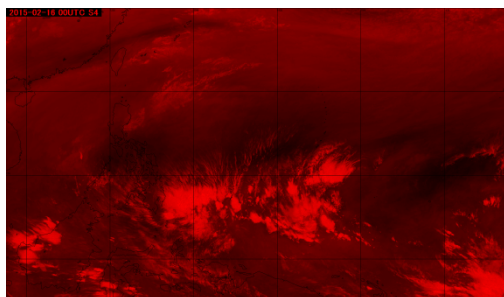




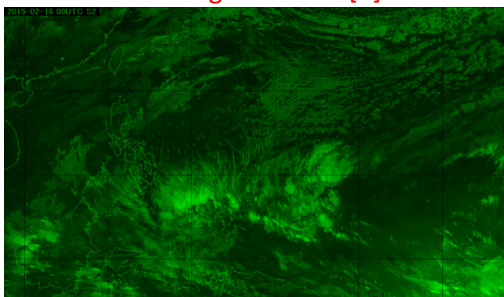
Day Convective Storm RGB Detection of Cumulonimbus Cloud

Meteorological Satellite Center, JMA

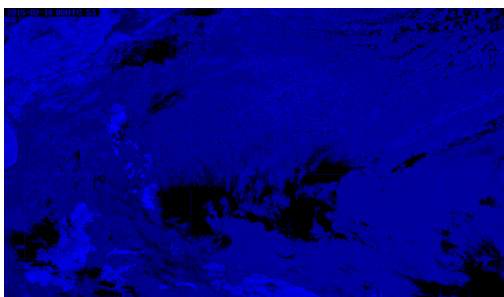
What's Day Convective Storm RGB?



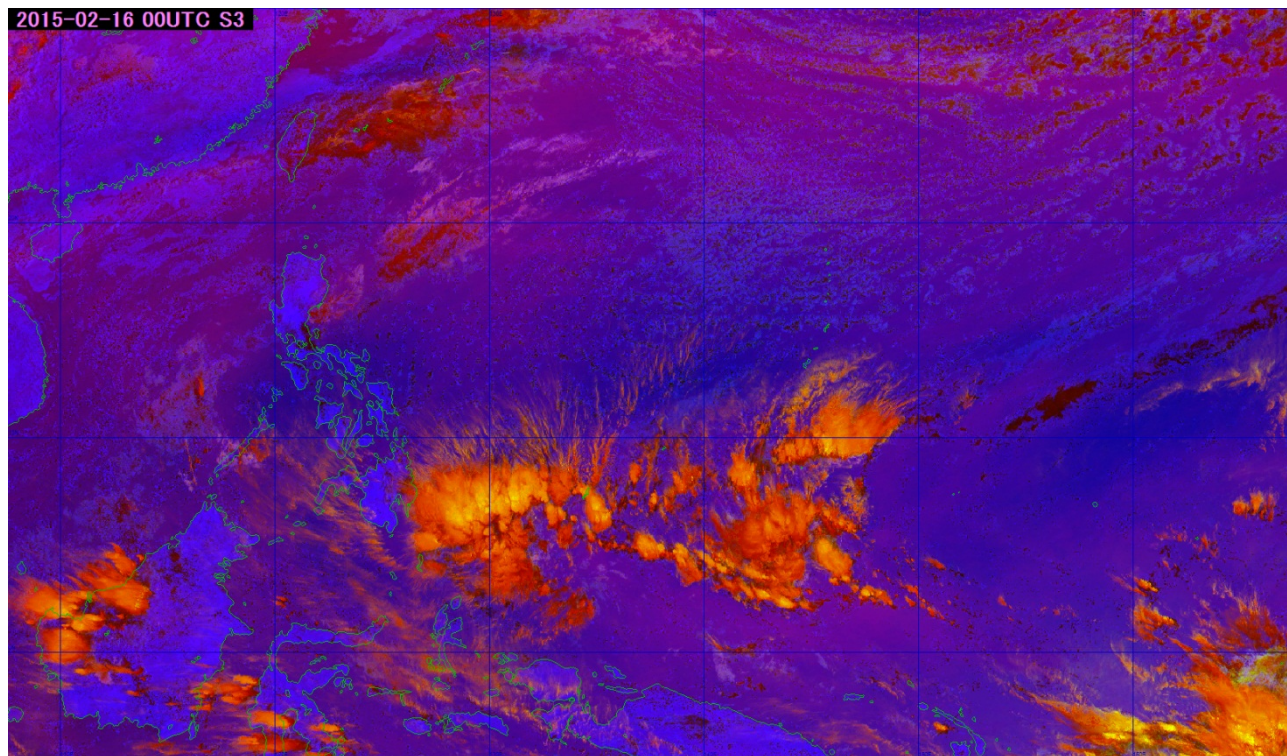
R : B08(WV6.2) – B10(W3 7.3)
Range : -35~5 [K] Gamma : 1.0



G : B07(I4 3.9)-B13 (IR10.8)
Range : -5~60 [K] Gamma : 0.5



B : B05(NIR1.6)-B03(VIS0.6)
Range : -75~25 [%] Gamma : 1.0



Components of “Day Convective Storm” RGB scheme

Channel	Himawari-8/ -9	MTSAT-1R/-2	MSG	Physical Properties	
1	0.46 μm			vegetation, aerosol B	Visible
2	0.51 μm			vegetation, aerosol G	
3	0.64 μm	0.68 μm	0.635 μm	low cloud, fog R	
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	Infrared
7	3.9 μm	3.7 μm	3.92 μm	low cloud, fog, forest fire	
8	6.2 μm	6.8 μm	6.25 μm	mid- and upper level moisture	
9	7.0 μm			mid- level moisture	Infrared
10	7.3 μm		7.35 μm	mid- and upper level moisture	
11	8.6 μm		8.70 μm	cloud phase, SO2	
12	9.6 μm		9.66 μm	ozone content	Infrared
13	10.4 μm	10.8 μm	10.8 μm	cloud imagery, information of cloud top	
14	11.2 μm			cloud imagery, sea surface temperature	
15	12.3 μm	12.0 μm	12.0 μm	cloud imagery, sea surface temperature	
16	13.3 μm		13.4 μm	cloud top height	

This scheme is displayed by compositing “three differences”, difference of two water vapor channels (B08(WV6.2), B10(W3 7.3)), difference of B07(I4 3.9) and (traditional) IR channel (B13 (IR10.8)), and difference of (traditional) visible channel (B03(VS 0.64)) and near infrared channel (B05(N2 1.6)).

