

Sunny Patel

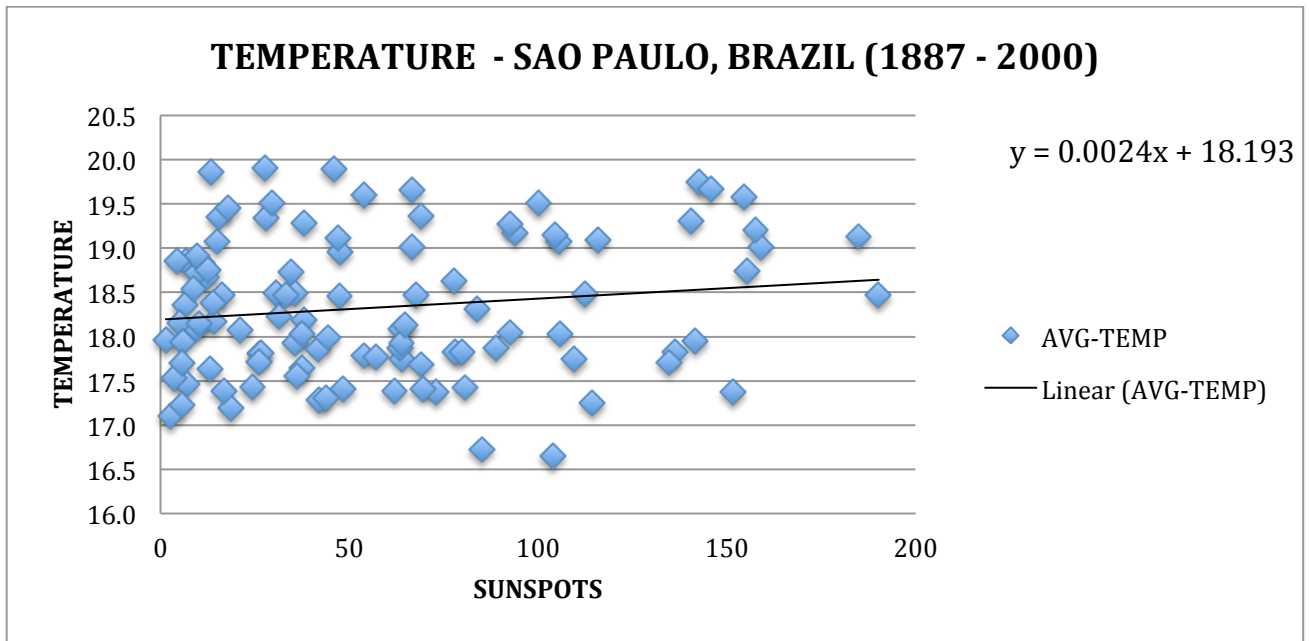
INTRODUCTION

Sunspots have fascinated humans for centuries. Before the invention of the telescope we had no way of observing these mysterious dark spots. Many scientists attempted to unravel the mysteries of sunspots since their first discovery sometime in 1611. Today, we have accumulated vast knowledge about them, according to George Fisher, a solar astronomer at the University of California, "A sunspot is a dark part of the sun's surface that is cooler than the surrounding area. It turns out it is cooler because of a strong magnetic field there that inhibits the transport of heat via convective motion in the sun. The magnetic field is formed below the sun's surface, and extends out into the sun's corona." [Wanner, Noel, Page 3]. Sunspots don't affect the earth directly but since they are produced by magnetic fields these magnetic fields continue to expand outside the Sun's surface. Plasma near sunspots interacting with magnetic fields cause solar flares. These solar flares consist of bursting energetic particles, x-rays, and magnetic fields and clash into Earth, which in turn cause geomagnetic storms. Earth's magnetic fields typically protect itself from the Sun's emissions however scientists have discovered that during times high sunspot activity there is a higher geomagnetic flow from the Sun. These emissions disrupt the Earth's protective cocoon of the magnetic field and have many affects on us. It is highly debated whether sunspot activity affects the Earth's climate. Much of this debate is caused by the complicated nature of the Earth's atmosphere and all that it entails. The difficulty lies with the fact of trying to distinguish the affects of sunspots verses the affects global warming on the earth's atmosphere.

