McIDAS-V Tutorial
Displaying Polar Satellite Imagery
updated May 2012 (software version 1.2)

McIDAS-V is a free, open source, visualization and data analysis software package that is the next generation in SSEC's 35-year history of sophisticated McIDAS software packages. McIDAS-V displays weather satellite (including hyperspectral) and other geophysical data in 2- and 3-dimensions. McIDAS-V can also analyze and manipulate the data with its powerful mathematical functions. McIDAS-V is built on SSEC's VisAD and Unidata's IDV libraries, and contains "Bridge" software that enables McIDAS-X users to run their commands and tasks in the McIDAS-V environment. The functionality of SSEC's HYDRA software package is also being integrated into McIDAS-V for viewing and analyzing hyperspectral satellite data.

More training materials are available on the McIDAS-V webpage and in the Getting Started chapter of the McIDAS-V User's Guide, which is available from the Help menu within McIDAS-V. You will be notified at the startup of McIDAS-V when new versions are available on the McIDAS-V webpage - http://www.ssec.wisc.edu/mcidas/software/v/ .

If you encounter an error or would like to request an enhancement, please post it to the McIDAS-V Support Forums - http://www.ssec.wisc.edu/mcidas/forums/. The forums also provide the opportunity to share information with other users.

This tutorial assumes that you have McIDAS-V installed on your machine, and that you know how to start McIDAS-V. If you cannot start McIDAS-V on your machine, you should follow the instructions in the document entitled *McIDAS-V Tutorial – Installation and Introduction*.

Terminology

There are two windows displayed when McIDAS-V first starts, the **McIDAS-V Main Display** (hereafter **Main Display**) and the **McIDAS-V Data Explorer** (hereafter **Data Explorer**).

The **Data Explorer** contains three tabs that appear in bold italics throughout this document: ***Data Sources**, **Field Selector**, and **Layer Controls***. Data is selected in the ***Data Sources*** tab, loaded into the ***Field Selector***, displayed in the **Main Display**, and output is formatted in the ***Layer Controls***.

Menu trees will be listed as a series (e.g. ***Edit -> Remove -> All Layers and Data Sources***).

Mouse clicks will be listed as combinations (e.g. *Shift+Left Click+Drag*).

Loading Polar Satellite Images and Loops

1. Create a local dataset to access the imagery files on your local machine.

    a. In the **Main Display** window of McIDAS-V, select *Tools* -> *Manage ADDE Datasets*.

    b. In the ADDE Data Manager, select **File -> New Local Dataset.** Enter in the following parameters to set up a dataset with the MODIS Level 1b HDF files provided with this tutorial:

    - **Dataset** – MODIS
    - **Image Type** – 1 km HDF MOD02 1 km files
    - **Format** – MODIS MOD 02 – Level-1B Calibrated Geolocated Radiances
   - **Directory** – select the *<local path>*/**Polar/modis_files** directory
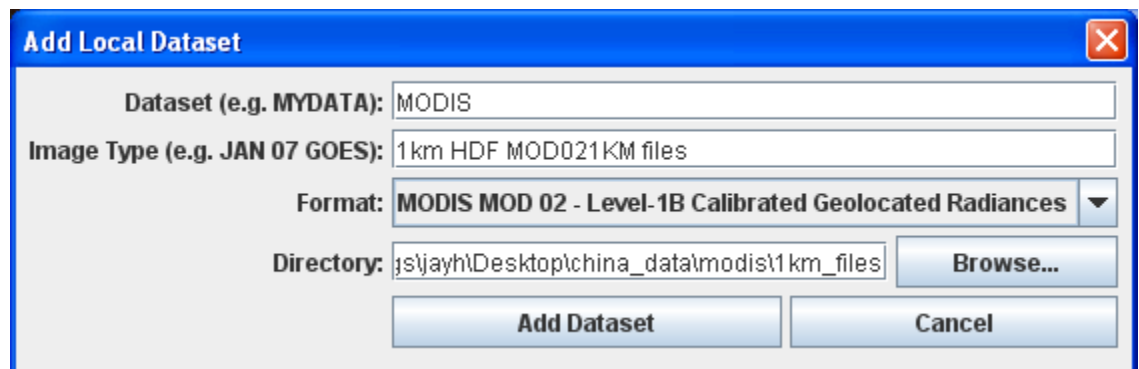
    c. Close the ADDE Data Manager by clicking "X" in the upper right-hand corner or select *File -> Close*.