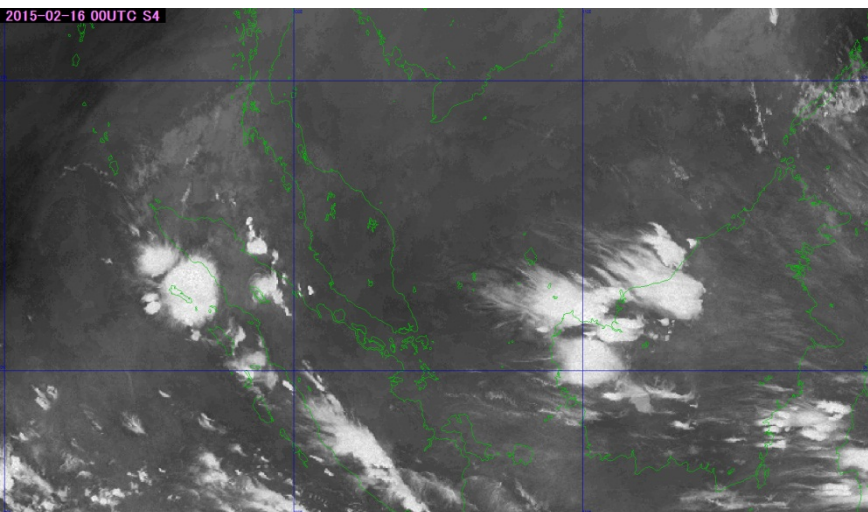
The phase and size of cloud particles distinction is possible by these differences.

For the above reason, fine distinction of convective cloud with severe phenomena such as gust or tornado is possible.

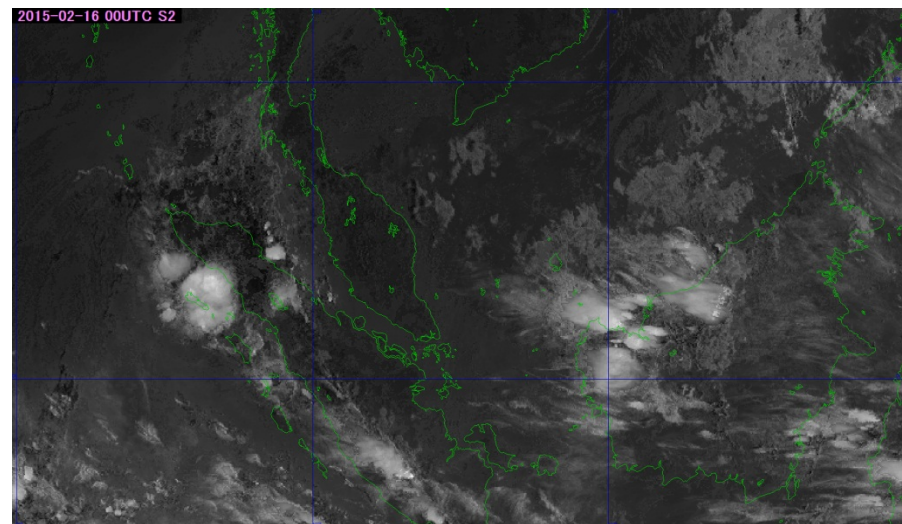
A set of RGB “Day Convective Storms” scheme
(RGB:B08-B10/B07-B13/B05-B03)

R : B08(WV6.2) – B10(W3 7.3)
Range: -35~5 [K] Gamma: 1.0
G : B07(I4 3.9)-B13 (IR10.8)
Range: -5~60 [K] Gamma: 0.5
B : B05(NIR1.6)-B03(VIS0.6)
Range: -75~25 [%] Gamma: 1.0

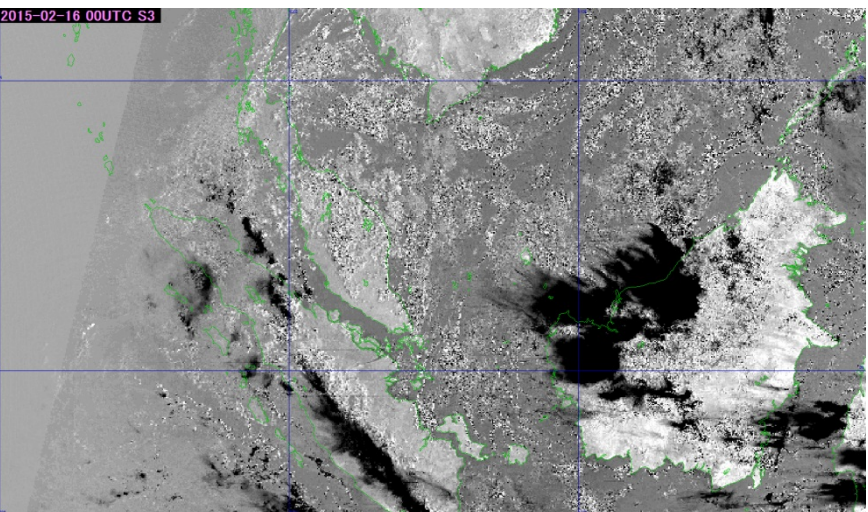
Characteristics and Basis of Three Components



