

Engaging Introductory Oceanography Students with Real Data in the Classroom and Online: OOI Data Exploration and Data Labs.

Dr. Melissa Hicks, Onondaga Community College, Syracuse, NY

Abstract

Teaching with real-world data is a fun and engaging tool to engage students in the true nature and process of scientific inquiry. The Data Explorations and Ocean Data Labs activities from the Ocean Observatories Initiative (OOI) incorporate various datasets collected by remote instrumentation into shareable interactive activities that can be modified for different academic levels.

One example of this is the "Dynamic Air-Sea Interaction" dataset, which uses atmospheric and oceanographic data to show the 2018 "Bomb Cyclone" that hit the northeastern U.S. Like many of the other lab activities, the online graphs are interactive allowing students to zoom into certain hours of data collection, toggle the visibility of other data sets for comparison, and create their own predictive rainfall curves. This type of exercise was designed to be incorporated into introductory oceanography laboratory classes, but it can also be modified with further challenges for upper-level classes.

This presentation will share reflections on how the Data Explorations and the Ocean Data Labs activities can guide students through the scientific inquiry process. We will share effective strategies we have found to be essential to aid students, including step-by-step instructions, videos, and knowledge checks. Our experience has shown that students using these types of datasets become more comfortable with analyzing data, recognizing patterns and trends between datasets, and developing and testing hypotheses. Online activities like these labs have been valuable in both classroom or online environments.

Example: OOI Data Exploration— Dynamic Air-Sea Interactions

Using data from the 2018 "Bomb Cyclone" to illustrate the interaction between atmospheric conditions and the ocean's surface.

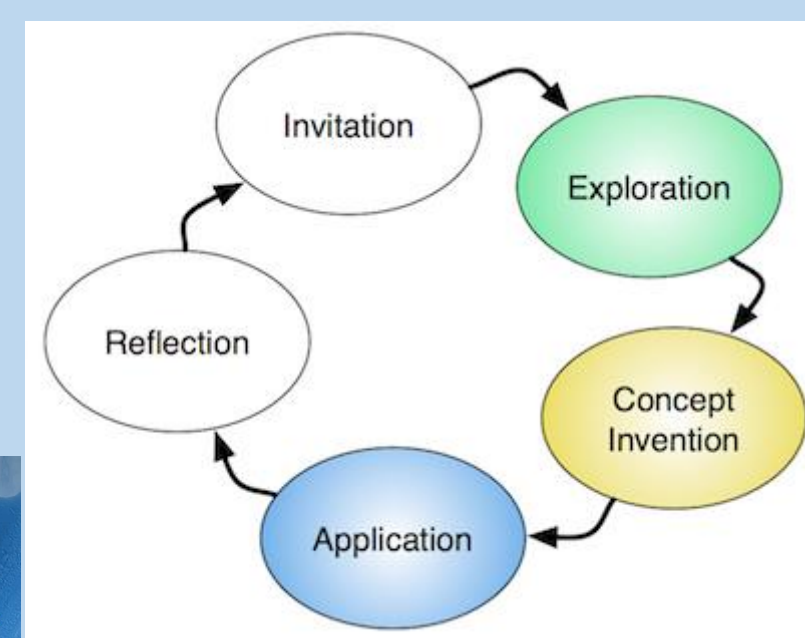
Classroom Setting:

As described herein, this exercise is used for a 100-level, non-science major classroom. This is used for both in-person and online lab settings after lecture on atmospheric cells, winds, and currents.

