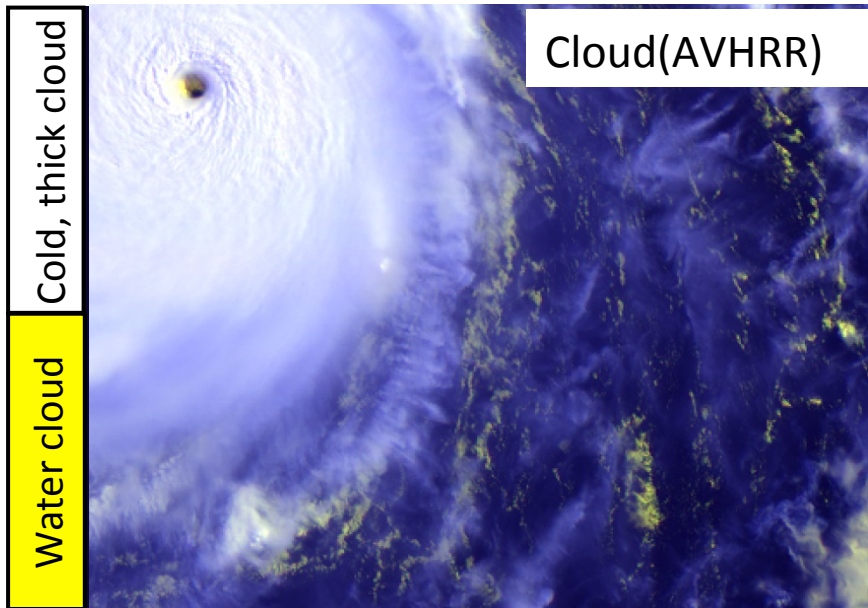
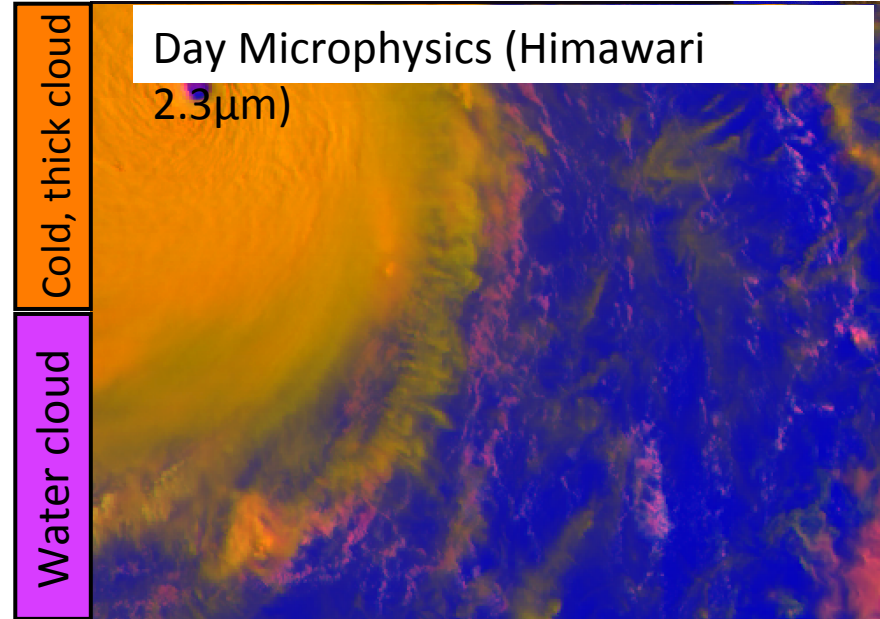
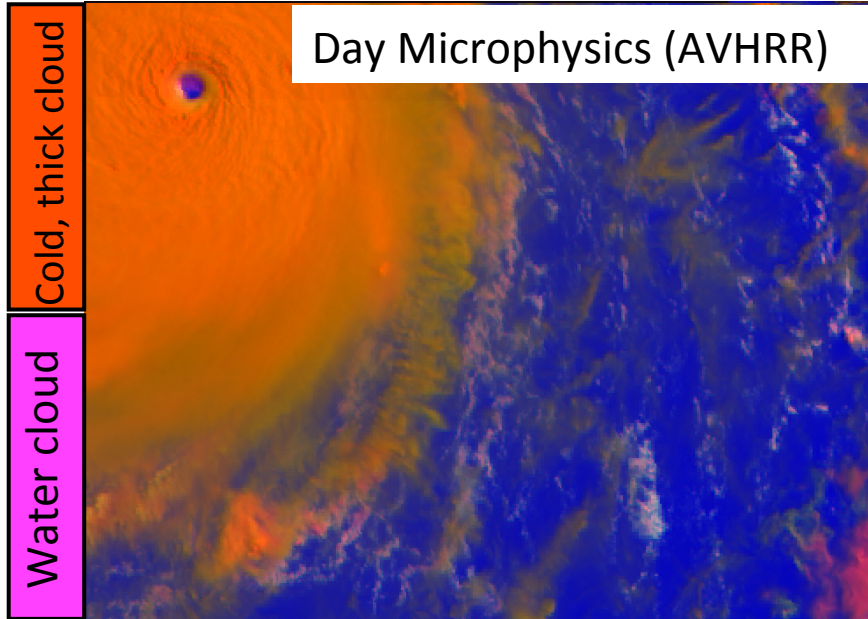


Appendix

Other cloud phase RGBs



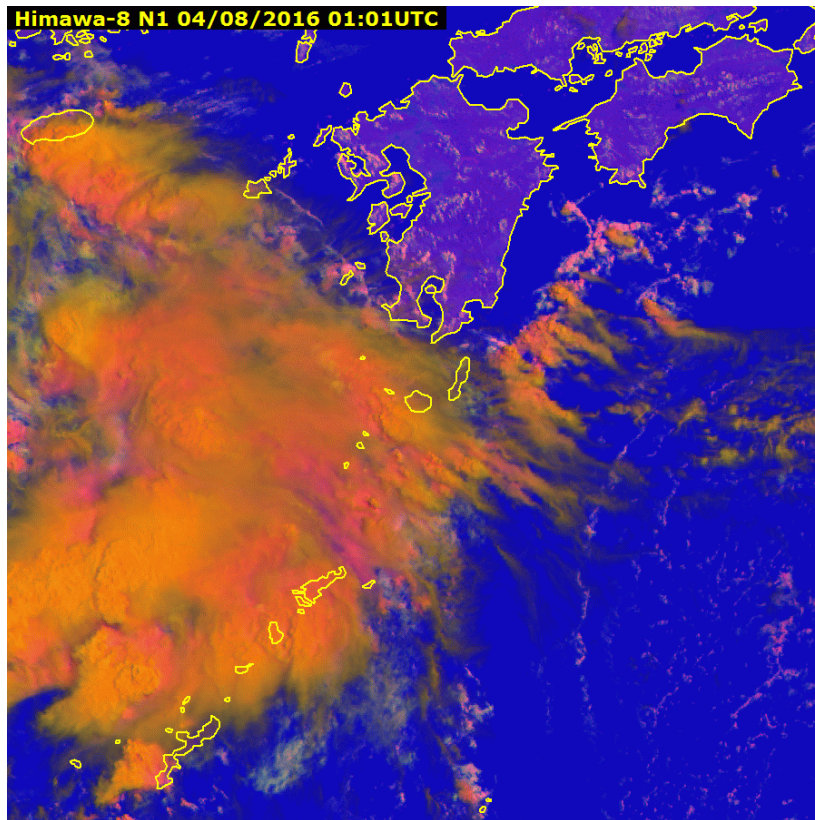
Some useful RGB recipes by MetOp/AVHRR imagery are able to apply to Himawari/AHI imagery.

The recipes don't use reflection component of 3.9 μ m, so it will be simple to create RGB composite imagery.

Day Microphysics (Himawari 2.3 μ m) is similar to Day Microphysics (AVHRR), but it contains 2.3 μ m instead of 1.6 μ m.

However, this RGB recipe is under investigation.