2. To load the data in this local dataset, follow these steps.

    a. Click on the [icon] button in the main toolbar to go to the *Data Explorer*.

    b. Select the *Satellite -> Imagery* chooser from the *Data Sources* tab.

    c. Select **<LOCAL-DATA>** for **Server:**, select MODIS for **Dataset:**, click **Connect**.

    d. Choose the *1km HDF MOD021KM files* **Image Type** and select an **Absolute** time of 02:50 UTC.

    e. Click **Add Source** to show the *Field Selector*.

    f. Select *0.6465 um Land/Cloud Boundaries -> Brightness*.

    g. Click **Create Display**. The 02:50 UTC 0.6465 μm image is displayed in the **Main Display** window.
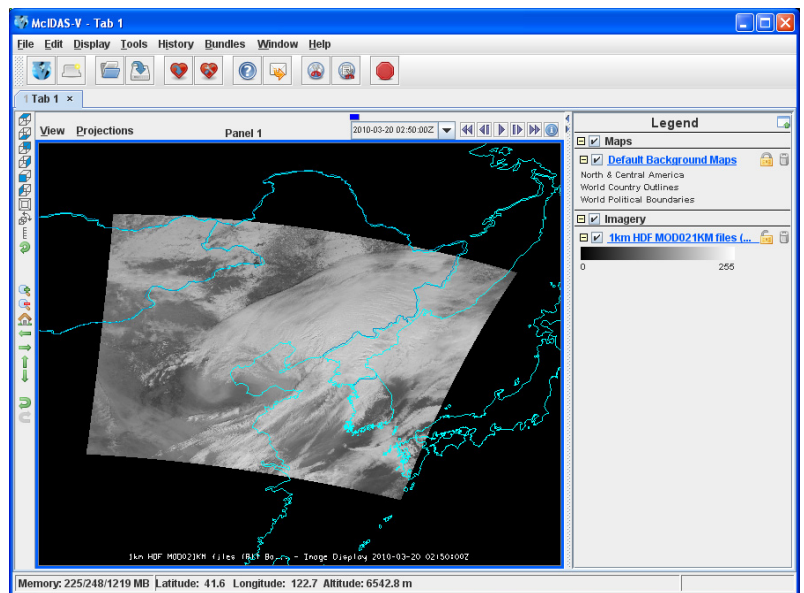
3. Use the zooming and panning controls in the left toolbar to inspect the image.

   a. Reset the display projection by clicking on the 🏠 icon below the zooming buttons on the left toolbar.

   b. Reproject the image with a pre-defined domain. Select **Projections -> Predefined -> Asia**. Use the scroll wheel to zoom into the image or *Shift + Left Click + Drag* a box around the image.

   c. Turn off the **Auto-set Projection** option under the **Projections** menu. When this option is checked, the projection will automatically change to the native projection of the new layer. When this option is unchecked, all new layers will be reprojected into the current projection.

4. Edit the maps in the display by using the options in the *Layer Controls*.

   a. Click on *Default Background Maps* in the **Legend** to go to the *Layer Controls*. The map controls will have two tabs. The first *Maps* tab lists the available maps, and the second *Settings* tab allows the user to control latitude and longitude lines, as well as the Z level of the maps in the 3D display.

   b. In the *Maps* tab, you can remove a map, change its visibility, line width, style and color. Use these options to create your own map display.

   c. If you choose, also add latitude and longitude lines in the **Settings** tab.

   d. To save a map configuration as the default, in the *Layer Controls* select *File -> Default Maps -> Save as the Default Map Set*. The next time you open a new tab, window, or start McIDAS-V, the defaults will reflect what you selected.

5. Return to the *Field Selector* to load an infrared image.

   a. Select ***11.0186 um Surface/Cloud Temperature -> Temperature*** .

   b. Click **Create Display**.

6. The 11.0186 μm temperature image is overlaid on top of the visible image. To see the visible image, turn off the top *1km HDF MOD021KM (All Bands...)* checkbox in the **Legend**. Turn the image back on and click and drag the middle mouse button to activate the **Cursor/Data Readout** option. This option brings up a latitude, longitude, and data value readout in the upper left part of the display on a mouse drag. Since there are two layers in the main display, there are two different readouts with the appropriate values and units.

7. Change the font and color of the labels on the **Main Display**.

   a. Choose *Edit -> Preferences*. Click on *Display Window*.

   b. In the right column under *Layer List Properties,* change *Font:* to Arial/Plain/14. Change the *Color:* to a yellow hue. Click **OK**.

   c. Return to the **Main Display** to see the changes.

