Lab: Fog and low clouds: case Kuwait, 26 November 2013

Key learning:

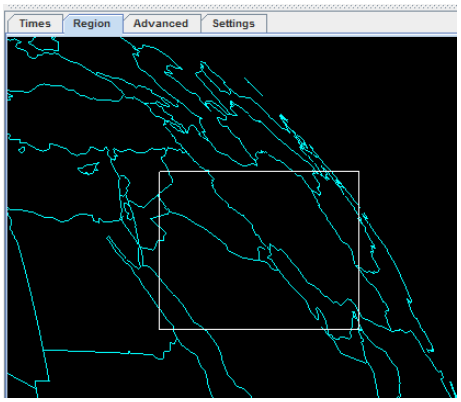
a. Explore the utility of IR window channels, and channel combination for low cloud detection
b. RGBs (for low cloud/fog detection specifically)
c. Day vs night low cloud/fog detection

1. <u>Set local ADDE servers</u> (skip this step(!), unless data can not be read later on)

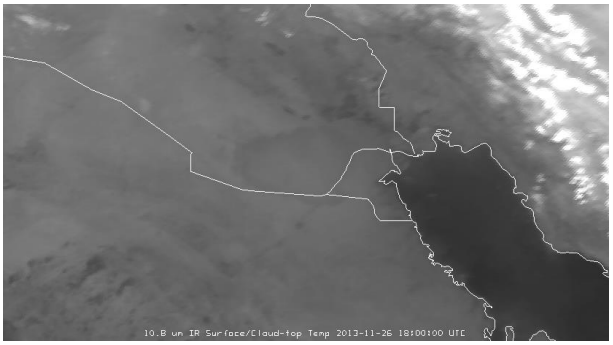
- McIDAS-V window, Tools <**Manage ADDE datasets**>
- Select <**Local Data**
- Select <**MSG**> Dataset
- Click <**Edit Dataset**>
- Directory: Browse to 'data/seviri'
- Click <**Open**>
- Click <**Save Changes**>
- **Click <Ok>**

2. <u>Open MSG SEVIRI IR Channels</u>

- McIDAS-V Data Explorer window, <**Data Sources**> tag
- Satellite Imagery should be highlighted
- Server: select <**Local Data**>
- Dataset: select <**MSG**>
- Click <**Connect**>, wait
- Image Type: select <**Channels 1-11**>
- Times: select <**Absolute**>
- Select the 18:00 UTC image
- Click: <**Add Source**>**, wait**
- Fields Selector window: select <**10.8 um**>**,** <**Temperature**>, wait
- Displays window: select <**Advanced**> tag
- Put <**Magnification**> slider to maximum (1)
- Select <**Region**> tag
- Select region around Kuwait (see example below)



- Click <**Create Display**>, wait
- Zoom on the area around Kuwait.
- Change the range to 260 to 300 K. The image should look like this:

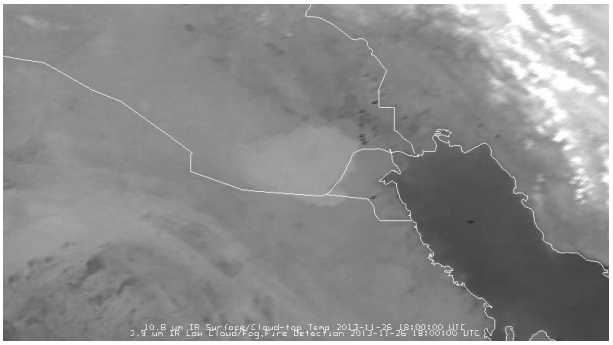


Question: Can you identify areas of low clouds?

- Go to the Data Explorer window
- Add the IR3.9 and the IR8.7 images to the display (same procedure as above)
- Change the range for all 3 image to 260 to 300 K, so that you can better compare the three IR images

Toggle the 3 images. Do the clouds (over Iran, RSA and Kuwait) look the same, do the land surfaces look the same? Can you explain the differences?

In the IR3.9 image. There are some dark spots (see image below), which are not visible in the other IR images. What feature is this?

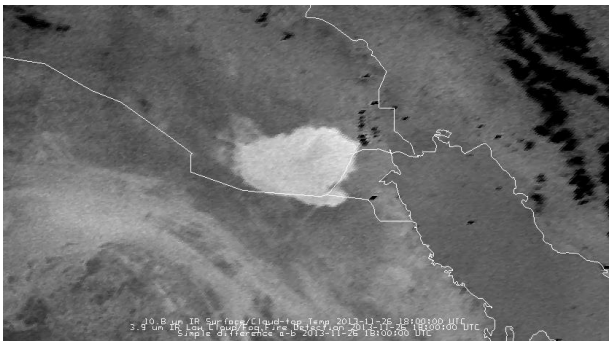


3. Generate the IR10.8 – IR3.9 Difference

- Now, let us display the classic IR10.8 – IR3.9 difference, to see if we can see low clouds at night
- Go to the Data Explorer window
- In the Field Selector window select data source: **<Formulas>**
- As field select **<Miscellaneous>, <Simple difference a-b>**
- As Display select **<Image Display>**
- Click **<Create Display>**
- A new window pops up
- for Field a select SEVIRI, 10.8 um IR, Temperature, wait
- for Field b select SEVIRI, 3.9 um IR, Temperature, wait
- Click <OK>
- Change projection to **World** (Main window: Projections > Predefined > World)

