

3. Dr. Charles Keeling began measuring carbon dioxide in the atmosphere on a continuous basis in 1958. At that time, Dr. Keeling found that the mean concentration level was approximately 315 ppmv. Currently, the level is approximately 385 ppmv. ²

(a) (4 points) Assuming that the mean concentration has been growing linearly from 1958 to 2007, find a formula for $L(t)$, the mean concentration level of CO₂, with t in years since 1958.

(b) (5 points) If instead, the mean concentration has been growing at an exponential rate, find an exponential function, $E(t)$, to model the mean concentration level of CO₂ in the environment t years after 1958.

(c) Future CO₂ levels are expected to rise due to burning of fossil fuels and land-use changes. The rate of this increase will depend on uncertain economic, sociological, technological, and natural developments. The IPCC Special Report on Emissions Scenarios gives a wide range of CO₂ scenarios by the year 2100. Use your functions from parts (a) and (b) to predict the concentration of CO₂ in 2100.

(i) (2 points) Prediction if growth is linear:

(ii) (2 points) Prediction if growth is exponential:

²See http://earthguide.ucsd.edu/globalchange/keeling_curve/01.html and http://en.wikipedia.org/wiki/Carbon_dioxide