The Ocean Shaping Our World

Grade: 6Th
Group Size: 20
Time: 50 Minutes

BACKGROUND:
The ocean comprises a significant portion of the earth's surface; more than 70% of the earth's surface is occupied by water. Surface water is constantly in motion and the circulation patterns of these waters greatly affect global and regional climate and weather. Winds created be differences in solar heating of the earth, drives the ocean's surface currents. The deep circulation of the global ocean is driven by the density differences between the cold Polar Regions and the rest of the ocean. Warm, salty water delivered to the Polar Regions is cooled, forming dense water that sinks to the depth and then spreads throughout the world ocean. Circulation in estuaries and the ocean depends, in part, on differences in the density of different water masses. A water mass with more salt is heavier and sinks, while a water mass with fresher water is lighter and floats on the surface. The buoyancy differences between water masses results in the separation on water into layers (stratification) within an estuary or in the coastal ocean. Stratification can be disrupted by heating and cooling of surface waters and/or by wind-generated water movement like waves and currents. Fresh water, rivers have a salinity of 0 to 5 partial salinity units (PSU) open ocean water has a sanity of 32 to 35 PSU. The interaction between the atmosphere and the ocean creates year-to-year changes that can have strong effects on weather. One of the better-known changes is the El Nino Southern Oscillation (ENSO), which results from fluctuations in wind and leads to changes in ocean surface temperature. Now scientists can use real-time data and information from ocean observing systems to interpret the ocean condition and make predictions about weather and climate.

OVERVIEW:
Students will participate in and log their observations during two demonstrations (Glob Toss and Density-Driven Currents) which demonstrate how the ocean is shaping our world.

CONTENT STANDARDS:
Shaping Earth's Surface: 2. Topography is reshaped by the weathering of rock and soil and by the transportation and deposition of sediment; as a basis for understanding this concept: c. Students know beaches are dynamic systems in which the sand is supplied by rivers and moved along the coast by the action of waves. **Heat (Thermal Energy) (Physical Sciences):** 3. Heat moves in a predictable flow from warmer objects to cooler objects until all the objects are at the same temperature. As a basis for understanding this concept: a. Students know energy can be carried from one place to another by heat flow or by waves, including water, light and sound waves, or by moving objects. **Investigation and Experimentation: 7.** Scientific progress is made by asking

meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations.

PERFORMANCE OBJECTIVES:

1. Students will understand that rivers supply the sand for beaches and waves move the sand along the coast.
2. Students understand that that the ocean and weather are inter-connected and therefore the ocean is shaping our world on several levels.

MATERIALS:

Glob Toss

-Five 16" inflatable globs, four groups of 4 students, worksheet

Density-Driven Currents

-Clear 10 gallon tank, blue and red food coloring, tap water, salt (kosher salt works best), straw or fan or hair dryer, worksheet

ADVANCE PREPARATION:

Glob Toss

Inflatable globs

Density-Driven Currents

Mix red food coloring in with 2.5 gallons of tap water in one bucket. Mix blue food coloring and 2.5 cups of salt in with 5 gallons of tap water in a second bucket

PROCEDURE:

1. **Inquiry Question:**

How is current affected by differences in density and temperature? How does the ocean's current affect the shaping of our world?

2. **Hypothesis:**

Teacher will lead the students in a classroom brainstorm; based on the background information given at the beginning of class and the Glob Toss worksheet data the students will determine a good hypothesis should contain ideas like salinity and coldness makes water denser, different density in water promotes ocean currents, and the ocean affects the weather.

Example: Additional mass introduced by temperature and salinity will affect the water currents. The Ocean is almost ¾ of the earth's surface and therefore will influence the temperature of the surrounding land.

3. **Assessments:**

   A. Observations of students during class period.
   B. Worksheets.

4. **Procedure**:

A. Glob Toss

1. With your partner, toss the globe back and forth a total of 10 times, with each person catching the ball 5 times.
2. On the worksheet provided, record how many of your 10 fingers touch ocean each time the globe is caught.

Globe Toss Worksheet

Toss Number	Number of fingers (out of 10) that touch ocean
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total =	**%**

Conclusion

What can you summarize from this activity?

B. Density-Driven Currents

Part 1

1. Measure enough tap water (to simulate river water) to fill about one quarter of your tank and put it a container (beaker, bucket, carboy, etc.).

2. Measure enough tap water to fill about half your tank and put it in a second container. Add blue food coloring and add 10 grams of salt (to simulate ocean water) or use actual sea water if you have it available. For each gallon of water, add about one half cup of salt to approximate ocean water. For each liter of water, add about one ounce of salt to approximate ocean water. One US gallon = 3.79 liters

3. Set up the tank with a divider in the middle. You might need someone to hold the divider steady. The divider should be cut to fit the width of the aquarium. Use ¼ inch durable plastic or glass.

4. Slowly pour the "river water" (red) in one side of the demonstration tank and the "ocean water" (dyed blue) to the other side. You might have one person pour the "river water" at the same time that someone else pours the "ocean water".

5. **Before you remove the divider from the tank, have the students draw this tank set up and write down their hypothesis predicting what will happen to the two water masses when the divider is removed.**

6. Remove the divider and observe.

7. Have your students record all of their observations on the worksheet.

Part 2

1. **Before you use the straw (or hair dryer or fan) to blow across the surface of the water, have your students write down their hypothesis predicting what they think will happen when you do this.**

2. Blow on the surface of the water through a straw and observe.

3. Have your students record all of their observations on the worksheet.

Density-Driven Currents Worksheet

Part 1

1. Draw the beginning tank set up with the divider and two different water masses. Label and/or color your diagram.

2. Which water mass has a higher density? Why do you think this?

3. What do you hypothesize will happen when the divider is removed?

4. After the divider is removed, what happened to the two water masses? Record your observations in words or drawings.

5. Where did the "ocean water" end up? Where did the "river water" end up? Why? Draw and label the tank now.

Part 2

1. What do you hypothesize what will happen when someone uses a straw to blow across the surface of the water?

2. While the wind is blowing across the surface of the water, what happens to the two layers of water? Draw and label the tank now.

3. What happens when the wind stops? Record your observations in words or drawings.

4. Did this experiment prove our hypothesis? How?

5. Did this experiment create new questions about our hypothesis or other ideas which would help prove or fine tune our hypothesis at a future date?