8. Notice the labels are the same in the **Legend** and on the main display window label. This can be customized.

   a. *Right Click* on the top **Legend** label *1km HDF MOD021KM (All Bands...)*.

   b. Choose *Edit -> Properties... .* Enter the following for the **Legend Label** and **Layer Label**:
      - **Legend Label** – *11.0186 um TERRA*
      - **Layer Label** - *%datasourcename% - 11.0186 um- %timestamp%*
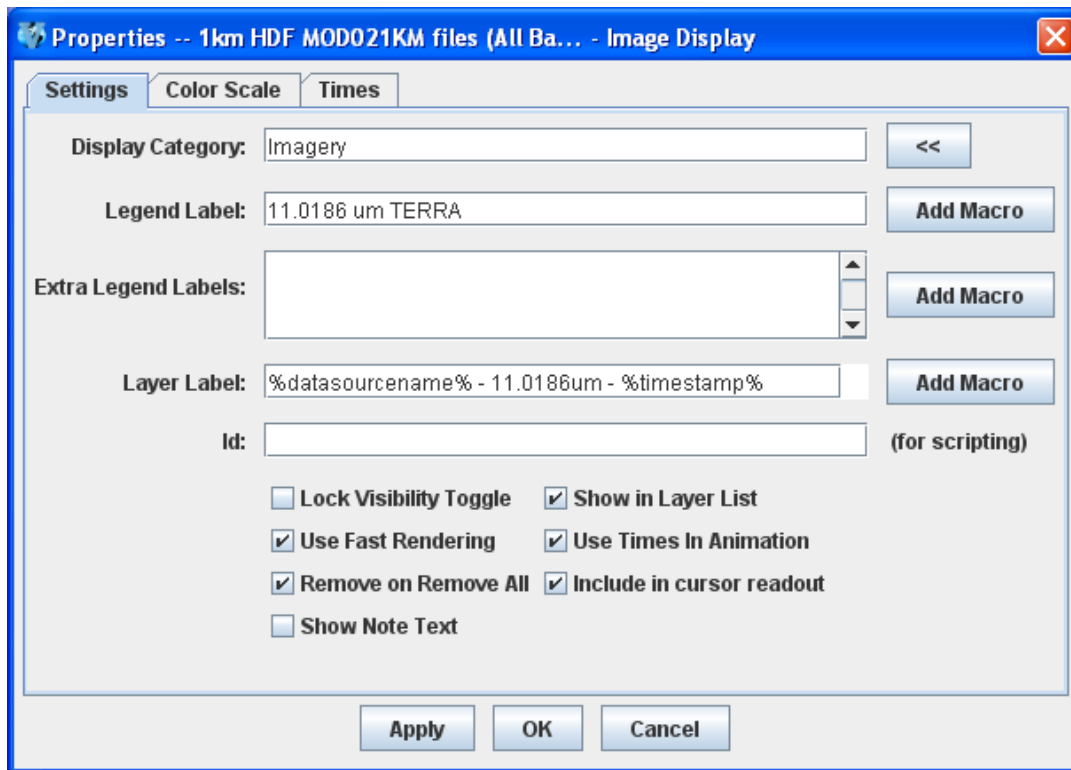
9. Return to the *Data Sources* to load another time.

   a. Select an **Absolute** time of 02:55 UTC. Click **Add Source**.

   b. A new data source is created in the *Field Selector*. To distinguish it from the first data source, the label is editable. *Right Click* on the highlighted *1km HDF MOD021KM (All Bands...)* and choose **Properties**. In the **Name:** field enter, 1km HDF 2:55 UTC MOD021KM. Click **OK**.

   c. Select *0.6465 um Land/Cloud Boundaries -> Brightness*.

   d. Click **Create Display**. The 02:55 UTC 0.6465 μm image is displayed in the **Main Display** window with the other displays also visible (because the **Auto-set Projection** setting is unchecked).

   e. In the **Legend**, click on the trash can next to **11.0816 μm TERRA** to remove the infrared display (the middle one listed with the color table range of 0 to 295.7).

10. Create a local dataset to access other polar orbiter imagery files on your local machine.

   a. In the **Main Menu Bar** in the **Main Display** window of McIDAS-V, select **Tools -> Manage ADDE Datasets.**

   b. In the ADDE Data Manager, select **File -> New Local Dataset.** To set up a dataset with the HRPT (High Resolution Picture Transmission) NOAA-18 AREA files provided with this tutorial enter the following parameters: **Dataset: HRPT Image Type:** HRPT N18 area files **Format:** McIDAS AREA. Under **Directory:**, select the *<local path>*/**Polar/HRPT_areas** directory.

   c. In the ADDE Data Manager, select **File -> New Local Dataset.** To set up a dataset with the GAC (Global Area Coverage) NOAA-18 AREA files provided with this tutorial enter the following parameters: **Dataset: GAC Image Type:** GAC N18 area files **Format:** McIDAS AREA. Under **Directory:**, select the *<local path>*/**Polar/GAC_areas** directory.

   d. Close the ADDE Data Manager by clicking "X" in the upper right-hand corner or select *File -> Close*.

