THE SCIENCE OF "FRINGE"

EXPLORING: WEATHER FORECASTING
A SCIENCE OLYMPIAD THEMED LESSON PLAN
EPISODE 320: 6:02AM EST

Overview:
Students will learn about weather forecasting.

Grade Level: 9-12

Episode Summary:
Walternate finally acquires all the components he needs to activate the doomsday device. Once activated, strange atmospheric and weather phenomena begin to occur 'over here', resulting in vortices that cause significant localized destruction. Once the Fringe Team realizes what is occurring, they work to implement an early warning system that forecasts the imminent occurrence of a vortex. In addition, Peter decides to try to activate the machine 'over here' to counter the results.

Related Science Olympiad Event:
Dynamic Planet - Teams will work at stations that display a variety of earth science materials and related earth science questions.

Learning Objectives:
Students will understand the following:
• Weather forecasting uses observations and historical data to try to predict the state of the atmosphere in a region.
• Scientists use large supercomputers to solve specialized equations that result in the weather forecast.
• Because of the chaotic nature of the atmosphere it is impossible to accurately generate a forecast more than about 2 weeks in advance.

FOX CODE
FOR SMARTPHONES

Episode Scenes of Relevance:
- Broyles briefing the team about the first incident (9:10 ' oh my' – 9:45 ' bet the farm on that')
- Olivia and Nina talking about forecasting the events (21:46 'police and fire' – 22:57 'is irrelevant')

Online Resources:
- Fringe "6:02AM EST" full episode: http://www.fox.com/watch/fringe
- Science Olympiad Dynamic Planet event: http://soinc.org/dynamic_planet_c
- National Oceanic and Atmospheric Administration Weather page: http://www.education.noaa.gov/Weather_and_Atmosphere/
- National Weather Service: http://www.nws.noaa.gov/
- The World Meteorological Organization: http://www.wmo.int/pages/index_en.html

Procedures:
1. Tell your students that they are going to learn about weather forecasting.
2. Have your students research weather forecasting in resources such as earth science textbooks and websites and discuss what they have learned.
3. Have your class complete the following activity:
   a. Materials: several weeks' worth of weather forecasts from newspapers, TV stations, or online weather websites
   b. Read through the weather forecasts. Note how far in advance some of the forecasts are and what types of information is included in the forecast.
   c. Have each group member select a different variable (e.g. max or min temperature, pressure, wind, rain, etc.) to analyze. Make a table showing the future forecast for that variable on each date available in the data. Also record the actual value of that variable if available.
   d. Create a graph analyzing how the accuracy for the forecast for the variable changes the nearer in the future the forecast date is.
   e. Present your results to the class and compare with each other.
4. Discuss with the class the results of the activity. Be sure to address:
   a. Are the forecasts for some variables more accurate than other variables?
   b. How many days in advance are the forecasts good for before their accuracy steeply drops off?
   c. Are there significant differences in the forecasts from the different weather sources?

Additional Discussion Suggestions:
- Most forecasts also have maps that show data using special symbols and graphical techniques. What are the common symbols used and what do they mean?
- The invention of real-time weather radar has allowed for very accurate short term forecasts of precipitation (i.e. on the order of hours). How does this compare to the more traditional 'long term' forecasts?
- Weather forecasting requires a lot of data on actual weather conditions. Many schools have automated weather stations that report this data back to a central location. Does your school have one and if so how does it work?

Extension to Other Subjects:

History: Before modern computational-based weather forecasting, many people relied on 'Farmer's Almanacs' to provide weather forecasts. Research some of these almanacs and how accurate they were.

Geography: Some types of weather, such as hurricanes, tornadoes, hail, and fog, occur more often in certain geographical locations. Research what some of the reasons are for these localized 'hot spots'.

Social Studies: Extreme weather events such as hurricanes or tornadoes occasionally destroy entire cities and communities. Research the impact some of these events have had on the cities and the populations who decide to remain and rebuild in the same location.

National Science Standards Alignment:

M.D.1 Structure of the earth system
      f. Water, which covers the majority of the earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle." Water evaporates from the earth's surface, rises and cools as it moves to higher elevations, condenses as rain or snow, and falls to the surface where it collects in lakes, oceans, soil, and in rocks underground.
      g. Water is a solvent. As it passes through the water cycle it dissolves minerals and gases and carries them to the oceans.
      h. The atmosphere is a mixture of nitrogen, oxygen, and trace gases that include water vapor. The atmosphere has different properties at different elevations.
      i. Clouds, formed by the condensation of water vapor, affect weather and climate.

H.D.1 Energy in the earth system
      a. Earth systems have internal and external sources of energy, both of which create heat. The sun is the major external source of energy. Two primary sources of internal energy are the decay of radioactive isotopes and the gravitational energy from the earth's original formation.
      b. The outward transfer of earth's internal heat drives convection circulation in the mantle that propels the plates comprising earth's surface across the face of the globe.