McIDAS-V Tutorial

Displaying Satellite Orbit Tracks Data
updated April 2024 (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 - https://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*).

Introduction

McIDAS-V has the ability of displaying TLE (Two Line Elements) Satellite Orbit Track data through the *Satellite Orbit Track* chooser. TLE data can be loaded into the Field Selector in three ways:

- Through a local file on your machine or a mounted drive
- Through ADDE
- Through a URL

This tutorial will describe how to load data through a local file and a URL. Different options for customizing the display will be covered as well.

Displaying TLE Data from a Local File

1. In the **Main Display**, remove all layers and data sources via the *Edit -> Remove -> All Layers and Data Sources* menu item.

2. Create a new tab with the *File -> New Display Tab -> Map Display -> One Tab* menu item.

3. Create a data source of satellite track data from a local file.

    a. In the *Data Sources* tab of the **Data Explorer**, navigate to the *Satellite -> Orbit Track* chooser.

    b. Under **Local**, verify that *File* is selected.

    c. Navigate to the *<local path>*/**Data/SatelliteTracks** directory and select *noaa.txt*.

    d. Click **Add Source**.

4. Display a full day's worth of NOAA-21 (JPSS-2) tracks from August 23, 2023.

    a. In the **Fields** panel of the *Field Selector*, select the *NOAA 21 (JPSS-2) [+]* field.

    b. In the **Displays** panel, select *Satellite Orbit Track*.

    c. The **Time Range** panel allows for selecting the beginning and ending date/time of the track to plot. McIDAS-V will default to displaying the tracks from 00:00:00Z – 23:59:59Z on the current date. To display the full track from August 23, 2023, click on the calendar widget (📅) next to **Begin Date** and select *Aug 23, 2023*. Repeat this process for the **End Date** field.

    d. Click **Create Display**.
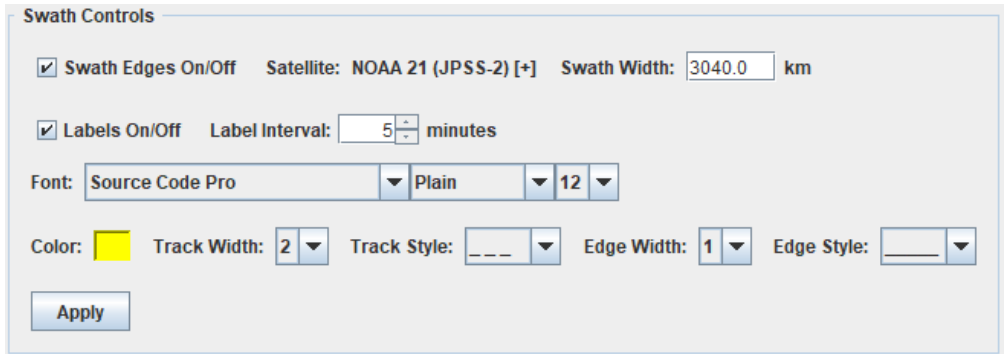
5. Inspect the display of the NOAA-21 tracks.

