



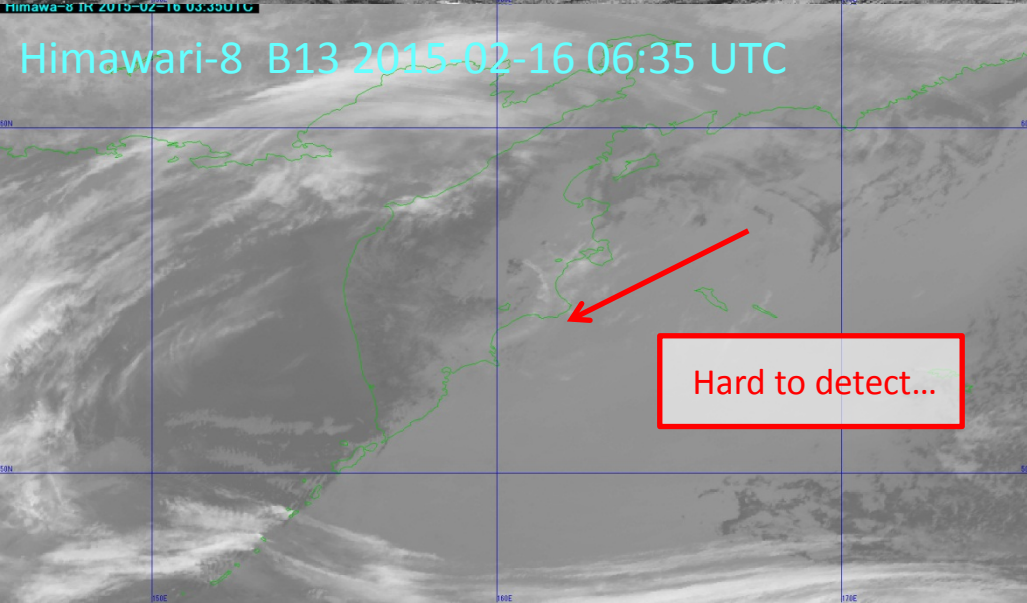
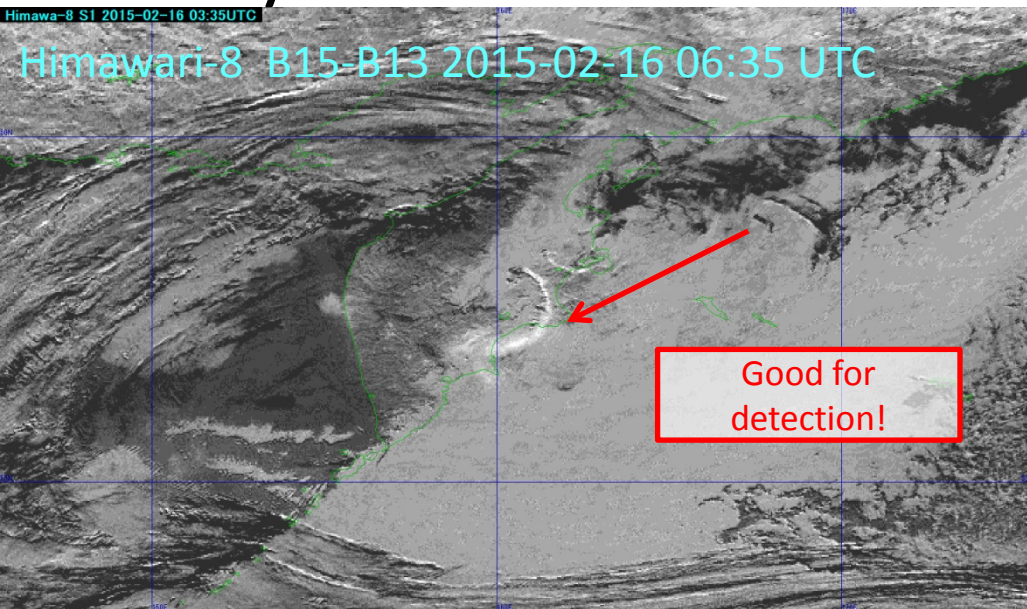
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# Ash RGB

## Detection of Volcanic Ash

Meteorological Satellite Center, JMA

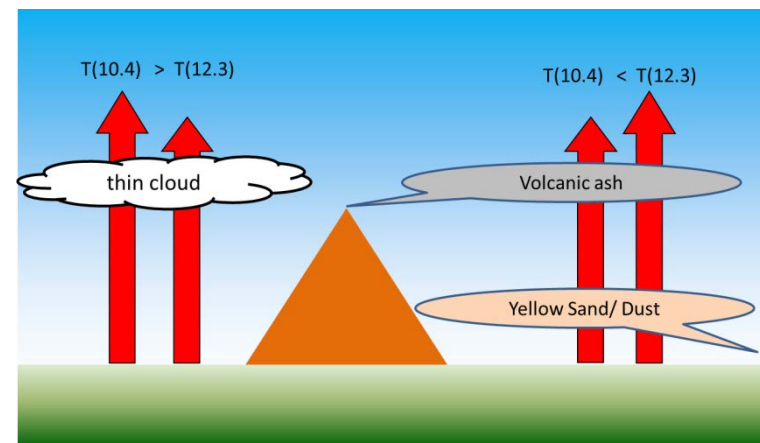
# Volcanic Ash Detection by Infrared and Difference Image, and Basis



