Modeling El Niño

Overarching question: How can I simulate the "El Niño" weather event?
How can I simulate the effects of global winds on deep ocean movement?

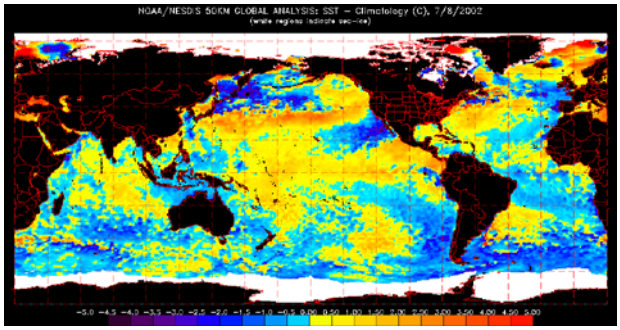
Purpose: To model the formation of an "El Niño" weather event.

Background Information: El Niño is the name given to weather events that occur in a cyclic pattern. It is an abnormal warming of surface ocean waters in the eastern tropical Pacific Ocean. This causes a temporary change in climate around in the region. Usually, the wind blows strongly from east to west along the equator in the Pacific. This actually piles up water in the western part of the Pacific. In the eastern part, deeper water (which is colder than the sun-warmed surface water) gets pulled up from below to replace the water pushed west. So, the normal situation is warm water (about 30 C) in the west, cold (about 22 C) in the east.
During El Niño, the winds pushing that water weaken. Because of this, some of the warm water piled up in the west slumps back down to the east, and not as much cold water gets pulled up from below. Both these tend to make the water in the eastern Pacific *warmer*.

• The coldest ocean water is most dense and stays at the bottom of the sea. It contains the most nutrients for living things.
• Living things need light and must live at the ocean's surface.
• Usually, the normal, or prevailing, winds blow surface water away from the coast and draw up colder nutrient rich water from the bottom. Schools of fish are attracted to the plankton that quickly grows there.
• During an El Niño year, the winds die or blow randomly and the water is not drawn up.

Materials:

- clear glass pie plate (deep dish works best)
- 1 beaker cold salty water with blue food coloring added
- 1 beaker warm fresh water with red food coloring added
- turkey baster
- map
- colored pencils



Procedure:
1. Carefully pour about 2 cm of warm water into the pie plate.
2. Use the turkey baster & draw up the cold, salty water.
3. Place the tip of the baster on the bottom of the pie plate, **under** the warm water.
4. **Slowly** squirt the cold, salty water in the baster into the dish. Keep adding cold water until it is as deep as the warm water. The result should be a two layer system of water. Diagram this system below:

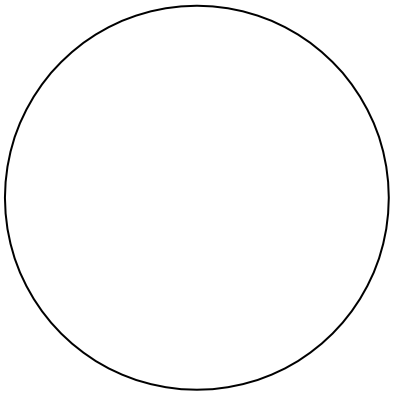
5. Blow across the top surface near an edge of the pie plate.
6. Observe the top of the pie plate. Record your observations.

Resource – http://www.science-class.net
M. Poarch
El Nino Satellite Image
http://www.noaanews.noaa.gov/stories/images/elnino070802.gif

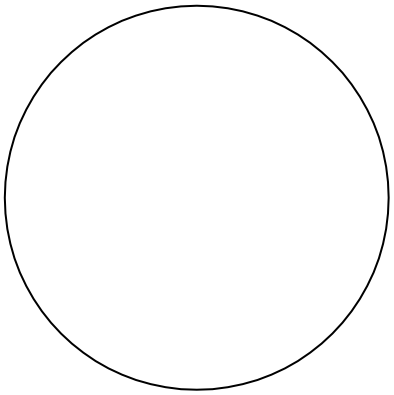
Name_____Class _____ Date _____

Student Sheet

Data: Using color pencils, illustrate the pie plate from the top:



Before blowing (El Nino year)



After blowing (non El Nino year)

Questions & Conclusion:
Answer using complete sentences.
1. Why is the coldest, saltiest water on the bottom of the ocean?

