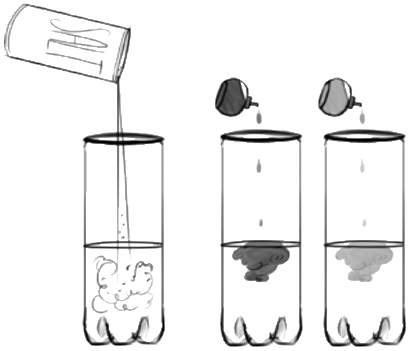
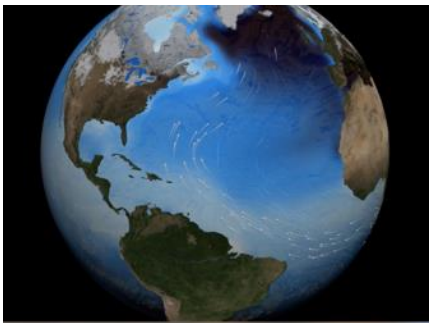
ICESat-2
ICE, CLOUD, AND LAND ELEVATION SATELLITE-2

Motion in the Ocean

Make your own ocean in a tube



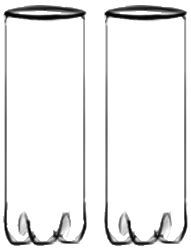
Did you know that most of the world's oceans are interconnected and move around the Earth like a giant conveyor belt? The motion of the ocean occurs because of differences in density (heaviness) of waters. This is mainly caused by the freezing of salty ocean water that forms into sea ice in the Arctic. Sea ice is instrumental in regulating our climate and keeping our planet cool. Satellites like ICESat-2  are measuring the thickness of sea ice from space.



Watch 'The Global Conveyer Belt' animation showing how salt water and cold water are heavier and sink down. Fresh water and warm water are lighter and rise up. When ocean water gets very cold, it freezes into sea ice. In the process, additional salt is released into the ocean. This salty water is heavier (more dense) and therefore sinks down. This is how the giant conveyor belt works.

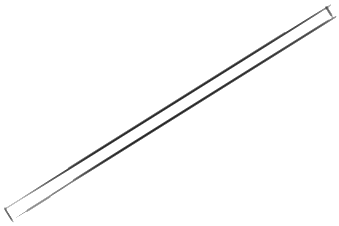
Let's get started and try it out for ourselves in this experiment!

Gather these items:



- **2 Tennis ball tubes** (tall, fitting 3 balls). This is where you'll mix the fluids: one for salt water, one for fresh. Or, one tennis ball tube for the experiment and one beaker, graduated cylinder, or other container to mix fluid. Use your imagination and recycle – a large mayonnaise jar, a large water bottle with the top cut off, etc.

- **Water** 
- **1 container** (plastic recycled cup or other vessel) for waste water.
- **Salt** 

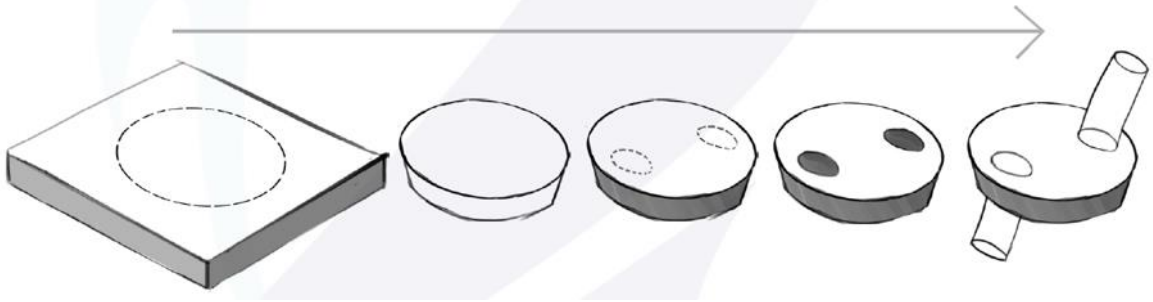
(~1 heaping Tablespoon per ~450 ml water – or half of the tennis ball container)
- **Food coloring**  (2 different colors – typically, blue and yellow are used.)
- **Stirring Stick** 
- **Fluid Separator Plug** (circular disk cut out to fit diameter of tennis ball container):

- Two **inner tubes**, such as clear tubing from a hardware store, for fluid transport that are ~ 10 mm diameter (could use clear straws instead)

Make the Separator Plug

Take high density foam 1/2” thick (such as a children’s puzzle floor mat). Place the opening of the tennis ball tube face down on the foam. Trace the opening with a pen. Cut out the circle using scissors, slightly beveling the cut downwards. (When you insert the plug, you will insert it

so that the beveled side goes down.) Cut out the two holes in the center of the plug (slightly less than 10 mm diameter) and insert the inner tubes.



Do the Experiment

Fill one of the tennis ball containers about half full, with ~450 ml (16 oz.) of room temperature water. Add 2 Tbsp salt, and stir to dissolve.

Place ~3 drops of yellow food coloring (or other color of choice) in salt water and stir.

Fill the other tennis ball container about half full with ~ 450 ml (16 oz.) of fresh, room temperature water. Place ~ 3 drops blue food coloring (or other color) in water and stir.

Insert inner tubes into fluid separator plug, then insert assembly (beveled side down) into the fresh water container until it reaches the top level of the fluid, trying not to squeeze out the water. A slight gentle rocking motion works best. (If excess water appears on top of the separator plug, hold inner tube shut with a finger and pour it off, or else pipet it off, or blot it with a tissue.)

Place finger on top of inner tube to seal it off. (Have your partner help you.)

Gently pour yellow salt water into the top chamber, aimed at any part of the foam separator except the other hole opening, while partner seals off inner tube. Fill past the top of the inner tube, which your partner has sealed.

Ask yourself what they think will happen before you release the tube. Then you or your partner take his or her finger off tube and see what happens.

Note: If you save the tennis ball tube top. You can close off the tube and turn it over to repeat the experiment. (Make sure to do this over a sink or bucket or outdoors.)

Safety Note: Be sure to check the inside top rim of the tennis ball container for sharp edges or burs. If necessary, use pliers to clamp down.

To learn more about ocean salinity and ocean currents, visit https://gpm.nasa.gov/education/videos/thermohaline-circulation-great-ocean-conveyor-belt Several NASA satellite missions study this process, including Aquarius (2011-2014) which measured salinity, and ICESat-2 (Launched in 2018), which measures the height of ice sheets, sea ice, glaciers, and ocean heights.