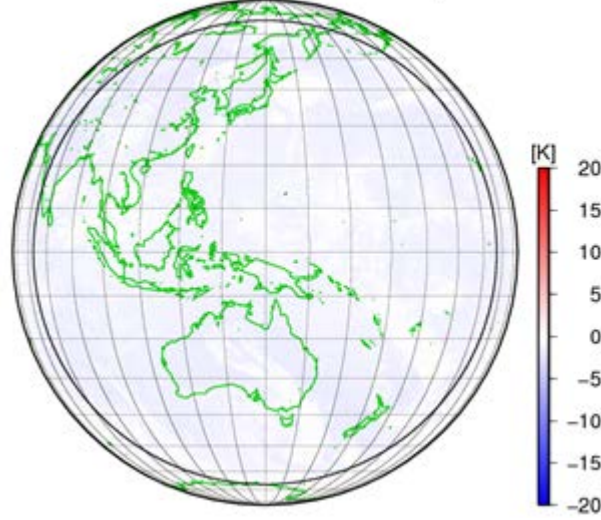


MSG vs H8@Infrared (8~10 micron)

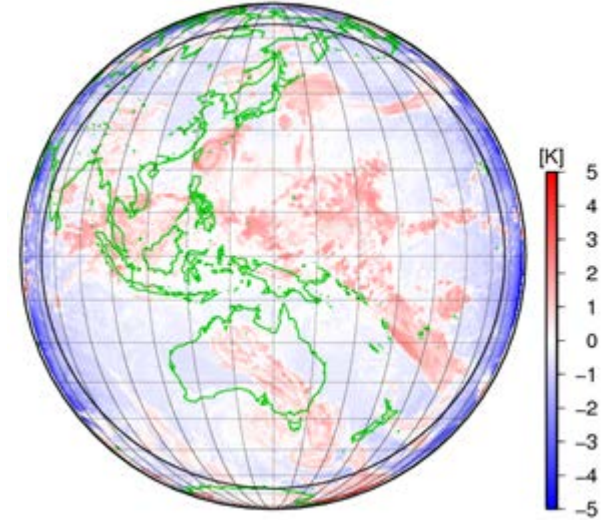
Himawari8/8.6 μ m – METEOSAT9/8.7 μ m



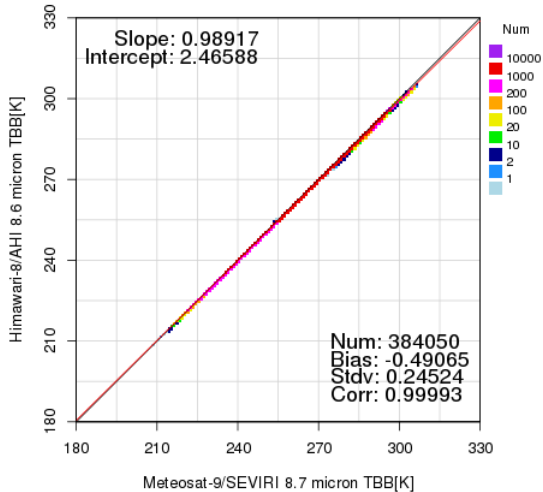
Himawari8/9.6 μ m – METEOSAT9/9.7 μ m



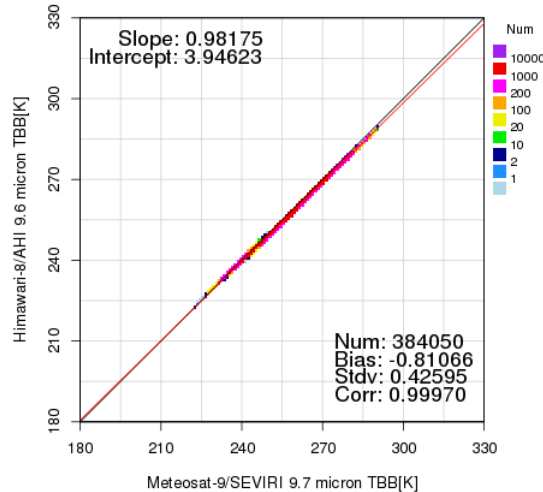
Himawari8/10.4 μ m – METEOSAT9/10.8 μ m



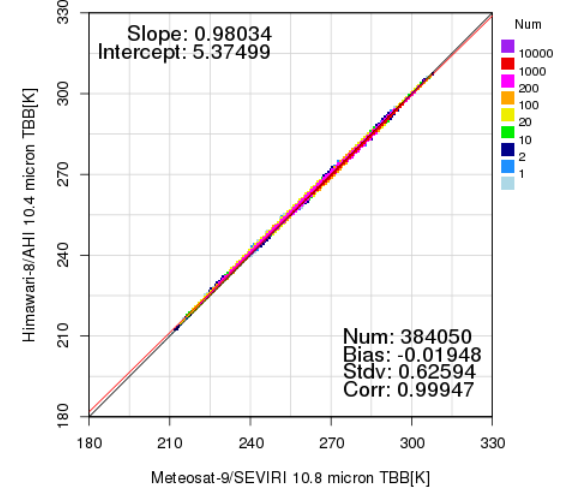
Comparison of simulated satellite observation



Comparison of simulated satellite observation

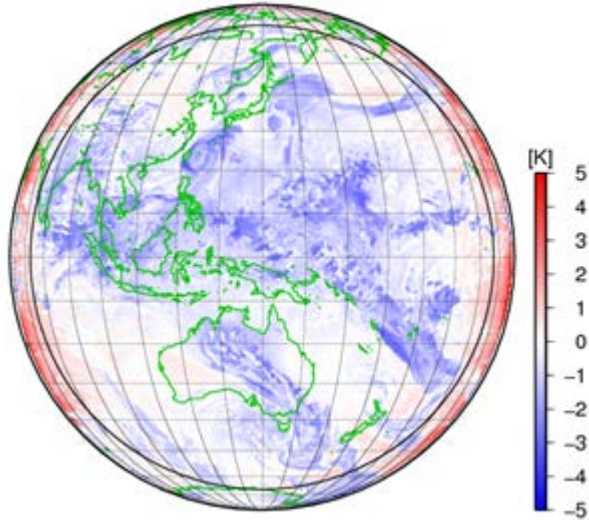


Comparison of simulated satellite observation

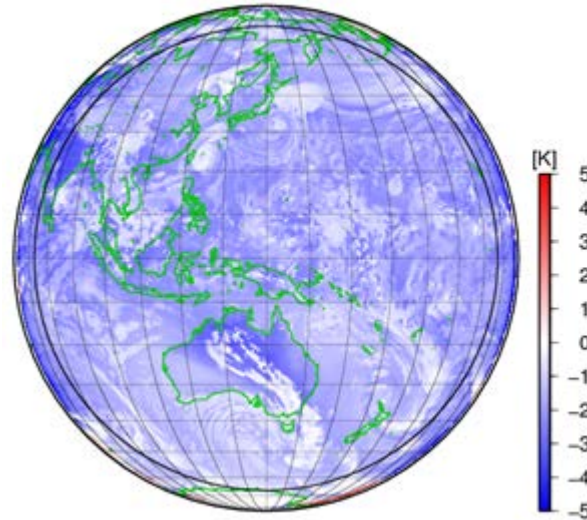


MSG vs H8@Infrared (11~13 micron)

