12.815 Atmospheric Radiation
Fall 2008

RADIATIVE EQUILIBRIUM EXERCISE

Key Concepts:
Radiative Flux
Eddington's Equation (2-stream approximation)
Grey approximation to absorption coefficient
Radiative Equilibrium
Discontinuity in surface boundary condition

Exercise:

1. Review the notes on "Approximate Solution for Planetary Radiation" and be sure to understand the physics and the mathematical derivations.

2. Under conditions of Radiative Equilibrium:

   a) Calculate the Mean or Effective Temperature of the Earth and explain its implication.
   b) Calculate the Surface Temperature, the Atmospheric Temperature just above the surface, and the Temperature at the Top of the Atmosphere and explain the meaning of these quantities, both in terms of the approximations involved and in terms of the real world.
   c) What is the temperature gradient at the surface? What is the temperature gradient at the top of the atmosphere? Examine and explain your results.

3. Please plan to hand in your responses to this exercise when we next meet. You should not have to spend more than 2-3 hrs on this exercise. Additional background material can be found in the Goody and Yung reference.