11. Remove the satellite image layers from the previous display.

   a. Select *Edit -> Remove -> All Layers and Data Sources*.

   b. Select **<LOCAL-DATA>** for **Server:**, select HRPT for **Dataset:**, click **Connect**.

   c. Choose the *HRPT N18 area files* **Image Type** and select an **Absolute** time of 04:45:04 UTC.

   d. Select **Lat/Lon** for the **Navigation:**.

   e. Click **Add Source** to show the *Field Selector*.

   f. Select *10.8 um Surface/Cloud-top Temp -> Temperature*.

   g. Under **Displays** click on the **Advanced** tab. Click on the green arrow icon to load the full image. Change the **Magnification** to 1 X 1 with the sliders, and click **Create Display**. (The **Magnification** of 1 X 1 downloads the full resolution of the data. Negative magnification values will reduce the amount of data downloaded. For example, -5 X -5 will sample the data, and every fifth line and every fifth element is sent from the server.)

   h. There are some bad data points in this image that cause the minimum and maximum values of the color table to be 0 and 6553.1. Change the range of the color table by right clicking on the color table in the Legend, selecting Change Range..., and entering the values 330 and 180..

12. Load an FY2E satellite image over the HRPT image. This dataset was previously created in the *Displaying Satellite Imagery* tutorial.

   a. From the *Satellite -> Imagery* chooser select **<LOCAL-DATA>** for **Server:**, select ZQ_IR for **Dataset:**, click **Connect.**

   b. Choose the *FY2E IR satellite data* **Image Type** and select an **Absolute** time of 05:01 UTC.

c. Click **Add Source** to show the ***Field Selector***.

d. Select ***10.8 um Surface/Cloud-top Temp -> Temperature***.

e. Under **Displays** click on the **Advanced** tab. Click on the green arrow icon to load the full image. Change the **Magnification** to 1 X 1 with the sliders, and click **Create Display**.

f. The **Auto-set Projection** is off from a previous exercise. To change to the FY2E image's projection, in the **Main Display** select ***Projections -> From Displays -> Image (GMSX) Projection from: Image Display***.

13. Zoom the Main Display over the HRPT image and place the HRPT image over the FY2E image.

a. Turn off the FY2E full disk image by unchecking the *FY2E IR Satellite Data* box in the **Legend**.

b. *Shift + Left Click + Drag* a box over the HRPT image to zoom into it.

c. Turn on the FY2E full disk image by rechecking the *FY2E IR Satellite Data* box in the **Legend**.

d. In the **Legend**, *right-click* on the *HRPT N18 area files* and select ***View -> Bring to Front***.

14. Make the data ranges the same for both images and compare them.

a. In the ***Legend***, *right-click* on the *FY2E IR satellite data's* color table and select ***Change Range...***. In the window enter **From:** 330 and **To:** 180. Click **OK**.

b. Use the middle mouse button to click and probe the data for a temperature comparison.

Problem Sets

The previous examples were intended to give you a general knowledge of how to load and display polar satellite data. The problem set below is intended to introduce you to new topics related to the data, as well as challenge your knowledge of McIDAS-V. We recommend that you attempt to complete the problem set before looking at the solution, which is provided below the problem set.

1. Load a loop of GAC (Global Area Coverage) NOAA-18 images on a Globe Display. Load visible and low-level water vapor images. Animate the loop on a rotating globe. Use the GAC N18 dataset created earlier in this tutorial.

2. Load a HRPT NOAA-18 image. Display the polar orbit track for the image using a two-line element text file with the Polar Orbit Track chooser. Add the swath width and antenna circles for the Wallops ground station.

Problem Set #1 – Solution

Load a loop of GAC (Global Area Coverage) NOAA-18 images on a Globe Display. Load visible and low-level water vapor images. Animate the loop on a rotating globe with a solid blue background image.

1. Create a globe display and load the data.

   a. Remove all layers and data sources.

   b. In the **Main Display** select *File -> New Display Tab -> Globe Display -> One Panel*.

   c. In *Data Sources*, select **<LOCAL-DATA>** for **Server:**, select GAC for **Dataset:**, click **Connect**.

   d. Choose the *GAC N18 area files* **Image Type** and select a **Relative** time of *8 most recent*.

   e. Select *Lat/Lon* for the **Navigation:**.

   f. Click **Add Source** to show the *Field Selector*.

