**Introduction**

Collisions between ice floes result in the development of pressure ridges, mirrored by the formation of underwater keels. As wind forces the lateral movement of these keels, they stir up the surrounding water. The relationship between the decreasing age of Arctic ice and the amount of wind-driven mixing occurring is not well understood.

In a series of two-dimensional numerical experiments, we simulate turbulence caused by ice keels of various drift speeds and subject to various mixed-layer depths.

**Background**

Observations from the past several decades confirm a reduction in the average age of Arctic sea ice, which corresponds to increased sea ice mobility and a change in mixed-layer depth [2, 3].

The Arctic Ocean may be modelled as a two-layer stratified system, with a fresher surface mixed layer overlying a thicker, more saline band of water.

**Effect of Variable Drift Speed**

First, we consider a pair of systems in which $\Delta h = 1m$. To attain the desired initial Froude numbers 0.8 and 1.2, we set $U_i$ equal to 0.10 m/s and 0.15 m/s, respectively. We allow the systems to evolve for approximately 350 seconds.

At this instant, we observe substantially greater turbulence in the Experiment B system. We also observe a greater degree of salt redistribution within the water in this system.

**Effect of Variable Mixed-Layer Depth**

Next, we consider a pair of systems in which $U_i = 0.10m/s$. To attain the desired initial Froude numbers 0.8 and 1.2, we set $\Delta h$ equal to 1m and 0.44m, respectively. We allow the systems to evolve for approximately 350 seconds.

We observe less turbulence in these simulations than in the Experiment B system due to their lower drift speeds. Despite their dynamical differences, the velocity and salinity fields for the systems with variable mixed-layer depth look quite similar, suggesting that changes to mixed-layer depth do not affect Arctic stirring by keels as significantly as changes to drift speed.

**Future Study**

- Account for the influence of Earth’s rotation.
- Track the Froude number across the domain, throughout each simulation.
- Determine the impact of variable density difference $\Delta \rho$ (i.e., variable $g_{\text{ref}}$).
- Use observations to quantitatively investigate changes to the Arctic sea ice cover, and use simulated data to predict future behaviour.

**References**