

NASA ARSET Extended Session on Water Quality Monitoring Using Remote Sensing Observations

May 5, 2016

Exercise: Mapping and Monitoring Lake Erie MODIS Chlorophyll Concentration (Ch)

Objective: Learn how to search, access, analyze, visualize, and download MODIS Chlorophyll data using the Giovanni web-tool.

There are two parts to this exercise: I) creating a seasonal Ch map and II) monitoring time series of Ch in Lake Erie.

Part I: Creating a Seasonal Chlorophyll Concentration Map for Spring and Summer of 2015

1. Navigate to the Giovanni data portal: <http://giovanni.sci.gsfc.nasa.gov/giovanni>

The screenshot shows the Giovanni data portal interface. At the top, there are navigation links for 'EARTHDATA', 'Data Discovery', 'DAACs', 'Community', and 'Science Disciplines'. Below this is the 'GIOVANNI' logo and the tagline 'The Bridge Between Data and Science v 4.19'. A yellow banner indicates 'MODIS Collection 6...' with a 'Read More' link. The 'Select Plot' section has 'Maps: Time Averaged Map' selected. The 'Select Date Range (UTC)' section shows a range from 00:00 to 23:59. The 'Select Region (Bounding Box or Shapefile)' section shows a bounding box of -180, -90, 180, 90. The 'Select Variables' section has a dropdown menu for 'Disciplines' and 'Measurements'. A red arrow points to the 'Measurements' dropdown menu.

2. Under the “Measurements” dropdown menu, **check** the box next to **Chlorophyll**, or use the “**Keyword**” and type **Chlorophyll** in the box.
 - This will list all of the available Chlorophyll data on the web page. **Select** the monthly Ch products from MODIS “**Chlorophyll a concentration (MODISA_L3m_CHL_v2014)**” by clicking the box.

Number of matching Variables: 4 of 1239 Total Variable(s) included in Plot: 1

Keyword : Search Clear

	Variable	Source	Temp.Res.	Spat.Res.	Begin Date	End Date	Units
<input type="checkbox"/>	Assimilated Total Chlorophyll (NOBM_DAY vR2014)	NOBM Model	Daily	0.667 x 1.25 °	1998-01-01	2012-12-31	mg chlorophyll/m ³
<input type="checkbox"/>	Assimilated Total Chlorophyll (NOBM_MON vR2014)	NOBM Model	Monthly	0.667 x 1.25 °	1998-01-01	2012-12-31	mg chlorophyll/m ³
<input checked="" type="checkbox"/>	Chlorophyll a concentration (MODISA_L3m_CHL v2014)	MODIS-Aqua	Monthly	4 km	2002-07-04	2016-02-29	mg m ⁻³
<input type="checkbox"/>	Normalized fluorescence line height (MODISA_L3m_FLH v2014)	MODIS-Aqua	Monthly	4 km	2002-07-04	2016-02-29	mW cm ⁻² um ⁻¹ sr ⁻¹

- At the top of the same webpage navigate to the “**Maps**” option under “**Select Plot**” Choose the “**User Defined Climatology**” option from the dropdown. This allows the user to compute the average for a given month or three-month season in each grid cell and plot the results to a map.
- Navigate to the “**Month or Season and YYYY Range,**” and hover over the calendar icon. Choose “**Seasons.**” Set the seasons to “**MAM**” and “**JJA**” (spring and summer months) and set the Start and End years “**2015**” to “**2015.**”

GIOVANNI The Bridge Between Data and Science v 4.19 [Release Notes](#) [Browser Compatibility](#) [Known Issues](#)

MODIS Collection 6... [1 of 1 messages] [Read More](#)

Select Plot

Maps: User-Defined Climatology
 Comparisons: Select...
 Time Series: Select...
 Vertical: Select...
 Miscellaneous: Select...

Select Seasonal Dates ←

Month or Season and YYYY range.

MAM,JJA 2002 to 2015

Select Region (Bounding Box or Shapefile)

Format: West, South, East, North

-180, -90, 180, 90

Valid Range: 2002-07-04 to 2016-02-29

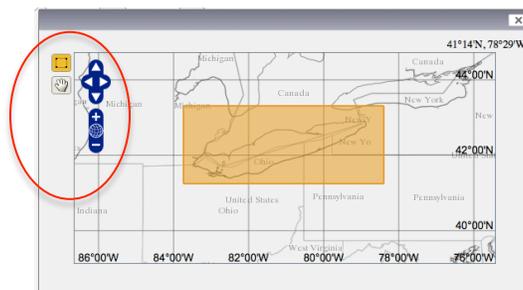
Select Variables

Number of matching Variables: 0 of 1239 Total Variable(s) included in Plot: 1

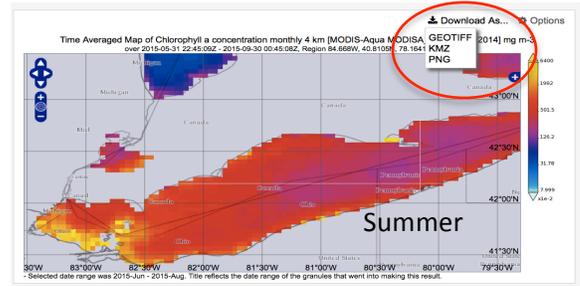
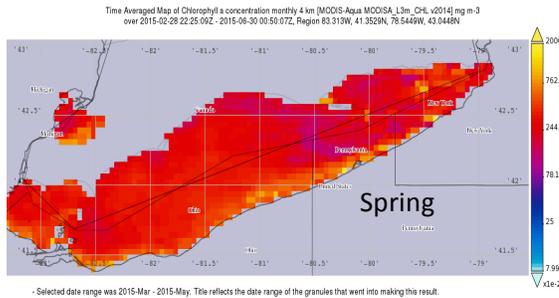
Keyword : Search Clear

