

## **Lab: Tuning of Dust RGB for AHI / ABI**

1. McIDAS-V skills:
  - a. Display data from a remote server
  - b. Create RGB images with Imagery tool
  - c. Create channel differences
  - d. Fine tuning RGB products
  - e. Comparing infrared bands
  
2. Key concepts:
  - a. Ash and dust clouds in infrared spectral range
  - b. Cloud phase in infrared spectral range
  - c. New infrared channels on AHI / ABI
  - d. Fine-tuning of Dust RGB
  - e. Thickness of dust clouds
  - f. Convective clouds in infrared and visible

The Airmass RGB and the Dust RGB are considered to be the most important RGB products for operational weather forecasting (24-h capability). As regards the Dust RGB for MSG SEVIRI, the bands IR8.7, IR10.8 and IR12.0 have been combined to monitor dust and ash, but it is also very useful for detecting thin cirrus clouds, cloud phase, low level clouds and low level moisture boundaries (see moisture lab).

The standard recipe of the SEVIRI Dust RGB is:

Red: IR12.0 – IR10.8, range -4 to +2 K, Gamma = 1.0  
Green: IR10.8 – IR8.7, Range 0 to +15, Gamma = 2.5  
Blue: IR10.8, range 261 to 289 K, Gamma = 1.0

The red component of the Dust RGB is used for (or contributes to): 1) discrimination of dust/ash clouds from ice and water clouds, 2) discrimination of thick and thin clouds (for mid and high level clouds, does not work for low level clouds), 3) detection of moisture boundaries (retrieval of Total Precipitable Water (TPW), which mainly depends on low level (boundary layer) moisture).

The main use of the green component is 1) cloud phase detection (water/ice, works day and night), but it also contributes to 2) identifying optical thickness of clouds, 3) detection of dust/ash clouds (over desert surfaces) and 4) moisture features.

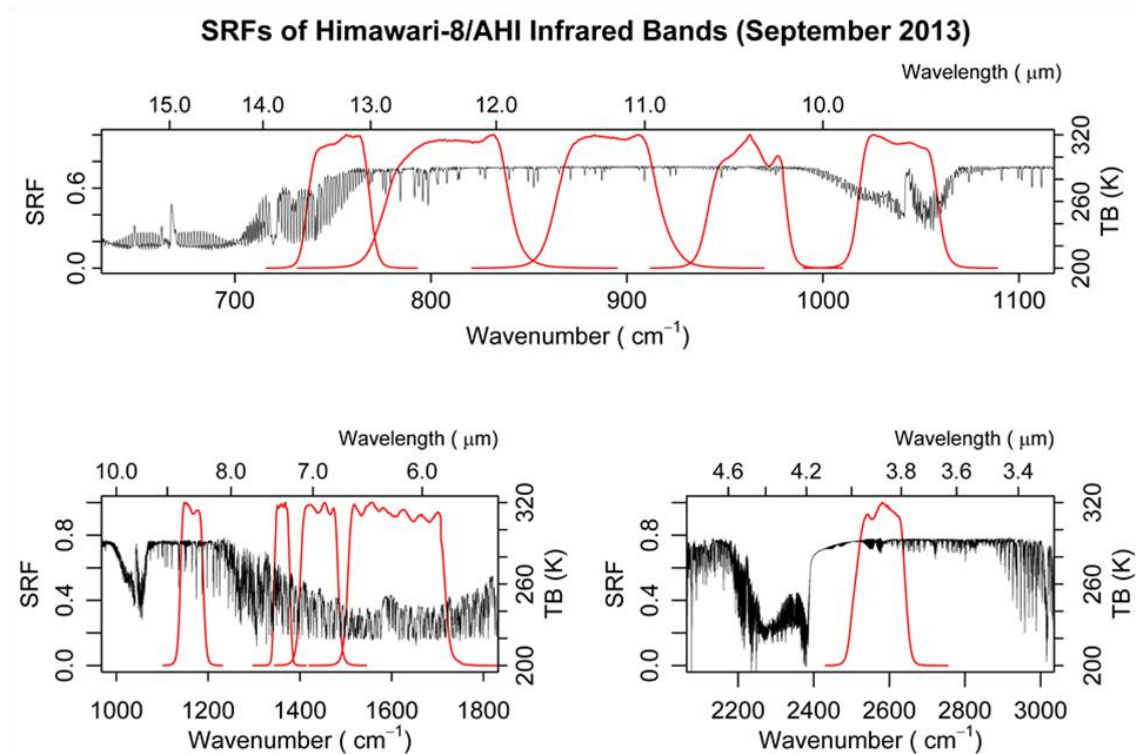
The blue component represents cloud top temperature, so its main use is for cloud height determination. For example, volcanic ash plumes (from major eruption) are often in the upper troposphere or lower stratosphere (relatively cold), so they have a low blue contribution (typical Dust RGB colour is red). On the contrary, dust clouds (e.g. post-frontal dust) are often travelling at low levels (relatively warm), thus they have a higher blue contribution (typical Dust RGB colour is magenta).

Depending on the situation (viewing angle, airmass / moisture, summer/winter), these ranges can be changed, to enhance certain features. For example, the Ash RGB is a modified version of the Dust RGB to better discriminate high level ash clouds from ice clouds and to enhance SO<sub>2</sub> clouds (frequently emitted by volcanic eruptions, see ash labs).

