Geophysical Fluid Dynamics Laboratory - Research School of Earth Sciences

Internal Waves

1) Use the “hot double bucket” system to fill the rectangular tank with a warm salinity stratification, noting the initial water temperature T_0. Inject dyes of different colours into the system at several different depths.

2) Carefully draw samples of stratified water from 5 different depths and measure their densities. Calculate the stratification $\frac{d\rho}{dz}$ and the buoyancy frequency $N = \sqrt{\frac{g}{\rho_0}\frac{d\rho}{dz}}$.

3) Note the layered structure of the stratified environment with the shadowgraph.

4) Drop some dye crystals into the tank and time the vertical oscillations generated by their falling wakes. Compare the frequency of these oscillations to the buoyancy frequency N.

5) Carefully lower the agitator into the tank. Set an agitation frequency ω that results in the radiation of internal waves, and make note of the propagation angle θ of the beams.

6) Adjust the agitation frequency ω, and record the new angle θ of the beams. Repeat this several times, collecting a set of agitation frequencies ω and beam angles θ.

Use the estimated buoyancy frequency N, the agitation frequencies ω and the beam angles θ to evaluate the dispersion relation for internal waves,

$$\omega = N\,cos\theta.$$