

Assignment:

Collect the data required to generate the figures and/or analyses described below. Answer any questions specified. All the data you need should be available through the online data sources provided.

- 1) **Variability in Columbia River salinity:** Characterize the variability in salinity at a fixed site at the mouth of the Columbia River.

Data collection: Go to the NANOOS Visualization System. Navigate to the Washington/Oregon border (or select "Columbia River" from the regions menu). Find one of the fixed shore platforms (yellow hula dancer icon) in the mouth of the Columbia River (OR) that is reporting real time salinity. View a plot of salinity over the past 7 days.

- a) What pattern do you observe? What is your explanation for this?
- b) Can you find more evidence to support your explanation? Consider going to the NOAA tide predictions website and using the NOAA tide gauge in nearby Seaside, OR.

- 2) **Wind, weather, waves and barometric pressure:** Use the NANOOS site to find the NDBC New Dungeness buoy and view plots of the last 7 days data for wind speed, wave height, air temperature and barometric pressure.

Data collection: Go to the NANOOS Visualization System. Navigate to the Strait of Juan de Fuca (or select "Puget Sound" from the regions menu to get there more quickly). Find the NDBC New Dungeness buoy icon and click to access real-time and recent data. You can plot data using the visualization software, or download directly into Excel by clicking on the download arrow below the data plot.

- a) Do you notice a relationship or pattern between wind speed, air temperature, wave height and/or barometric pressure?
- b) What is the connection between these parameters and weather? How do your data observations support recent observations of local weather in Anacortes?

- 3) **Regional differences in annual temperatures among coastal systems:** Use NERR data to compare annual variability in 2012 surface water temperature from Reserves representing Mid-Atlantic, Gulf of Mexico, Northeast, and Pacific Coast estuaries. The reserves and sites to use for these are Winyah Bay (Oyster Landing), South Slough (Charleston Bridge station), Apalachicola (East Bay Surface station) and Narragansett Bay (T-wharf surface). Find these stations on the NERR website and familiarize yourself with the local ecosystem and observe current conditions.

Data collection: Go to the NERR data export website (<http://cdmo.baruch.sc.edu/get/export.cfm>) and select the reserve of choice in the interactive map. Select the station indicated in the description above in each reserve. Make sure it is a "water quality" station (as opposed to nutrient or meteorological). Graph temperature data for each reserve for the 2012 calendar year (1/1/12 to 12/31/12). You can either plot these in multiple tabs in your browser, or click the "save this graph as an image" button. Create figures of 2012 surface water temperatures at each reserve using the NERR SWMP data.

- a) What are the most striking differences among these four estuarine ecosystems? Which estuaries have similar temperature profiles?
- b) What are some of the things that might explain differences in temperature patterns among these estuaries? What unique temperature pattern do you observe for South Slough? (HINT: Think about all the factors that might influence water flowing in and out of the estuary, as well as what effects water temperature on the west coast. You could explore further evidence using USGS stream flow data or upwelling indices).

- 4) **Annual and seasonal differences in Nooksack River Flow:** The Nooksack River empties into Bellingham Bay just west of the WWU campus. USGS has a gauging station on the Nooksack River in Ferndale (USGS#12213100), which is above the height of tide. Using the USGS data visualization page, complete the following:
- 1) Plot river flow (discharge) for the entire year of 2012 (1/1/12 – 12/31/12). What do you observe about the annual pattern of river flow in the Nooksack River? What is your explanation for this pattern?
 - 2) Compare plots of river flow for a week in July (7/8/12 – 7/15/12) and the most recent week (1/8/13 – 1/15/13) of flow data. What do you observe about these time series? What explanation can you offer for the difference in these patterns?

Data collection: Go to the USGS Washington site. Use the map to link to the “Nooksack River at Ferndale” gauging station data (click the green dot in the NW corner of the map). Scroll down to see the most recent seven days of data from the Nooksack River. Select a new date range using the date fields in the blue box.

- 5) **Seasonal and diel variability in dissolved oxygen:** Use the NERR datahub to compare the variability in dissolved oxygen for a 48 hour period during a winter and summer month.

Data collection: Find the North Inlet Winyah Bay (SC) on the NERR map of reserves. Navigate to the Oyster Landing water quality station and select data for 2/27-28/06 and plot a figure of DO (percent saturation). Repeat this for 7/16-17/06. You will need to use a screen capture (SHFT – Prnt Scrn) to cut and paste your plot into another program (e.g. Word) for comparison.

- a) Compare the lowest oxygen concentrations observed during summer and winter. When do you see the lowest concentrations? What is an explanation for this?
- b) Can you offer an explanation for the variation in oxygen concentrations during the 48hr period? What explains this pattern and why is it different in winter and summer?

- 6) **Annual variability in chlorophyll concentrations:** Make a comparison of annual patterns in chlorophyll (aka phytoplankton) at Padilla Bay Gong Surface station and the same time series of data from another NERR Reserve of your choice.

Data collection: Once you have selected the appropriate station (make sure it is a “nutrient” station) and moved to the data plotting page, click the “Preselected options” radio button then select “1 year” from the preset option drop-down menu, select Chlorophyll, and Graph!

- a) Describe the annual patterns in chlorophyll a. What explanation can you offer for these patterns?
- b) How do these patterns differ among the two sites you selected? How are they similar?

- 7) **Water column profiles and upwelling:** Using NANOOS NVS, view data from PRISM station P105 for August 2008 and compare profiles of different parameters. (TIP: Graphs of profile data can be copied into another program using right-click, copy image).

Data collection: Click on the cruise icon in NANOOS (left hand side of the screen) and select the PRISM cruises. Find station 105 at the mouth of the Strait of Juan de Fuca. Click on this for station data. Go to the PFEL website for upwelling data.

- a) Describe where the station is located.
- b) Describe the distribution of chlorophyll in the water column. Compare chlorophyll concentrations at 1m, 11m and 25m. What explanation can you offer for the differences in these concentrations? Use graphs to support your answer.
- c) Is there any evidence of stratification during this time? Explain your answer.
- d) Explain how the salinity and/or density structure of the water column might relate to the observed chlorophyll concentrations?
- e) Was there upwelling at this time? How would this influence the water column structure in temperature and salinity you have observed?