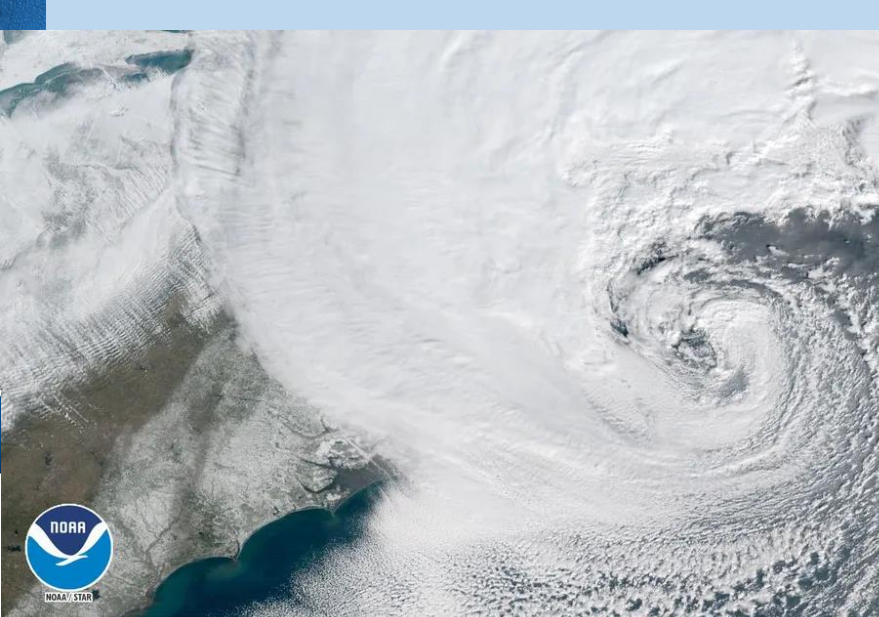
Learning Goals:

1. Building student confidence in analyzing data
2. Creation of hypothesis using data
3. Testing and evaluation of hypotheses

Location Map of the Data Collection Instruments



The Learning Cycle Phases used in this exploration



