McIDAS-V Tutorial:

Viewing Visible, Near Infrared and Infrared GOES-16 Cloud Moisture Imagery (CMI)

GOES-16 Preliminary, Non-Operational Data

0.64 µm   6.9 µm   13.3 µm
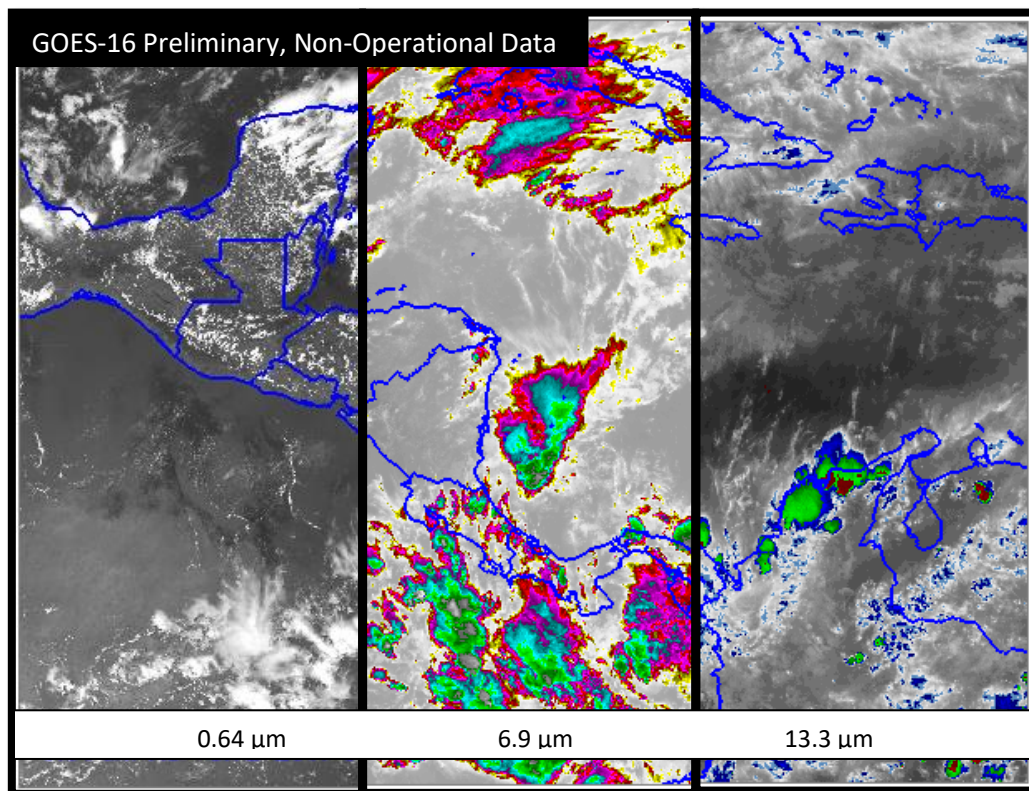
Contents

1. Getting Started

McIDAS-V

McIDAS-V is a visualization and data analysis software package. This tutorial assumes that you have little to no experience with the software. To download and install McIDAS-V visit the site below. At the time this tutorial was created McIDAS-V Version 1.6 was the latest available.

https://www.ssec.wisc.edu/mcidas/software/v/download.html

Be sure to check out the McIDAS-V online Documentation page, which includes a user's guide, tutorials and instructional videos, by clicking the link in the upper left corner.

GOES-16 CMI Data and McIDAS-V Bundle Files

The following instructions will load all 16 channels of full disk Level 2 GOES-16 Cloud Moisture Imagery (CMI)* on 19 April 2017 (Julian Day 109) at 1845 UTC. Create a directory where you can save the data on your system. In this tutorial we use *D:\McIDAS-V_Examples\GOES16_CMI_20170419*. The example data and two McIDAS-V bundle files (with the extension .mcv) can be found at:

ftp://rammftp.cira.colostate.edu/Dagg/McIDAS-V_Examples/GOES16_CMI_20170419

Download and save all the files to the new directory. For the McIDAS-V bundle files to function properly, it is important that they are located in the same directory as the data.

Note: GOES-16 data used in this tutorial are preliminary, non-operational data and are undergoing testing. Users bear all responsibility for inspecting the data prior to use and for the manner in which the data are utilized.

About This Tutorial

In this tutorial McIDAS-V data bundle files (with the extension .mcv) are used to quickly display the GOES-16 Cloud and Moisture Imagery (CMI) data (in netCDF format with the extension .nc) with predefined settings. The objectives of this exercise are to demonstrate that McIDAS-V can load a sub-sector of full disk images in the given netCDF file format, and to be able to view, probe, and compare the Level 2 CMI data in two groups: 6 visible and near infrared (IR) channels and 10 infrared channels. This exercise provides the user with many examples of environmental, meteorological, and hydrological features that are highlighted in the first six modules of the Satellite Foundation Course for GOES-R:

http://rammb.cira.colostate.edu/training/visit/training_sessions/satfc-g.asp

The example bundle files were created and worked well on an HP ENVY laptop with 16 GB of RAM. The main reason this tutorial focuses on a sub-sector of the data is that it takes more time and more memory for McIDAS-V to load the full resolution, full disk imagery that will be available through the GEONETCast Americas (GNC-A) broadcast. On the HP ENVY laptop McIDAS-V was able to individually load full resolution, full disk imagery for each channel except for channel 2 (0.64 um). On a new system with 128 GB RAM, it took 6.5 minutes to load the full 0.5 km resolution channel 2 file.

For more detailed instructions on loading the data for a selected region, adapting text labels and applying color tables yourself, see *McV_Tutorial_GOES16_16Channels_20170419_Long.pdf*. For instructions on loading a bundle file with a single channel's full resolution, full disk image, see *McV_Tutorial_GOES16_FullDisk_20170419_Bundle.pdf*.

