Climate Modelling in-class worksheet 1 (week 2)

Group members:

1. _
2. _
3. _
4. _

This worksheet is based on Lab 2: Modelling the global energy budget (zero-dim-ebm.md). Working through this lab, completing the exercises within the lab, and adding some additional cells/calculations will help you answer the following questions (don't forget to make a copy of the lab before you open/change anything!).

1. If instead of $\tau = 0.611$, the atmosphere had $\tau = 0.59$ (i.e. we decreased the transmissivity of the atmosphere, by, for example, adding greenhouse gases to it), assuming the OLR didn't change, what would happen to the temperature (give a numerical answer).

2. If we decrease τ by another 0.0214, i.e. to 0.5686, what is the change in temperature now? How does this compare to your answer from Q1. What would be the general rule for how you would expect T to change? (solve this either graphically using python if your group has enough python experience (you can import numpy and matplotlib in this environment), or analytically).

3. In the above analysis we've assumed that the OLR doesn't change. In reality it would (and is!) changing. Describe the changes that would happen to the OLR (including why):
    a. Immediately following the sudden decrease in τ
    b. In the decades following this sudden change
    c. The final value it would reach

    Make sure to list all the assumptions that you are making in your answer above, and whether you think they are likely to hold under greenhouse-gas induced global warming

4. Complete section 7 of lab 2 (this will require you to define functions for ASR and OLR if you haven't already). For initial temperatures of a. 280K, and b. 305K, paste graphs of the evolution of global mean temperature below (add a title that gives information about the initial temperature). For one of these, describe what's happening and why, in the context of the global energy budget.