Day Microphysics (Himawari 2.3 μm)



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

Thick, large and cold clouds

Water clouds
(thick large droplets)

Water clouds
(thick small droplets)

A part of Interpretation
(under investigation)

	Band	Gamma	TBB/Reflectivity range
R	B04(N1 0.86)	1.0	0.0~1.0
G	B06(N3 2.3)	1.0	0.0~0.7
B	B13(IR 10.4)	1.0	203.0~323.0 [K]

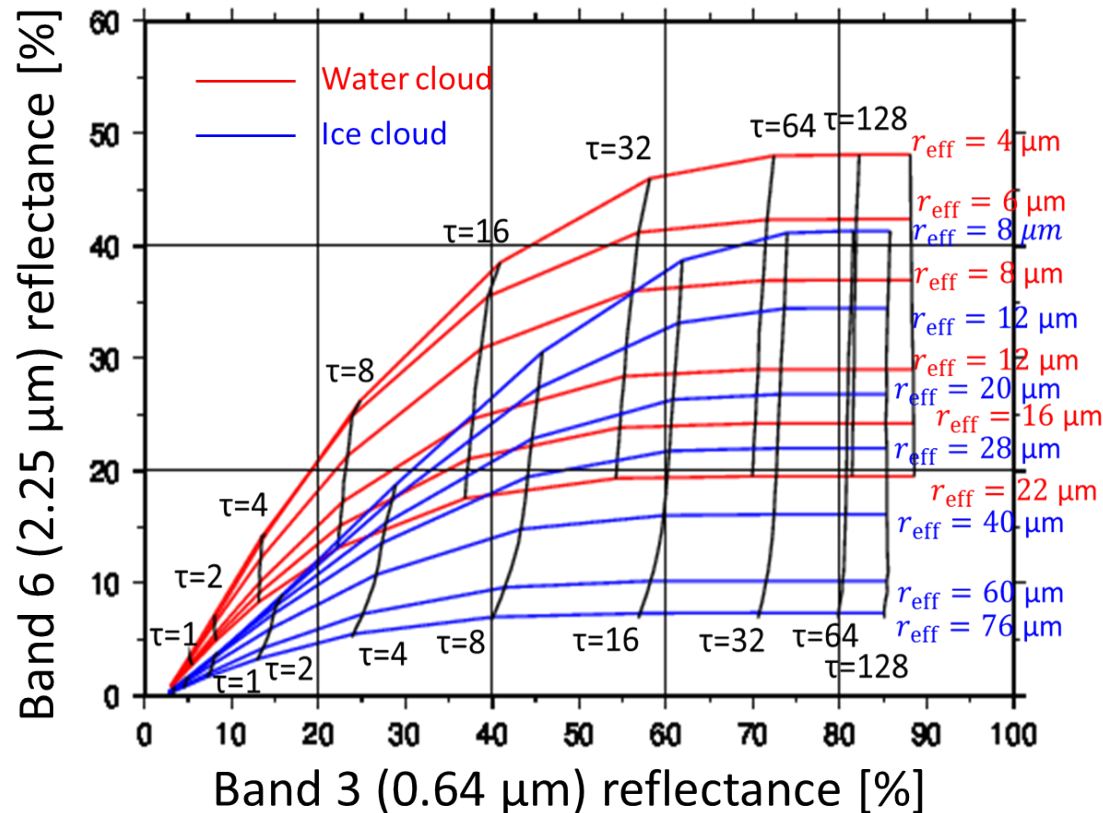
→ Cloud thickness

→ Cloud phase

→ Cloud height, temp

AHI Sensitivity to Cloud Parameters (VIS, NIR)

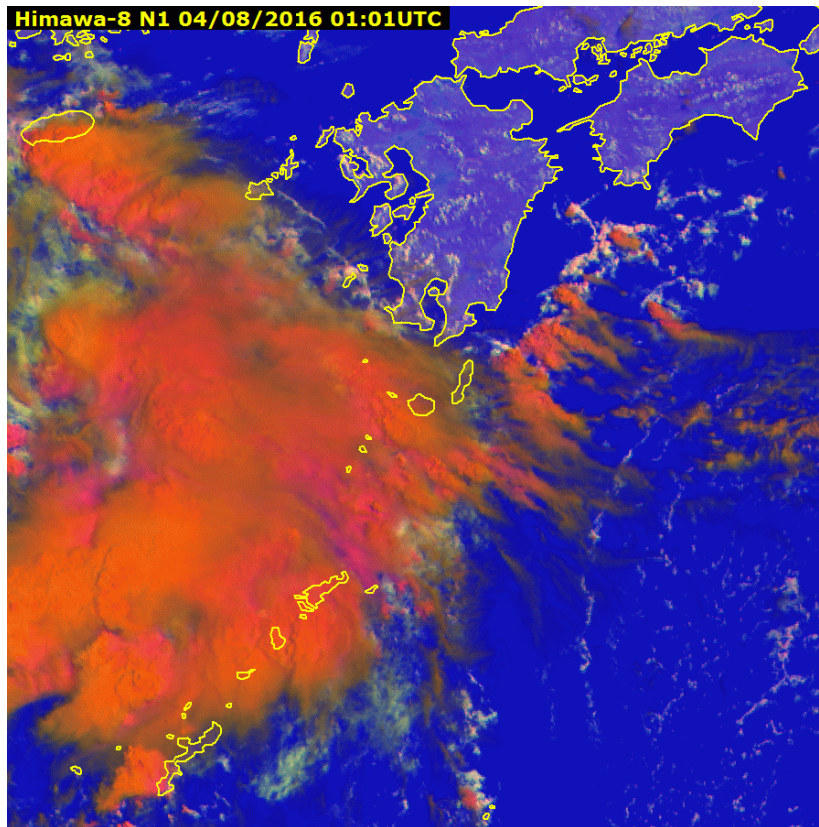
Simulated TOA Reflectance for typical water and ice cloud over ocean (M. Hayashi)



The graphs shows how TOA reflectance of AHI varies with different **cloud optical depth** τ and **cloud effective radius** (cloud droplet size) r_{eff}

(Reference) Day Microphysics (AVHRR)

Application for AHI/Himawari-8 (based on EUMETSAT material)



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

Thick, large and cold clouds

Water clouds
(thick large droplets)

Water clouds
(thick small droplets)

A part of Interpretation
(under investigation)

	Band	Gamma	TBB/Reflectivity range
R	B04(N1 0.86)	1.0	0.0~1.0
G	B05(N2 1.6)	1.0	0.0~0.7
B	B13(IR 10.4)	1.0	203.0~323.0 [K]

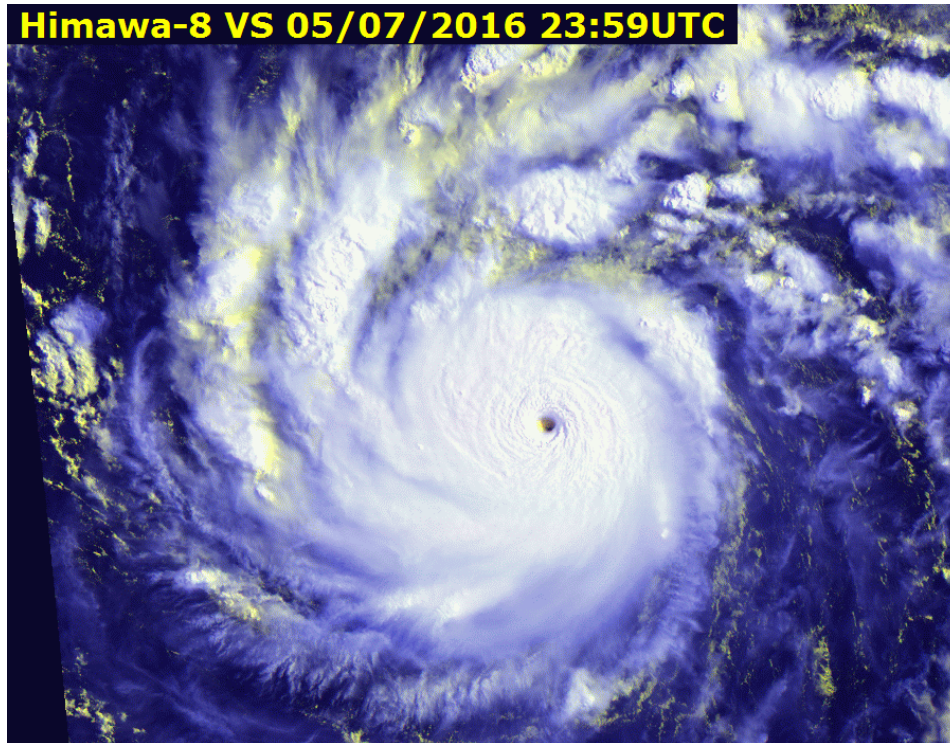
→ Cloud thickness

→ Cloud phase

→ Cloud height, temp

(Reference) Cloud (AVHRR)

Application for AHI/Himawari-8 (based on EUMETSAT material)



Application:

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

Thick, ice cloud
(cold)

Water cloud
(warm)