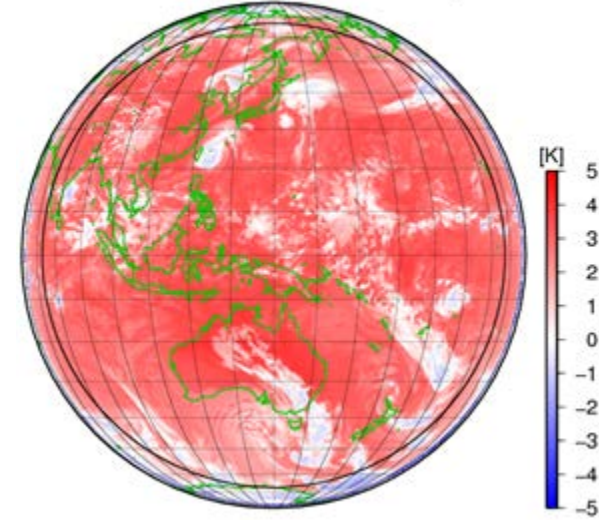
Himawari8/11.2 μ m – METEOSAT9/10.8 μ m



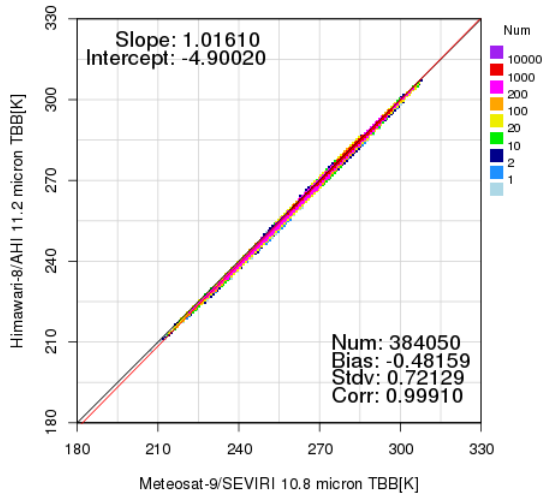
Himawari8/12.4 μ m – METEOSAT9/12.0 μ m



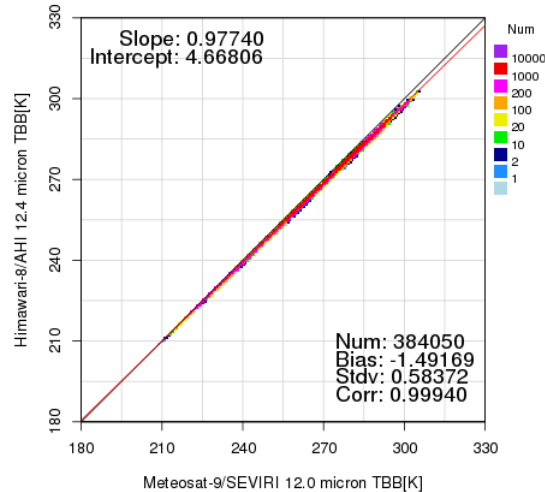
Himawari8/13.3 μ m – METEOSAT9/13.4 μ m



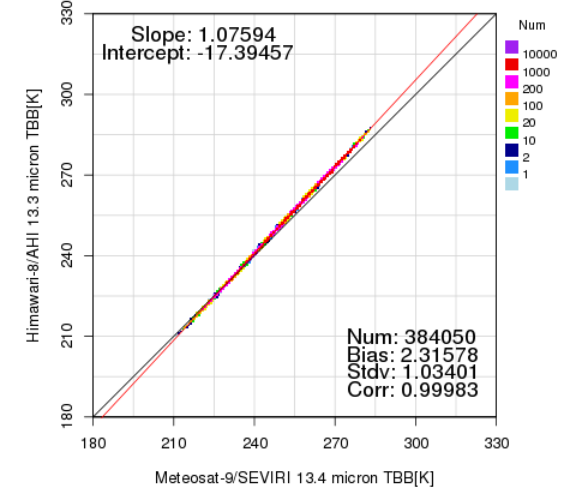
Comparison of simulated satellite observation



Comparison of simulated satellite observation



Comparison of simulated satellite observation



Tentative adjusted recipe by (linear) regression coefficients

AIR MASS

RGB	band (MSG)	min (MSG)	max (MSG)	gamma	band (H8)	min (H8)	max (H8)	gamma
R	6.2-7.3	-25	0	1.0	6.2-7.3	-26.2	0.6	1.0
G	9.7-10.8	-40	5	1.0	11.2-9.6	-43.2	6.7	1.0
B	6.2(inv)	243	208	1.0	6.2(inv)	243.9	208.5	1.0

DUST

RGB	band (MSG)	min (MSG)	max (MSG)	gamma	band (H8)	min (H8)	max (H8)	gamma
R	12.0-10.8	-4	2	1.0	12.4-10.4	-6.7	2.6	1.0
G	10.8-8.7	0	15	2.5	11.2-8.6	-0.5	20.0	2.5
B	10.8	261	289	1.0	10.4	261.2	288.7	1.0

Night Microphysics #1

RGB	band (MSG)	min (MSG)	max (MSG)	gamma	band (H8)	min (H8)	max (H8)	gamma
R	12.0-10.8	-4	2	1.0	12.4-10.4	-6.7	2.6	1.0
G	10.8-3.9	0	10	1.0	11.2-3.9	-3.5	6.9	1.0
B	10.8	243	293	1.0	10.4	243.6	292.6	1.0