- The Difference IR10.8 – IR3.9 (the green component of the Night Microphysics RGB) is now displayed in a black/white scale (if not, right-click on the colour table > **System** > **Gray Scale**)

- Change the range to [0, +10] (the same range used in the RGB product)
- Click **<OK>.** The image should look like this:



This difference is the main input in the Night Microphysics RGB for detecting low clouds. Question: which IR10.8-IR3.9 values do you find in the cloudfree / low clouds areas? Why are the values positive (around +8 K) for low clouds?

- If you wish, you can **Save** this image
- Deselect all layers except the difference image
- McIDAS-V window, **<View>, <Capture>, <Image>**
- Choose location and set the Filename to something like '20131126_1800_msg_diff_09-04.png'
- Click: <Save>

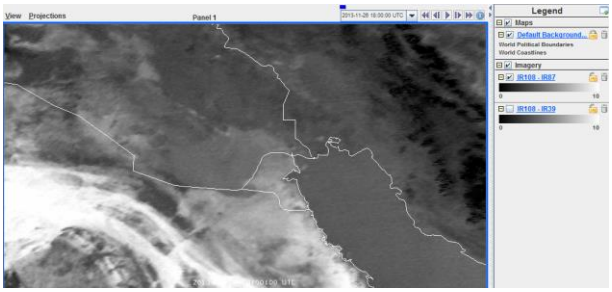
4. Generate the IR10.8 – IR8.7 Difference

- Now, let us display the IR10.8 – IR8.7 difference, to see if we can see low clouds also in this difference
- Similar as for last difference, go to the Data Explorer window
- In the Field Selector window select data source: **<Formulas>**
- As field select **<Miscellaneous>, <Simple difference a-b>**

- As Display select **<Image Display>**
- Click **<Create Display>**
- A new window pops up
- for Field a select SEVIRI, 10.8 um IR, Temperature, wait
- for Field b select SEVIRI, 8.7 um IR, Temperature, wait
- Click <OK>

- The Difference IR10.8 – IR8.7 (the green component of the Dust RGB) is now displayed with a greyscale table

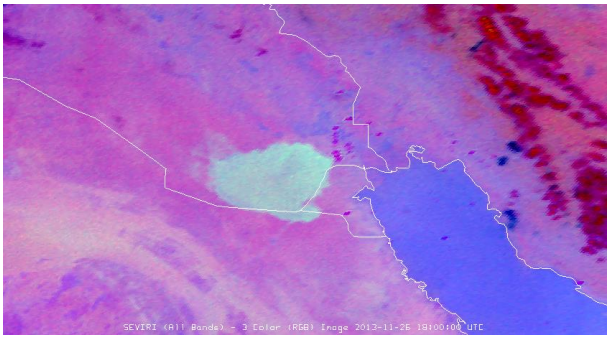
- Change the range to [0, +10] (the same range used in the other difference)
- Click **<OK>**. The image should look like this:



Toggle the two difference images. Which one is better to detect low clouds? Is it possible to improve the IR10.8-IR8.7 difference image by changing the range? Can you see the hot spots also in the IR10.8-IR8.7 difference?

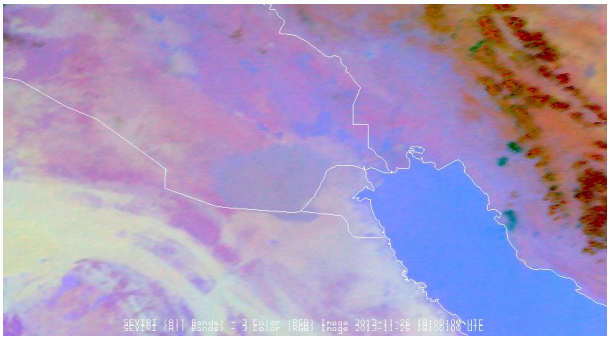
5. <u>Compare the corresponding RGB products which use these two differences</u>

- Go to the Data Explorer window
- In the Field Selector window select data source: **<Channels 1-11 (All Bands)>**, **<SEVIRI RGB>, <NCMP>**
- Make sure that Magnification is set to maximum (1)
- Select region around Kuwait
- Click **<Create Display>**, the Night Microphysics RGB that uses the IR10.8-IR3.9 difference (on green) should appear (see below):



Which colour do you get for low clouds? Can you see the hot spots?

