How to use the SATURN Observation Network: Endurance Stations Site:

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Preface

How to use the SATURN Observation Network: Endurance Stations site is designed to allow someone to physically manipulate the SATURN Observation Network: Endurance Stations site located on the Center for Coastal Margin Observation and Prediction website. SATURN stands for Science and Technology University Research Network. SATURN includes tidal freshwater stations, ocean gliders, autonomous underwater vehicles (AUVs), and estuarine and plume stations measuring everything from salinity and temperature to biogeochemistry and microbial diversity on a twenty-four hour time frame every day of the year. The data collected from SATURN feeds into the Virtual Columbia River, a modeling system that offers multiple representations of processes, variability and change across river-to-ocean scales.

This how-to manual is part of an effort to translate CMOP environmental systems knowledge to a broader audience so we can inform people and help to develop a workforce skilled in science and technology.

1. How to manipulate your way through the SATURN website.

2. How to manipulate the tools located on the SATURN website.

Introduction to the SATURN Interface

Go to http://www.stccmop.org/datamart/observation_network , the title at the top of this webpage should say SATURN Observations Network: Endurance Stations under the CMOP heading the Endurance Stations are listed to the left, Figure 1.

There are three ways to pick a station:

1. To the left of the screen, under the Endurance Stations drag the cursor over each bulleted heading and click desired station

2. Choose a specific type of station by clicking the Order, Show, and Station list

3. By clicking on the markers on the map of the Columbia River and the Columbia River Estuary.

This map has several interesting features:

- Click the word Satellite in the upper right corner of the map to view as a satellite image.
- Click the plus or minus sign in the upper left corner to enlarge or shrink it. The yellow person above the plus sign is a Google overlay function for the map. To use,
- Click the yellow person in the left hand corner, drag, and then release at particular area of interest to see image of a road or address location.

To get back to the map: Click the back arrow and then click any of the red highlighted words saying Observation Network

Below the map are markers which look like upside down colored teardrops. These markers, represented both on and under the map, show where and how the data is recorded at each station. In the upper right hand corner of this page you will see the words DATA Explorer inside a square box. This is a shortcut to the DATA Explorer which will be discussed later.

Figure 1.
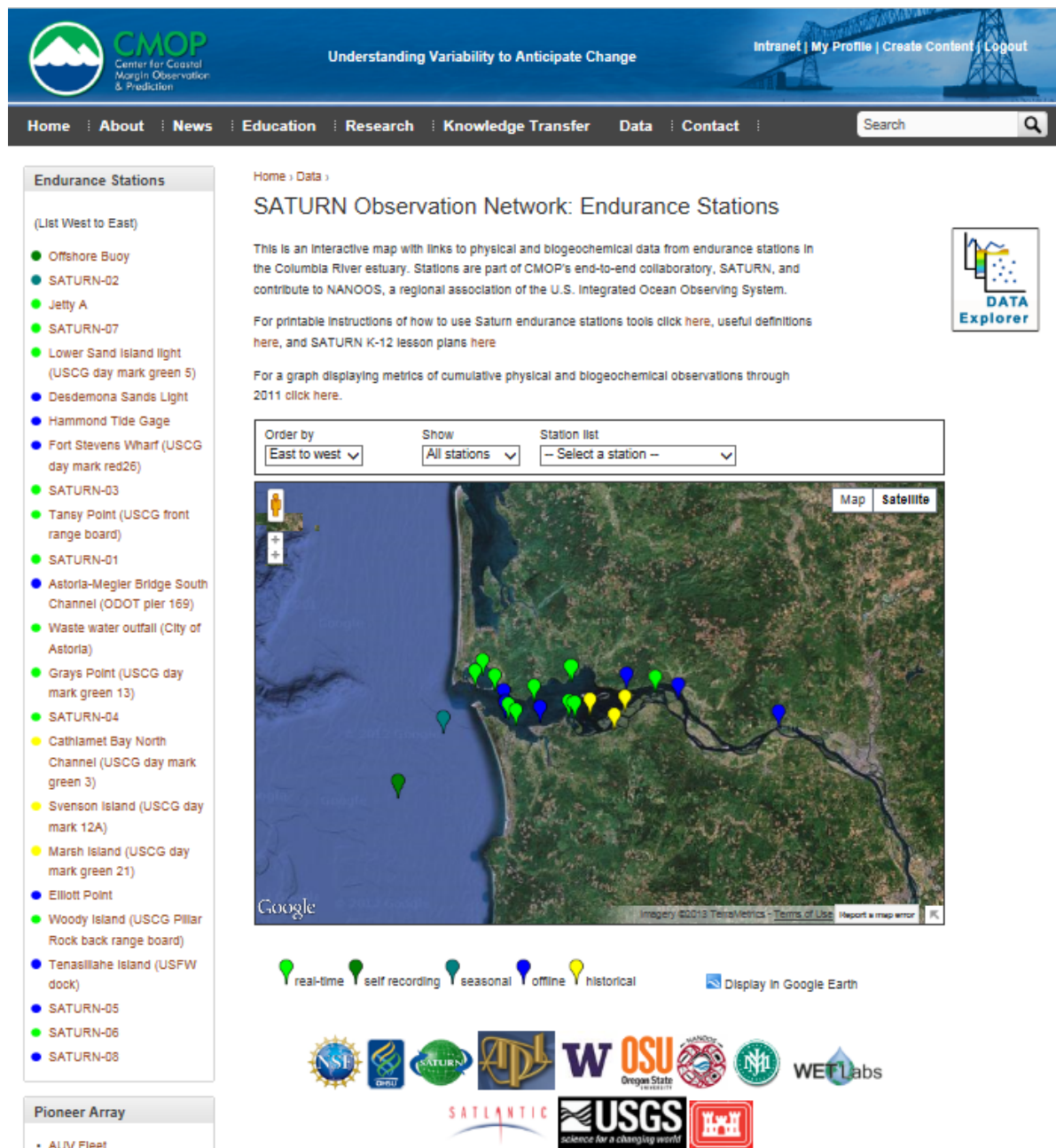
Fixed station user interface

The **Fixed station user interface** allows for manipulation of data from those stations which remain in a fixed location in the Columbia River and the Columbia River Estuary.

- Click on the SATURN-03 Endurance Station
- You will see the Fixed station user interface heading at the top of the page and SATURN-03 listed below in the drop down box.
- Located below the drop down box are four tabs named **Recent**, **Inventory**, **Metrics**, and **Map** (**Figure 2.**)

Figure 2.
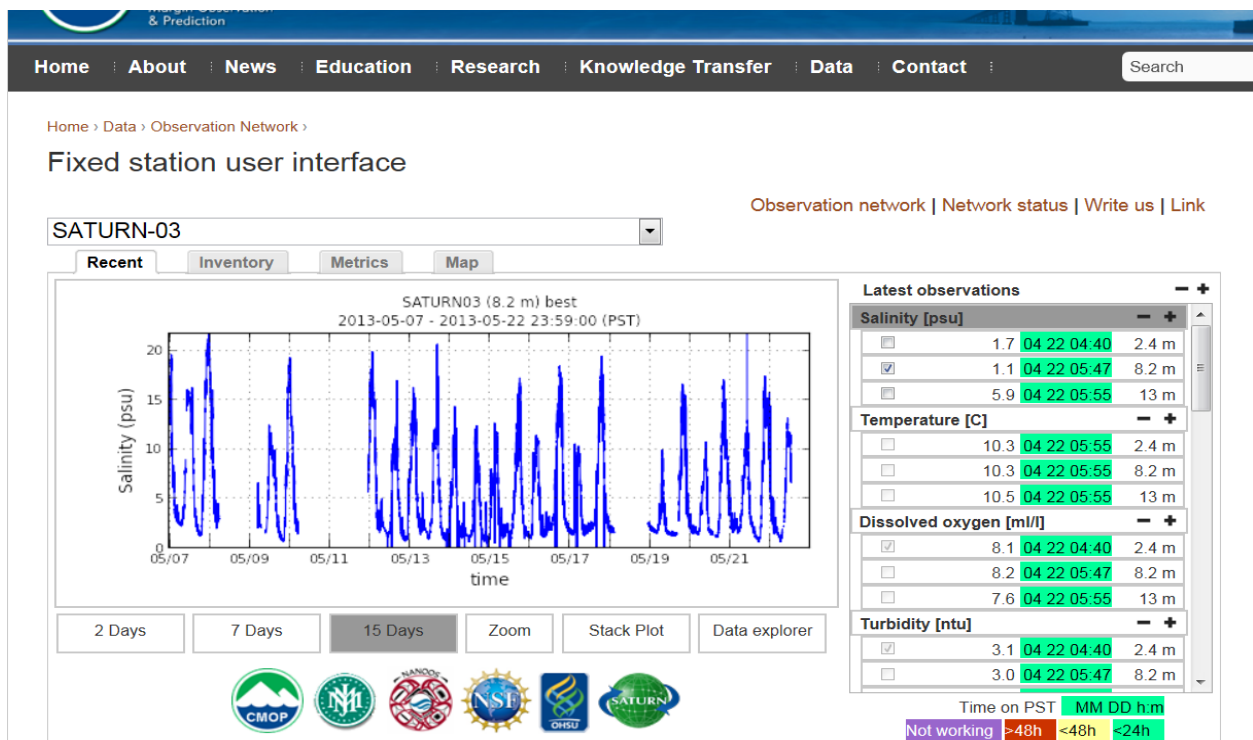
The Recent Tab

The **Recent** tab shows data collected within the last 15 days.