Satellite Image of the 2018 "Bomb Cyclone"

Background Information provided for the Data Exploration includes:

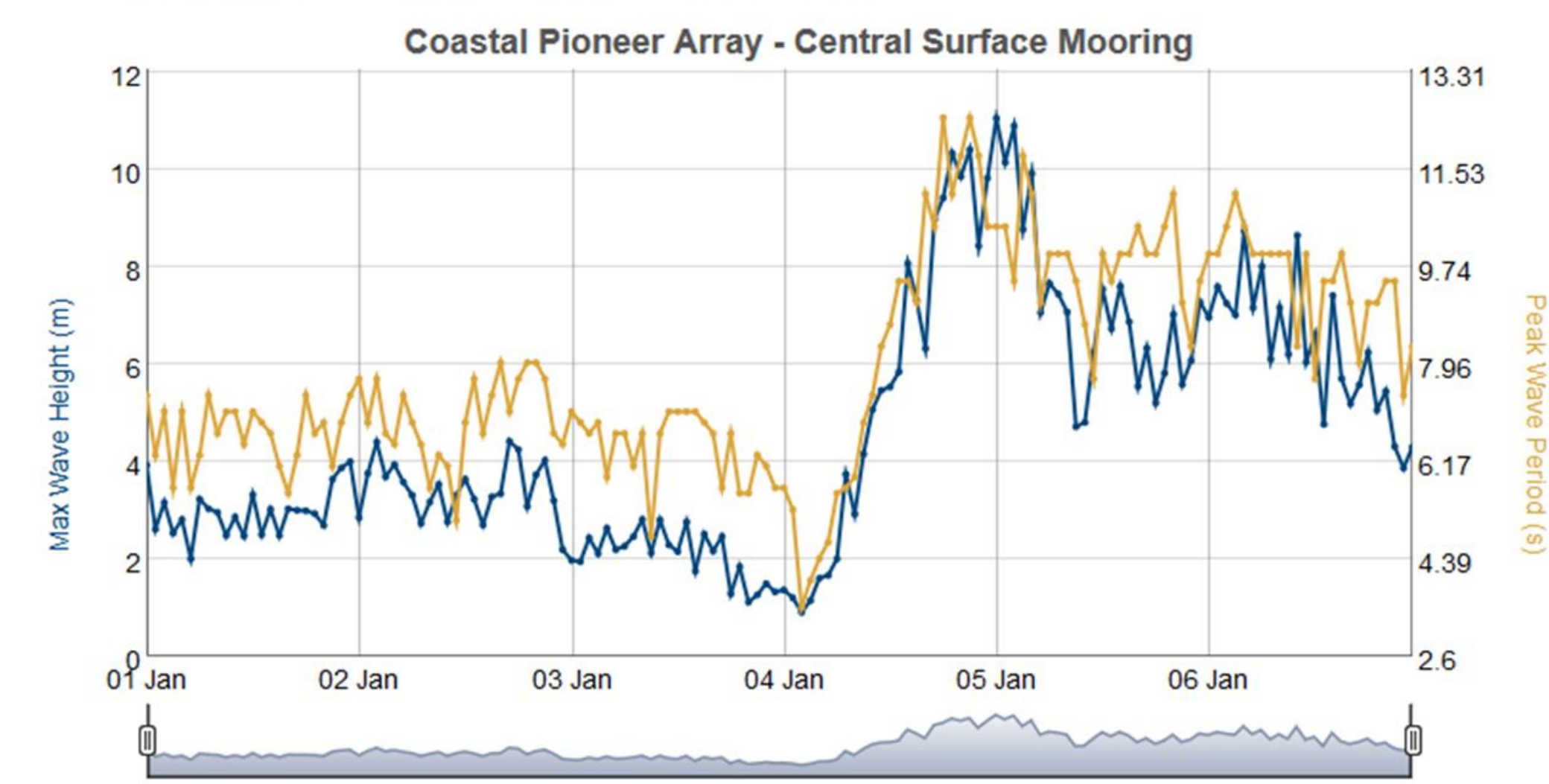
- ✓ The how and where the datasets were collected
- ✓ The Instructor's Guide
- ✓ Downloadable .csv file of the data

