Fall 2009
SMALL SCALE AIR-SEA INTERACTION
OCN 665/MET665

Instructor: Roger Lukas (MSB418, x67896, rlukas@hawaii.edu)

Texts: Boundary Layer Meteorology
by Roland Stull

Atmosphere-Ocean Interaction (2nd edition)
by E.B. Kraus and J.A. Businger

This course will introduce physical oceanography and meteorology students to the one-dimensional theories of turbulent boundary layers, to observations of the planetary boundary layer of the atmosphere, and to observations of the surface mixed layer of the ocean. Necessary concepts of turbulence theory are studied, along with the appropriate statistical tools. Coupled one-dimensional models of air-sea interaction will be studied with a view towards understanding the importance of interactions of the turbulent boundary layers with each other, and with the interior of their respective fluids. Finally, the subject of the influence of horizontal variability will be opened, with the objective of appreciating the role that ocean and atmosphere dynamics play in modulating the thermodynamics of the turbulent boundary layers, and as an introduction to the associated course on Large-Scale Ocean-Atmosphere Interactions.

Course Outline

1) **Introduction to Air-Sea Interaction**

2) **Review of Basic Meteorology and Physical Oceanography (Kraus and Businger)**

3) **Mean boundary layer characteristics (Stull; Kraus and Businger)**

4) **Concepts and Mathematical Tools of Turbulence (Stull)**

5) **Parameterization of Turbulent Fluxes (Stull; Kraus and Businger)**

6) Boundary Layer Models (Stull; Kraus and Businger)

7) Coupled Boundary Layers

Student learning outcomes:

- **Ability to identify and quantify the individual components of the momentum, heat and moisture (salinity) budgets of the lower atmosphere (upper ocean)**
- **Understand how the ocean and atmosphere are physically coupled by momentum, heat, moisture and buoyancy fluxes**
- **Understand the basic physics of surface turbulent boundary layers in the atmosphere and ocean**
- **Know the essential characteristics of turbulent flows and the components of the turbulent kinetic energy budget**
- **Ability to quantify the level of turbulence in boundary layer flows**
- **Understand the methods for measuring key variables used to estimate air-sea fluxes**
- **Understand the common methods of estimating air-sea fluxes from observations and in numerical models**
- **Ability to identify positive and negative local feedbacks within the coupled ocean-atmosphere boundary layers**
- **Understand how large-scale circulations in the atmosphere and ocean modify local air-sea interactions, and how they are affected by them**