Using the **Recent** tab you may perform the following tasks:

- Graphically obtain information by choosing a variable under the <u>Latest observations</u> item box on the right side of the graph.
    - The variables available may include: **Salinity, Temperature, Dissolved oxygen, Turbidity, Phycoerythrin, Colored Dissolved Organic Matter (CDOM), Chlorophyll, Nitrate, pH, and pCO$_2$** , among others.

Example: Salinity

Click the box where **Salinity** [psu] is written.

- The **Salinity** box becomes gray
    - You now have the option to graphically represent **Salinity** at depths of 2.4 meters (m), 8.2m, 13m and/or 14.8m.
- Click inside the checkboxes boxes under Salinity [psu].
    - All four depths of 2.4m, 8.2m, 13m, and 14.8m can be viewed at the same time.

Temperature [C], **Dissolved oxygen** [ml/l], and other variables can be viewed in the same way.

Note: Using the **Fixed station user interface** variables such as Salinity [psu] and Temperature [C] cannot be viewed together at the same time. This can be done in the DATA Explorer which will be discussed later.

In the bottom right hand corner of **Figure 3**, you see **Time on PST** followed by green highlighted letters, **MM DD h:m**. This shows the time it was when the data was captured, if it has been less than 24 hours.

- **PST** stands for Pacific Standard Time
- **MM** stands for month
- **DD** stands for day
- **H** stands for hour

The yellow highlighting stands for times **less than 48 hours**, red stands for times **greater than 48 hours**, and the purple means the feature is not working. The color indicates when the latest data for the instrument has been collected.

Figure 3.
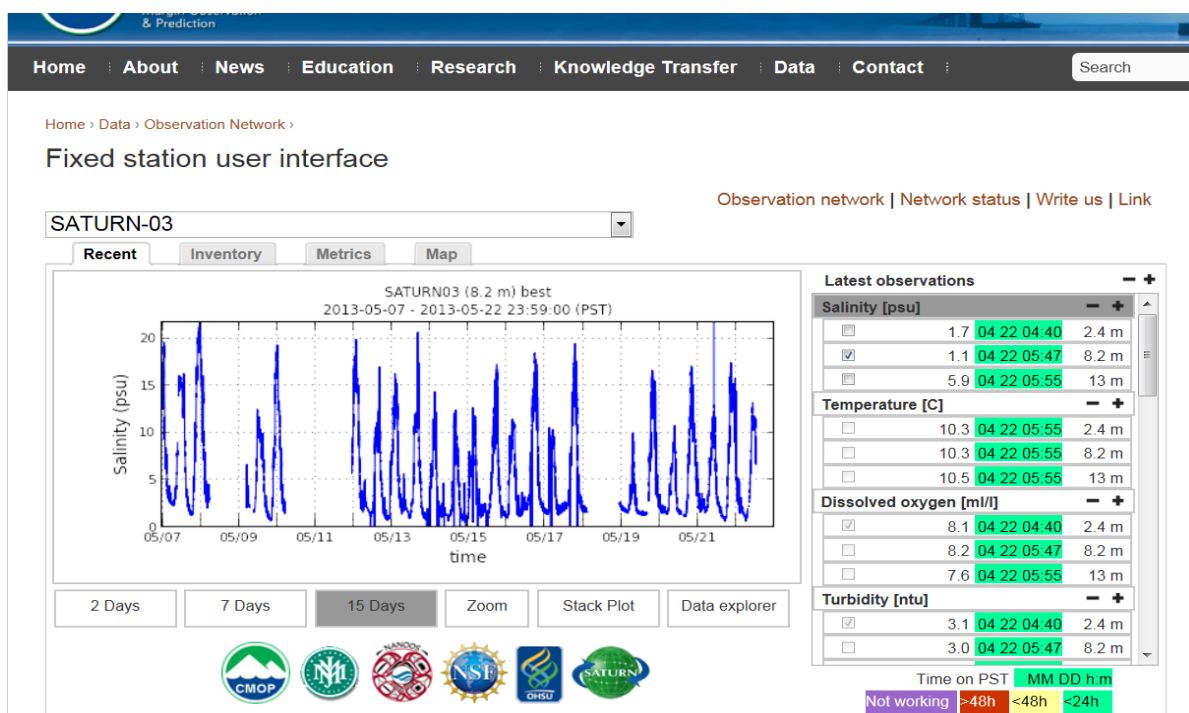
Below the graph there are square boxes which say **2 Days, 7 days, 15 Days, Zoom, Stack Plot,** and **Data Explorer.** The **2, 7, or 15 Day** buttons change the number of days of observation data that will be plotted on the graph.
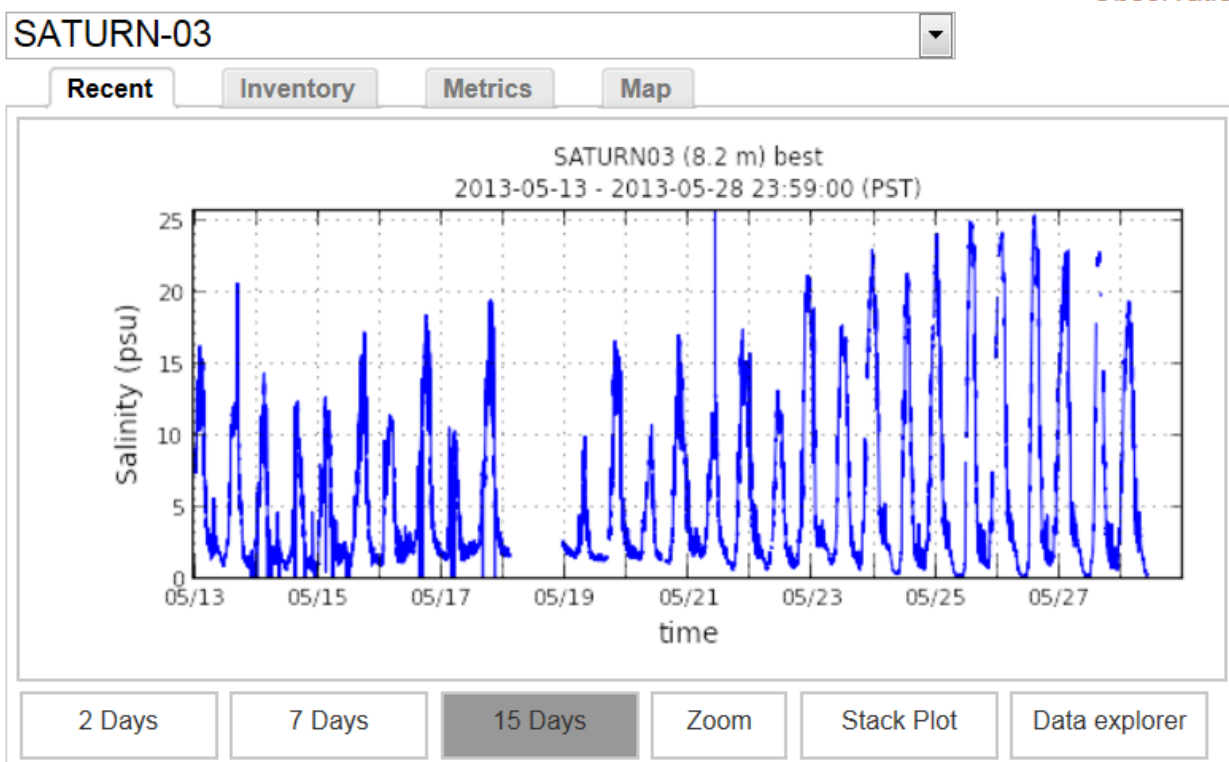
Reading the graph

Look at **Figure 4**

Above the graph you will see a heading. This heading tells you what station is being used (**SATURN03**), the depth being viewed (**8.2 meters**) and **best**. **Best** means the data has been through quality assurance and control assessment.

Below the **SATURN03 (8.2 m) best** heading you will find starting date through the ending date that is displayed on the graph (**2013-05-13** – May 13, 2013 through **2013-05-28** – May 28, 2013) followed by the time (**23:59:00** –11:59 PM) and time zone (**PST** – Pacific Standard Time).

On the graph, **time** is located on the horizontal x-axis and the variable chosen, in this case **Salinity** is located on the vertical y—axis.

Figure 4.

Look at Figure 5.

Under the **Salinity** heading on the right hand side the 2.4m, 8.2m and 13m boxes have been checked.
Three colored lines appear in the graph.
Each depth is represented by a different color.
The **blue line** is **2.4m**, **red line** is **8.2m**, and **green line** is **13.0m**. Inside the graph matches the corresponding data highlighted in its specific color for the representative data.