1. Implementation of Dynamic Air-Sea Interactions OOI Exploration

Dynamic Air-Sea Interactions Exploration

Your Objective

Your objective for this activity is to examine how atmospheric processes affect surface oceanographic conditions. In this section, you will analyze the relationship between wave height and wave period, and speculate on the processes that can influence wave properties.



Orient the students to the graph and its interactive aspects.

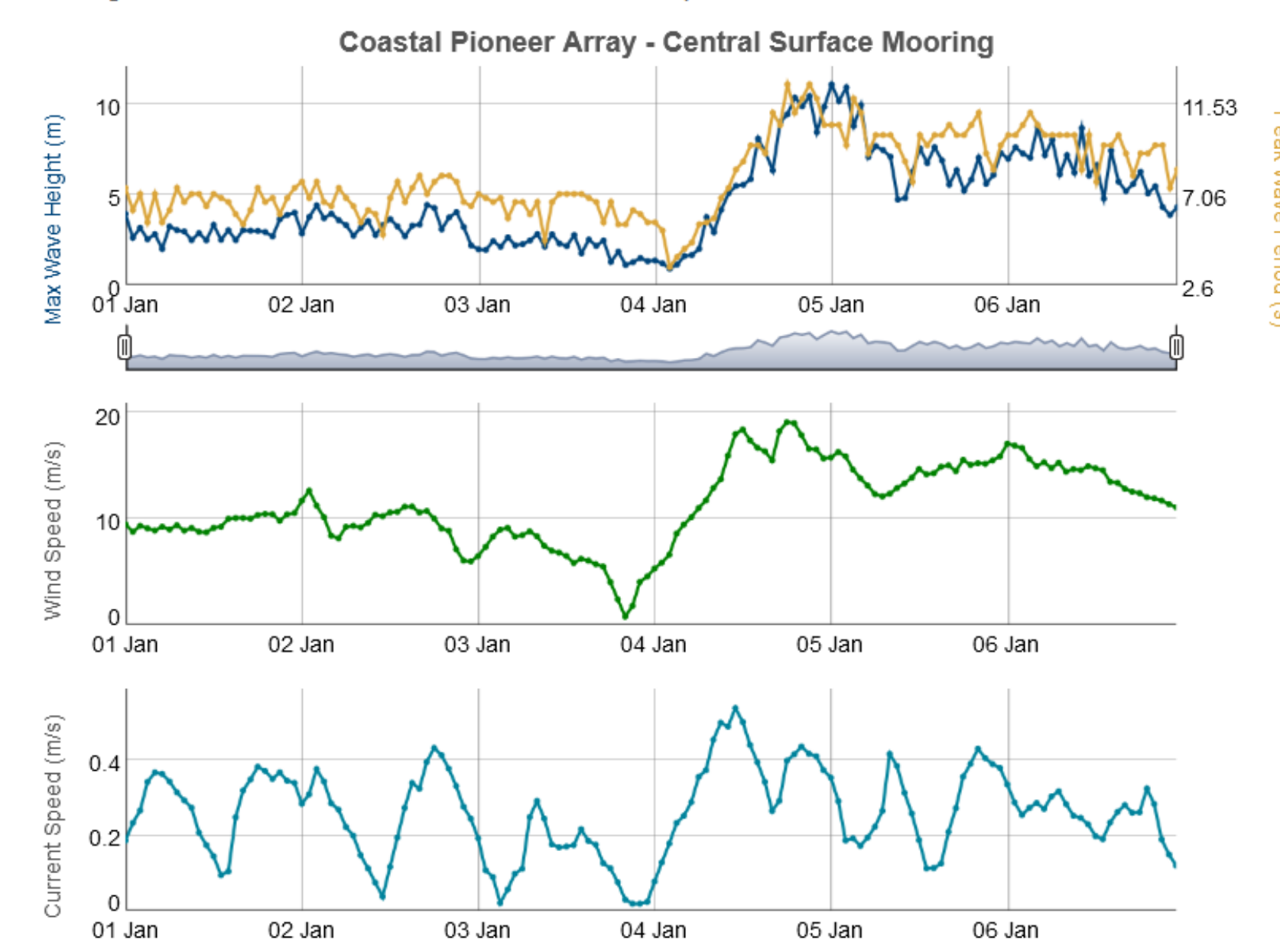
- Key questions that can be part of the (a) early classroom discussion, (b) early group discussions, or (c) explanatory video (if asynchronous)
 - ✓ What data is the x-axis displaying? What data is the y-axis displaying?
 - ✓ Across what time periods are the wave data in this graph?
 - ✓ What are the minima and maxima of the wave height and wave period?
 - ✓ Are the minima and maxima of the 2 variables coincident?
- Have them describe the trends they see with wave height and wave periods.

