SMS-303: Integrative marine sciences III.

Lab 2, Mixing.

Stations and activities:

I. Convective mixing, heat:
You have two tanks. In one you have a heating element near the bottom, in the other you have a heating element near the surface.
Before you do anything answer the following:

Q: Which of the heating elements is likely to cause the most mixing through entrainment of adjacent waters?

Plug both heating elements (if they are not plugged already) and use food coloring to trace the waters.

Q: Observe the circulation and speculate where in the oceans does such a circulation takes place. Discuss at least one oceanic setup for which each tank is an analogue for.

II. Convective mixing, ice:

You have two tanks one with ice water (analogue to the ocean) the other with fresh water (analogue to a lake) in which you will put ice (or there may be ice already).

Q: How will the ice affect the circulation if you put it all in one place? Will it be different in the different tanks? Why?

Q: Will there be a different if the ice is near the wall vs. the center of the tank? Why? Try it and explain your observations.

Use dye to trace water as it interacts with the ice.

Q: Observe the circulation and speculate where in the oceans does such a circulation takes place.

III. Kelvin-Helmholz billows:

In a long skinny cylinder you have water overlaid by mineral baby oil. You are about to lift one side (the right one) and observe what happens at the interface between two fluids flowing in opposite directions (why will they flow in opposite direction?).

Q: What do you think will happen at the interface between the two fluids?

Lift the right side 10-20cm above the table and observe the interface.

Q: Why don't the two fluids mix?

IV. Diffusion of momentum:

You have a cylindrical vessel full of water on a rotating table.
Q: How will the fluid react when you start/stop the rotating tank?

Use sawdust or dye to check your answers as you start the fluid rotating and then stop it and to determine how fast the fluid is rotating as function of distance from the boundary.

V. Wind mixing:

You have two tanks filled with water and a hair dryer. One tank is stratified the other is not. Before you start discuss the following questions:

Q: How can you use the food dye to determine which is stratified?

Q: How different will the mixing be in the stratified tank compared with the non-stratified one?

Keep the dryer on low and direct it parallel to the water's surface. Perform the experiment and explain the observations. BE VERY CAREFUL NOT TO INSERT THE HAIR DRYER IN THE WATER.

VI. Breaking internal waves.

You have a tank with fresh water on top of blue salty water. Slowly move up and down once paddle to generate an internal wave packet. See how they interact with the sloped surface on the other side of the tank. Can you observe the mixed fluid formed by the breaking waves?

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