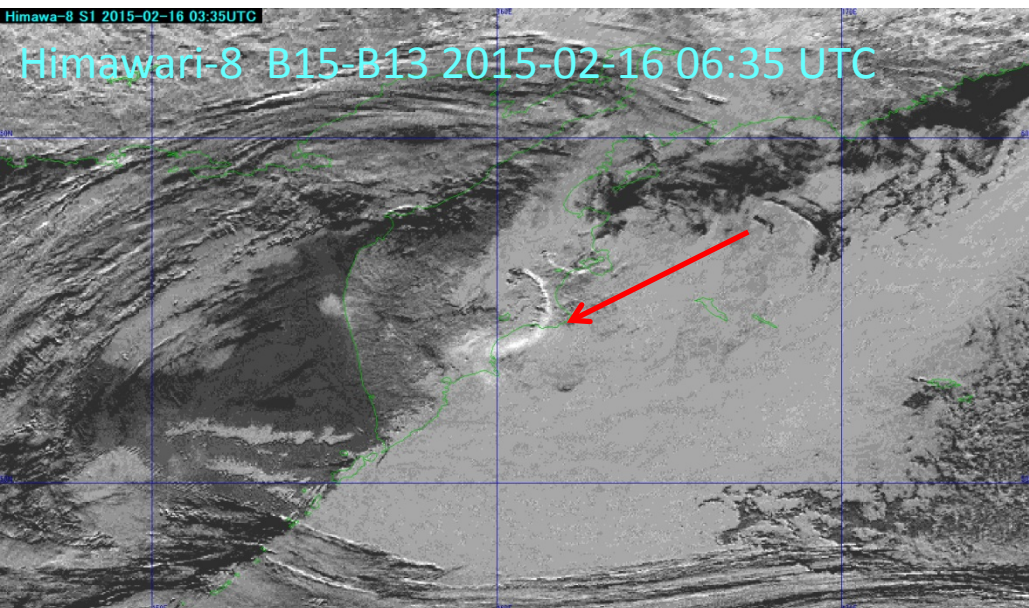
B13 (10.4 microns) and B15 (12.3 microns) have opposite characteristics of absorption and scattering for water or quartz particles.

If the difference between B13 and B15 is positive, it would correspond to clouds, which consist of the droplets or ice particles, and if the difference is negative, it would correspond to the particles of quartz.

This characteristics make it possible to detect the dust and volcanic ash.

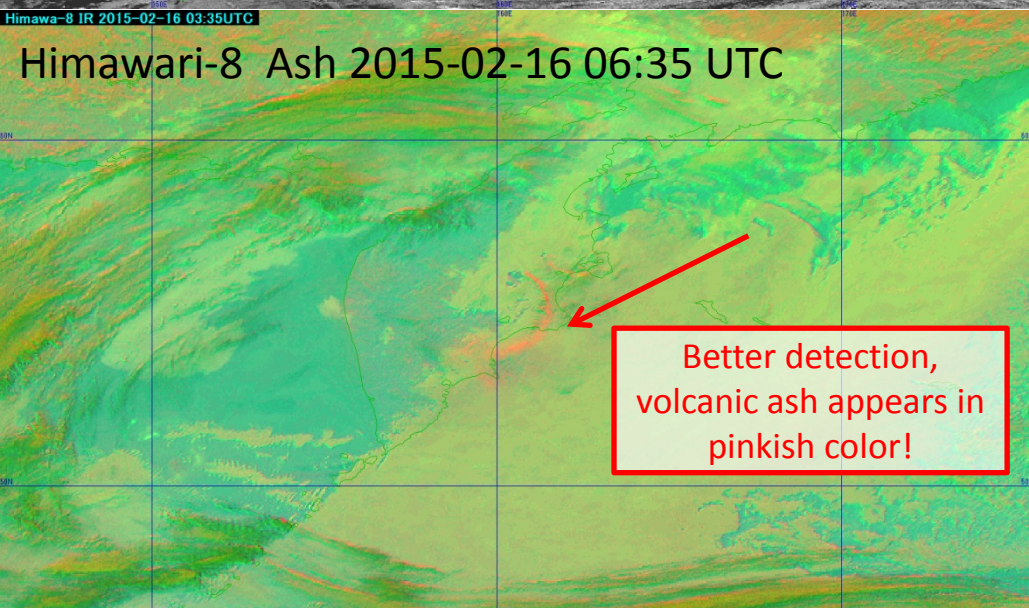


# Volcanic Ash Detection Difference vs. Ash RGB



This RGB scheme contains the above B13-B15 difference as the “Red” image component, therefore the volcanic ash is displayed on the RGB.

