Wave Heights

Below is an overview of the activity Wave Heights (National Geographic) to incorporate information learned from Dr. Herrington's presentation and subsequent discussion.

Lesson Overview

Students learn about the varying heights of ocean waves and what causes the variation, how waves are formed, and the parts of waves.

Lesson Rationale

Many students visit the New Jersey shore each summer and thus are familiar with waves for recreation. However, few students understand how waves are formed. Gaining a better understanding of wave formation gives students a broader understanding of a phenomenon many are familiar with. In addition, it begins to teach students about forces and the movement of matter.

While tsunamis are not are a grave risk to communities in New Jersey, there have been multiple large tsunamis to affect the rest of the world in recent years. These events have been well televised and have caused significant damage to homes and have resulted in the loss of many lives. Tsunamis can be a scary topic for young students, but understanding how they are formed and where they are most likely to occur can help diminish the fear of the events.

Key Concept

Through a demonstration, visual representations, and a computer simulation students get to explore the components of waves and how the size varies, different properties of waves (height and length), and how the tsunamis form.

Wave Heights (3-5)

Overview:
In this lesson, students will learn about the varying heights of ocean waves and what causes the variation. They will begin by learning the parts of a wave, and then discuss the meaning of wave height and wavelength in terms of various points of reference. A demonstration will spark discussion about how geography affects wave heights, and will allow students to experiment with various forces to create different sized waves. Students will use the National Geographic Wave Simulator to experiment with creating different types of waves, and will draw waves based on the heights and lengths of familiar structures around the school.

Connections to the Curriculum:
Geography, math, earth science

Connections to the National Geography Standards:
Standard 7: "The physical processes that shape the patterns of Earth's surface"

Time:
Two to three hours

Materials Required:
- Computer with Internet access
- Wall map of the world
- Blank Xpeditions outline maps of the world, one for each student
- Globe
- Large baking pan partially filled with water
- Cork
- Yardstick and ruler
- Paper and writing utensils

Objectives:
Students will
- identify various bodies of water on the planet, discuss their observations about the amount of water on the planet, and hypothesize about the texture of the surface of these bodies of water;
- learn the different parts of the wave and identify them on their own models;
- look at different types of waves and discuss their heights and lengths in terms of the different international monuments;
- watch a physical demonstration of how force makes waves and see how a boat may react to those waves; and
- simulate additional waves online with the National Geographic Wave Simulator.

Suggested Procedure
Opening:
Show the students a wall map of the world as well as a globe. Ask them to identify the areas that are covered with water, and then to label those areas on their own outline maps of the world.

Next, pose the challenge to the students to determine how much of the Earth's surface is covered by oceans (71%). Demonstrate this by having them imagine that 3/4 of the classroom is covered with water.

Ask the students to describe the world's oceans. For example, have them identify which oceans are the largest, or which ones they think may be the deepest. Then ask the students which oceans might have the largest waves. Gather the students around the pan of water. Demonstrate different sized waves by lifting one end of the pan to varying heights and allowing different waves to roll across the pan. Place the cork in the pan to represent a boat on the ocean. Ask the students to describe how the boat moves as the waves change.

Development:
Draw one wave on the board so that all of the students can see it. Explain that each part of a wave has a name—the highest part of a wave is called the crest, and the lowest part is the trough. Have the students draw their own waves and label the crests and troughs on their drawings. Then show the students that wave sizes are measured in terms of their wave heights and wavelengths. Line up a group of students, side by side, in front of the room and ask them to reach out and grab hands. Explain that the students, all of different sizes, now act as a set of waves by tracing from their hands to their heads. The wave heights can be measured from the tops of their heads, to their hands (from crest to trough). Wavelength is measured from crest to crest or trough to trough. Take out a yardstick and measure the distances between different students' hands and heads.

Place the students in pairs or small groups and give them the following information describing the sizes of tsunamis (large waves that are formed due to undersea disturbances, such as earthquakes or volcanoes) as they compare to familiar structures such as monuments. Ask the students to mark the locations of the waves on the map, and sketch the waves in order of size.

Finally, send the students to the simulator in their groups to try to re-create the waves.

- In 1737 a tsunami measuring 210 feet (64 meters), the highest wave ever measured, hit Siberia's Kamchatka Peninsula. That would be like looking up at half of the Washington Monument, which is 555 feet (169 meters) tall.
- A record-breaking tsunami occurred in 1958 in Lituya Bay, Alaska, causing the water in the bay to surge as high as 1,720 feet (525 meters). That is higher than the Sears Tower in Chicago (1,454 feet, 443 meters).
- In the Sunda Island group (near Krakatoa, Indonesia) in 1883, waves over 100 feet (30 meters) high were recorded after a volcanic eruption. That is higher than 9 basketball goals stacked on top of each other.
- During the Perfect Storm, waves in the Northern Atlantic may have reached as high as 100 feet. That is taller than the Lincoln Memorial which is 99 feet (30 meters) high.
- The total length of the Sydney Harbour Bridge is 3,770 feet (1,149 meters) and its arch span is 1,650 feet (503 meters). A wave of the same height would be taller than the Eiffel Tower (986 feet, 300 meters).

