

OCEAN CURRENTS AND TEMPERATURE

(Level: primary school to high school)

SUBJECT: OCEAN CURRENTS
EXPERIMENTS TO DO IN CLASS

1. THE QUESTION

Cédric: “Does temperature affect ocean currents?”

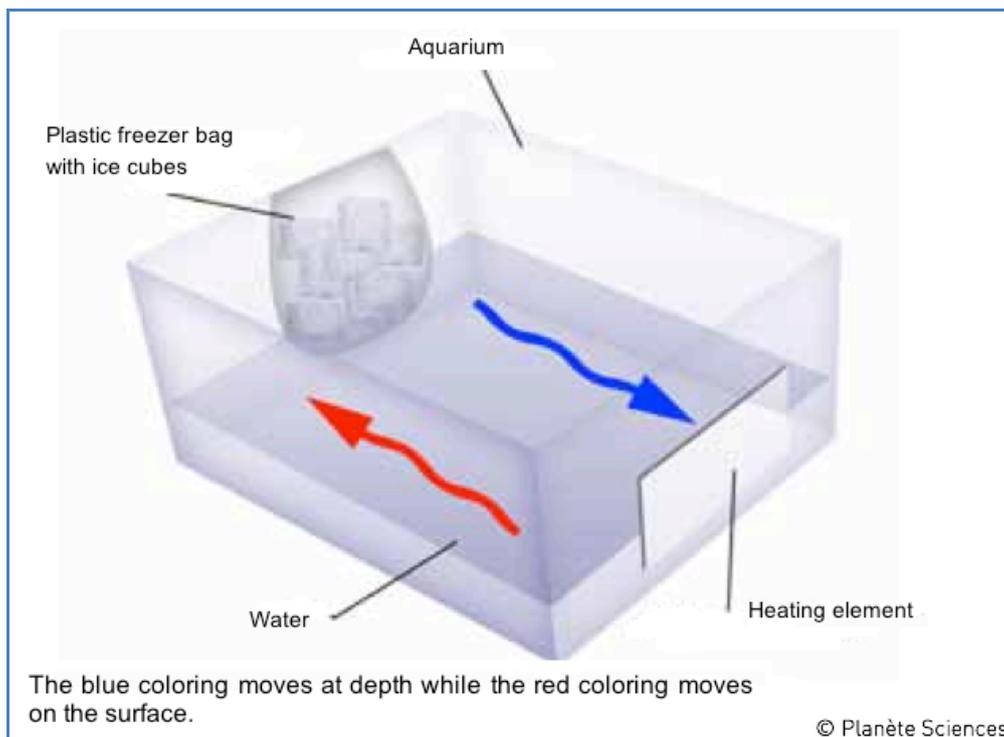
To answer this question, the association Planète Sciences proposes the following experiment.

2. MATERIAL

- 1 transparent rectangular aquarium
- 1 plastic freezer bag
- Ice cubes
- Food coloring (2 different colors, red and blue for example)
- 1 aquarium heater element

3. EXPERIMENT

1. Fill the aquarium to about half-full with water.
2. Fix the heater to the smaller wall of the aquarium. Turn on the heater and wait several minutes. Fix a freezer bag filled with ice cubes to the opposite wall of the aquarium.
3. Very delicately, put a drop of red coloring on the inside wall near the heater, and a drop of blue coloring on the inside wall near the ice cube bag. Be careful not to move the aquarium during the experiment!!
4. Let the experiment run for several minutes and observe what the two colors do.



4. GOING FURTHER

In this experiment, the difference in density between the water cooled by the ice cubes and the water heated by the resistance causes a current to rise to the surface from water warmed by the heater, and a current at the other cooler end of the aquarium to sink. *Cold water is denser than warm water.* After a few minutes, you can see the circuit created by the current.

Various factors can cause the formation of ocean currents: a difference in density is one of them. This density difference is linked to water temperature and salinity (see Ocean Currents and Salinity Experiment). On a global scale, the surface currents and those at depth are all connected. They make up the general ocean circulation, also called the “conveyor belt”.

As less dense surface currents become denser due to a drop in temperature or a rise in salinity, they descend by simple gravity to the depths, creating a vertical circulation. This phenomenon takes place, for example, in the North Atlantic. The surface current moving north in the Atlantic (the Gulf Stream) carries less dense waters from the equator (these are warm because of the intense solar radiation at the equator, and less salty because of the heavy precipitations) towards the Norwegian and Labrador seas. At the end of their northern course, these waters become more dense, due in part to a rise in salinity (linked to high evaporation rates in the tropics and exclusion of salt from the formation of the ice pack), and due also to a drop in temperature from reduced solar radiation at higher latitudes. In these cold regions, the denser surface waters sink to great depths before returning southwards. At warmer latitudes, the current rises to the surface and closes the circuit.

This experiment was designed by the association Planète Sciences.