

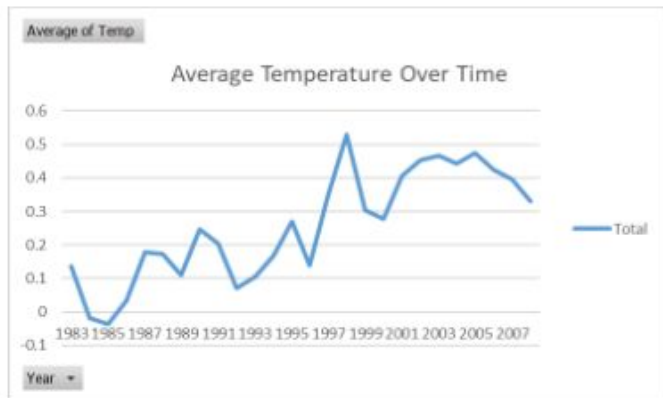
Excel and MiniTab - Temperature Increase Over Time in Comparison to Released Gases

By: Ashley Krause

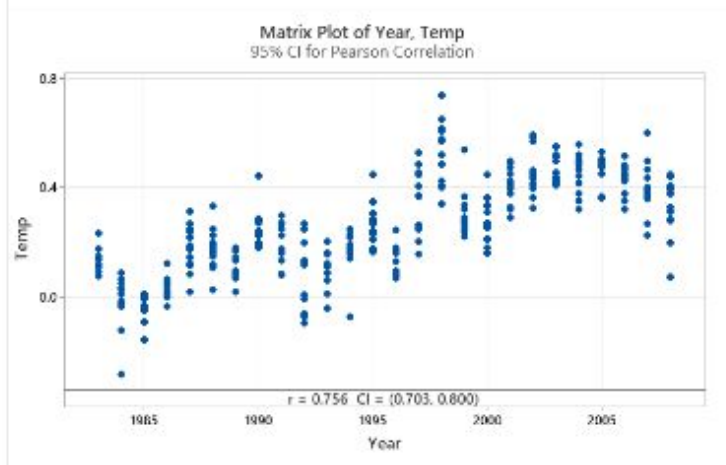
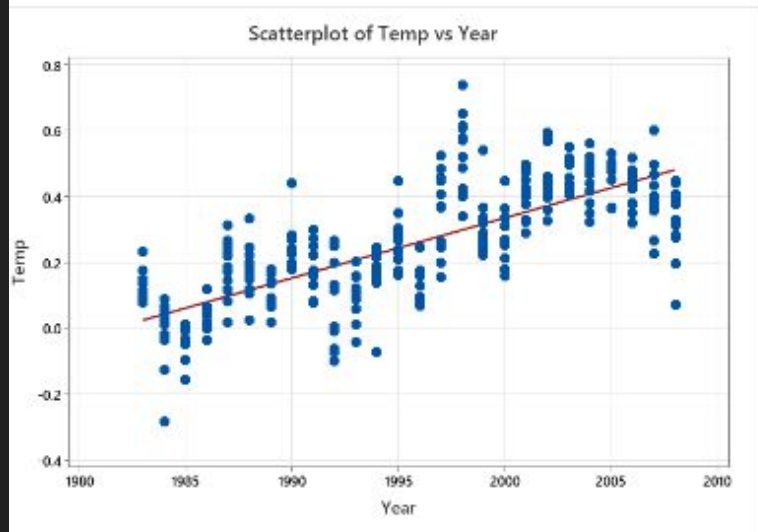
DATA & ANALYSIS

Part 1: Taking a look into temperature over the years

The first step I told to look into was the idea of overall temperature increase over the years from 1980 to 2010. When initially looking into the dataset I could see that they collected this data each month throughout the years stated above.



When I initially started this project I immediately wanted to see the relationship between average temperature over time. As we can see in the graph above we can definitely see an overall positive correlation between average temperature over the time frame of 1980 - 2010. Once looking at this graph I wanted to take a deeper look into the true relationship of temperature and time.



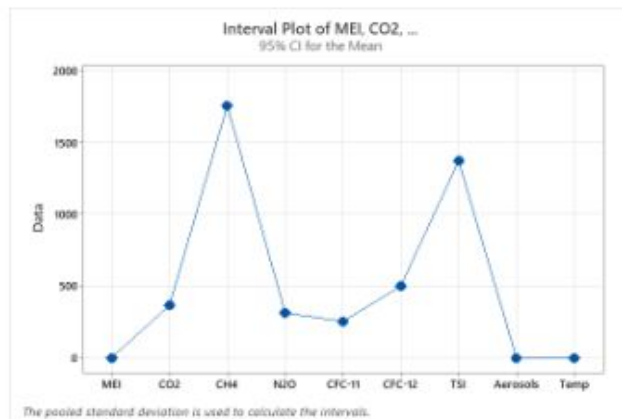
This led me to create a scatter plot to determine the true relationship between temperature and time. Again we see a relatively strong relationship between the two factors. The graphic also showed the r-squared percentage which was 51.7%. The left graphic also shows the r-value. Which states that there is a pretty strong positive correlation between the two variables. The value of r is shown as .756. This is great evidence showing how over the years temperature has increased greatly.