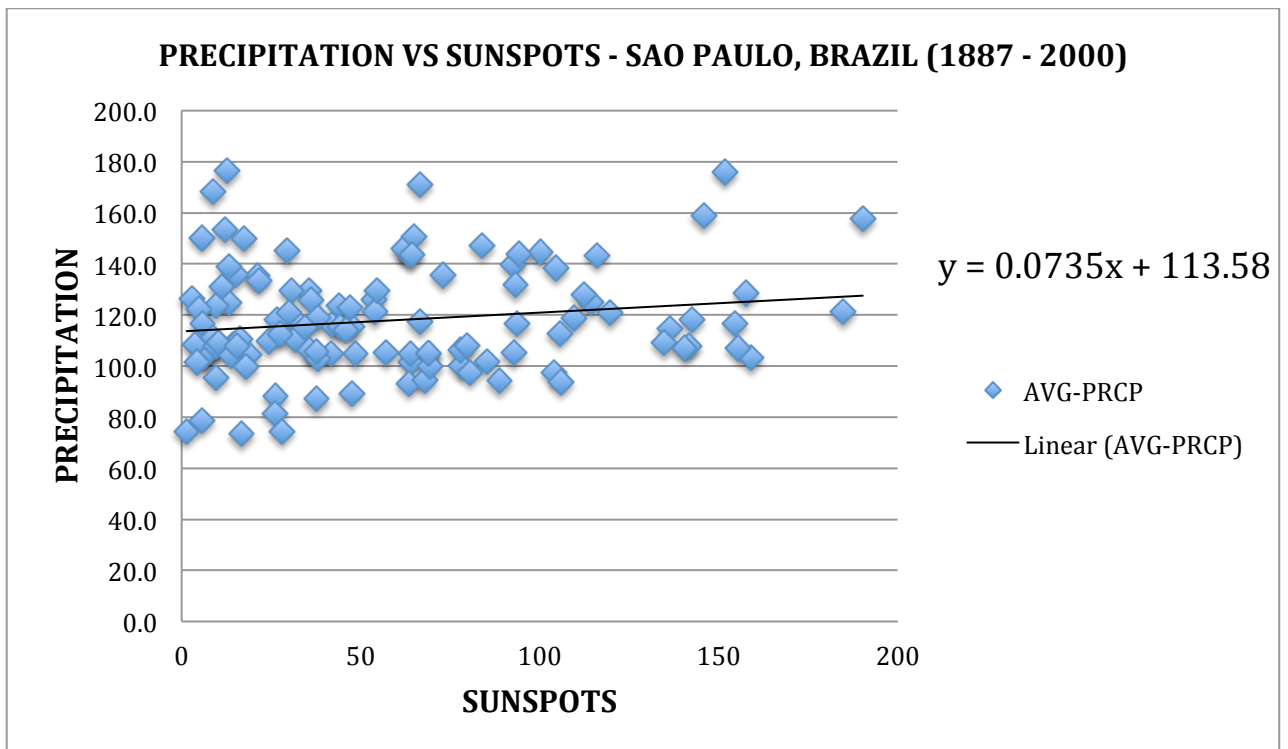
There is much research still being conducted to further enhance our knowledge base on sunspots and their effects on our climate.