2. Why is cold water coming to the surface important?

3. What happens to air over warm ocean water?

4. What would the above air mass do when it reaches land?

5. How does El Niño affect you?

As this experiment utilizes boiling water, educators should use best judgment on whether or not to allow the students to directly participate.

Levels of Inquiry

Confirmation – Provide the students with the overarching question and the procedure, as well as the materials. Place several instrument artifacts around the room so that students can check their progress.

Structured - Provide the students with the overarching question and the procedure, as well as the materials. Allow students to discover the finished product on their own.

Guided – Provide the students with the overarching question and materials. Students are to create and write their own procedures and determine which materials to utilize. Allow students to discover the finished product on their own.

Open - Students are given a scenario that describes a situation. From this scenario, students are to generate an overarching question. From that point, students are to create and write their own procedures and determine which materials to utilize. Allow students to discover the finished product on their own.

Possible scenario – Monique wonders how global winds affect the movement of deep ocean waters.

Correlated Literature

(All literature can be found on the Galileo website unless otherwise noted.)

Begley, S. (1997). Searching for El Nino. *Newsweek*, *130*(14), 54. (1030) (Audio capable)

Monster from the sea. (cover story). (1997). *Current Events*, *97*(6), 1. (990) (Audio capable)

Scherer, R. (1998, February 5). Not just your average storm. *Christian Science Monitor*. p. 3. (1030) (Audio capable)

Technology Integration

Digital Camera – Documenting your student's work with a digital camera is a great idea. Not only do you have digital media, but students are usually excited about presenting their work to be captured by camera. With the media, there are endless possibilities, from PowerPoints to blogs to Glogs and beyond!!! (Always refer to your school's policies about posting student's pictures or work on the Internet.)

Presentation Platforms – Presentation platforms have evolved. PowerPoint is still effective, but here some examples of Internet based platforms. (Many of them allow the embedding of pictures, video, and audio, as well as text.)

http://www.prezi.com – zoomable slide presentation tool

http://edu.glogster.com/ - Internet based poster maker

http://museumbox.e2bn.org/index.php - description of an event or person in an interactive box

http://www.voki.com/ - create an avatar to speak for you

Common Core (Grades 6-8)

L6-8RST3: Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
L6-8RST7: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
L6-8WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.
b. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
c. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
d. Use precise language and domain-specific vocabulary to inform about or explain the topic.

e. Establish and maintain a formal style and objective tone.

f. Provide a concluding statement or section that follows from and supports the information or explanation presented.

Georgia Performance Standards

S6CS2. Students will use standard safety practices for all classroom laboratory and field investigations.
a. Follow correct procedures for use of scientific apparatus.
b. Demonstrate appropriate techniques in all laboratory situations.
c. Follow correct protocol for identifying and reporting safety problems and violations.

S6CS4. Students will use tools and instruments for observing, measuring, and manipulating equipment and materials in scientific activities.
c. Read analog and digital meters on instruments used to make direct measurements of length, volume, weight, elapsed time, rates, and temperature, and choose appropriate units for reporting various quantities.

S6CS5. Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters.
a. Observe and explain how parts are related to other parts in systems such as weather systems, solar systems, and ocean systems including how the output from one part of a system (in the form of material, energy, or information) can become the input to other parts. (For example: El Nino's effect on weather)
b. Identify several different models (such as physical replicas, pictures, and analogies) that could be used to represent the same thing, and evaluate their usefulness, taking into account such things as the model's purpose and complexity.

S6E3. Students will recognize the significant role of water in earth processes.
b. Relate various atmospheric conditions to stages of the water cycle.

S6E4. Students will understand how the distribution of land and oceans affects climate and weather.
a. Demonstrate that land and water absorb and lose heat at different rates and explain the resulting effects on weather patterns.
b. Relate unequal heating of land and water surfaces to form large global wind systems and weather events such as tornados and thunderstorms.
c. Relate how moisture evaporating from the oceans affects the weather patterns and weather events such as hurricanes.