2. McIDAS-V Windows

2.1   Open McIDAS-V. The following 3 windows will pop up:
- **Help Tips** – gives helpful hints (you can close this window)
- **Data Explorer** – where data is selected and layer properties are modified
- **Main Display** – shows a map projection and any selected data
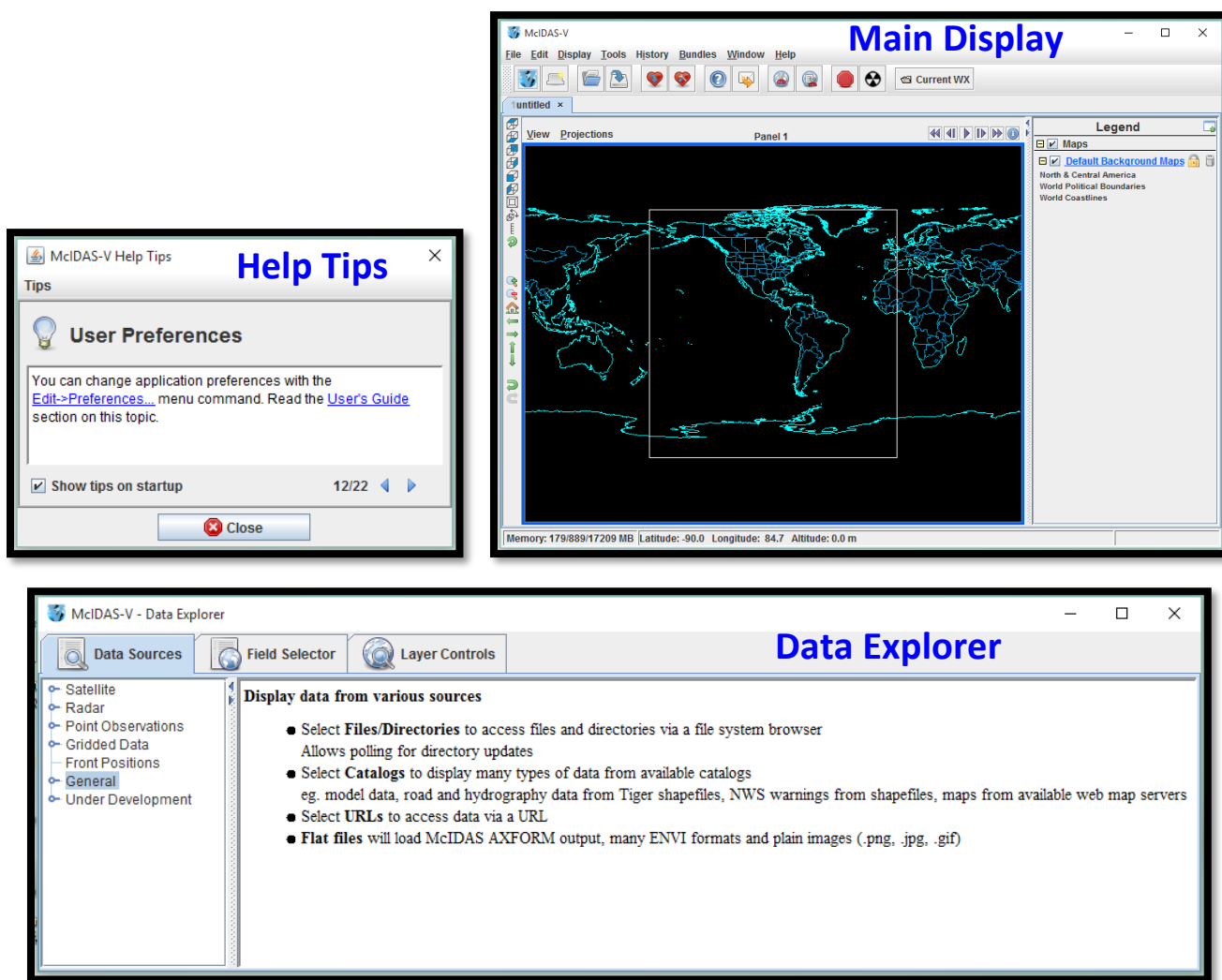
McIDAS-V Tip: When you start McIDAS-V the Data Explorer window opens automatically. If you accidentally close it or have multiple open, you can pull up the one belonging to a given Main Display window by clicking on the icon.

3. Loading the McIDAS-V Bundle File: Channels 1-6

3.1   Locate the directory with the McIDAS-V bundle file (.mcv) and GOES-16 CMI data files (.nc) for channels 1-6. Here they are in **D:\McIDAS-V_Examples\GOES16_CMI_20170419**.

3.2   Load the McIDAS-V bundle file.

a) From the **Main Display** window select **File → Open File…**
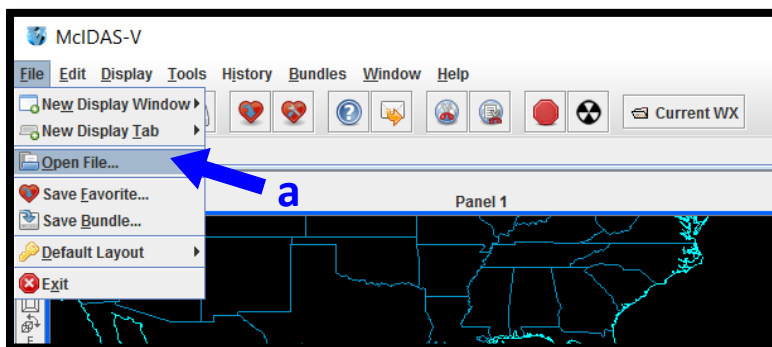
b) In the **Open File** window, use the **Look in** drop-down menu to navigate to **\GOES16_CMI_20170419**. Select the file **GOES16_CMI_20170419_Region_Ch1-Ch6_ColorTables_Labels_RelPath.mcv** and click the **Open** button.

