The Keeling Curve, Revisited
Read-ahead

Introduction

In the first application, we introduced the Keeling Curve, which illustrates the dramatic rise in the concentration of carbon dioxide in the earth's atmosphere over the past half-century. We attempted to model this curve with a linear function drawn through two points on the curve. In this application we use the method of linear regression to find the "best fit" line for the data, i.e., the linear function that (in a precisely defined way) matches the data as well as possible.

Instructions

After reading through *The Keeling Curve, Revisited* context and questions below, you should complete the application reflection in Canvas. Note: *you will have a chance to talk further with your coach before answering the questions below in detail*. The point of the pre-read is to "prime the pump" for further conversations with your coaches.

The Keeling Curve, Revisited

Recall the following figure from the first application.

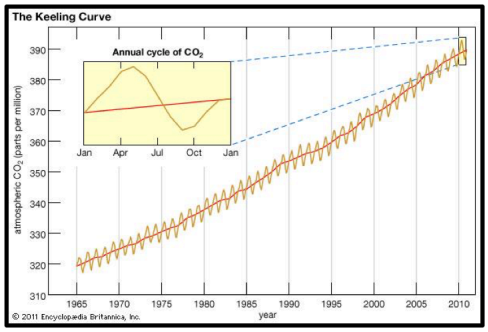

Figure 1: The Keeling Curve

As in the first application, we are only considering the baseline concentration, which is represented by the thick curve in Figure 1.

Questions

1. The following table shows the baseline atmospheric CO_2 levels at five-year intervals.

year	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010
CO_2 level	320	325	330	338	345	353	359	369	378	388

   What is the equation for the line $L(t)$ of best fit to this data, as determined by linear regression? Round all coefficients to five significant digits. *See the instructions for using linear regression in the*

"Explore" panel of the "Functions and Fitting Data" module. Write your answer in slope-intercept form $L(t) = mt + b$.

2. How does the slope of the line of best fit compare to the slopes you calculated in Questions 2 and 8 in the original "Keeling curve" application?
3. What is the R^2 value for the line of best fit? Give the answer to five significant digits.
4. Now, experiment with selecting different types of trend lines for this data set. What are the R^2 values for the following function types? *Note that Power and Logarithmic trend lines can be found using Excel, but not using Google Drive. Also, for these two methods you will need to enter the horizontal data as the years themselves (i.e., 1965, 1970, etc.), rather than as years after 1965. This is because these two methods involve functions that may not be defined when the input value is zero.*
   (a) Polynomial, order 2
   (b) Polynomial, order 3
   (c) Exponential
   (d) Power
   (e) Logarithmic
5. (Graded for completeness only.) Which type of trend line do you think is the best fit for the Keeling Curve? Why?
6. (Graded for completeness only.) Why might someone want to use regression to model the Keeling Curve? Why not just "eyeball" a line of best fit?

Instructions, part deux

After reading and reflecting on these questions, complete the application reflection on Canvas. This will give your coach some insight on your thinking in order to best help you before you are required to formally answer these questions.