Part 2: Taking a look into causes of temperature increase.

Grouping Information Using the Tukey Method and 95% Confidence

Factor	N	Mean	Grouping
CH4	308	1749.82	A
TSI	308	1366.07	B
CFC-12	308	497.52	C
CO2	308	363.227	D
N2O	308	312.392	E
CFC-11	308	251.97	F
MEI	308	0.2756	G
Temp	308	0.2568	G
Aerosols	308	0.01666	G

Means that do not share a letter are significantly different.



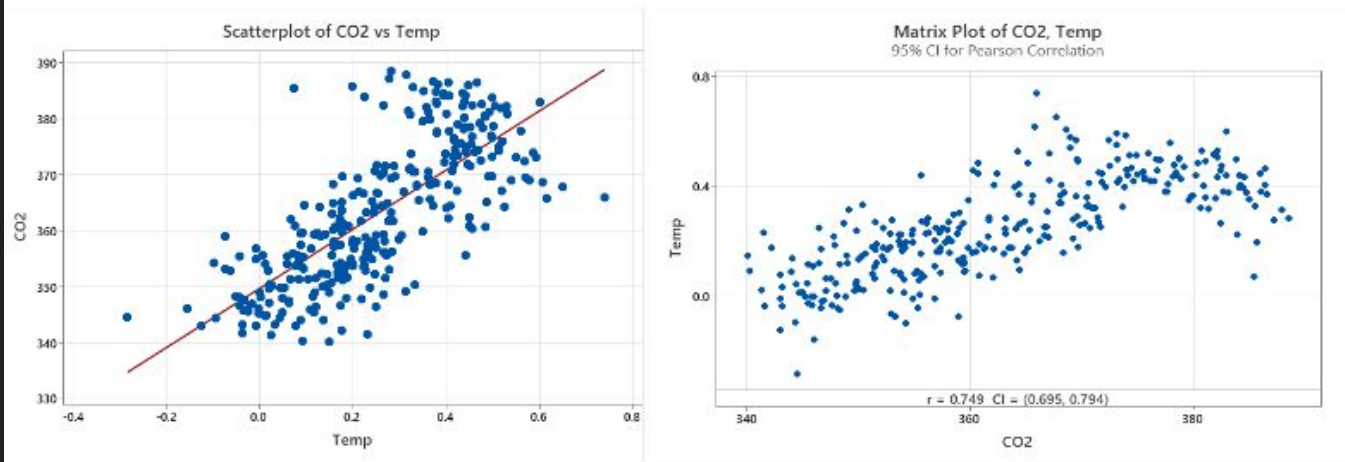
When first thinking about what may cause the temperature increase I decided to take a quick look at the ANOVA test. As seen in the graphics above there seems to be a relationship between MEI Temperature and Aerosols in a basis of the mean. After looking at the ANOVA test I started to question what is the best explanation to describe the temperature increase.

Regression Equation

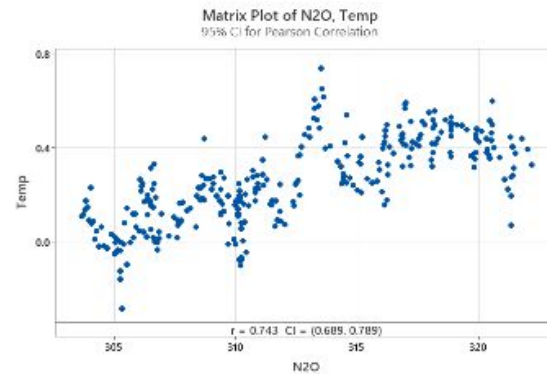
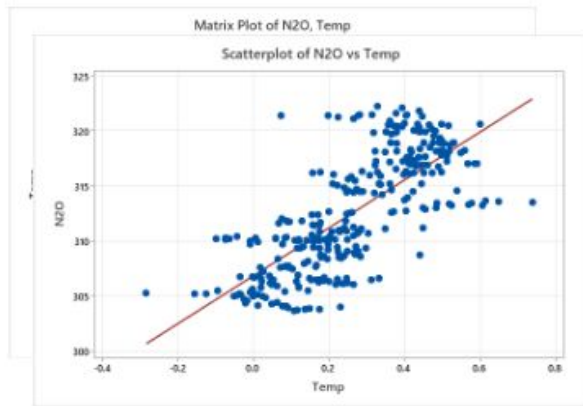
$$\text{Temp} = -136.3 + 0.06903 \text{ MEI} + 0.00575 \text{ CO}_2 + 0.01010 \text{ N}_2\text{O} + 0.0961 \text{ TSI} - 1.745 \text{ Aerosols}$$