c) In the **Open bundle** window, select **Merge with active tab(s)** and **Save as default preference.** Click the **OK** button.
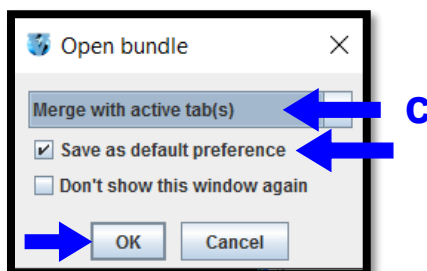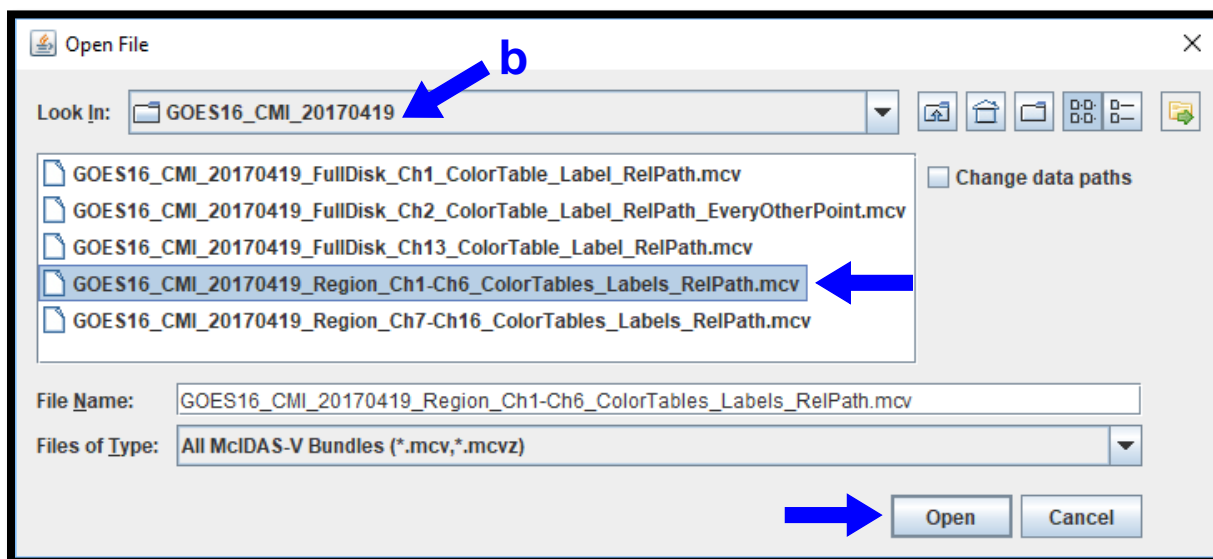
3.3   The bundle file will open with imagery from the 6 visible and near IR channels loaded in the
      Main Display window. You can choose channels to view by checking the boxes to the left of
      the labels in the **Legend** column. Labels for selected channels are displayed along the
      bottom of the image.
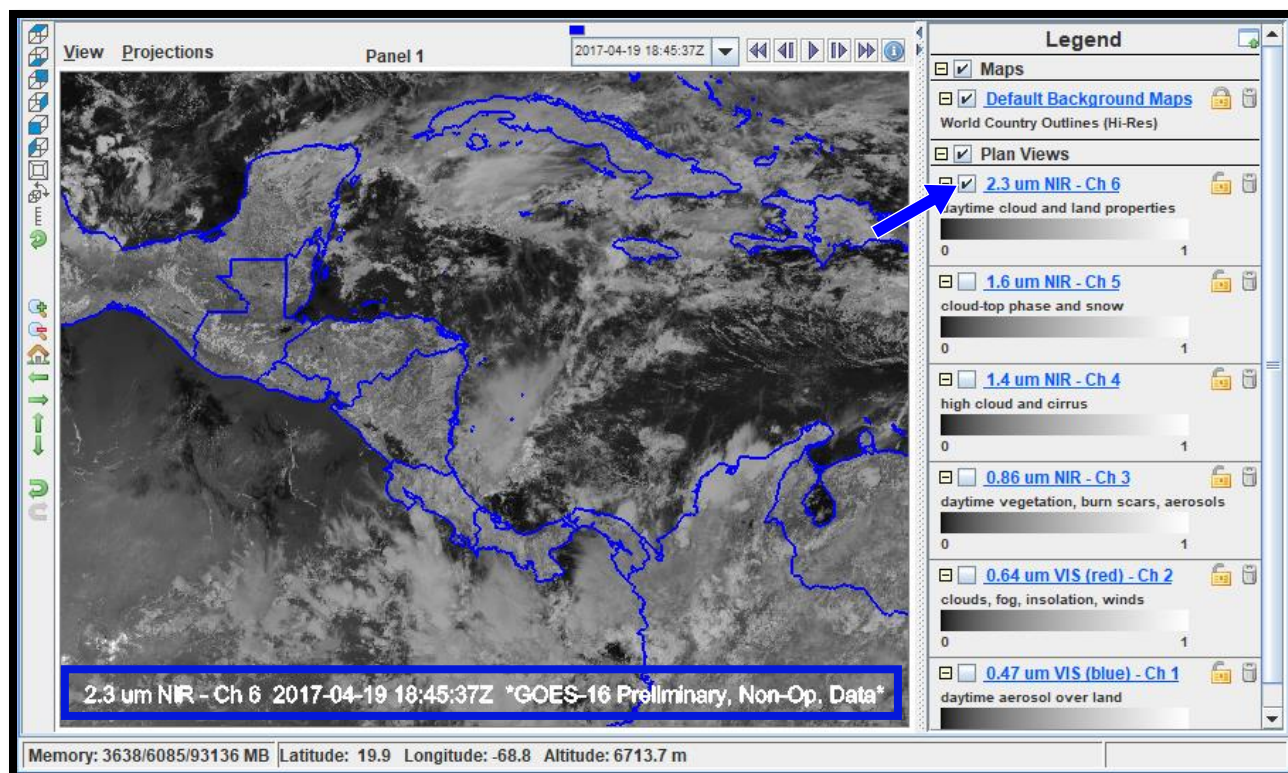
3.4   To view an animation of the imagery for the 6 channels, go to the **Main Display** window and
      click on the **View** tab. Select **Displays → Visibility Animation → On**. Here you can also
      choose to loop through the layers faster or slower.
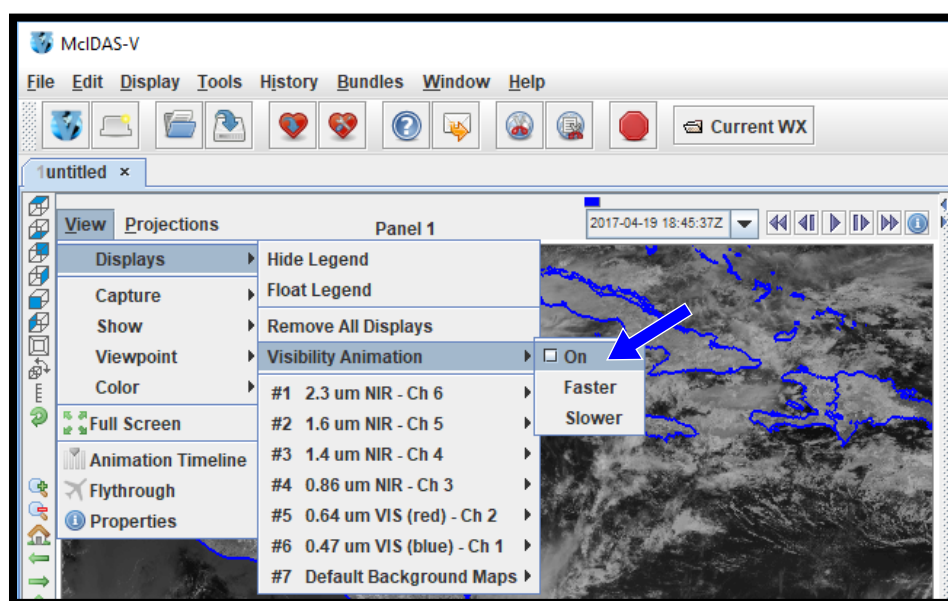
3.5   By clicking on the image with the mouse scroll wheel, the value at that location for each of the channels will be displayed in the lower right corner of the window. If you are using a laptop computer with a touchpad instead of a mouse, you will need to set the navigation controls in the user preferences (see instructions at the end of this document).
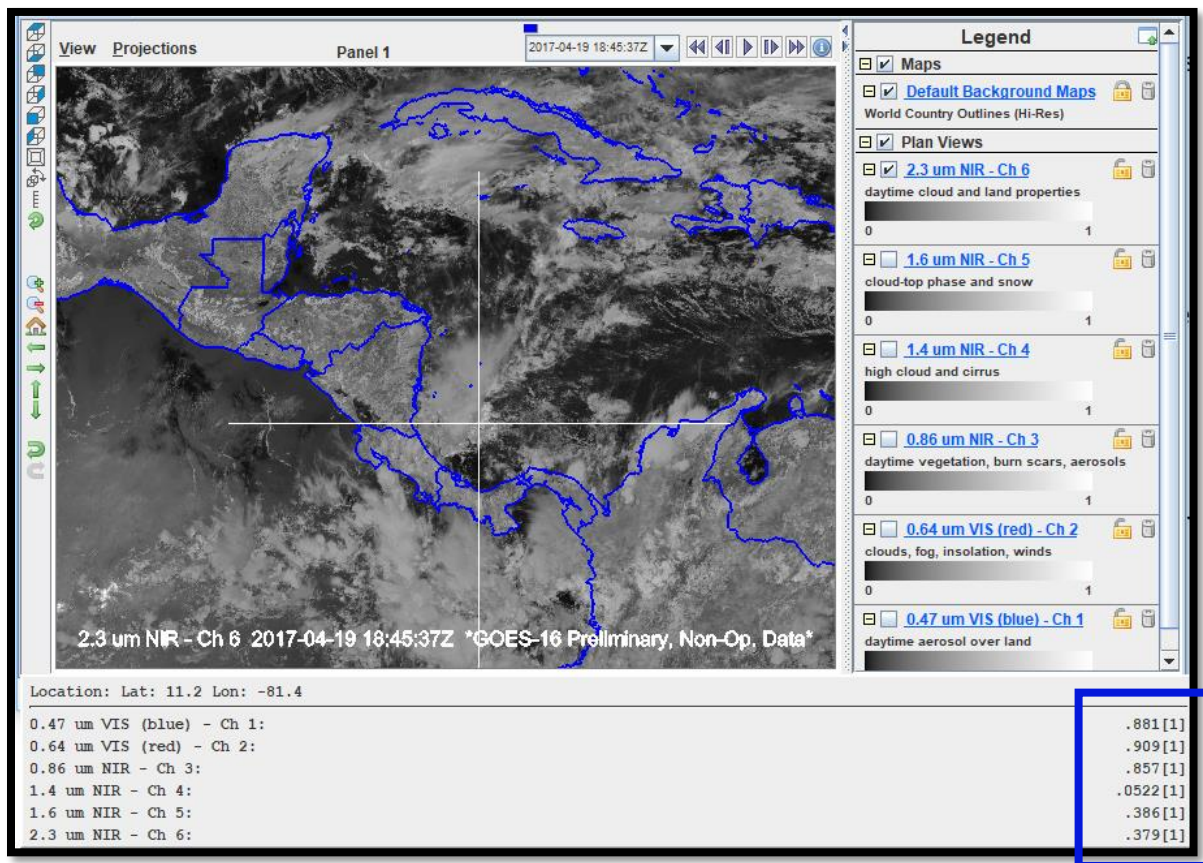
McIDAS-V Tip: The magnification icons and navigation arrows on the left hand side of the Main Display window can be used to change your display view. Refer to the McIDAS-V Shortcuts at the end of this document for a list of keyboard and mouse shortcuts.