Furthermore, by the difference of 8.6 micron, the volcanic gas (sulfur dioxide, SO<sub>2</sub>) is viewable on this RGB.



**A set of RGB “Ash” scheme**  
(RGB:B15-B13/B13-B11/B13)

R : IR12.3-IR10.4  
Range: -4~2 [K] Gamma: 1.0  
G : IR10.4-IR8.6  
Range: -4~5 [K] Gamma: 1.0  
B : IR10.4  
Range: 243~208 [K] Gamma: 1.0

Ash  
(RGB:B15-B13/B13-B11/B13)



# Components of “Ash” RGB scheme RGB

Channel	Himawari-8/ -9	MTSAT-1R/-2	MSG	Physical Properties	
1	0.46 μm			vegetation, aerosol <b>B</b>	Visible
2	0.51 μm			vegetation, aerosol <b>G</b>	
3	0.64 μm	0.68 μm	0.635 μm	low cloud, fog <b>R</b>	
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	3.92 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	
11	8.6 μm		8.70 μm	<b>cloud phase, SO2</b>	
12	9.6 μm		9.66 μm	ozone content	
13	10.4 μm	10.8 μm	10.8 μm	<b>cloud imagery, information of cloud top</b>	
14	11.2 μm			cloud imagery, sea surface temperature	
15	12.4 μm	12.0 μm	12.0 μm	<b>cloud imagery, sea surface temperature</b>	
16	13.3 μm		13.4 μm	cloud top height	

This scheme is displayed by compositing two differences and IR 10.4 micron images.

The two differences are as follows:

- Difference of B15 (12.0 micron, corresponds to traditional IR2) and B13 (10.4 micron, corresponds to traditional IR)
- Difference of B13 and B11 (8.6 micron, MI: Mid-wavelength infrared)

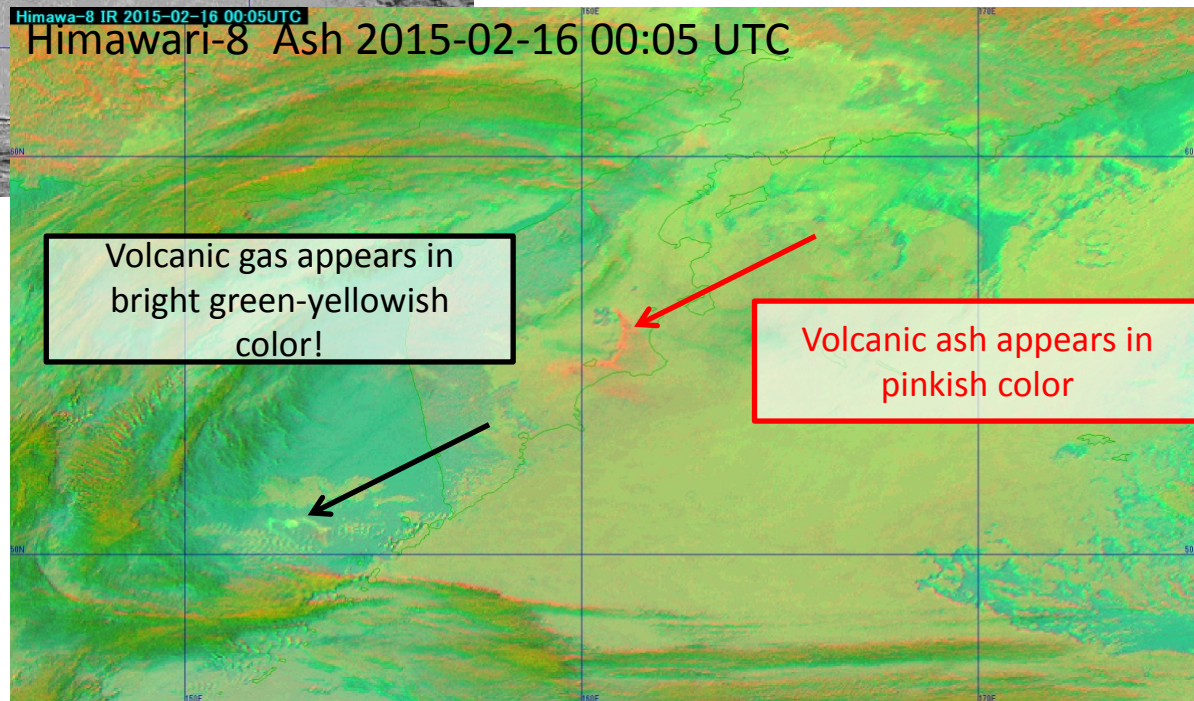
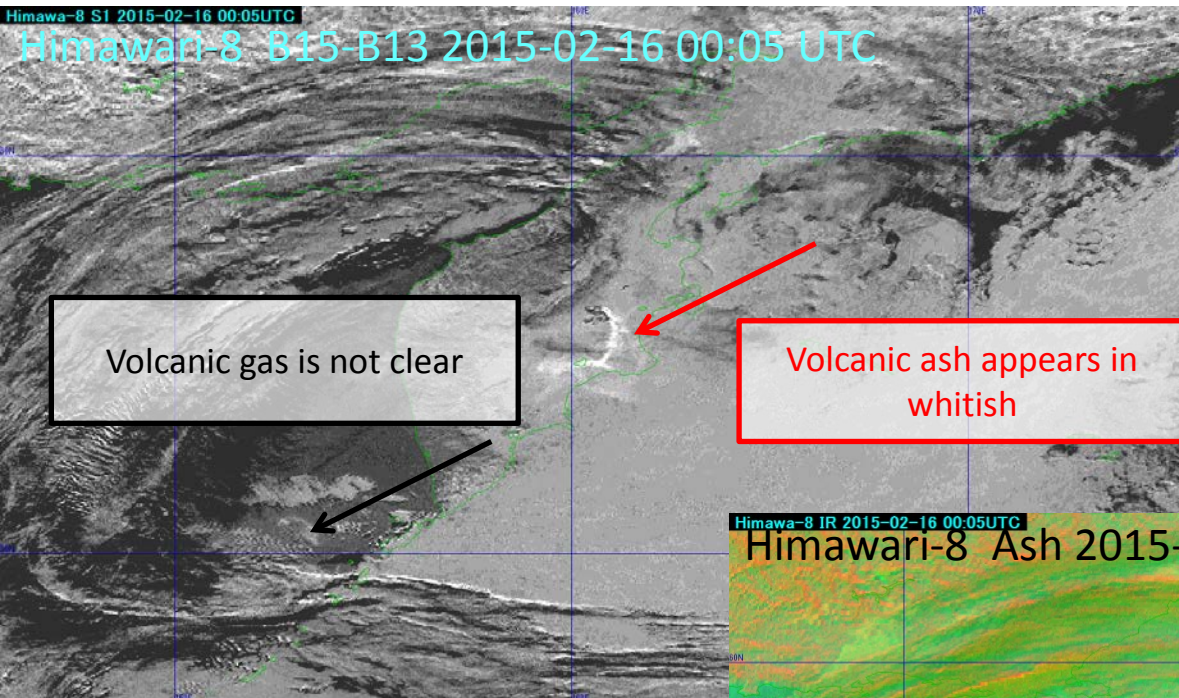
B11 has a characteristic of absorption by sulfur dioxide (SO2).