Figure 5
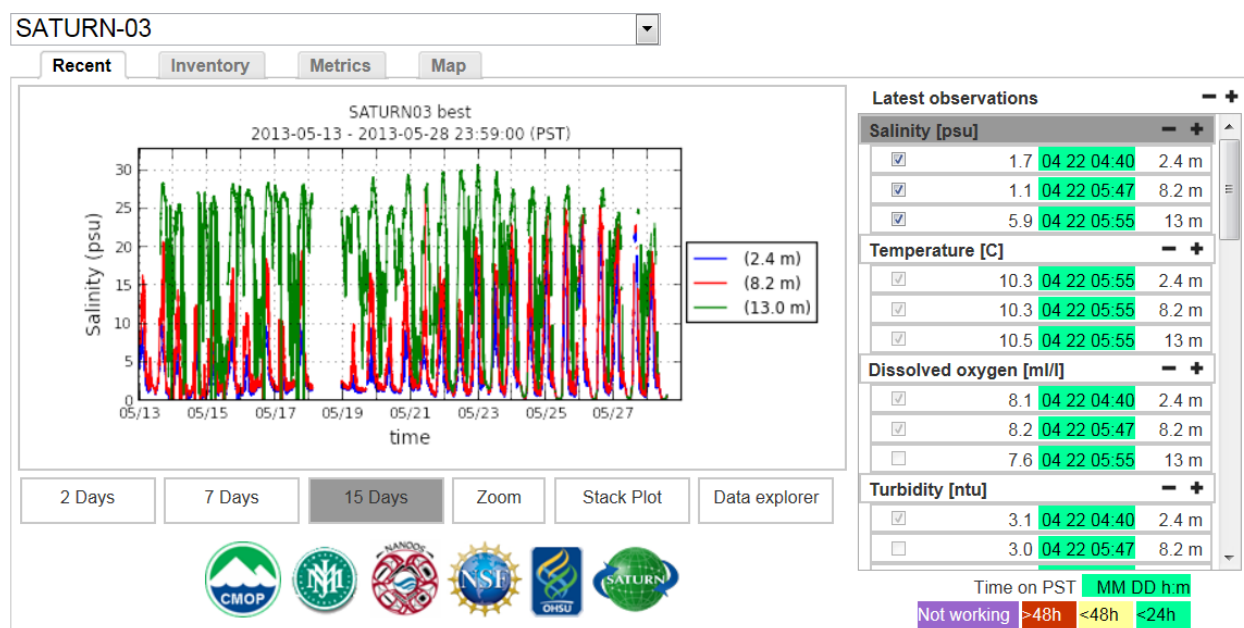
Zoom Box

Clicking the **Zoom** box allows you to enlarge and **print** the graph.
To return to the **Fixed station user interface** go to the right upper corner of the graph and click the X.
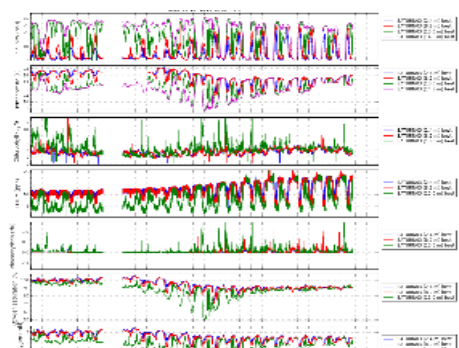
Stack Plot

Clicking the **stack plot** box shows time series plots according to the **2 Days**, **7 Days**, or **14 Days** selected on the Fixed station user interface page. These plots are graphed in the order of the items listed in the Latest observation item box located on the Fixed station user interface webpage.

- Choose 2 Days, 7 Days, or a5 Days
- Click the **Stack Plot** box located below the graph
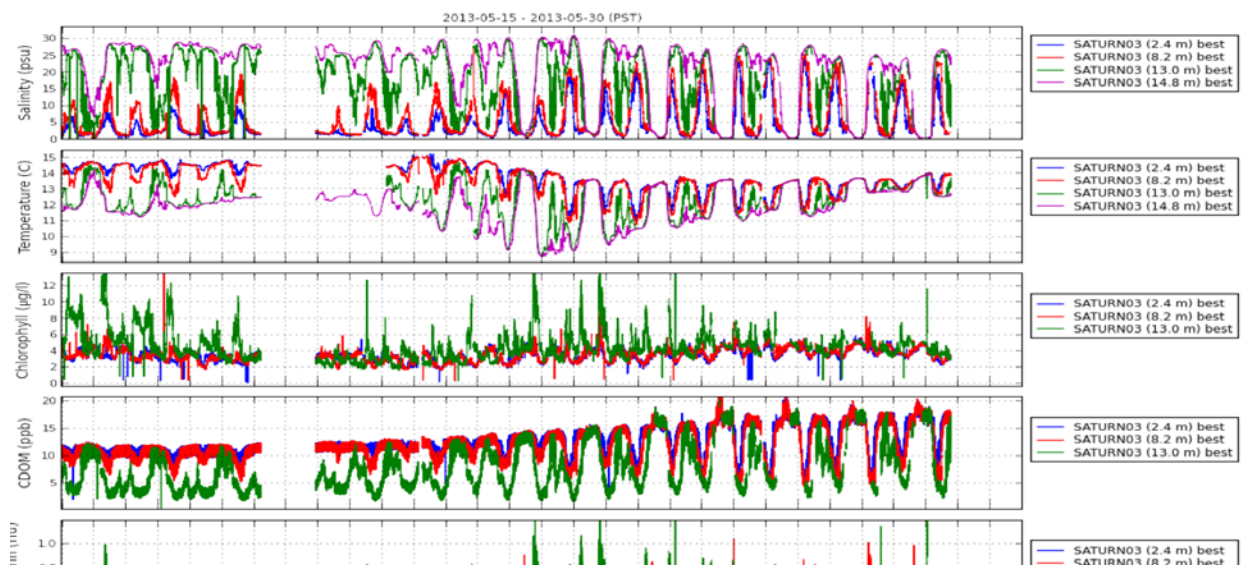- All of the time series plots will be very small (**Figure 6**)

Figure 6.

To enlarge the stack plots of the time series image (**Figure 7**):

- Move your cursor over the stack plots and the cursor will change to a magnifying glass with a plus sign in the middle,
- Now click

Figure 7

Description of what is seen on the page, example Figure 7:

Above time series graph is listed: **2013-05-15 – 2013-05-30 (PST)**

- Describes the dates represented by time series plots and the time zone

Writing on the left hand side of each plot is listed: **Salinity (psu), Temperature (C), Chlorophyll (ug/l), CDOM (ppb)**

- Describes what is being measured on each particular time series

Legend on the right hand side of each time series plots, the first legend is listed as an example below:

----- SATURN03 (2.4m) best

----- SATURN03 (8.2m) best

----- SATURN03 (13.0m) best

----- SATURN03 (14.8m) best

- Colored lines corresponds to data represented in the graph
- **SATURN03** is the Endurance station
- (**2.4m, 8.2m, 13.0m, 14.8m**) is the depth at which the sensor recorded the data
- **best** is describing the quality of the data

Although not shown in **Figure 7**, the X-axis is found below the last time series plot on the webpage in which:

- **All** of the time series plots are graphed over the same dates

To minimize the stack plots click on the graphs.

To leave the page, close the tab of the stack plots page.

The original page for the Fixed station user interface will still be open under the tab.

How to Use The Data Explorer

The **Data Explorer** allows you to construct graphs of the different data from **all** of the sensors throughout the Observation Network.

Click on the **Data Explorer** box below the graph. A toolbar and blank page will appear, as in **Figure 8.**

Look at **Figure 8**.

Data Explorer help page can be found by click the box with a picture of and (i) in a circle found in the upper right hand corner.

Tool Bar

The tool bar is a set of buttons found at the top of the page under Data Explorer that allow users to (from left to right): **Add new plots, Save session, Open session, Download session as image,** and **Clear all plots** from canvas.

Figure 8.
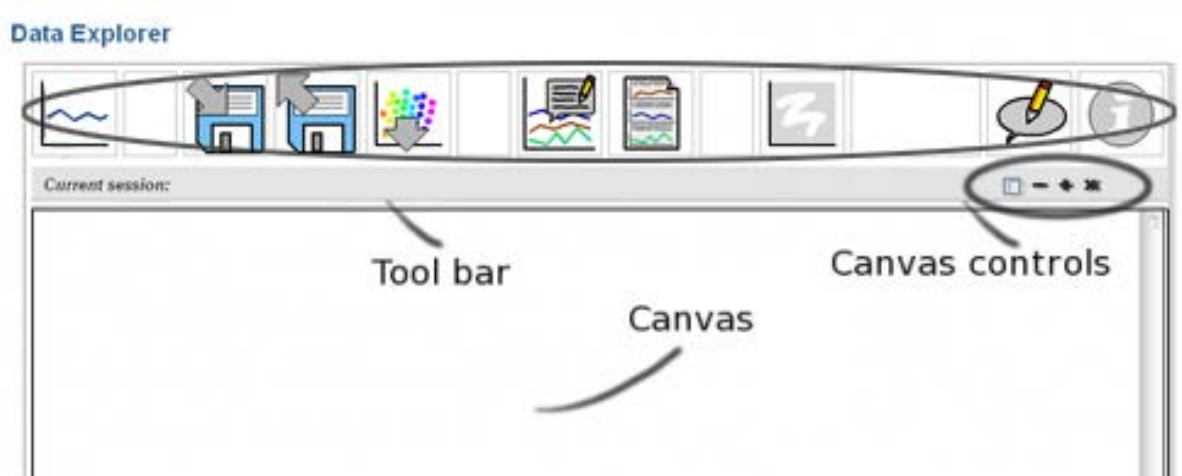
Canvas Controls

Canvas controls allow users to minimize (-), maximize (+), and remove (x) selected plots.

