2014

2016

Overview of Himawari-9 and Introduction to SATAID and RGB image

SAKURAI Mayuko Meteorological Satellite Center / Japan Meteorological Agency

3rd March 2023

Himawari-9

Himawari-8



Overview of Himawari-8, 9

★ Himawari-8, 9 Operation Plan

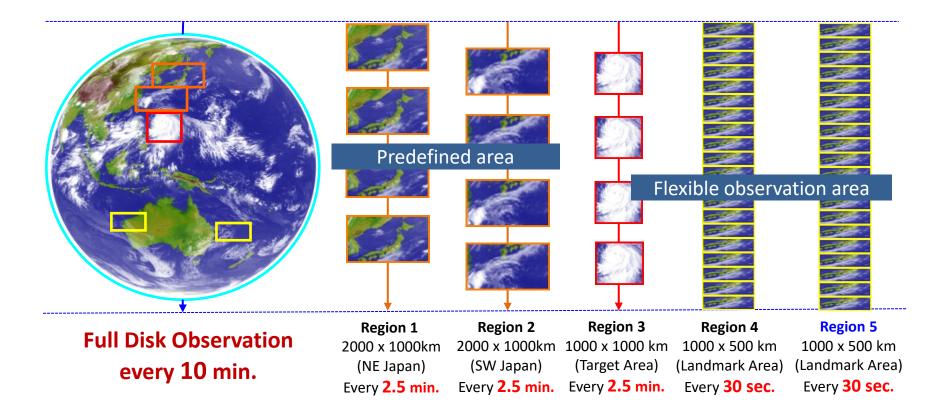
FY Satellite	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Himawari-8					auno				O	pera	tior	nal			1	n-o	rbit	stai	ndbr	y	
		Mai	nufa	ctu	ring																
Himawari-9						L	aun	ch	I	n-oi	bit	stan	dby			O	bera	tior	nal		

★Satellite conceptual diagram

★Satellite spec

Advanced Himawari Imager(AHI)	Total length	Approx. 8m
Communication Antenna	Weight	Approx. 3,500kg (including fuel) Approx. 1,300kg (only main unit)
	Initial generated power	Approx. 2.6kW
	Design lifetime	Over 15 years (main unit) Over 8 years (observation functions)
Solar Array Panel		

Overview of the Himawari-9 observation (10 minutes Repeat Cycle)



- AHI (Advanced Himawari Imager) on Himawari-9 has the ability of various scans during 10 minutes Full Disk observation.
- AHI can flexibly change the scan range of "Target Area" for observation of phenomena such as **typhoons** and active volcanoes.
- Lunar observation: performed using Landmark Area (Region 5)



AHI Spectral Bands (5 bands -> 16bands)



cf. MTSAT-2 **Bands**

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16



0.68 µm



IR3 6.8 µm



12.0 µm

Band	Spatial Resolution	Central Wavelength	
	1	0.47 µm	
Visible (VIS)	1 km	0.51 µm	
(110)	0.5 km	0.64 µm	

Himawari-8/9 Imager (AHI: Advanced Himawari Imager)



