McIDAS-V Tutorial
Displaying Polar Satellite Imagery
updated November 2023 (software version 1.9)

McIDAS-V is a free, open source, visualization and data analysis software package that is the next generation in SSEC's 50-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. 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 - https://mcidas.ssec.wisc.edu/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*).

Displaying Local MODIS Data

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** – *Canada Fires*
   - **Format** – *MODIS MOD 02 – Level-1B Calibrated Geolocated Radiances*
   - **Directory** – select the *<local path>*/**Data/Polar/modis_files** directory

   c. Click **Add Dataset**.

   d. Close the **ADDE Data Manager** by clicking **Ok** or *File -> Close*.

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

   a. Click on the 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 the **Server**, select *MODIS* for the **Dataset**, and click **Connect**.

   d. Choose the *Canada Fires* **Image Type** and select an **Absolute** time of *14:55 UTC*.

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

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

   g. In the *Advanced*, click the green four arrow button to get the full resolution and full domain of the data.

h. Click **Create Display**. The 14:55 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. Specifically, notice the smoke from the fires in southern Quebec, Canada.

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

   b. 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. Return to the *Field Selector* to load a surface/cloud temperature image.

   a. Select *3.7882 um Surface/Cloud Temperature -> Temperature*.

   b. In the *Advanced*, click the green four arrow button to get the full resolution and full domain of the data.

   c. Click **Create Display**. The 3.7882 μm temperature image is overlaid on top of the visible image. To see the visible image, turn off the top *HDF MOD02 1km file (All Bands...)* checkbox in the **Legend**. Turn the visibility of the 0.6465 μm back on.

5. Modify the enhancement range to make the fire pixels easier to locate.

   a. Zoom in on the region where the data is displayed in the **Main Display**.

   b. *Right-Click* on the grayscale enhancement for the 3.7782 μm layer in the **Legend** and choose *Change Range*.

   c. In the **Change Range** window, change the **To** value to *340* and click **OK**.

   d. *Right-Click* on the grayscale enhancement for the 3.7882 μm layer in the **Legend** and choose the *Satellite -> Fire – Transparent* enhancement.
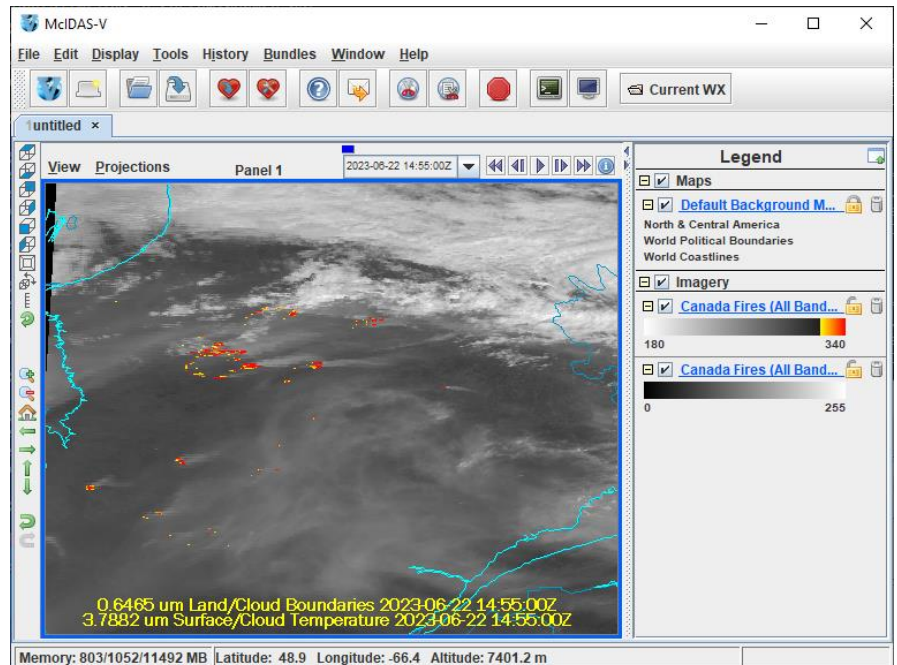
   This makes high end temperatures yellow, orange, and red, while the lower end cooler temperatures are 100% transparent, allowing the 0.6465 μm data to be seen.

