ATOC 1060 - 001: Review guideline for exam 2

Fall 2010

NOTE: Two copies of the textbook are available as reserve material in the Math-Physics Library (in Duane, one floor up from the classroom)

Exam 2 will cover the last portion of lecture 12 (geostrophic flow) and online lecture notes 13-18, which are chapters 4 and 5 of the textbook. These are the materials we cover after exam 1 up to the day of exam 2. You should review all materials in the lecture notes and the corresponding sections of the textbook. I will provide a guideline regarding what is required and what is not, and will also provide example questions. The exam format is multiple choices.

1. Concepts

   You are not required to memorize the exact words and numerical values of the concepts we have covered, but you are required to fully understand them.

   For example: geostrophic balance, geostrophic wind, geostrophic currents, heat capacity, latent heat of vaporization, latent heat of fusion, evaporation, condensation, saturation vapor pressure, relative humidity, super saturation, oceanic Ekman spiral, Ekman transport, Ekman divergence and convergence, upwelling and downwelling, salinity, thermohaline circulation, mixed layer, pycnocline, thermocline, halocline, Subtropical Gyre, westward intensification (western boundary currents).

2. Interpretation of charts (figures)

   Understand the figures. You should understand and be able to explain them. Example 1, figure 4-21 of the textbook describes Asian monsoons. How is the southwest monsoon formed? How is the Northeast monsoon formed?

   Example 2: slide 13 of lecture 15 shows the observed surface winds and SST in the eastern tropical Pacific. How is the equatorial cold tongue formed? How is the cold SST along the west coast of South America formed?

3. Geostrophy, Ekman transport, wind-driven circulation, and thermohaline circulation.

   Fully understand geostrophy. For a given pressure distribution, you should be able to tell the directions of pressure gradient force, Coriolis force, and the geostrophic currents (or winds) in both the northern and southern hemispheres.

   Similarly, for a given wind, you should know which direction the Ekman

transport is in both hemispheres. The real surface (or mixed layer) currents are the sum of the geostrophic currents and Ekman drift (Ekman transport).

Understand how the STG is formed.

Understand the processes that can affect the deep water formation and thus the thermohaline circulation. Say, surface heating/cooling, sea ice formation (that can affect salinity), evaporation and precipitation.

Understand how the North Atlantic Deep Water (NADW) is formed, and how The warmer and saltier Mediterranean water is formed.

Understand the differences of atmosphere and ocean circulations for normal, El Nino and La Nina conditions, and the El Nino climatic and societal impacts.

4. Example questions. **Note that these are only examples. You need to review all materials that covered in the corresponding lectures.**

What does CTD stand for (lecture 15)?
Why is there a seasonal variability of Hadley cell?
What are the major differences between land and ocean (land-ocean contrasts)?
How do these differences cause land-sea breeze and monsoon?
Why does land have much larger seasonal variation of temperature than ocean?
What regions generally have strong precipitation and why?
What regions have deserts and why?
Why is latent heat important for hydrological (and energy) cycle? Understand how energy is absorbed or released associated with the phase changes of water.
How is the Ekman spiral formed?
Is there convergence or divergence of water in subtropical gyre region? Why?
How is this convergence cause geostrophic flow?
Is the ocean circulation symmetric or asymmetric in the east-west direction?
What is the name of the western boundary current in the subtropical North Atlantic Ocean?
What causes the thermohaline circulation?
Why is the thermohaline circulation important for global heat balance?
What processes can affect the deep-water formation and thus the thermohaline circulation?
Where is the salt of ocean from?
What is El Nino? What is La Nina? What is ENSO?
How do atmosphere and ocean circulations change during El Nino?
How does El Nino affect rainfall in the tropics and subtropics?
How does El Nino affect fishery?