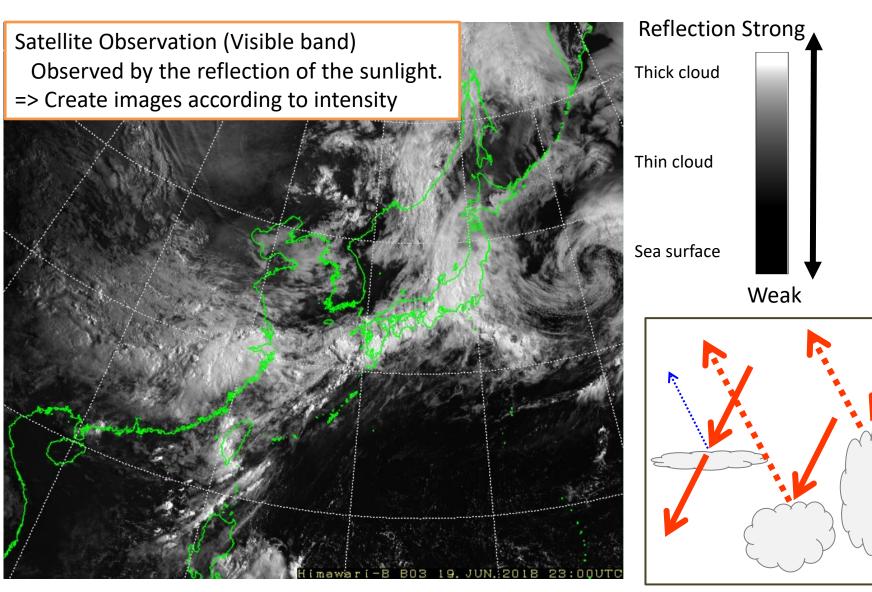
Band	Spatial Resolution	Central Wavelength	Physical Properties	
	1 km	0.47 µm	vegetation, aerosol	
Visible (VIS)		0.51 µm	vegetation, aerosol	
(110)	0.5 km	0.64 µm	Vegetation, low cloud, fog	
Near	1 km	0.86 µm	vegetation, aerosol	
Infrared	2 km	1.6 µm	cloud phase/particle size	
(NIR)	Z KIII	2.3 µm	cloud particle size	
		3.9 µm	low cloud, fog, forest fire	
		6.2 µm	upper-level moisture	1
		6.9 µm	mid- and upper-level moisture]
		7.3 µm	mid-level moisture	J
Infrared	2 km	8.6 µm	cloud phase, SO_2	1
(IR)	Z KIII	9.6 µm	Ozone content	
		10.4 µm	cloud imagery, information of cloud top][_
		11.2 μm	cloud imagery, sea surface temperature	
		12.4 µm	cloud imagery, sea surface temperature	
		13.3 µm	cloud top height	J

V Bands

R Bands

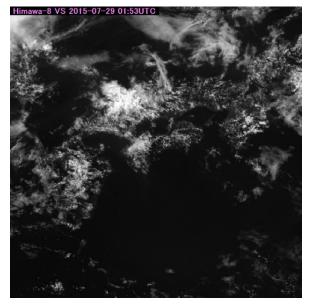


Visible band(B03,0.64µm)

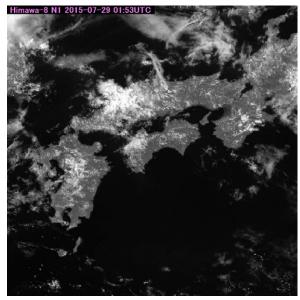


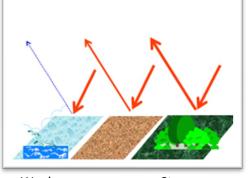
Near–Infrared band(B04,0.86 μ m)

Visible band (B03, 0.64µm)



Near-Infrared band(B04, 0.86µm)





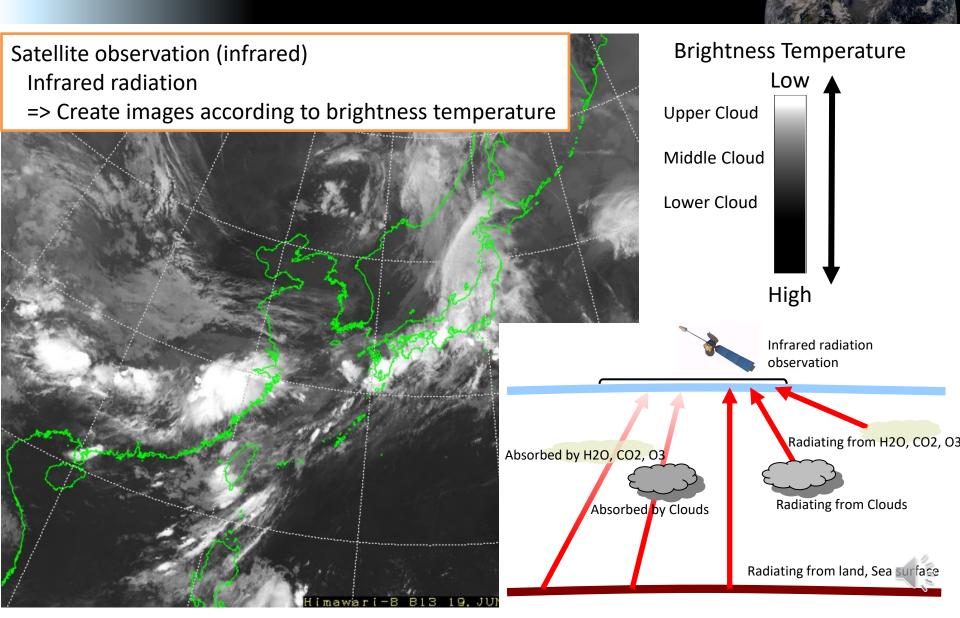
B04(0.86µm) receives strong reflection from vegetation

