Where the Wind Blows

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Skill Level

5th & 6th grade

Learner Outcomes

Youth will be able to list two factors that cause ocean currents.

Youth will be able to label the general flow of water around the world.

Education Standard(s)

CCSS.ELA-Literacy.SL.5.1.C

CCSS.ELA-Literacy.SL.5.1.D

CCSS.ELA-Literacy.SL.6.1.C

CCSS.ELA-Literacy.SL.6.1.D

GLE 0507.Inq.2

GLE 0507.8.1

CCSS.MATH.Content.6.NS.C.7.C

GLE 0607.Inq.5

GLE 0607.8.3

Success Indicator

Model the movement of oceans.

Life Skill(s)

Team Work, Communication

Tags

Wind, temperature, ocean currents, science, STEM

Time Needed

30-45 minutes

Materials (per group)

Water (hot and cold), tin pie plate, oregano or chili powder (any herb that floats), 2 plastic straws, map of the world

Background

Note: Background information is provided here; facilitators do not distribute to the learners. It can be discussed briefly after youth have completed the experience.

"Surface currents play an enormous role in Earth's *climate*. Even though the equator and poles have very different climates, these regions would have more extremely different climates if ocean currents did not transfer heat from the equatorial regions to the higher latitudes" (*How Ocean Currents Moderate Climate*).

Ocean currents are caused by five primary factors: wind, temperature, density of water, *solar heating*, and Earth's rotation. Ocean currents are generated mainly by wind. However, differences in water temperature and density as well as solar heating and Earth's rotation also play a huge role. Wind creates water flow that is interrupted by landmasses. When wind pushes water toward a landmass such as North America, the water flow is interrupted as soon as it comes into contact with the continent. This causes a current that is then influenced by Earth's rotation. Earth's rotation forces currents in the Northern Hemisphere into a clockwise rotation and currents in the Southern Hemisphere into a counter-clockwise rotation.

Water temperature and density create currents in a different way. Warm, less salty water floats while cold, salty water sinks. This creates uneven heating in the ocean causing warm equatorial water to flow from the equator toward the poles, while cold, salty water will sink and flow from the poles toward the equator. This movement of water creates ocean currents which keep Earth's climate balanced by preventing the poles from getting too cold and the equator from overheating – there is a constant flow of cold water and warm water around the planet that balances the climate of the Earth.

Introduction and Opening Questions

How many of you have been to the ocean or a lake? Was the water cold or warm? Why might ocean temperature be important? Have you ever had hot chocolate that was too hot so you added ice cubes to it? What happened to that ice cube and what happened to the hot cocoa? What could cause a mixture between the two temperatures of water?

Experience *(use the Experiential Learning Model and encourage critical thinking and the use of science abilities and skills)*

Examine how ocean currents are driven by wind and influenced by the landmasses that obstruct the flow of water.

1) Divide students into pairs.
2) Have one student fill a tin pie plate halfway with cold tap water (*to prevent the water from spilling and making a big mess, facilitator can choose to ask students to cover their tin pie plates with saran wrap. Students can poke a small hole at one end and use the hole to insert the thermometer and straw).*
3) Record the temperature of the cold water in the plate (*if student has a science notebook, record this temperature in the notebook, if not, use the student handout provided on the last page)*.
4) Sprinkle a teaspoon of herb (oregano or chili powder) over the entire surface of the water.
5) Using a plastic straw, gently blow across the middle of the surface from one side of the pan.
6) Observe how wind creates ripples in the water and how these ripples are impacted when they hit the edge of the plate (a representation of landmasses that obstruct water flow).
7) Obtain a cup of hot (not boiling) water and record the temperature of the water.
8) Now add hot water to the tin pie plate already containing cold water until the water level reaches the inner rim of the plate.
9) Using a plastic straw, gently blow across the middle of the surface from one side again.
10) Record the *final* temperature of the cold and hot water mixed together.
11) Calculate how much the cold and hot water changed to reach the final temperature using absolute value (|final – cold| and |final – hot|).
12) Discuss with students how the wind helped mix the water and how this affected the water temperature.
13) Have students map the general flow of ocean currents on a map of the world.

Talk It Over...