APPROACH

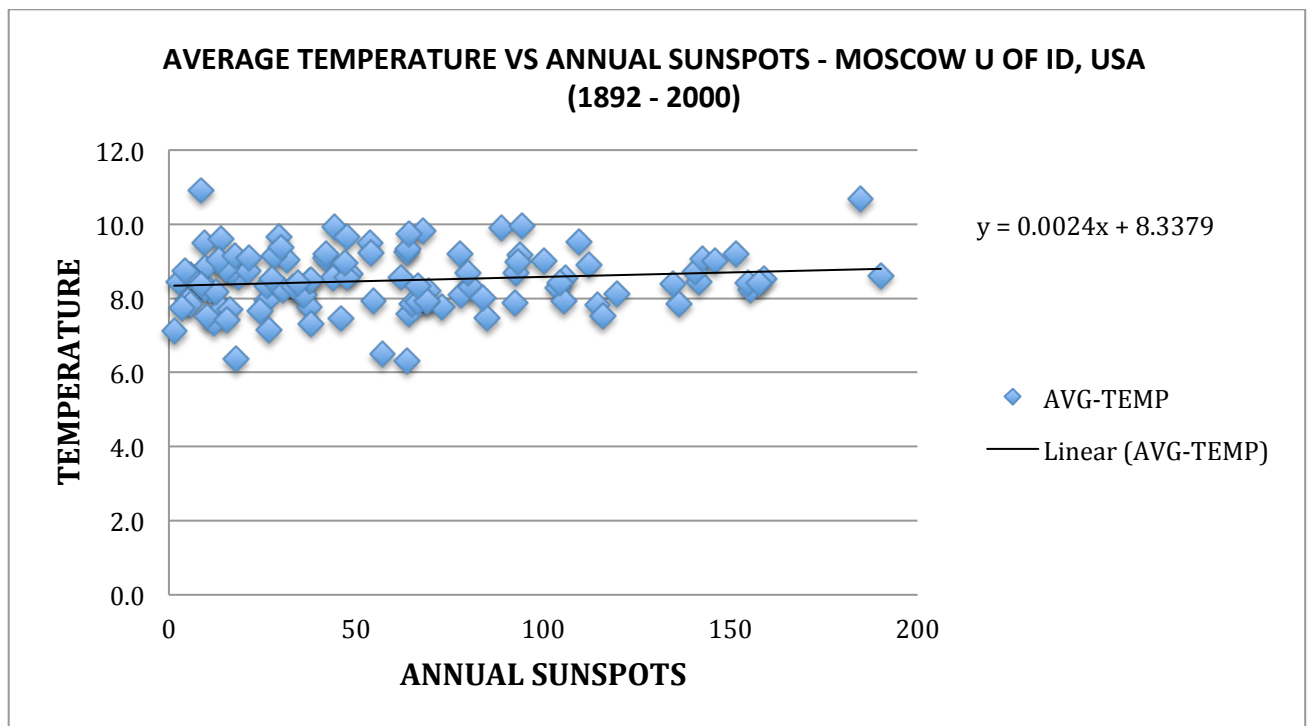
The following graphs show the average annual temperatures verses the annual sunspots around 200 years of accumulated weather data as well as the average annual precipitation verses annual sunspots. This data is collected for different locations such as United States, Kagoshima, Japan, Nantes, France, SAO PAULO, Brazil. This should show any correlation between sunspot activity and temperature changes and also between sunspot activity and precipitation.



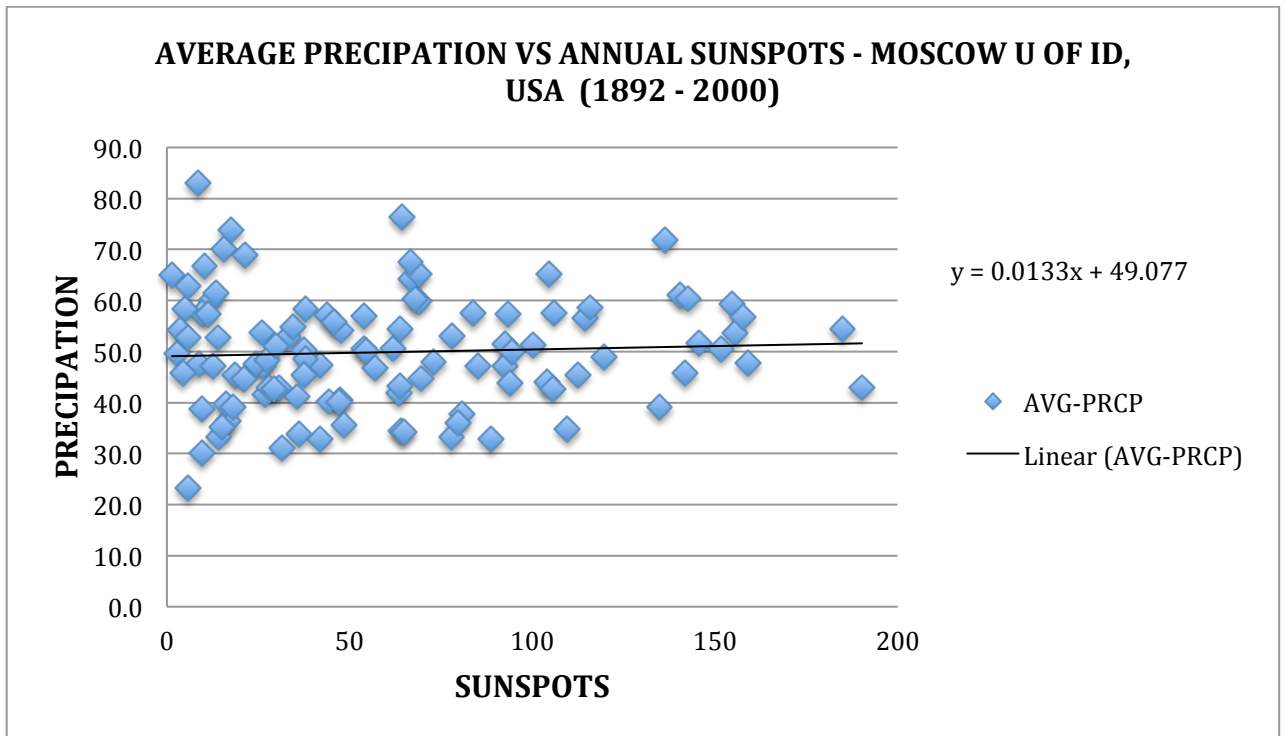
In Brazil from 1887-2000 we have found temperature slightly increases as higher sunspot activity is observed. This is proven by our very low R-value for the linear fit line.