Difference in reflection due to vegetation

Wavelength near B03 doesn't sense vegetation.(difficult to distinguish from the sea)Wavelength near B04 sense vegetation clearly.(be able to clearly understand the difference from the sea)

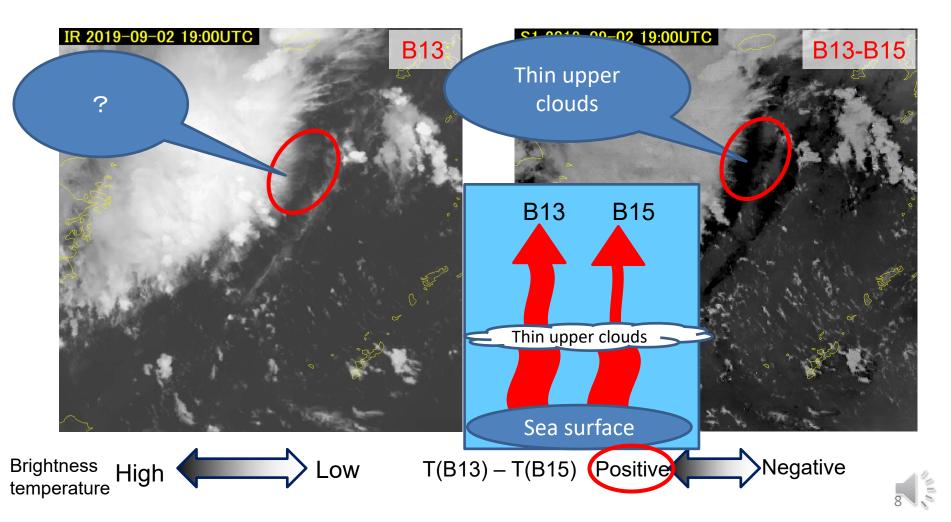


Infrared band(B13,10.4µm)



Difference imagery of B13 – B15

• Subtract the brightness temperatures of B15 from B13.



Too many bands!

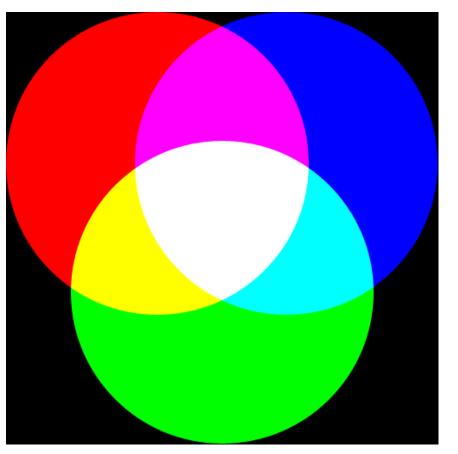
- 16 bands' images contain a lot of information about
 - Cloud thickness, top temperature
 - Cloud particle size, cloud phase (ice/liquid)
 - Humidity
 - Volcanic ash
 - Vegetation
 - etc.

Solution -> RGB image

- Can illustrate multiple information on one image.
- Can be composed by simple process.
- "SATAID" can compose RGB image easily.

What's RGB?

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



three primary colors RGB



Application to Satellite Imageries

RGB composite

Thick and high cloud (Cb) areas appear yellow!