R : B08(WV6.2) – B10(W3 7.3) Range: -35~5 [K] Gamma: 1.0



G : B07(I4 3.9)-B13 (IR10.8) Range: -5~60 [K] Gamma: 0.5

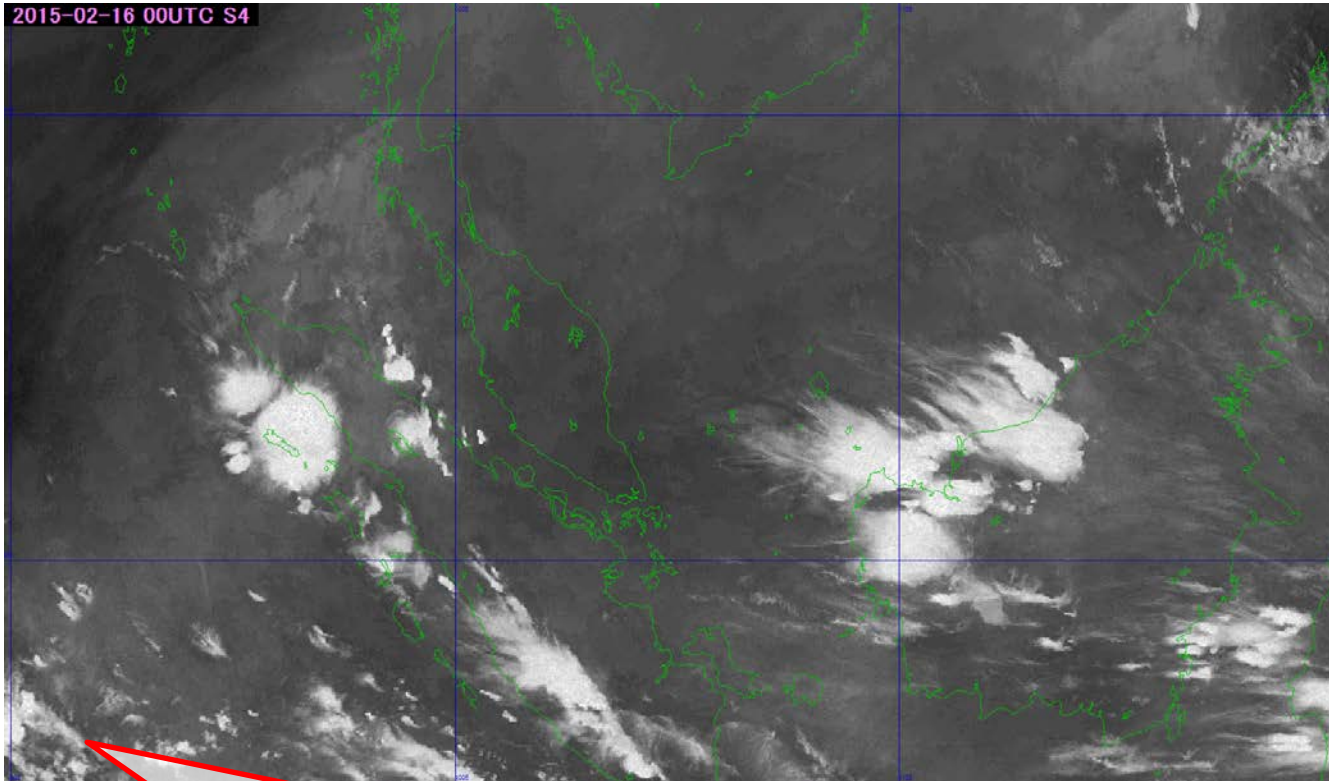


B : B05(NIR1.6)-B03(VIS0.6) Range: -75~25 [%] Gamma: 1.0

Characteristics and Basis of Three Components

Red Beam

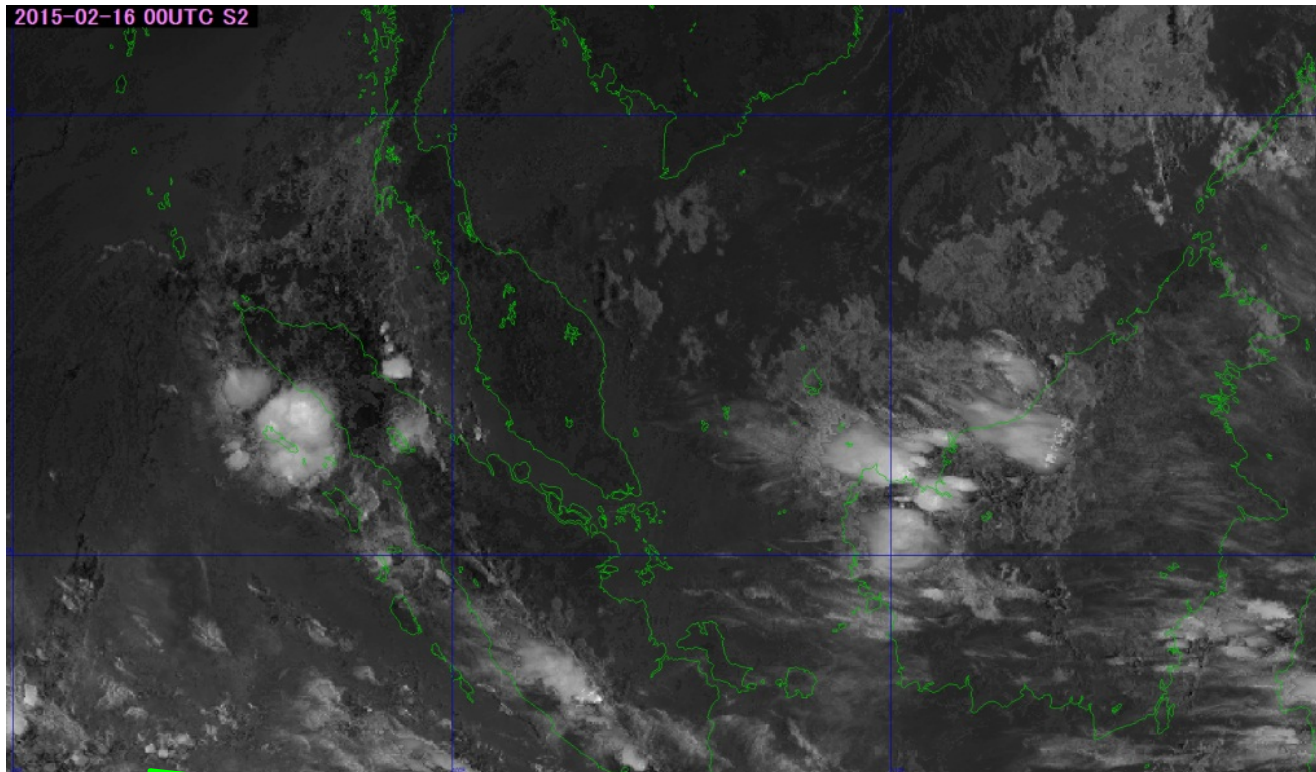
R : B08(WV6.2) – B10(W3 7.3) Range: -35~5 [K] Gamma: 1.0