6. Use the cursor readout option to see the temperature values for the fire pixels.

a. Click and drag the middle mouse button to activate the **Cursor/Data Readout** option and list the latitude, longitude, and data value under the cursor. Since there are two layers in the main display, there are two different readouts with the appropriate values and units. Notice the high 3.7882 μm temperature values are located at the location of the fire. The data probe from the cursor/data readout option shows that values in the fire are approximately 50 degrees K warmer than outside of the fire.

7. 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 *Lat/Lon* tab allows the user to control latitude and longitude lines and labels. At the bottom of both tabs, there is a **Position** slider that allows you to control the vertical positioning of the maps in the **Main 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 and labels in the *Lat/Lon* 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.

8. Notice that both layers are labeled the same in the **Legend**. Change the text of the labels in the **Main Display**.

   a. *Right Click* on the top *Canada Fires (All Bands)* label in the **Legend** and select *Edit -> Properties*.

   b. Enter the following for the **Legend Label**: *3.7882um - %datasourcename%*
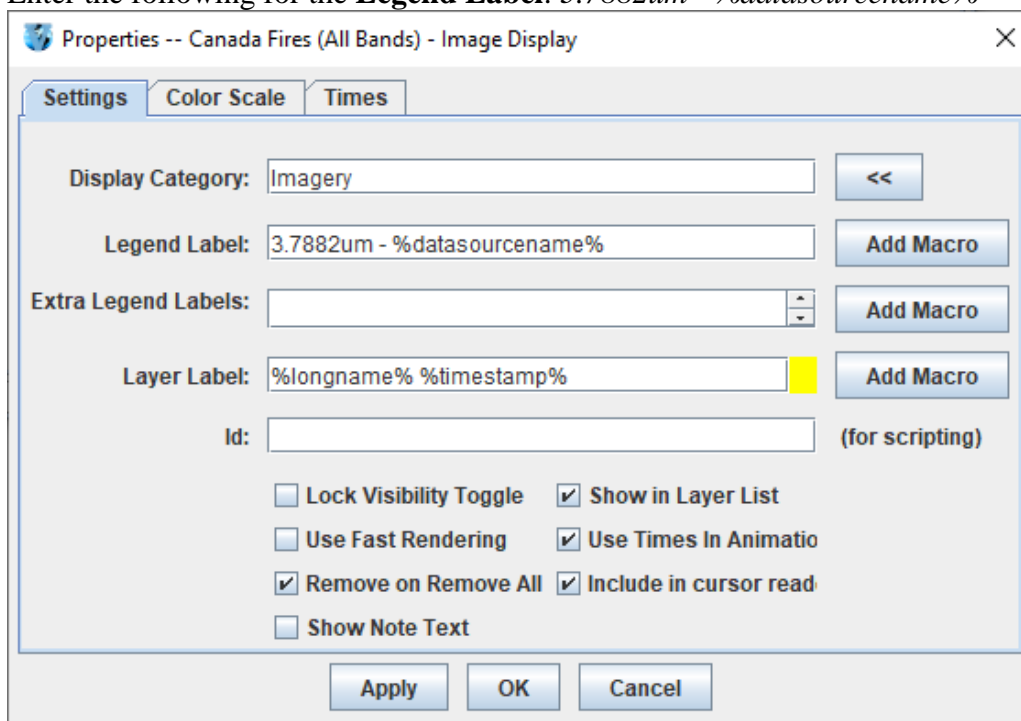
9. Display a true color RGB image of the scene and it with the 3.7882 μm data.

    a. In the *Field Selector*, choose *Imagery -> MODIS Functions -> MODIS True Color RGB*.

    b. In the **Displays** panel, select *Imagery -> 3 Color (RGB) Image*.

    c. Click **Create Display**.

    d. Inspect the display and notice how the true color RGB image is displayed on top of the other layers. Bring the 3.7882um layer to the front *Right-Clicking* on the blue text of the layer in the **Legend** and selecting *View -> Bring to Front*.