As seen above I decided to run the stepwise function to show the line of best fit that best describes why the temperature on Earth is increasing. According to this test the best way to describe the temperature increase would be the oceanic temperature increase (MEI), CO₂, N₂O, the measurement of solar radiation reaching Earth (TSI), and aerosols. This led me to take a deeper look into the relationship between the increasing temperature and each of these values that are listed above.

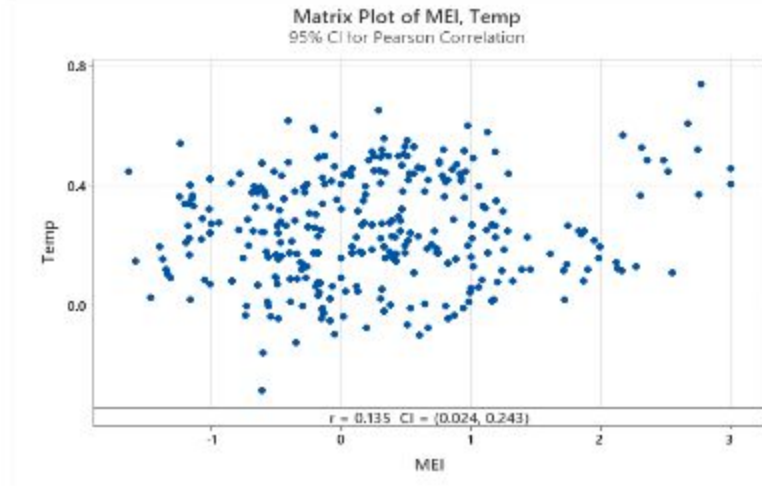
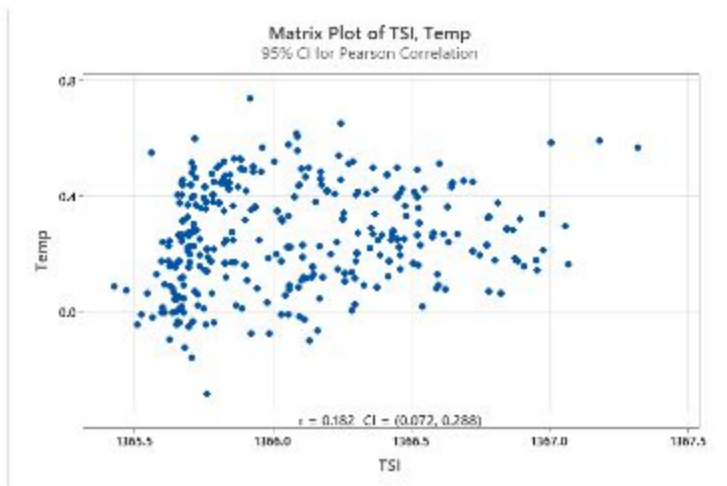
Part 3: Taking a look into temperature and each value listed above



The first relationship I decided to look into was the release of carbon dioxide and temperature increase. In the first graph (on the left) with the regression line we can see an obvious increase in temperature as there is more of a release of carbon dioxide. On the second graph (on the right) we can see that the r-value was .749. This tells us that there is a very strong positive relationship between temperature and carbon dioxide emissions. This makes sense due to the fact that there is evidence that releasing carbon dioxide creates a depletion of the ozone layer. This allows more radiation to come onto Earth. This also causes a “blanket” of greenhouse gasses over the Earth which ultimately is evidence that CO2 is causing temperature increase.