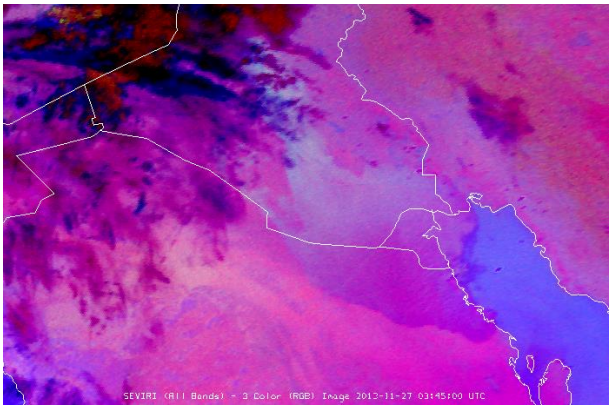
- Now, we open the Dust RGB image
- Go to the Data Explorer window
- In the Field Selector window select data source: **<Channels 1-11 (All Bands)>**, **<SEVIRI RGB>, <DUST>**
- Make sure that Magnification is set to maximum (1)
- Select same region around Kuwait
- Click **<Create Display>**, the Dust RGB that uses the IR10.8-IR8.7 difference (on green) should appear (see below):



Toggle the two RGB images. Which one is better for the detection of low clouds? Does this confirm our findings about the differences?

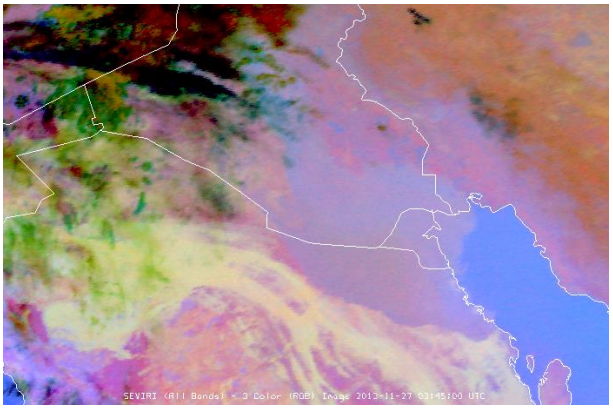
6. Some hours later at 3:45 UTC next morning

- McIDAS-V Data Explorer window, **<Data Sources>** tag
- Satellite Imagery should be highlighted
- Server: select **<Local Data>**
- Dataset: select **<MSG>**
- Click **<Connect>**, wait
- Image Type: select **<SEVIRI>**
- Times: select **<Absolute>**
- Select the 03:45 UTC image
- Click: **<Add Source>, wait**
- Go to the Data Explorer window
- In the Field Selector window select data source: **<Channels 1-11 (All Bands)>**, **<SEVIRI RGB>, <NCMP>**
- Make sure that Magnification is set to maximum (1)
- Select region around Kuwait
- Click **<Create Display>**, the Night Microphysics RGB that uses the IR10.8-IR3.9 difference (on green) should appear (see below):



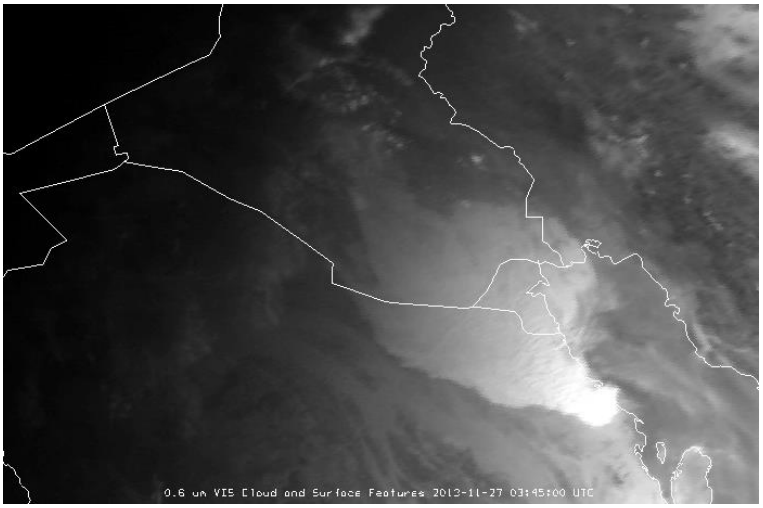
Question: where are the low clouds? Why is the colour of the low clouds not greenish?

- Now, we open also the Dust RGB image for 3:45 UTC
- Go to the Data Explorer window
  - In the Field Selector window select data source: < **Channels 1-11 (All Bands)**>, **<SEVIRI RGB>, <DUST>**
- Make sure that Magnification is set to maximum (1)
- Select same region around Kuwait
- Click <**Create Display**>, the Dust RGB that uses the IR10.8-IR8.7 difference (on green) should appear (see below):



Toggle the two RGB images. Which one is better for the detection of low clouds at dawn/dusk?

- Let us see if there is already some sunlight at 3:45 UTC?
- Fields Selector window: select **<0.6 um>, <Reflectivity>**
- Click <**Create Display**>
- Change the range of the image (right mouse click on the colour bar) to 0 to 10%, the VIS0.6 image should appear (see below)



Compare this visible image with the RGB images. Which one is better to detect the low clouds?