The new generation of geostationary weather satellites (Himawari-08, GOES-16, MTG) will have slightly different infrared channels which poses the question of tuning the Dust RGB to the new channels.

In this lab, we will try to tune the Dust RGB for the AHI (on Himawari-08 and Himawari-09) and ABI (on GOES-16, 17 ...) instruments. These instruments (identical instruments, but channels slightly different) have 4 (instead of 3) bands in the IR window regions (8.5 and 10 to 12 microns). These are (for AHI): band 11 - IR8.6, band 13 - IR10.4, band 14 - IR11.2 and band 15 - IR12.4 (SEVIRI has IR8.7, IR10.8 and IR12.0).

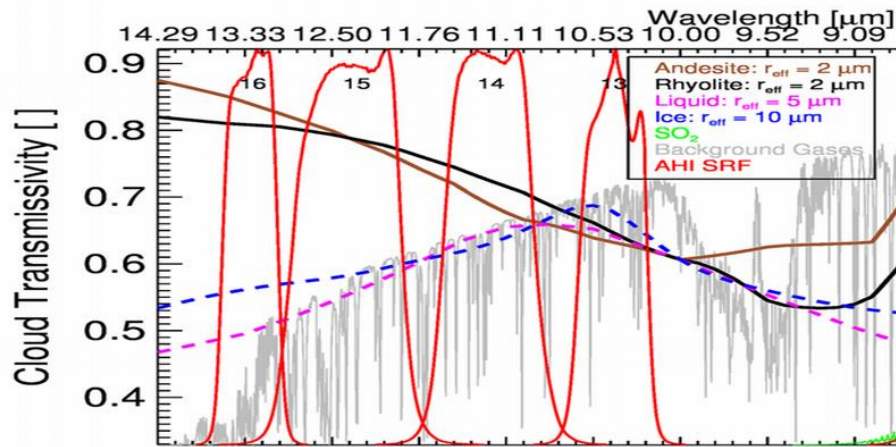
See here below the filter functions (spectral response functions (SRF)) of the AHI infrared bands.



With these 4 window channels in the infrared, the question comes up which combination of these 4 channels should be used to device the Dust RGB, remembering that the main scope of the Dust RGB is to detect dust / ash clouds and to discriminate between water and ice clouds (cloud phase). Without thinking too much, we tried the following recipe: red = IR12.4 – IR10.4, green = IR10.4 – IR8.6, blue = IR10.4, but this approach was not the best one. Please, try yourself to find the optimal tuning of the Dust RGB for AHI and ABI.

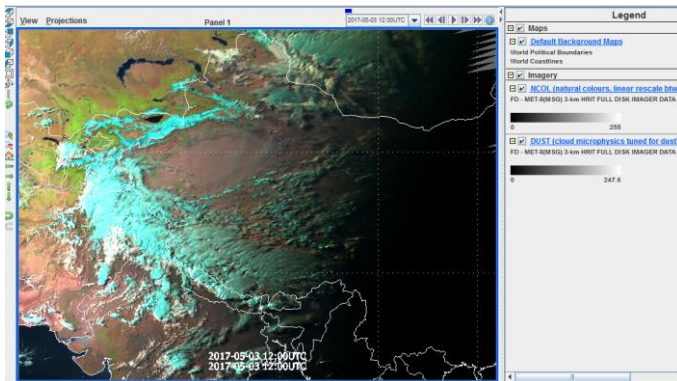
### I. Tuning of the red component of the Dust RGB for AHI / ABI

In the 10-12 μm “infrared window” region, ash and dust clouds generally become more transparent to radiation with increasing wavelength. The opposite is true for liquid water clouds, ice clouds, and background atmospheric gases (mainly H<sub>2</sub>O and CO<sub>2</sub>). The magnitude of the slope in cloud transmissivity is largely dictated by the effective particle radius. This can be seen in the following figure, where andesite and rhyolite are volcanic (ash) materials. The Spectral Response Functions of AHI bands 13 to 16 are shown by red curves. Note that band 16 – IR13.3 is not a window channel (CO<sub>2</sub> absorption).



From this figure it follows that the combination of AHI/ABI bands 13 (10.4  $\mu\text{m}$ ) and 15 (12.4  $\mu\text{m}$ ) should be better suited for both qualitative (RGB) and quantitative volcanic ash detection techniques. BUT: is this always the case in practice?

