

## **LAB – Investigate a tropical depression with MODIS and AMSR in addition to AIRS**

We will continue to explore the tropical depression case from the weighting function lab, but will use data from the AMSR-E sensor and focus on interpretation of microwave imagery.

Goals for this lab:

1. Learn how to create MODIS true-color RGB images
2. Learn how to create a local ADDE dataset (this will likely be a useful skill if you ever try to use your own data with McIDAS-V)
3. Plot several microwave channels from the AMSR-E (Advanced Microwave Scanning Radiometer for the Earth Observing System) sensor and learn to interpret the differences between them

Instructions for this lab (key questions are in **bold**):

1. Open McIDAS-V
2. In the map display window, click **View** → **Properties**, and confirm that the **Auto-set projection** option is **unchecked**. Click **OK**.
3. We'll start by creating a true color MODIS RGB image so you can remind yourself how things look.
  - a. Click the **Data Sources** tab in the **Data Explorer** window
  - b. Click the arrow next to **Satellite**, then click **HYDRA**
  - c. Navigate to the MODIS file “**MYD021KM.A2011244.1905.005.2011245153109.hdf**” in the folders **Data** → **MODIS**
  - d. Click on the file and click **Add Source**
  - e. In the **Field Selector** tab, click **Formulas**
  - f. In the **Fields** display click the arrow next to **Imagery** and select **Three Color (RGB) Image (Auto-scale)**
  - g. Select **RGB Composite** under the **Displays** panel
  - h. Click **Create Display**
  - i. A new window will open. For each color (*RGB = Red, Green, Blue*), select **Hydra** → **MultiSpectral** → **Reflective Bands**, and select the appropriate band under the **Channels** tab:
    - i. Red: Band 1 (0.67 microns)
    - ii. Green: Band 4 (0.565 microns)
    - iii. Blue: Band 3 (0.479 microns)
  - j. Click **OK** and wait.
  - k. Brighten the image by lowering the Gamma value in the **Layer Controls** tab - 0.5 works well. You only need to change the value in the **Common Gamma** box at the bottom and click **Apply to All Gamma Fields**.
  - l. Now you have a true-color image of the scene that you can compare to the microwave channels we will plot in the following steps.
4. Now you will add the AMSR-E data to explore the scene using various microwave channels.
  - a. First, we need to add a local ADDE dataset in McIDAS-V.
    - i. In the map window click **Tools** → **Manage ADDE Datasets**
    - ii. Click **Add New Dataset** and fill in the required information
    - iii. **Dataset**: “**MW\_LAB**”
    - iv. **Image Type**: “**AMSRE**”
    - v. **Format**: “**AMSR-E L 1b**”
    - vi. **Directory**: browse to the folder **Data** → **AMSR**. You need to select the directory itself, not the file inside it.
    - vii. Click **Add Dataset** and **OK**
  - b. Add this as data source
    - i. Go to **Data Sources** tab in the **Data Explorer** window
    - ii. Click the arrow next to **Satellite** and select **Imagery**

- iii. Select **Server**: <LOCAL-DATA>
  - iv. Select the **Dataset** you've just created: MW\_LAB
  - v. Click **Connect**
  - vi. Select **Image Type**: AMSRE
  - vii. Go to the **Absolute** tab and select the image at **2011-09-01 18:30:52 UTC**
  - viii. Click **Add Source**
- c. Now you can create displays for as many AMSR channels as you wish. For example, here are step-by-step instructions to create a display of 6 GHz vertically polarized brightness temperatures:
- i. In the **Field Selector** tab, click **AMSR (All Bands)** in the **Data Sources** panel
  - ii. Under the **Fields** panel, click the arrow next to **6 GHz-V Brightness Temperature** and select **Temperature**. Note: H stands for Horizontal Polarization, but V- for Vertical Polarization.
  - iii. Select **Imagery** → **Image Display** under the **Displays** panel
  - iv. Click the **Advanced** tab, and click the button with 4 green arrows - this is to make sure you get a full-resolution image
  - v. Click **Create Display**
  - vi. We'll be adding several channels, therefore rename this display so you keep track of all your channels:
    - 1. In the **Layer Controls** tab, click **AMSR (All Bands)**
    - 2. Select **Edit** → **Properties**, and change the **Legend Label** to something like "6V"
  - vii. Play around with different enhancement tables and data ranges to get you plot to display nicely. A good color table choice for microwave brightness temperatures is **System** → **Temperature**.
- d. Now you can keep plotting AMSR channels using the instructions from the previous step (Definitely plot at least 6H, 10H, 37V, 89V-B). You should be able to skip the "Click the *Advanced tab...*" step from now on. Here are some important questions to consider as you explore these channels:
- i. Which channel sees most of the surface? Why?
  - ii. Which channel sees least surface signal? Why?
  - iii. Focus on the deep convective clouds over the Gulf of Mexico.
    - 1. At 37 GHz, precipitating areas are warmer than the ocean surface.
    - 2. However, at 89 GHz, precipitating areas are colder than the ocean surface.
    - 3. Why?
  - iv. Now focus on the clouds over Florida.
    - 1. Now you see that the tall clouds are colder than the land surface at both 37 and 89 GHz.
    - 2. Why?
  - v. Can you identify any strange features over land that look like artifacts (hint: focus on 6 and 10 GHz)? If so, what do you think is causing them? Why aren't they present at higher frequencies?