2. Select the 0.63 μm and 12.0 μm bands and display them.

   a. Select *0.63 um VIS Cloud and Surface Features -> Brightness*.

   b. Under **Displays** click on the **Advanced** tab. For **Coordinate Type:** choose **Image Coordinates**. Change the **Magnification** to 1 X 1 with the sliders. Click on the green arrow icon to load the full-size image. For **Location:** choose **Upper Left**, and click **Create Display**.

   c. Repeat this process with the *12.0 um IR SFC/Cloud Temp, Low-level WV -> Brightness*.

3. Animate the globe and add the background image. Then analyze and animate the globe display.

   a. Select *Display -> Add Background Image*.

   b. In the *Layer Controls* in **Layer:** choose **Solid Blue**.

   c. Start the loop by using the Time Animation buttons at the top of the **Main Display**. Turn on the **Auto-Rotate view** option (*View -> Viewpoint* from the main display window, or the Auto-Rotate button in the Viewpoint Toolbar to the left of the image).

   d. Change the orientation of the globe in the **Main Display** with the mouse controls. Restart the **Auto rotate view**.

Problem Set #2 – Solution

Load a GAC NOAA-18 image. Display the polar orbit tracks for the image using a two-line element text file with the Polar Orbit Track chooser. Add the swath width and antenna circles for the Wallops ground station.

1. Display the 19:46:04 UTC NOAA-18 image in a new tab.

    a. Remove all layers and data sources. Click the [icon] in the **Main Display** to create a new tab.

    b. Select **<LOCAL-DATA>** for **Server:**, select HRPT for **Dataset:**, click **Connect**.

    c. Choose the *HRPT N18 area files* **Image Type** and select an **Absolute** time of 04:45:04 UTC.

    d. Select **Lat/Lon** for the **Navigation:**.

    e. Click **Add Source** to show the *Field Selector*.

    f. Select *0.63 um VIS Cloud and Surface Features -> Brightness*.

    g. Under **Displays** click on the **Advanced** tab. For **Coordinate Type:** choose **Image Coordinates**. Change the **Magnification** to 1 X 1 with the sliders. Click on the green arrow icon [icon] to load the full-size image. For **Location:** choose **Upper Left**, and click **Create Display**.

    h. Reproject the display to the continental United States domain. In the **Main Display**, select *Projections -> Predefined -> US -> CONUS*. Zoom into the image to fill the display.

2. Display the polar orbit tracks from a two-line element file.

    a. Select the *Under Development -> Imagery – Polar Orbit Track* chooser from the *Data Sources* tab.

    b. Click the **URL** radio button. Enter the directory path to the two-line element file, noaa18.txt, with the file:/// nomenclature, then click **Add Source**:

    Windows:

    ◉ URL
    URL: file:///C:/Users/jayh/Polar/noaa18.TXT

    Unix:

    ◉ URL
    URL: file:///home/jayh/Polar/noaa18.TXT

    c. Under **Displays** click **Polar Orbit Track**. In the **Time Range** tab enter Apr 26, 2012 in both **Date:** fields. Then enter 19:30 in **Begin Time:**, and enter 20:00 in **End Time:**. Click **Create Display**.

    d. In the *Layer Controls*, enter 3000 in **Swath Width:**. Enter 5 in **Font Size:**. In **Ground Station:** click the arrow to show the list of stations, choose **Wallops14** (near the top of the list).

Zooming, Panning, and Rotating Controls

Zooming	Panning	Rotating
	Mouse	
Shift-Left Drag: Select a region by pressing the *Shift* key and dragging the left mouse button. **Shift-Right Drag:** Hold *Shift* key and drag the right mouse button. Moving up zooms in, moving down zooms out.	**Control-Right Mouse Drag:** Hold *Control* key and drag right mouse to pan.	**Right Mouse Drag:** Drag right mouse to rotate.
	Scroll Wheel	
Scroll Wheel-Up: Zoom Out. **Scroll Wheel-Down:** Zoom In.		**Control-Scroll Wheel-Up/Down:** Rotate clockwise/counter clockwise. **Shift-Scroll Wheel-Up/Down:** Rotate forward/backward clockwise.
	Arrow Keys	
Shift-Up: Zoom In. **Shift-Down:** Zoom Out.	**Control-Up arrow:** Pan Down. **Control-Down arrow:** Pan Up. **Control-Right arrow:** Pan Left. **Control-Left arrow**: Pan Right.	**Left/Right arrow:** Rotate around vertical axis. **Up/Down arrow:** Rotate around horizontal axis. **Shift-Left/Right arrow:** Rotate Clockwise/Counterclockwise.