

**Earth's Atmosphere, ESS 55**

Homework 1, due April 15

1. Calculate the 1000–500 hPa (1000–500 mb) thicknesses for isothermal conditions with temperatures of a) 273 K and b) 250 K.
2. Show that an atmosphere where density is independent of height has a finite height that depends only on the temperature at the lower boundary. Compute the height of such an atmosphere with surface temperature  $T_0 = 273$  K and surface pressure 1000 hPa. (Hint: Use the ideal gas law and hydrostatic relation.)
3. Calculate the emission temperature of Earth, if the planetary albedo is changed to that of ocean areas without clouds, about 10%.
4. How would the length of day vary with latitude if the Earth's angle of inclination were  $0^\circ$ ?
5. Explain the simple conceptual model of the greenhouse effect in a one layer atmosphere that is transparent to shortwave radiation and opaque to longwave radiation.
  - Why is the greenhouse effect beneficial?
  - If enhanced, how can it become a problem?