

**Aim: detection of volcanic ash and SO<sub>2</sub> gas.**

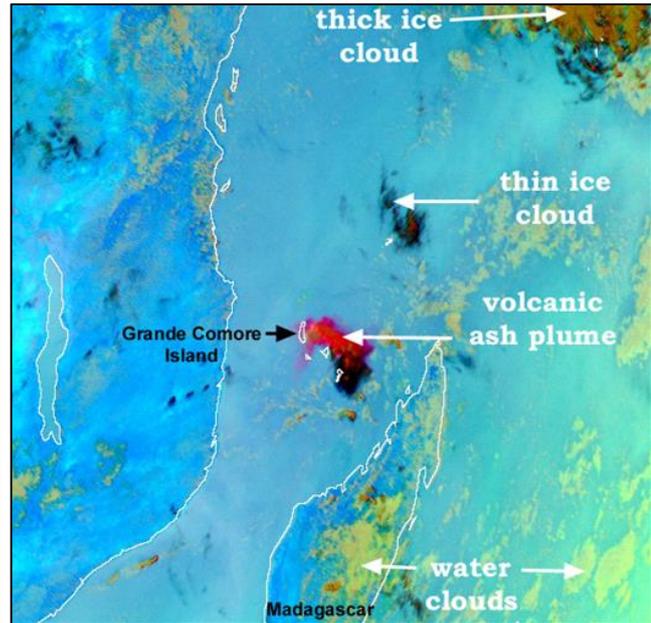
**Time period and area of its main application:** In case of volcanic eruption.

**Guidelines:** Optically **thin ash cloud** can be well detected and clearly distinguish from ice and water clouds in the Ash RGB images. Optically **thick ash clouds** look like thick ice clouds. However, the volcanic ash becomes rapidly optically thin. **Pure SO<sub>2</sub> gas plumes** can be well detected at low satellite viewing angles closer to the sub-satellite point than for example London or Copenhagen.

In case of **very low concentrations**, ash and SO<sub>2</sub> gas might be not seen from geo satellites, only by the sounding instruments of polar orbiting satellites. Ash RGB does not provide information on height and concentration, but it provide high temporal resolution.

Volcanoes inject **water vapour** as well, which becomes cirrus cloud when reaching a height.

Note that higher level SO<sub>2</sub> plumes are detected by Airmass RGB as well.



Volcanic ash ejected by Karthala volcano, Comoros SEVIRI Ash RGB for 25 November 2005 08:00 UTC

### Background

The table shows which channels (or channel differences) are used in the Ash RGB and lists some of the land and cloud features which have typically low or high contribution to the colour beams in this RGB. Thin volcanic ash is separated from water and ice clouds by the (IR12.0-IR10.8) channel difference. SO<sub>2</sub> gas is detectable due to its absorption band at 8.7 μm.

Colour	Channel [μm]	Physically relates to	Small contribution to the signal of	Large contribution to the signal of
Red	IR12.0 - IR10.8	Cloud optical thickness	Thin ice clouds	<b>Thin volcanic ash</b>
Green	IR10.8 - IR8.7	Cloud phase	Ice clouds / thin volcanic ash	<b>SO<sub>2</sub> gas plume / Water clouds</b>
Blue	IR10.8	Temperature	Cold clouds	Warm surface/ Warm clouds

Notation: IR: infrared, number: central wavelength of the channel in micrometer. Remark: The channel combination is the same as for Dust and 24 hour Microphysics RGBs, the tunings are different (not shown here).