Canvas

Canvas is the working area where plots are added.

Plots

Plots are elements added to the canvas by users during a session.

Adding Plots

There are three different types of plots in Data Explorer: **Time series, Scatter plot,** and **Colored plots**.

To add a Plot, click on the first button to the left, as seen in **Figure 9**

Figure 9. Data Explorer Tool Bar

The **Plotting parameters** window will appear (**Figure 10**)

Figure 10. Plotting Parameters window

Time Series plot

A **Time Series** is a sequence of data points which is typically measured at uniform time intervals (ex. once every hour). A **time series plot** represents these measurements on a graph over time. See **Figure 11.**
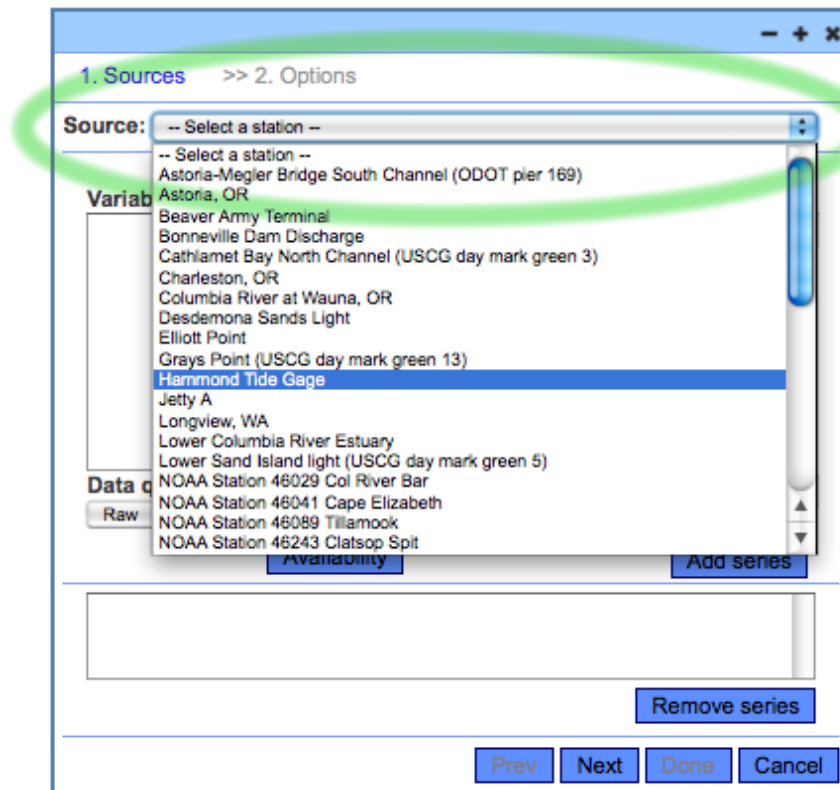
Figure 11. Time Series Plot
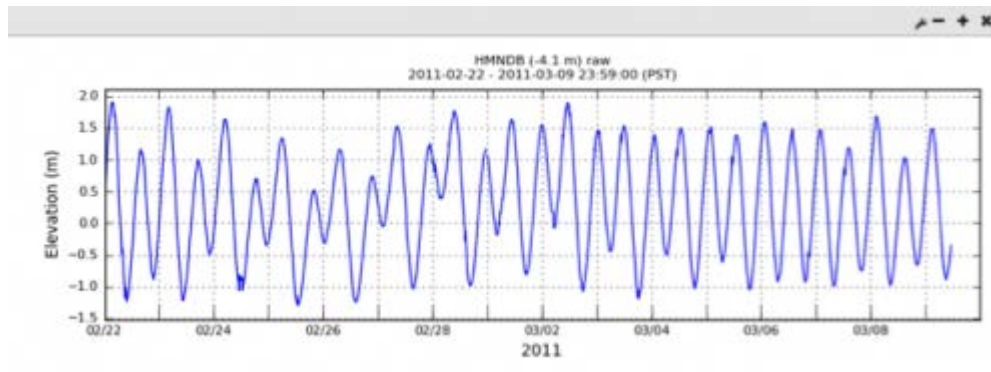
To Create a Time Series Plot:

An Example Using SATURN03

- Add a plot
- Select SATURN03 from the Source drop-down menu. (**Figure 12**)
- All the variables available for this station will be displayed on **Variables** list

Figure 12. Selecting a Station

- Select **CDOM at 2.4m** by clicking on the value in the variables window
- While it is still highlighted in blue, click the > button by the Y: box (Third button down)
- Repeat for the variables **CDOM at 8.2m**, and **CDOM at 13m** (**Figure 13**)
  - The selected variables will be added to "Y" variables. Notice that "X" variable value by default is "Time".

Figure 13. Adding Y Variables
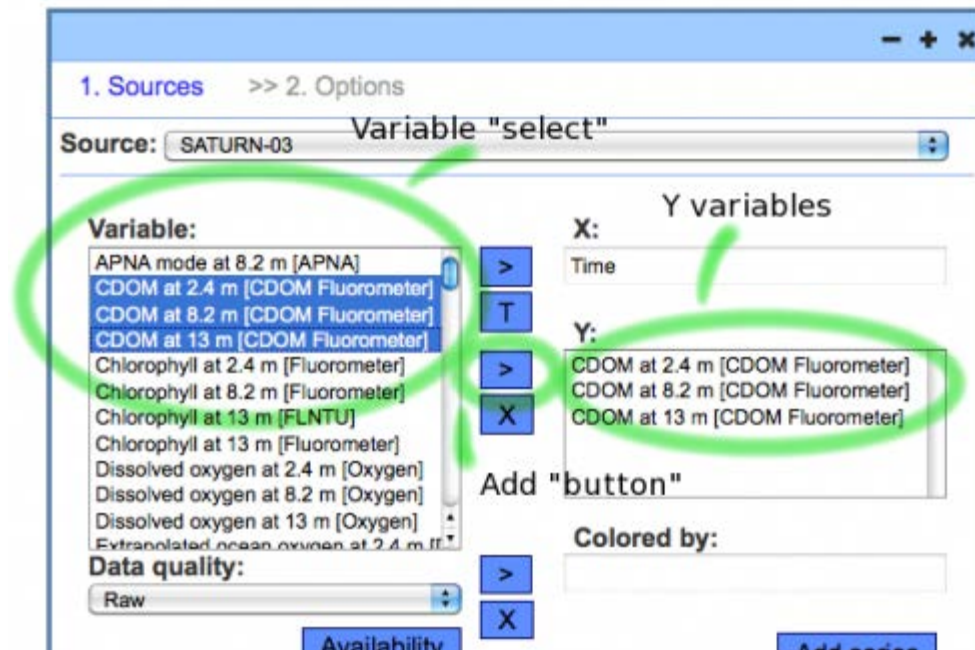
Note: If you want to add variables from other stations, repeat directions above. If you want to remove a series from **Y** variables, select the variable you want to remove and click on **<**

- Click on **Add series** button and the variables from **Y:** will be moved to a list of plots.
- Click on **Next** button to change time/date. (**Figure 14.**)

Figure 14. Adding Y variables to the plot

- After clicking on **Next** button the **Time range** menu is displayed.
- There are two ways to change the time range of the data:
  - Select one of the standard time spans (**1, 7, 15**, and **30 days**) and **select the end date**
  - Change start time and end time (**Figure 15**)
- Click on **Next** button

Figure 15. Changing the time parameters

Quality Levels

Quality levels describe the level of processing the data has gone through. The 3 quality levels currently available are: raw data, with no quality control (abbreviated as PD0); preliminary data, with some quality control applied (PD1); and verified data (PD2), which has been subject to full quality control processing.

Note: We are currently working to perfect the quality control feature in Data Explorer.