Night Microphysics #2

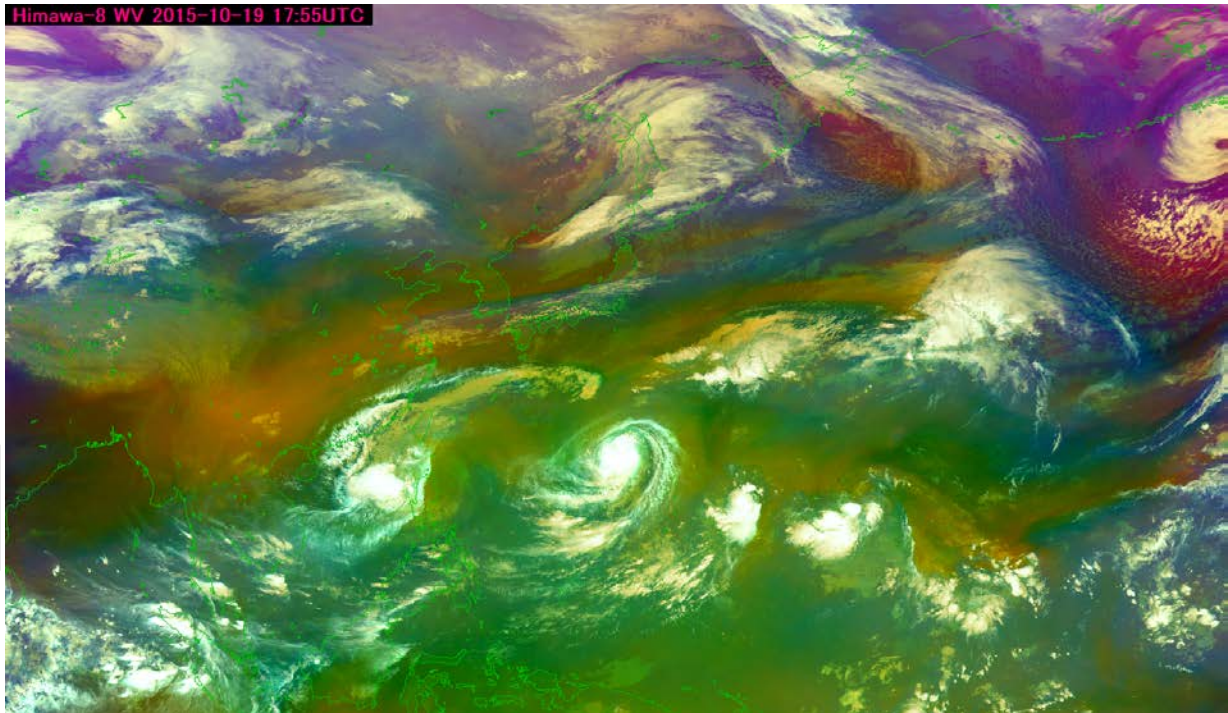
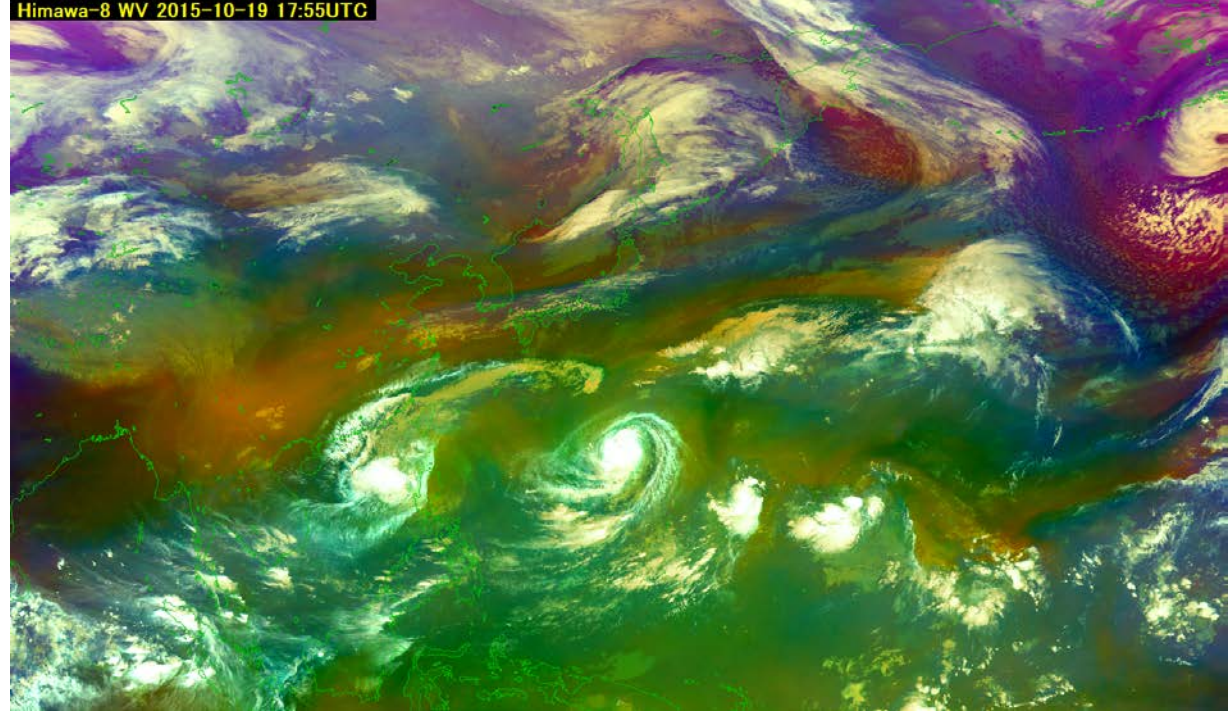
RGB	band (MSG)	min (MSG)	max (MSG)	gamma	band (H8)	min (H8)	max (H8)	gamma
R	12.0-10.8	-4	2	1.0	12.4-10.4	-6.7	2.6	1.0
G	10.8-3.9	0	10	1.0	10.4-3.9	-3.1	5.2	1.0
B	10.8	243	293	1.0	10.4	243.6	292.6	1.0

NaturalColors

RGB	band (MSG)	min (MSG)	max (MSG)	gamma	band (H8)	min (H8)	max (H8)	gamma
R	1.6	0	100	1.0	1.6	0.0	97.5	1.0
G	0.8	0	100	1.0	0.86	0.0	108.6	1.0
B	0.6	0	100	1.0	0.64	0.0	100.0	1.0