A set of RGB “Ash” scheme (RGB:B15-B13/B13-B11/B13)

R : IR12.3-IR10.4  
Range: -4~2 [K] Gamma: 1.0  
G : IR10.4-IR8.6  
Range: -4~5 [K] Gamma: 1.0  
B : IR10.4  
Range: 243~208 [K] Gamma: 1.0

# Example of Ash RGB

## Difference vs. Ash RGB, Kamchatka Peninsula

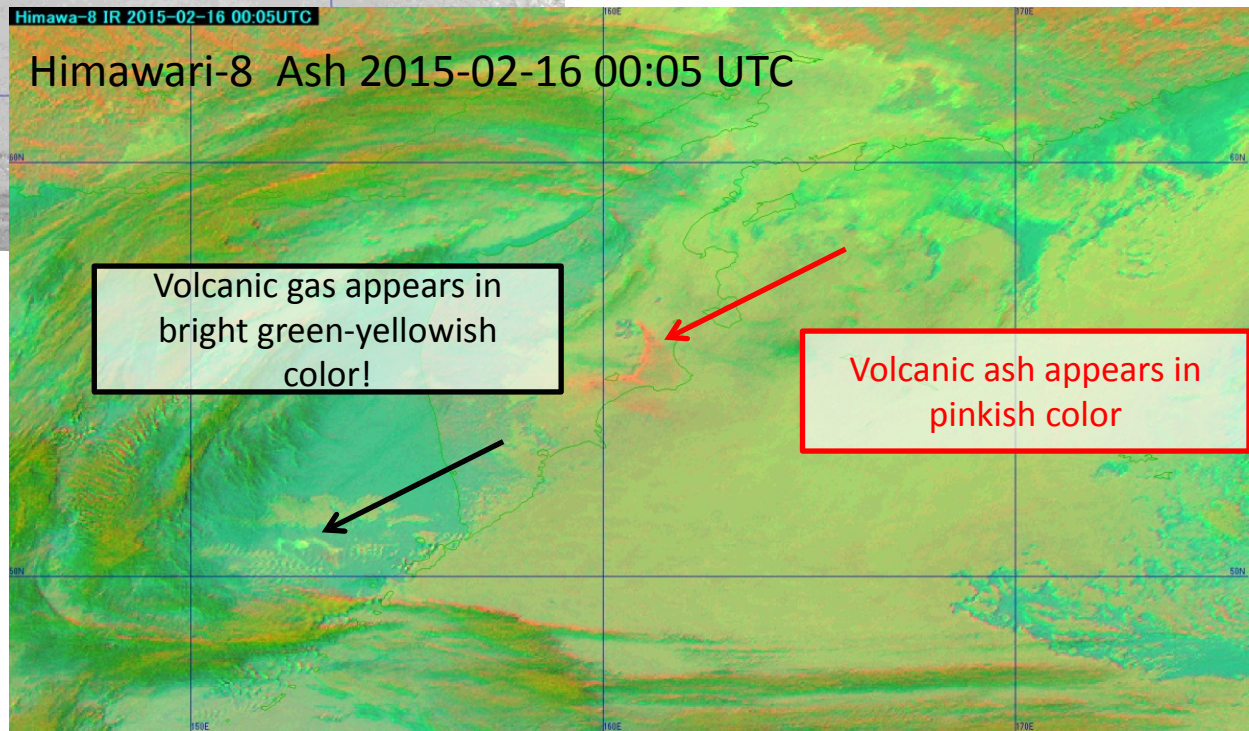
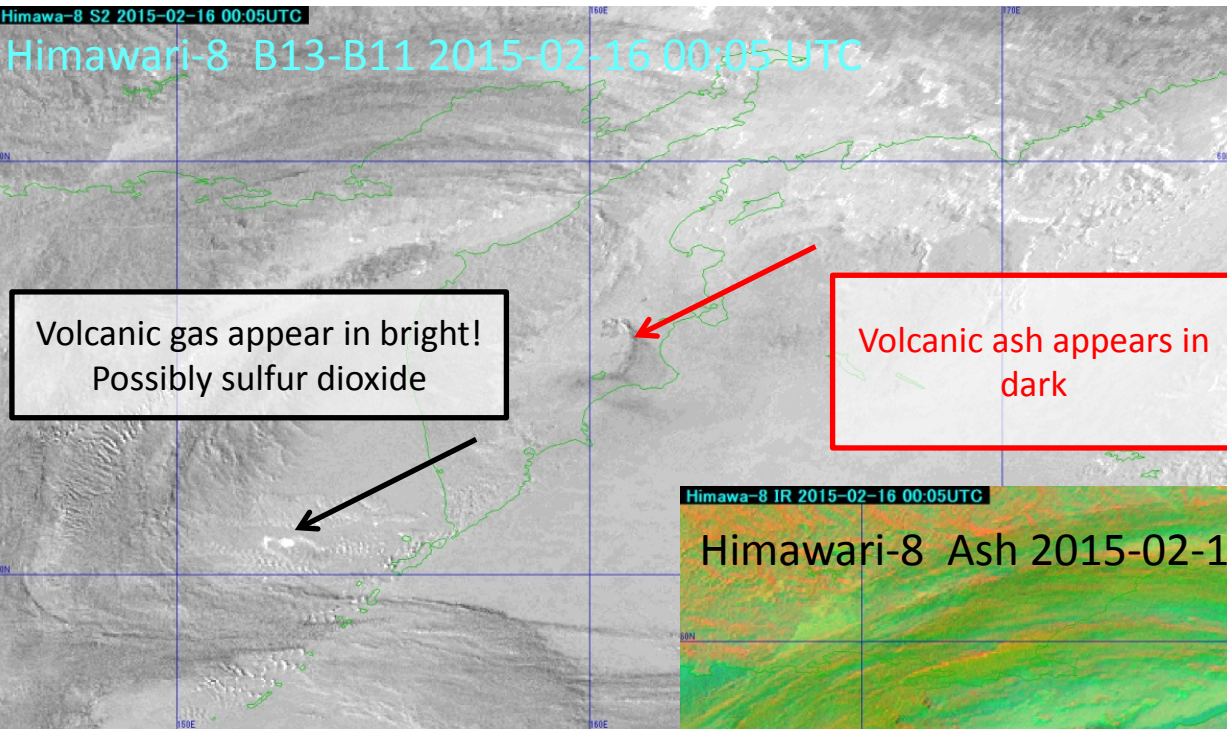


Ash  
(RGB:B15-B13/B13-B11/B13)