a. When the display is created, you may see horizontal lines going across the display, as is shown here:
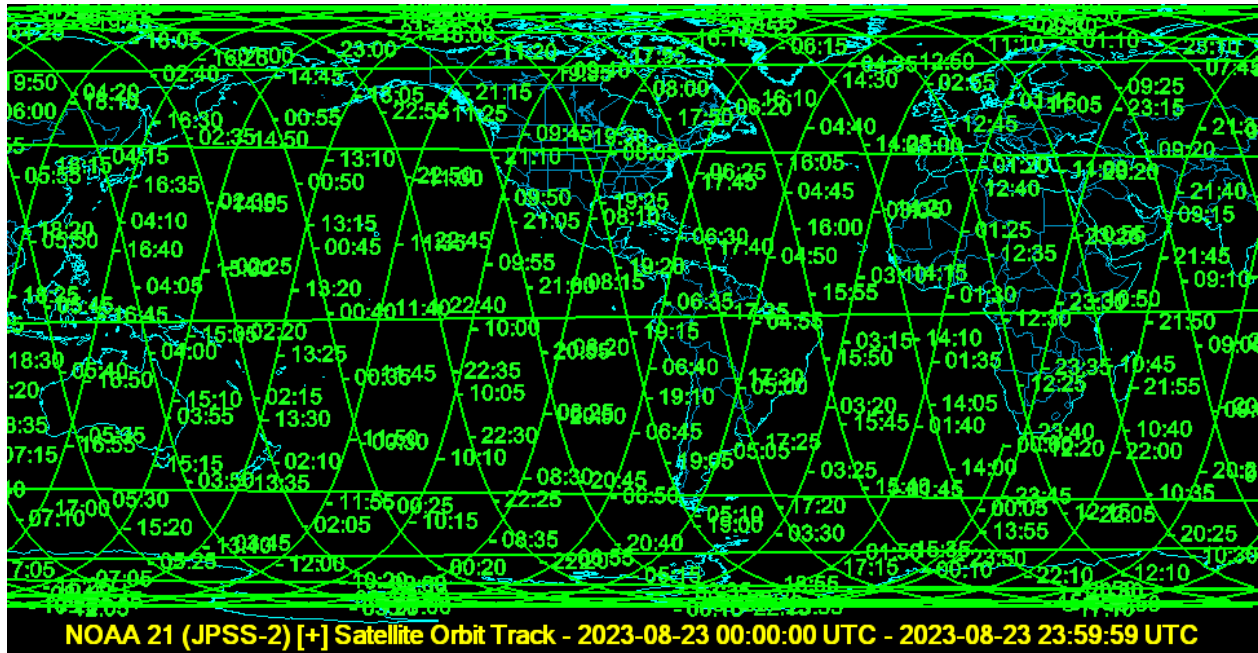
If you see these horizontal lines, go to the *Layer Controls* tab of the **Data Explorer** for the orbit track layer and select *Edit -> Properties*. At the bottom of the **Properties** window, uncheck **Use Fast Rendering** and click **OK**. Once this is done, the display may look like the following image:
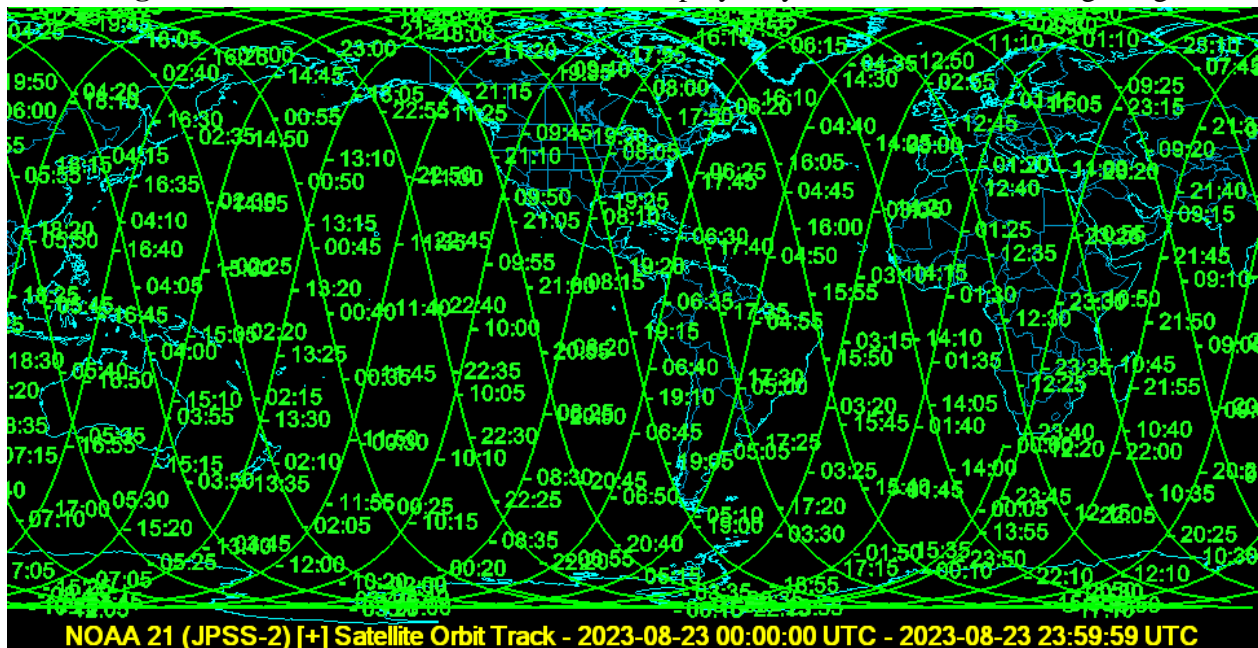

There are times where disabling fast rendering can remove spurious lines. There are other times where enabling fast rendering can fix gaps in lines when viewing a polar projection. In general, if the display's lines don't look correct, changing the fast rendering setting for the layer is a good idea.

b. Zoom in on the region of interest in the **Main Display** by using *Shift+Left-Click+Drag*. For example, select an area over the central United States. Observe the track times, and determine a good time range where the track lines cross through the United States. The times are written along the track. For example, you may determine a time range of 19:20 through 19:35 is good. In the next section of this tutorial, this time range will be plotted.