3.6   Exploration:

Visible and near infrared channels are displayed as albedo, which is related to reflectance.

| Reflectance	Albedo	Appearance on Imagery
High	High	Brighter
Low	Low	Darker

   i.   Can you locate the following features across the 6 visible and near infrared channels?
        Why or why not?
           - low cloud
           - deep convective cloud
           - water surface
           - land surface
  ii.   Compare and contrast the reflectance/albedo across the 6 channels. Which channel
        depicts each feature the most clearly? Why?
 iii.   Which features in this example can be used in reference to section(s) of the first six
        modules in the Satellite Foundational Course for GOES-R/16 (SatFC-G)?
        http://rammb.cira.colostate.edu/training/shymet/satfc-g_intro.asp
 iv.   Refer to the spectral graphs at the end of the tutorial for cloud and land surface
        interpretation and comparisons of the different channel imagery from current GOES,
        GOES-16, and VIIRS.

4. Loading the McIDAS-V Bundle File: Channels 7-16

4.1   Before loading the next 10 GOES-16 channels, clear the current data. If you do not have memory limitations, skip this step! From the **Main Display** window, click the icon that looks like a circle with paper and scissors. In the **Confirm Removal** window that opens, click the **Remove all layers and data** button.
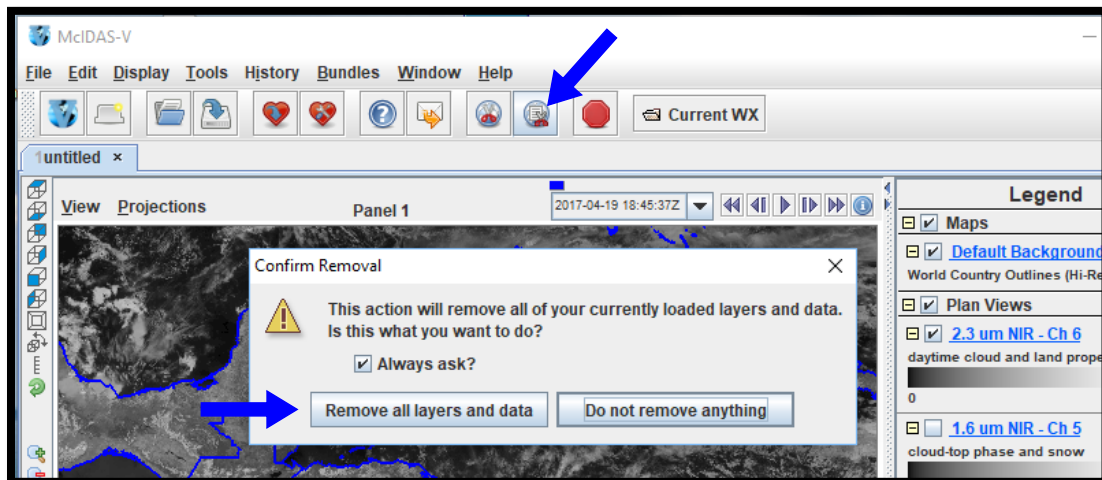

4.2   Load the McIDAS-V bundle file for channels 7-16. Pull up the **Main Display** window and repeat the steps in 3.2 for the bundle file **GOES16_CMI_Region_Ch7-Ch16_ColorTables_Labels_RelPath.mcv**.