### Benefits

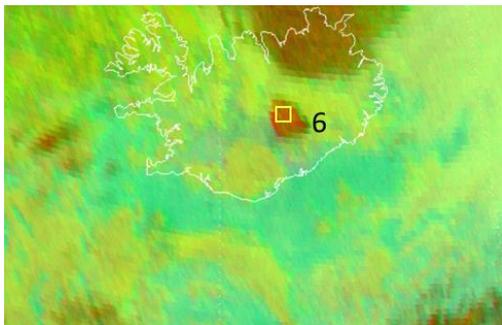
- It works both night- and daytime. (This allows to create long animations.)
- Different colours for thin volcanic ash, SO<sub>2</sub> gas plume and cirrus clouds (and for the mixture of ash and SO<sub>2</sub> gas).
- Thin volcanic ash has good colour contrast against water and ice clouds and surface features.
- SO<sub>2</sub> gas plume has good colour contrast against ice clouds and surface features, but close to the limb water clouds might have similar colour as pure SO<sub>2</sub> plume – see limitations.
- The colours of the water and ice clouds and the surface are similar (paler) to their colours in the Dust / 24 hour Microphysics RGBs.

### Limitations

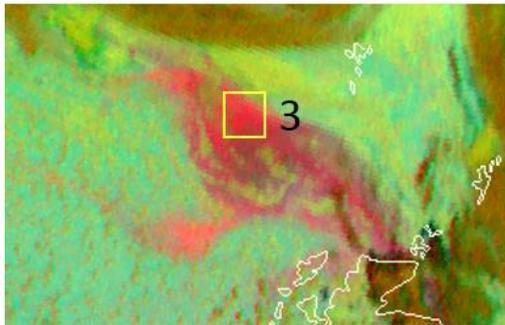
- Lower-level volcanic ash and SO<sub>2</sub> gas plume can be covered by higher-level clouds.
- Very thick ash clouds cannot be discriminated from ice clouds.
- In case the volcanic ash and/or SO<sub>2</sub> gas plume is mixed with cirrus cloud their identification might be problematic.
- The colours considerably depend on the satellite viewing angle. The colour of the water clouds turn into green towards the limb. Thus pure **SO<sub>2</sub> gas plume** can be easily separated from water clouds only at low satellite viewing angles closer to the sub-satellite point (zero latitude and longitude) than for example London or Copenhagen. In case of high satellite viewing angles Dust RGB is more appropriate for SO<sub>2</sub> detection.

# SEVIRI Ash RGB Quick Guide

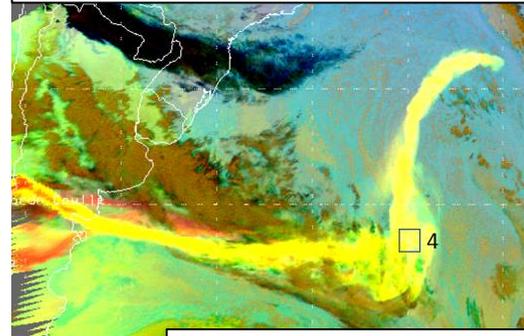
Thick ash cloud over Iceland  
21 May 2011 20:10 UTC



Thin ash cloud originated from Iceland  
24 May 2011 03:10 UTC



Mixed ash and SO2 originated from Chile  
06 June 2011, 12:00 UTC



Source: EUMETSAT, Image Library

## Interpretation

1

Cloud free land  
(Shades of blue or pink depending on the temperature and water vapour content)

2

SO<sub>2</sub> gas plume  
(Shades of bright green depending on the concentration)

3

Thin volcanic ash  
(Shades of red depending on the concentration)

4

Mixed ash and SO<sub>2</sub> gas  
(Shades of yellow depending on the concentrations)