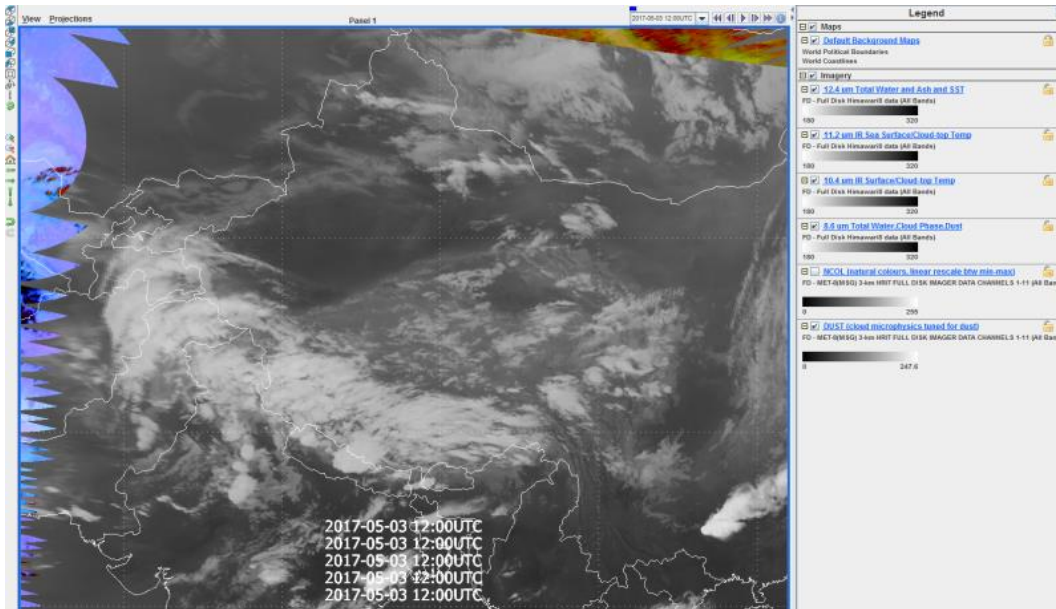
1. Display Met-8 SEVIRI imagery on 3 May 2017 (over Tibet area)
  - a. Open McIDAS-V (version 1.5)
  - b. In the McIDAS-V window, go to **File**  $\rightarrow$  **Open File**
  - c. Open the bundle “seviri\_20170503\_met08.mcvz” in the **Data**  $\rightarrow$  **bundles** directory (wait)
  - d. If asked, select **Merge with active tab(s)** (default option) and **Write to temporary directory** (default option)
  - e. Click **OK** when error message appears
  - f. In the **Select input** window select minrefl 0 and maxrefl 20
  - g. Wait until all frames are loaded, the display window should look like this (Natural Colors RGB image is in front):



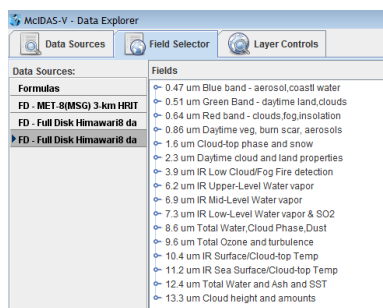
- h. First, inspect the Natural Colours RGB: is this a morning or evening image? Can you identify areas with dust?
  - i. Now, move to the Dust RGB and toggle the two images. Which dust clouds do you see?
  - j. From the colour of the dust clouds and from its opaqueness (can you see surface features through it?) can you say something about the thickness of the dust clouds?
  - k.
2. Display Him-08 AHI infrared images for the same case
  - a. In the McIDAS-V window, go to **File**  $\rightarrow$  **Open File**
  - b. Open the bundle “ahi\_20170503\_him08\_ir.mcvz” in the **Data**  $\rightarrow$  **bundles** directory (is a bit slow in

opening!)

- c. If asked, select **Merge with active tab(s)** (default option) and **Write to temporary directory** (default option)
- d. Wait until all frames are loaded, the display window should look like this (IR12.4 image is in front):

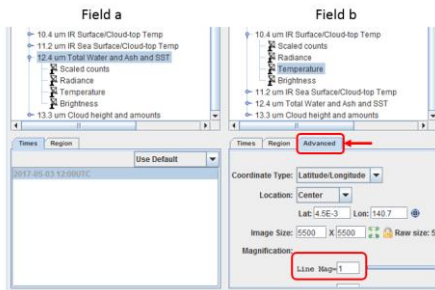


- e. All 4 IR window bands of AHI have been loaded, with the range 180 to 320 K (standard range). **Can you see the dust clouds in these IR images?** You may enhance the images by selecting different ranges.
- f. **Read some IR values for thick, high clouds, mid level clouds and cloudfree areas (land, Ocean). For each scene, which IR channel has the highest brightness temperature?**
- g. Now, we want to calculate the difference image IR12.4-IR10.4. For this, unfortunately, we cannot use the data of the bundle (McV 1.5 and 1.6 has a bug as regards displaying data from a bundle). So we will read the Him-08 data for this case (3 May 2017) from the Wisconsin archive of satellite data (remote server).
- h. Go to the **Data Explorer** click on satellite imagery (left) and select the geoarc.ssec.wisc.edu server. Select the **AHIM08** dataset and connect to the server.
- i. As **Image Type** select FD (Full Disk) data and select the archive day 03-May-2017. Click ok and wait (it takes time to connect and read the time slot information).
- j. The **Absolute** tag should be highlighted. Select the image from 12:00 UTC and click on **Add Source**. Wait. The Data Explorer moves to the **Field Selector** where you see all 16 bands of the AHI instrument on Him-08 (see screenshot below).