4.3   The bundle file will open with imagery from the 10 infrared channels loaded in the **Main Display** window.
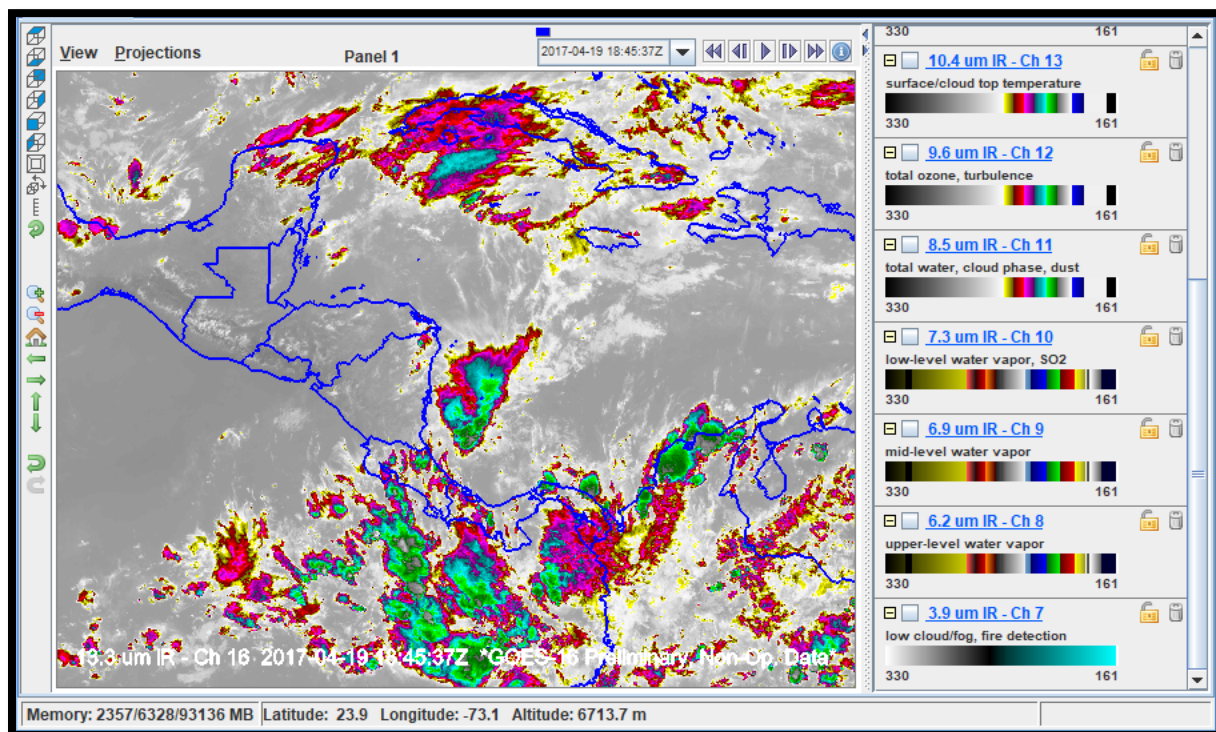
4.4 Optional Step: convert brightness temperatures in units of Kelvin to degrees Celsius.

    a) From the Data Explorer window Layer Controls tab select **Edit → Display Settings…**
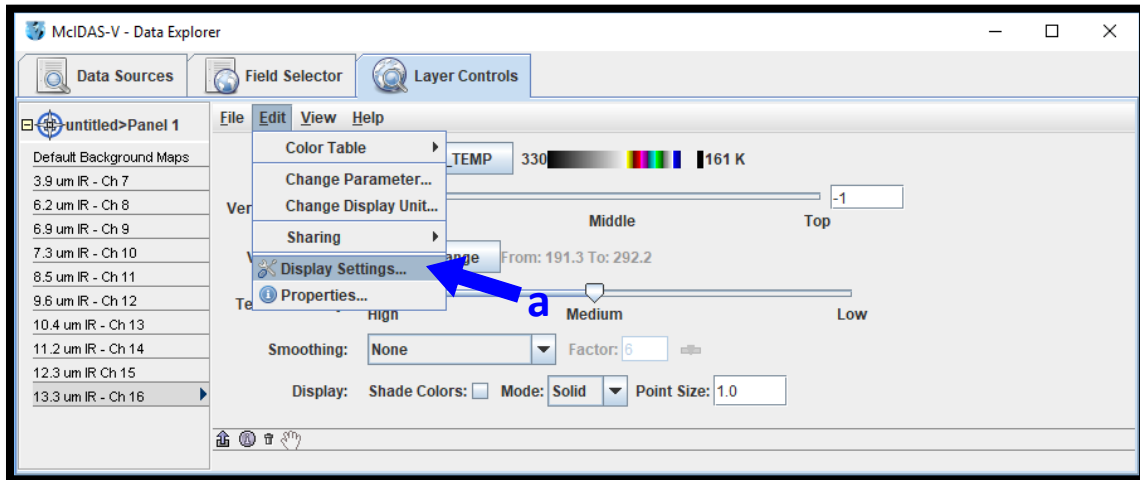
    b) In the window that opens, confirm that in the **Source** column on the left one of the data layers (not Default Background Maps) is selected.

    c) Under the **Properties** column, check the box to the left of **Display Unit ()** to select it.

    d) To the right of **Display Unit ()** click on the tools icon.

    e) In the **Change unit** window that opens, use the **New unit:** drop-down menu to select **°C**. Click the **OK** button.
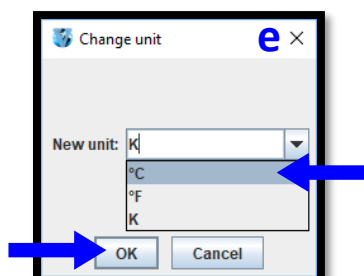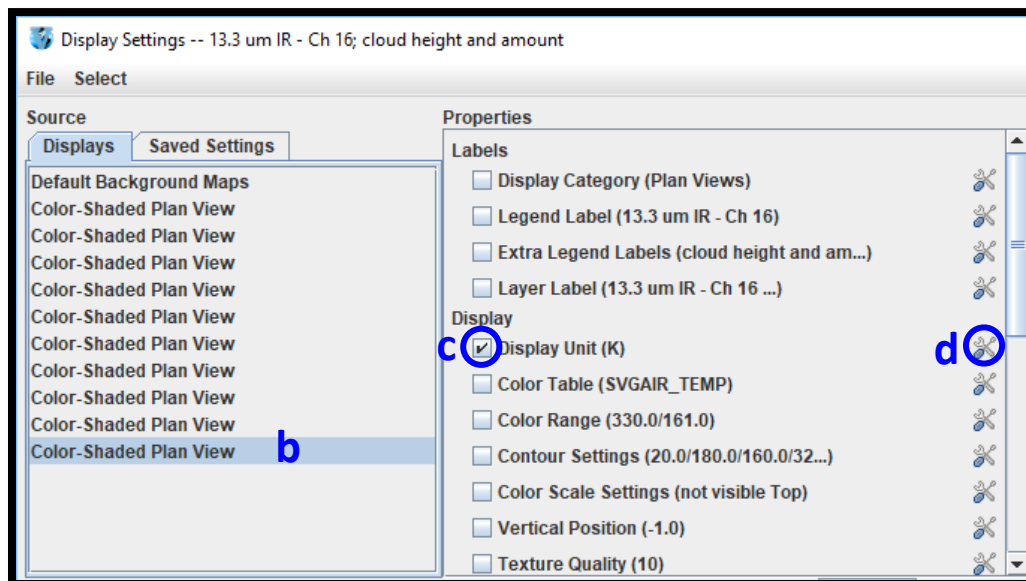
f) To apply this unit change to every layer, go to the **Target Displays** column and check the box to the left of each of the 10 channel labels.

