12.802 — Small-scale Ocean Dynamics

Description

Fundamental principles of GFD will be applied to study oceanic motions on scles from hundreds of kilometers down to centimeters. Topics will include wave motions, instabilities and turbulence.

Syllabus

1) Waves – using surface gravity waves as an example.
   a) Kinematics: frequency, wavenumber, phase, phase speed
   b) Group velocity – wave packets and inhomogeneities
   c) Initial value problem
   d) Shallow water
   e) WKB theory
   f) Stokes drift
   g) Nonlinear effects on profiles
   h) Interaction with mean flows

2) General linearized waves in rotating stratified fluid
   a) sound (sound channel)
   b) surface and internal
   c) comment on geostrophic

3) Internal gravity waves
   a) Energy and generation mechanisms
   b) Topography and vertical propagation/ trapping, amplification, radiation condition
   c) Unsteady flow
   d) Winds
   e) Normal modes
   f) Vertical propagation – steady flow and the radiation condition
   g) Garrett-Munk and triad interactions

4) Boundaries, topography, and tides
   a) Poincaré and Kelvin waves
   b) Shallow water waves
   c) Storm surges and topography
   d) Tides - generation, topography, basins
   e) Tidal rectification

5) Upwelling
   a) Linear theory
6) River plumes
   a) Adjustment
   b) Relation to Kelvin waves/ bores
7) Instabilities
   a) Symmetric
   b) shear
   c) KH
8) Turbulence
   a) Definitions
   b) Kolmogorov
   c) Stratified

Meets:

MW 9:00-10:30

54-823

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