SIO213/MAE 214B   Turbulence and Mixing

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COURSE DESCRIPTION: Introduction to turbulence, importance of coherent structures, semi-empirical theories, effects of stratification and rotation on turbulent structure, entrainment and mixing, ocean mixing mechanism, their identification, description and modeling.

SOME TOPICS COVERED

- Introduction to turbulence
  - Experimental descriptions of turbulence, the importance of coherent structures
  - Turbulence and its relation to unstable flows
  - Critical Reynolds number
  - Mixing layer experiments
  - Vortex pairing
  - Eddy coherences and lifetimes; related inferences from correlations measurements

- Summary of basic concepts and their relation to experiments on coherent structures
  - Reynolds equations and the closure problem
  - Dimensional arguments, "laws"' semi-empirical theories:
    - Law of the wall, Velocity defect law,
    - Kolmogorov -5/3, Taylor microscale
  - Pedigrees for various flows: Spectra and correlations

- Stratification effects
  - Kelvin-Helmholtz stability, turbulent and flux Richardson numbers
  - Mixing layer experiments with stratification
  - Stirred grid experiments
  - Entrainment and the turbulent Richardson number

- Boundary layers, rotational effects
  - Boundary layer turbulence observations
  - Turbulent Ekman layer, dimensional arguments
  - Inferred flow structure in the Ekman layer, Planetary boundary layer measurements

- Oceanic mixing mechanisms – across isopycnals
  - Inferences from global advective diffusive balances
  - Estimates from microstructure observations
  - Breaking internal waves
  - Bottom and surface mixed layers
  - Spatially inhomogeneous mixing models

- Isopycnal property distributions and diffusion
  - Isopycnal analysis, Advective diffusive models
  - Inferences from current meters, floats and hydrographic surveys

- Sample special subjects (at discretion of instructor and students)
  - Shear dispersion
  - Variable diffusivity effects