Airmass

Original (EUMETSAT) recipe



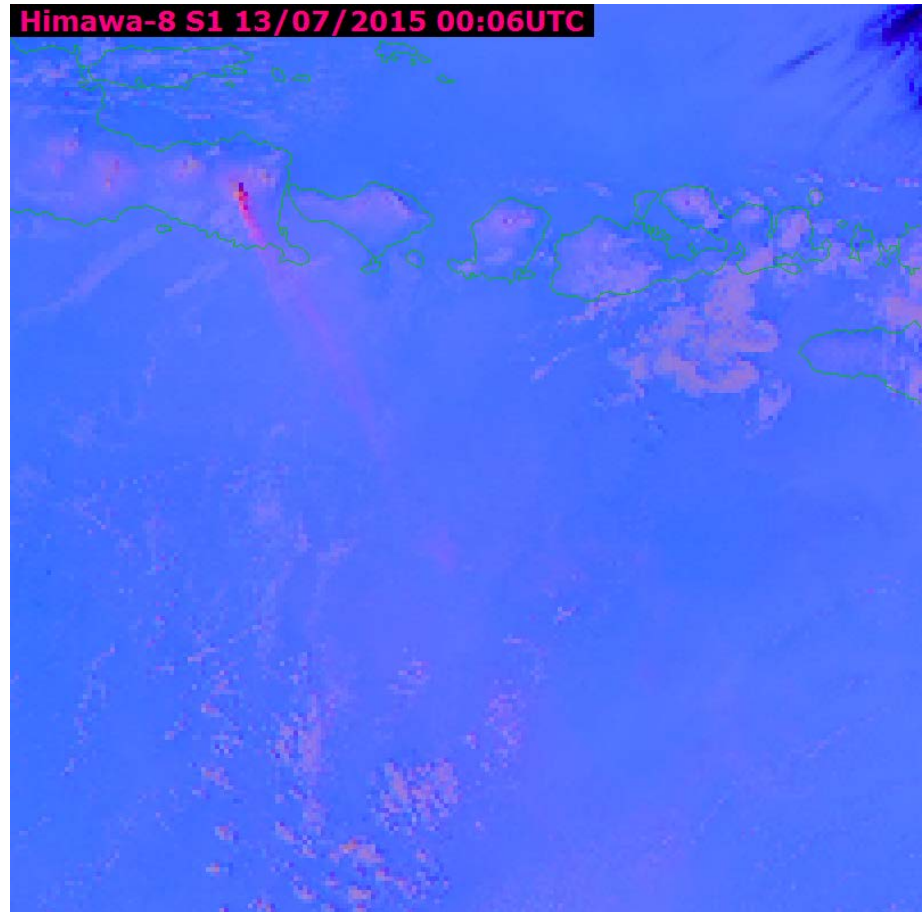
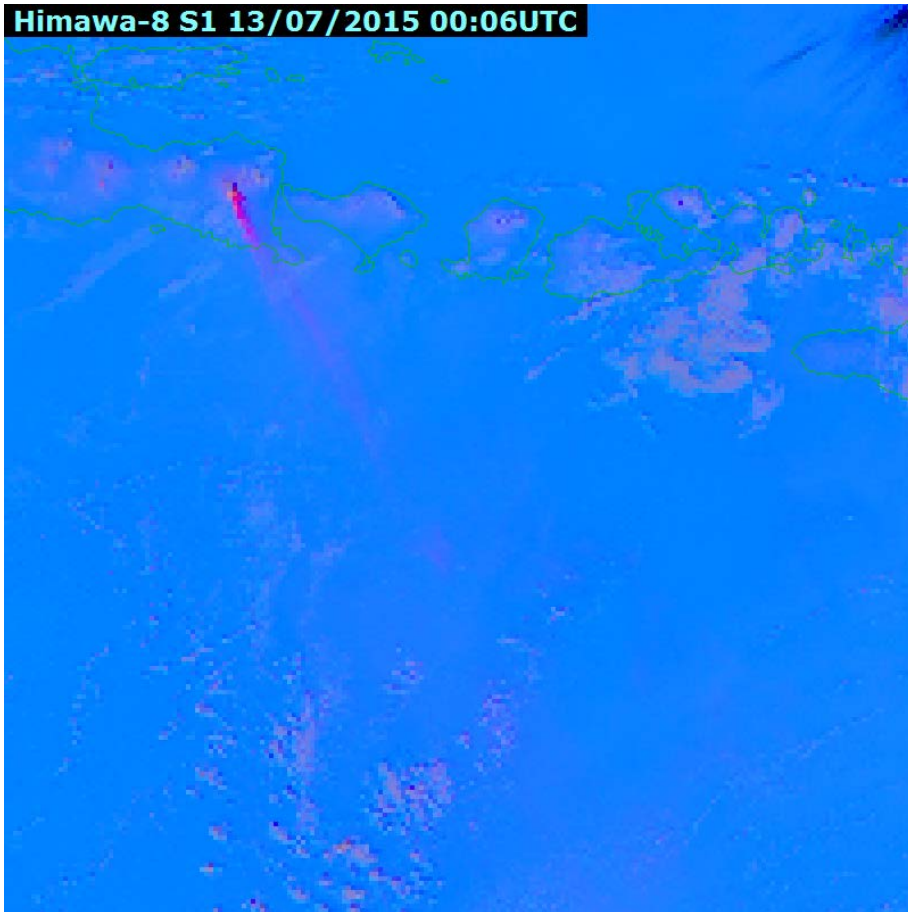
Interpretation of colors by EUMETSAT