# Example of Ash RGB

## 8.6 micron Difference vs. Ash RGB, Kamchatka Peninsula

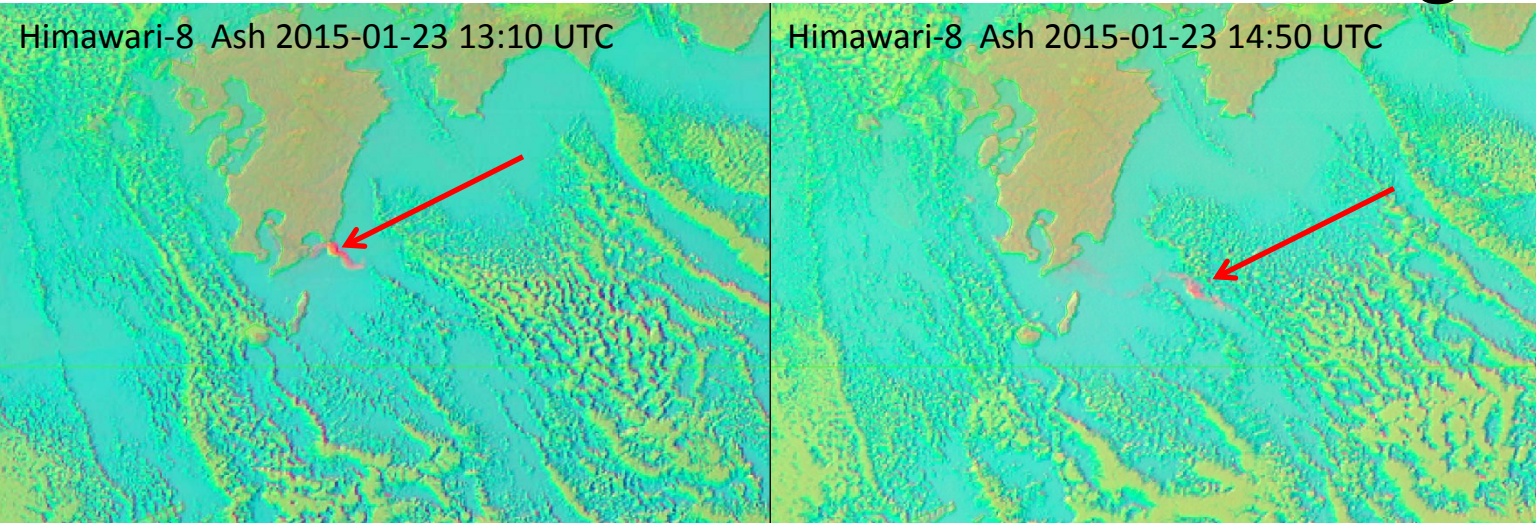


Ash  
(RGB:B15-B13/B13-B11/B13)



# Example of Ash RGB

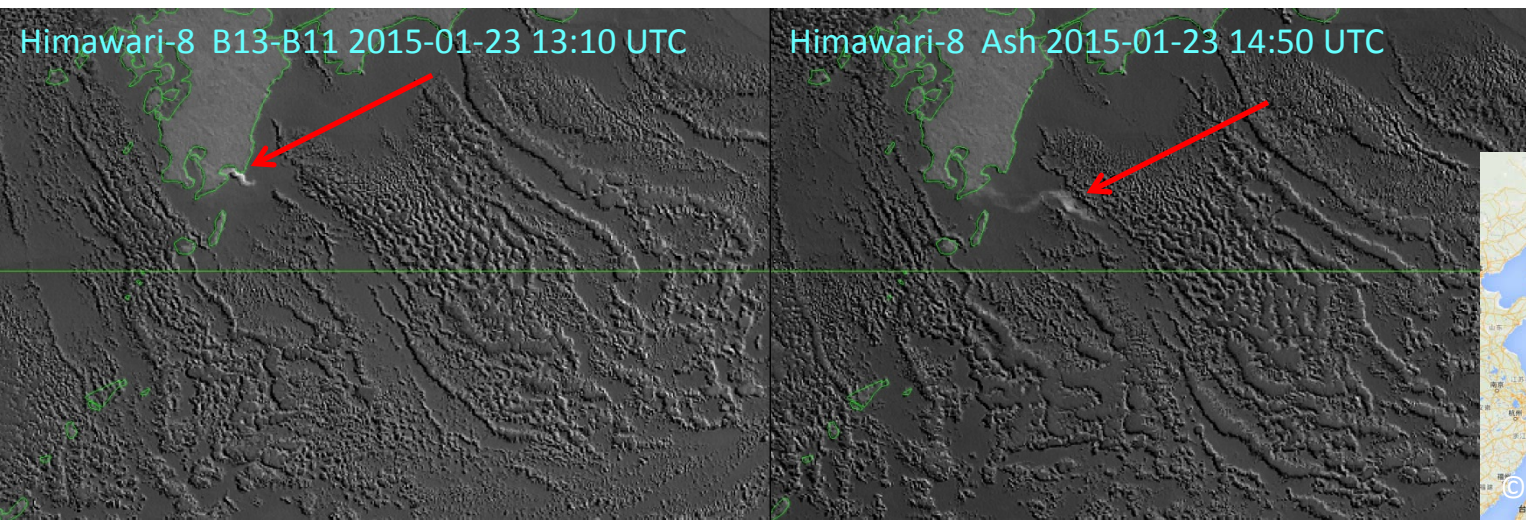
## Volcanic ash with volcanic gas



The green-yellowish part is overlapped by the pinkish volcanic ash.