"High" cloud

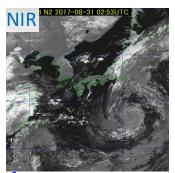
IR

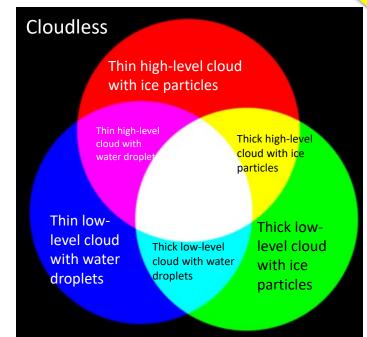
17-08-31 02:53UTC

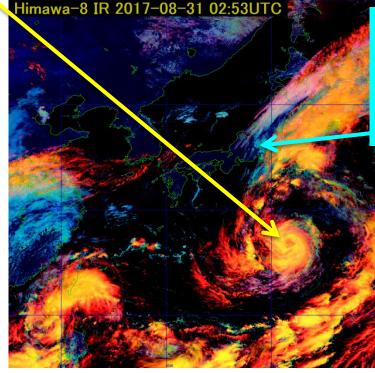


"Thick" do

ice cloud

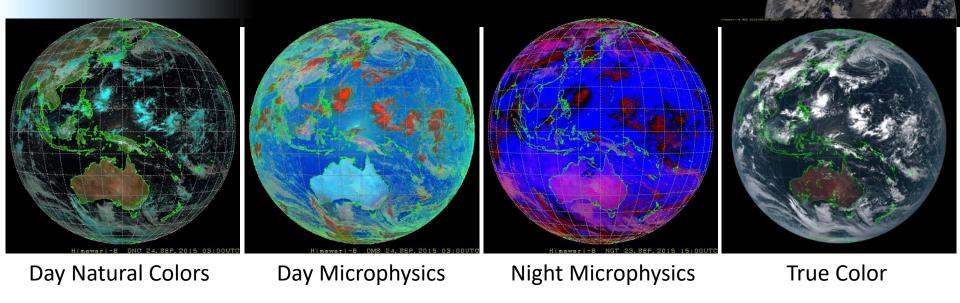


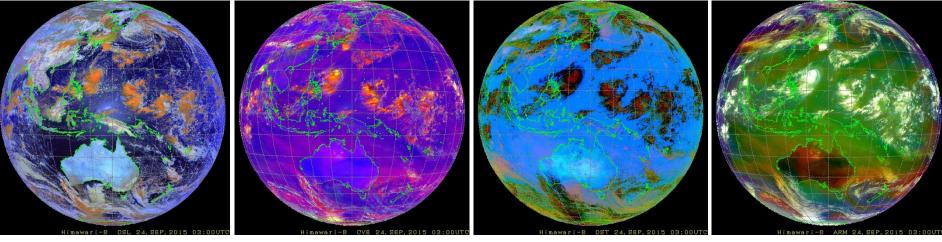




If you want to focus on the low level clouds, look at cyan area.

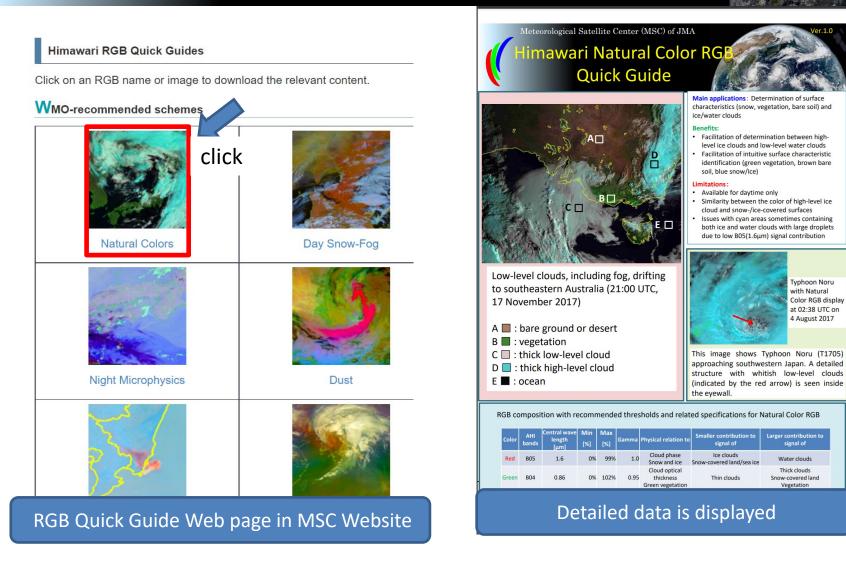
Well-known RGBs from Himawari-9





Day Snow-Fog Day Convective Storm Dust Airmass https://www.data.jma.go.jp/mscweb/data/himawari/sat_img.php?area=fd_

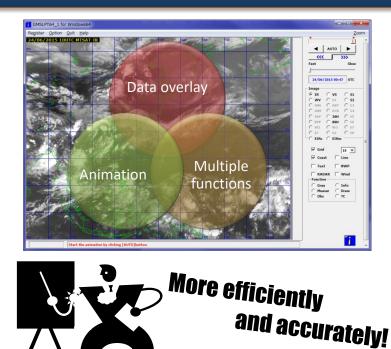
RGB Quick Guides

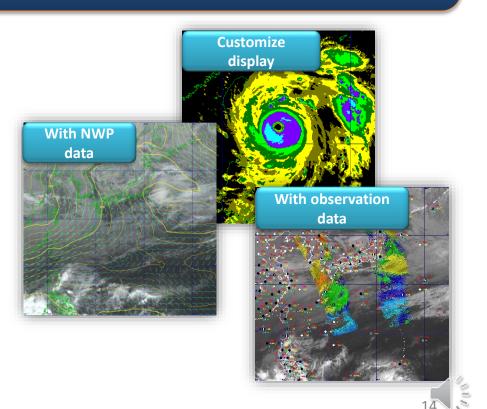


https://www.jma.go.jp/jma/jma-eng/satellite/VLab/RGB_QG.html

What is SATAID?

