Ocean Layering: Density, Salinity, Temperature, and Circulation

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Day 1 Overview: Ocean Density

Warm up & demo: 10 min
Activity: 25 min
Info: 15 min
Conclude: 5 min

Warm up: What is density? What makes one object denser than another?
Student responses:

- Weight / how heavy it is
- Size / how big it is
- Compactness

This should be a review for the students, although many may not remember. Density depends on two things, mass or how much stuff there is, and volume or how much space the stuff takes up. The more you compress something the denser it gets, and the more stuff you pack into a certain space the denser it gets. We care about density because it determines what can sink or float in the ocean.

Demo: density column
See '01t.activity.densitycolumn' (http://earthref.org/cgi-bin/erda.cgi?n=1001)
Goal: introduce the idea that liquids can have different densities and can sink and float on top of each other.
Transition: Just like solid objects have different densities that determine if they sink and float, liquids have different densities that determine if they sink or float. For example, oil floats on water, whether it's in your salad dressing or an oil spill in the ocean.

Activity: Density lab
See '01t.activity.densitylab' (http://earthref.org/cgi-bin/erda.cgi?n=1002)
See '01c.handout.densitylab' (http://earthref.org/cgi-bin/erda.cgi?n=998)
See '01t.handout.densitylab.answers' (http://earthref.org/cgi-bin/erda.cgi?n=1003)
Goal: Students will determine the relationship between salinity and density.
Transition: Salt has a different density than water, so salt water has a different density than fresh water. We're going to do a lab experiment to determine if salt water or fresh water is denser.

Info: Density in the ocean
See '01c.slides.density' (http://earthref.org/cgi-bin/erda.cgi?n=1000)
See '01t.slides.density' (http://earthref.org/cgi-bin/erda.cgi?n=1006)
See '01c.handout.notes' page one only (http://earthref.org/cgi-bin/erda.cgi?n=999)
See '01t.handout.notes.answers' page one only (http://earthref.org/cgi-bin/erda.cgi?n=1004)
Goal: Students will take notes, learn about the vertical currents in the ocean, currents near the bottom of the ocean, and the role of density in ocean circulation.

Transition: Discuss the relationship between salinity and density. Proceed onto the first slide: ‘density in the ocean’.

Conclude: How do temperature and salinity affect density? Why does it matter?
Review the big picture. Cold water is denser than warm water and sinks. Salty water is denser than fresh water and sinks. Density matters because dense water sinks, which causes horizontal currents near the bottom of the ocean. These currents transport heat and nutrients around the globe between all of the oceans. These are currents traveling 1000’s of kilometer caused because water near the bottom of the ocean has small differences in density.