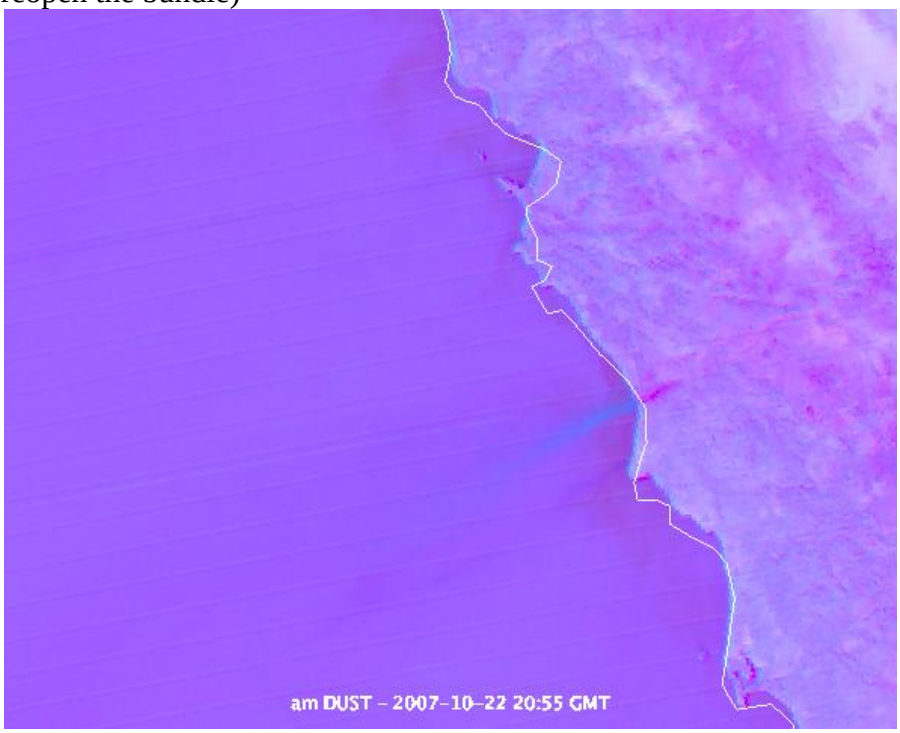
LAB 5 – Discrimination of Dust and Smoke

Instructions for this lab (key questions are in yellow):