6. Create a new tab via the *File -> New Display Tab -> Map Display -> One Panel* menu item.

7. Display NOAA-21 satellite tracks for the time range chosen in step 5b.

   a. From the *Field Selector* tab of the **Data Explorer** select *NOAA 21 (JPSS-2) [+]*.

   b. In the **Time Range** panel, verify that Aug *23, 2023* is selected for the **Begin Date** and **End Date** fields. For **Begin Time**, enter *19:20:00* (or the start time determined in step 5b) and for **End Time** enter *19:35:00* (or the end time determined in step 5b) and click **Create Display**.

8. Modify different aspects of the track line display.

   a. Zoom in over the track data in the **Main Display** by using *Shift+Left-Click+Drag*.

   b. Add swath edge lines to the display by going to the *Layer Controls* and enabling **Swath Edges On/Off**.

   c. By default, time labels are drawn along the track every 5 minutes. Change the display to show time labels at every minute by going to the *Layer Controls*, setting **Label Interval** to *1*, and clicking **Apply**.

   d. From the *Layer Controls*, change the color of the lines and labels in the display to yellow by clicking on the green **Color Swatch**, selecting *Yellow*, clicking **OK** in the **Color** window, and clicking **Apply**.

   e. From the *Layer Controls*, change the **Track Style** from a solid line to a dashed line by using the dropdown menu and click **Apply**.

   f. From the *Layer Controls*, change the **Edge Style** from a dashed line to a solid line by using the dropdown menu and click **Apply**.

9. Add a SSEC (Space Science and Engineering Center) ground station to the display.

a. From the **Ground Stations** panel of the *Layer Controls*, select *SSEC* for the **Ground Stations Available** menu and click **Add Selected**.

Investigate the display. A ground station for SSEC has been added to the display over south central Wisconsin. There is a ring around the ground station that denotes the region where an antenna at the SSEC ground station can detect the NOAA-21 satellite. The size of this ring is based on the altitude of the satellite as well as the **Antenna Angle**, which is defined at the bottom of the *Layer Controls*. This is the angle that the antenna at the SSEC ground station scans at. Once the ground station is added, the final display may look like:
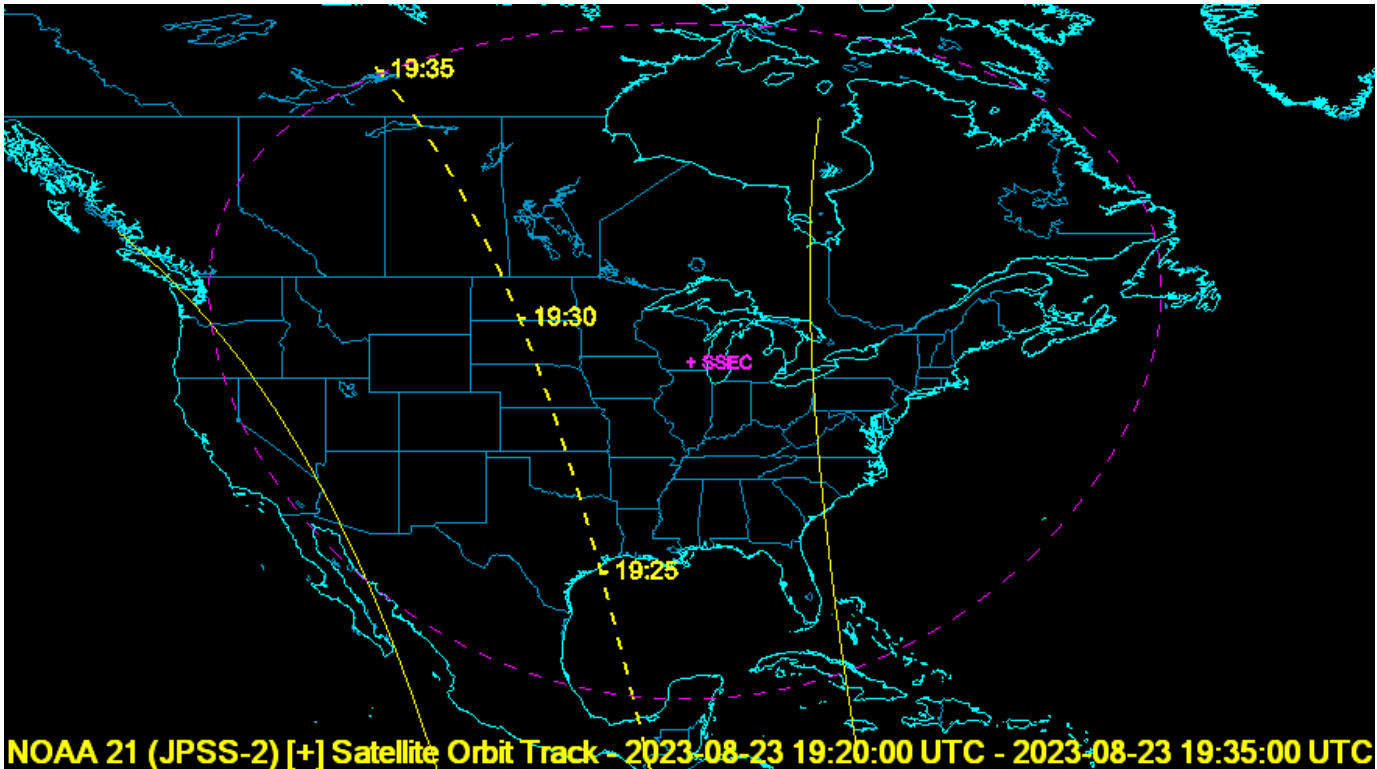
Displaying TLE Data from a URL