- Click **Next**

The **Next** button adds the new plot/(s) to the canvas.
Same variables are grouped in the same plot, i.e. if we added salinity from SATURN-03, SATURN-05, and SATURN-02 this will create one plot not three plots. If you want different plots for the same variable, repeat steps 1-5 for each plot

Scatter plots

A **scatter plot** is a graph of plotted points that show the relationship between two sets of data.
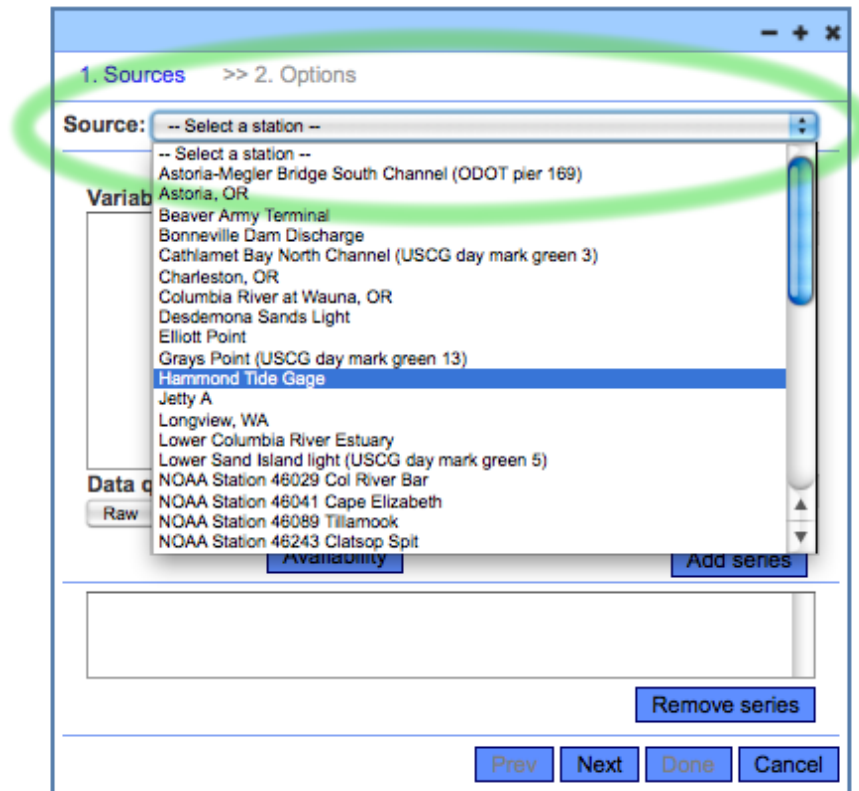
To Create a Scatter Plot:

An Example Using SATURN03

- Add a plot
- Select SATURN03 from the Source drop-down menu. (**Figure 16**)
- All the variables available for this station will be displayed on **Variables** list

Figure 16. Selecting a Station

- Select **CDOM at 8.2 m** by clicking on the value in the variables window
- While it is still highlighted in blue, click the > button by the **Y:** box (Third button down)
- Select **Elevation at 14.8 m** by clicking on the value in the variables window
- While it is still highlighted in blue, click the > button by the **X:** box (First button down) (**Figure 17**)

Figure 17. Adding X and Y Variables to the plot

- Click on **Add series** button and the variables from **X:** and **Y**: will be moved to a list of plots.
- Click on **Next** button to change time/date. (**Figure 18.)**
- The **Time range** menu is displayed. There are two ways to change the time range of the data:
  - Select one of the standard time spans (**1, 7, 15**, and **30 days**) and **select the end date**
  - Change start time and end time (**Figure 18**)
- For the purpose of this exercise, choose **7 days from End date**
- Click on **Next** button

Figure 18. Changing the time parameters

Quality Levels

Quality levels describe the level of processing the data has gone through. The 3 quality levels currently available are: raw data, with no quality control (abbreviated as PD0); preliminary data, with some quality control applied (PD1); and verified data (PD2), which has been subject to full quality control processing.

Note: We are currently working to perfect the quality control feature in Data Explorer.

- Click **Next**

The **Next** button adds the new plot/(s) to the canvas. **(Figure 19)**

Figure 19. Scatterplot example CDOM vs. Elevation
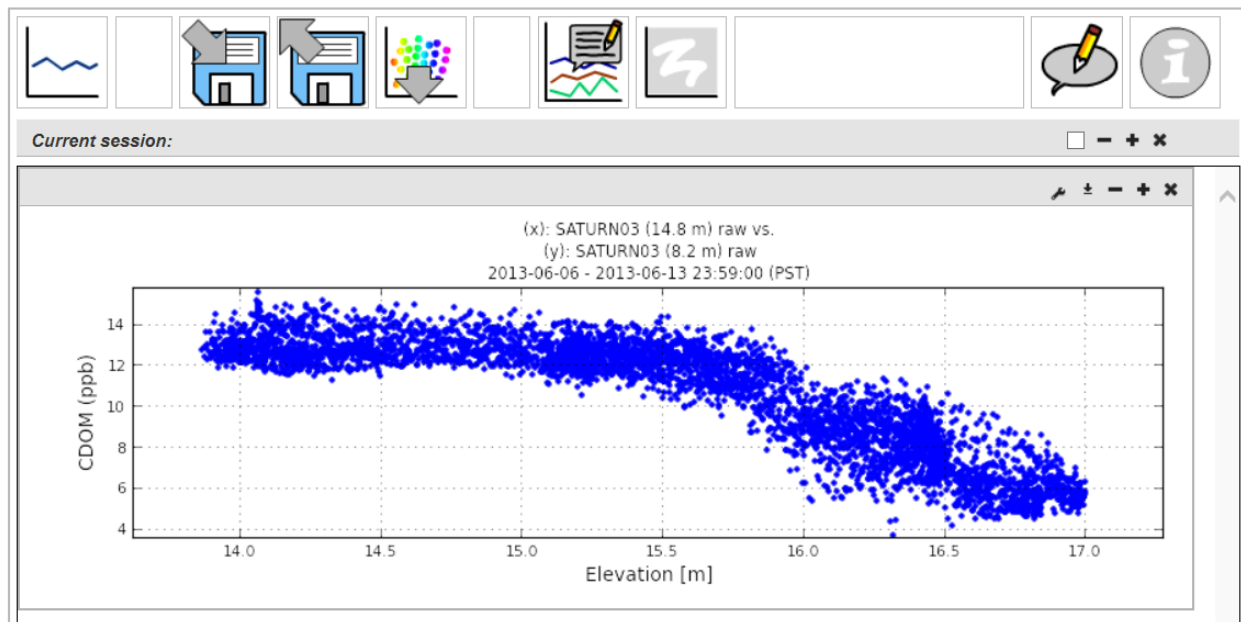
Colored Scatter plot

Color can be added to a plot to reflect the values of a third parameter.

Time series and Scatter plots can be colored using a third variable adding a variable to **Colored by** field.

To Create a Colored Scatter Plot:

An Example Using SATURN03

- Add a plot
- Select SATURN03 from the Source drop-down menu. (**Figure 20**)
- All the variables available for this station will be displayed on **Variables** list

Figure 20. Selecting a Station
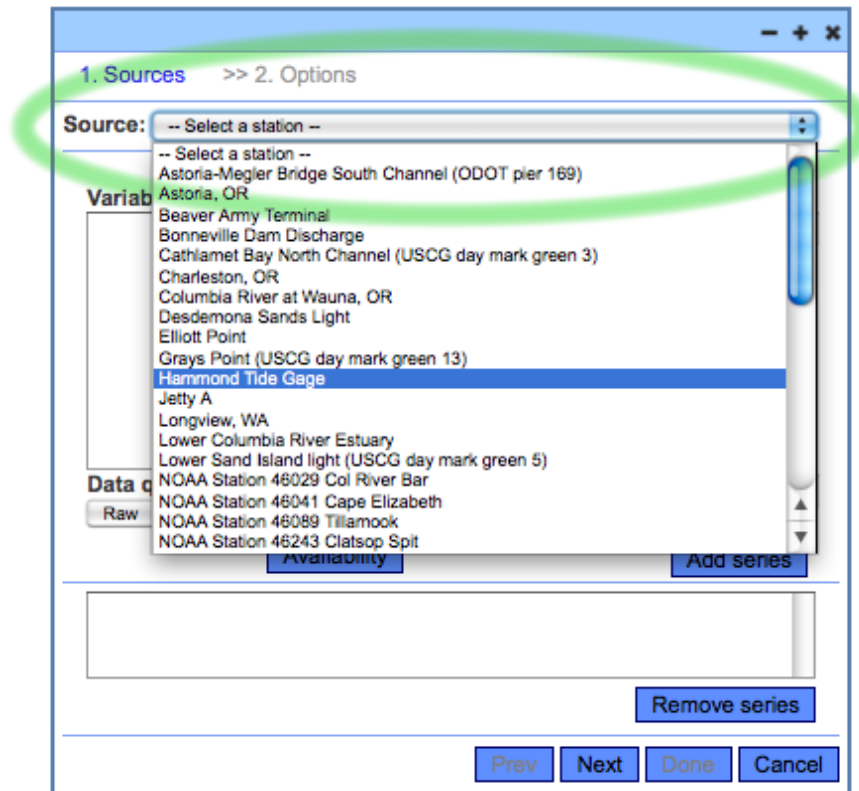
- Select **CDOM at 8.2 m** by clicking on the value in the variables window
- While it is still highlighted in blue, click the > button by the **Y:** box (Third button down)
- Select **Elevation at 14.8 m** by clicking on the value in the variables window
- While it is still highlighted in blue, click the > button by the **X:** box (First button down) **(Figure 21)**
- Select Dissolved Oxygen at 13 m by clicking on the value in the variables window
- While it is still highlighted in blue, click the > button by the **Colored by:** box (Fifth button down)

Figure 21. Adding X, Y, and Colored by Variables to the plot

- Click on **Add series** button and the variables from **X:** and **Y**: will be moved to a list of plots.
- Click on **Next** button to change time/date. (**Figure 22.)**
- The **Time range** menu is displayed. There are two ways to change the time range of the data:
  - Select one of the standard time spans (**1, 7, 15**, and **30 days**) and **select the end date**
  - Change start time and end time (**Figure 22**)
- For the purpose of this exercise, choose **7 days from End date**

- Click on **Next** button

Figure 22. Changing the time parameters

Quality Levels

Quality levels describe the level of processing the data has gone through. The 3 quality levels currently available are: raw data, with no quality control (abbreviated as PD0); preliminary data, with some quality control applied (PD1); and verified data (PD2), which has been subject to full quality control processing.

