*This activity is based on the Project EDDIE: Wind and Ocean Ecosystems module, Part C.*

Learning Objectives

The exercises in this multi-week module are designed to help you answer the question: how does wind impact ocean ecosystems? In class next week, we will continue exploring NOAA buoy data. This time, we’ll move over to the Pacific Ocean to look at upwelling events and how they’re related to wind. I’ve also attached a short video that walks through the following directions for finding and plotting data in excel. If you are comfortable with R, matlab, or python feel free to plot your data with these programs instead.

This pre-exercise will prepare you for next week’s in class exercise. In this pre-exercise you will learn how to download and analyze oceanographic buoy data. The questions you should answer directly in your copy of the google doc are highlighted in yellow below. When you reach the end of this pre-exercise, you will be able to:

● Download NOAA buoy data

● Clean up your dataset

● Plot and read time series data

● Identify an upwelling event from temperature data

Pre-Exercise Instructions and Questions

1. First you are going to find a buoy off of central California (south of San Francisco, north of Pt. Conception) that has a wind direction, wind speed, and water temperature data to look for evidence of upwelling events.
   1. Navigate to: <https://www.ndbc.noaa.gov/>
   2. Select the “Historical Data” bubble to show buoys with historical data. Choose a few of your favorite buoys that are in the ocean, close to the coast, south of San Francisco and north of Pt. Conception, California. Write down their ID numbers.
   3. Now navigate to the historical data page: <https://www.ndbc.noaa.gov/historical_data.shtml>
   4. Under “Standard Meteorological”, find the first buoy you wrote down and take a look at the data from one of the following years: 2005, 2007, 2008, 2010, 2017, or 2020
   5. Preview the data using “Method 2” on the data page-- this will pull up a browser text file. Take a look at the data and make sure it has all the data you need: WDIR, WSPD, WTMP. 999 values indicate missing data-- if you have a few 999 points that is okay, but if you have a whole column of 999 data then you’ll need to choose another dataset.
   6. Once you’ve found a dataset, follow the directions on the website to download it and open your dataset in excel.
2. Now you’re going to plot the water temperature as a time series (x-axis = time, y-axis = temperature data) to identify an upwelling event.
   1. First, you’ll need to add a DATE&TIME column in excel. Add a column F and type in =DATE(A3,B3,C3)+TIME(D3,E3,0). Double click the bottom right corner of the cell to tell excel to use this formula on the whole column.
   2. Now plot your new date-time column vs. the water temperature. At this step you may need to remove any missing values (ctrl F to find and replace 999 with empty cells). Adjust the axes of your graph so you can visualize changes in the data better.
   3. Identify an upwelling event-- a period in your data that shows a fairly abrupt drop in sea surface temperature, indicating that deep cold water is rising to the surface. You’ll likely see a few possible events somewhere between February and May.

[[Insert your time series here and indicate the upwelling event you’ve identified. Please include a title and axes titles.]]

1. Once you’ve identified an upwelling event, you’re going to take a look at what the wind conditions were leading up to the upwelling event.
   1. Select the WDIR data for the two weeks leading up to the beginning of your upwelling event and visualize it to determine the common wind direction. The easiest way to do this is to create a simple histogram, using a program of your choice or this easy online program: <https://www.aatbio.com/tools/online-histogram-maker>
      1. Alternatively, if you really love rose diagrams, you could make one of those. But you’ll have to do the leg work of converting the WDIR data to cardinal directions before filling out that table in excel. Or you could use this script in R: <https://stackoverflow.com/questions/17266780/wind-rose-with-ggplot-r>

[[Insert your histogram or rose plot here]]

What is the most common wind direction? State what you mean in words (i.e., what direction is the wind blowing from and to)? (You may be able to check this against EarthNull data from the dates you’ve chosen)

1. Repeat step #3 for a NON-upwelling period. Identify a two week period prior to a time period with generally high and stable sea surface temperatures. What were the most common wind directions during times without upwelling?
2. Input your data into the google sheets file I’ve shared with the whole class: [[link to shared google sheets file]]