I. Introduction

- Applications in Ocean-Atmosphere Interaction
- Energy Balance of the Earth's Climate System

II. Basic concepts of ocean-atmosphere coupling

- Air-sea exchanges of heat, moisture, momentum, and gases
- Thermodynamics: boundary layers, mixing
- Ocean and Atmosphere Dynamics
- Interaction of dynamics and thermodynamics
- Feedbacks
- Modes of coupled variability
- Interaction of coupled modes

III. Modes of coupled climate variability: Description, Dynamics and Predictability

- Madden-Julian Oscillation
- The Annual Cycle and Monsoons
- El Nino/Southern Oscillation
  - Observations
  - ENSO theory
  - Phase-locking of ENSO to annual cycle
  - Numerical Modeling and prediction
  - Dynamical Systems Theory--Chaotic Oscillation of tropical climate
  - Interaction of Monsoon and ENSO
• **Extratropical Air-Sea Interaction-Decadal Variations**
  - Ocean as an integrator/heat reservoir
  - Ocean to atmosphere feedback, large scale
  - Ocean to atmosphere feedback, observations/modeling
  - Decadal climate variability in the North Pacific
  - The North Atlantic Oscillation

• **The Thermohaline Circulation (THC) problem**
Student Learning Outcomes for
Large-scale Ocean-Atmosphere Interaction
OCN/MET666

Upon successful completion of the course, students are expected to:

- Understand concepts on how the ocean and atmosphere are coupled by momentum, heat, moisture and buoyancy fluxes
- Understand the basic physics of surface boundary layers in the atmosphere and ocean
- Understand the basic large-scale dynamics of the ocean and atmosphere underlying the major modes of coupled ocean atmosphere variability
- Describe the statistical and dynamical approaches to discovering modes of coupled ocean-atmosphere variability
- Know the essential features of the dominant modes of coupled ocean-atmosphere variability
- Understand the key dynamics related to the dominant modes of coupled ocean-atmosphere variability
- Understand the key thermodynamics and air-sea coupling mechanisms of the dominant modes of coupled ocean-atmosphere variability
- Understand the physics governing predictability and predictive methods for modes of coupled ocean-atmosphere variability
- Be able to critically evaluate knowledge of the major modes of coupled ocean atmosphere variability