Ghana Summer School

I. Buoyancy Frequency

Supply List:

- 2 Large Containers
- Funnel and tube
- Small Vial w/ String
- Stick
- Eye-Dropper
- Fresh Water
- Salt Water
- Timer
- Dye

Make a two-layer fluid: Fill one container about ½ full with fresh water and ½ with salt water. Using the funnel and tube, add dyed salt water gently beneath the fresh until the container is nearly full.

The goal is to adjust the density of a small vial with air and water so that the middle (roughly) of the bottle floats at the interface of the two fluids. Lower the bottle carefully with the attached string. Adjust the buoyancy of the bottle by adding or removing water from inside the bottle with an eyedropper. Try not to mix the interface during this process.

Once floating at the interface, depress the bottle slightly with a stick and estimate the period of oscillation T. It is easiest to time several oscillations and divide by the number of oscillations, rather than timing one cycle.

Compute buoyancy frequency: $N = 2\pi/T$ (radians/second). Estimate the density difference from the buoyancy frequency

$$N^2 = -\frac{g}{\rho_o}\frac{\partial \rho}{\partial z} = -\frac{g}{\rho_o}\frac{\Delta \rho}{h}$$

where *h* is the height of the small vial.

Repeat with a lower layer solution that has half the salinity by mixing ½ salt water to ½ freshwater. Use the medium container to mix the solution.

Interpret what is happening to the bottle in terms of the forces acting upon it (again consult Archimedes). Explain the differences between the two experiments (i.e. the less salty lower layer). How does the movement of the bottle relate to the demonstration of internal waves?

II. Dam Break Demonstration

III. Cartesian Diver Demonstration

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