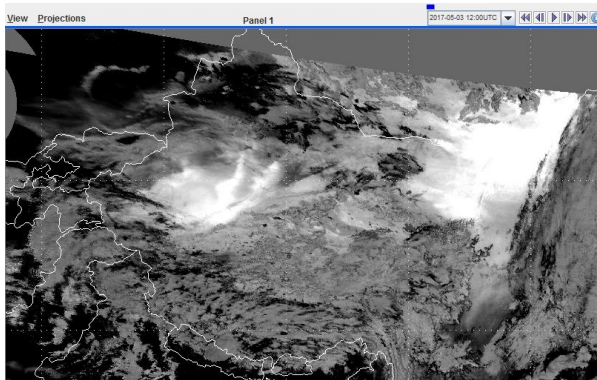


- k. For calculating a channel difference, we need to go to **Formulas** (left). In the **Fields** panel, select **Image Filters** (remember it is Miscellaneous in McV 1.4) → **Simple difference a-b**
- l. Select **Imagery** → **Image Display** in the **Displays** panel

- m. Click **Create Display**, and a new window pops up
- n. For Field a select 2<sup>nd</sup> **Full Disk Himawari** → **12.4 um** → **Temperature** (wait)
- o. For Field b select 2<sup>nd</sup> **Full Disk Himawari** → **10.4 um** → **Temperature** (wait)
- p. Important: before you click **OK**, expand the **Field Selector** window so that you see the **Region** and the **Advanced** tabs (see screenshot below). FIRST: set the **Magnification** slider to 1 (max resolution).



- q. Then, select the **Region** (shift left mouse, China and India) and now click **OK**.
- r. The difference  $IR_{12.4} - IR_{10.4}$  is now displayed as top image. It looks greyish as the range is not correct. Change the range to **-4 to +2 K**.
- s. Change the label of the displayed image to the “ $IR_{12.4} - IR_{10.4}$ ”
- t. Now, the difference image should look like this:



- u. Thin dust and ash clouds have a positive  $IR_{12.4} - IR_{10.4}$  difference and appear whitish in this difference image; thin water and ice clouds have a negative difference and appear dark (black) in this image. Thick clouds have differences around 0 K and appear light grey.
  - v. Toggle the **Met-08 Dust RGB** and the **Him-08 difference image**: do they correspond as regards dust detection? What is the largest difference  $IR_{12.4} - IR_{10.4}$  that you can find? From the values that you find, can you guess what is the height of the dust clouds (low, medium, high)?
3. Calculate the other IR differences to check which difference gives the best results for dust detection (in a qualitative way)
- a. As above, calculate the  $IR_{12.4} - IR_{11.2}$  and the  $IR_{11.2} - IR_{10.4}$  differences and display them with the same range (-4 to +2 K). Keep max resolution and the same **Region** (already set).
  - b. Rename the difference images to  $IR_{12.4} - IR_{11.2}$  and  $IR_{11.2} - IR_{10.4}$ .
  - c. Toggle all three difference images. Which difference gives the best results as regards dust detection?
  - d. Read the difference values for various scenes (press middle mouse button, see screenshot below): thick & thin dust, cloudfree land, cloudfree Ocean, low, mid, high clouds. What rule do you note, are the differences adding up (see example below)?



|   |             |
|---|-------------|
| Location: Lat: 45.2 Lon: 112.4                      |             |
| DUST (cloud microphysics tuned for dust):           | 224.8[null] |
| NCOL (natural colours, linear rescale btw min-max): | 0[null]     |
| 8.6 um Total Water,Cloud Phase,Dust:                | 264.2[K]    |
| 10.4 um IR Surface/Cloud-top Temp:                  | 260[K]      |
| 11.2 um IR Sea Surface/Cloud-top Temp:              | 262.6[K]    |
| 12.4 um Total Water and Ash and SST:                | 264.9[K]    |
| IR12.4 - IR10.4:                                    | 4.9[K]      |
| IR12.4 - IR11.2:                                    | 2.3[K]      |
| IR11.2 - IR10.4:                                    | 2.6[K]      |

IR differences

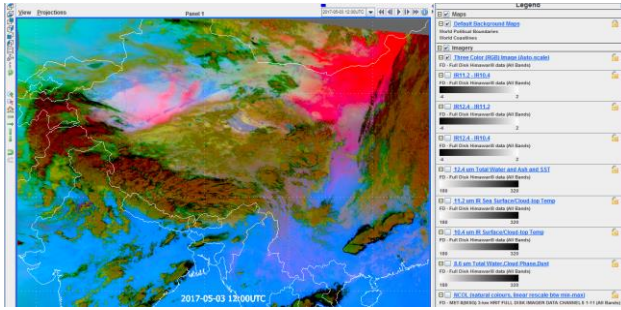
4. Generate the Dust RGB for the Him-08 ABI image and compare to the Met-08 SEVIRI Dust RGB
  - a. Go to the **Field Selector** tab in the **Data Explorer** window
  - b. Select **Formulas** in the **Data Sources** panel
  - c. In the **Fields** panel, select **Imagery** → **Three Color (RGB) Image (Auto-scale)**
  - d. Click **Create Display**, and a new window pops up
  - e. For Field red select **Formulas** → **Image Filters** → **Simple Difference**
  - f. For Field green select **Formulas** → **Image Filters** → **Simple Difference**
  - g. For Field blue select 2<sup>nd</sup> **Full Disk Himawari** → **10.4 um** → **Temperature** (wait)
  - h. Click **OK**
  - i. A new window pops up (for red difference)
  - j. put Field a **Full Disk Himawari** → **12.4 um** → **Temperature** (wait)
  - k. Put Field b **Full Disk Himawari** → **10.4 um** → **Temperature** (wait)
  - l. Click **OK**
  - m. A new window pops up (for green difference)
  - n. Put Field a **Full Disk Himawari** → **10.4 um** → **Temperature** (wait)
  - o. Put Field b **Full Disk Himawari** → **8.6 um** → **Temperature** (wait)
  - p. The RGB image is displayed in the McIDAS-V window and the **Layer Controls** in the Data Explorer window, see screenshot below.

