

## **DEW Guide to selecting and ordering MODIS images from EOS-EARTHDATA, and for analyzing the images using Multispec.**

The EOS-EARTHDATA digital library hosts a set of MODIS Surface Reflectance data for the entire continental USA, beginning in 2003 and continuing as new images are available from NASA. Images are 8-day composites, that is, a snapshot of the best cloud free day during an 8-day window. Images are from the MODIS instrument onboard the Terra or Aqua satellites. It is possible, for example, to see green-up and senescence at different geographic locations from files spaced every 8 days and to look at difference among years.

Ordering MODIS surface reflectance data from EOS-EARTHDATA in GEOTIFF format permits you to look at the latitude-longitude value when panning across the image with the mouse. See the example choices below for selections for making and downloading an order. The order will have a separate file for each band. You can choose to load only 3 or 4 of the bands, and imaging programs can only display 3 bands at once anyway. The file size will depend on the subset area of the US you choose. (for example a box, or a state) For example, each band for a file covering the state of California would be about 11 megabytes, or 77 megabytes for all 7 MODIS bands.

## STEP-BY-STEP INSTRUCTIONS

Go to the EOS-EARTHDATA home page.

<http://eos-earthdata.sr.unh.edu/>



### Welcome to EOS-EarthData

- Click on the “Data” button located in the banner. This brings up the **Browse and Order Data Page**.

Use the Data Page to Select a MODIS image to download.



### Browse and Order Data

- Click on the links below to browse our data collections.
- Follow the steps to make your selections, place your order, and download your data.
- Data Guides and help are available on each collection page.
- Repeat as needed.

#### Satellite Data

- Educational Image Subsets
- **Global Vegetation Indices**
- MODIS Aggregate Products
- Landsat Clip n Pic

#### Regional and Global Projects

- Carbon Cycle Model Linkage-CCMLP
- Climate Changes in the 21st Century
- NCAR Science and Research Data for IPCC AR4
- US Hydrologic Data (GHAAS)
- US National Assessment
- VEMAP2 Transient Dynamics Data
- VEMAP2 Transient Dynamics Data for Alaska
- VEMAP Reference Data

#### Geographic and Demographic Data

- China County Data
- Global Demographic Data
- Global Landuse Modeling
- Global Model Reference Data
- India Rice Cropping Maps
- LBA HydroNet Data
- LBA / South American Data
- New England Methane
- New Hampshire Landcover
- Tapajos Tree Census
- US County Data

Choose the MODIS Aggregate Products Collection.

- Click on the link for “MODIS Aggregate Products.” This brings you to the MODIS Aggregate Products collection page.



EOS-EarthData: Your Library of Free Earth Science Data

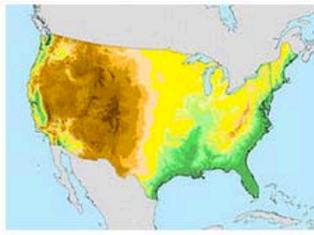


This collection is made up of spatially aggregated MODIS tiles for specific regions of the globe. EOS-WEBSTER has created MODIS products for the conterminous USA from the 8-day 500 m Surface Reflectance MOD09A1 bands 1-7. Data products have been spatially seamed together and reprojected into Geographic coordinates. The US 8-day Surf Refl Products (MOD09A1) includes two sets of holdings: US 8-day Surf Refl (MOD09A1) that contains Surface Reflectance Bands 1-7 and US 8-day Surf Refl Supp (MOD09A1) that contains supplemental information on band quality, angle, state flag, day of year and input tile code. **More Info** [Data Guide].

**1. These data can be subset. Make your selection(s) here.**

Choose a smaller region of interest.

Select a category ▾



Choose a different time period.

Begin: (2000 ▾) (Feb ▾) End: (2012 ▾) (Aug ▾) [reset](#)

Select keyword(s) to display fewer holdings in the table below. [Data Guide].

