Exploring Marine Chemistry with ODV
COESSING 2020
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Ocean Data View (ODV) is a freely available software that can be used to visualize physical, chemical, and biological data in the ocean. Data can be plotted by depth and across distance, latitude, longitude, or time. Data can be plotted discretely as individual points or intercalated to allow broad trends to be seen more easily. In this virtual lab module you will plot a variety of types of chemical data using different tools available in ODV. For this exercise you will need to download the Ocean Data View software and the GEOTRACES dataset which we will be working with here. GEOTRACES is an extensive oceanic chemical dataset that has been collected as part of an international effort to more fully characterize ocean chemistry.

If you run into any problems or have questions as you complete this lab please contact Winn Johnson on Slack in the #chemical-oceanography channel and by notifying @winnjohnson. This Slack channel is also a place for a broader discussion about chemical oceanography with other participants and instructors. There is much more to explore in the GEOTRACES dataset so don't limit yourself to the exercises described here. Have fun exploring ocean chemistry!

First download the software and the dataset.

To download Ocean Data View:

1. Go to: https://odv.awi.de/software/download/

2. Click on link that reads "register for the non-commercial version"

3. You will be asked to fill out some contact details and create a password. Submit this information and confirm it on the following page.

4. A confirmation email will be sent to you. Go to your email and click the link.

5. The link will prompt you to log into ODV. Once logged in, click on the "Software" dropdown menu and click on "Download".

6. Click on "1_ODV_Application". Then click on "Latest_Version".

7. Select the folder that corresponds to your operating system. It is available for Linux, MacOS, and Windows. Then click on "64_bit". For Windows, then click on "odv_5.1.7_w64.exe" and the installation file will automatically download.

8. Double click on downloaded file and follow instructions to install.

To download the GEOTRACES dataset:

1. Go to: https://www.bodc.ac.uk/geotraces/data/idp2017/

2. Scroll down to the category: “Discrete Sample Data” and click on “ODV format”

3. To monitor who is using this data they will request that you create an account before you may download the dataset. Click on the “register” link in the box that pops up.

4. Once you create your account and agree to the terms the dataset should begin to automatically download as a zip file.

Looking at data in ODV:

1. Double click on the zip file and then locate then double click on the ODV file within the folder.

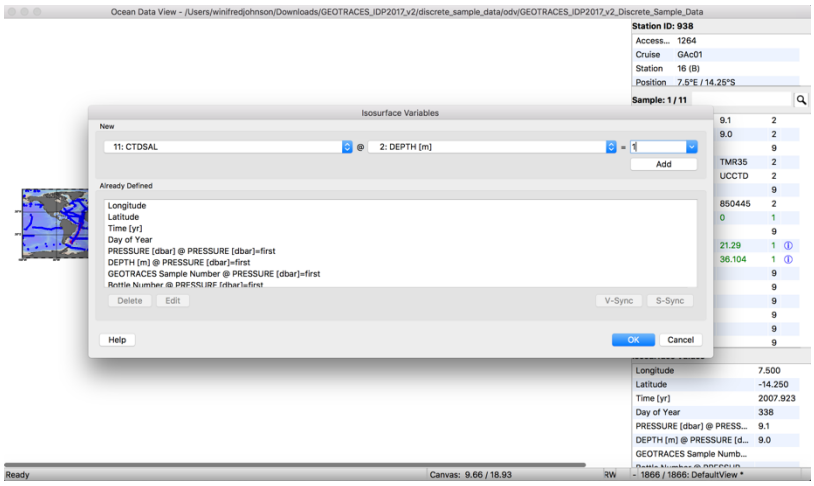
2. ODV will open automatically and you will see a map with a dot representing each location or station where samples were collected. By clicking on an individual dot and looking at the text on the right, you can see what data is available from that site.