|              |  |                                     |              |                                  |                                      |
|--------------|--|-------------------------------------|--------------|----------------------------------|--------------------------------------|
| Red range:   | <input type="text" value="-124.729996"/> | <input type="text" value="133.65"/> | Red Gamma:   | <input type="text" value="1.0"/> | <input type="button" value="Reset"/> |
| Green range: | <input type="text" value="-146.64"/>     | <input type="text" value="129.47"/> | Green Gamma: | <input type="text" value="1.0"/> | <input type="button" value="Reset"/> |
| Blue range:  | <input type="text" value="0.0"/>         | <input type="text" value="302.12"/> | Blue Gamma:  | <input type="text" value="1.0"/> | <input type="button" value="Reset"/> |
|              |  |                                     |              |                                  | <input type="button" value="Apply"/> |

- q. To generate the Dust RGB, change the ranges of all three color beams: -4 to +2 for red range, 0 to +15 for green, and 261 to 289 for blue. Also, set the green Gamma to 0.4 (which is actually 2.5). Each input value has to be confirmed by **Enter**. See final settings below.

|              |                                    |                                    |              |                                  |                                      |
|--------------|------------------------------------|------------------------------------|--------------|----------------------------------|--------------------------------------|
| Red range:   | <input type="text" value="-4.0"/>  | <input type="text" value="2.0"/>   | Red Gamma:   | <input type="text" value="1.0"/> | <input type="button" value="Reset"/> |
| Green range: | <input type="text" value="0.0"/>   | <input type="text" value="15.0"/>  | Green Gamma: | <input type="text" value="0.4"/> | <input type="button" value="Reset"/> |
| Blue range:  | <input type="text" value="261.0"/> | <input type="text" value="289.0"/> | Blue Gamma:  | <input type="text" value="1.0"/> | <input type="button" value="Reset"/> |
|              |                                    |                                    |              |                                  | <input type="button" value="Apply"/> |

- r. The Him-08 “Dust RGB” should look like this:

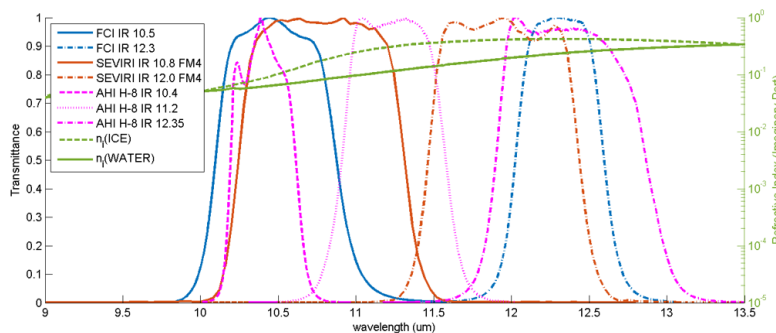


Question: which features can you see in this RGB? Toggle the Met-08 and Him-08 Dust RGBs: what differences do you see, as regards dust clouds, as regards water and ice clouds and as regards cloudfree areas?

## II. Tuning of the green component of the Dust RGB for AHI / ABI

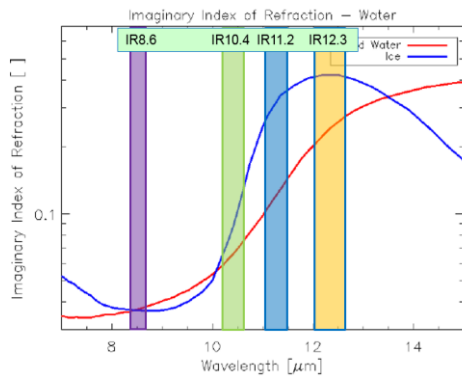
As already mentioned, the main use of the green component is 1) cloud phase detection (water/ice, works day and night), but it also contributes to 2) identifying optical thickness of clouds, 3) detection of dust/ash clouds (over desert surfaces) and 4) moisture features.

As regards cloud phase, water and ice clouds absorb differently in the infrared region; see the refractive index of water and ice (green curves) in the following figure. Remember that the imaginary part of the refractive index indicates the amount of attenuation when the electromagnetic wave propagates through the material (water/ice cloud). At around 10 micron and at around 13.5 micron water and ice have the same refractive index, while at around 11 to 11.5 micron there is the largest difference between water and ice.



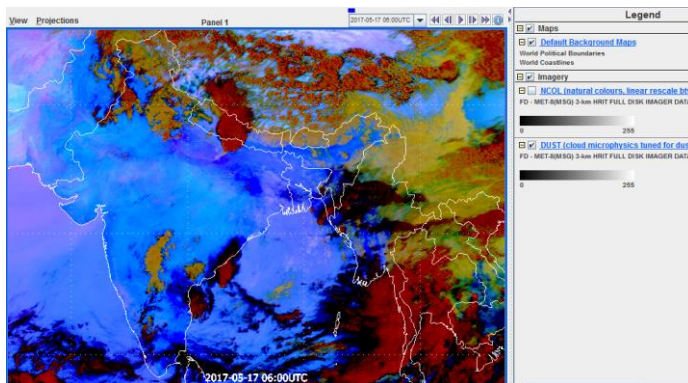
The colored curves show the spectral response functions of 3 instruments: red curves SEVIRI (2 relatively broad channels), magenta curves AHI (three more narrow channels) and blue curves the future FCI (on MTG, only 2 channels). From this figure, it appears that the AHI IR11.2 channel should be the most suitable channel for being used on the green beam of the Dust RGB, i.e. the IR11.2 – IR8.6 difference.