2. Comparison of various data collected.

Dynamic Air-Sea Interactions Concept Invention

Your Objective

Your objective for this activity is to examine how atmospheric processes affect surface oceanographic conditions. In this section, you will link the wave data from the previous activity to wind and current data, to investigate the interaction between the oceans and atmosphere.



Each dataset can be added separately or have them describe collectively.

Key questions/concepts:

- Compare datasets and describe any correlations or relationships.
- Make sure they do NOT interpret the data

Ask specific questions:

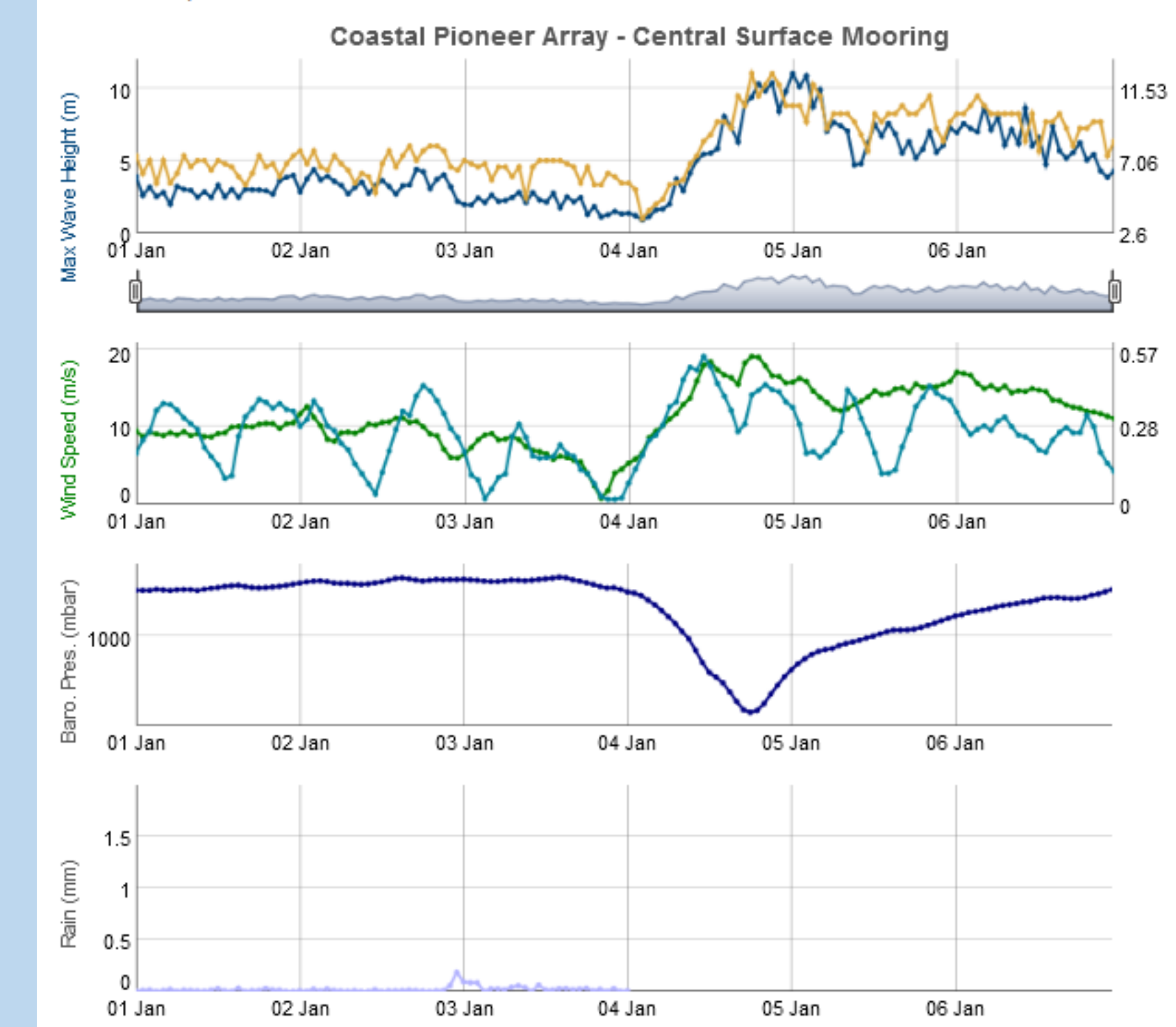
- ✓ Over how many minutes/hours is the wind speed increase? The current speed increase?
- ✓ What effect does wind speed have on waves and surface currents?
- ✓ Have them hypothesize as to what natural processes may be responsible for the collective air-sea changes seen in the data.