g) Click the **Apply** button. Click the **Close** button.
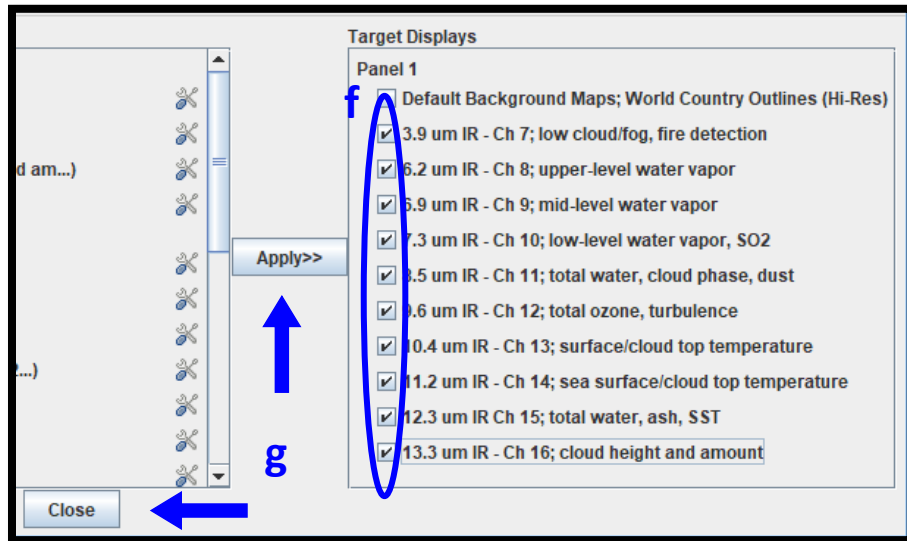
4.5 Exploration:

i. Can you locate the following features across the 10 infrared channels? Why or why not?
- low cloud
- deep convective cloud
- water surface
- land surface

ii. Use the cursor readout feature to compare and contrast the brightness temperature across the 10 channels. What is the warmest feature and which channel does it appear in? Why does it show up as the warmest feature? What is the coldest feature and which channel does it appear in? Use the visibility animation function to loop through the images.

iii. Which features in this example can be used in reference to section(s) of the first six modules in the Satellite Foundational Course for GOES-R/16 (SatFC-G)?
http://rammb.cira.colostate.edu/training/shymet/satfc-g_intro.asp

iv. Refer to the spectral graphs at the end of the tutorial for cloud and land surface interpretation and comparisons of the different channel imagery from current GOES, GOES-16, and VIIRS.

5. McIDAS-V Shortcuts

Main Toolbar

	Save as...
	Show help
	Save as favorite bundle
	Show data explorer
	Layer visibility animations
	Create formula
	Edit color tables
	Remove all layers and data

Navigation

←	Translate Left ▪ Ctrl + right arrow
→	Translate Right ▪ Ctrl + left arrow
↑	Translate Up ▪ Ctrl + down arrow
↓	Translate Down ▪ Ctrl + up arrow
Pan	o Ctrl + right mouse button (drag)
Select Region	o Shift + left mouse button (drag)

Note: Translate (Left) = Pan (Left)
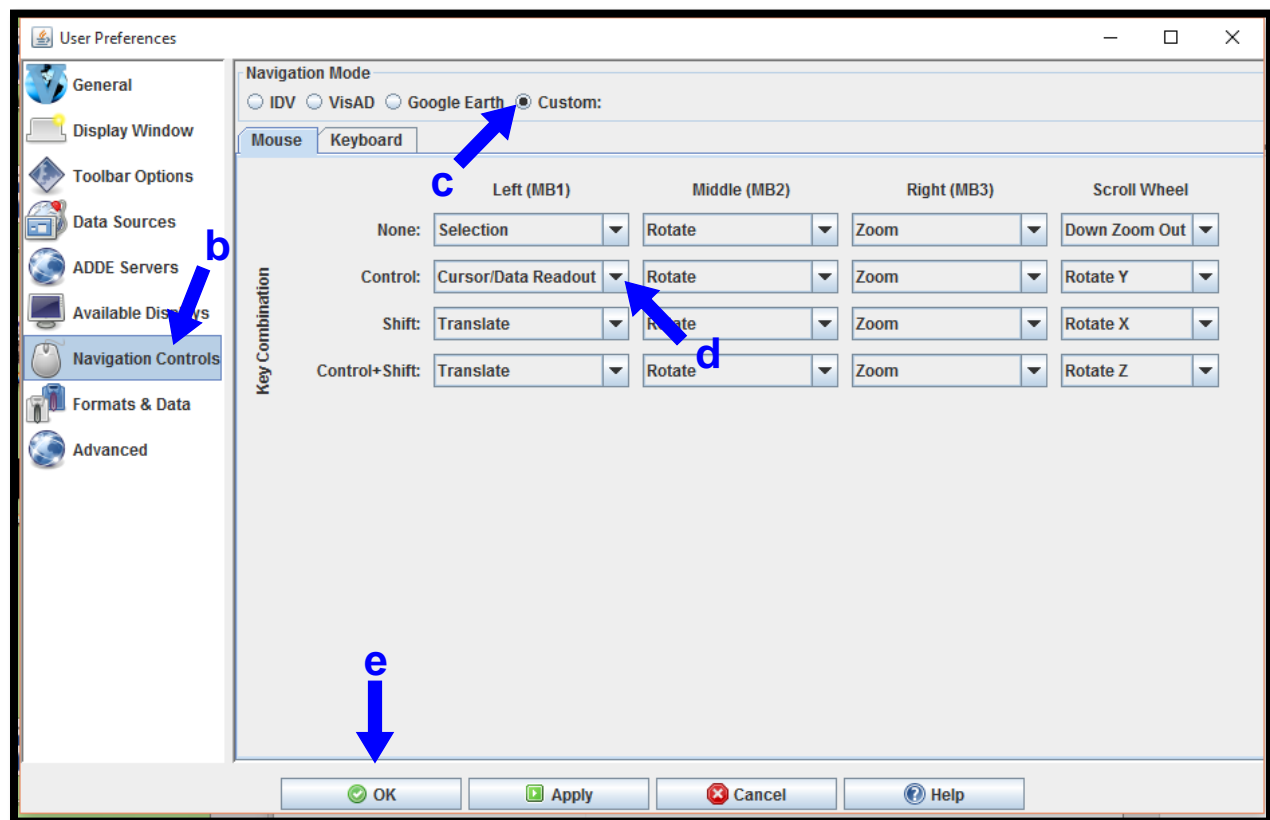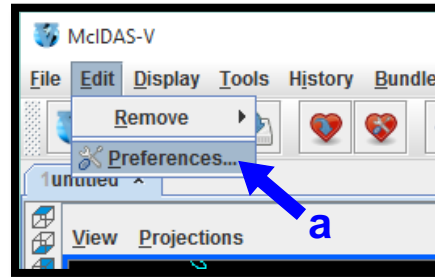
Other

