# Rising Oceans

**Background Information:**

Has anyone seen the glass bulbs with colored water in them that move when you place your hand on them? (Show a sample.) Why does this move? (Water expands when it is heated.) What happens when the oceans warm? How can all that water expand and where does it go?

Out in the open sea, ocean waters are driven by two great wind systems. Close to the equator the Trade Winds blow the surface waters westward. In the temperate zone, the Westerlies blow the surface waters back toward the east. The result is that in each great ocean basin there is roughly circular movement of the surface waters. In the northern hemisphere these wind driven currents move clockwise and in the southern hemisphere they move counter clockwise. Both surface and deep-water currents affect the world's climate by moving cold water from the poles toward the tropics and vice versa.

Ocean waters are always in motion. Currents flow like rivers, waves crash against seashores, and tides rise and fall. Currents are created by the sun warming ocean layers in certain areas like at the equator. The warmer water expands slightly, creating a slope, and the warm water runs downhill toward the poles. Ocean waves are created by wind. Energy in the form of waves moves across the ocean surface but the water itself moves in a circular motion beneath the surface. Tides are rhythmic, predictable and are affected by the gravitational pull of the sun and moon. Tidal range can vary dramatically depending on the shape of the water basin that the tides flow through.

Sea surface highs occur because of the expansion of the upper ocean water after it is heated throughout the summer. As the oceans warm the water expands. The air above has less resistance than the mass of water beside it, so that area of the ocean will rise in height.

**Objective:** Students will observe fluid motion.

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| **Standards:** | Science: unifying concepts & processes; physical science | | |
| **Vocabulary:** | Westerlies | sea surface | tides |
| **Materials:** | Large test tube<br>Glass tubing<br>Test tube clamp | One-hole stopper<br>Ring stand<br>Food coloring | |

**Directions to the Teacher:** Insert a piece of glass tubing into the stopper. The glass tubing needs to be about one-half inch off the bottom of the test tube and extend at least eight inches above the test tube.

1. Fill the test tube half full of water and mix in food coloring.
2. Carefully clamp the test tube on the ring stand and insert the stopper.
3. Hold the bottom of the test tube with your hand to slowly heat the water.
   **[Do NOT use a burner or hot plate or hot pot to heat the test tube.]**
4. Observe and record what happens.
5. Now place your hand on the part of the test tube that is above the water level.
6. Observe and record what happens.
7. Ask students the following questions:
   - What can you conclude about heat and liquids?
   - What can you conclude about air pressure and liquids?
   - What part of the experiment represented air at a constant pressure? At an increasing pressure?
   - If the oceans heat up, what happens to the water? Where does it go?

**Extensions:**

- Make a larger version using a flask. Be sure to extend the tubing above the stopper. Use a heat lamp to warm the water.
- Review Charles and Boyles Gas Laws.
- Why is the ocean salty?
- Make a topographic 3-D model of the sea surface from Topex Poseidon: http://topex-www.jpl.nasa.gov/education/3Dmodel.html

**References / Resources**

http://earthobservatory.nasa.gov/Observatory/Datasets/sst.avhrr.html
http://www.es.flinders.edu.au/~mattom/IntroOc/lecture01.html