Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Turbulence, mixing, and blooms at ocean fronts JOHN TAYLOR, Department of Applied Mathematics and Theoretical Physics, University of Cambridge, RAFFAELE FERRARI, Department of Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of Technology — Regions with large horizontal density gradients, or fronts, are ubiquitous features of the upper ocean. As locations where density surfaces outcrop from the ocean interior, fronts serve as conduits for transport of fluid properties, linking the deep ocean and the atmosphere. Although fronts are under-resolved in most global ocean models, recent work has shown that they strongly affect the large-scale circulation and biology of the ocean. This talk will describe results from recent studies based on large-eddy simulations (LES), which find that turbulent mixing is strongly affected by fronts and is subject to two competing effects: turbulence is generated from the available potential energy associated with the front, but vertical mixing is inhibited by the stable stratification that develops as the front slumps. By coupling a simple biological model with the LES, we find that reduced vertical mixing at fronts can trigger phytoplankton blooms in light-limited conditions. These results help explain satellite-based observations of unexpected mid-ocean blooms at high latitudes.

John Taylor
Department of Applied Mathematics and Theoretical Physics,
University of Cambridge

Date submitted: 05 Aug 2011 Electronic form version 1.4