MPO 650 / AMP 650 – Coastal Ocean Circulation

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COURSE DESCRIPTION

This course seeks to expand upper level students understanding of coastal oceanographic physical processes. There will be a concentrated focus on coastal circulation, waves and their interaction. We will cover scales ranging from boundary currents to shelf processes to the surf zone. Recent developments in modeling and observational approaches will be highlighted along with their applications to ecological, human health and management issues.

COURSE OUTLINE

1. Introduction
   Physical characteristics of coastal waters

2. Equations governing coastal circulation
   Basic equations of circulation
   Shallow water equations

3. Tides and tidal currents

4. Wind-driven circulation
   Coastal sea level set up/set down
   Upwelling, downwelling and coastal jets
   Storms and extreme events

5. Surface waves
   Wave generation, dissipation and propagation
   Wave induced transport
   Global and local models
   Wave current interaction/wave blocking
   Wave set-up

6. Wind/wave-driven surges

7. Topographic effects on coastal currents
   Frictional adjustment
   Inclined plane beach model

8. Exchange processes and mixing
   Advection and diffusion of seawater
   Coastal Eddies
Lagrangian Coherent Structures
Pollution dispersion

9. Thermohaline shelf circulation

10. Dynamics of river plumes
   Transport and fate of freshwater discharges
   Ephemeral rivers

11. Biogeochemical coastal processes
    Nutrient transport
    Sediment transport
    Larval transport

12. Coastal to offshore interactions
    Boundary currents
    Shelfbreak eddies and fronts
    Inner shelf and surfzone exchange

13. Numerical models of shelf circulation

14. Integrated Ocean Observing Systems
    HF radar
    Buoy networks
    Data assimilation in numerical models

15. Remote Sensing of the Coastal Ocean
    SST
    Interferometric-SAR
    Optical properties
    Lidar/bathymetric mapping

16. Coastal management
    Real time predictions
    Mitigation

GRADING
Emphasis will be given in critical thinking and the development of the ability to
synthesize class material to address research questions. Students will develop a project
that will replace a final exam, graded as a 10-page (double spaced) Report and as a
presentation in class. Homework will include assignments for paper reading and
discussion. A mid-term exam will be given. The final grade will be based on:
Homework: 20%, Mid-term exam: 20%, class Project Report: 40%, class Project
Presentation: 20%