TRENT UNIVERSITY

PHYSICS & ASTRONOMY SEMINAR SERIES

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Wednesday, November 2, 2022

11:00 a.m. to 11:50 a.m. in ENW 115

Join via Zoom:
https://trentu.zoom.us/j/98170138259?pwd=UUNYaWRhZWJGQlBCZFFHVFdPSkdRdz09
Meeting ID: 981 7013 8259 Passcode: 145017

Simulations and scaling of density driven flows in the cabbeling regime

There is ample evidence to suggest that under our shifting climate conditions, lake and other lake-related conditions in the winter will undergo significant change. Thus, understanding the behavior of wintertime fluid flows is of utmost importance. In this talk I will discuss recent numerical work I have done which is focused on the dynamics of fresh water with characteristic temperatures around the temperature of maximum density (four degrees celsius). In this temperature regime, the temperature of maximum density implies that masses of water with equal densities but different temperatures can mix, and can form a mass of water that is denser than either parent mass; a process known as cabbeling.

The first example I will focus on is a series of numerical simulations of cabbeling density currents. I will highlight how the initial density driven intrusions flow along the upper surface of the simulation domain and mix with ambient water. Cabbeling induces vertical transport and a secondary current is formed along the bottom surface. I will define an important control parameter and describe how tuning this parameter changes the dynamics of the system; specifically the maximum horizontal extent of the initial intrusions, as well as the late time temperature distributions.

The second part of this talk focuses on the vertical mixing and entrainment within a stratified parallel shear flow where upper and lower layers are on different sides of the temperature of maximum density. I will show the results of a series of three dimensional numerical simulations as well as the relevant dimensional analysis and scaling. Finally, I will highlight how cabbeling leads to re-stratification after a temporary mixing dominated regime.

Time permitting, I will complete the talk by giving a brief overview of some of the other projects our research group has been a part of in the last few years.