Ocean Currents and Sea Surface Temperature

Modified from "My NASA Data" project

Purpose: To discover the link between ocean temperatures and currents as related to our concern for current climate change

Grade Level: 8-12

Estimated Time for Completing Activity: 50 minutes

Learning Outcomes:

- Students will be able to explain how differential heating of Earth affects circulation patterns in the atmosphere and oceans that globally distribute the heat.
- Students can describe the relationship between ocean currents and temperatures on continental margins.
- Students will make predictions by linking current scientific satellite data to concerns about global climate change.

CA science standards

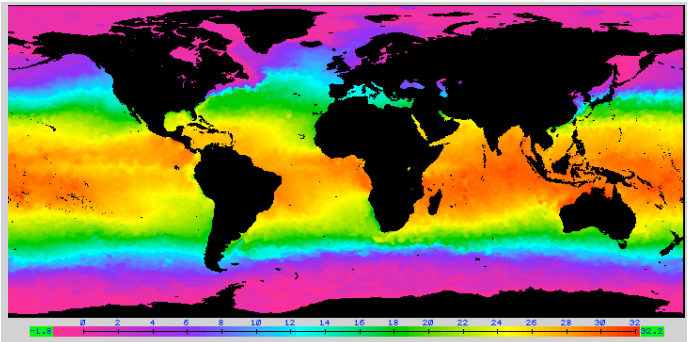
Grade 5 Earth Sciences: Energy from the sun a, b, c, d, e; grade 6, Energy in earth systems; Grade 9 through 12 Earth science, Energy in the earth system

Materials

Sea surface temp images

Blank world map

Map of ocean currents



Background:

Uneven heating of the Earth by the Sun causes the equatorial areas to have an excess of heat, while the polar areas have a heat deficit. The ocean, working with the atmosphere, moves the heat poleward and the cold equatorward to try to balance the temperature. Because of the rotation of the Earth and the Coriolis Effect, that movement becomes deflected, forming ocean gyres that turn clockwise in the Northern Hemisphere and counterclockwise in the Southern Hemisphere.

In these gyres, equatorial surface waters are carried poleward on the western sides of the ocean basins, and polar surface water is carried equatorward on the eastern sides of the ocean basins. These currents are wind-driven currents. Also, along the eastern basins, the cool waters bring nutrients to the surface. This is called upwelling, and it usually makes for good fishing grounds!

There is also the effect of a deep water circulation. In fact, a combination of surface and deep flow creates a giant global heat conveyor belt. These deep currents are caused by the temperature or density

differences of the waters... they are temperature-driven currents, that is, density-driven currents. This is because cold water is denser than warm water and wants to sink.

In this lesson, we will focus our attention to the surface currents by examining a parameter called sea surface temperature. Although these are wind-driven currents, the water temperature marks the movement of surface heating, which can be seen and monitored by satellites.

Procedure:

Pre-activity:

1. Students should discuss the question, 'How do you think global climate change may be related to ocean temperatures and currents?' Discuss student answers.

2. Obtain maps of sea surface temperature (SST) from NASA's Live Access Server or NOAA sources.

3. Have students discuss in groups the relationship between the movement of the water and the resulting Sea Surface Temperature.

4. Have students draw arrows on the blank world map, using blue pencil for the cold currents and red pencil for warm currents.

5. Have students compare their arrows with the map of surface currents. Are there places where there are unexpected or particularly strong warm or cold currents?

6. Have students discuss and answer the questions.

Questions:

1. What clues helped you decide how the ocean water is moving?

2. Where are ocean water movements carrying heat towards the poles? Where are the currents bringing cool water toward the equator?

3. What drives the surface currents in these ocean basins?

4. Where will the fishing be very good, due to upwelling?

5. Along what coastal margin will you commonly find fog? Why?

6. If global weather change (warming) continues, predict how the Sea Surface Temperature (SST) and Ocean surface maps might look in the year 2100.

Lesson plan contributed by Joan Carter, San Jose, CA

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