Adjusted recipe

Dust

Adjusted recipe

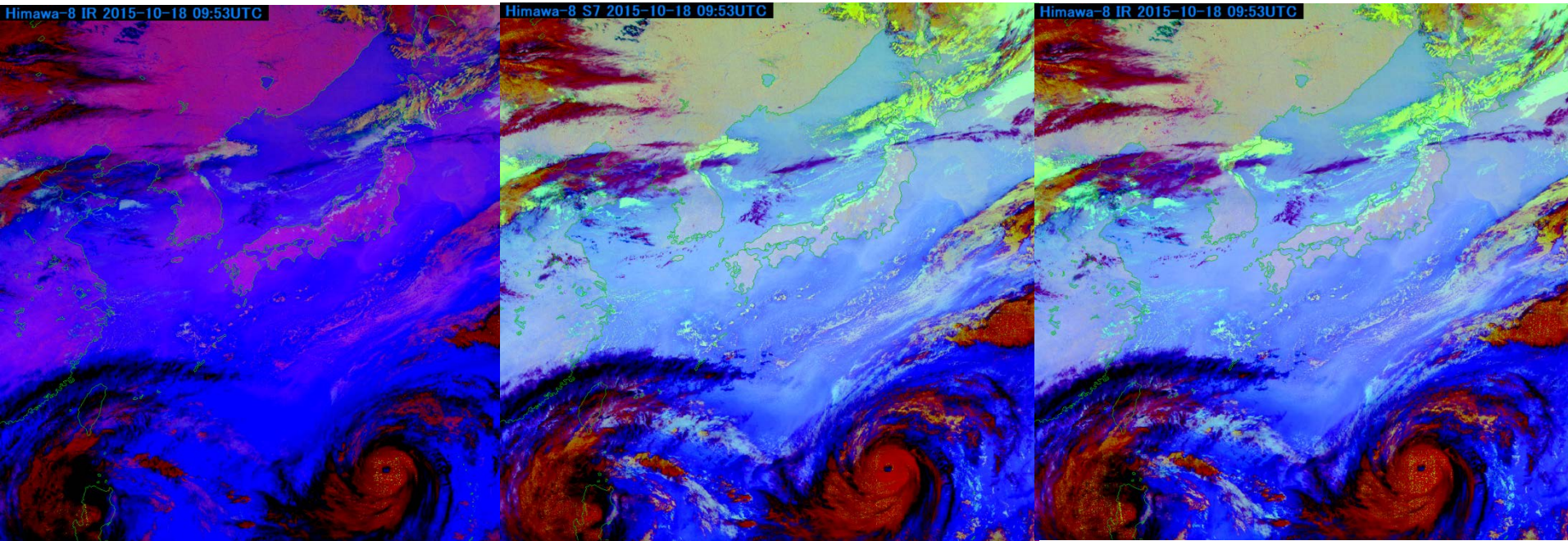
Original (EUMETSAT) recipe



Cold, thick, high-level clouds	Low-level cloud (cold atmosphere, High latitude)
Thin Cirrus clouds Contrails	Low-level cloud (warm atmosphere, Low latitude)
	Dust
	Ocean

Interpretation of colors by EUMETSAT

Night Microphysics

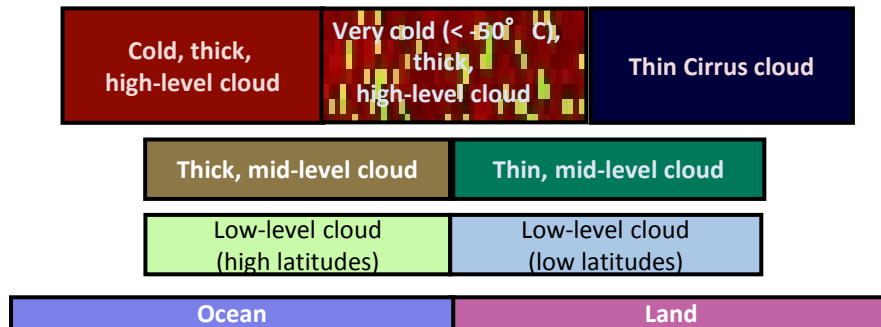


Original (EUMETSAT)recipe

Adjusted recipe #1

Adjusted recipe #2

Interpretation of colors by EUMETSAT

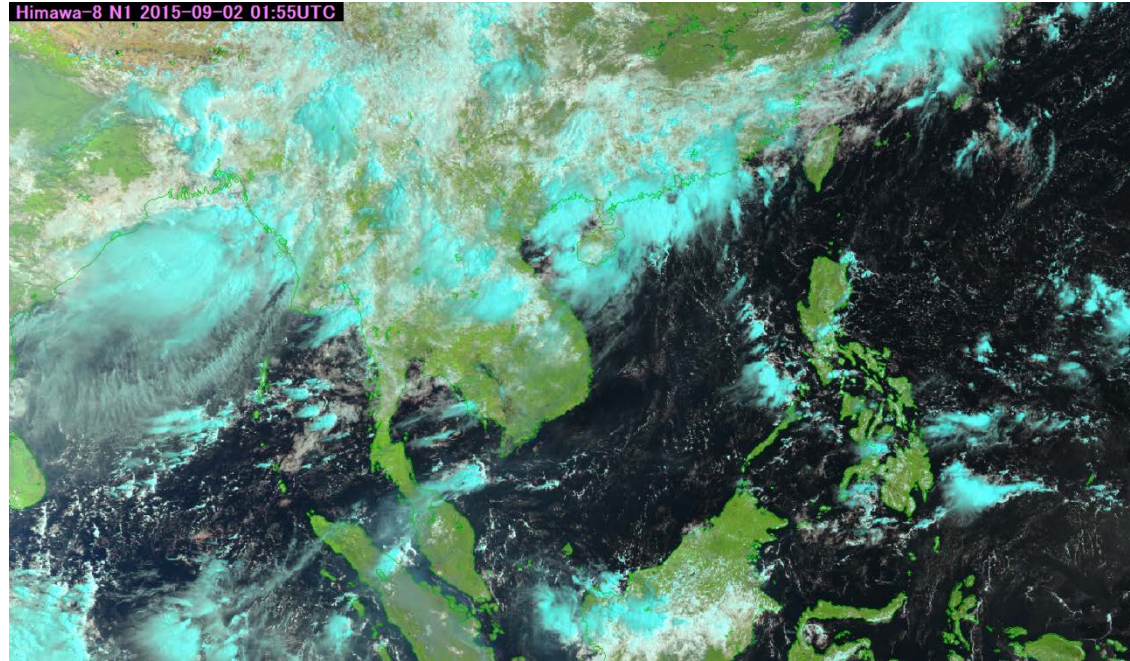


Either adjustments are better than unadjusted one!

Appearances of low-cloud and surface are improved.