	Zoom In ➢ scroll mouse wheel down ▪ Shift + up arrow o Shift + right mouse button (drag up)
	Zoom Out ➢ scroll mouse wheel up ▪ Shift + down arrow o Shift + right mouse button (drag down)
+	**Cursor Readout** ➢ {Mouse} click scroll wheel o {Touchpad} Ctrl + left click*
🏠	Reset Display
↺	Undo

Shortcut Symbol Legend:
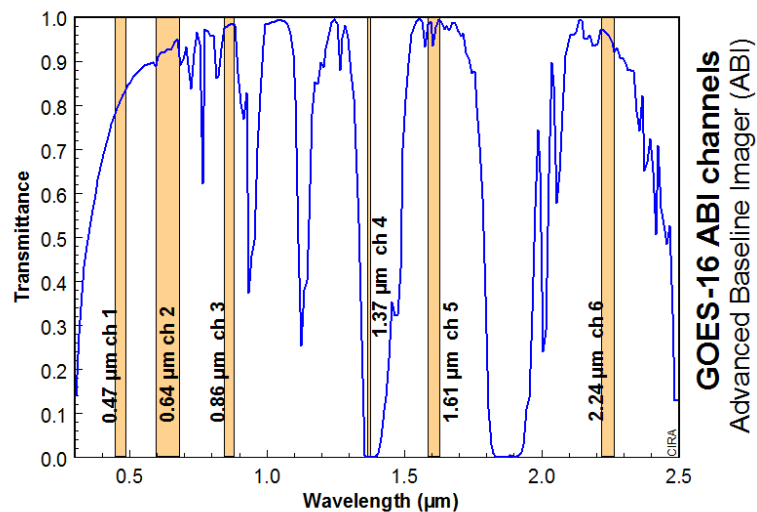➢ mouse scroll wheel
▪ keyboard only
o keyboard + mouse

*To display the cursor readout using a laptop touchpad, you must first change the navigation controls in the user preferences by following the instructions on the next page.

5.1   To use the cursor readout feature on a laptop, you will need to change the navigation controls in the user preferences.

a) From the Main Display window, select **Edit** → **Preferences…**
b) In the User Preferences window, click on **Navigation Controls** in the left column
c) Under **Navigation Mode** at the top, select **Custom.**
d) For **Left (MB1)** and **Control**, use the drop-down menu to select **Cursor/Data Readout**
e) Click the **OK** button.
f) You should now be able to probe the data by holding down the **Ctrl** button while clicking the bottom left corner of the touchpad.
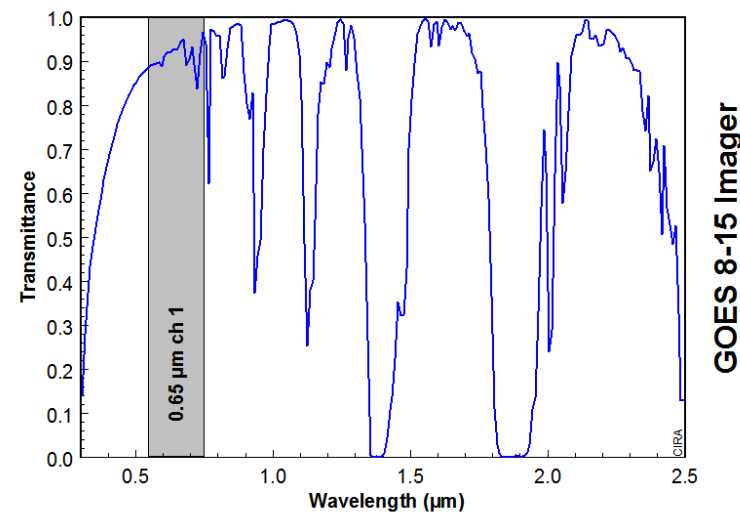
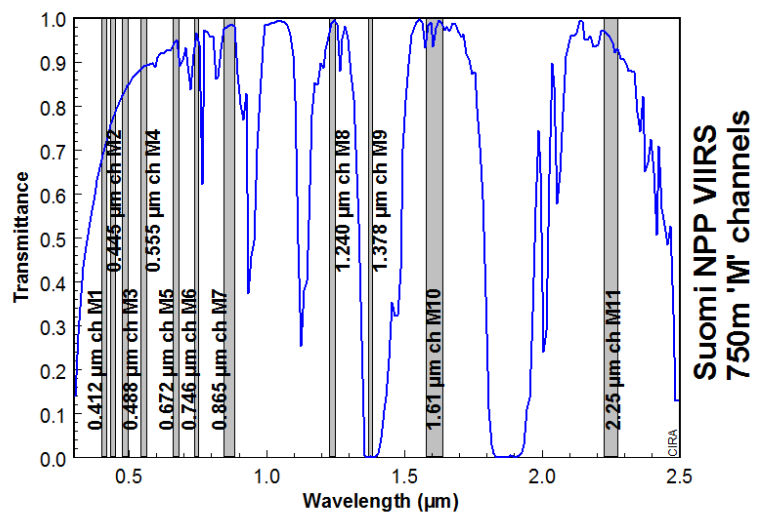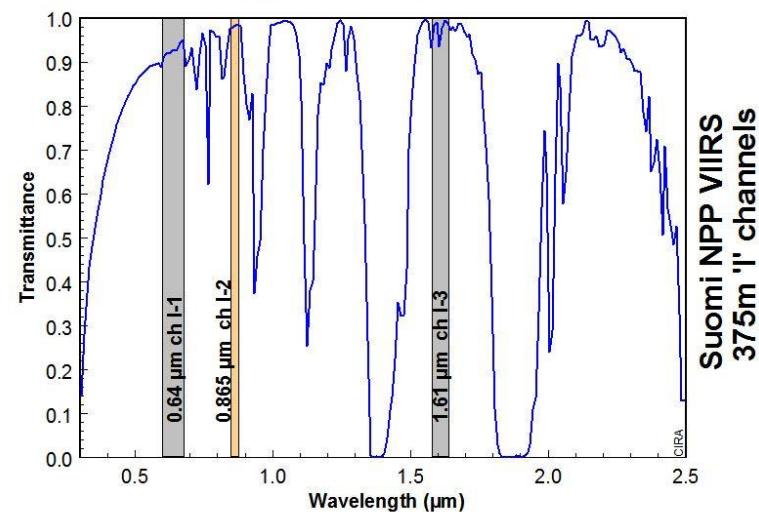# 6. Satellite Channels and Spectral Graphs

Visible to Near Infrared

GOES-16 ABI channels
Advanced Baseline Imager (ABI)