5

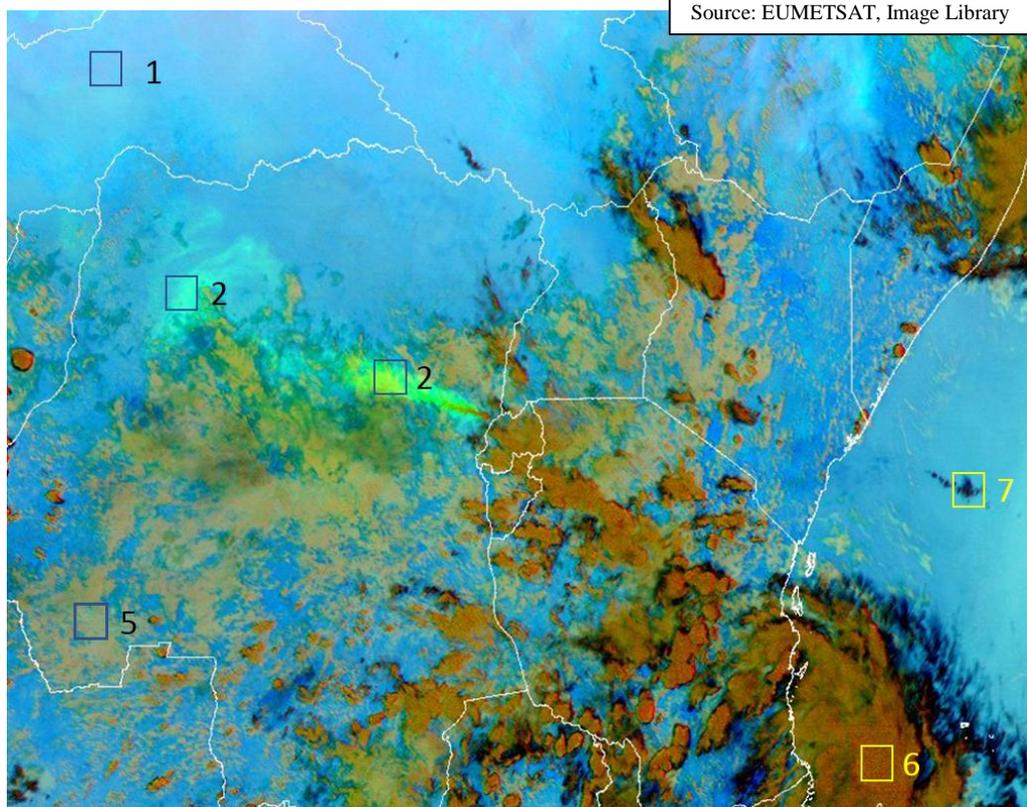
Water cloud  
(Shades of greyish tan)

6

Thick ice cloud or  
Thick volcanic ash cloud  
(shades of brown)

7

Thin ice cloud  
(Shades of dark blue depending on the transparency)



SO<sub>2</sub> plume ejected by the Nyamuragira volcano, Congo  
SEVIRI Ash RGB for 29 November 2006 11:10 UTC

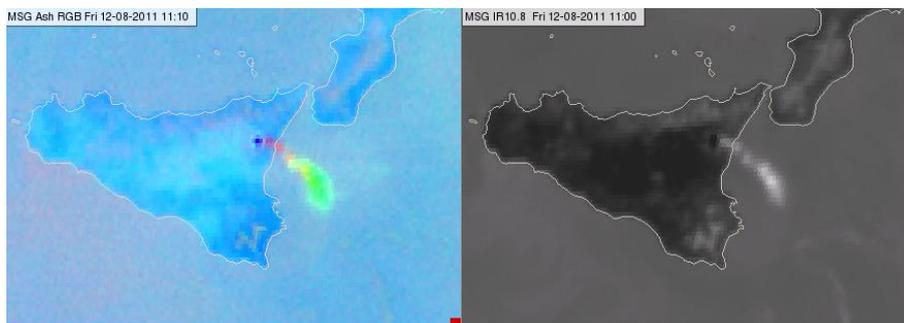
Colours may depend on viewing angle, concentration, cloud transparency, temperature, surface emissivity and water vapour content

### Useful links:

- [MSG Interpretation Guide](#)
- [EUMeTrain Training Module](#)
- [RGB Colour Interpretation Guide](#)
- [NASA SPORT COMET module](#)

## Comparison to other products

In the Ash RGB one can see both the ash (red/magenta) and the SO<sub>2</sub> gas plume (green). In the IR10.8 image one cannot see the SO<sub>2</sub> gas plume at all. In the IR10.8 image one can see the volcanic ash plume but one can not distinguish it from water or ice clouds.



Volcanic eruption of Mount Etna in Sicily. Ash RGB (left) and IR10.8 (right) images for 12 August 2011, 11:10 UTC