- B08 is similar to the traditional WV channel, it has the information on water vapor of the tropospheric upper/middle layer
- On the upper layer, water vapor transparency of B10 is higher than B08, therefore it has the information on water vapor of the middle-lower part of the upper layer
- On difference image, thick clouds with high cloud are displayed in white, low clouds and thin Ci are indistinct
- On RGB image, thick clouds are displayed in red

Characteristics and Basis of Three Components Green Beam

G : B07(I4 3.9)-B13 (IR10.8) Range: -5~60 [K] Gamma: 0.5

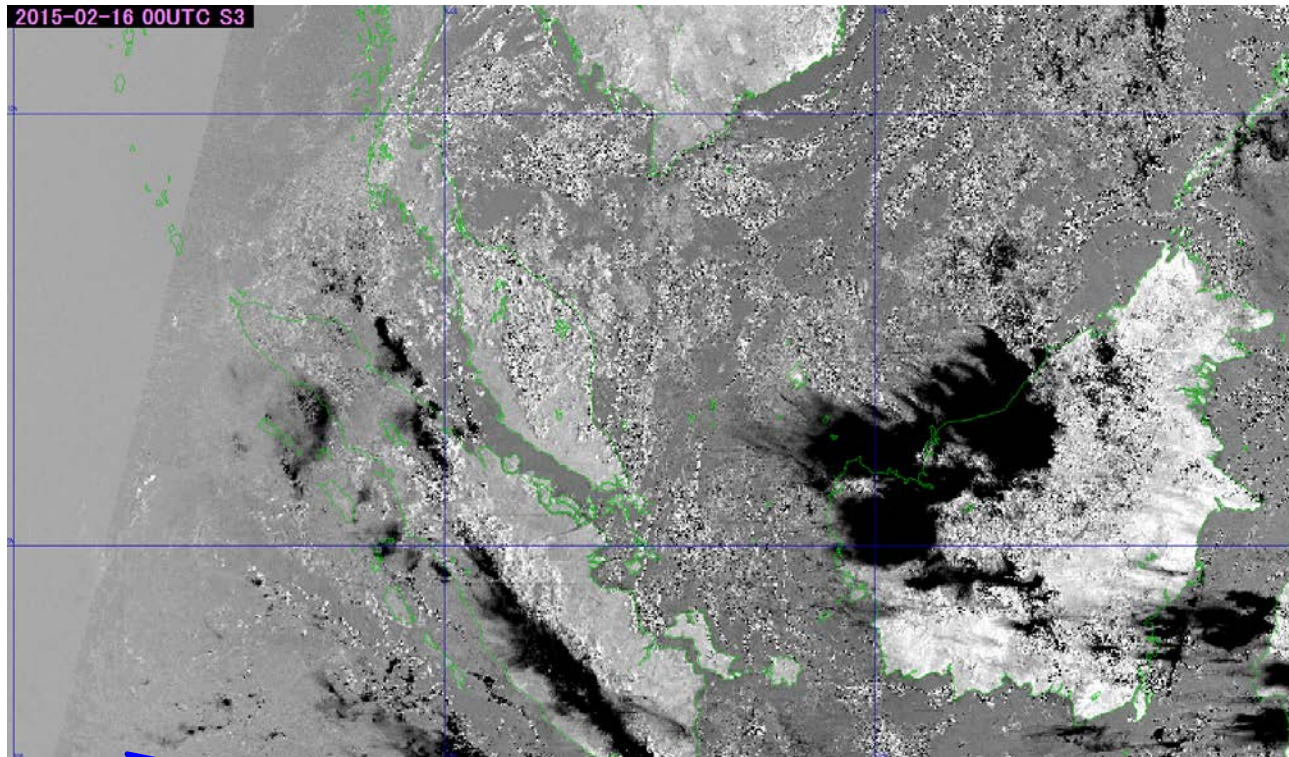


- B07 display of daytime consists of the components of infrared radiation and sun light reflectance
- Reflectivity of B07 depends on the phase and size of cloud particles
- Reflectivity is larger for small ice cloud particles
- Convective clouds with strong updraft contain number of small ice particles
- On difference image B07-B13 of daytime, the reflectance component contributes much to the image
- On RGB image, clouds with thick (red) and number of small ice particles (green) appear in yellow

Characteristics and Basis of Three Components

Blue Beam

B : B05(NIR1.6)-B03(VIS0.6) Range: -75~25 [%] Gamma: 1.0



- Reflectivity of B05 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
- Reflectivity of B03 depends on optical thickness
- On difference image, thick clouds with large ice particles are displayed in black (dark), low clouds and land/sea surface look whitish (bright)
- On RGB image (similarly on difference image), thick clouds with large ice particles are displayed in black (dark)

Interpretation of Colors for “Day Convective Storms”



Deep precipitating cloud
(precip. not necessarily
reaching the ground)