Review the parts of the wave and the concepts of wave height and wavelength. Ask them to describe what they had to do in order to re-create their waves on the National Geographic Wave

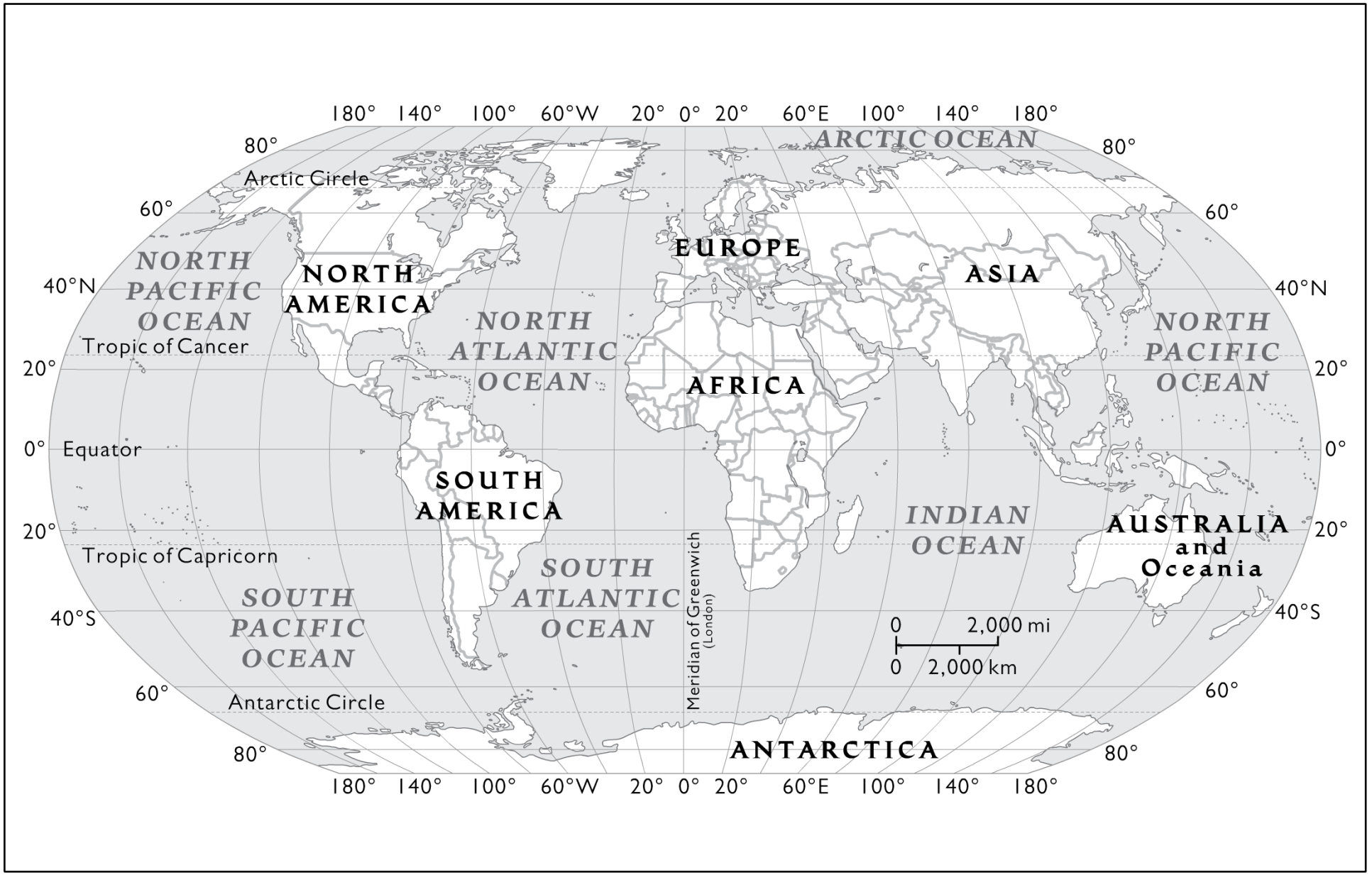
Simulator. What did they have to adjust to make the waves taller? Smaller? Do they feel that the simulator gave them an accurate picture of how the boat would react to those waves in the real world? What affected the speed at which the waves appeared?

Closing:
Have a class discussion about what the students have learned. Where did students find the largest waves? What can they conclude from their maps about the different oceans? What factors may contribute to having larger waves?

Suggested Student Assessment:
Provide the students with a list of the heights and lengths of landmarks from around the school, and give them a unit of measure and a scale (i.e., one foot=one inch on the diagram). Ask the students to draw waves based on these measurements of heights and lengths, and to label each wave's crest and trough. As a conclusion, ask the students to identify where they might find waves of this nature and explain why they might find them there.

Extending the Lesson:
Tell the students to pretend that they are oceanographers. Their mission is to teach a group of sailors everything they need to know about waves in order to sail around the world. Remind the students that they may want to recommend particular routes that would keep the sailors safe from large waves. Where might the sailors visit that would be dangerous? What should they know about interpreting weather reports that would describe the waves in terms of their height, length, and period?

Related Links:
NOAA: Tsunami The Great Waves
National Geographic: WORLD Magazine Killer Wave! Tsunami
National Geographic: Wave Simulator
Tsunamis Forces of Nature



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