Note: We are currently working to perfect the quality control feature in Data Explorer.

- Click **Next**

The **Next** button adds the new plot/(s) to the canvas. **(Figure 23)**

Figure 23. Scatterplot example CDOM vs. Elevation Colored by Dissolved O$_2$
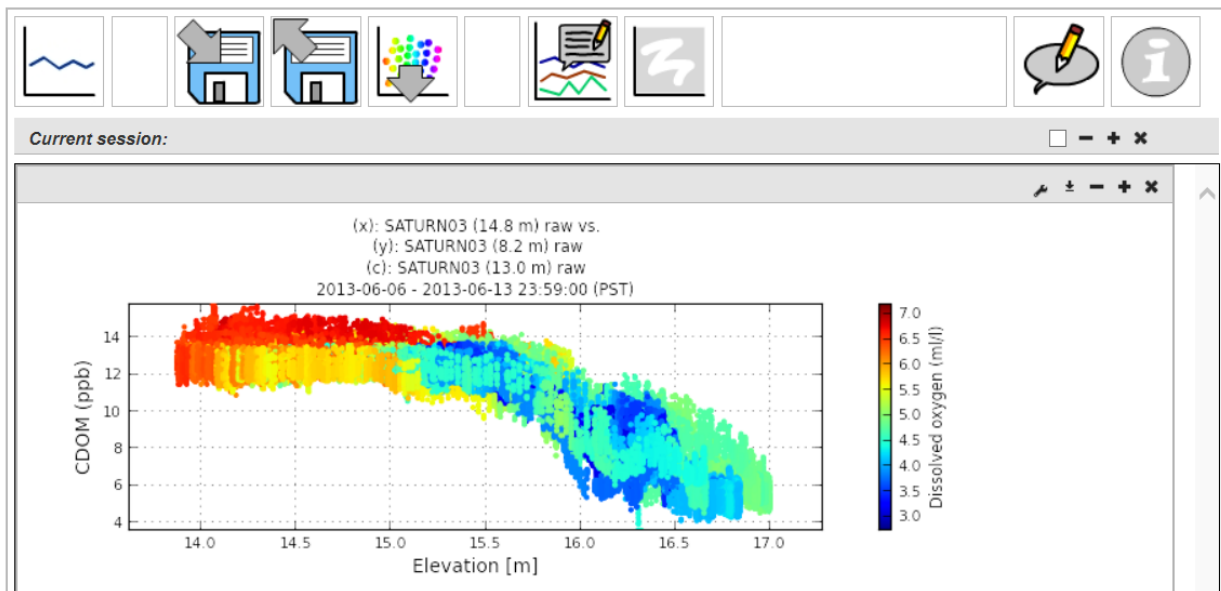
Saving, Opening and Commenting on sessions

Data Explorer allows you to save, retrieve, and share your work with other users.

 ONLY LOGGED IN USERS ARE ALLOWED TO SAVE SESSIONS.

For more information on saving, opening, or commenting on sessions please refer to the CMOP website through the following links:

How do I save my session?

How do I share my saved session?

How do I delete a saved session?

How do I comment on a saved session?

How do I publish a saved session as a web page?

Plot Controls

Some of the plot controls are similar to canvas controls, but only affect the behavior of one plot. The plot controls also add the plot options control and the download data control.

Figure 24. Plot Controls
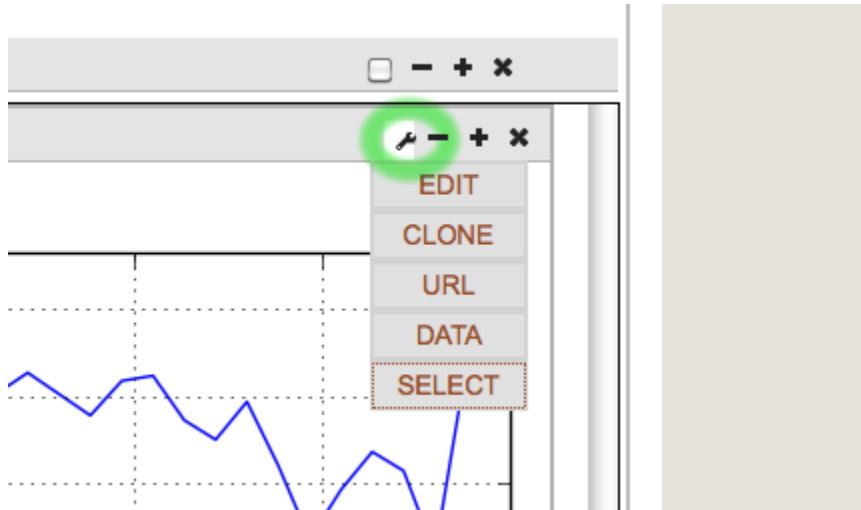
This control allows users to edit, clone, display URL, download data, and select a plot.

Edit plot, opens "plot parameters" windows and users can add or delete variables, change time range, change limits, and change layout of a plot. If multiple plots are selected a confirmation will ask you if you want to edit the current plot or all the selected plots.

Clone plot, creates a copy of a plot.

URL, displays the URL of the plot. You can copy and paste the URL on an email if you want to share the image with another user.

Data, allows you to download the data used on a plot.

Select/Deselect, selects and deselects a plot to tie its behavior to "canvas controls".

Data Availability

The **Data Availability** control brings up a diagram representing years and months data was collected for each variable at each station.

Figure 25. Data Availability

- Select Source: SATURN 03
- Select CDOM at 8.2 meters
- Click the Availability box
- A table pops up which allows you to see when data was collected for this variable, at this station.

Fixed station user interface II

Fixed station user interface gives directions on the use of **Inventory tab, Metrics tab and Map tab** (**Figure 26)**.

Using this page you may also perform the following task:

- Go back to the home page of the Observation network
- Check the Network status of the observation network stations and sensors
- Write us
- Link to this webpage
- Go to the **Inventory tab**, **Metrics tab**, and **Map tab**
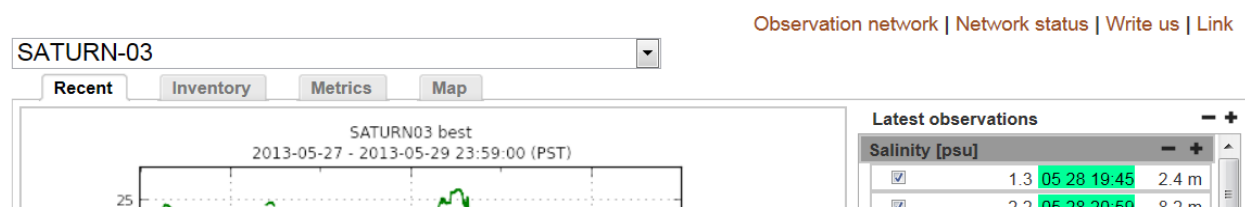
Figure 26.

Clicking Network status, **Figure 27**

- This webpage provides a Daily field report/record of the sensors and stations.
    - A map allows you to look at the reports by day, month, and year, example May 29, 2013 has been selected on the calender

There are two ways this webpage may be displayed to the user, example **view 1-Figure 27** and **view 2-Figure 28/29**. Major similarity and difference from the way in which you may see this webpage presented.

- Similarity- both view 1 and view 2 will have a comment box at the bottom of the webpage
- Difference- view 2 uses the legend in the upper right to denote status of stations and sensors in that station

Figure 27.
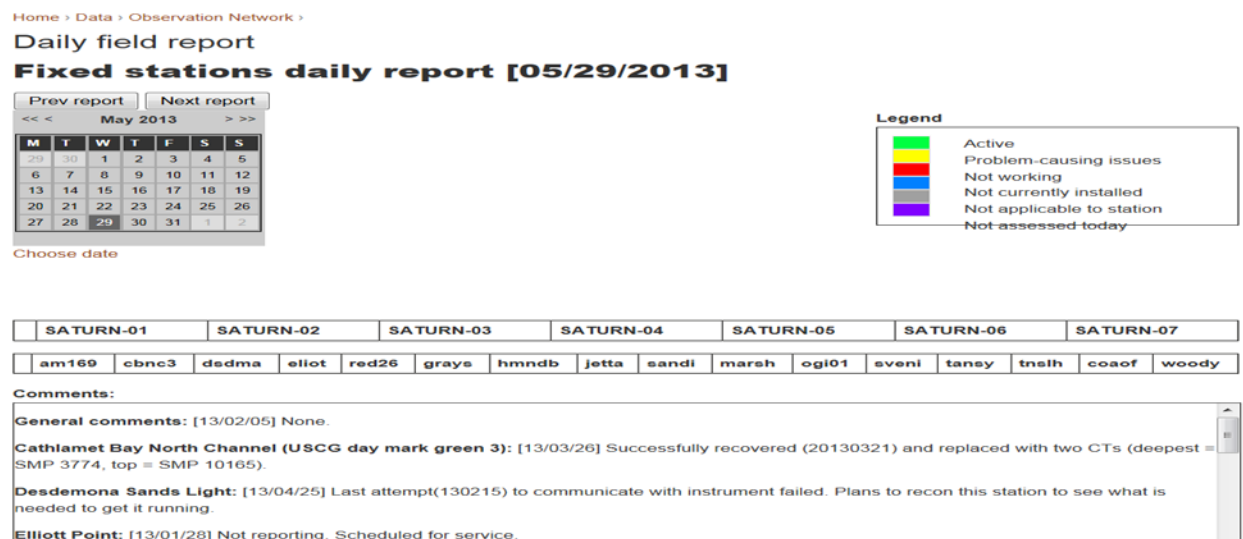
The boxes labelled SATURN-01, SATURN-02… are stations as well as the boxes that have abbreviations such as am169, cbnc3.... The boxes on the left hand side found in **view 2-Figure 28/29** such as ADP, Algae watch, CDOM Fluorometer are the sensors.The abbriviated stations are defined and a description of the sensors can be located under the Definitions of Relevant Terms for the Observation Network.

