

**Course Outline          Atmospheric Sciences 321          Spring 2009**

Readings from Hartmann are given by chapter and section.

Lectures in Weeks 5 and 6 (April 27 – May 6) will be given by Mark Zelinka (ATG 714, tel. 685-9303, email mzelinka@atmos.washington.edu)

**Week 1: The Climate System.** Chapter 1.

*The climate system is composed of the atmosphere, oceans, land surface and ice sheets.*

**Week 2: Geometry of Earth's orbit, distribution of solar radiation. Energy balance of the earth-atmosphere system.** Chapter 2.

*The temperature of Earth is determined by its energy balance through the first law of thermodynamics. The variation of incident sunlight with latitude is the main determinant of climate.*

**Week 3: Greenhouse effect, energy-balance climate models, effect of clouds.** Chapter 3, Sections 3.1-3.6, 3.8-3.12 (Section 3.7 will be covered in ATMS 341).

*The surface temperature and the emission temperature are different, due to the greenhouse effect.*

**Week 4: Surface energy balance, hydrological cycle.** Chapter 4, Sections 4.1-4.4, 4.7-4.10 (Sections 4.5, 4.6 will be covered in ATMS 431). Chapter 5 (all).

*Temperature at the surface depends on the surface energy balance which has convective as well as radiative terms. The heat balance is strongly coupled to the water balance of the surface.*

**Week 5: The Atmospheric General Circulation and Energy Transport.** Chapter 6. (Lectures by Mark Zelinka)

*The atmosphere rapidly moves heat and water from place to place through zonal mean and eddy circulations.*

**Week 6: The Atmospheric General Circulation and Patterns of Climate.** Chapter 6. (Lectures by Mark Zelinka)

*The atmospheric circulation has a strong control on regional moisture and heat balances.*

**Week 7: The ocean, thermal inertia, the seasons.** Chapter 7.

*The ocean has long-term memory because of its high heat capacity. It also is a fluid and moves energy around.*

**Week 8: History of Climate and Natural Climate Variations.** Chapter 8.

*Earth has experienced major climate changes over time. This history is apparent in natural recording systems.*

**Week 9: Natural Climate Change.** Chapter 11.

*Natural forces drive climate change. These effects, like changing orbital parameters, are amplified by the natural feedback processes within the climate system.*

**Week 10: Anthropogenic Climate Change.** Chapter 12.

*Humans now compete with the natural forces that drive climate change, particularly through the release of long-lived greenhouse gases into the atmosphere.*