The volcanic ash appear in whitish area in the 8.6 difference images. It is considered that the ash would contain sulfur dioxide gas.

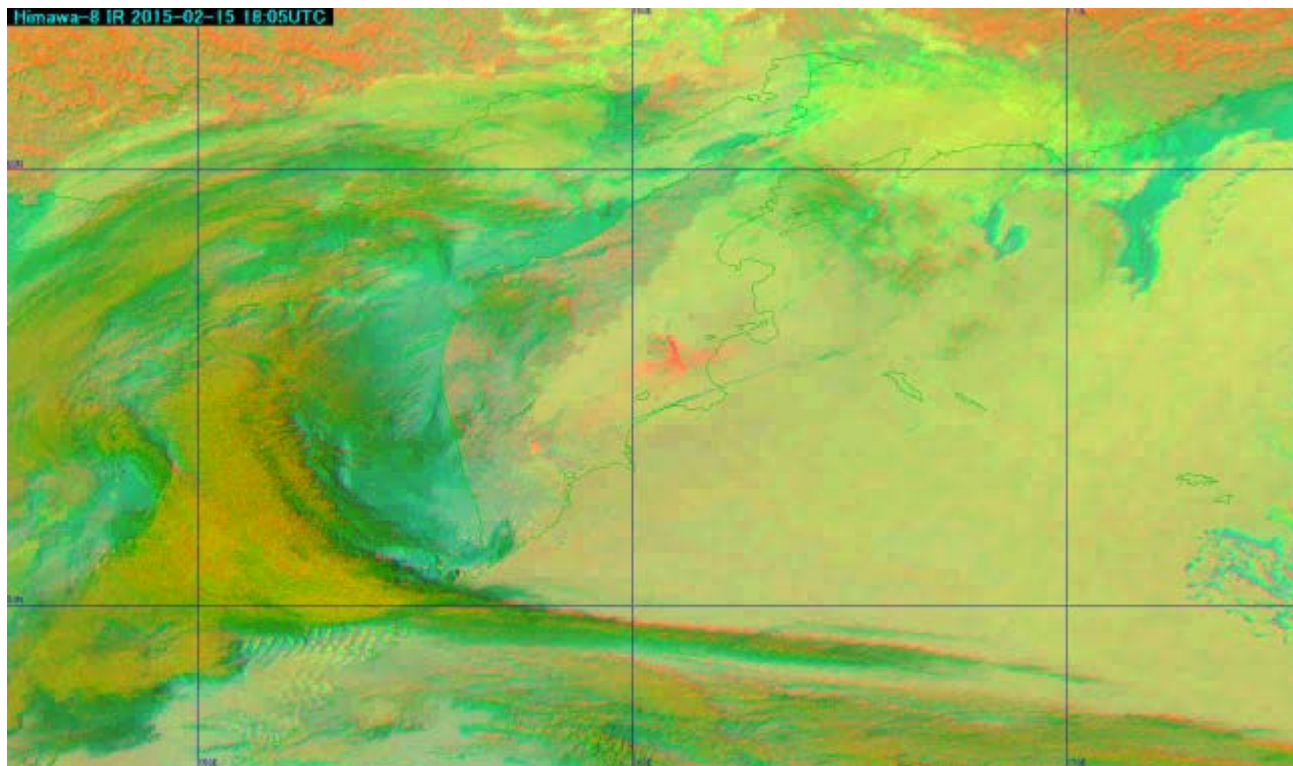
Ash  
 (RGB:B15-B13/B13-B11/B13)





