DALHOUSIE MATHEMATICS COLLOQUIUM

Thursday November 22 2018, 2:30 pm, Chase 319

Speaker: Joseph Siddons
University of Liverpool

A Large Eddy Simulation Study of the Formation of Deep Chlorophyll Maxima: The Roles of Turbulent Mixing and Grazing

Deep chlorophyll maxima (DCM) are typically attributed to a balance of two opposing gradients that contribute to phytoplankton growth, namely nutrient resources and light availability. Recent observed measurements of fluorescence values and turbulent energy dissipation rates recorded in weakly stratified ocean boundary layers have highlighted a significant correlation between the formation of DCM and turbulent mixing. In particular, the depth of many DCM are observed to form below, but within approximately one standard deviation of, the depth at which the energy dissipation rate reaches its maximum. This correlation is surprising, as turbulent mixing is generally considered to be a destructive force in regards to the formation of DCM.

In order to investigate this phenomenon, I will introduce a three-dimensional large eddy simulation (LES) of the ocean boundary layer which has been coupled with a generic nutrient-phytoplankton-zooplankton (NPZ) type biological model. I will present simulation results, based upon various sets of biological and physical parameters, that demonstrate DCM formation occurs under similar conditions to those seen in the experimental observations. The simulations support the hypothesis that DCM are generated by a combination of high grazing pressure restricting phytoplankton growth near the surface, and a decline in the strength the vertical mixing processes advecting nutrient through the boundary layer. This results in a zone of low grazing pressure and high nutrient aggregation, suitable conditions for DCM formation.

Related paper: *https://aslopubs.onlinelibrary.wiley.com/doi/full/10.1002/lno.10566*