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**Atmospheric Radiation and Convection**

Problem Set 8: Radiative-Convective Equilibrium

1. Using the MIT single-column model, available on <http://rcmodel.mit.edu/advanced.html>, perform and interpret the following experiments:
   1. While leaving the other parameters at their default values, double, triple and quadruple the concentration of CO2 from its default value and compare the results among these experiments as well as the control. What happens to surface temperature, surface precipitation, and surface shortwave and longwave fluxes (see table) and why?
   2. While leaving the other parameters at their default values, double the ozone concentration. What happens to the surface temperature and to the profile of temperature through the whole atmosphere, and why?
   3. While leaving the other parameters at their default values, use diurnally varying radiation” and run the model to equilibrium. Compare the 25-day average quantities to the control run. What happened to mean temperature and precipitation? Now, having checked off the box labelled “Restart from end of previous simulation” run the model for another 5 days and examine the graphical output. Interpret the diurnal behavior of temperature and precipitation, paying particular attention to the phase of the diurnal cycles of each.
   4. Repeat *c* above but change the fraction of surface covered by water to 0.1 In this case, also examine the equilibrium profiles of temperature and relative humidity and interpret their differences from the experiment performed in *c* above.