Using Real-Time Data: Introduction

Time: 3-5 class periods
National Benchmarks: Benchmarks 5A: Diversity of Life; 5D Interdependence of Life; 5E: Flow of Matter and Energy; 9B:Symbolic Relationships; 9D:Uncertainty; 12B:Computation and Estimation; 12D:Communication Skills; 12E:Critical-Response Skills.
National Science Content Standards: *Science as Inquiry: A*; *Life Science: C*: Biological Evolution; The Interdependence of Organisms; Matter, Energy, and Organization in Living Systems; *Science and Technology: E:* Abilities of Technological Design; Understandings about Science and Technology; *Science in Personal and Social Perspectives: F:* Population Growth; Natural Resources: Environmental Quality; Natural and Human-induced Hazards; Science and Technology in Local, National, and Global Challenges
New York State Standards: 1, 2, 4, 5, 6, 7

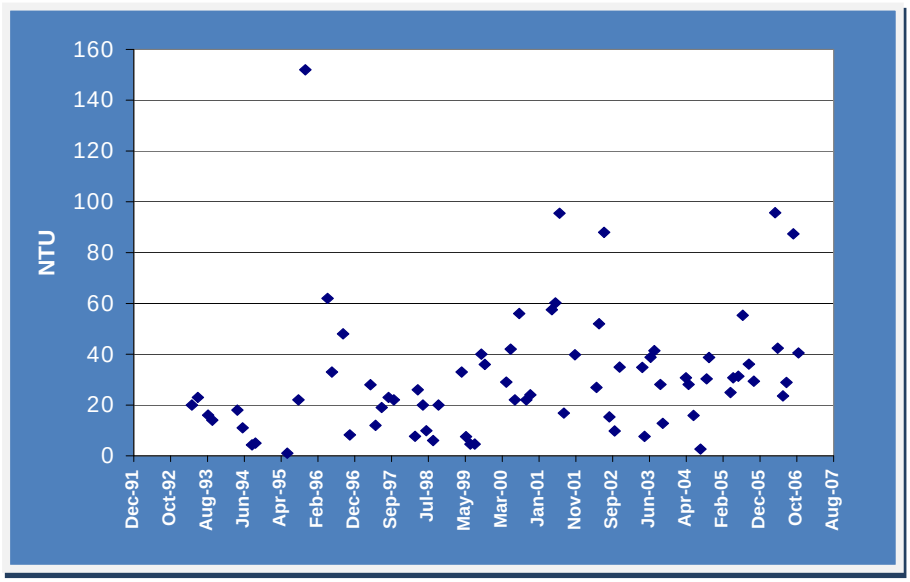
Objective: Students will know how to retrieve data from a real-time data website, be able to explain and pose questions about data from two locations on the Hudson River.

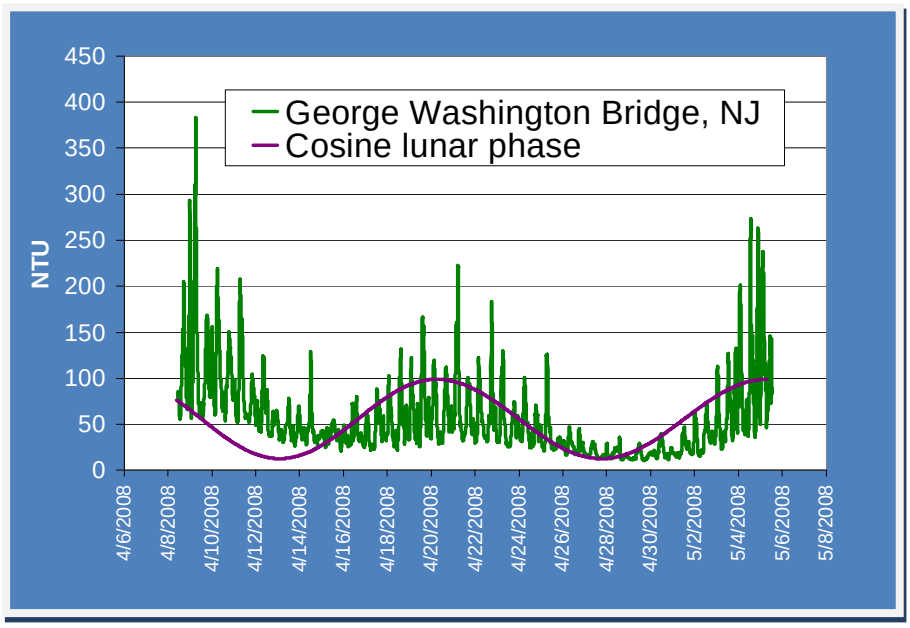
Lesson Outline:

1. Students discuss how remote sensing occurs, and what can be measured.
2. Students use the HRECOS website to learn about dissolved oxygen and how to use the website to create graphs.
3. Students choose another parameter to investigate using the HRECOS website.

Materials: Computers with internet access

Engagement: Ask students to think about how we know about the weather, or the tides, or the temperature of the water on any given day. Some students may know about remote sensing technology, or may be able to imagine it. Show students pictures of buoys and other equipment. Create a list on the board of possible things a remote sensor could learn about.
Explore: During this lesson, students will become familiar with using the HRECOS (Hudson River Environmental Conditions Observing System) website, and will have the freedom to investigate their own variables as the lesson progresses. Students should have access to the internet during class, or, this can be given as homework.
Explain: Why is high-frequency, constant monitoring important? The Hudson is a highly variable system that changes on an hourly, daily, seasonal, yearly, and multi-yearly basis. Collecting data at certain set times gives you only a limited understanding of the changes that take place over time. Consider the following example, using turbidity. The first graph shows 73 observations, made over the course of 15 years at Poughkeepsie. There is no discernible pattern. However, when made consistently, the measurements look very different. The second graph is turbidity from the George Washington Bridge, with constant sampling over a period of 28 days (2,600 distinct observations). The lunar phase is much more evident, and it is much easier to see that there is a pattern.





Constant monitoring can also document rare or unpredictable events, which are unlikely to be discovered unless monitoring is frequent and prolonged.

HRECOS, or the Hudson River Environmental Conditions Observing System, is a grassroots effort designed to collect observational data on the Hudson River estuary. It is part of a growing national network to detect and understand environmental change in response to extreme and episodic events, understand ecosystem linkages, and provide environmental baseline data. HRECOS consists of eight monitoring stations along the estuary, with partners including the Hudson River Estuary Management Program, USGS, Stevens Institute of Technology, Cary Institute of Ecosystem Studies, Hudson River Foundation, Lamont-Doherty Earth Observatory, Riverkeeper, New York DEC, and the National Estuarine Research Reserve System. Measurements include meteorological data along with water quality data. Plans are in the works to add water sample collection equipment at several stations, expand the network, reach a

broader audience, and integrate the effort into the larger Integrated Oceans Observing System (IOOS).

Students completing this first lesson will be introduced to using real-time data by creating two specific graphs which show the change in dissolved oxygen over a two day period in August of 2008, one at Norrie Point, and the second at Castle Point, NJ. Students should notice the change in dissolved oxygen which follows a day/night cycle in the Norrie Point data, while that at Castle Point shows less of a relationship with the tides, and instead is declining quite quickly. Ask: Could this be related to either temperature or salinity? Have students think about other possibilities, and make a list on the board about other pieces of information students would like to know. In addition, students should notice the large difference between dissolved oxygen levels in the two locations, with Castle Point having significantly lower levels.

To complete the lesson, students choose two other locations, and compare another parameter. They are also asked to take one parameter and compare it at two different times of the year. You may ask the students to download the data, or to print the graphs for future use. As the combinations of graphs are unending, it is impossible to suggest any possible answers. It may also be interesting to engage students in a discussion about the validity of the data, and whether or not they trust the data. There are several times throughout the year when the parameters simply fall to zero, indicating equipment failure or another similar problem.

Extension: Students can compare data from the HRECOS website with other real-time data sites, such as the Weather Underground site (http://english.wunderground.com). While this does not give water quality, it would allow students to compare some meteorological data, providing them with some measure of confidence for the other range of parameters.

Evaluate: Collect students graphs and responses to the questions.