- US 8-day Surf Refl Bands (MOD09A1)
- US 8-day Surf Refl Supp (MOD09A1)

**2. Select Holdings**

Holdings Displayed: 570  
Holdings Selected: 0

Region selected - entire region  
Time period selected - entire time period

[clear](#)

**3. Place Order**

Select an output format ▾ [help me choose](#)

[Get Data](#)

Select	Table of Holdings (Click on an image to see Browse Product)	
<input type="checkbox"/>	<b>US 8-day Surf Refl Bands (MOD09A1)</b> (2012-07-27 to 2012-08-03) 7-bands, 500 m 8-day Surface Reflectance, spatially aggregated over the conterminous USA from MOD09A1 tiles, bands 1-7. Units are reflectance. Data are scaled by 10000. The spatial resolution of this holding is 15 arc seconds (500 m).	
<input type="checkbox"/>	<b>US 8-day Surf Refl Bands (MOD09A1)</b> (2012-07-19 to 2012-07-26) 7-bands, 500 m 8-day Surface Reflectance, spatially aggregated over the conterminous USA from MOD09A1 tiles, bands 1-7. Units are reflectance. Data are scaled by 10000. The spatial resolution of this holding is 15 arc seconds (500 m).	
<input type="checkbox"/>	<b>US 8-day Surf Refl Bands (MOD09A1)</b> (2012-07-11 to 2012-07-18) 7-bands, 500 m 8-day Surface Reflectance, spatially aggregated over the conterminous USA from MOD09A1 tiles, bands 1-7. Units are reflectance. Data are scaled by 10000. The spatial resolution of this holding is 15 arc seconds (500 m).	
<input type="checkbox"/>	<b>US 8-day Surf Refl Bands (MOD09A1)</b> (2012-07-03 to 2012-07-10) 7-bands, 500 m 8-day Surface Reflectance, spatially aggregated over the conterminous USA from MOD09A1 tiles, bands 1-7. Units are reflectance. Data are scaled by 10000. The spatial resolution of this holding is 15 arc seconds (500 m).	
<input type="checkbox"/>	<b>US 8-day Surf Refl Bands (MOD09A1)</b> (2012-06-25 to 2012-07-02)	

Use this page as a guide to follow the steps on the next page to select and order your data!

## **Follow the Numbered Steps on the MODIS Aggregate Products page.**

### **Box 1. Make your selections for subsets and/or to see a smaller list in the Table of Holdings.**

Choose a smaller region of interest.

*You can skip this step if you want the entire spatial data set, which is shown on the map as the conterminous USA.*

*Or, use the “Select a Category” pull down menu to choose a category, such as “USA States”.*

*This brings up a 2<sup>nd</sup> pull down menu, where you can select a location, such as “New Hampshire”.*

*Once you have made a selection, your data order will be clipped to this region.*

Choose a different time period.

*You can skip this step if you want to see the holdings for all available dates, which are shown as the “Begin” and “End” dates.*

*You can reduce the list of MODIS images in the **Table of Holdings** by selecting one or more dates from the “Choose a Different Time Period” box. The range of valid dates is shown in the “Begin” and “End” pull down menus. Use these menus to select a smaller date range.*

*Or, you can scroll through the list to see what is available. There are over 500 images, so it is advisable to choose a smaller time range to more easily see the images you are interested in.*

*There is an image file every 8 days.*

Select Keywords.

*You can skip this step if you want to see all of the holdings for this data collection.*

*Select “US 8-day Surf Refl Bands (MOD09A1)” in the Keywords box to the right of the map.*

*This will show only the image files in the Table of Holdings. The other, supplemental data files, will not be used, so there is no reason to view them in the table.*

### **Box 2. Select Holdings**

*Use the check boxes on the left-hand side to select one or more images to place in your order.*

### **Box 3. Place an Order**

*Use the pull-down menu in the “Place an Order” box to select an output format for your images.*

*Select “GeoTiff” as your output format.*

*Once you have selected an output format, the “Get Data” button is activated.*

*Click on the “Get Data” button.*

*You will be directed to a new page, “My Data Orders”, that will show the progress of your order and give you instructions on getting your data.*



## My Data Orders

- When you place a data order, your data order will appear in the table below.
- Wait for the Status to read "**ready**". You can leave this page, but, **Do NOT close your browser or you will have to place your order again!**
- Click on the zip filename to download your data.
- All data and a Readme file are included in the zip file.
- To use the data, unzip the file on your computer.
- The Readme file describes your order, the data, and how the data files are named.

Data Order File	File Size (bytes)	Time Placed	Time Ready	Collection	Data File Format	Status
<a href="#">eosearthdata19.zip</a>	3,890,180	2012-08-22 12:42:13	2012-08-22 12:42:20	MODIS Aggregate Products	GeoTIFF	<b>ready</b>

## Retrieve Your Data.

Once the Status of your order is “ready”, you can download a zip file of your data. Click on the zipped file name in the “Data Order File” column to download the file to your desktop. From there, you need to unzip the file to see the contents and use the data.