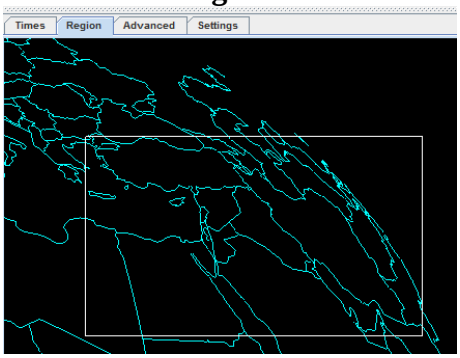
1. Open McIDAS-V
2. Load a bundle containing MetOp-A AVHRR data file:
    a. In the map window click **File → Open File**
    b. Navigate to the bundle '**metop_rgb_natcol.mcvz**' under **Data → Bundles**
    c. Click **OK** a few times (If the system asks *Open Bundle*, select '*Merge with active tabs*'. If the system asks '*Zip File Date*' select '*Write to temporary directory'*)
3. The bundle will open the Natural Colours RGB product (RGB NIR1.6, VIS0.8, VIS0.6), but not with a good enhancement (very reddish colour)
    a. Go to **Data Explorer** window, click the **Field Selector** tab and display the **VIS 0.6** channel by selecting **Image Display** and clicking **Create Display**
    b. Set the reflectance range (**Change Range**) of this channel to 0-50%
    c. Now display the **VIS 0.8** channel, set the range to 0-50%
    d. Now display the **NIR 1.6** channel, set the range to 0-50%
4. Toggle the 3 images and try to identify smoke and dust plumes
5. Try to create an enhanced Natural Colors RGB image that shows smoke and dust plumes in different colors
    a. Click on the **RGB Composite**. This brings up the **Data Explorer**, **Layer Controls**. Change the Gamma values to **0.5** and press **Apply** or Enter
    b. This changes the RGB image, i.e. the image gets much brighter and the smoke and dust plumes are enhanced.
    c. Identify again areas of smoke and areas of dust. What is the color for smoke? Why? What is the color for dust? Why?
    d. You can find a tool **Color Selector** for reading the color values of RGBs in the main folder of the USB stick.
6. Looking at the same scene (about 2 hours later) with MODIS
    a. Locate the MODIS true color RGB data file you will need for this lab. Load the bundle **File → Open File** browse to: '**modis_rgb_truecol.mcvz'** under **Data → Bundles**
    b. If the system asks *Open Bundle*, select 'Merge with active tabs'. If the system asks '*Zip File Date*' select '*Write to temporary directory'*
    c. The image will show the MODIS true color RGB image. Which channels are used in this RGB product? (Hint: Under McIDAS-V **Data Explorer**, click on **Field Selector** and then on the needed **Data Source**)
    d. Can you see the smoke and the dust plumes? Why is the true color RGB not so good for discriminating dust from smoke (compared to the "natural colors" RGB NIR1.6-VIS0.8-VIS0.6)?
    e. To see if the IR based dust RGB product shows the dust clouds, open the second MODIS bundle '**modis_rgb_dust.mcvz'**. Again, merge with the previous bundle (merge with active tabs)! Toggle the 2 images.
    f. Can you see dust clouds? Why? Why not? Is this low or high level dust?
    g. If you zoom (magnifying class on the left, or scroll button on your mouse) on the area shown below (Lat 30, Lon -116), you see a dust plume that has a nice magenta color over land but turns to a strange, bluish color over the ocean. Why? To help you, create the simple difference IR12-IR11 and display the result in the range - 1 to +1 K by using the color scale under **System → Gray Scale**.
    h. To do this, select the **Field Selector** tab in the **Data Explorer** window, click on **Formulas**, then under **Miscellaneous**, highlight **Simple difference a-b**. Make sure **Image Display** is highlighted in the **Displays** window, click **Create Display** and select the appropriate channels. That will generate the difference image. (If you have a memory restriction, you probably must close the true color RGB

(click on the trash bin) to free enough memory space. If this still does not work, close McIDAS and reopen the bundle)

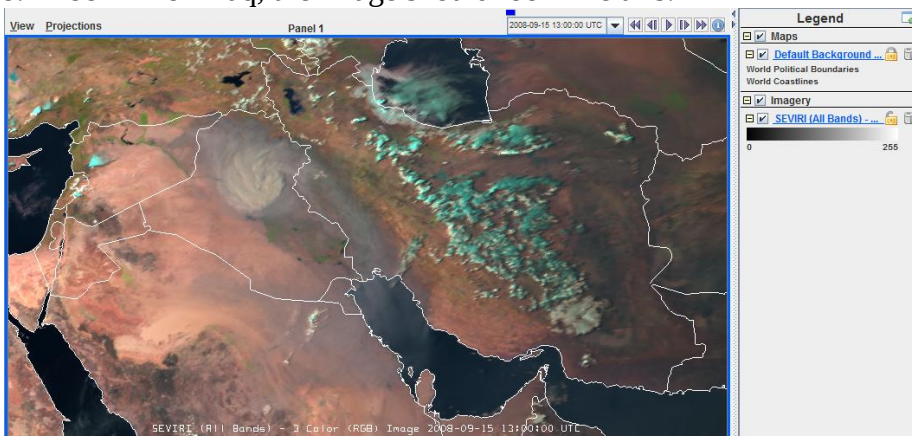


Extra lab (if you have time)

