SMS-204: Integrative marine sciences.

Lab 5, Settling, drag and swimming in high and low *Re* flow.

Today you will investigate the drag experienced by bodies in different flows.

Station 1. Choose two sets of clay plankton models (4 in each set) and two spheres; select the clay ball such that it weighs the same or slightly less than the phytoplankton models. Also select two white rods of the same size.

In two graduated cylinders, one with Glycerin and the other with water, measure the settling velocity of your models (one sphere and two phytoplankton models in two different orientations) using a stopwatch and a ruler. Can you get the non-spherical objects to settle slower than the spheres (even though they may be larger)? In what orientation are they slowest?

Compute the Reynolds number (R =Length x fluid density x velocity / viscosity) of the flows produced by the models and sphere in water and in glycerin using: $\mu_{glycerin}$=0.016 Pa s, $\rho_{glycerin}$=1.17g cm^{-3}, μ_{water}=0.001 Pa s, ρ_{water}=1.0 g cm^{-3}. How do they compare to phytoplankton in the ocean (assume a phytoplankton of about 10μm settling at about 50m/day):

	Plankton Model I				Plankton Model II				Sphere in Water	Sphere in Glycerin
	Glycerin		Water		Glycerin		Water			
	Orientation I	Orientation II	Orientation I	Orientation II	Orientation I	Orientation II	Orientation I	Orientation II		
Size (cm)										
Time										
Velocity (cm/s)										
Re										

Drop the white rods into the glycerin, one vertically and one at a 45 degree angle. Is there a difference in the way they sink?

Station 2. Sinking in stratified fluid. You have a cylinder stratified with normal Karo on the bottom and less viscous Karo at the top. Observe the settling of several spheres released within a small time interval in the fluid. Is the settling (and spacing between balls) affected by the change of density and viscosity of the fluid? Can you think of oceanic/ limnological (lake) conditions for which this demonstration may be relevant?

Station 3. Sedimentation tube: simulate a nephloid (near-bottom) storm by reversing the tube and letting the particles settle. Watch the settling as function of time as well as the water turbidity. Describe to your team member what is going on.

Station 4. Swimming at low and high *Re*:
You have several bath toys/swimmers. Take one and have it swim in water. Note its velocity. Now put it in Glycerin. How fast does it swim? Why are there differences?

Station 5. Feeding at low *Re*:
Try to catch plastic balls in glycerin using a spatula and a fork. Do not use the air-glycerin interface or the glass walls. Which utensil can get closest to the particle and in what orientation? What does it teach us about filter feeding on particle at low *Re*?

This page was last edited on 2/21/2016