10. Remove all layers and data sources from the previous displays via the *Edit -> Remove ->All Layers and Data Sources* menu item in the **Main Display**.

11. Create a new tab via the *File -> New Display Tab -> Map Display -> One Panel* menu item.

12. Remove all previous tabs, so only the tab created in step 11 is in the **Main Display**.

13. Create a data source of satellite track data from a URL.

a. In the *Data Sources* tab of the **Data Explorer**, navigate to the *Satellite -> Orbit Tracks* chooser.

b. Under **Remote**, select *URL*.

c. Verify that the default URL of *https://www.celestrak.com/NORAD/elements/noaa.txt* is in the text field.

d. Click **Add Source**.

14. Display six hours of NOAA 20 satellite tracks for the current date.

    a. From the *Field Selector* tab of the **Data Explorer** select *NOAA 20*.

    b. In the **Displays** panel, select *Satellite Orbit Track*.

    c. In the **Time Range** panel, verify that the current date is entered for the **Begin Date** and **End Date** fields. For **Begin Time** and **End Time**, enter a 6 hour range. For example, 02:00:00Z – 08:00:00Z.

    d. Click **Create Display**.

    e. If horizontal lines are visible in the display, repeat step 5a to change the fast rendering setting of the layer.

15. Add a ground station from the **Ground Stations Available** menu to the display.

    a. From the **Ground Stations** panel of the *Layer Controls*, select a station (such as *Madrid26*) for the **Ground Stations Available** menu and click **Add Selected**.

    b. At the bottom of the **Ground Station Controls** in the *Layer Controls*, change the **Color** to red, **Line Width** to *2*, and **Line Style** to *solid*. Click **Apply**.

    c. Note how the ground station in the **Main Display** changed from the previous step. At the bottom of the *Layer Controls*, change the **Antenna Angle** to *20* and click **Apply**. With the higher elevation angle, you should notice that the ring around the ground station becomes smaller.

16. Add a custom ground station to the display

    a. In the **Main Display** window, choose a latitude/longitude location contained in the region where the track lines are located. To do this, move your cursor over the display and record the latitude/longitude readout at the bottom of the window.

    b. In the **Ground Station Controls** panel of the *Layer Controls*, add a custom ground station at the location determined in step 16a at an altitude of 0 meters. The **Label** can be chosen by the user. For example, the **Custom Ground Station** values could be:

    Label: *Grand Cayman*
    Lat: *19.3*

Lon: *-81.3*
Alt: *0*

   c. Click **Add Custom**.

17. Investigate and update the display.

   a. After the completion of step 16, the custom ground station will be displayed and it should look similar to the ground station added in step 15. This is because any newly-added stations will use the **Color**, **Line Width**, **Line Style**, and **Antenna Angle** defined at the bottom of the *Layer Controls*.

   b. Change the first station plotted to yellow.

      i. For the **Ground Stations Plotted** menu, select the station added in step 15.

      ii. Change the **Color** at the bottom of the *Layer Controls* to yellow and click **Apply**.

        At this point, the ground station selected under the **Ground Stations Plotted** menu should change to yellow and the custom ground station displayed in step 16 should remain red.

   c. Remove the yellow ground station by clicking **Remove Selected** next to **Ground Stations Plotted**. This will remove the station selected under the **Ground Stations Plotted** menu and leave the other in the display.

18. Zoom in over your custom ground station and capture an image of the display.

   a. Zoom in over the ground station in the **Main Display** by using *Shift+Left-Click+Drag*.

   b. If the label of the ground station is too small, increase the font size using the controls at the bottom of the *Layer Controls* and click **Apply**.

   c. In the **Main Display** window, select *View -> Capture -> Image*.

   d. In the **Save In** menu of the **Save** window, select the directory to write the image to.

   e. In the **File Name** window, enter a file name. For example, *NOAA20_Ground_Station.jpg*.

   f. Under **Capture What**, select *Current View*.

   g. Click **Save** at the bottom of the **Save** window.

   h. View your image using a software package external to McIDAS-V, such as a web browser.

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.