Natural Colors

Original (EUMETSAT) recipe



Interpretation of colors by EUMETSAT

High-level ice clouds

Low-level water clouds

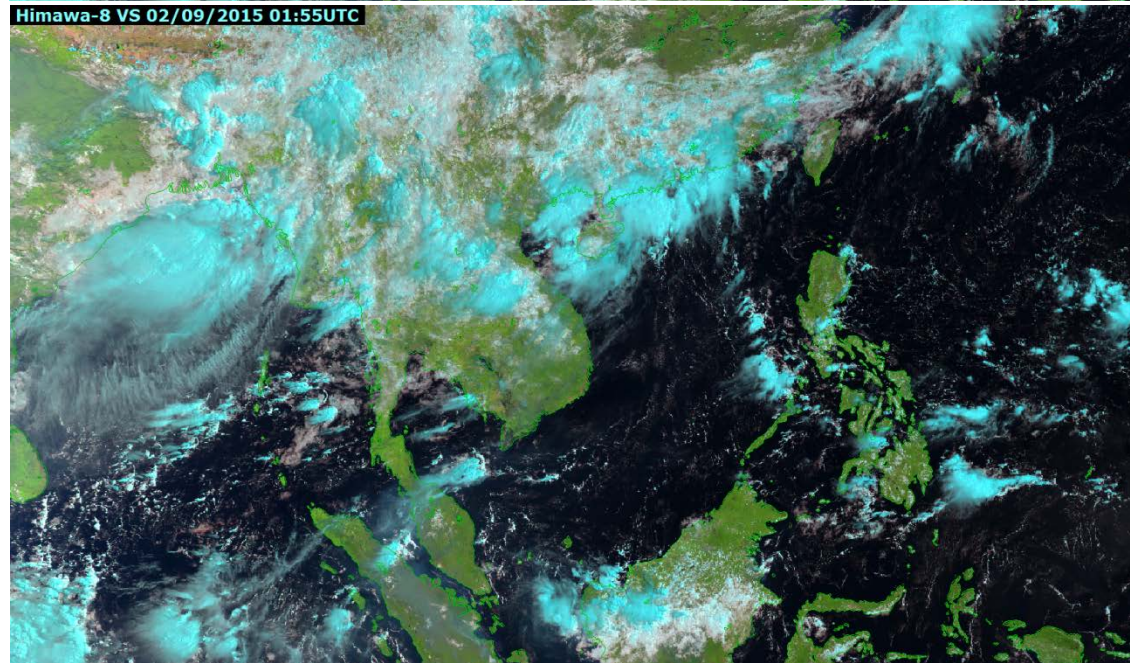
Ocean

Vegetation

Desert

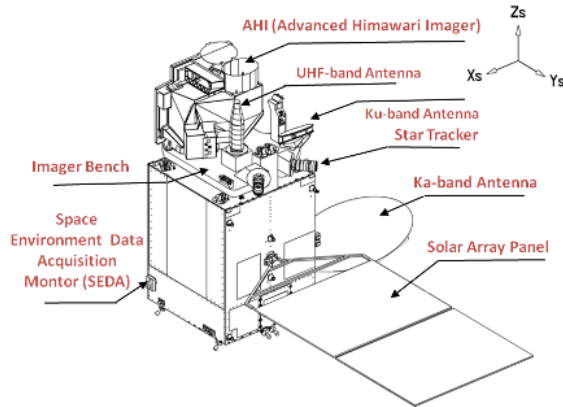
Snow

Adjusted recipe



Summary of the adjustment RGB recipes

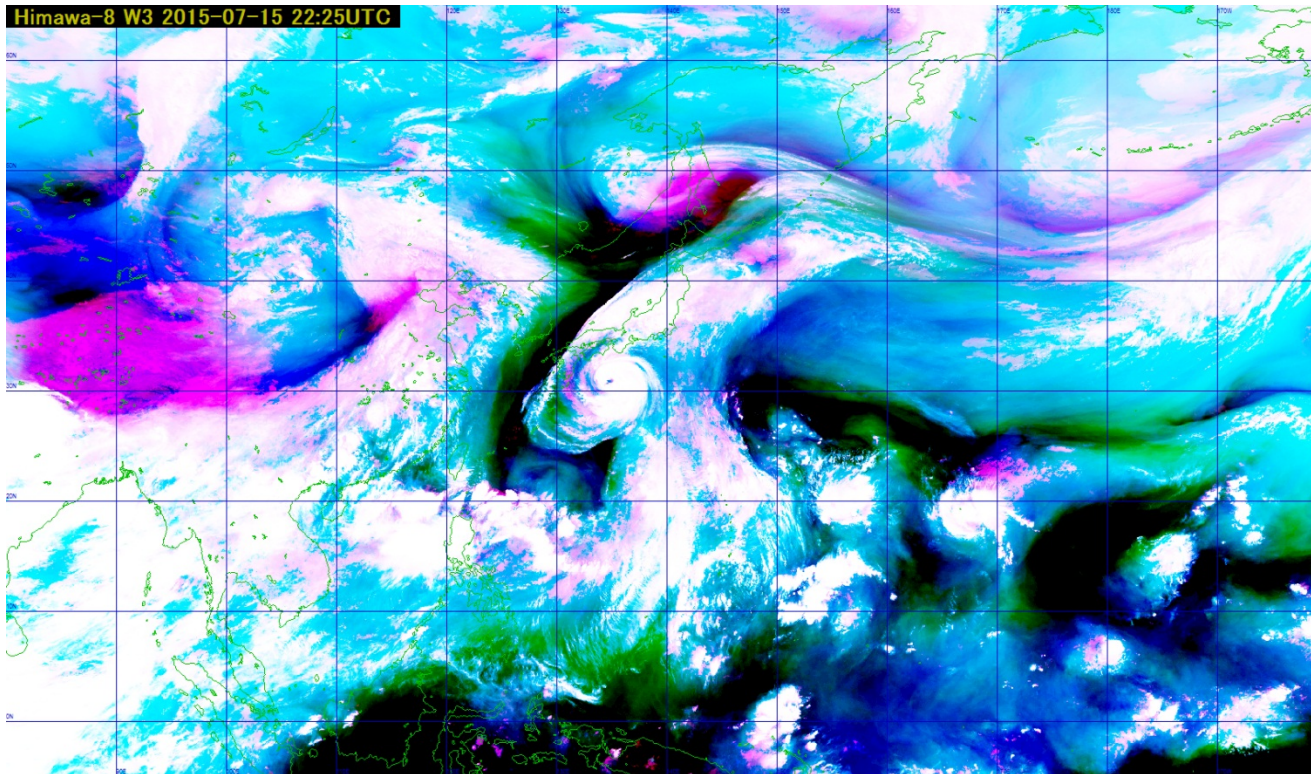
- Generally, the adjustments of MSG recipe to Himawari RGB by regression coefficients derived from the investigation seem to be good matching.
- However, the coefficients are linear.
 - Possibility of quadric (or more accurate method) adjustment
- More detail investigation will be required.