3. There are four main ways to visualize data in ODV and the following exercises will illustrate three of these options.

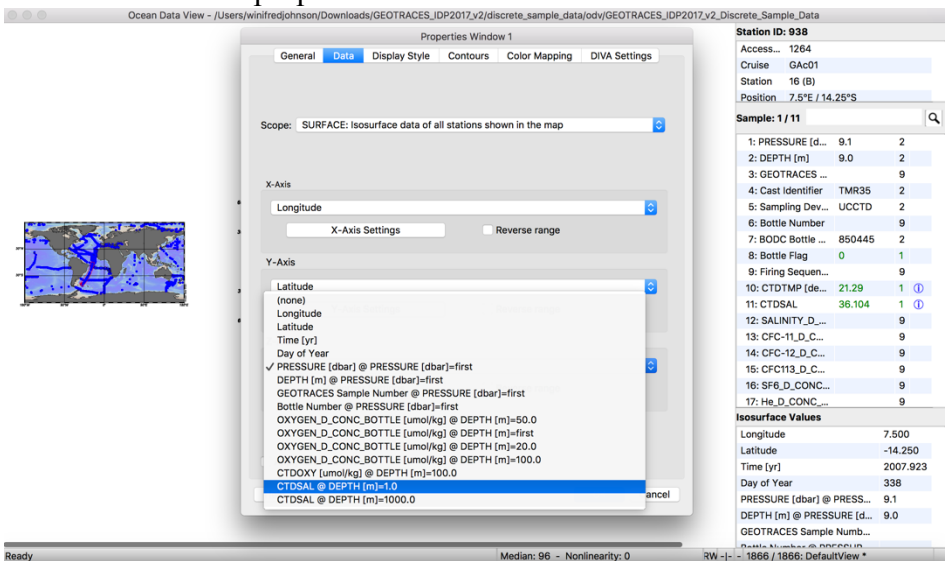
4. If the instructions below are not sufficient, I will be posting links to video tutorials that walk you through the basics of using ODV.

Exercises:

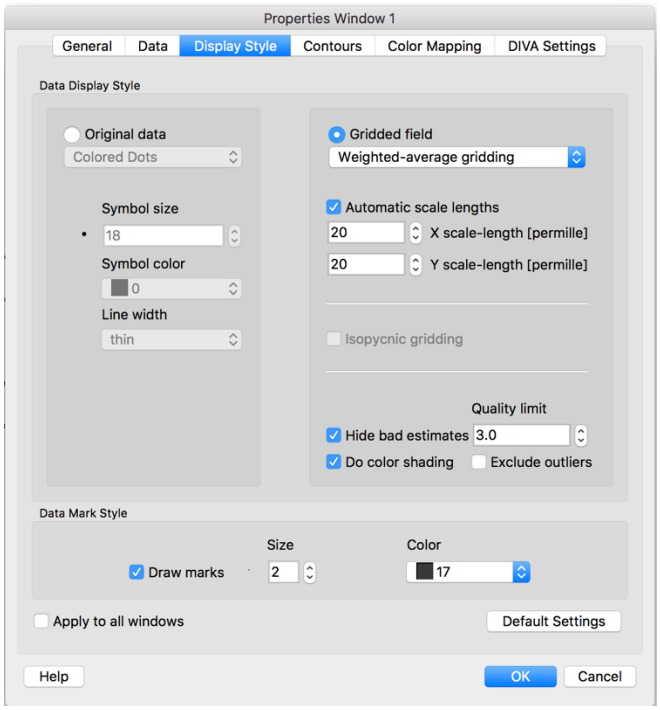
A. The distributions of elements in the ocean can be indicative of physical processes. These processes predominantly control the concentrations of the ions that contribute to the salinity of seawater. To plot global surface variation in salinity do the following:
    a. In ODV, go to the “View” dropdown menu. Under “Template Layouts” and select “1 SURFACE Window”.
    b. Return to the “View” dropdown menu and select Isosurface Variables… Select the dropdown menus variables as shown in the image below and set the depth to 1 and click add.



c. Right click on the map plot and select “Properties”. Under this series of tabs you can select what variables you would like to plot and how to plot the data. Your x and y axes should already be set to the latitude and longitude of the map. For the z-axis, click on the dropdown menu and select CTDSAL @ DEPTH[m]=1.0. Click Ok to exit properties.



d. Each station is now colored according to the salinity at 1 m depth. To more easily visualize regional trends in salinity, you can use algorithms provided by ODV to estimate the values between data points. To do this, return to “Properties” and under “Display Style”, select Gridded field.

