

## **ASTR/ATOC 3720: Homework Assignment #3**

**Due: Tues. Feb 25 in class**

Show your work, as partial credit will be given for your thought processes, even if you don't get to the correct answer at the end! Work the problems on a separate sheet of paper please. Be neat and organized! We can't give credit for answers we can't read! You may work in groups, but turn in your own individual answers. Remember: **RTDQ** (Read the D\*\*\* Question)!

1. In class we calculated a total optical depth for the Earth of 0.6 using our "slab" model of the atmosphere and a  $T_e=255\text{K}$  and  $T_g=288\text{K}$ . Assume that of that total optical depth,  $\text{CO}_2$  accounts for a partial optical depth of 0.2.
  - a. What happens to  $T_g$  if we double the amount of  $\text{CO}_2$  in the atmosphere and keep  $T_e$  the same?
  - b. What happens to  $T_g$  if we increase the amount of  $\text{CO}_2$  in the atmosphere to 50 times the current amount, keeping  $T_e$  the same?
  - c. What happens to  $T_g$  if we double the amount of  $\text{CO}_2$  in the current atmosphere, but allow the cloud cover to increase, thereby changing the earth's albedo to 0.45?
  
2. Assume that the pressure at the surface of Earth over a land mass is 1013 millibars and the pressure at the surface over a neighboring large body of water is also 1013 millibars, but the temperature at the surface of the land is 300 K, while the temperature at the surface of the water is 290K.
  - a. Assuming that the temperature remains constant in the air above the land and water, calculate the pressures at an altitude of 3km above the land and at 3km above the water.
  - b. Which way will the wind be blowing at 3km?
  - c. Which way will the wind be blowing at the surface?