A part of Interpretation
(under investigation)

	Band	Gamma	TBB/Reflectivity range
R	B03(VS 0.64)	1.0	0.0~1.0
G	B04(N1 0.86)	1.0	0.0~0.7
B	B13(IR 10.4)	1.0	203.0~323.0 [K]

→ Cloud thickness

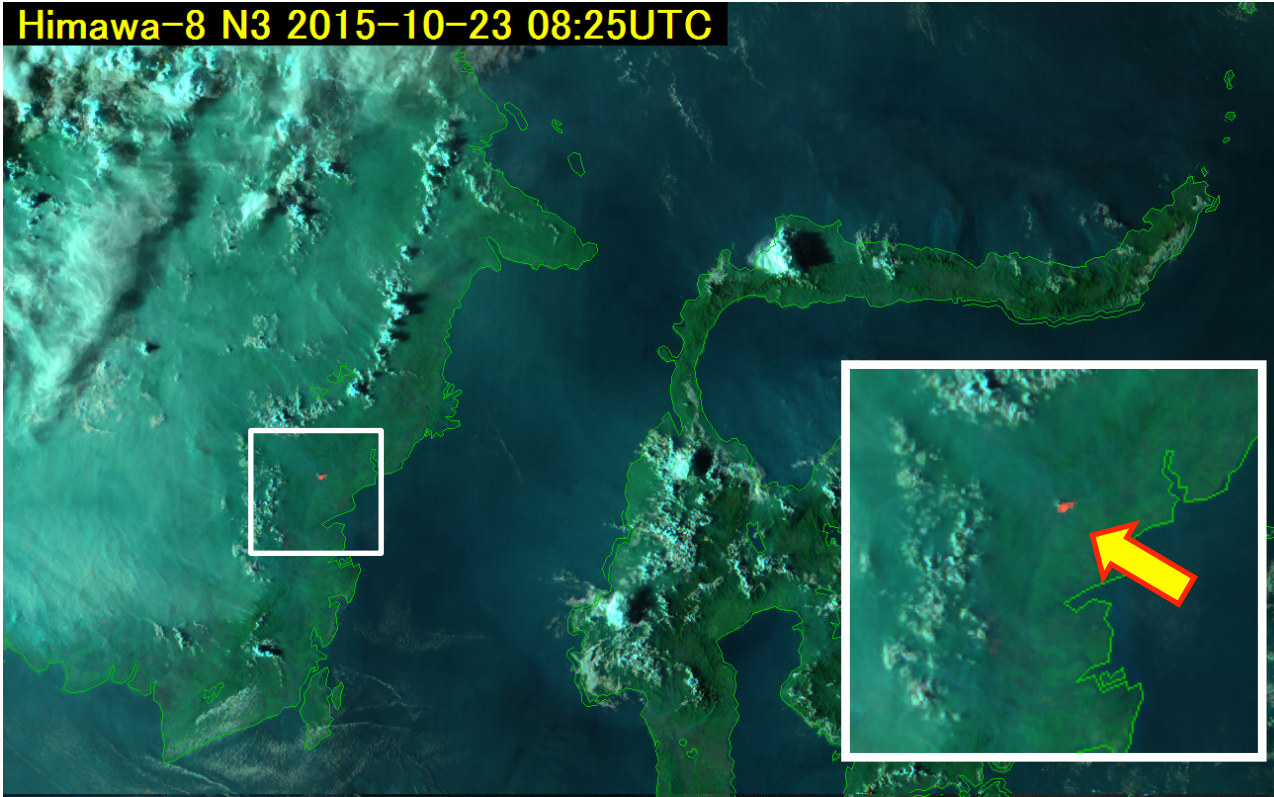
→ Cloud thickness

→ Cloud height, temp

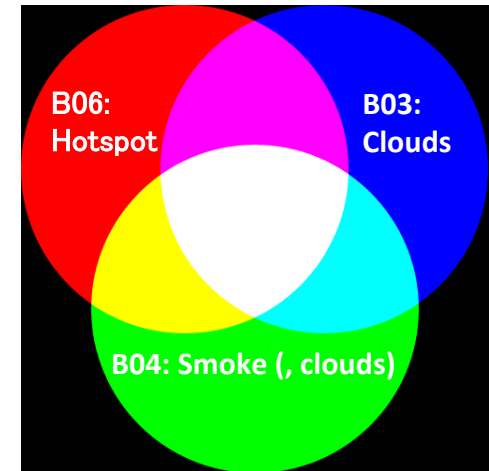
(Reference)

CIRA's Natural Fire Color RGB (False color RGB)

Application for AHI/Himawari-8

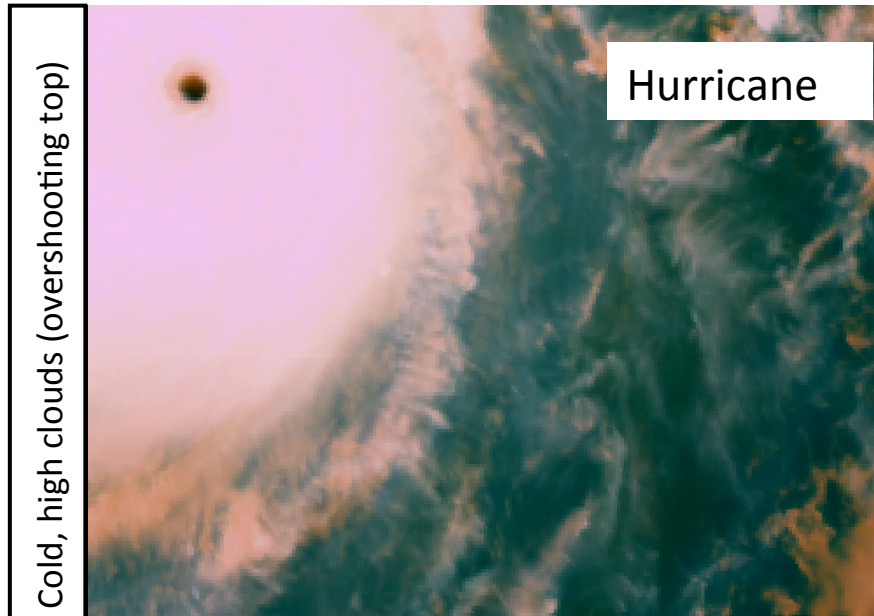
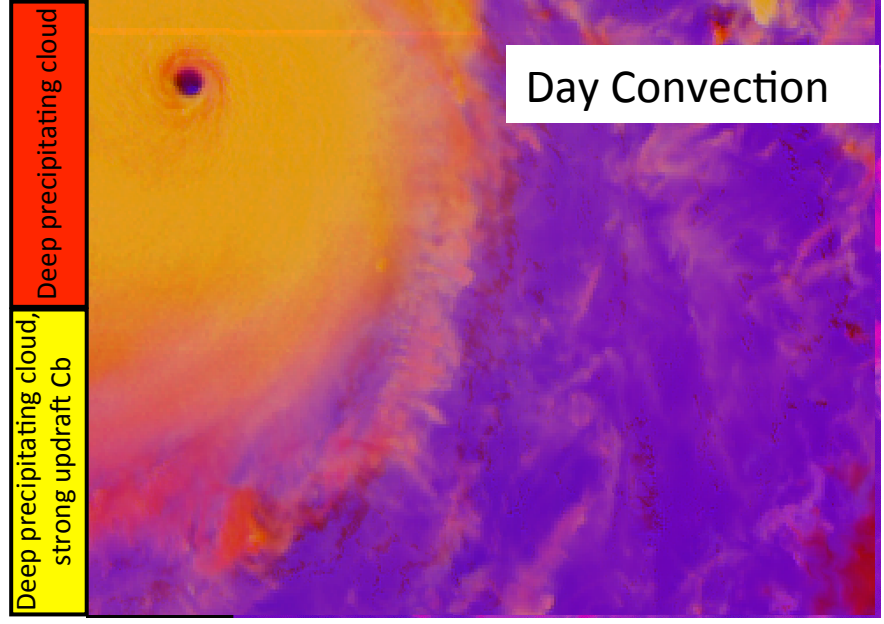
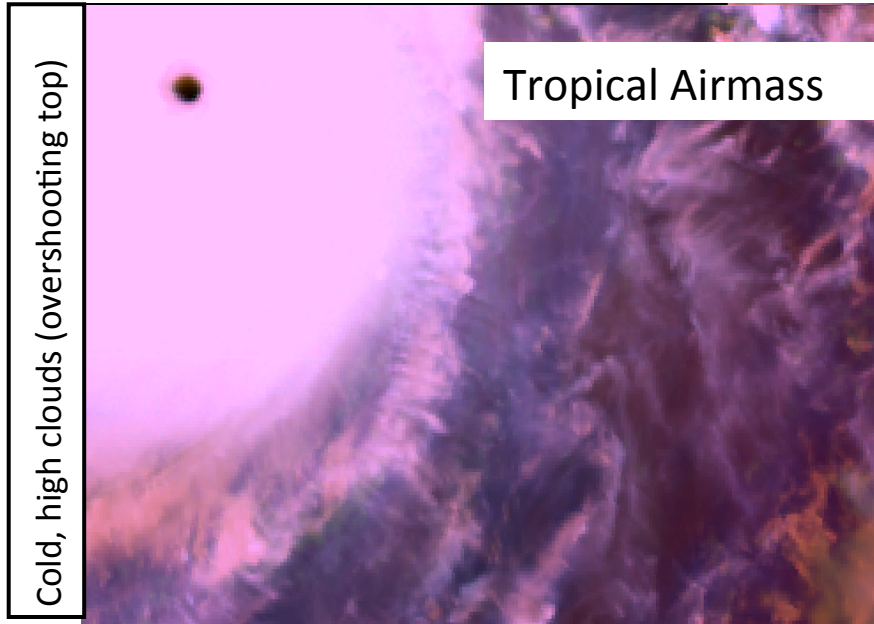


