Atmospheric Science 350
Fall 2009

Questions to think about: energy and the atmosphere.

- What is meant by the term "positive feedback?" What role could positive feedback play in the atmospheric greenhouse effect? Would this enhance or reduce global warming? Can you think of any "negative feedback" mechanisms?
- In the discussion of the earth's annual energy balance we saw that the earth absorbed approximately 51 units of solar energy but emitted 117 units of infrared energy. What prevents the earth from getting colder and colder over time?
- Will a rising parcel of air always expand? Why? Does this expansion cause the air temperature to increase or decrease? Why?
- Explain how energy in the form of sunlight absorbed at the ground could be transferred upward in the atmosphere in the form of latent heat. How or when is the latent heat energy released in the air above the ground?
- Describe and give examples of the various ways that heat can be transported in the atmosphere.
- Describe the atmospheric greenhouse effect. Is there any difference between the way the atmospheric greenhouse effect works on a clear night and on a cloudy night?
- Several of the planets in our solar system are further from the sun and cooler than the earth. Do they emit electromagnetic radiation? Why are we able to see the planets in the sky at night?
- How could increased cloud cover cause an increase in the average surface temperature? How could increased cloudiness cause a decrease in average surface temperatures?
- When you remove a cold beverage from a refrigerator in a humid room, water vapor will condense on the sides of the container. Would this act to warm or cool the beverage, or would the condensation have no effect on the beverage's temperature?
- Imagine that the temperature of the sun were to change. Describe or discuss some of the effects that this might have on the earth's energy budget and the earth's climate.
- Many people will blow on a bowl of hot soup to try to cool it. In your view, what are the two most important heat transport processes being used to cool the soup?
- Consider how the climate system would change if the albedo of the Earth was changed to 50%. Quantify the change in radiative equilibrium temperature of the Earth system.
- Consider how the climate system would change if the radiative output of the sun was doubled. Quantify the change in radiative equilibrium temperature of the Earth system.
- Consider how the climate system would change if the tilt of the Earth was increased to 45 degrees.
- Explain the difference between the atmospheric greenhouse effect, and how a greenhouse works in a garden.
- Explain the difference between the atmospheric greenhouse effect, and the effect of putting another blanket on your bed during a cold night.
- Describe how the Earth would be different in the absence of a greenhouse effect. Consider changes in the seasonal cycle, the daily cycle, and the long-term mean climate.