

**This is a review sheet for EXAM 1 to be held TUESDAY, FEBRUARY 12th, 2008 in class**

The exam is based on my lectures, though since much of this is 'review' from previous courses, understanding the material in the book associated with the topics I discussed in class certainly wouldn't hurt.

### **1. Introduction**

- What is the difference between weather and climate?
- What is the difference between meteorology and climatology?
- How did the ancient Greeks divide up the globe climatically?
- Know the basic timeline of inventions / discoveries as presented in class.

### **2. Energy balance**

- How is temperature important in determining the amount of energy radiated by an object and by the wavelengths in which it radiates?
- In which bands does the sun radiate? The Earth?
- Though we'll assume the sun's energy is constant, what sort of cyclical variability does the sun have?
- What are the different possibilities in terms of what happens to the sun's radiation as it traverses the atmosphere? Which of these possibilities is the largest?
- What is albedo and how does it vary from surface to surface? What's your first clue to something's albedo?
- What can happen to the earth's energy that's radiated out?
- What is the "atmospheric window" and what can "close" it?
- What is the greenhouse effect? How big is it (in terms of energy) relative to other processes?
- What is net radiation? What are its components and what does each component mean?
- What can the energy absorbed at the surface be used for?
- How do Net SW, Net LW, H and LE vary across space? Why do they vary?
- What is the Bowen ratio? What does it mean if it's high or low? Why would this one number be a good indicator of climate?

### **3. Temperature**

- How do day length and solar elevation angle contribute to determining seasons?
- Why does the sun near the horizon transmit much less energy to the earth than a sun right overhead?
- Where does solar energy vary most seasonally?
- What causes the seasons?
- How does radiation vary across a hemisphere during winter/summer?
- What are the principal controls upon temperature? How and why are each important? Think of examples.
- Of the principal controls on temperature, which is most important to temperature value? Annual range?
- How does the local vertical profile of temperature vary from day to night? How does this change with windy or cloudy conditions?
- What does the vertical profile of temperature in the atmosphere look like? Why does it vary?

### **4. Moisture and precipitation**

- What is the difference between relative humidity and absolute humidity measures?
- What is dew point?
- Know how the saturation vapor pressure curve changes with temperature.
- Why is the environmental lapse rate? What are the moist adiabatic lapse rate and dry adiabatic lapse rates and why are their values different?

- What is stability? Stable? Unstable? Conditionally unstable? How do we determine which is the case on any given day?
- Know the major reservoirs of water in the climate system and the relative size of the atmosphere.
- Know the general flow of moisture through the hydrologic cycle and the residence times we mentioned.
- What affects potential and actual evapotranspiration? What is the difference between the two?
- What factors are needed for precipitation? What are the primary sources of lift? Broadly, how does precipitation vary worldwide?
- What affects soil moisture storage and how is the season cycle?
- What is surplus? Deficit?
- Be sure you can understand graphically the water budget over a season cycle. What does the water budget annual cycle look like in Ohio? How (generally) does this vary from place to place?

## **5. Motion**

- What does the equation of state tell us about the relationship among pressure, density, and temperature?
- What is “sea level” pressure and why do we need to calculate it?
- What is the Pressure Gradient Force? Coriolis force? Friction? Centrifugal force? How do each operate, and how do they vary from place to place?
- Why doesn’t gravity pull the atmosphere down to the ground?
- How do the different forces combine into geostrophic and surface flow?
- What does the upper level flow look like in the tropics? Mid-latitudes? Poles?
- How do winds blow around a high or low? In the upper levels and on the ground? In the Northern Hemisphere? Southern Hemisphere?
- How are convergence and divergence aloft associated with high and low pressures at the surface?

## **6. Atmospheric circulation**

- Why does the atmosphere circulate?
- How is the heat moved around?
- What does the single-cell circulation look like and what does it neglect?
- How is the three-cell circulation different?
- Know: Hadley Cell, ITCZ, trades, subtropical highs, polar lows, westerlies, and the general reasons for their existence.
- How does the ITCZ migrate?
- Where does the jet stream appear in the atmosphere? (Both vertically and latitudinally.)
- What is the polar vortex? How does it vary seasonally?
- What are the middle latitude undulations in the upper-level circulation called? What are troughs and ridges? What are some preferential locations for troughs to occur?
- What differences between the land and ocean cause seasonal migration of highs and lows? How do they change from one season to the next?