

Adopt-a-Buoy A Data & Graphing Extension Lesson

Overview: The overarching goal of the *Earth as a System is Essential: Seasons and the Seas* (EaSiE) Project is to transform the traditional middle school study of terrestrial seasons and weather into an exploration of the dynamic interactions between Earth's land, water, atmosphere, and the living world using NOAA resources.

The *Adopt-a-Buoy* lesson is an extension of an introductory unit, *Data & Graphing*, which guides students through the collection, graphing, and interpretation of weather data. This lays the foundation for lessons on graphing and interpreting data from a GoMOOS buoy. The *Data & Graphing* lessons, related learning goals from national and state standards, research on student learning, and teacher background information can be downloaded at www.mmsa.org/easie

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Background information and prior lesson: The Gulf of Maine Ocean Observing System (GoMOOS) consists of a set of about ten moored buoys located around the Gulf of Maine. The buoys are approximately two meters wide, solar powered, with instruments that fit inside a water-tight case. Sensors are used to measure air conditions (air temperature, wind speed and direction, visibility) and wave height. The buoys can also collect water measurements, including water temperature. The data is transmitted once an hour via cellular telephone to a geostationary GOES satellite. This data is then checked by scientists and distributed by NOAA for public use. GoMOOS buoy data can be found at <http://gomoos.org/data/recent.html>.

In Step 5 of the EaSiE *Data & Graphing* unit, students receive a table containing historical monthly air temperature and wind speed data from the GoMOOS B1 buoy (*Data & Graphing* Lesson, Handout #4). Students work in pairs to discuss the B1 buoy air temperature and wind speed data and create a graph representing the data.

Students refer to their data tables and graphs as they discuss the following:

- What do the data and the graphs tell you?
- Are there any trends in the air temperature data from this buoy located in the Gulf of Maine?
- What about the wind speed data – is there a pattern here?
- Are the air temperature and wind speed patterns similar or different? (Students will notice that as one “goes up”, the other “goes down”.)
- How can you explain the data – what might be the reason for the patterns?
- Does your explanation allow for you to predict what future data might look like?
- What additional data would be helpful in explaining your ideas that you've gained from this data?
- What other questions would you like to ask?

Students are encouraged to ask questions as they examine the data, and their questions are posted for future reference.

Adopt-a-Buoy

One of the suggested extensions in the *Data & Graphing* unit is to use GoMOOS data to spark interest in students' "bigger backyard" by having students adopt a buoy and monitor the current weather conditions at their location on a daily or weekly basis.

Prior Knowledge: Students will have had experience constructing data tables and graphing data (See *Data & Graphing* unit found at www.mmsa.org/easie)

Goals

Students will:

- understand that there are buoys in the Gulf of Maine that collect weather and ocean data.
- identify the kinds of data the GoMOOS buoys can provide.
- be aware that the patterns or trends in the data can be used to answer questions and "tell a story" about their bigger backyard – the Gulf of Maine.

Procedure:

1. In advance, visit <http://gomoos.org/data/recent.html> and determine which buoys are currently collecting data. Create a list of buoys available for students.
2. Group students in teams of two to four.
3. Have each team adopt a specific buoy, recording only two individual measurements of their buoy. Determine which measurements you would like students to monitor. Suggested parameters: air temperature, water temperature, wind speed, and wave height.
4. At the beginning of each class, one member of the team will go to an online computer to obtain the current daily data. Each student should have a notebook that is kept in the classroom to record data.
5. Record data in table format for one month.
6. Have students create a graph from their data (See *Data & Graphing* unit found at www.mmsa.org/easie for suggested guidelines).
7. Use the discussion prompts from Step 5 of the *Data & Graphing* unit to have students present a "data story" to their classmates.
8. Class discussion: Compare data across buoys.
 - Do they tell similar stories?
 - Are there differences? Why might that be?
 - As we look at data from buoys across the Gulf of Maine system, what's the "bigger story"?
 - What further questions do you have, and how might we find out?

Suggestions from EaSiE Project Teachers:

- If students are absent, have them check the historical data or get data from partners.
- If a buoy becomes inoperative, students should switch to another buoy.
- Dial-A-Buoy: If you do not have computer access, dial 888-701-8992 to get the information.
- Develop a common graphing language with students' math teacher.
- You may want to provide students the option of using various size grids on graph paper.
- If appropriate, students can have the option of using computers for graphing.
- Once students are familiar with the process, the data retrieval can be done as part of "Bell Work"
- When students complete their 20-30 day cycle graphs, the data table and graph can be used to assess:
 - Interpretation and analysis of data: stating a claim and justifying the claim based on the data. This could be done as group sharing or conferencing.
 - The skill of graphing can be assessed using a rubric co-developed with students or the students' math teacher.

Extension of EaSiE Project *Weather and Climate* Unit:

During the *Weather and Climate* unit, a minimum of two weeks of local weather data are collected on a daily basis (this unit can be downloaded at www.mmsa.org/easie). This allows students the opportunity to study weather patterns they find over time - in a particular place. The findings demonstrate that weather is always changing and can be described in measurable quantities such as air temperature, wind direction and speed, and precipitation. These observations and the discussions that accompany them aid in understanding that large masses of air with certain properties move across the surface of the earth and that the movement and interaction of these air masses is used to forecast the weather.

Once daily air temperature, wind direction and wind speed data has been collected from multiple buoys on a daily basis, the weather patterns students find over time in their backyard can be connected to their "bigger backyard" – the Gulf of Maine. The observations and discussion can again be based upon the interpretation and analysis of data, but it is now utilizing multiple datasets. Similar questions can again be asked:

Refer to the local weather and the GoMOOS buoy data tables and graphs.

- What do the data and the graphs tell you? Are some patterns in air temperature or wind speed similar?
- Are there differences? Why might that be?
- How can you explain the data – what might be the reason for the patterns?
- As we look at the data spatially – starting with our schoolyard, and extending across the Gulf of Maine system, what's the "bigger story"? (Note if there are examples where the data can be used to observe movement of air masses with certain properties.)

- Does your analysis allow for you to predict what future data might look like?
- What additional data would be helpful in explaining your ideas that you've gained from this data?
- What other questions would you like to ask, and how might we find out? (Post these questions for future reference.)

Additional Extensions:

- Continue the data collection and discussion for the entire school year.
- Partner with other schools: Share and discuss similarities, differences in local weather and GoMOOS buoy weather data.
- Look at areas around the country for interesting weather patterns; consider East Coast vs. West Coast.
- Compare seasonality data sets; consider Northern Hemisphere vs. Southern Hemisphere.
- Based on comparison of data, ask students to predict what would be happening at different spatial or temporal instances (e.g. opposite seasons).
- Source for buoy data beyond the Gulf of Maine can be found at the National Buoy Center: www.ndbc.noaa.gov