Principles of Planetary Climate
EC2213

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1 MidSemester Assignment 2

1.1 Input Quantities

- Temperature of the star (T_{star})
- Amount of CO_2 present (p_{CO_2})
- Cloud Forcing(C)

Suppose minimum distance from a star is r_{min} and maximum is r_{max}.
We need:
i) For r_{max} : $T_{poles} \geq 220$ and
ii) For r_{min} : $T_{equator} < 320$

1.2 The Algorithm

1. Choose arbitrary $220 < T_{equator} < 320$ and arbitrary $220 \leq T_{poles} < T_{equator}$ and find range of average planetary temperatures.
2. Find average albedo.
3. Given amount of CO2(p_{CO_2}) find range of solar constants to achieve a average temperature in the range of temperatures computed above.
4. Find r_{min} and r_{max} using lower and upper bounds of solar constants.

1.3 Functions required

1. This can be calculated by first getting the temperature profile using get_temp_profile(equator_temperature,equator latitudes).
   Then getting a weighed average using get_weighed_average(temperature_profile, latitudes)
2. Use get_average_albedo() from notebook 1.
3. Modify the net_radiation function to take solar_constant as argument instead of co2(which can be fixed). Apply newton's method to compute the roots of net_radiation given the range of planetary temperatures computed above and C(Cloud Forcing).
4. Define a function which takes solar constant as argument and outputs r according to the formula:

   $$s = \frac{\sigma T_{star}^4}{4.\pi.r^2}$$

   Pass the lower and upper bounds of s as parameters to this function and we get r_{min} and r_{max}.