Contribution to
RGB Colors



	Band	Gamma	TBB/Reflectivity range
R	B06(N3 2.3)	1.0	0.0 ~ 1.0
G	B04(N1 0.86)	1.0	0.0 ~ 1.0
B	B03(VS 0.64)	1.0	0.0 ~ 1.0

(Reference) Other well-known RGBs



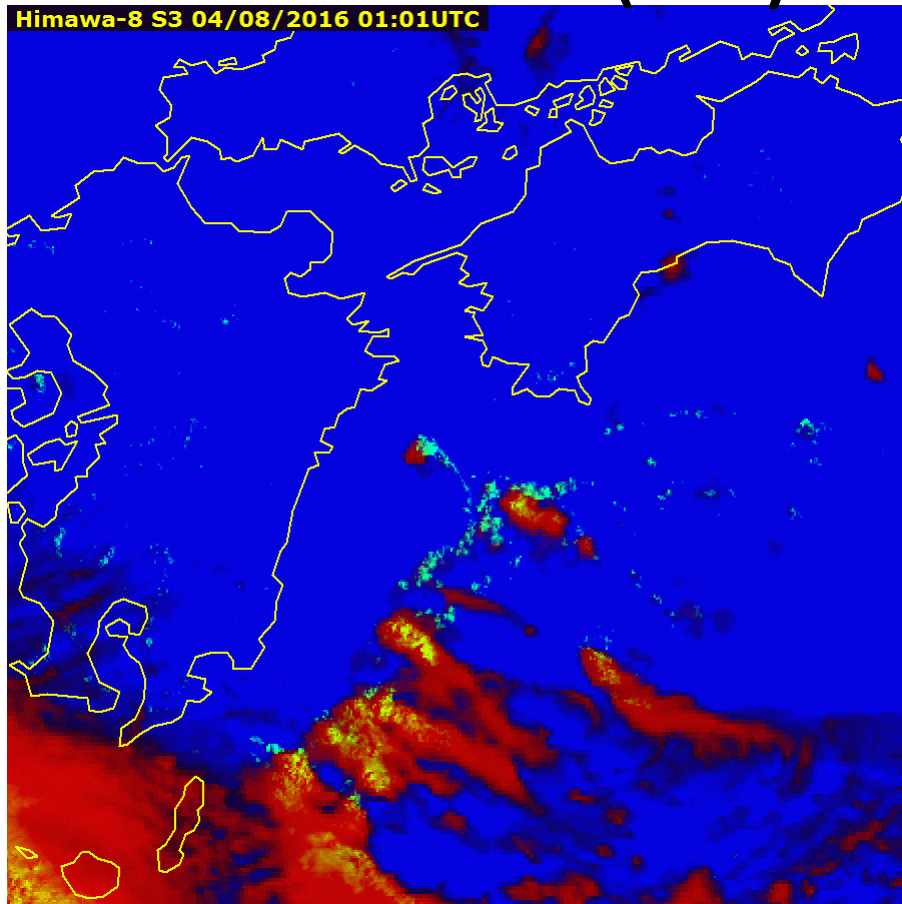
Tropical Airmass RGB and Hurricane RGB are useful for detection of cold, high clouds. Especially these are suitable for detecting overshooting tops.

* “Tropical Airmass” RGB is based on an article by Dr. J. Kerkmann (EUMETSAT).

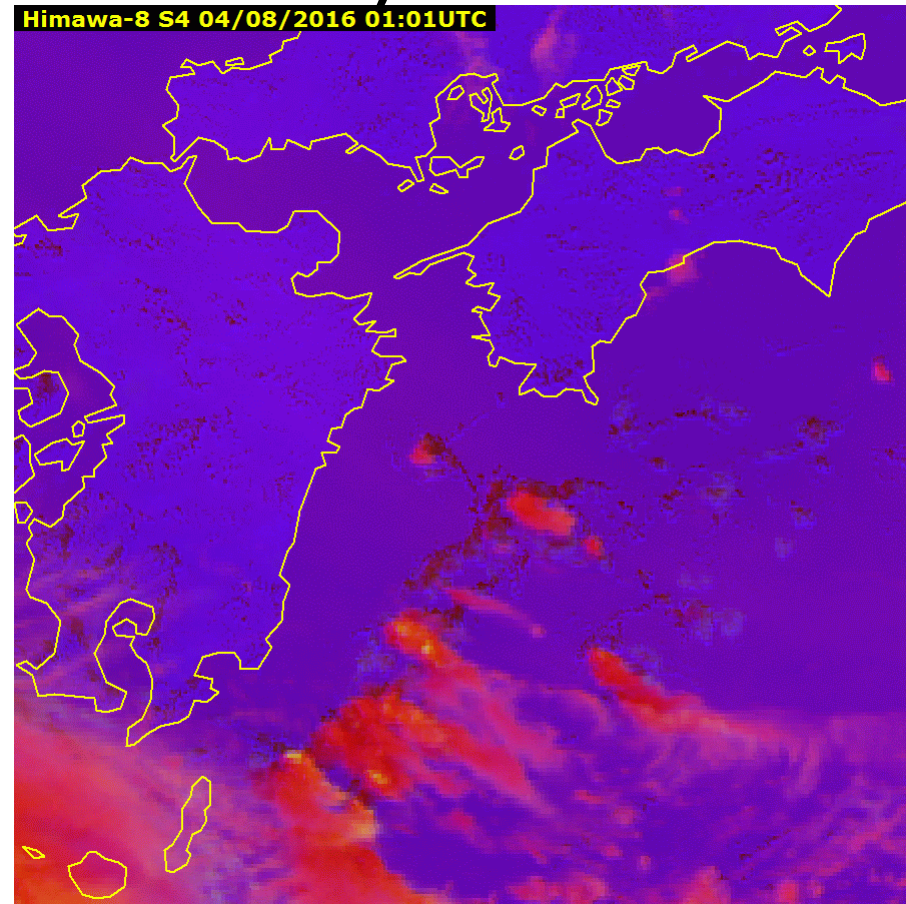
http://www.eumetsat.int/website/home/Images/ImageLibrary/DAT_2861499.html