Share…

1) What did you do during this activity? What did you discover about wind and ocean currents?
2) How did you feel working in a group during this activity?
3) What was your favorite part of this activity?
4) What was your least favorite part of this activity?

Process…

1) How do ocean currents create a flow between hot (equatorial) water and cold (polar) water?
2) If you lived close to the equator *without* ocean currents, what kind of temperatures would you experience?
3) If you lived near the poles *without* any ocean currents, what kind of temperatures would you experience?
4) Why was it helpful to work with a partner on this activity?

Generalize…

1) Where have you experienced ocean currents?
2) How have you experienced mixing of temperatures?
3) Why is it important to know how to work well with other people?

Apply…

1) What is another situation where you would need to use teamwork?
2) When would communication skills be helpful and important to use?
3) In what other situations do you mix liquids of different temperatures?

Term and Concept Discovery

Current – a body of water or air moving in a definite direction

Solar heating – the process in which earth is heated from energy it absorbs from the sun

Climate – the weather conditions of an area over a long period of time

Appendix

Standards:

5th Grade

CCSS.ELA-Literacy.SL.5.1.C: Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.

CCSS.ELA-Literacy.SL.5.1.D: Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.

GLE 0507.Inq.2: Select and use appropriate tools and simple equipment to conduct an investigation.

GLE 0507.8.1: Analyze and predict how major landforms and bodies of water affect atmospheric conditions.

6th Grade

CCSS.ELA-Literacy.SL.6.1.C – Pose and respond to specific questions with elaboration and detail by making comments that contribute to the topic, text, or issue under discussion.

CCSS.ELA-Literacy.SL.6.1.D – Review the key ideas expressed and demonstrate understanding of multiple perspectives through reflection and paraphrasing.

CCSS.MATH.CONTENT.6.NS.C.7.C – Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation.

GLE 0607.Inq.5 – Communicate scientific understanding using descriptions, explanations, and models.

GLE 0607.8.3 – Investigate the relationship between currents and oceanic temperature differences.

Resources:

Adapted from: Ready-to-Use Earth Astronomical Science Activities, "*How Ocean Currents Moderate Climate*"

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Student Handout

Name _____

Record the varying temperatures and perform the calculations to determine the final change in water temperature.

Cold water temperature: _____

Hot water temperature: _____

Final water temperature: _____

By how many degrees (Celsius or Fahrenheit) did the cold water change?

|final water temperature – cold water temperature **| = _____**

Did the cold water get warmer? (circle one) YES NO

By how many degrees (Celsius or Fahrenheit) did the hot water change?

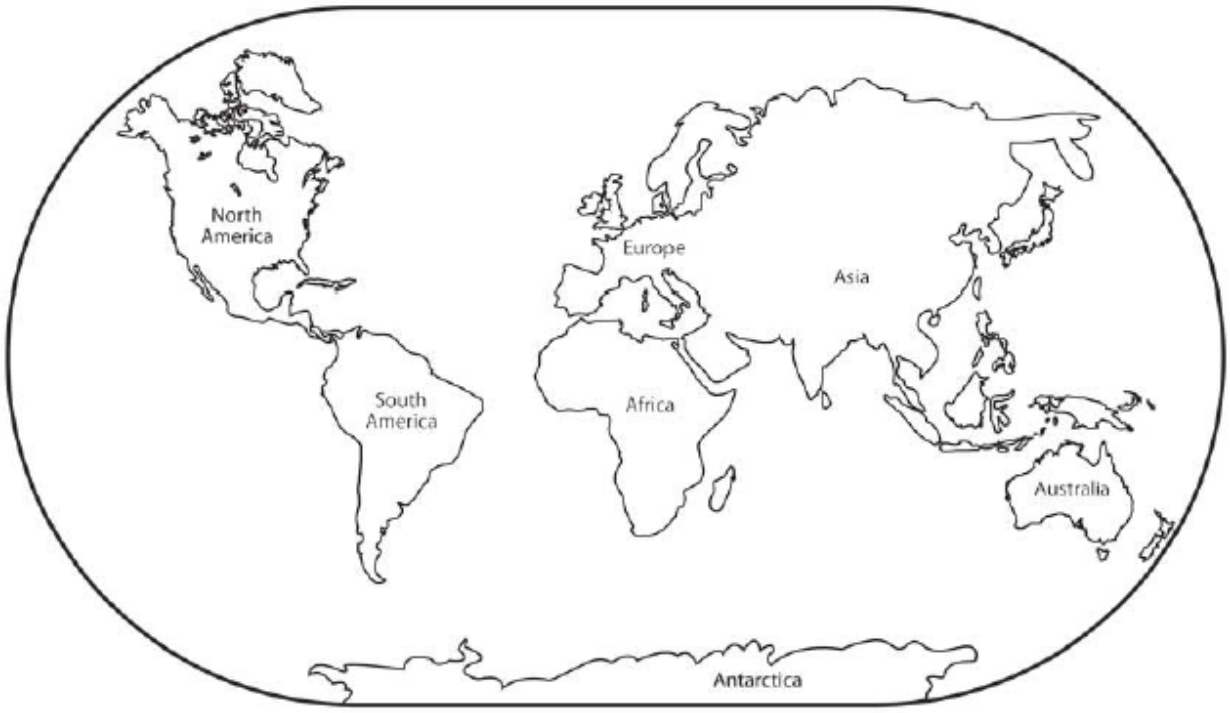
| final water temperature – hot water temperature **| = _____**

