

ATS 421 / 521 Homework 1 due Monday, April 6th

1. Implement the 0-D EBM in a FORTRAN program. Include your commented code (for this, and all following steps and assignments). (2)
2. Using a time step $\Delta t=10$ days, the present solar constant, and ~ 10 different initial conditions between -40 and $+40$ °C, integrate the model forward. Describe your methodology such that someone could repeat your steps. Plot the temperatures as time series. (2)
3. Compare the numerical solutions to the analytical solutions for the present solar constant (given in lecture 2). (1)
4. Increase the time step for one of the initial condition cases. What happens? (1)
5. ATS 521 students only: Calculate the hysteresis curve (plot T as a function of S) for the model numerically by slowly increasing and then decreasing the solar constant in a transient model simulation. (You will need to experiment a bit to pick a good rate of change of the solar constant to allow the model to reach approximate equilibrium for your different values of S .) Compare this curve to the analytical solution (eq. 2.7). (4)