

Simple Rotating Tank Demonstrations

General Circulation of the Atmosphere

total time just over one hour

1. Hadley Cell

set-up time 20 minutes, viewing time 15 minutes

- a. Place cylindrical insert in the square tank.
- b. Fill with ~10 cm of water.
- c. At the center of tank, concentric with the cylinder, place open can weighted down to prevent it from floating away.
- d. Set turntable to the slowest speed, ~1-2 rpm and allow the water to come into solid body rotation, ~10 minutes.
- e. Carefully, fill can with ice and water to establish a radial temperature gradient.
- f. Wait a few minutes for the circulation to develop.
- g. Use permanganate and colored dye to visualize. Use very little of each.

2. Eddies

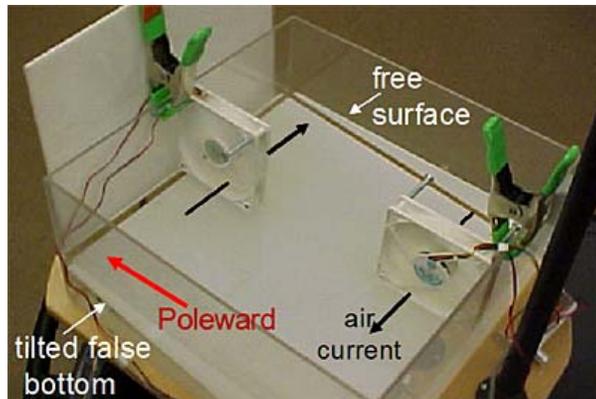
set-up time 15 minutes, viewing time 15 minutes

- a. Pour some bleach into the already-rotating tank in which the Hadley Cell demo was just performed.
- b. Increase the rotation-rate by a lot, to ~10 rpm.
- c. Allow the water to come into solid body rotation and for the eddies to form, ~5 minutes.
- d. Use permanganate and colored dye to visualize. Use very little of each.

Ocean Gyres

set-up time 30 minutes, viewing time 15 minutes

1. Before adding water to the tank, follow the two steps below.
2. Inside the square tank, place a snugly fitting white acrylic sheet propped up along one edge to provide a tilted bottom. This creates a beta plane.
3. Attach two fans on opposite sides of the tank, as shown in the figure below. The fans are driven by the 12V DC power supply on the turntable.



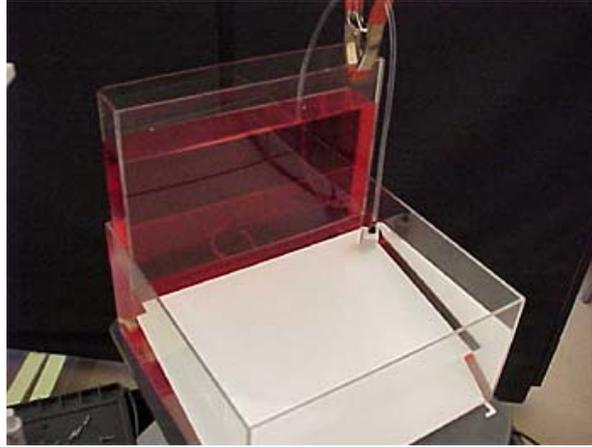
4. Fill up the tank with water to just below the fans.
5. Set the turntable to ~ 10 rpm, make sure the fans blow (on low, if possible) and allow the water to come into solid body rotation and for the circulation to develop, ~ 15 minutes.
6. Use colored dye to visualize.

Thermohaline Circulation

set-up time 30 minutes, viewing time 15 minutes

1. Place the tall narrow rectangular tank inside the large square tank and push it against the side.
2. Inside the square tank, place a snugly fitting white acrylic sheet propped up along the side of the tower to provide a tilted bottom. This creates a beta plane.
3. Pour water into the tower until $\sim 80\%$ full.
4. Fill the large square tank until water completely covers the slanted bottom to a depth (at the shallowest point) of ~ 2 inches.
5. To transfer water from the tower to the water in the tank, use a siphon arrangement through a diffuser, as shown below.





Charge the siphon system by submerging the diffuser along with its tubing in the water of the tower. When the tube is completely filled with water, tighten the valve to block any flow of water. Keeping the open end submerged, take the diffuser out of the tower, attach to the tower with the clamp and let the diffuser hang down into the water at the shallow end of the tank, as shown above.

6. Mix some dye into the water in the tower.
7. Set the turntable to ~ 10 rpm and allow the water to come into solid body rotation, ~ 5 minutes.
8. Open the valve slightly (\sim one or two turns) to allow the dyed water to begin flowing through the diffuser into the tank.