	Variable	Source	Temp.Res.	Spat.Res.	Begin Date	End Date	Units
<input checked="" type="checkbox"/>	Chlorophyll a concentration (MODISA_L3m_CHL v2014)	MODIS-Aqua	Monthly	4 km	2002-07-04	2016-02-29	mg m ⁻³

- Under “**Select Region**” click the “**Show Map**” button, use the zoom-in button and arrows to navigate to the Great Lake region and **draw a bounding box** around Lake Erie. This will create a subset of the data so that climatology maps for the area we are focused on will be calculated. ↑

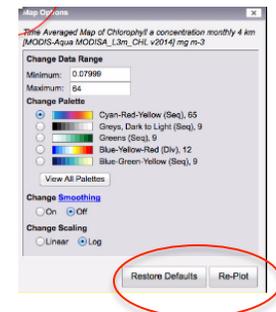


- Click **“Plot Data”** at the bottom right of the page. Giovanni will begin to process the data for our defined spatial and temporal variables.
- The resulting climatology maps will be shown on the web page. This may take a few minutes.



This will produce two maps, one for each season. By clicking on the **“Download As”** button next to the image on the right side, you can select to download a GeoTIFF raster, KMZ Google earth product, or a PNG image file.

- By clicking on the **“Options”** button next to **“Download As”** a window will appear where you can change the range to be plotted and the color scheme for visualization. Once you have made your changes **click “Re-Plot”** and data will be visualized with the new parameters.

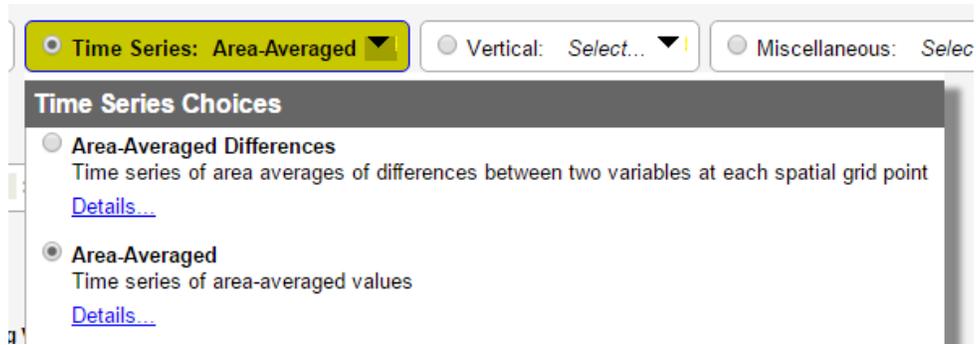


Answer the Following Questions Based on the Seasonal Maps:

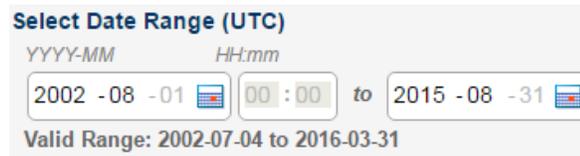
- 1) What is the unit of Ch? What is the range of Ch values in the seasonal maps?
- 2) Which season has more Ch concentration in the lake?
- 3) Which part of the lake has the maximum Ch concentration? Which season?

Part II: Creating a Time Series of Chlorophyll Concentration

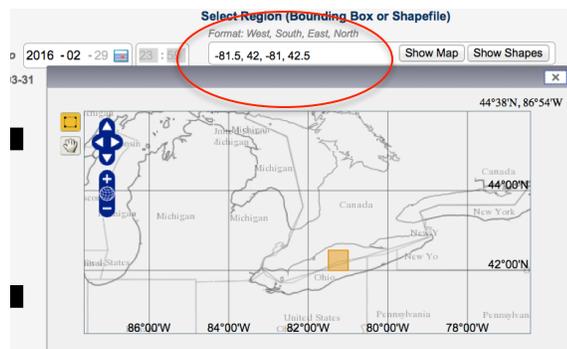
1. To create a monthly time series product for our target area we will click on the **“Back to Data Selection”** button at the bottom of the screen to re-select our parameters.
2. Once back to the selection page we will select **“Time-Series: Area-Averaged”** for the plot type.



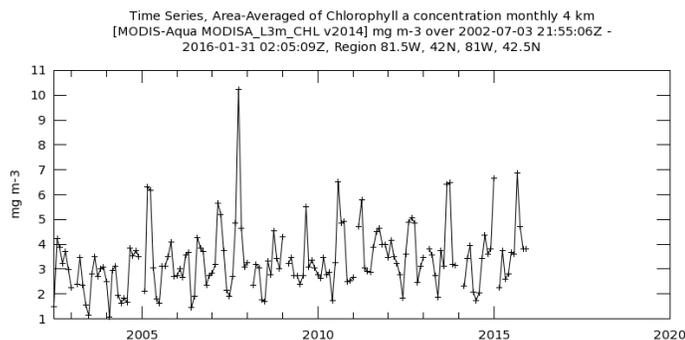
- Next set the **Date Range** to **August 2002- August 2015**.



- Select a small region in Lake Erie either by drawing a box or by entering latitude and longitude as shown below.



- Click **“Plot Data.”**
- This will produce a time series of the given data over the specified time range. This can be saved and downloaded by clicking on **“Image.”**



- Selected date range was 2002-Jan - 2015-Dec. Title reflects the date range of the granules that went into making this result.

Answer the Following Questions Based on the Time Series:

- 1) Do you think the chlorophyll time series shows an overall increase at this location?
- 2) Which year and month has the highest chlorophyll? Go back to the map option as in Part I and make a map for this year and month. Note the area on the map where the Ch concentration is maximum.