Displaying Local NOAA-19 Data

1. Create a local dataset to access the AVHRR (Advanced Very High Resolution Radiometer) NOAA-19 HRPT (High Resolution Picture Transmission) polar orbiter imagery files on your local machine.

    a. In the **Main Menu Bar** of the **Main Display** window, select *Tools -> Manage ADDE Datasets*. This will open the **ADDE Data Manager**.

    b. Select *File -> New Local Dataset*. Enter the following parameters to set up the dataset:

    - **Dataset** – *AVHRR*
    - **Image Type** – *NOAA-19*
    - **Format** – *NOAA AVHRR L 1b*
    - **Directory** – select the *<local path>*/**Data/Polar/AVHRR** directory.

    c. Click **Add Dataset**.

    d. Close the **ADDE Data Manager** by clicking **Ok** or select *File -> Close*.

2. Remove all layers and data sources and display AVHRR 3.74 μm Temperature data.

    a. In the **Main Display** select *File -> New Display Tab -> Map Display -> One Panel*.

b. In the *Satellite -> Imagery* chooser of the *Data Sources* tab of the **Data Explorer**, select *<LOCAL-DATA>* for the **Server**, select *AVHRR* for the **Dataset**, and click **Connect**.

c. Choose the *NOAA-19* **Image Type** and select an **Absolute** time of *14:06:22 UTC*.

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

e. Select *3.74um IR Low Cloud/Fog, Fire Detection -> Temperature*.

f. Under **Displays** click on the *Advanced* tab. Click on the green arrow icon next to **Image Size** 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* loads and displays the full resolution of the data. Negative magnification values will reduce the amount of data loaded and displayed. For example, *-5* X *-5* will sample the data, and every fifth line and every fifth element is sent from the server.

g. Change the display to the World projection through the *Projections -> Predefined -> World* menu item. Use *Shift+Left-Click+Drag* to zoom in over the data.

h. Optionally, modify the display to highlight the fire activity as was done previously with the MODIS data. This can be done by changing the enhancement and adjusting the enhancement range.

Problem Sets

The previous examples were intended to give you a general knowledge of how to load and display polar satellite data. The problem sets below are 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 each problem set before looking at the solutions, which is provided below the problem set.

1. Using the *<local path>*/**Data/Polar/MOD02/*** data, create a local dataset, and display an animation of 3 times of data on a globe display with a blue marble background basemap. Disable auto-set projection in the new display tab and display the data using Line/Element navigation so the data will plot at the correct location for each timestep. These are all daytime images, so displaying any visible or infrared band will produce good images.

Problem Set #1 – Solution

Using the *<local path>*/**Data/Polar/MOD02/*** data, create a local dataset, and display an animation of 3 times of data on a globe display with a blue marble background basemap. Disable auto-set projection in the new display tab and display the data using Line/Element navigation so the data will plot at the correct location for each timestep. These are all daytime images, so displaying any visible or infrared band will produce good images.

1. Remove all layers and data sources, 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 the *Data Sources* tab of the **Data Explorer,** using the *Satellite -> Imagery* chooser, select *<LOCAL-DATA>* for the **Server**, select *MODIS* for the **Dataset**, and click **Connect**.

   d. Choose the *Canada Fires* **Image Type**. In the *Relative* tab, enter a value of *3* for **Number of times**.

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

2. Select the 3.7882 μm Temperature and display the data for all three timesteps.

   a. Select *3.7882 um Surface/Cloud Temperature -> Temperature*.

   b. Under **Displays** click on the *Advanced* tab. For **Coordinate Type:** choose **Image Coordinates**. Click on the green arrow icon ⬈⬋ next to **Image Size** to load the full-size image. For **Location:** choose *Upper Left*, and click **Create Display**.

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

   a. From the **Main Display**, select *Display -> Add Background Image*. In the *Layer Controls* for the background image, select **Blue Marble – Static** from the *Layer* dropdown..

   b. Start the loop by using the Time Animation buttons at the top of the **Main Display**.

   c. 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**.

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/counterclockwise. **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.