Aerosol Lifetime Programming Assignment

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Problem Description:

Consider a box model for the US atmosphere with a constant source S of aerosol particles. The box is ventilated by a steady wind resulting in a residence time of 5 days for air in the box. Another pathway for removal of aerosol particles is by episodic precipitation. We assume that short rain events occur in the box every 5 days and that 100% of the aerosol is scavenged every time it rains.

Calculate the evolution of aerosol mass in the box over a 10-day period, starting from a mass of zero at time t = 0. Plot your result.

Calculate the time-averaged aerosol mass over that period.

We would like to simplify the treatment of aerosol lifetime in the box model by viewing the rain as a constant sink for aerosol with a rate constant $k_r = 0.2 d^{-1}$.

What would be the resulting steady state mass of aerosol in the box? How does it compare to the time-averaged aerosol mass calculated in question 2?

Programming Methodology

There are example python code in Airborne Data Processing and Analysis (ADPAA) Sourceforge package. Create your own program to calculate mass as function of time using the information provided in Problem Section. Use mass - m(t) = (S/k)*(1-exp(-kt),where S is mass source, k = 0.2, and t is time. Your program should create the time series plot (Figure 1) as a png file.



Figure 1: Image showing the plot to produce with your python code.

Assignment

Turn in electric version of your program and plot by uploading them to class Blackboard site. Test your code to ensure that your code get a Mass/Source value of approximately 1.975 at a time of 2.5 days. Include testing your code results, in the code comments. Your lab grade will be split equally between your program and your plot. Ensure that your program follow that Programming Guide.