



## CO<sub>2</sub> measurements at Mauna Loa, Hawai'i



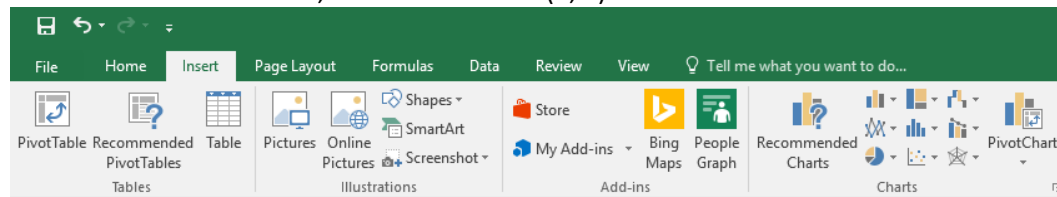
**Data Link:** <https://www.esrl.noaa.gov/gmd/ccgg/trends/data.html>

### Introduction/Background

The carbon dioxide data, measured as the mole fraction in dry air, on Mauna Loa, Hawai'i constitutes the longest record of direct measurements of CO<sub>2</sub> in the atmosphere. They were started by Dr. C. David Keeling of the Scripps Institution of Oceanography in March 1958 at a facility of the National Oceanic and Atmospheric Administration. NOAA started its own CO<sub>2</sub> measurements in May 1974, and they have run in parallel with those made by Scripps since then. Data are reported as a dry mole fraction defined as the number of molecules of carbon dioxide divided by the number of molecules of dry air multiplied by one million (parts per million or ppm).

### Directions

1. Open the **Mauna-Loa-CO<sub>2</sub>-data** Excel spreadsheet located on <https://kamscmrc.weebly.com/kamsco-big-data-2020.html>
2. The data file should look like the image at right. Scroll through the file to ensure you have data from 1958.21 to 2017.88.
3. Under the **Insert** tab, select the Scatter (X, Y) chart.



4. Plot Year (from 1958 through 2019) along the x-axis vs. CO<sub>2</sub> Level (from 310 ppm to 410 ppm) along the y-axis.
5. Identify trend lines by determining, with your partners, the general tendencies illustrated by the graph of Year vs. CO<sub>2</sub> Level.

	A	B	C	D
1	Year	CO2 Level		
2	1958.21	314.62		
3	1958.29	315.29		
4	1958.38	314.71		
5	1958.46	314.85		
6	1958.54	314.98		
7	1958.63	315.94		
8	1958.71	315.91		
9	1958.79	315.61		
10	1958.88	315.31		
11	1958.96	315.61		
12	1959.04	315.70		
13	1959.13	315.88		
14	1959.21	315.62		
15	1959.29	315.56		
16	1959.38	315.50		
17	1959.46	315.92		
18	1959.54	315.66		
19	1959.63	315.81		
20	1959.71	316.55		
21	1959.79	316.19		
22	1959.88	316.78		

### Questions

1. By what percentage (%) have CO<sub>2</sub> levels increased over the past ~60 years?
2. What kind of mathematical function best describes the overall trend line for CO<sub>2</sub> levels at Mauna Loa?
3. What is the baseline for CO<sub>2</sub> levels? In other words, what was the average value for CO<sub>2</sub> levels prior to the Industrial Age? Note: This may require some research online.
4. Does this data support global climate change? Why or why not?
5. How confident are you that the data represents what's "really happening"? What additional information would you need to confirm your theory or theories?
6. At what point (in ppm) does CO<sub>2</sub> result in catastrophic effects? Based on the current trend line(s) you graphed, approximately when would that be likely to occur?

### References

Dr. Pieter Tans, NOAA/ESRL ([www.esrl.noaa.gov/gmd/ccgg/trends/](http://www.esrl.noaa.gov/gmd/ccgg/trends/)) and Dr. Ralph Keeling, Scripps Institution of Oceanography ([scrippsco2.ucsd.edu/](http://scrippsco2.ucsd.edu/))  
<https://www.esrl.noaa.gov/gmd/ccgg/trends/full.html>