## Download the browse image.

Click on the small map of the USA for any holding, and it will load the browse image into a new browser window. You can download this image and any others of interest. These browse images can be put together into a Quicktime movie or analyzed for seasonal or other changes on a regional scale.

## For more information:

Review the PDF file “[MODIS Aggregate Products Data Guide](#)” for more information about the EOS-EARTHDATA MODIS archive.

## MODIS vs. Landsat

Many users of remote sensing data are most familiar with the Landsat program and less with MODIS imagery. The MODIS surface reflectance product, MOD09A1, is a seven-band product computed from the MODIS Level 1B land bands 1, 2, 3, 4, 5, 6, and 7 (centered at 648 nm, 858 nm, 470 nm, 555 nm, 1240 nm, 1640 nm, and 2130 nm, respectively). The product is an estimate of the surface spectral reflectance for each band as it would have been measured at ground level if there were no atmospheric scattering or absorption. It has a pixel size of 500m, compared to Landsat's 30m pixel. The wavelengths of the MOD09A1 product correspond roughly with the Landsat band wavelength, but the terms band 1, band 2, etc are used differently between the two instruments' project members. Here is a table of the bands acquired for each and their names by that team. The MODIS band listed are only those relative to the MOD09A1 product. MODIS collects 36 bands of light information.

Comparison of reflectance bands for Landsat and MODIS

Landsat			MODIS	
Band number	Color	Wavelength range (nm)	Color	Wavelength Center (nm)
1	Blue	420-520	Red	648
2	Green	520-600	Near IR*	858
3	Red	630-690	Blue	470
4	Near IR	760-900	Green	555
5	Mid IR	1550-1750	Mid IR	1240
6	thermal	Not used	Mid IR	1640
7	Mid IR	2080-2350	Mid IR	2130

\*IR = infrared

Common band combinations for image analysis\*

Landsat	MODIS	Color combo	Best used for
742	724	MNG; false color	Vegetation, wetlands
432	214	NRG; false color	Vegetation, forest cover
321	143	RGB; true color	What your eye sees
542	624	MNG	Stressed vegetation

\*The letters R, G, B, N, M are used here as abbreviations for Red, Green, Blue, Near-infrared (NIR) and Mid-infrared (MIR).

Check out the [Landsat Image Compositor](#) or the [MODIS Band Compositor](#) to view band combinations.

## USING MULTISPEC

### How to Stack the bands

In MULTISPEC, in this example, you can load 4 bands to create a new image file by:

1- MULTISPEC **File** menu -> **Open Image**,

In the browser window, choose Multispectral type.

Choose the blue band (this is band 3 in MODIS)

Chose the button Open in the box.

The greyscale image appears on your screen. For large files, (1000 or more lines and columns) this will take a minute.

2- Go back to the **File** menu -> **Open Image**

In the browser window choose link to active window

Choose multispectral type

Choose the green band (MODIS band 4)

Click the button Open in the box.

This will not change your image display, but will leave you in the browser OPEN box.

3- multispectral type and link to active file should still be “on”

Choose the red band (MODIS band 1)

Click the button Open in the box again

4- multispectral type and link to active file should still be “on”

Choose the NIR band (MODIS band 2)

Click the Open button in the box.

Choose the Cancel button

5- In the MULTISPEC **Processor** menu

choose **Reformat -> Change Image File Format**

The pop-up box should pick up your lines and columns and describe your data format properly. It should indicate that there are 4 bands. Make sure you are creating GEOTIF format. Click OK. It will ask you for the new filename. I chose WestUS-M04.tif as my 4-band file.

Now MULTISPEC will request to form statistics – just say OK and when it is done, it will be necessary to close the single band displayed (just click in the upper left hand corner) and load the new file. (Open Image->browser multispectral, choose WestUS-M04.tif)

### Modifying contrast

Use the **Processor** menu-> **Display Image**

Change Stretch from Linear to Gaussian

Change Min/Max to User Specified

In the pop-up box, for the 3 bands, change the low value of -1 to 0.