- High level Cloud
- Large ice particles



Deep precipitating cloud
(Cb cloud with strong
updrafts and severe
weather)*

- High level Cloud
- Small ice particles

*or thick, high-level lee
cloudiness with small ice
particles



Thin Cirrus cloud
- Large ice particles



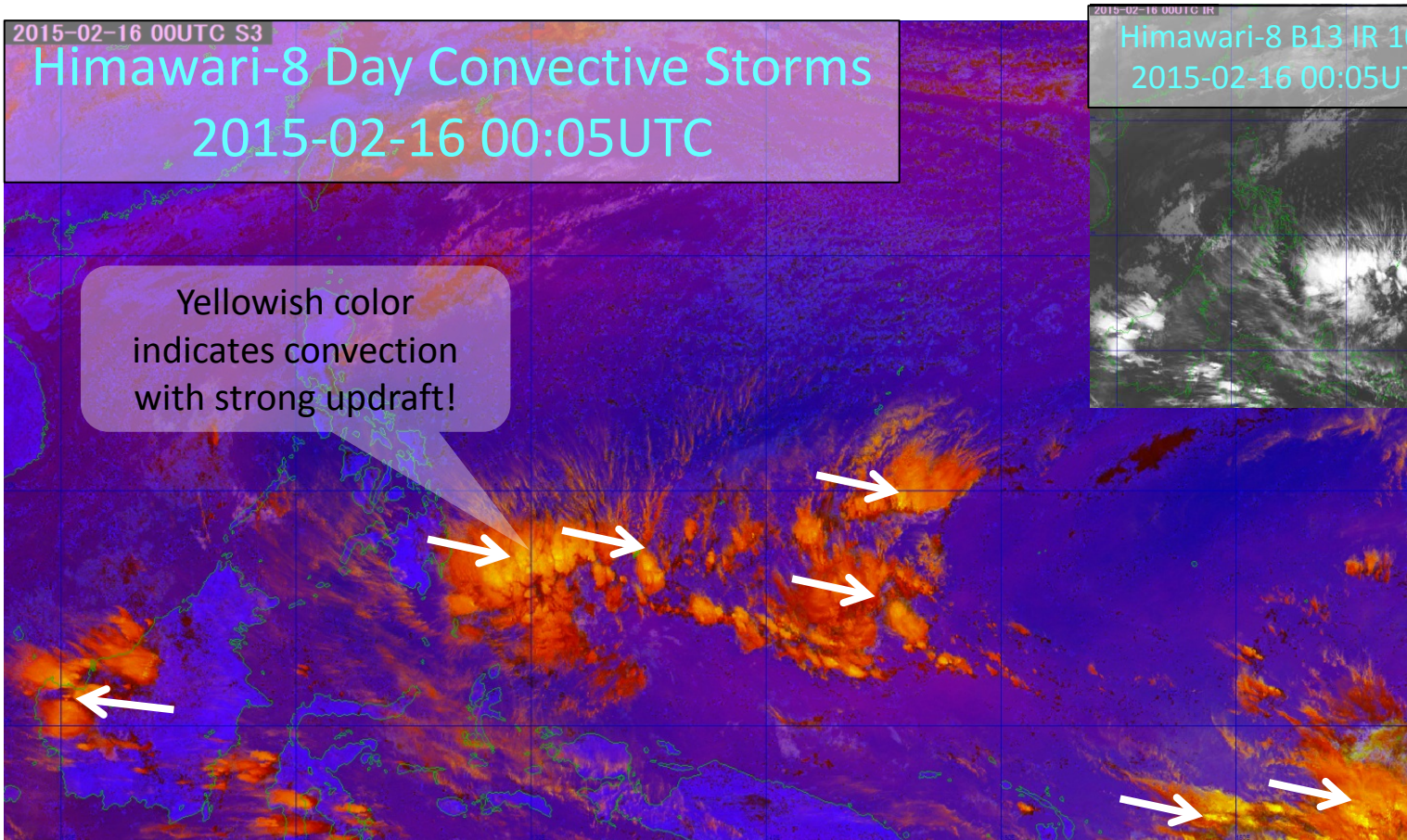
Thin Cirrus cloud
- Small ice particles

Ocean

Land

