Finding Monster Waves

Below is an overview of the activity Finding Monster Waves (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 and begins to teach students about forces and the movement of matter. In addition, many students are familiar with sailing, or go sailing themselves. So again by using something they can relate with helps to make the lessons of how waves form to varying sizes more linked to the real world.

Key Concept

Students learn about the varying sizes of ocean waves, what causes the variation, and where to find giant waves.

Finding Monster Waves (6-8)

Overview:
In this lesson, students learn about the varying sizes of ocean waves, what causes the variation, and where to find giant waves. Students will learn the parts of a wave, and discuss wave height, wavelength, and wave period. They will experiment with creating waves on the National Geographic Wave Simulator and discuss how geography affects waves.

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:
One to two hours

Materials Required:
- Computer with Internet access
- Wall map of the world
- Blank Xpeditions outline map of the world with latitude and longitude lines, one for each student
- Two pieces of rope, one that is at least 3 feet (1 meter) long and one that is 5 feet (1.5 meters) long or more
- 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 potential wave size in each location;
- learn the different parts of the wave and identify them;
- look at the effects of wave height, wavelength, and wave period on the overall size of a wave and watch a physical demonstration of how each of these variables affects waves; and
- discuss how a boat reacts to waves and simulate various scenarios with the National Geographic online wave simulator.

Suggested Procedure
Opening:
Show the students a wall map of the world as well as a globe. Ask them to identify and label each of the oceans 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 ocean (71%). Illustrate this to the students by estimating what 71 percent of the classroom would look like, and asking them to imagine that section covered in 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 to hypothesize where on the planet they might find the largest waves.

Use the ropes to demonstrate different wave heights, lengths, and periods. Have a student volunteer to hold one end. By lifting and lowering the other end at different speeds and heights, create different sets of waves for the students to see. Ask the students to imagine how a boat might react as the waves change sizes and periods.

Development:
Draw a simple picture of a wave on the board so all of the students can see it. Explain that each part of a wave has a name. Identify the crest, trough, wave height, and wavelength of each wave; then show the students that a wave period is measured as the time it takes for two consecutive crests to pass a given point, and that all of these variables affect how a wave may look from a boat.

Ask the students to imagine that they are on a sailboat. Explain to them that a wave with a long wavelength or long wave period might just feel like a gentle roll, or riding a bicycle on a road with really shallow hills, regardless of the height of the wave. Next, ask them to think of a really massive roller coaster. As waves decrease in wavelength or increase in wave period, they become steeper. A single 100-foot (30-meter) wave might cause nothing more than a gentle rocking motion out in the open ocean where it has a long wavelength; however, several 18-foot (six-meter) waves could seem enormous if the boat has to rise steeply over each one.
Next, have the students look at their maps again. Ask them to locate where they might encounter waves with the longest wavelength, the largest height, and the longest or shortest period. They can use the following resources to help them find this information:
Current Marine Data Wave Graphics
Wind Speeds over Earth's Oceans & Wave Heights in Earth's Oceans

Tell the students that they have been transported to a sailboat traveling around the world. Place the students in pairs, or small groups, with the National Geographic Wave Simulator and have them try to create waves for a point on each ocean.

Closing:
Review the parts of the wave and the concepts of wave height, wavelength and wave period. Ask the students to describe the waves that they created on the simulator. Where did they think that they would find the largest waves? The smallest? 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 can they conclude from their maps about the different oceans? What factors may contribute to larger waves? What other factors might contribute to how a boat reacts to a wave?

