



Weather in a Tank



General Circulation: Hadley Cell



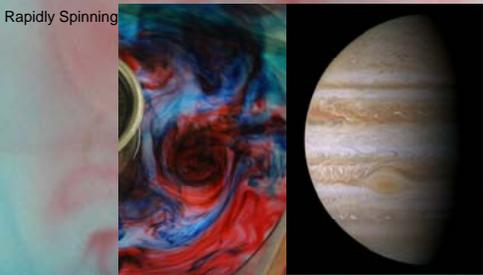
Using the rotating tank we can study the large scale eddy patterns of the atmosphere. An eddy is basically a swirling of a fluid. The ice in the center of the tank acts like the North Pole, while the outer warmer portions of the tank act like the equator. Warm water flows away from the "equator" and toward the "poles" while cold water flows away from the "poles" toward the "equator". The eddies are produced by the Coriolis Effect due to the rotation of the Earth or the tank. This is also the way the atmosphere on Venus behaves as seen above.

General Circulation: Extra Tropical Eddying



The Hadley cell near the equator is characterized by warm air rising and flowing away from the equator and cool air sinking at mid-latitudes and flowing toward the equator. In our experiment, cool water sinks to the bottom of the tank flows out, while warmer water on top of the tank flows toward the ice (away from the equator). The Coriolis force from the rotation then causes a shear in this flow and water at the bottom and top of the tank flows in opposite directions around the ice.

General Circulation: Very High Rotation

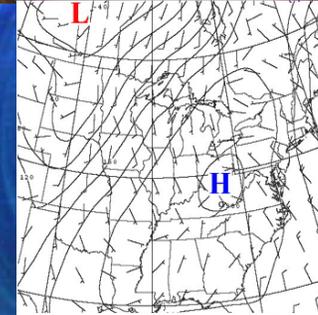


Jupiter is the largest planet in the solar system and is more than ten times the size of earth, yet it rotates around its axis in only nine hours! This high rotation speed causes many small eddies to form in the atmosphere of Jupiter. With our tank rotating at high rates we can experiment with the fluid dynamics of Jupiter's atmosphere.

Ekman Layers

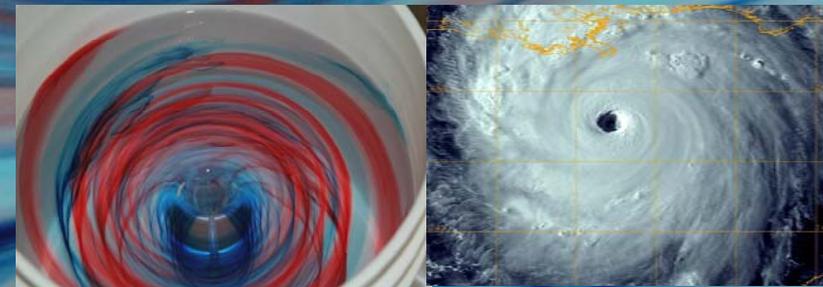


Ocean Gyres



In the region where the earth's atmosphere comes in contact with the ground friction is important. In low pressure weather systems air therefore spirals inward toward the low pressure, and in high pressure weather systems air spirals outward. We study these effects with our tank by dyeing the water at the bottom and slowing rotation down for low pressure and speeding rotation up for high pressure.

Balanced Vortex



Hurricanes and tornadoes are intense low pressure weather systems with flow spiraling inward toward their centers. We can set up a low pressure fluid vortex with our rotating tank by placing a bucket on the rotating table and then draining it to study fluid vortices like hurricanes and tornadoes.



N_Atlantic Gyre: "Courtesy of I. Yashayev, BIO"

Oceans have large scale stable currents that flow circularly around the ocean basins. They are caused by the wind. These flow patterns are called gyres. Using fans and the rotation of our tank we can study these ocean gyres on a much smaller scale the laboratory.