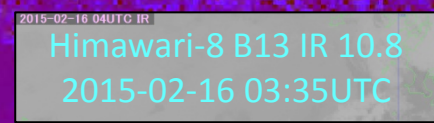
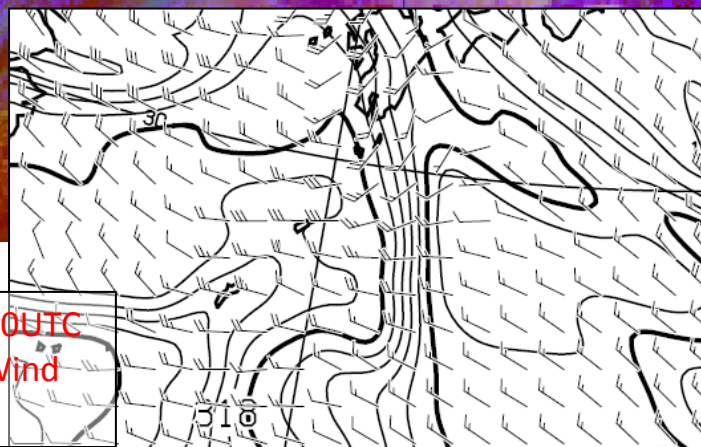
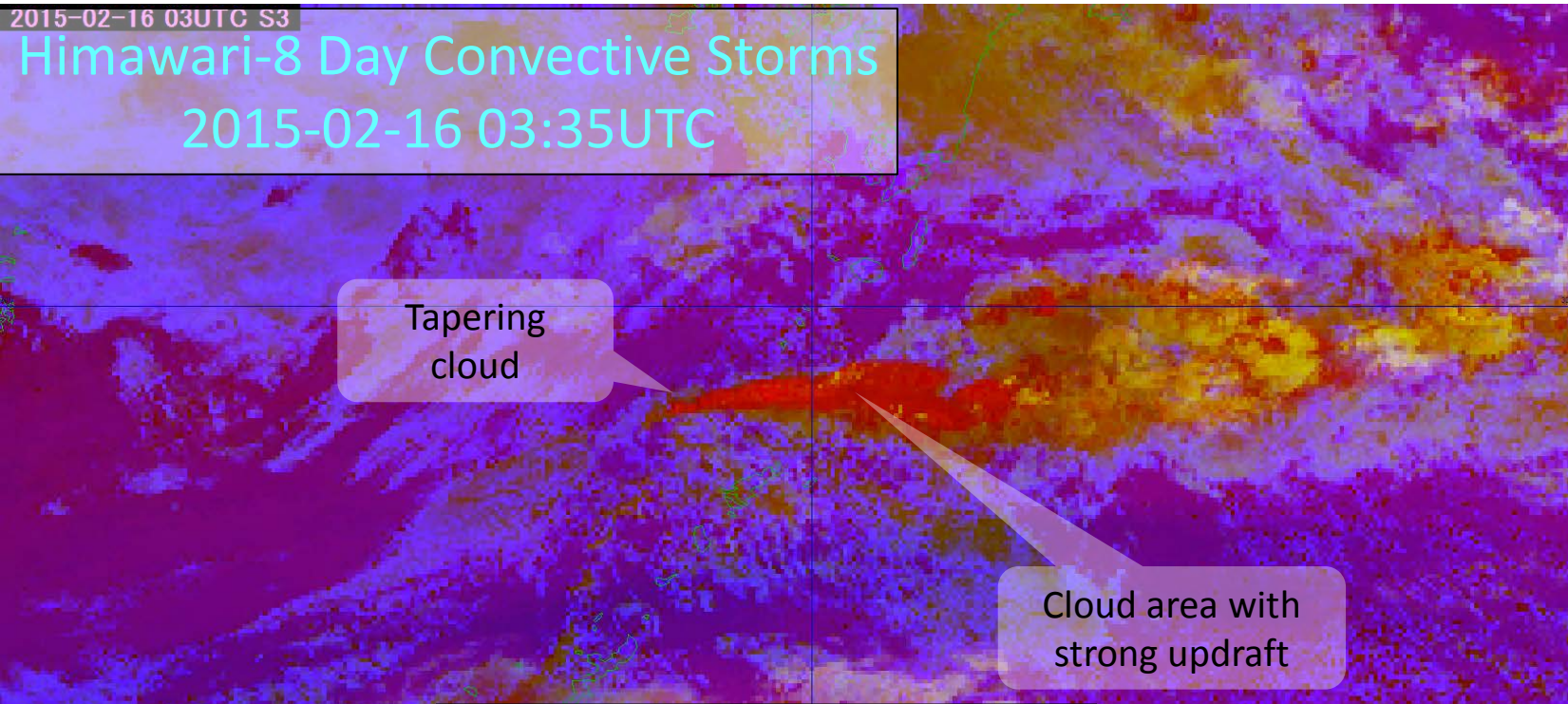
Case Study of Day Convective Storm RGB

ITCZ (Intertropical Convergence Zone)



Case Study of Day Convective Storm RGB

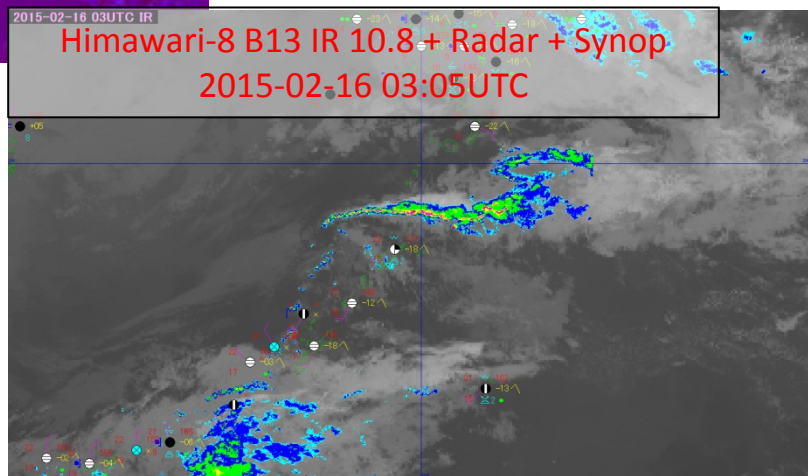
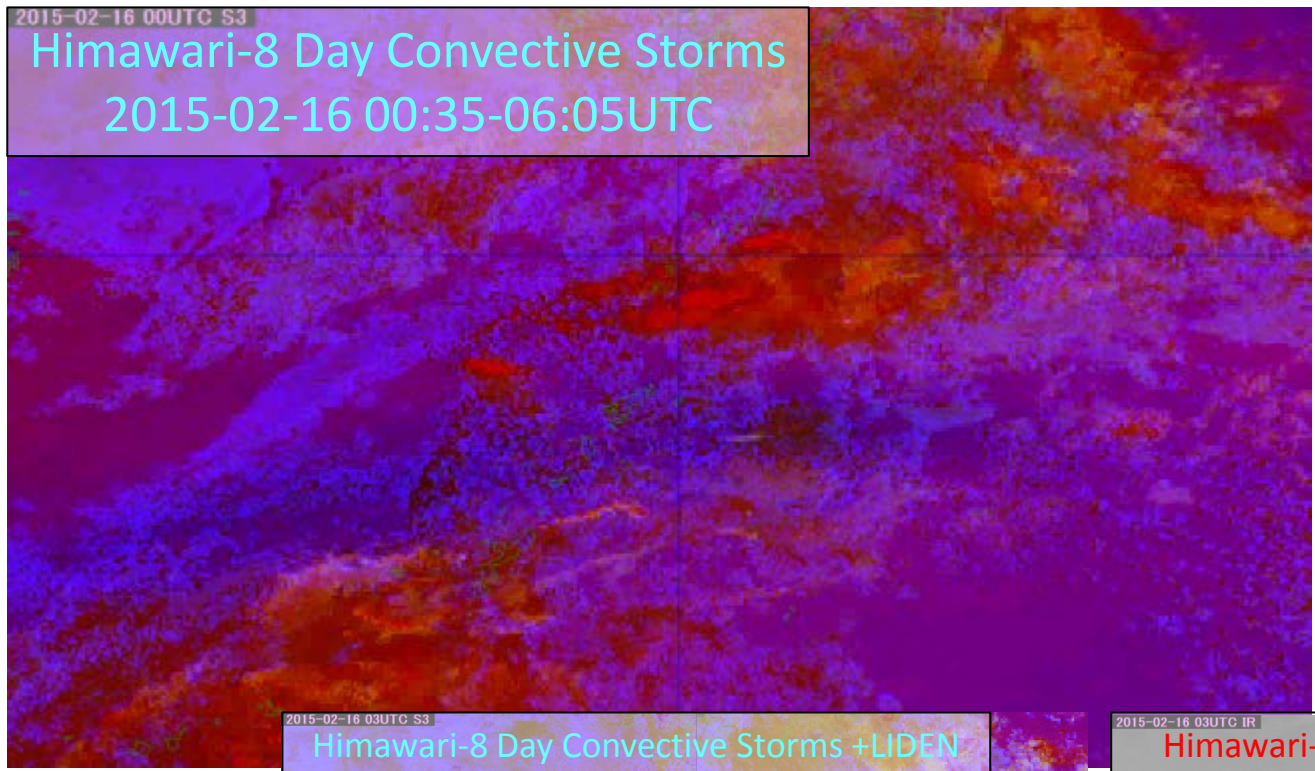
Tapering cloud (Nansei Islands, Japan)