Click OK

Suppose you are ordering MODIS Surface Reflectance data from EOS-EARTHDATA. You are comparing the same time of year for two different years. (We have 2003 – 2005 data and continue to add data as it arrives) The data are composites from 8 day intervals, and so are available on a timeframe that should help you see green-up for an area of interest, or the last traces of snow. I chose to look at March 6<sup>th</sup> based on looking at the preview images on EOS-EARTHDATA to notice the period just before snow disappeared from the mountains.

2004



2005



The EOS-EARTHDATA selection choices for this search would be to choose

Collection: MODIS Aggregate Products

Date Range (Temporal): March 1, 2004 -> March 31, 2005

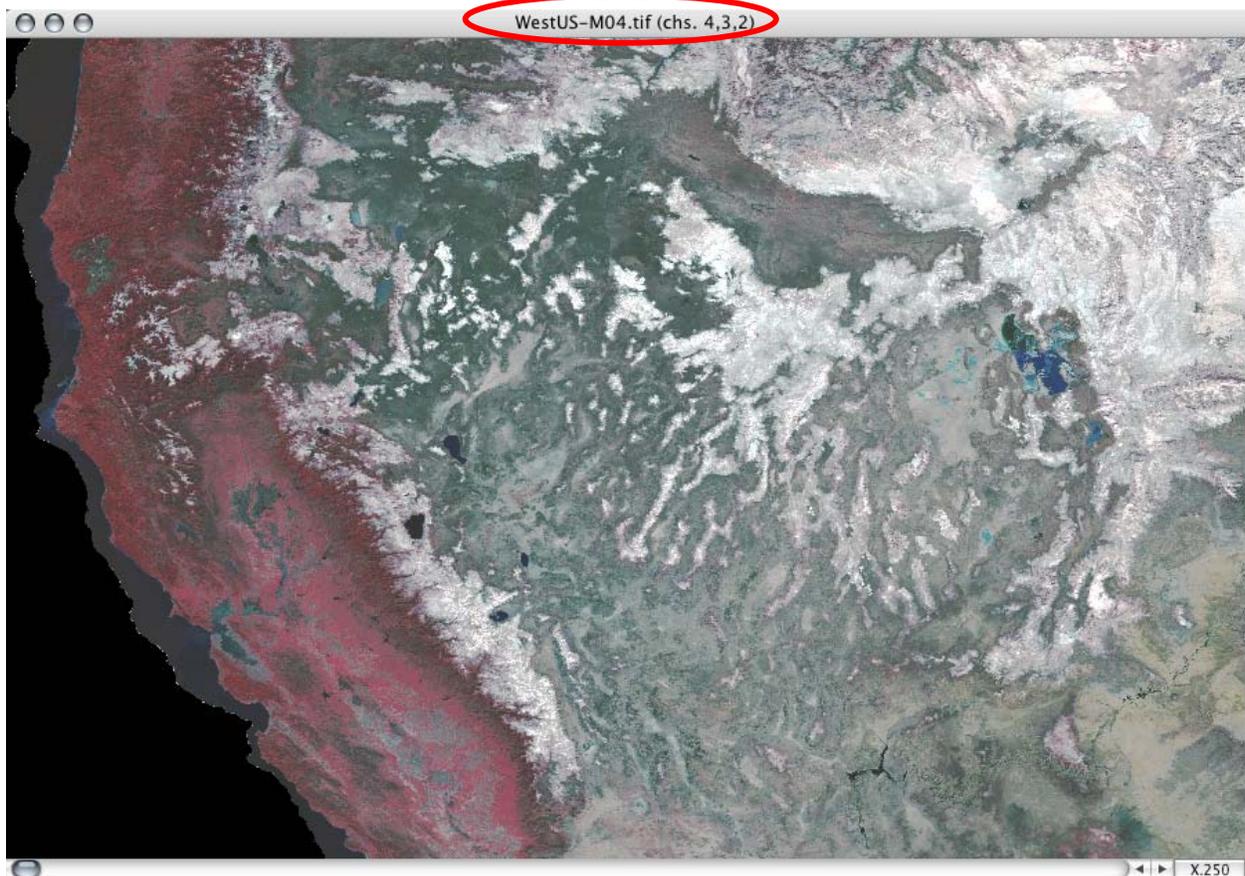
Keyword: 7-band

Spatial – NAST Mega Regions; Southwest

This gives me the central western to southwestern US, including the Rocky Mountains, extending to the Pacific Ocean.