Did the hot water get cooler? (circle one) YES NO

Where the Wind Blows

Student Handout

Draw the general flow of ocean currents on the map below.



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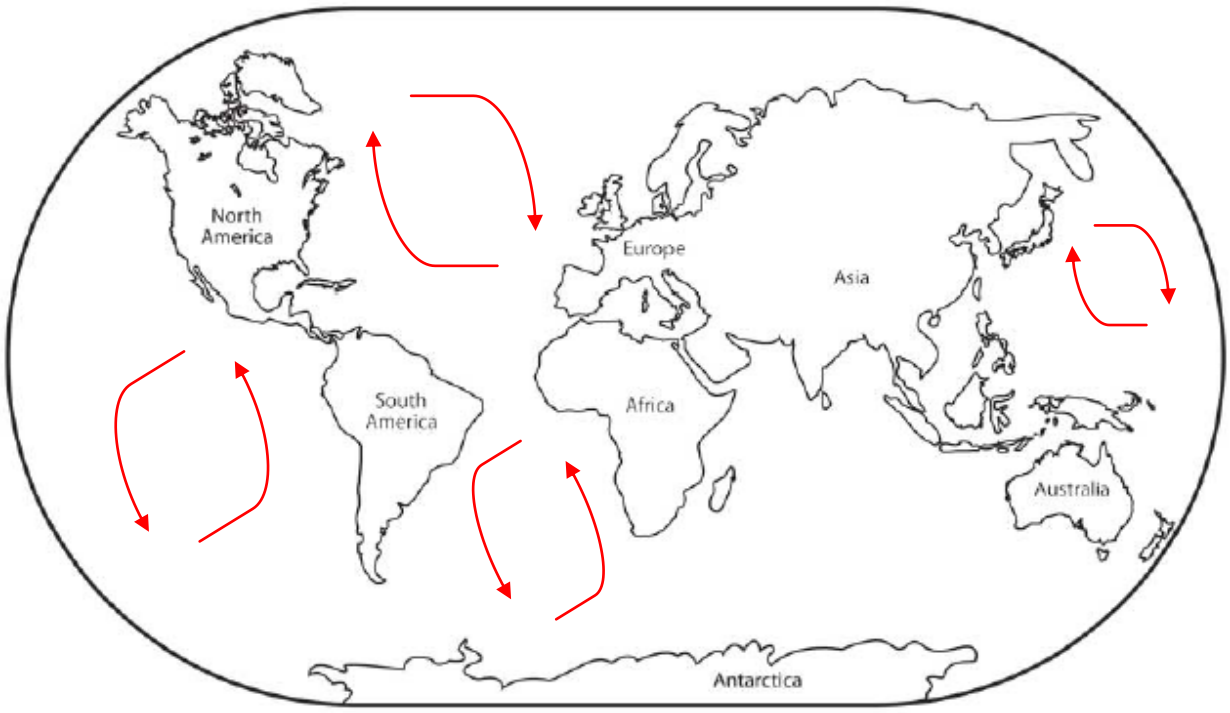
Facilitator's Guide

Example Map



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