GENERATIONGENIUS
ALWAYS QUESTION. ALWAYS WONDER.

LESSON PLAN

CLIMATE ZONES AND OCEAN CURRENTS
GRADES 6-8

SUMMARY

Students develop and use models to explain how variations in air and water temperature form currents which impact the weather and climate of particular regions.

NEXT GENERATION SCIENCE STANDARDS CORRELATION

MS-ESS2-6. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

Science & Engineering Practices	Connections to Classroom Activity
Developing and Using Models	• Students draw models to explain how interactions between sunlight, winds, and density form ocean currents which impact climate.

Disciplinary Core Ideas	Connections to Classroom Activity
ESS2.C: The Roles of Water in Earth's Surface Processes Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. **ESS2.D: Weather and Climate** Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents.	• Students use ideas from the Generation Genius video to support the development of models to explain how variations in temperature and salinity form ocean currents which impact the weather and climate of particular regions.

Cross Cutting Concepts	Connections to Classroom Activity
Systems and System Models	• Students use science ideas from the Generation Genius video and their investigation to help develop models which explain how interactions within subcomponents of systems generate ocean currents and affect climate.

DURATION

90 min.

MATERIALS

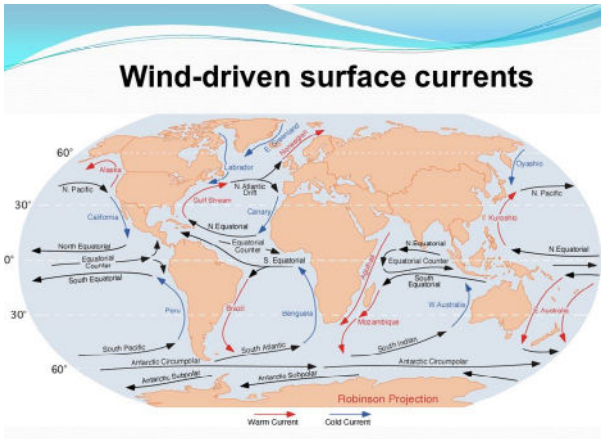
- 3 thermometers (long slender glass thermometers or those with metal backs work best) *If you only have one thermometer this will still work
- Lamp with 40-watt incandescent bulb
- Clay
- Watch/Timer
- Tape
- Paper/Pencil
- Calculator

ENGAGE

Tell students you have an interesting phenomenon you want to share with them. Ask students to create a t-chart and then write “Notice” on one heading and “Wonder” on the second. Tell them to record observations in the notice column and questions in the wonder column.

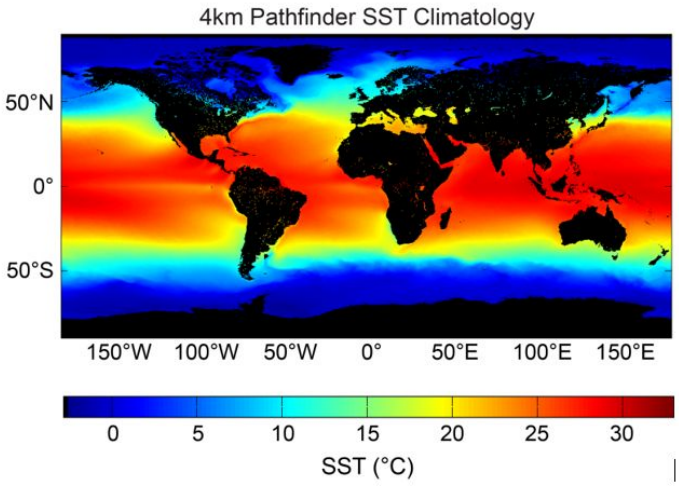
Share the following models with the students. You may want to share this via a projection screen, slide show, or by printing out the individual models:

Wind Driven Currents



https://images.app.goo.gl/rXn8cw8MCVpWXcwp6

Sea Surface Temperatures



https://www.ncei.noaa.gov/products/climate-data-records/pathfinder-sea-surface-temperature

After students study the models, ask them to share their T-chart with a partner.

Next, ask students to share observations and questions with the class. Record them on a display board for the class (projection screen, white board, dry erase board, chalkboard, etc.). Some students may wonder, *“Why is the surface*

temperature of the water so much warmer at the equator?"; "Why do so many of the warm air currents originate at the equator?"; "If we have all of these currents, why isn't the temperature of the ocean (or Earth) the same?"; or "Would we have these same patterns if the sun didn't warm Earth as it does?"

EXPLORE

Tell students many of us wondered what caused the air and the water to be so warm at the equator and ask them if it makes sense to investigate that question first.

Provide small groups of students the materials needed to conduct an investigation for the purpose of collecting data. Instruct students they need to record their observations as they conduct the investigation. You might discuss with students what data they think they will need to collect to explain the phenomenon of uneven air and water temperatures across the globe.

1. Put the lamp on the desk with the bulb 20 cm above the surface. Do not turn on the lamp.
2. Place the clay along the edge of the table.
3. Label the thermometers "A", "B", and "C".
4. Place the thermometers in the clay. *Make sure the middle of each thermometer is lined up along the edge of the table.
    a. Thermometer A should be vertical.
    b. Thermometer B should be at a 45° angle.
    c. Thermometer C should be horizontal on the table.
5. Create a data table.

Temperatures Recorded when Light Strikes Thermometer(s) at Different Angles

Thermometer	Original Temperature	Final Temperature (after 10 minutes)	Change in Temperature
A (Vertical)			
B (Angled)			
C (Flat)			

6. Record the original temperature of the thermometers.
7. Turn on the lamp for 10 minutes.
8. Record the final temperature. Safety Note: Thermometers and desk may be hot.

Have groups share their data with the class. As each group shares, challenge them and other members of the class to use any science ideas they are familiar with to explain what caused the observed effect. Remind students to refer to their data and provide evidence to support their ideas.

EXPLAIN

WATCH THE GENERATION GENIUS CLIMATE ZONES AND OCEAN CURRENTS VIDEO AS A GROUP

Facilitate a conversation using the Discussion Questions.

ELABORATE

After watching the video, have students work in small groups or with a partner to draw a model to explain the interactions between the sun, ocean currents, and climate. Prompt students to label each component (part) and show the relationships between the components. For example, arrows can be used to show the motion of air or water currents.

Students should include the components of density and salinity into their models, as was examined in the video. Guiding questions can be used to support students in creating their models and making sense of the science ideas.

After giving time for students to work on models, bring the class together to create a class consensus model. The teacher draws the consensus model at the front of the class using input from students. Have each small group or partnership share one component of their model to be included in the consensus model.

Facilitate a discussion on whether a shared component provides scientific information necessary for explaining the phenomenon of the patterns of uneven temperatures in air and water across the globe. Tell students to bring their attention to any student questions listed on the poster paper that were answered during this discussion while creating the consensus model.

EVALUATE

There are multiple ways to assess your students' understanding of this topic. The exit ticket is an opportunity for students to use the science ideas they built in the lesson in a new context. Alternatively, you can use the Kahoot! quiz (which provides downloadable scores at the end of the game) and/or the paper quiz. All these resources are located right below the video in the assessment section.

EXTENSION

Have students research the Argo Ocean Project which uses floating robotic instruments that float along with ocean currents and collect a variety of data. https://argo.ucsd.edu.