3. Causality and Hypothesis Testing

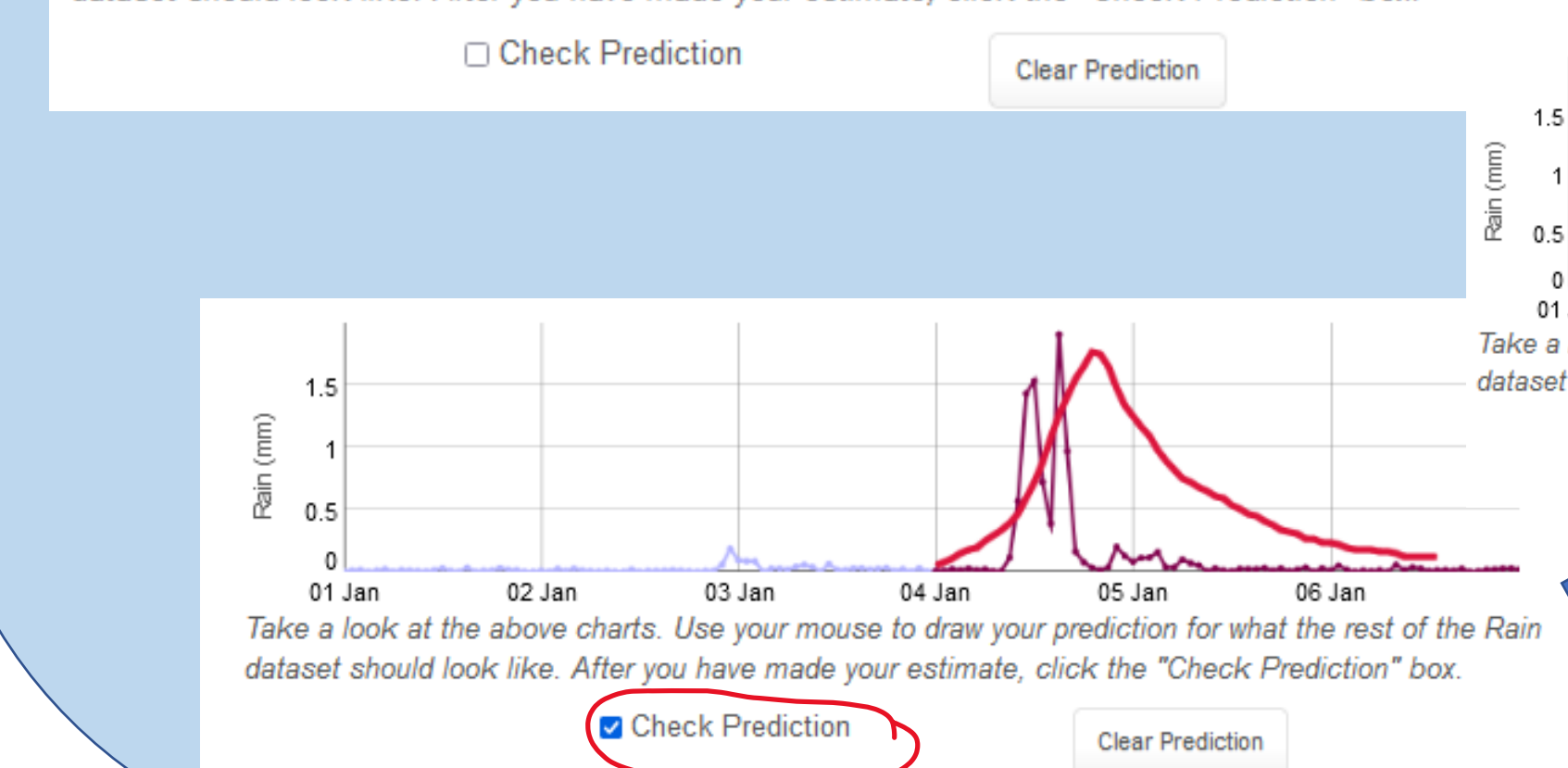
Dynamic Air-Sea Interactions Application

Your Objective

Your objective for this activity is to examine how atmospheric processes affect surface oceanographic conditions. In this section, you will link the data from the previous activities to atmospheric pressure, and make some predictions about rainfall.



Take a look at the above charts. Use your mouse to draw your prediction for what the rest of the Rain dataset should look like. After you have made your estimate, click the "Check Prediction" box.



Students now have barometric pressure data to correlate with other previously viewed data.

- ✓ This provides both surface ocean and atmospheric data where Barometric Pressure is new data.
- ✓ Good to remind them about the ability to track the time (hours/minutes) over which the changes occur.
- ✓ Students need to recall what type of weather is associated with Low Pressure.
- ✓ Students can hypothesize what natural process is responsible for the collective Air-Sea changes.
- ✓ Students can then use the cursor to draw in their predicted precipitation.

Students can then compare their predicted to the actual.

Teaching Tips and Strategies

For any Modality:

- ✓ Be sure students understand the interactive aspects of the OOI Data Explorations.
- ✓ Find a video that shows the effects of the Bomb Cyclone and be sure that students watch it after they have written a hypothesis explaining what the data is illustrating (bit harder to enforce with online)
- ✓ Ask the question of how they believe an event such as this would impact them if they lived in a coastal area.

In Person:

- ✓ Preference the activity by using the NOAA buoys and looking at wind speed vs wave height of various online buoys.
- ✓ Have the students work in groups of no more than 3 while using the OOI Data

Online/Asynchronous:

- ✓ Provide an online video tutorial. Walk the students through the use of the webpage and widgets.
- ✓ Create a worksheet that is fillable—I use a Word document and insert one table box for the students to use for answers—it is expandable.

Activity Citation: Degan, J., Hicks, M., Mitra, S., Webb, P., & Lichtenwalner, C. S. (2019). Dynamic Air-Sea Interactions. OOI Data Labs Collection.