# Example of Ash RGB

## Volcanic ash pursuit by RGB animation



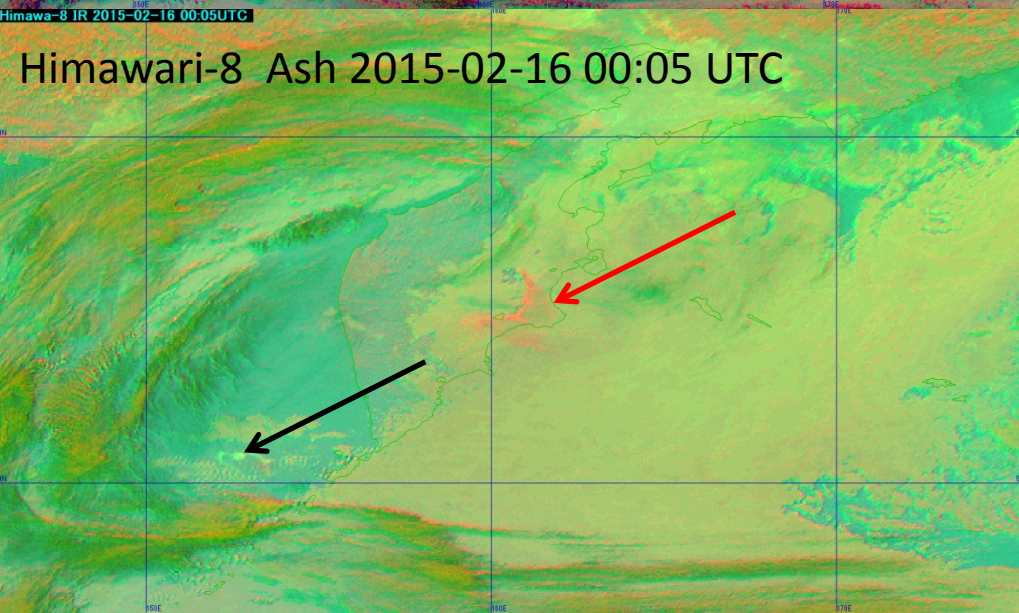
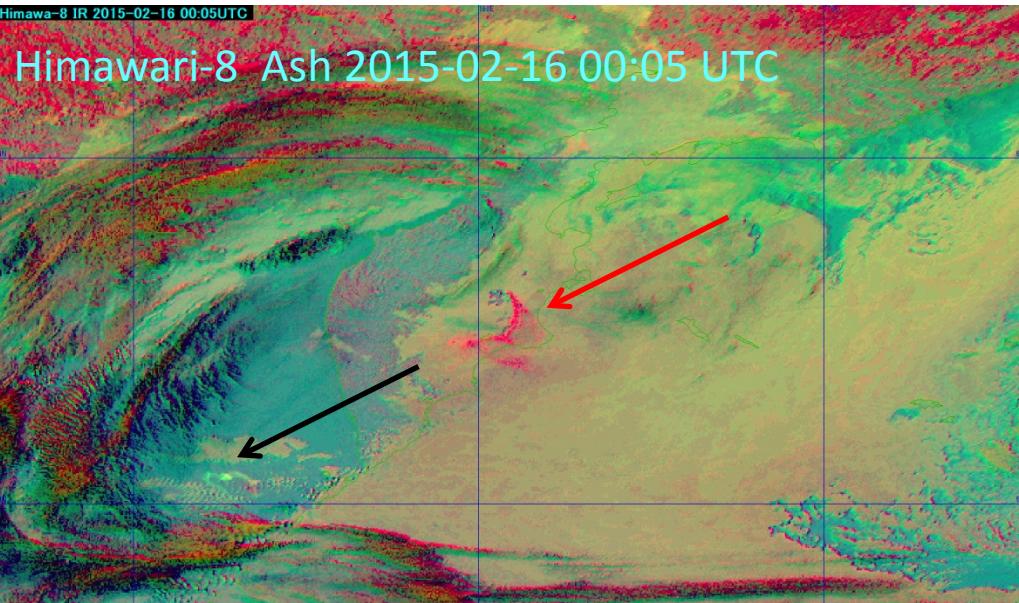
Himawari-8 Ash 2015-02-15 18:05UTC - 2015-02-16 21:35UTC

Ash  
(RGB:B15-B13/B13-B11/B13)

By animation display, it will be easy to distinguish and pursue the volcanic ash!



# Adjusting of RGB scheme



Dust  
(RGB:B15-B13/B13-B11/B13)

R : IR12.3-IR10.4  
Range: -4~2 [K] Gamma: 1.0  
G : IR10.4-IR8.6  
Range: 0~15 [K] Gamma: 2.5  
B : IR10.4  
Range: 261~289 [K] Gamma: 1.0

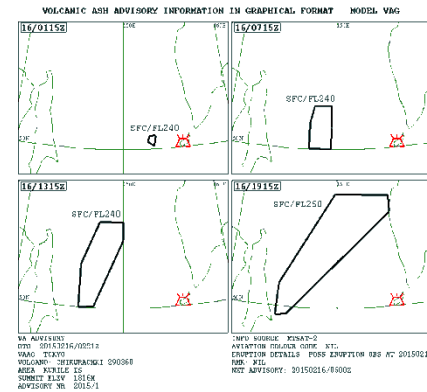
Ash  
(RGB:B15-B13/B13-B11/B13)

R : IR12.3-IR10.4  
Range: -4~2 [K] Gamma: 1.0  
G : IR10.4-IR8.6  
Range: -4~5 [K] Gamma: 1.0  
B : IR10.4  
Range: 243~208 [K] Gamma: 1.0

The RGB “Ash” and “Dust” have same combination of images. Their scheme are adjusted gradations for focusing on respective phenomena.

Sometimes the distinction between ash and (high) clouds is not easy by using “single” RGB.

It is effective to choose scheme(s) according to proper appearances.



# Ash RGB

## Detection of Volcanic Ash

# Summary

- ✓ Ash RGB is adjusted scheme for volcanic ash detection
- ✓ Useful to distinguish and pursue volcanic ash, in addition to difference images
- ✓ Especially useful for distinction between “ash-rich” fume and “sulfuric gas-rich”
- ✓ Available for day and night
- ✓ Sometimes detection of “Steam-rich” fume is not easy