Figure 28 (Top half of the webpage)

Fixed stations daily report [5/9/2013]

Prev report | Next report

<< <   May 2013   > >>

M	T	W	T	F	S	S
29	30	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	1	2

Choose date

Legend

- Active (green)
- Problem-causing issues (yellow)
- Not working (blue)
- Not currently installed (gray)
- Not applicable to station (purple)
- Not assessed today

	SATURN-01	SATURN-02	SATURN-03	SATURN-04	SATURN-05	SATURN-06	SATURN-07
ADP	Active			Not working			
AlgaeWatch			Active				
CDOM Fluorometer	Not working		Active	Active			Active
CT	Not working		Active	Not working			Active
CyanoWatch			Active				
Derived SO			N/A				
Derived ST			N/A				
FLNTU	Not working						
Fluorometer				Active			
LISST	Not working						
LOBO					N/A		
Multi-exciter							Active
Oxygen							

Figure 29 (Bottom half of the webpage)

	SATURN-01	SATURN-02	SATURN-03	SATURN-04	SATURN-05	SATURN-06	SATURN-07
LOBO					N/A		
Multi-exciter							Active
Oxygen	Not working		Active	Active			Active
pH			Active				
Phycoerythrin	Not working						
Phytoflash			Active				
Pressure	Not working						
Pump			Active	Active			
SAMI CO2				Active			
SUNA			Active		N/A		
Thermistor			Active				
Turbidity			Active	Active			
YSI6600V2					N/A		

	am169	cbnc3	dsdma	eliot	red26	grays	hmndb	jetta	sandi	marsh	ogi01	sveni	tansy	tnslh	coaof	woody
CT		Active	Not working					Active					Active			
CTD				Not working		Active								Not working	Not working	
Thermistor																Active

Comments:

General comments: [13/02/05] None.

Cathlamet Bay North Channel (USCG day mark green 3): [13/03/26] Successfully recovered (20130321) and replaced with two CTs (deepest = SMP 3774, top = SMP 10165).

Desdemona Sands Light: [13/04/25] Last attempt(130215) to communicate with instrument failed. Plans to recon this station to see what is needed to get it running.

Elliott Point: [13/01/28] Not reporting. Scheduled for service.

The Inventory Tab

The **Inventory** Tab page shows the data collected before, during, and after the Quality Control, Quality Assurance checks. Data Quality Assurance methods can be viewed if needed, **Figure 30**.

Key features of the **Inventory** page:

- This page allows access to the RAW, PRELIMINARY, and VERIFIED data collected via RAW, PRELIMINARY, VERIFIED radial buttons.
- When orange highlighted line, for example CDOM (ppb), CDOM fluorometer at depth 8.2 m is chosen under the RAW heading in the webpage that data will come up in a excel spreadsheet.

Figure 30
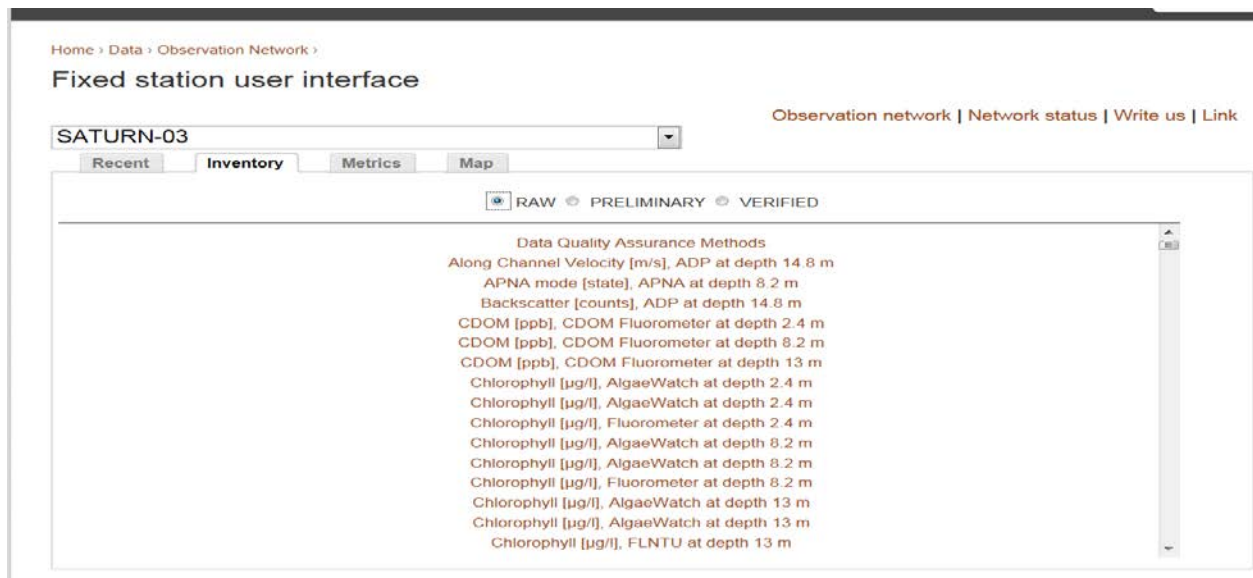
- Scrolling down the page you will find a calendar with orange highlighted dates and months and black highlighted dates and months, **Figure 31**.
  - Orange highlighted dates on the calendar denote data that is avaliable
  - **Black** dates on the calendar denotes data that is not avaliable

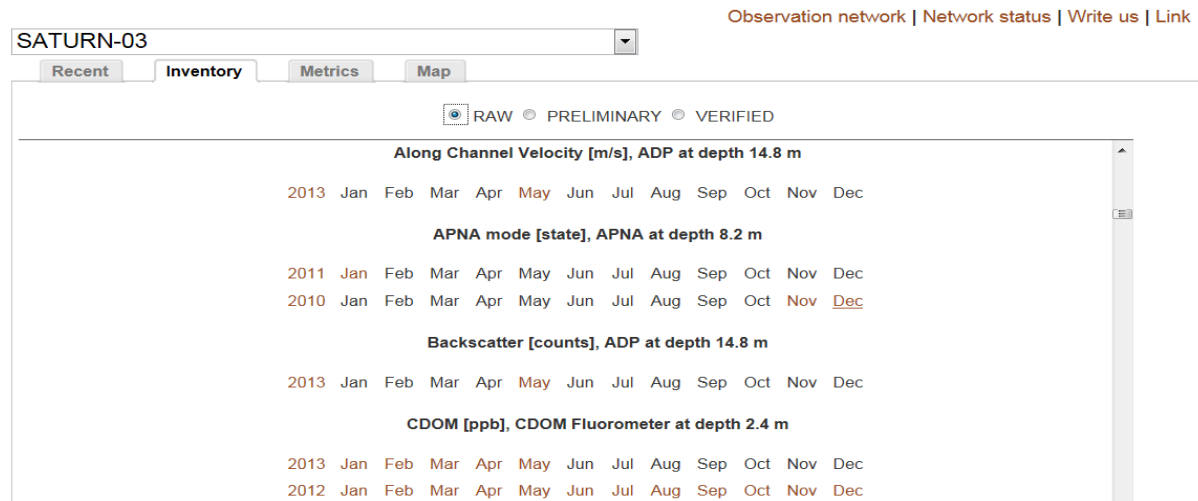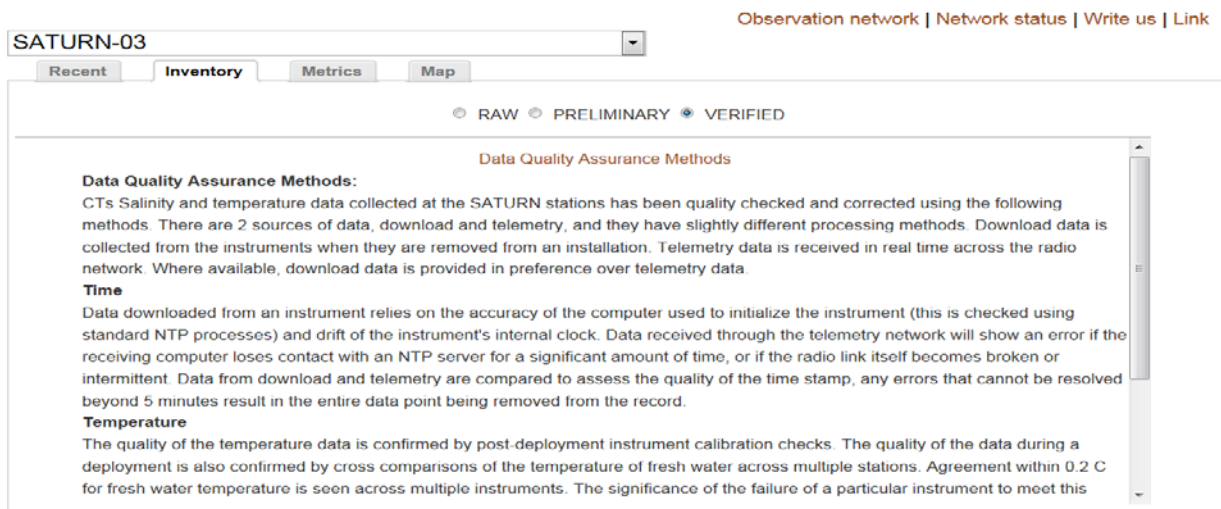**Figure 31**

- Click on Verified radial button you will find information about Data Quality Assurance (QA) Methods, example, **Figure 32**.