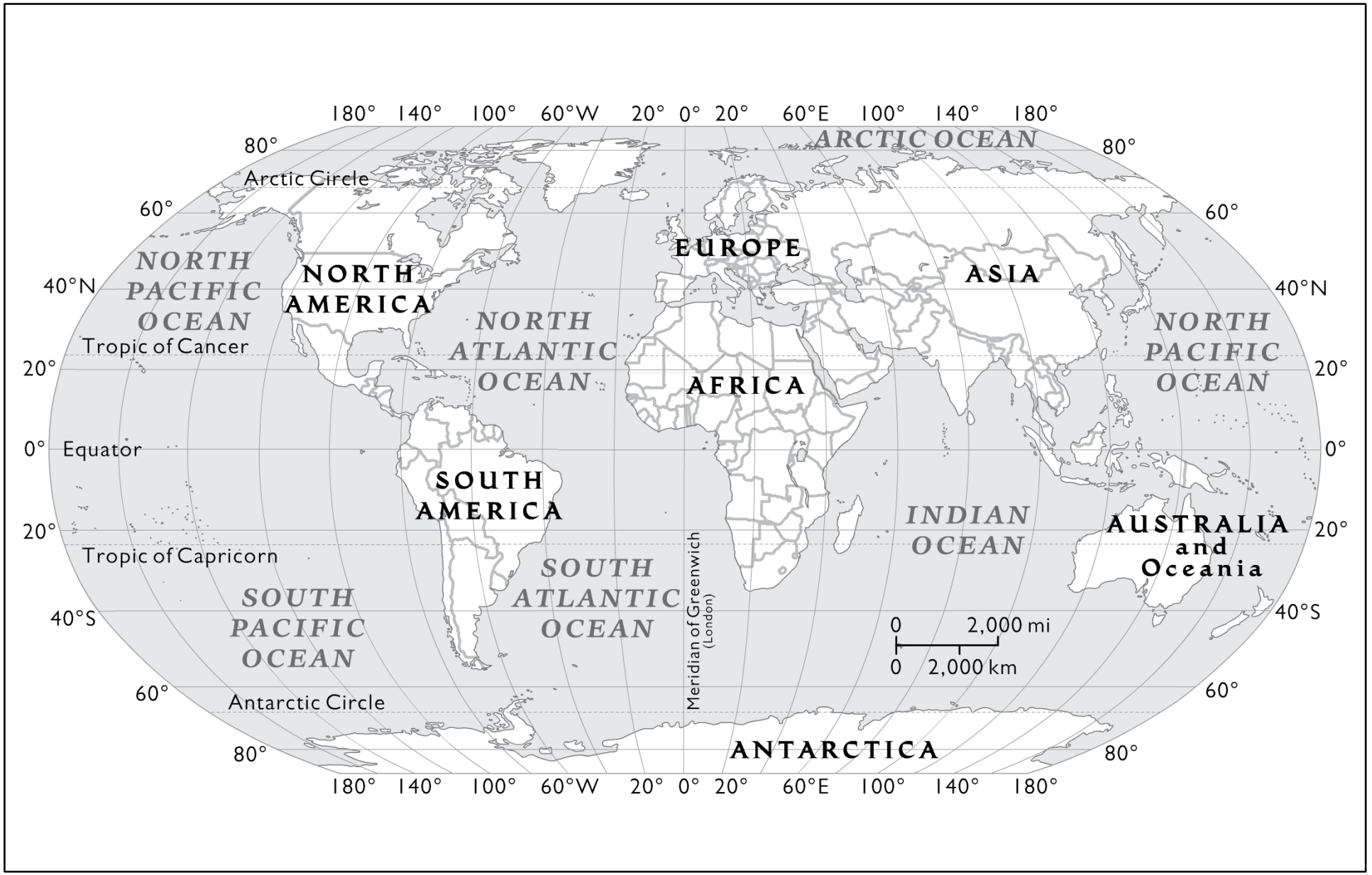
Some of the largest recorded waves exist in what is often referred to as the Southern Ocean, the stretch of water surrounding Antarctica to 60: south latitude. In these southern latitudes, the winds and currents wrap around the planet with little land to slow them down. Sailors refer to them as the "Roaring 40s," "Furious 50s," and "Screaming 60s" for the latitudes where these

winds occur. Ask the students to find these areas on their charts and see if they identified them as areas where large waves are likely to occur.

Suggested Student Assessment:
Ask the students to describe their vision of a long country road, the route of a cable car in San Francisco, a roller coaster, and a path over a mountain range. Remind them that from a boat, a wave with a large wave height, but with a long wavelength might just feel like a shallow roll; however, that same height but with a shorter wavelength would be much steeper. Either on the simulator or on paper, have them re-create these roads as waves, indicating the wave height and wavelength in either miles or kilometers and the wave period in either miles per hour or kilometers per hour. Finally, ask the students to identify which parts of the ocean might generate these types of waves and to explain why that may happen.

Extending the Lesson:
Tell the class it has been recruited by Team Geo to serve as navigators and tacticians for a famous race, such as the America's Cup or the Volvo Ocean Race. Their job is to chart the path that their boat should travel in order to sail the course in the fastest possible time (have them note the current record). What route should Team Geo take? Where will they have the best wind? Where might they want to avoid so that the crew does not risk being hit by unmanageable waves? Are there any other dangers that the students should take into account?

Related Links:
Museum of Science, Boston: Oceans Alive!
National Geographic: Wave Simulator
Ocean World



THE WORLD