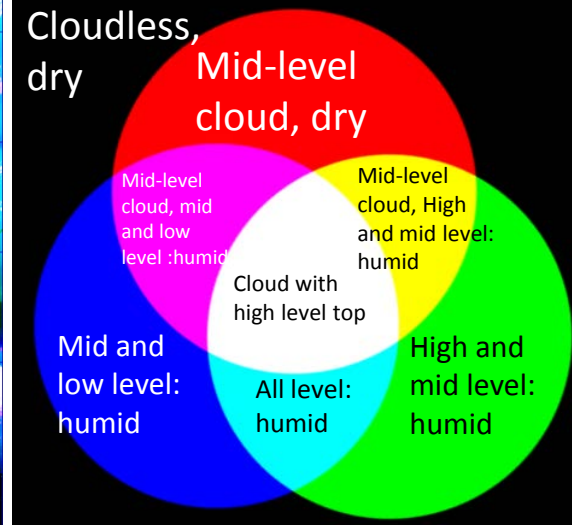
http://www.data.jma.go.jp/mscweb/en/himawari89/space_segment/spsg_spacecraft.html

Introduction of Experimental RGB by Himawari-8/AHI

Water Vapors



Application:
Analysis of water vapor
distribution for each level
excluding cloud area



	Band	Gamma	TBB Range
R	B13(IR10.4)	10	202.29 ~ 278.96[K]
G	B08(WV6.2)	5.5	214.66 ~ 242.67[K]
B	B10(WV7.3)	5.5	245.12 ~ 261.03[K]

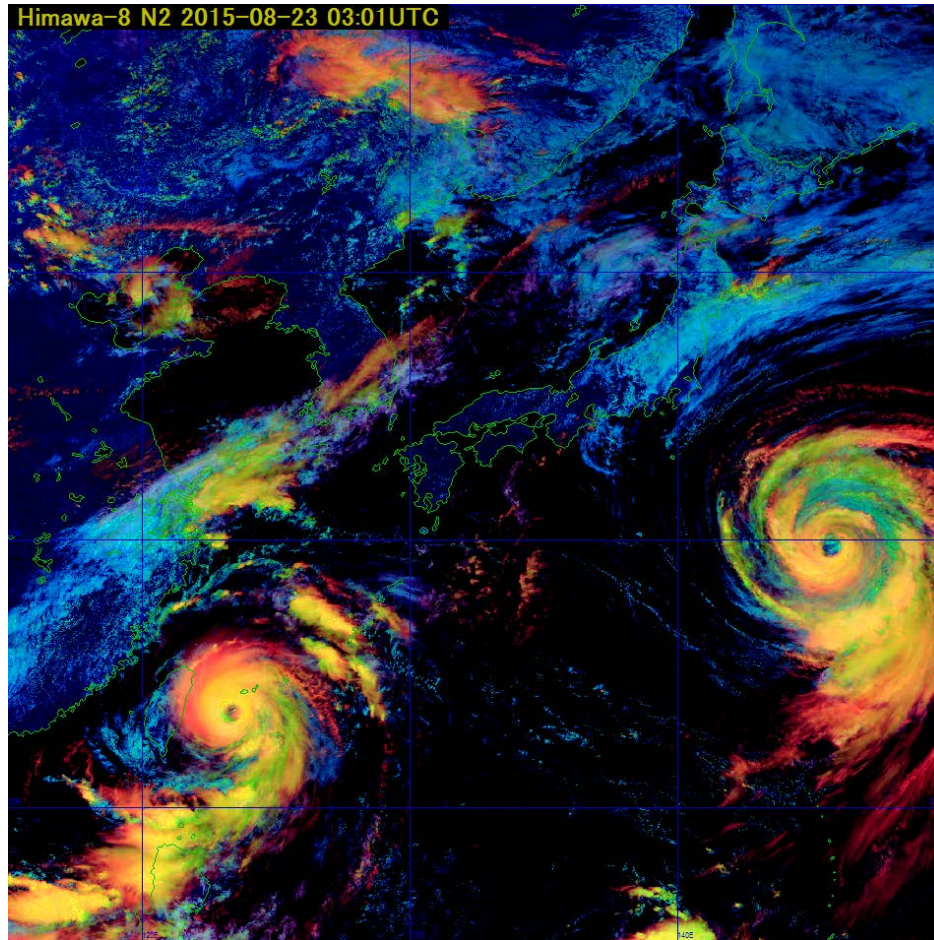
Interpretation
(under investigation)

→ cloud area

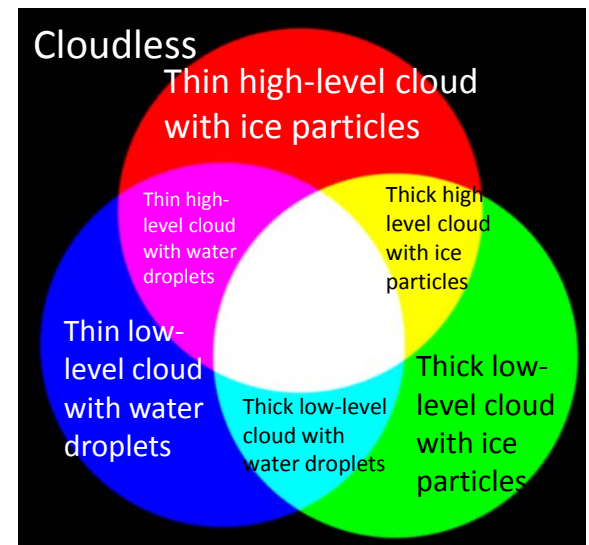
→ Upper level water vapor

→ Mid or lower level water vapor

Cloud Phase Distinction



Application:
Analysis cloud thickness, height of cloud top and cloud phase at one time.