Convection

Comparison with Day Convective Storms (Day Convection) RGB



Day Convection by traditional ver.1

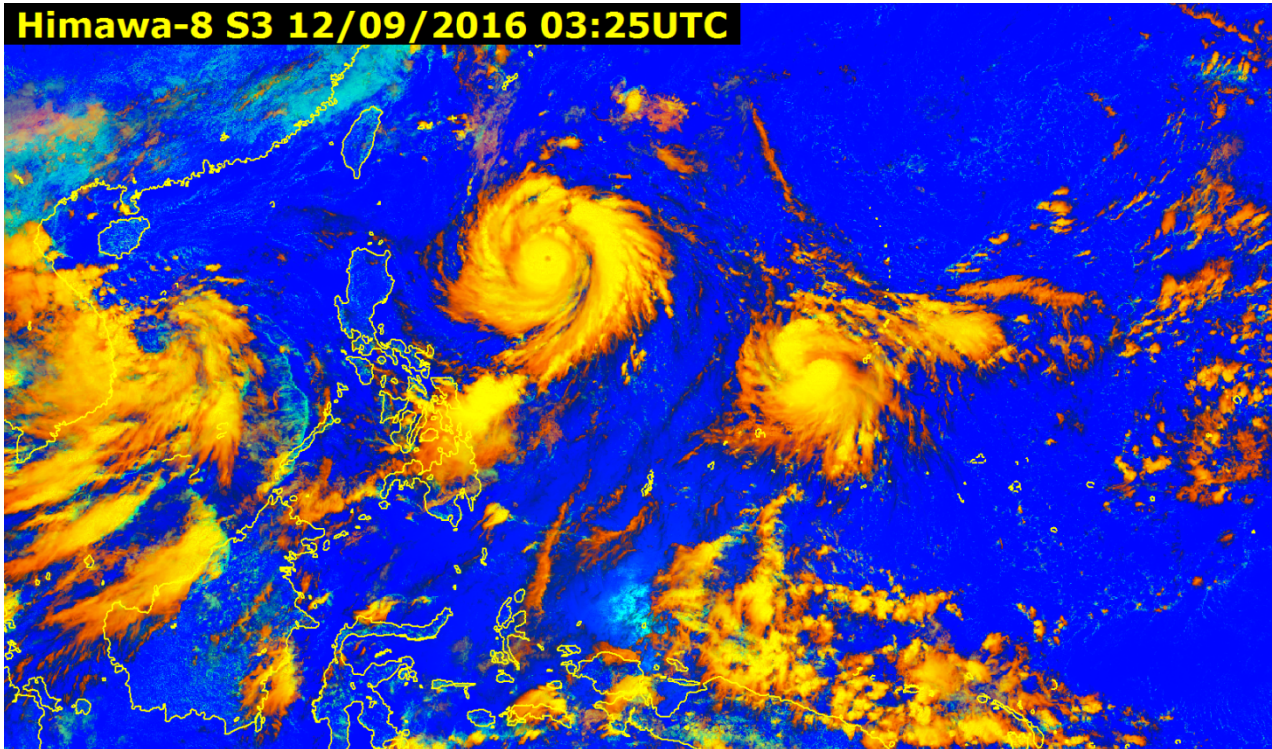


Day Convection

4th August, 2016 Vicinity of Western Japan

Day Convection ver.2

by traditional bands (for WIS users)



Thick cloud
(overshooting Cb)

Low cloud

Thin high cloud

Ocean

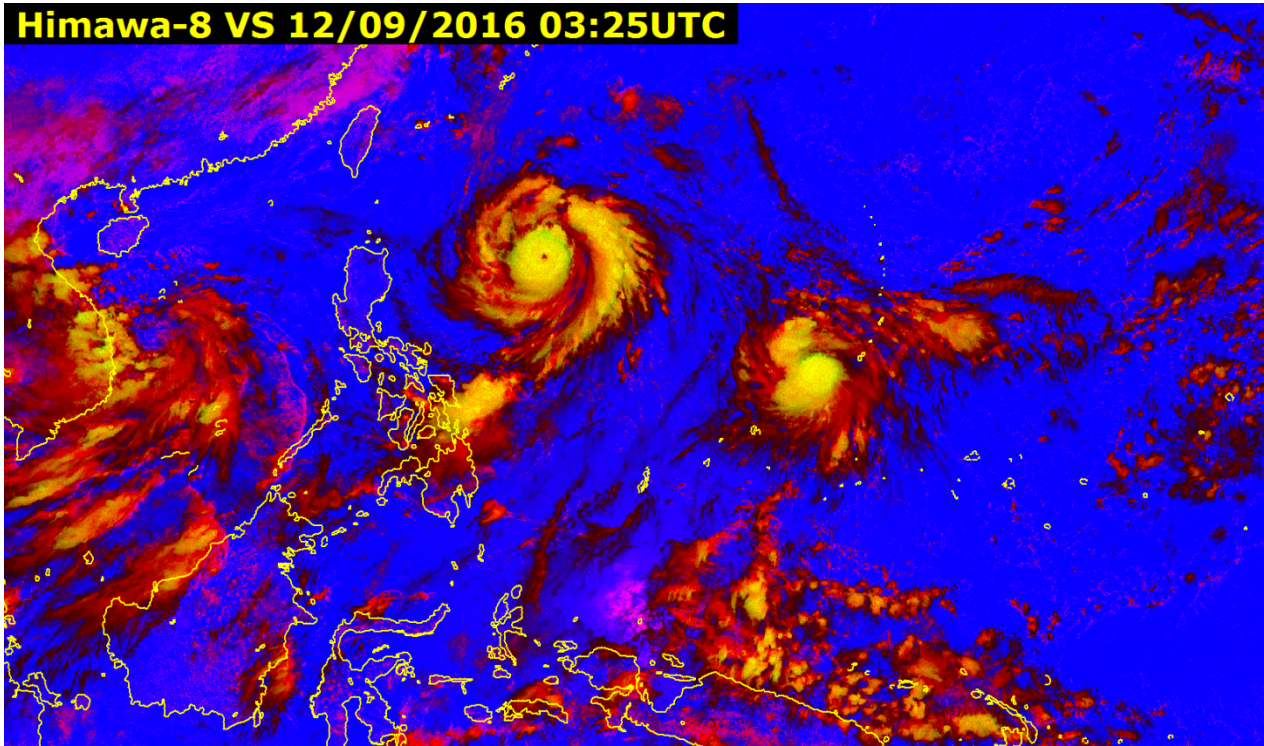
Interpretation
(under investigation)

	Band	Gamma	TBB/Reflectivity range
R	B13(IR 10.4)-B08(WV6.2)	2.5	-5.0~40.0 [K]
G	B03(VS 0.64)	1.0	0.0~1.0
B	B13(IR 10.4)	1.0	243.6~292.6 [K]

Day Convection ver.3

by traditional bands (for WIS users)

