Atmospheric Sciences 111 Homework 3 Due Tuesday July 13

Cloud Feedbacks

1. Clouds can have both a greenhouse (warming) effect and an albedo (cooling) effect. So, when we consider the effect of clouds on climate, the first question we should ask ourselves is what how the warming and cooling effect of clouds compare. The answer depends on the type of cloud you consider. For the question below, do not worry about giving the technical names for different cloud types (e.g., cirrus). Simple descriptions will be fine.

A. Which type of clouds has the biggest greenhouse effect? (1)

B. Which type of clouds has the greatest albedo effect? (1)

C. For what type of clouds does the greenhouse warming effect outweigh the albedo cooling effect? (1)

D. For what type of clouds does the albedo cooling effect outweigh the greenhouse warming effect? (1)

2. Global warming deniers often highlight scientific uncertainties in how clouds will respond to climate change as a reason to not take major action to reduce greenhouse gas emissions. Using the information from class lecture, and external sources if you like, write a brief paragraph explaining your perspective on this topic. Do climate models generally find cloud feedbacks to be positive, negative, or both, and what is the range of magnitudes? How major are the uncertainties in cloud feedbacks? How should this uncertainty play into social decision-making? Page 235 of *Rough Guide* contains a brief description of clouds in climate models and may be useful. (6)

Extreme Heat

3. Both the textbook and lecture give several different definitions of "heat wave." A good definition should make it possible to quantitatively determine if and how heat extremes have changed over time (or are predicted to change in climate models) in a given region. Give at least two possible definitions and list the benefits and drawbacks of both in the above terms. (5)

4. What is the role of humidity in extreme heat? Explain. (3)

5. What do you think is the relationship between global warming and an extreme heat event (current events as well as predictions for the future)? I encourage you to think in terms of statistics here! (5)

6. Please write down at least one question from this week's material that you would like to discuss on Friday. This may be on a topic you don't feel you understand well enough, or it may be a topic you found interesting and would like to discuss more. (2)