Interpretation
(under investigation)

	Band	Gamma	TBB/Reflectivity range
R	B13(IR10.4)	1.0	219.619 ~ 280.6707[K]
G	B03(VS0.64)	1.0	-0.0346 ~ 0.7792
B	B05(N21.6)	1.0	0.0119 ~ 0.5932

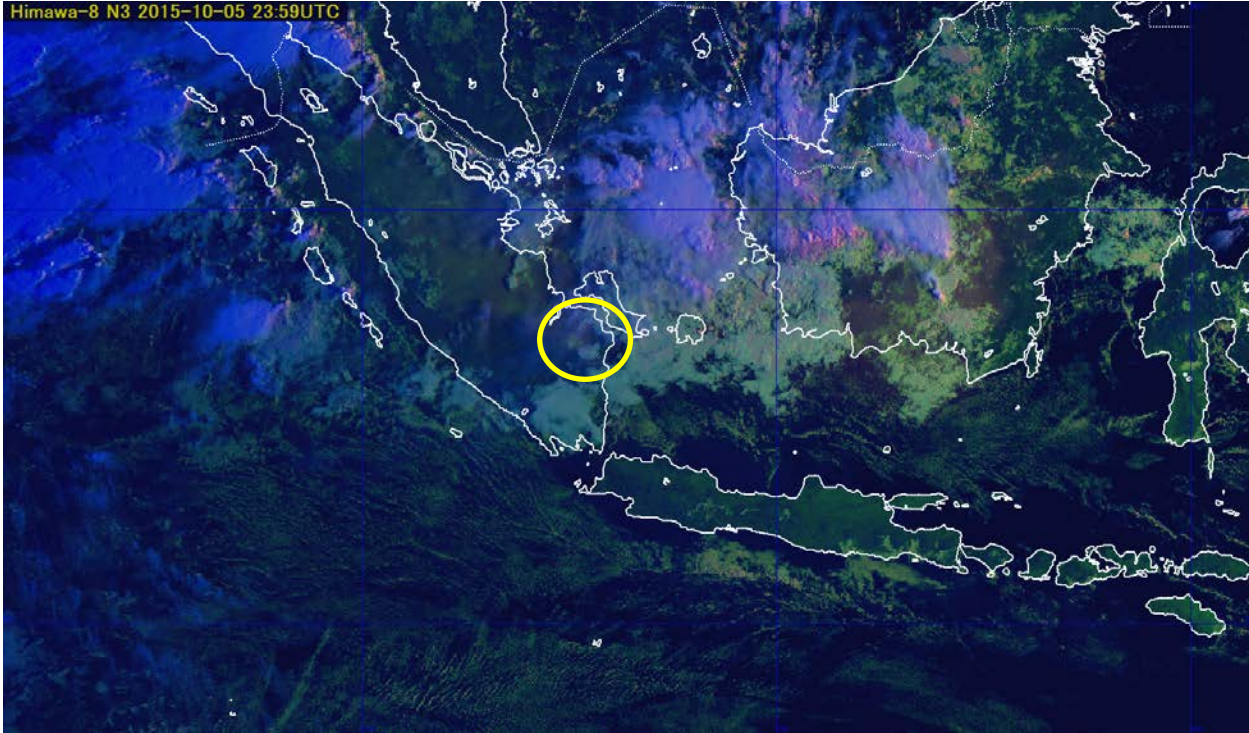
→ Cloud height

→ Cloud thickness

→ Cloud phase distinction

Fire Detection

Himawa-8 N3 2015-10-05 23:59UTC



Application: Fire (hot spot) and smoke detection

Smoke at daytime



Hotspot at nighttime

Interpretation
(under investigation)

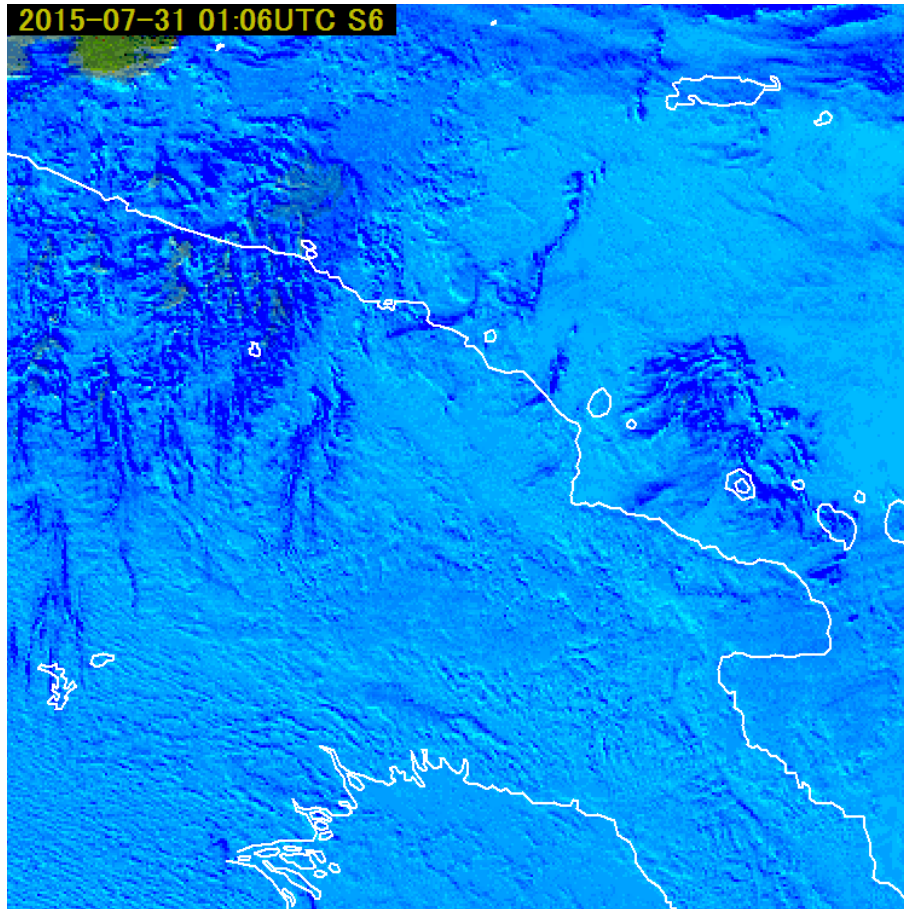
	Band	Gamma	TBB/Reflectivity range
R	B01(V1 0.64)	1.0	0.1 ~ 0.95
G	B06(N3 2.3)	1.0	0.0 ~ 0.5
B	B14(L2 11.2)	1.0	158.15 ~ 323.15 [K]

→ Aerosol

→ Cloud phase distinction

→ Cloud top

SO2



Application: Detection of volcanic gas (sulfur dioxide)

This scheme is modified Ash RGB (Red beam: originally, difference (12.0-10.8), modified difference (6.9-7.3)).

Volcanic gas (SO2 > Water vapor?)

Volcanic gas (SO2 < Water vapor?)

Interpretation
(under investigation)

	Band	Gamma	TBB/Reflectivity range
R	B9(WV6.9)-B10(WV7.3)	1.0	-4 ~ 2 [K]
G	B13(IR10.4)-B11(IR8.6)	1.0	-4 ~ 5 [K]
B	B13(IR10.4)	1.0	243 ~ 303 [K]

→ SO2, water vapor

→ SO2 (water vapor)

→ Cloud height

Thank you!