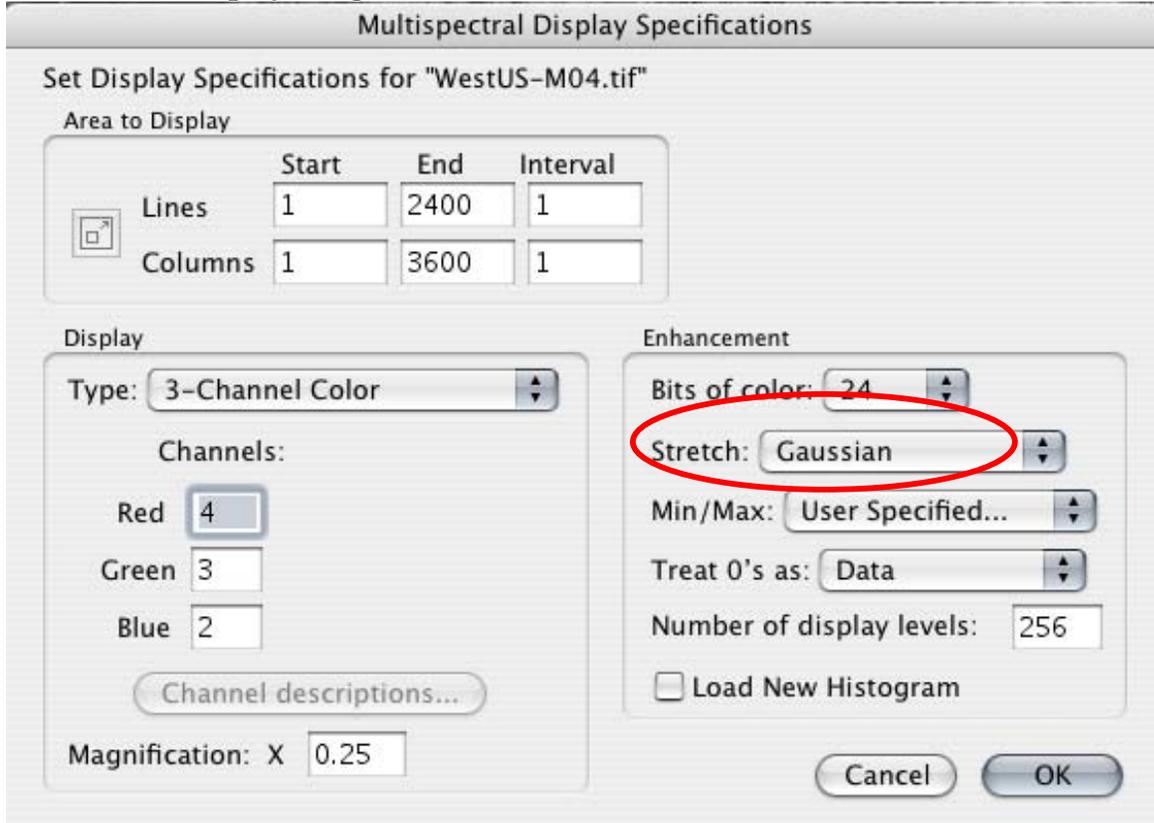
I chose a geographic box to see the influences of rivers and coastal area instead of the California, the state outline, but you could choose just a watershed area for example, if it existed in our gazetteer. I chose to order March 6, 2004 and March 6, 2005 in EOS-EARTHDATA, format GEOTIFF.

Here is the full area for 2004 that I chose in false color (near-infrared-red-green) in MULTISPEC software. Since I loaded the image as blue band first, then green, red and NIR, this is 432 or Near-infrared \* Red\* Green band combination.