0.47 µm ch 1
0.64 µm ch 2
0.86 µm ch 3
1.37 µm ch 4
1.61 µm ch 5
2.24 µm ch 6

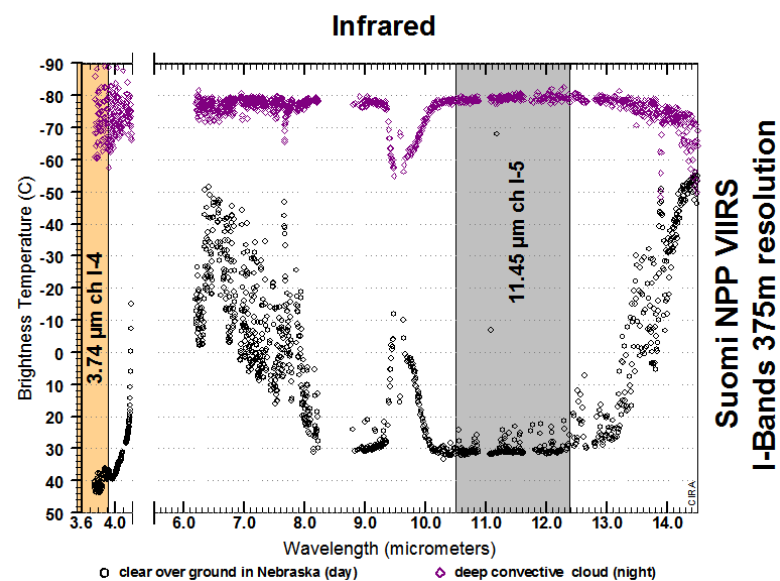## Visible to Near Infrared

GOES 8-15 Imager

0.65 µm ch 1

Spectral interval = full width at half maximum

Visible to Near Infrared

Suomi NPP VIIRS
750m 'M' channels

0.412 µm ch M1
0.445 µm ch M2
0.488 µm ch M3
0.555 µm ch M4
0.672 µm ch M5
0.746 µm ch M6
0.865 µm ch M7
1.240 µm ch M8
1.378 µm ch M9
1.61 µm ch M10
2.25 µm ch M11

Visible to Near Infrared

Suomi NPP VIIRS
375m 'I' channels

0.64 µm ch I-1
0.865 µm ch I-2
1.61 µm ch I-3
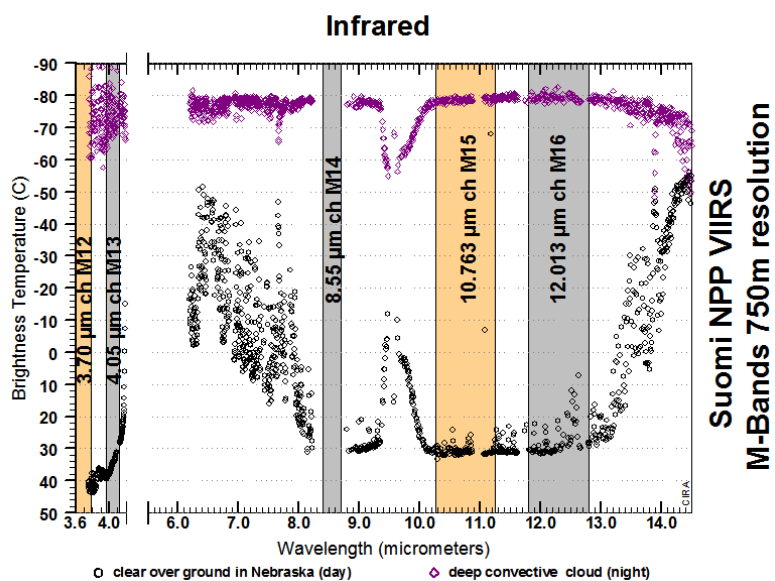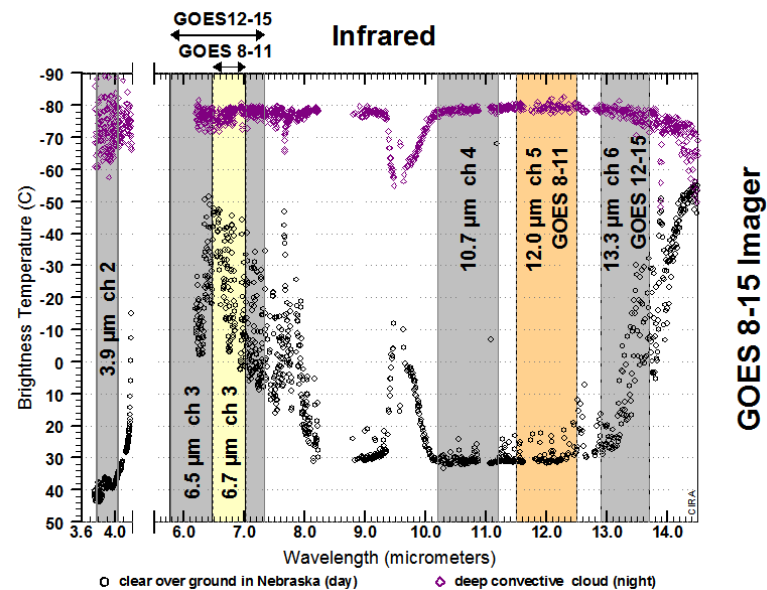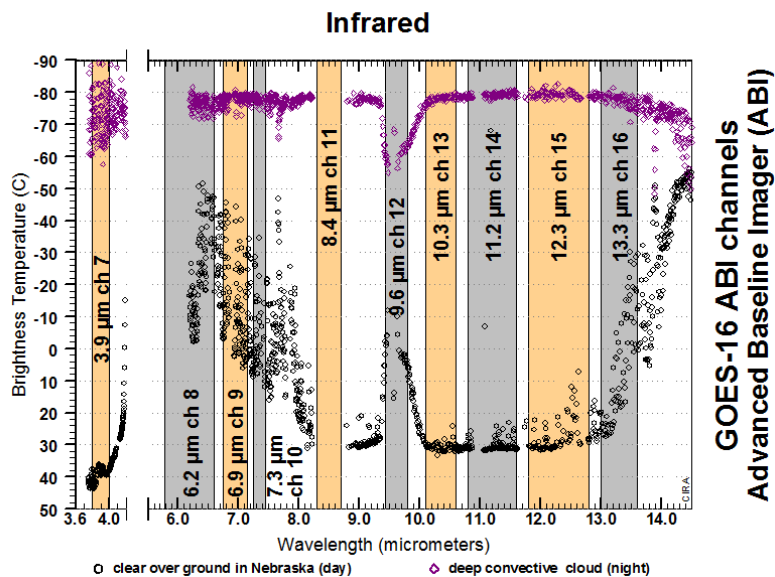
For html5 loops of these and other satellites: http://rammb.cira.colostate.edu/training/rmtc/newsat.asp