This becomes a bit more evident when you blow up the above figure as shown below. The position of the AHI infrared bands are indicated by colored rectangles. In the following lab we will test and see which difference (IR10.4-IR8.6, IR11.2-IR8.6, IR12.4-IR8.6) gives the best results for cloud phase detection (and should be used for the green beam of the Dust RGB).



5. Display Met-8 SEVIRI imagery on 17 May 2017 (over India and SE Asia)

- a. Close and Re-Open McIDAS-V (version 1.5)
- b. In the McIDAS-V window, go to **File** → **Open File**
- c. Open the bundle “seviri\_20170517\_met08.mcvz” in the **Data** → **bundles** directory (wait)
- d. If asked, select Merge with active tab(s) (default option) and Write to temporary directory (default option)
- e. Click OK if error message appears
- f. In the Select input window select minrefl 0 and maxrefl 80
- g. Wait until all frames are loaded; the Met-08 Natural Colours RGB image should be in front. Toggle to the Dust RGB, which should look like this:



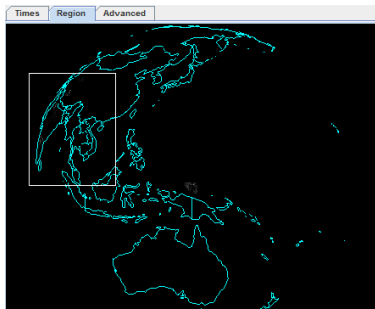
- h. This image will be the reference for us to tune the AHI Dust RGB (green beam). Mid level water clouds (brownish) have a very different color than high level ice clouds (dark red). Thin ice clouds are black or dark blue. Also moisture features can be seen.
- i. Also the Natural Color RGB helps to identify cloud phase; ice clouds have cyan color, water clouds white to pinkish. Toggle the Dust RGB and the Natcol RGB: is the Natcol RGB good for cloud phase, where does it have problems?
- j. There is a thunderstorm over Northern India (Ganges valley): what type of thunderstorm is this? If you know the type (conceptual model), what can you say about the future development of this storm (forecast next 6 hours)?
- k.

6. Create the Himawari-08 Dust RGB for the same case (with the IR10.4 channel)

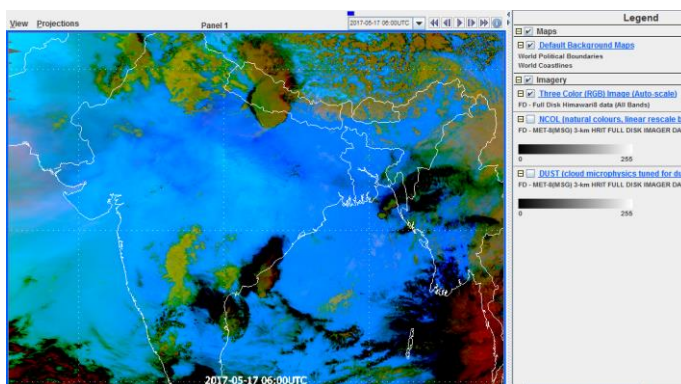
- a. We will again read the Him-08 data for this case (17 May 2017) from the Wisconsin archive of satellite data (remote server). The RGBs will be generated with the same procedure as before.
- b. Go to the **Data Explorer** click on satellite imagery (left) and select the goarc.ssec.wisc.edu server. Select the **AHIM08** dataset and connect to the server.



- c. As Image Type select **FD (Full Disk)** data and select the archive day 03-May-2017. Click ok and wait (it takes time to connect and read the time slot information).
- d. The **Absolute** tag should be highlighted. Select the image from 06:00 UTC and click on **Add Source**. Wait.
- e. The Data Explorer moves to the Field Selector where you see all 16 bands of the AHI instrument.
- f. Go to the **Field Selector** tab in the Data Explorer window
- g. Select **Formulas** in the Data Sources panel
- h. In the Fields panel, select **Imagery** → **Three Color (RGB) Image (Auto-scale)**
- i. Click **Create Display**, and a new window pops up
- j. For Field red select **Formulas** → **Image Filters** → **Simple Difference**
- k. For Field green select **Formulas** → **Image Filters** → **Simple Difference**
- l. For Field blue select 2nd **Full Disk Himawari** → **10.4 um** → **Temperature** (wait)
- m. Important: before you click OK, expand the Field Selector window so that you see the **Region** and the **Advanced** tabs. **FIRST:** set the Magnification slider to 1 (max resolution).
- n. Then, select the Region (shift left mouse, India and SE Asia, see below) and now click **OK**.