FXJP854 Valid 2015-02-15 00UTC
T=12 850hPa E. P. Temp, Wind
2015-02-15 12UTC

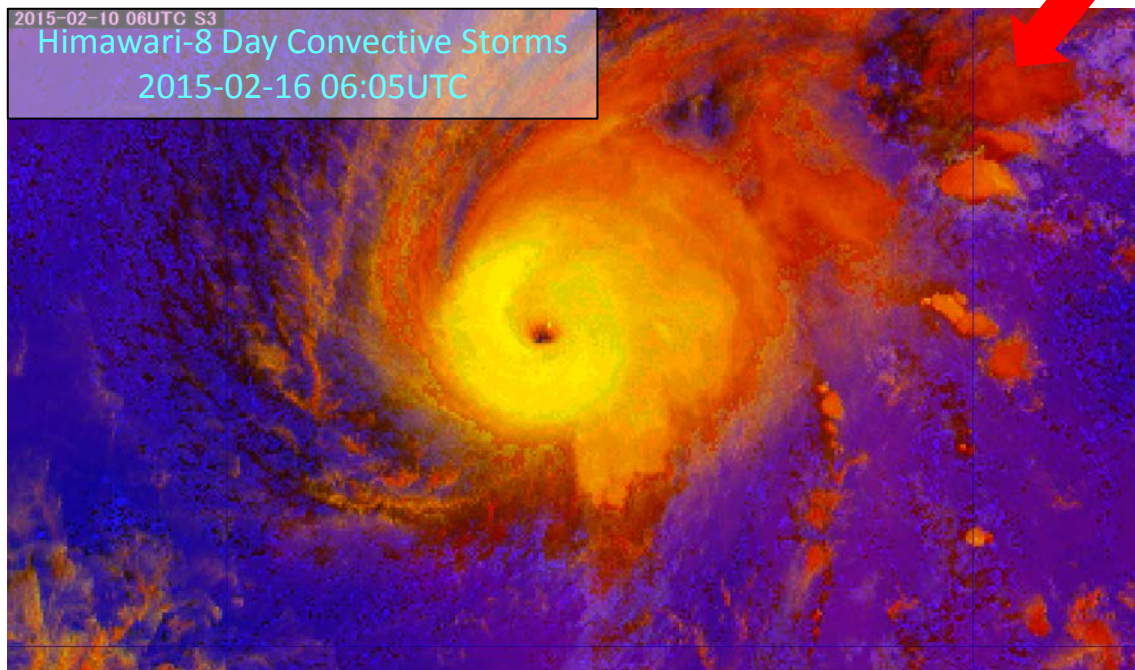
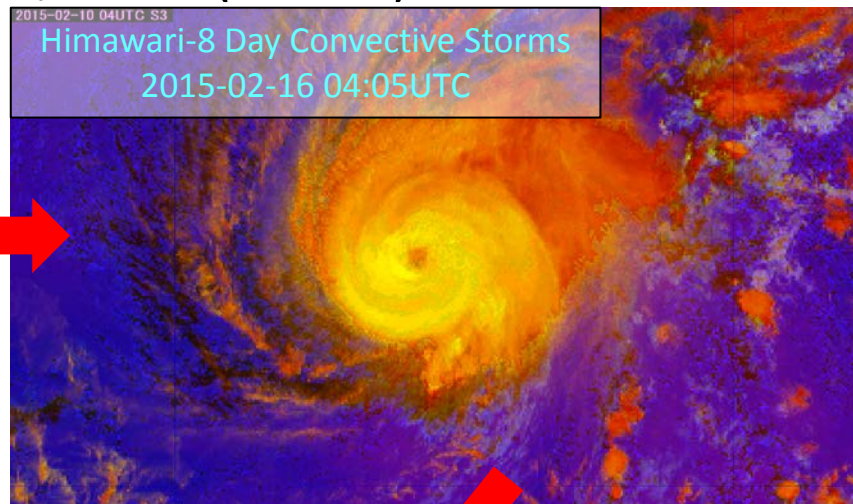
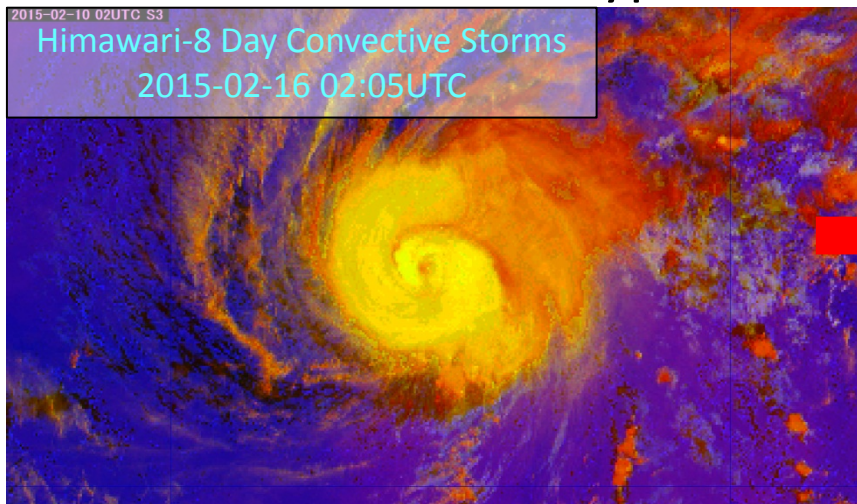
Case Study of Day Convective Storm RGB