Himawa-8 VS 12/09/2016 03:25UTC



Thick cloud,
overshooting Cb

Thick cloud

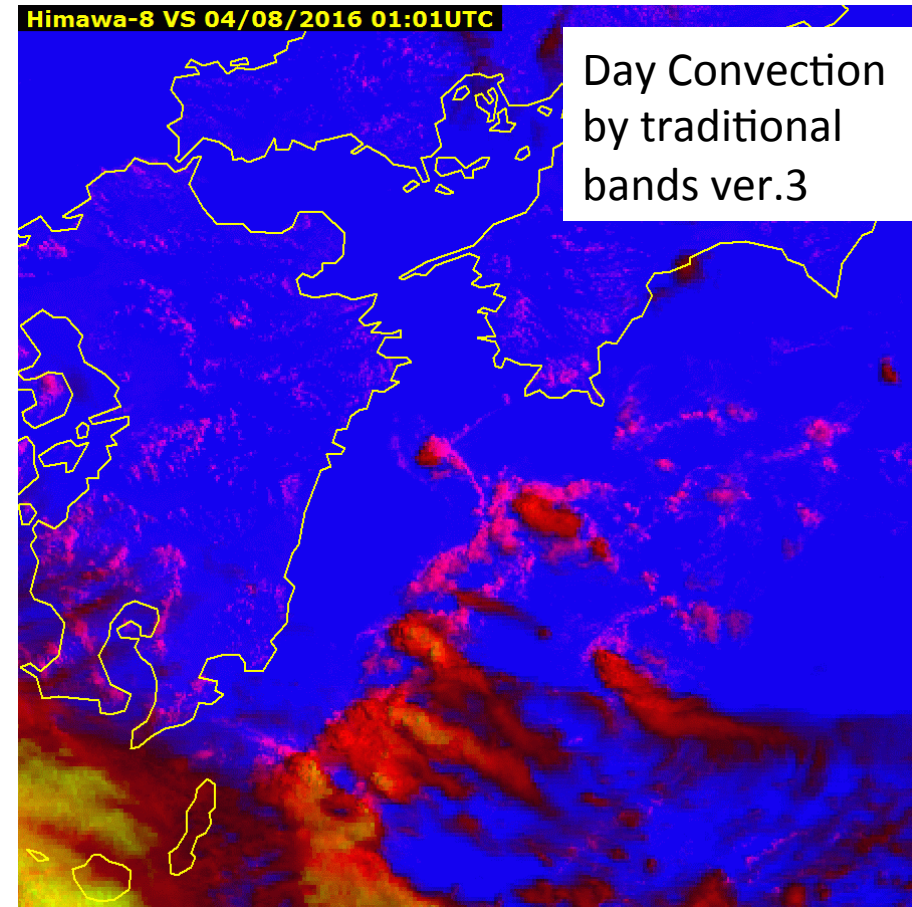
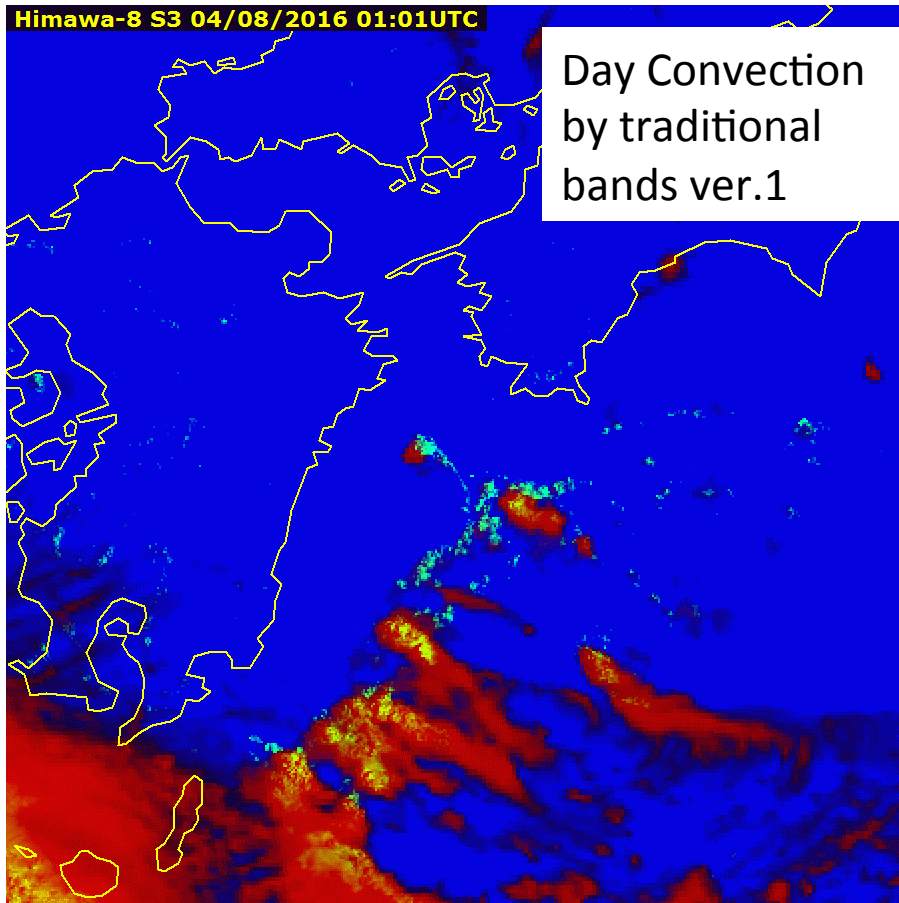
Low cloud

Ocean

Interpretation
(under investigation)

	Band	Gamma	TBB/Reflectivity range
R	B03(VS 0.64)	1.0	0.0 ~ 1.0
G	B13(IR 10.4)-B08(WV6.2)	1.0	0.0 ~ 7.0 [K] (mid latitude, summer) -3.0 ~ 4.0 [K] (Tropical area)
B	B13(IR 10.4)	1.0	243.6 ~ 292.6 [K]

Day Convection by traditional bands ver.1 vs. ver.3

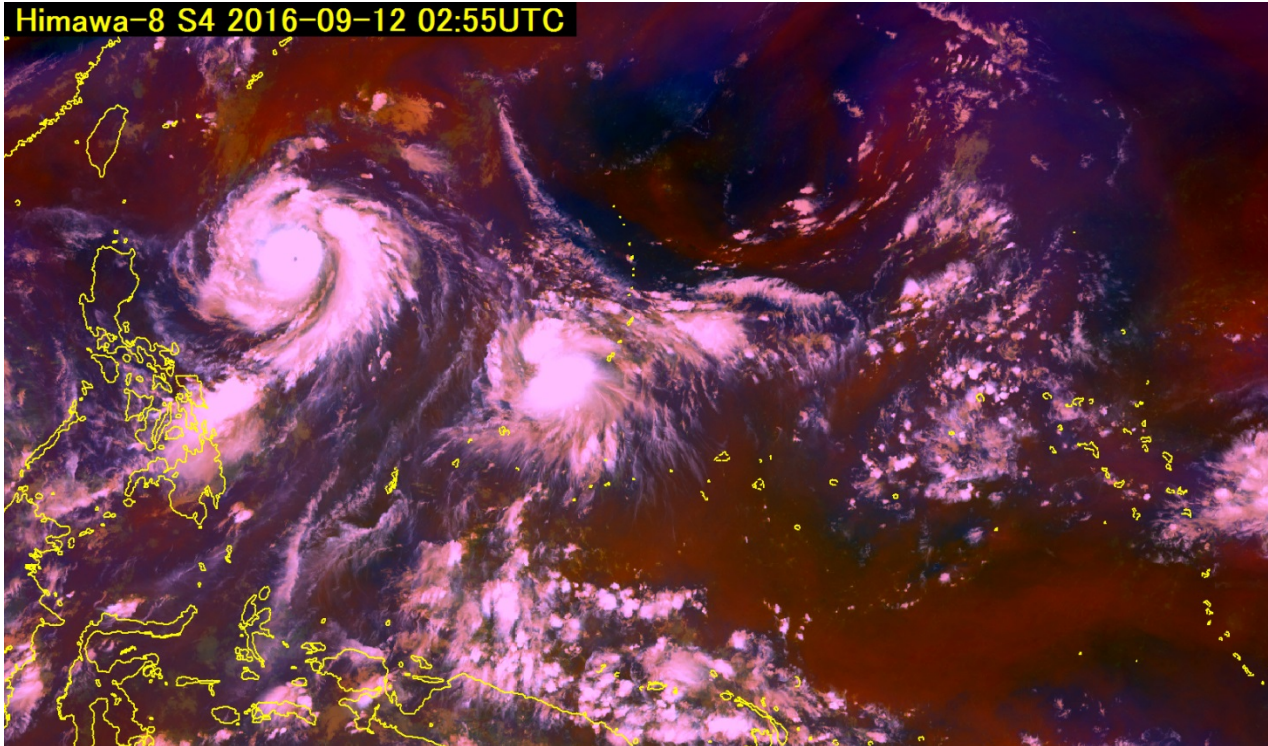


As for Cb detection, Ver.1 looks better than ver.3.
Low clouds are clear on ver.3 image.

(Reference) Tropical Airmass

Application for AHI/Himawari-8 (based on EUMETSAT article)

http://www.eumetsat.int/website/home/Images/ImageLibrary/DAT_2861499.html



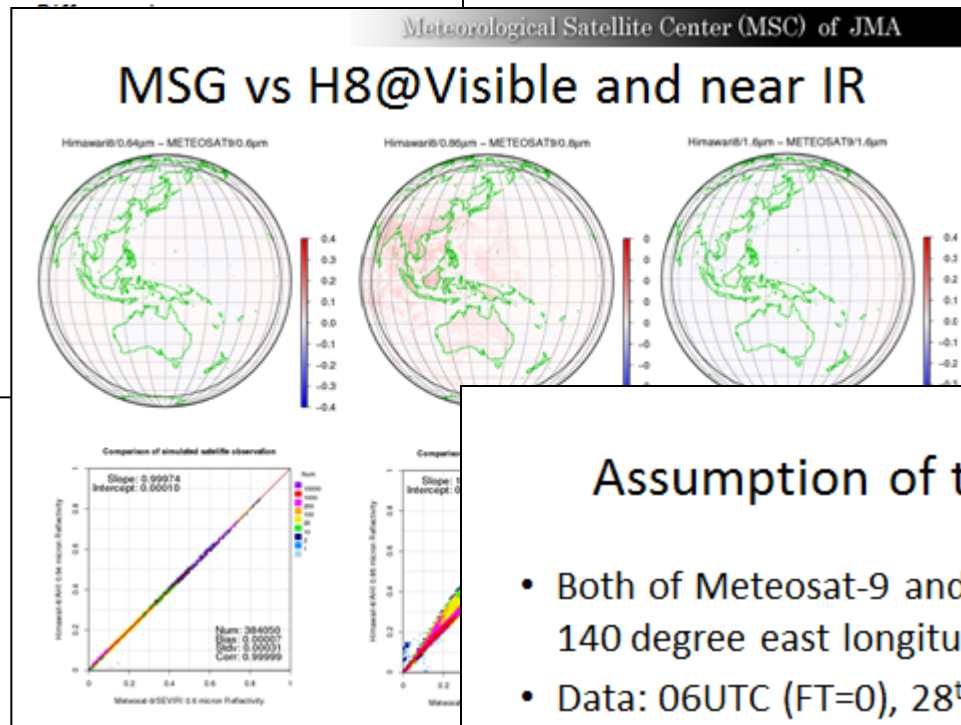
cold, high clouds
(overshooting top)