- o. A new window pops up (for red difference)
- p. Put Field a **Full Disk Himawari** → **12.4 um** → **Temperature** (wait)
- q. Put Field b **Full Disk Himawari** → **10.4 um** → **Temperature** (wait)
- r. Click OK
- s. A new window pops up (for green difference)
- t. Put Field a **Full Disk Himawari** → **10.4 um** → **Temperature** (wait)
- u. Put Field b **Full Disk Himawari** → **8.6 um** → **Temperature** (wait)
- v. Click **OK**.
- w. The RGB image is displayed in the McIDAS-V window and the Layer Controls in the Data Explorer window.
- x. Set the ranges and the Gamma: -4 to +2 for red range, 0 to +15 for green, and 261 to 289 for blue. Gamma 0.4 for the green beam. Each input value has to be confirmed by Enter. The AHI RGB should look like this:



Question: Have a look at water and ice clouds in this image. Compare to the Met-08 Dust RGB. Which one is better (better color contrast) for cloud phase detection? Measure the parallax shift between Met-08 and Him-08 images (for high clouds).

7. Create the Himawari-08 Dust RGBs for the same case (with the IR11.2 and IR12.4 channels)
  - a. As above, use **Imagery → Three Color (RGB) Image (Auto-scale)** to generate the AHI Dust RGBs, with the same red and blue components, but with different green components. Use the same ranges and Gammas as above. Keep the same Region and the maximum resolution (should already be set).
  - b. For the second AHI Dust RGB, use the difference IR11.2 – IR8.6 (on green).
  - c. Finally, for the third AHI Dust RGB, use the difference IR12.4 – IR8.6 (on green).
  - d. Compare all three AHI Dust RGBs to the SEVIRI Dust RGB: which one gives the best results (best contrast for cloud phase detection)?
  - e. Do the results confirm the theory, namely that the AHI IR11.2 channel is the most suitable channel for being used on the green beam of the Dust RGB?
  - f. Last but not least, try to fine tune the AHI Dust RGB (the one with the best contrast) by tuning all three color ranges. Can you find an optimal tuning?
  - g.
  
8. Extra task: look at this case in high resolution visible data
  - a. Go to the Field Selector and display the high resolution visible band (AHI band 03, VIS0.64). Display the “albedo” in the range 0 to 100%.
  - b. Compare the visible image to the Dust RGB: where is the visible image better, where the Dust RGB?
  - c. Zoom on the thunderstorm over Northern India: compare to the Dust RGB - which features do you see?

Annex: Dust RGB quick guide (from EUMeTrain)

# SEVIRI Dust RGB Quick Guide

**Primary aim:** Detection of dust and volcanic ash in the atmosphere.

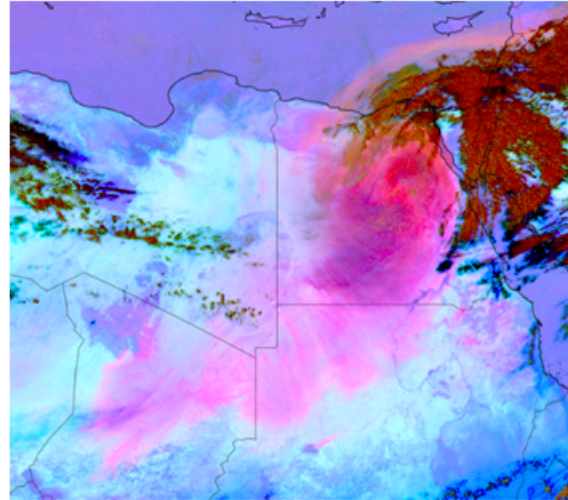
**Secondary aim:** Identification of high level cirrus clouds and low level moisture boundaries. Discrimination of low level water clouds from multilayered ice clouds.

**Time period and area of its main application:** Day and night throughout the year.

**Guidelines:** Highly concentrated dust clouds in the atmosphere appear magenta in the Dust RGB image. The Dust RGB does not provide information on height and concentration of the dust cloud. Less concentrated dust clouds become rapidly invisible.

**Water vapor boundaries** in lower atmospheric levels can be seen in the Dust RGB with different shades of blue.

**Cirrus clouds** are depicted in dark blue to black in the Dust RGB (sometimes in magenta if very thin and not very cold), while low to mid-level water clouds are greenish and high reaching, multilayered ice clouds appear reddish.



SEVIRI Dust RGB, 18 March 2017, 12:00 UTC

## Background

The Dust RGB makes use of the three window channels of MSG. While both, cirrus clouds and dust are more or less transparent in the visible channels, they show an antagonistic behaviour in the split-window differences.

For the split-window difference IR12.0 – IR10.8 (red channel) the resulting temperatures are largely positive for dust and ash while being negative for cirrus clouds. Neither cirrus clouds nor dust clouds contribute to the green channel of the Dust RGB, the split-window difference IR10.8 – IR8.7 is very small or negative.

Dust detection is strongly influenced by the surface temperature. While high and cold cirrus clouds are absorbing most of the thermal radiation from the ground, atmospheric dust is more transmissible for the latter, and contributes to the red channel with a higher amount of blue (IR10.8), hence the resulting magenta colour (red + blue).

| Colour | Channel [ $\mu\text{m}$ ] | 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                     | Dust                                |
| Green  | IR10.8 – IR8.7            | Cloud phase             | Thin ice clouds<br>Dust             | Water clouds                        |
| Blue   | IR10.8                    | Temperature             | Cold clouds                         | Warm surface<br>Warm clouds         |

Notation: IR: infrared; number: central wavelength of the channel in micrometer.

