CFC-12 Box model exercise

Using historical data for CFC-12 emissions, construct an atmospheric box model showing the evolution of CFC-12 (CCl\(_3\)F) levels in the troposphere over the past century and into the next century.

CFC-12 emissions:  [http://www.geiacenter.org/reviews/cfc12.html](http://www.geiacenter.org/reviews/cfc12.html)

Assume:
1. there are no natural source of CFC-12.
2. emissions are zero after 2000 (due to the Montreal Protocol).
3. CFC-12 is stable in the troposphere.
4. CFC-12 is lost by transport to the stratosphere and photolysis. As a result of this process, the atmospheric lifetime of CFC-12 is 100 years.

Tasks:
1. Write an equation describing the mass balance of CFC-12 in the troposphere.
2. Solve the mass balance equation for CFC-12 numerically as a function of time over the time period 1900-2100. Choose an appropriate time step and explain your choice.
3. Plot the results in units of ppt.
4. Is there a steady state solution for this problem?
5. Compare your results to actual measurements of CFC-12 in the atmosphere.

Some useful facts:

- mass of air in the atmosphere = 5.2*10\(^{18}\) kg
- troposphere contains ~80% of the mass of the atmosphere