Figure 32

A further description of the QA and Quality Control (QC) methods used are written below.

Quality Assurance (QA)/ Quality Control (QC) General Information

This is general descriptive information regarding quality controlled data levels and QA/QC procedures.

Levels of Data Processing Available via the Data Explorer:

- **PD0** (processed data level 0): These are the raw data prior to any corrections.

- **PD1** (processed data level 1): These are preliminary data that have undergone some initial quality control, such as a real-time correction for a data artifact or preliminary flagging of periods of bad data, but they have not been subjected to the full quality control process outlined below.

- **PD2** (processed data level 2): These are the verified data that have been subjected to the full quality control process outlined below and assigned one of 5 data quality levels.

Data Quality Levels:
Data that have been evaluated are assigned one of five data quality levels ranging from good at level 1 to bad at level 5:

- **QL1 (GOOD)**: data have met all of the criteria for that sensor type to qualify as good data.

- **QL2**: data that are often good, but may be missing some information to verify the data are good

- **QL3**: data that have some quality concerns and users should pay particular attention to the quality control notes (via metadata or supporting documentation) to determine whether data are appropriate for use.

- **QL4**: data that have serious quality concerns. Users should pay particular attention to the quality control notes (via metadata or supporting documentation) and use the data with caution.

- **QL5 (BAD)**: "garbage" data such as during periods of sensor malfunction or outliers.

QA/QC procedure:
The QA/QC of biogeochemical data include the following types of evaluation:

1. **Visual Inspection**: of the data: the data are examined visually to identify periods of sensor malfunction, outliers and any unusual or suspect data patterns.

2. **Calibration Evaluation**: for those sensors that are calibrated, the accuracy of the calibration is evaluated based on the results of sensor-specific field protocols. For some sensors, a calibration is developed based on data from field samples.

3. **Data corrections**: may be applied to certain data sets to correct for calibration drift or offset, data artifacts, or for sensor fouling (when possible).

The visual inspection of data, calibration evaluation, and any data corrections each result in their own quality assessment, all of which are used to determine the final data quality flag. For example if visual inspection found the data to be good (QL1), but the calibration was determined to be of intermediate quality (QL3), the final data quality flag would be QL3.

Versioning:
Occasionally there will be updates or changes to the quality controlled data or quality assessments. Each release of quality flags is assigned a version number which will be provided with the relevant flag metadata. A log detailing the flag-set versions, the dates the changes were applied, and a description of the type of changes made to the quality flags will also be available with the flag metadata.

Access to QA/QC Information:
Users are encouraged to consult the QA/QC metadata and the in order to fully understand the reasoning behind the quality assessments prior to determining whether the data is appropriate for a particular use.

Metadata: all data that are flagged as less than good and some good data will have associated comments detailing the data quality determination. These comments are included in the QC metadata available for through the Data Explorer. To view the QC metadata for plotted data, select the QC metadata link under the tool icon in the upper right corner of the Data Explorer plot.
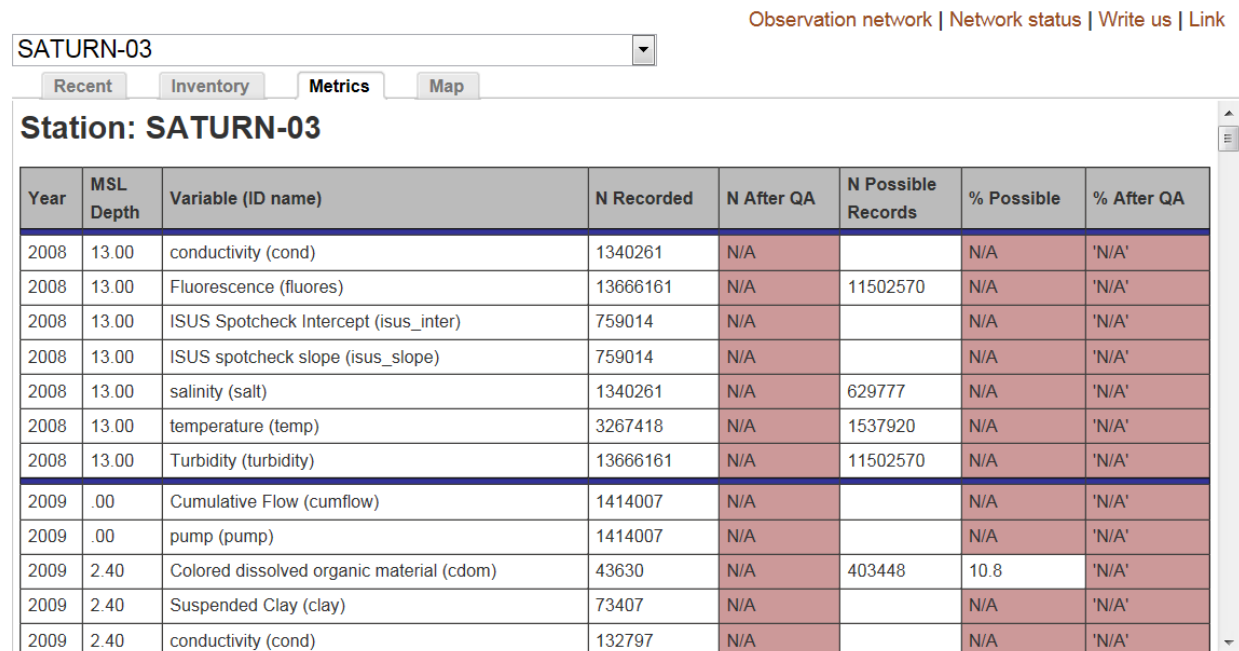
The Metrics Tab

The **Metrics tab**, this page quantifies the number of data records of the particular sensors located in the station of choice, **Figure 33**.

Figure 33

The definition of what the MSL Depth, N Recorded, N After QA, N Possible Records, % Possible, and % After QA can be found by scrolling down to the bottom of the page, example **Figure, 34**. The Variable (ID name) are the probes and sensors of that particular station. In this case it still is SATURN-03.

Figure 34

Home › Data › Observation Network ›

Fixed station user interface

Observation network | Network status | Write us | Link

SATURN-03

| Recent | Inventory | **Metrics** | Map |

2012	999.99	ISUS spotcheck slope (isus_slope)	119585	N/A		N/A	'N/A'
2012	999.99	Phycoerythrin (phycoeryth)	707418	N/A		N/A	'N/A'
2012	999.99	Turbidity (turbidity)	707959	N/A		N/A	'N/A'

The preceding table was generated by computing the number of possible samples per year across all instrument deployments at a given station and depth.

- MSL depth is the NGVD29 depth of the instrument deployments in meters. Several stations have had multiple simultaneous deployments at varying depths, e.g. red26 and am169.
- The 'N Recorded' column gives the number of data records retrieved from the deployment(s) and includes data received from telemetry and data downloaded from the instruments internal recorder. Not all instruments have internal recorders so records received are from telemetry only.
- The 'N After QA' column is the number of records for each physical variable that survived quality control procedures. Salinity is most sensitive to biofouling and is the variable most likely to fail quality control tests.
- The 'N Possible Records' is the number of records that could be seen given the length of cumulative deployments and the sample rate for each deployment.
- The '% Possible' column is the percentage of actual records retrieved. The 'N/A' indicates possible problems in the database such as an incorrect sampling rate or computational issues with this application that need further investigation.
- The '% After QA' column is the percentage of records surviving quality control procedures. The 'N/A' indicates possible problems in the database such as an incorrect sampling rate or computational issues with this application that need further investigation.

The Map Tab

The **Map tab**, this page uses a map to show the location of the stations in Columbia River and Columbia River Estuary, **Figure 35**.

Salient features of the **Map tab**:

- Stations are represented by red markers with a black dot in the middle
- Points to the location of the station you are using with white glove
- A station can be selected by clicking on a marker

Figure 35