Greenhouse Gases and Atmospheric Radiation

2023-02-01

Contents

Homework

Homework Exercises:

- *Forecast*, Ch. 4, Ex. 1 & 3

Notes on Homework:

- Exercise 1:
  - Start from the default settings of MODTRAN (400 ppm CO_2 and 1.7 ppm CH_4, with a tropical atmosphere In MODTRAN, CO_2, CH_4, and stratospheric ozone are given by the concentration in parts per million (ppm) or parts per billion (ppb), and tropospheric ozone, water vapor, and freon are given by a "scale", where 1 means the current atmospheric concentration, 2 would mean twice the current concentration, and 0.5 would mean half the current concentration.
  - To see where in the spectrum any greenhouse gas absorbs, you can set all the other greenhouse gases to zero.
  - "Equivalent CO_2" means the change in ppm of CO_2 that would change the outgoing heat ("Upward IR Flux") by the same amount as adding a certain amount of CH_4?
- Exercise 3:
  - This exercise introduces the concept of the **water vapor feedback** that we will study in Chapter 7. This is an important contribution to global warming.
  - When you set the temperature offset to a nonzero value, you will have the choice of setting the "Holding Constant" option to either "Water Vapor Pressure" or "Relative Humidity". "Water Vapor Pressure" means the amount of water vapor in the air stays constant when it heats up or cools down (no additional water evaporates or condenses). "Relative Humidity" means that when it heats up, extra water evaporates into the atmophere and when it cools off, extra water condenses and falls as rain or snow.