A part of Interpretation
(under investigation)

	Band	Gamma	TBB/Reflectivity range
R	B10(W3 7.3)-B08(WV6.2)	1.0	0.6 ~ 26.2 [K]
G	B13(IR 10.4)-B12(O3 9.6)	1.0	-26.2 ~ 27.4[K]
B	B08(WV6.2)	1.0	208.5 ~ 243.9 [K]

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



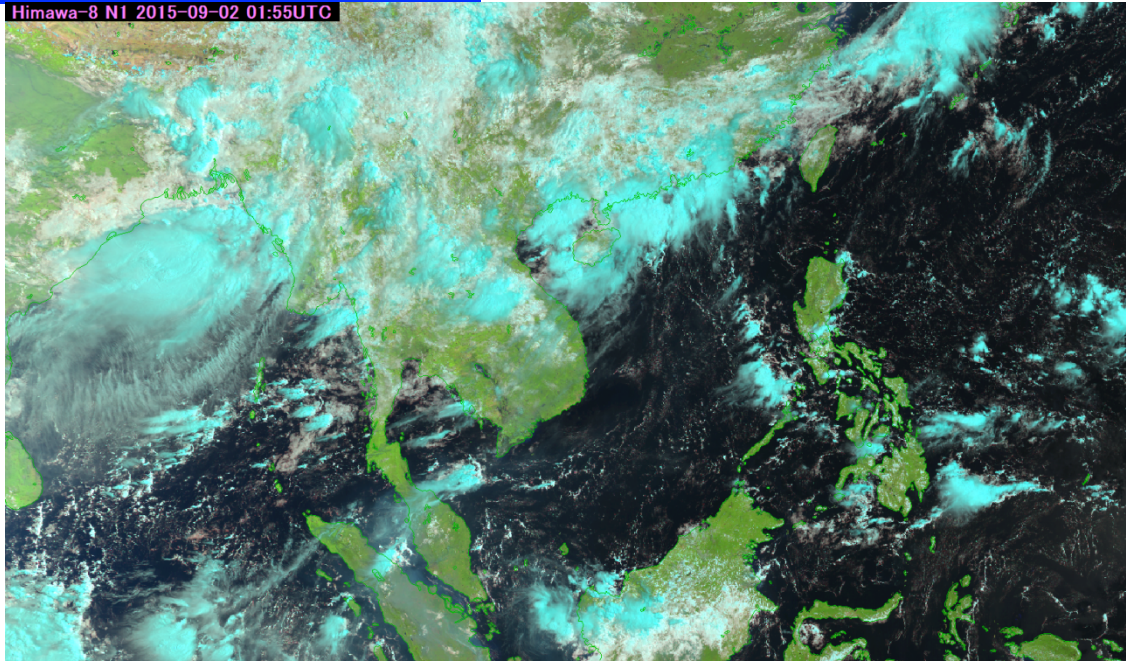
Assumption of the simulation

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

Natural Colors

Original (EUMETSAT) recipe

Himawa-8 N1 2015-09-02 01:55UTC



Interpretation of colors by EUMETSAT

High-level ice clouds

Low-level water clouds

Ocean

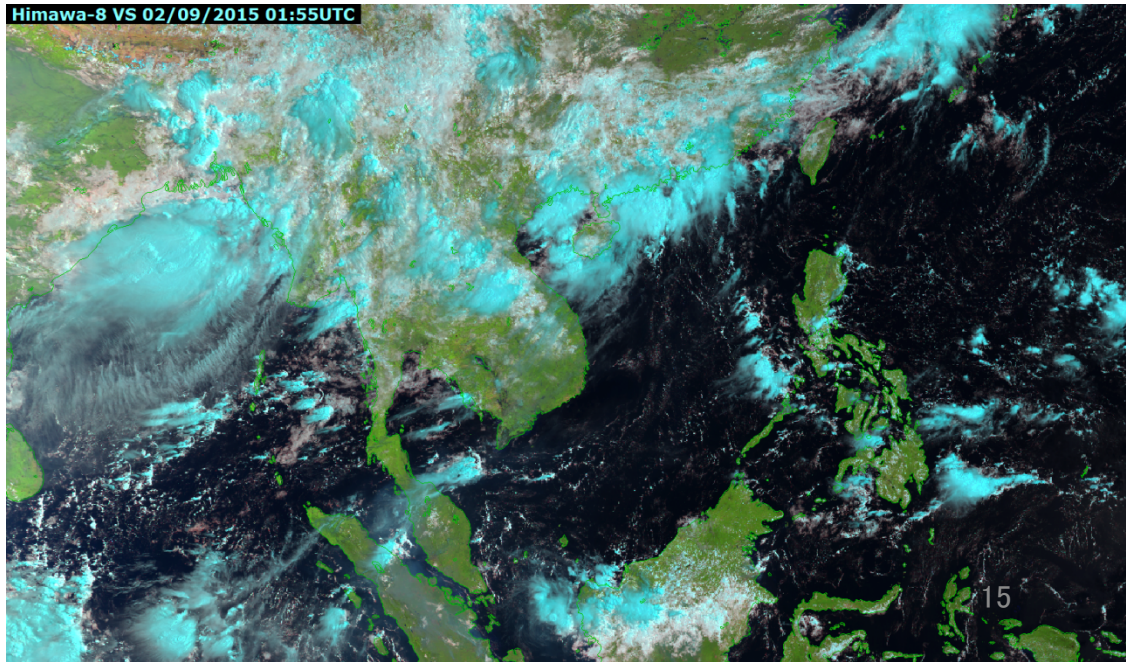
Vegetation

Desert

Snow

Adjusted recipe

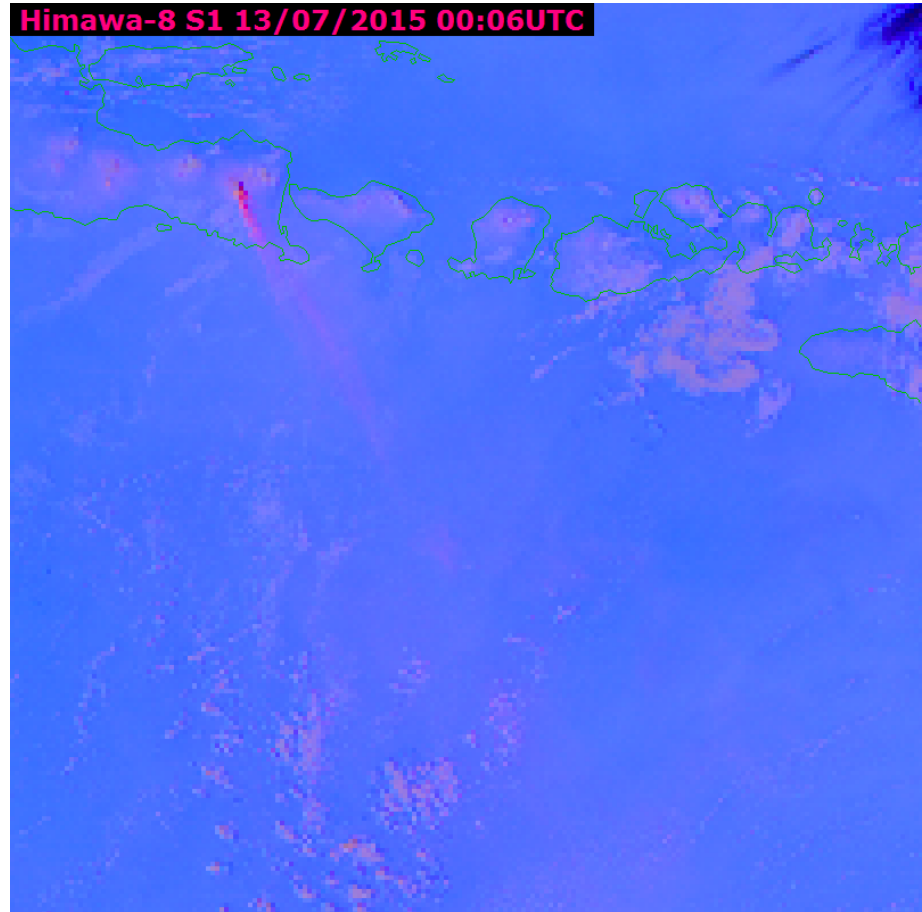
