

ATM/OCE/MPO 731: Air-Sea Interactions

Fall 2017,
Tu/Th 3:00-4:20,
MSC 329

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Office Hours: 1:30-3:00 Tu/Th
MSC 367

Description:

Oceanic and atmospheric mixed layers including fluxes of heat, momentum, moisture and salt between the ocean and atmosphere; vertical distribution of energy sources and sinks at the interface including the importance of surface currents; forced upper ocean dynamics, the role of surface waves on the air-sea exchange processes and ocean mixed layer processes.

1. Introduction: Basic Processes (Week 1)
 - A. Definitions
 - B. Governing Equations/Laws

2. Instabilities (Week 1-2)
 - A. Atmospheric
 - B. Oceanic

3. Reynolds Decomposition (Weeks 2-4)
 - A. Generating turbulence
 - B. Approximations and Consequences
 - C. TKE Equations

4. Oceanic Mixed Layers (Weeks 5-8)
 - A. Bulk Treatments
 - B. Kraus-Turner/PRT
 - C. Deardorf
 - D. TKE
 - E. Surface Wave Effects on OPBL dynamics
 - F. Langmuir Cells

5. Atmospheric Boundary Layer (Weeks 8-10)
 - A. Friction velocity and surface layer
 - B. Log layer
 - C. Methods of determining wind stress
 - D. Surface Wave Effects on APBL fluxes
 - E. Nondimensional Scaling/Buckingham Pi Theorem

6. Heat Fluxes (Weeks 10-12)
 - A. Bulk aerodynamic formulas
 - B. Obukhov Length Scales

- C. Approximations
- D. Role of SSTs
- E. Precipitation and Evaporation
- F. Methods of determining heat fluxes

7. Forced Upper Ocean Response (Weeks 13-15)

- A. Ekman Dynamics
- B. Projection of wind stress onto baroclinic modes
- C. Near-inertial (fronts, tropical and extratropical cyclones)
- D. Wind Forced Equatorial Kelvin Waves

Books:On Reserve

Kraus, E. B., and J. A. Businger, 1994: Atmosphere-Ocean Interaction, 2nd edition, Oxford University Press, Oxford, 362 pp. (Reference).

Brown, R. A., 1991: Fluid Mechanics of the Atmosphere, Academic Press, Inc. (Reference)

Garratt, J. R., 1992: The Atmospheric Boundary Layer, Cambridge University Press (Reference)

Gill, A. E., 1982: Atmospheric-Ocean Dynamics, Academic Press, Inc., London, 662 pp. (Reference)

Kraus, E. B., 1977: Modeling and Prediction of the Upper Layers of the Ocean, Pergamon Press, 143 pp.(Reference)

Phillips, O. M., 1977: The Dynamics of the Upper Ocean, 2nd edition, Cambridge University Press, 336 pp. (Reference)

Phillips, O. M. and K. Hasselman, 1986: Wave Dynamics and Radio Probing of the Ocean Surface, Plenum Press, 681 pp.(Reference)

Csanady, G., 2001: Air-Sea Interaction: Laws and Mechanics. Cambridge University Press, Cambridge, United Kingdom, 239 pp. (Reference)

Selected manuscripts as assigned.

Grading:

1. Homework assignments: 50%
2. Mid Term Exam: 25%
3. Final Exam: 25%