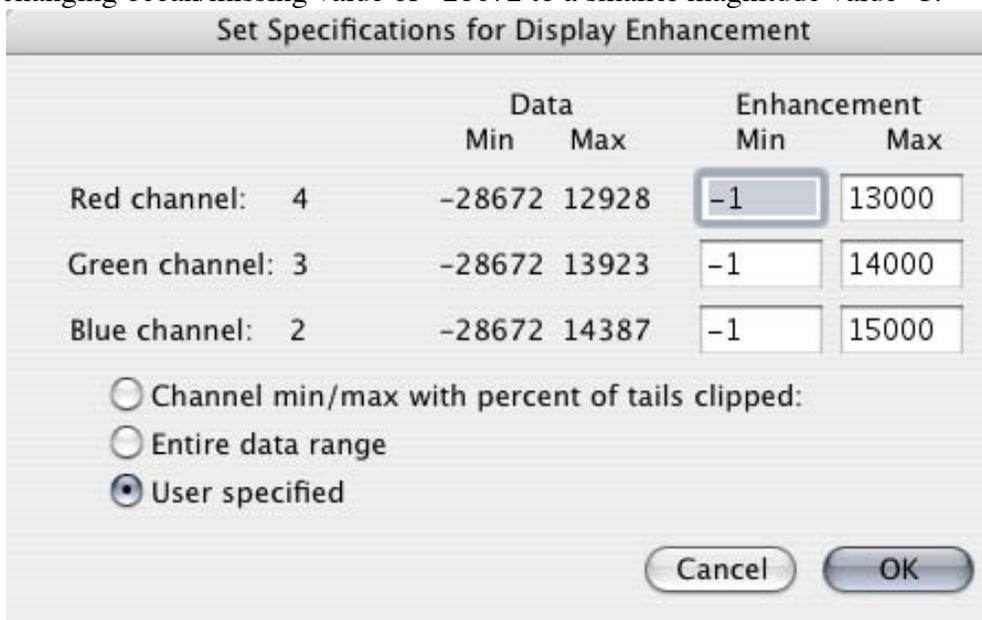


To see latitude-longitude, choose **Window->Show Coordinate View**. In the upper right corner of the image, change lines and columns by the drop-down menu to decimal degrees .

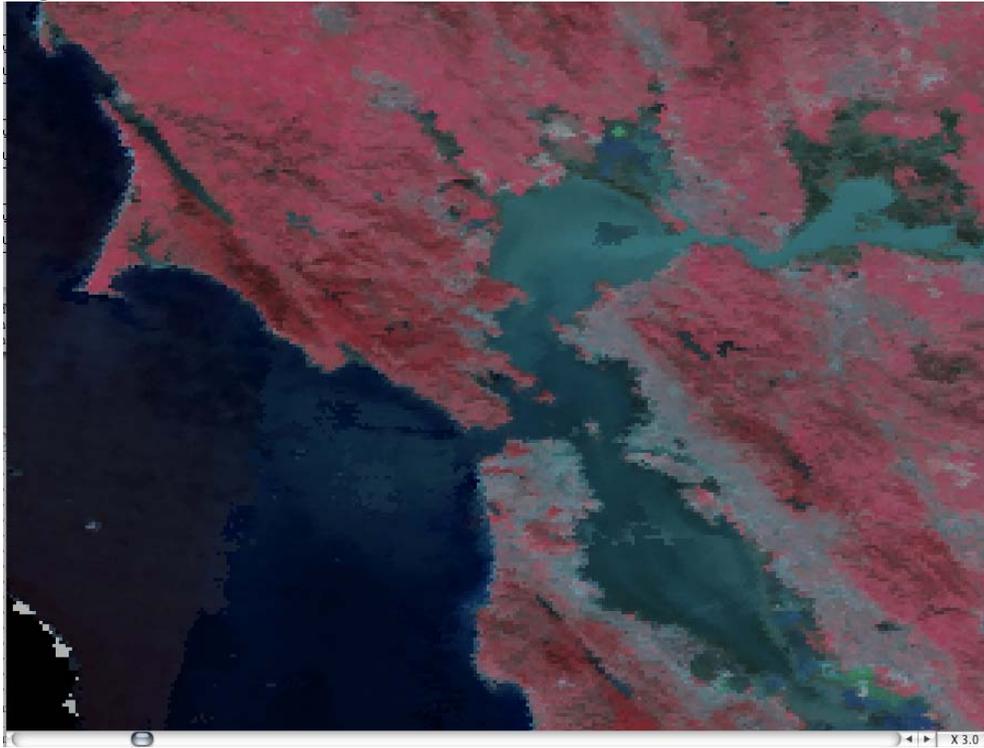
I further chose to limit my image to a range of values that would sharpen it. In the **Processor** menu, choose **Display Image**. I was able to choose Gaussian as the kind of stretch.



For **Min/Max**, I chose **User Specified** and in the pop-up box, specified a new range of the data changing ocean/missing value of  $-28672$  to a smaller magnitude value  $-1$ .



This resulted in a nice coloring of the water in the bay showing discharge. Here is a magnification from MULTISPEC.



You can also see it in True color (red-green-blue) which you can reset in the **PROCESSOR** menu, the **Display Image** option to display bands 3, 2, 1.