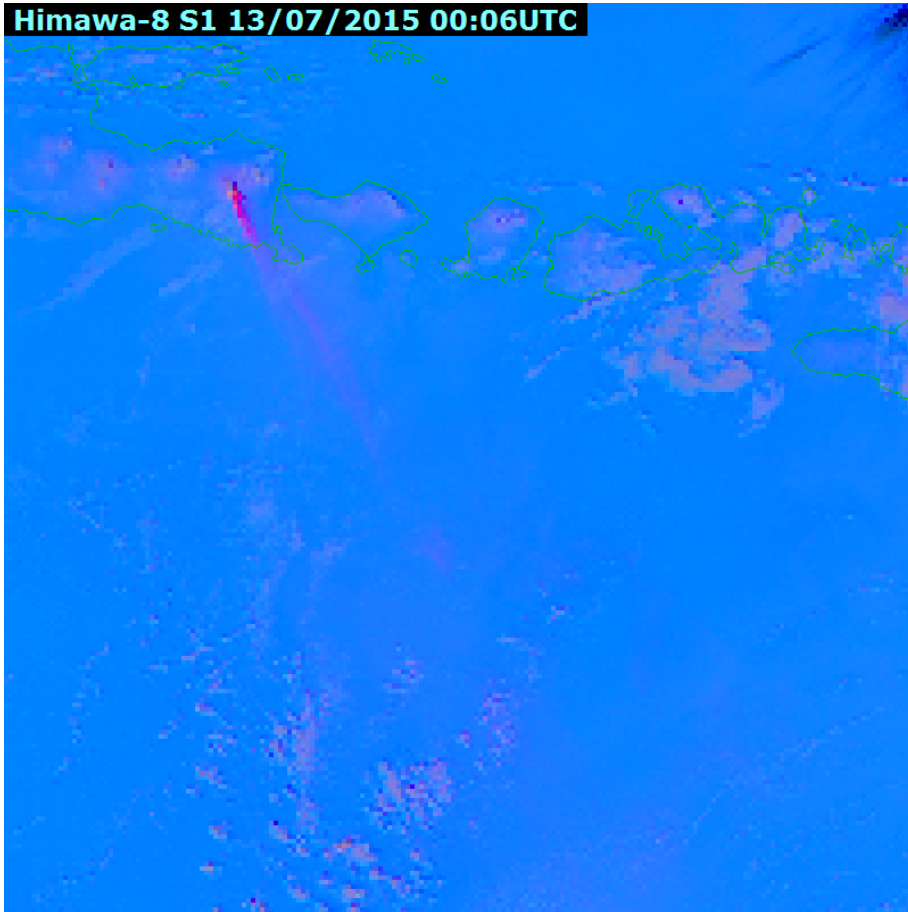
Himawa-8 VS 02/09/2015 01:55UTC



Dust

Adjusted recipe

Original (EUMETSAT) recipe

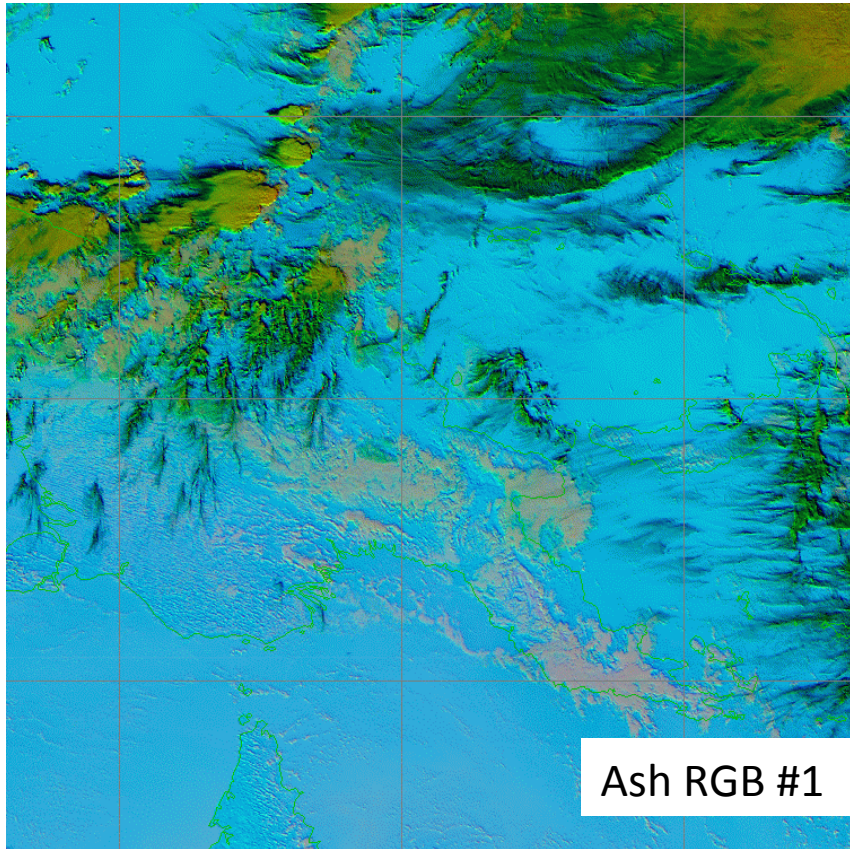


Cold, thick, high-level clouds	Low-level cloud (cold atmosphere, High latitude)
Thin Cirrus clouds Contrails	Low-level cloud (warm atmosphere, Low latitude)
	Dust
	Ocean

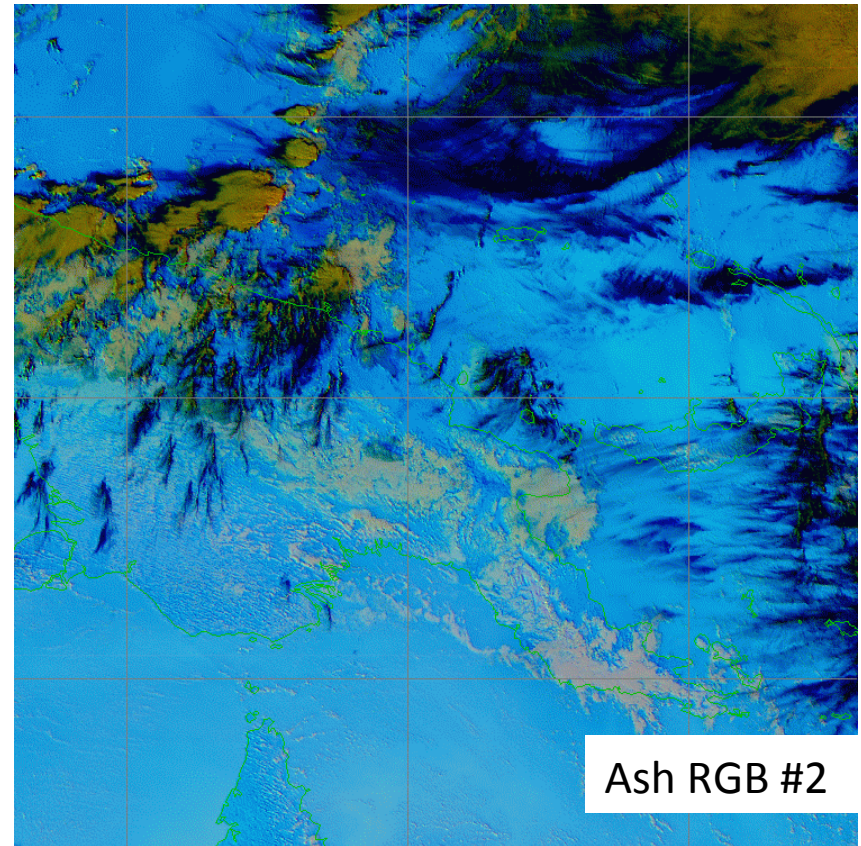
Interpretation of colors by EUMETSAT

Adjustment RGB recipes (tentative) Band options

Ash RGB (without TBB range adjustment)



Green Beam: **B13(IR10.4)**-B11(IR8.6)
Min -4.0 K, Max 5.0 K (EUMETSAT/
SEVIRI recipe)



Green Beam: **B14(IR11.2)**-B11(IR8.6)
Min -4.0 K, Max 5.0 K (EUMETSAT/
SEVIRI recipe)

Better water/ice discrimination?₁₇