Tapering cloud with animation and observation data



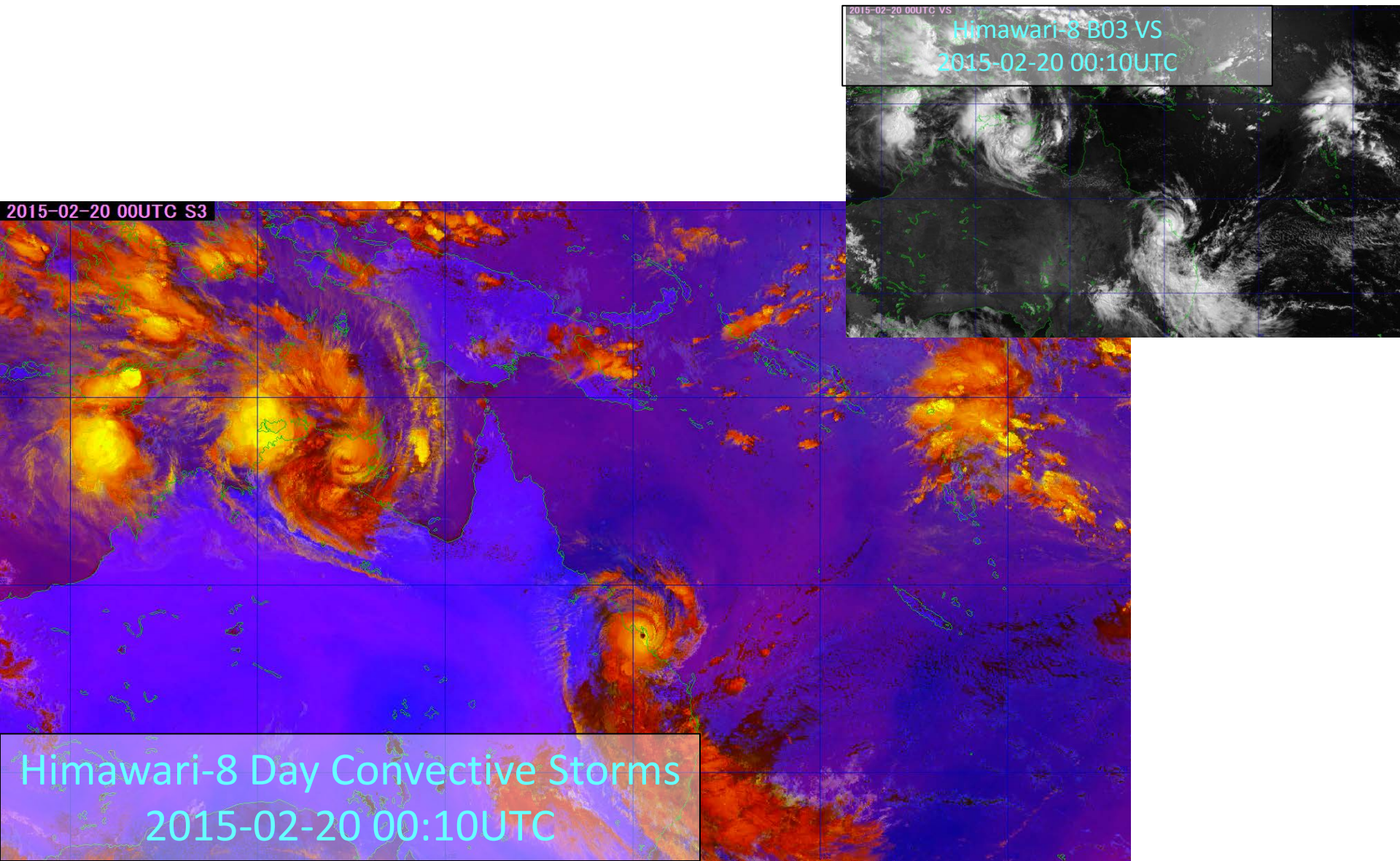
Case Study of Day Convective Storm RGB

Typhoon No.2, 2015 (T1502)



Case Study of Day Convective Storm RGB

Cyclones of South Hemisphere



Himawari-8 Day Convective Storms
2015-02-20 00:10UTC

Day Convective Storm RGB Detection of Cumulonimbus Cloud Summary

- ✓ Available to distinguish convective clouds with severe phenomenon (gust, tornado etc.)
- ✓ Especially useful for the aim of Cb with strong updraft
- ✓ But in day-time only