SATAID (**SAT**ellite Animation and Interactive Diagnosis) is a sophisticated display software visualizing meteorological information in multiple dimensions (spatial and temporal), which assists forecasters to analyze and monitor continually weather parameters and phenomena for better meteorological services.





What can we do by using SATAID?

- With SATAID, you can ...
 - Display (and overlay) satellite imagery and NWP data

(and various observations i.e. SYNOP, SHIP, TEMP, Radar, Wind Profiler, ASCAT etc. if its format prepared)

Use many functions

vertical cross-sectional chart, time-series chart, digital data output to CSV file.....

- Save as a file including a package of all data your drawings and comments, which will be useful for trainings and case study archives
- Analyze position and intensity of tropical cyclones



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Apply

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Color interpr.

RGB composite imagery on SATAID

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[new]New Day Micro... N1

[new]Fire Detection V1

[new]Fire Power/Te... 14-

new Natural FireColor 14-

[new]CIRA's Natural... N3

[new]Simple Fire & S... 14-

[new]Deep Clouds/D... S3(IR-...

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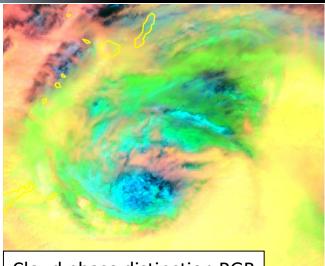
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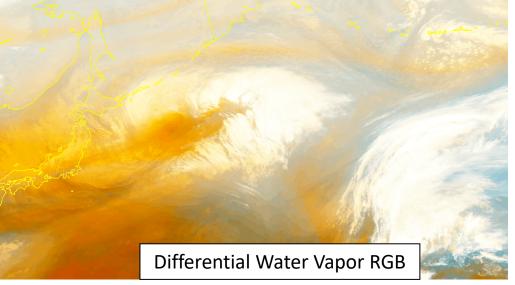
- SATAID can show RGB imagery easily by using RGB image list dropdown menu.
- Select the name of RGB imagery
 -> Apply
- You can edit the RGB list file and add new RGB recipe.

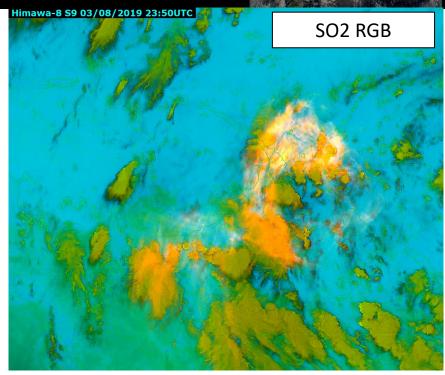
JMA original RGB recipes



Cloud phase distinction RGB

Himawa-8 30/01/2017 14:52UTC





 RGB list file for SATAID includes some JMA original RGB recipes

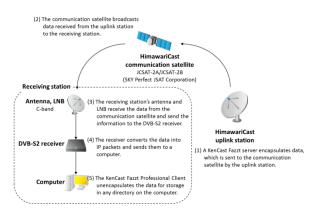
How can we get SATAID?

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■ WIS Website







https://www.wis-jma.go.jp/cms/sataid/

- Internet Environment is required
- 5 channels are available every 10 minutes
- ID and Password are required (wis-jma at met.kishou.go.jp)

https://www.data.jma.go.jp/mscweb/en/hima wari89/himawari cast/himawari cast.php

- Dedicated antenna and computers are required
 - 14 channels are available every 10 minutes



Summary so far



• Himawari-8, 9 Overview

Himawari-8, 9 make Full Disk observation every 10 minutes and Region observation every 2 and a half minutes. The number of observed bands are 16, and a variety of information can be obtained. These are useful for disaster prevention and so on.

• RGB Composite

To get important information efficiently, RGB composites were developed. RGB images can be created by a simple process of image compositing. Various information is derivable by one RGB image.

• SATAID

SATAID has a variety of functions and easily displays satellite images, RGB composites and other meteorological data.