1. Case 15 March 2008: dust Iraq (MSG SEVIRI)
    a. Close and re-open McIDAS-V
    b. In the **Data Explorer** window, select the **Data Sources** tab
    c. Select **Imagery** under **Satellite** in the panel on the left side
    d. Select **Server**: <LOCAL-DATA>
    e. Select the **Dataset**: MSG
    f. Click **Connect** and wait
    g. Select the **Image Type**: Channel 1-11
    h. Go to the **Absolute** tab and select the image at **2008-09-15 13:00:00 UTC**
    i. Click **Add Source** and wait
    j. In the **Field selector** tab, select **SEVIRI RGB → NCOL** under the **Fields** panel and wait
    k. Select the **Advanced** tab and put the **Magnification** slider to the maximum
    l. Go to the **Region** tab and select the entire region around Iraq (see below)

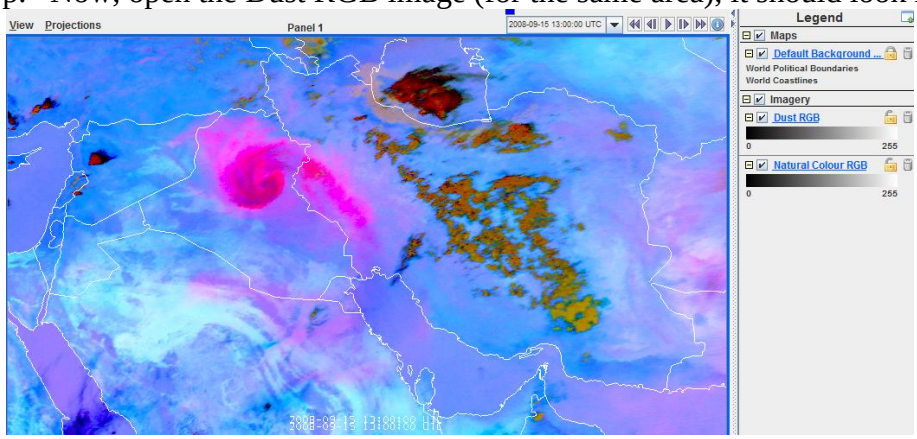


m. Click **Create Display** and wait
n. In the **Select input** window, select minrefl=0 and maxrefl=40 and click **OK**
o. Zoom in on Iraq, the image should look like this:



This is an afternoon image from 15 March 2008. Question: Which features do you recognize? Can you outline the dust cloud? Where is the thickest dust?

p. Now, open the Dust RGB image (for the same area), it should look like this:



The IR-based Dust RGB complements the information from the VIS-based Natural Colour RGB. Question: does it help to better outline the dust cloud? Can you see moisture boundaries in this Dust RGB image?

2. Case 26 October 2007: dust Libya (MODIS)
   a. Close and re-open McIDAS-V (or clear other images and data by clicking **Edit → Remove → All Layers and Data Sources)**
   b. For this classic dust scene, open the bundle '**extra_modis.mcvz'** as a McIDAS-V bundle. Turn on and off various channels to observe which spectral regions are sensitive to the dust and cloud regions.
   c. Try different RGB composites
   d. In the **Data Explorer** window, under the **Field Selector** tab, click on **Formulas**, then in the **Fields tab**, click on the flag **Imagery**, and choose **Three Color RGB Image (Auto-scale)** and click **Create Display** at the bottom.
   e. Then a separate window will appear and you can select you MODIS bands that are displayed in the red, green and blue 'guns'.
   f. RGB with wavelengths: 0.85, 0.65 and 0.46
   g. RGB with wavelengths: 0.65, 0.55 and 0.46

h. RGB with wavelengths that include visible and near-infrared (the 1.6 micron observation is noisy, so it is not included in the files).
i. The images might flip over, if so, select the right projection (Africa in this case) under **Projections** in the map window.
j. Or, try computing Brightness Temperature Differences
k. In the **Data Explorer** window, under the **Field Selector** tab, click on **Formulas**, then in the **Fields tab**, click on the flag **Miscellaneous**, and choose **Simple difference a-b** and click **Create Display** at the bottom.
l. Then a separate window will appear and you can select you MODIS bands that are to be computed and displayed.