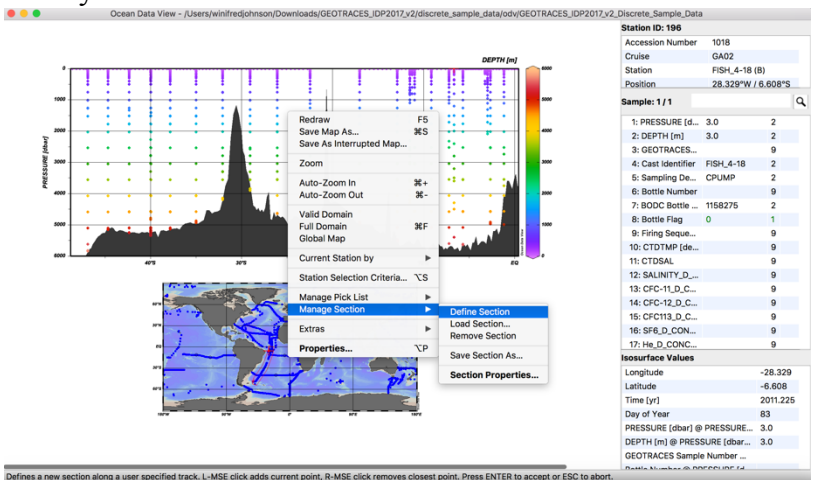


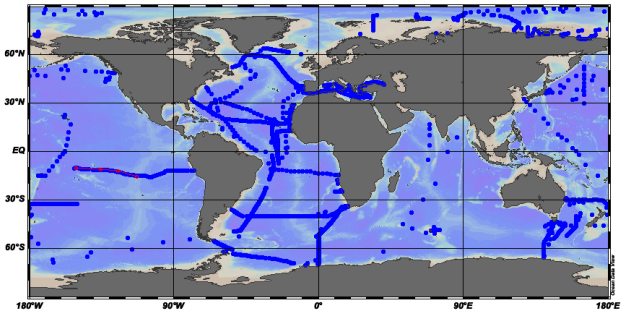
e. You should now be able to more clearly see how salinity varies at different latitudes. What physical processes are shaping these surface salinity concentrations?

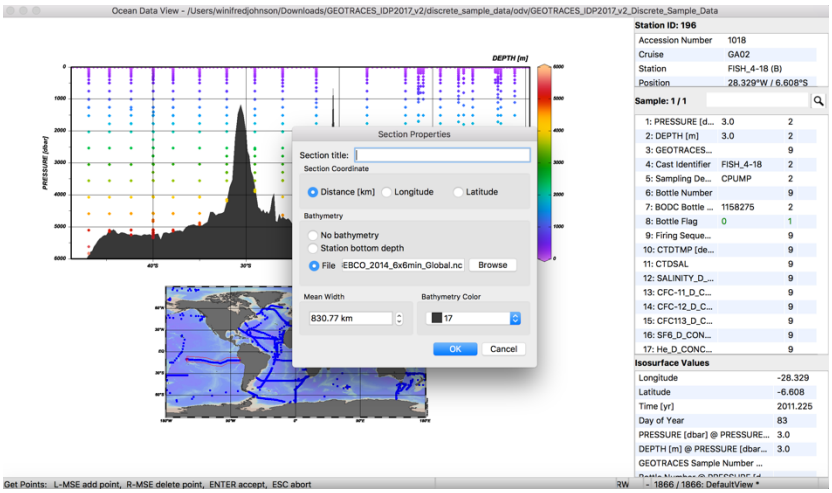
B. In this exercise you will compare the vertical distributions of nutrients in different regions where the physical and biological processes that control their abundance differ. To do this comparison you will compare a region with a subsurface oxygen minimum zone and with another region that lacks this feature. To identify locations to compare, create a similar plot as you did in Exercise A, but define the variable you will be plotting as CTDOXY [umol/kg] @ DEPTH [m]=200.00. This will show you the dissolved oxygen concentration at 200 m. Choose a region with low oxygen and another region with higher oxygen to compare in the following exercise.

a. To look at nutrient profiles by depth we will select a different type of plot. Go to the "View" dropdown menu. Under "Template Layouts" and select "1 STATION Window".
b. Right click on the resulting plot and return to "Properties" where you can change variables. Select PHOSPHATE_D_CONC_BOTTLE [umol/kg] for the x-axis and DEPTH [m] for the y-axis (and select Reverse range). Double click on the blue dots to add the data for a specific station. Compare the profiles of the stations with low oxygen to other stations.
c. Repeat this but plot NITRATE_D_CONC_BOTTLE [umol/kg] in the x-axis.
d. How do dissolved nutrient profiles differ between oxygen minimum zones and other ocean regions? What are controlling these concentrations?

C. Finally, you will plot the trace metal and micronutrient iron. Plot dissolved iron along different cruise trajectories. What sources of iron to the ocean can you identify? How do other essential nutrients such as nitrogen and phosphorus compare to iron distributions?
    a. Go to the "View" dropdown menu. Under "Template Layouts" and select "1 SECTION Window".
    b. Right click on map and under "Manage Section", select "Define Section". A red cursor will appear that will allow you to click along a row of dots to define the area of the ocean you would like to plot. Double click when you reach the end of the transect you wish to define. See the following screen shots to define the stations you wish to view.







c. Now, right click on the section plot and select “Properties”. Under this series of tabs you can select what variables you would like to plot and how to plot the data. Select the variables as shown below and select “Gridded field” under “Display style.” See below.