### Benefits

- The Dust RGB is available day and night.
- Allows to monitor the displacement of a dust clouds at high temporal resolution.
- Allows to discriminate high cirrus clouds, low level water clouds and multi-layered ice clouds.
- Allows to detect water vapour boundaries in the lower troposphere.

### Limitations

- It is not possible to determine the height nor the concentration of the dust cloud in the atmosphere from the Dust RGB alone.
- Hence it is not possible to deduce the visibility on the ground.
- The typical magenta colour of dust in the atmosphere is not visible when clouds obscure the scene.
- Low level dust clouds over the sea or cold land are difficult to detect. Solar imagery should be used in this case.
- Very thin (low concentration) dust clouds are not detected by the Dust RGB.

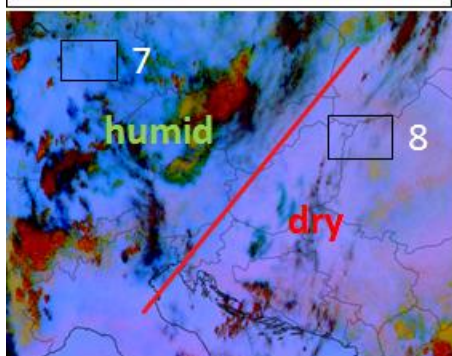


# SEVIRI Dust RGB Quick Guide

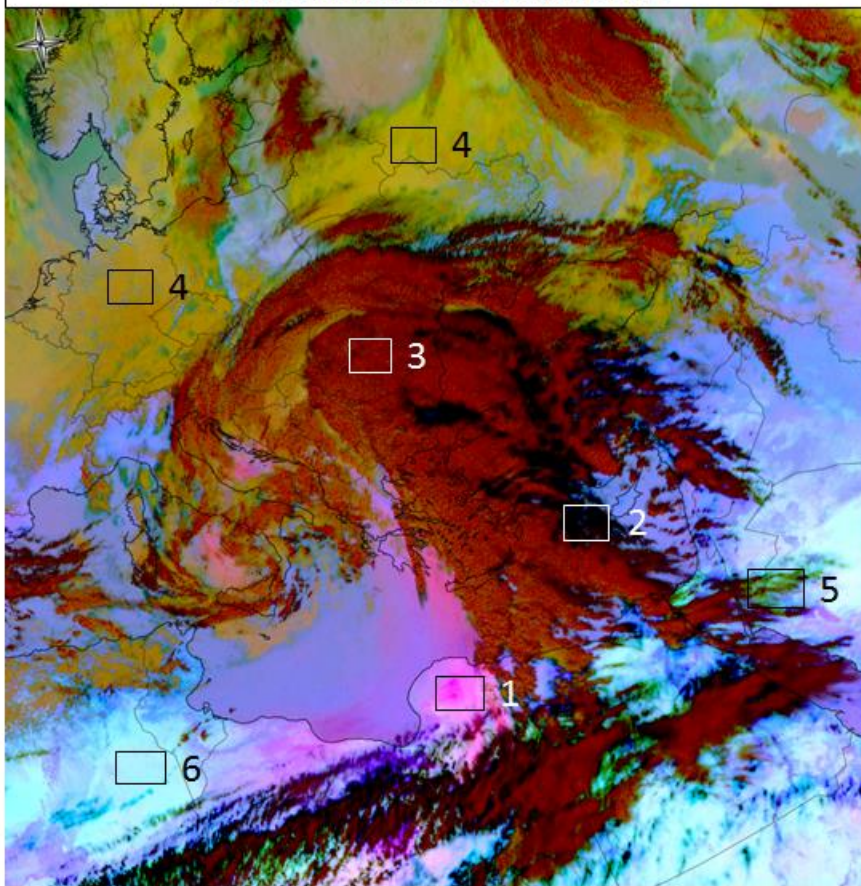
## Colour Interpretation

- 1 Dust or ash clouds.
- 2 Cirrus clouds with no clouds below.
- 3 Thick ice clouds with large ice crystals in higher levels.
- 4 Thick mid-level water clouds.
- 5 Semi-transparent mid-level water clouds.
- 6 Hot sandy deserts, dry air mass.
- 7 Humid air in lower levels (~ 700 hPa).
- 8 Dry air in lower levels.

Dust RGB image, 29 May 2017, 18:00 UTC



SEVIRI Dust RGB, 23 March 2016, 12:00 UTC



Left hand image: Low level humidity gradients can be observed in the Dust RGB in form of a colour gradient from darker blue (humid air mass) to a more pinkish blue (dry air mass).

## Comparison to other RGBs

[More about RGB on eumetrain.org](http://eumetrain.org)

Dust in cloud free regions is depicted in magenta by the Dust RGB. Inside clouds, the presence of dust particles acts as cloud condensation nuclei and generates small ice crystals which can be seen in the Severe Storms RGB (bright yellow colour).  
Severe Storms RGB, 23 March 2016, 12:00 UTC

The comparison of the Dust RGB with the Natural Colours RGB shows that the latter better resolves dust clouds over the sea due to higher reflectivity of dust particles compared to the sea (high contrast). Over land, the situation is reversed. Because of the high reflectivity of sand for shortwave solar radiation, the contrast between dust cloud and land is poor in the Natural Colours RGB.  
Natural Colours RGB (left) and Dust RGB (right) from 1 June 2017, 12:00 UTC