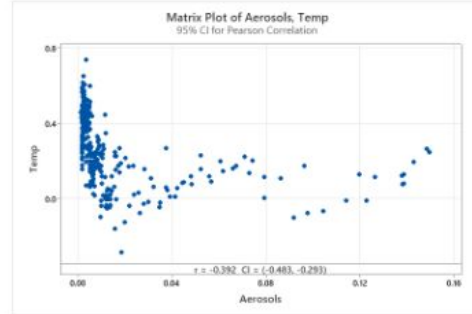
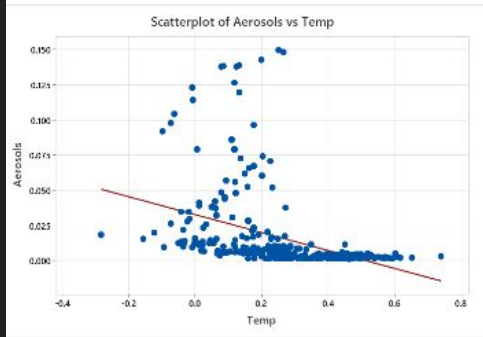


I then took a look into the relationship between nitrogen oxide and temperature over the years. Again we can see that there is a strong relationship between temperature and nitrogen oxide. We see this from the r-value which is .749. This is very interesting because that is the same r-value as carbide dioxide. This does make some sense due to the fact that it is a potent greenhouse gas, just like carbon dioxide is. They both get released, create a depletion in the ozone layer, and create a heated blanket over the Earth.



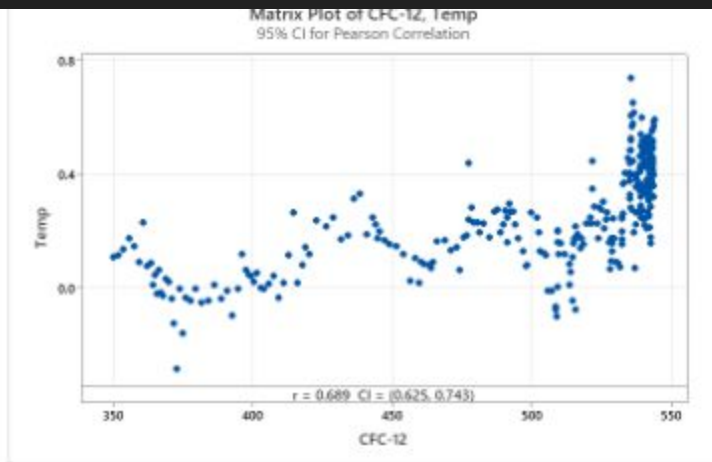
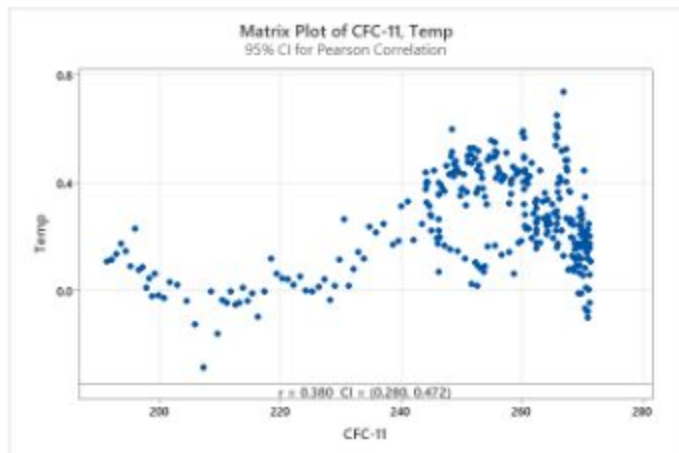
I then decided to take a look at the relationship between temperature and MEI as well as temperature and TSI. I believed that taking a look at these two together was the best because the increase in solar radiation to the Earth should have an effect on ocean temperature which leads to increasing the Earth's temperature. I was surprised to see that their r-values were both around .1. This shows that there is a very slight positive increase between TSI or MEI and temperature. This was shocking to me because I would have thought that there would be more of a relationship when having to do with temperature. Though there is still a slight positive increase I had originally thought that there would be more of a correlation between MEI or TSI with temperature.

Part 4: Taking a look at confusing results found.



When taking a look at the correlation between temperature and aerosols I was very surprised that there was a light negative relationship between the two variables. The r-value reads -3.92 which is evidence of a negative correlation. This is surprising to hear that as the temperature

increases, aerosol use decreases. This is interesting because the start of the ozone layer depletion was originally started from aerosol use. This ultimately leads to heating of the Earth. I do know that there was a push to diminish the use of aerosol sprays due to the fact of the increasing climate crisis. Once thinking about this I believe we see a negative relationship because of the push to get rid of aerosol spray, but the increased use of greenhouse gasses may be the reason the Earth is still heating. The aerosol sprays may be the start, but the greenhouse gasses are the continuation.



The last bit of data I wanted to take a look at was the correlation between temperature and the release of CFCs. Due to previous knowledge I know the emissions of CFCs were a big cause of the depletion of the ozone layer and the overall heating of the Earth. I was surprised to see that stepwise did not happen to include CFCs when describing temperature. In both cases we can see a positive correlation (CFC-12 being a little bit more of a correlation).