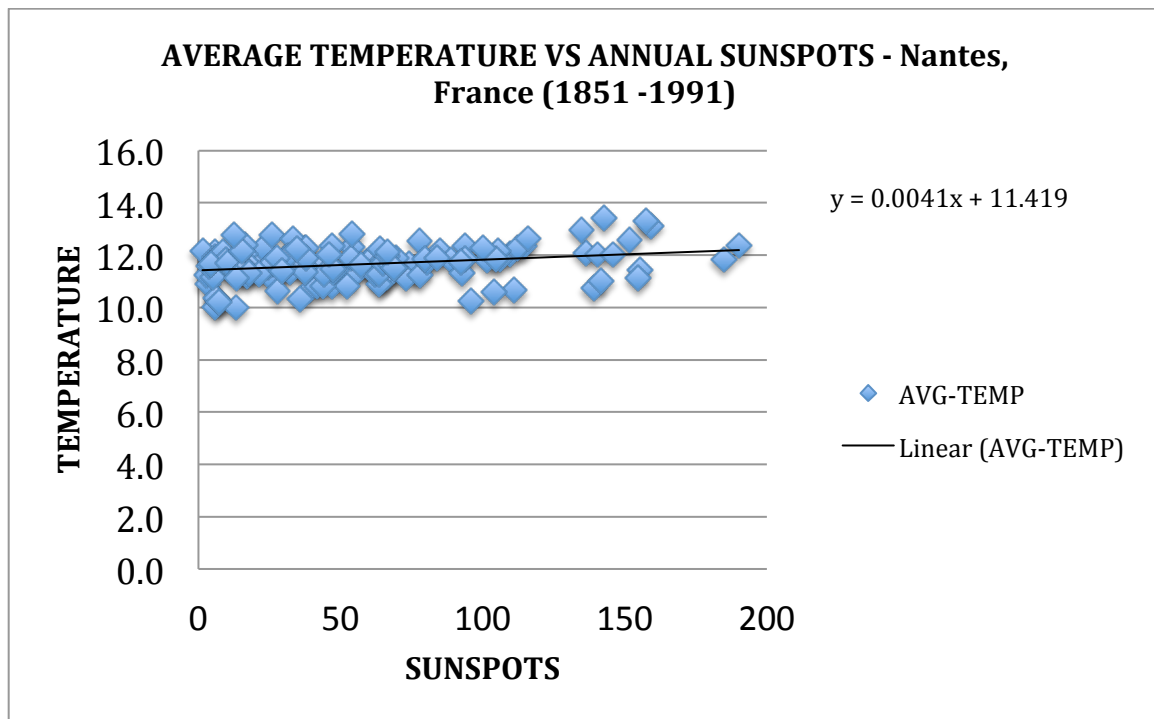
In Sao Paulo, Brazil data collected from 1887 to 2000 shows that precipitation does increase with increased sunspot activity, however this could be related to sunspot activity or some other unrelated factor.



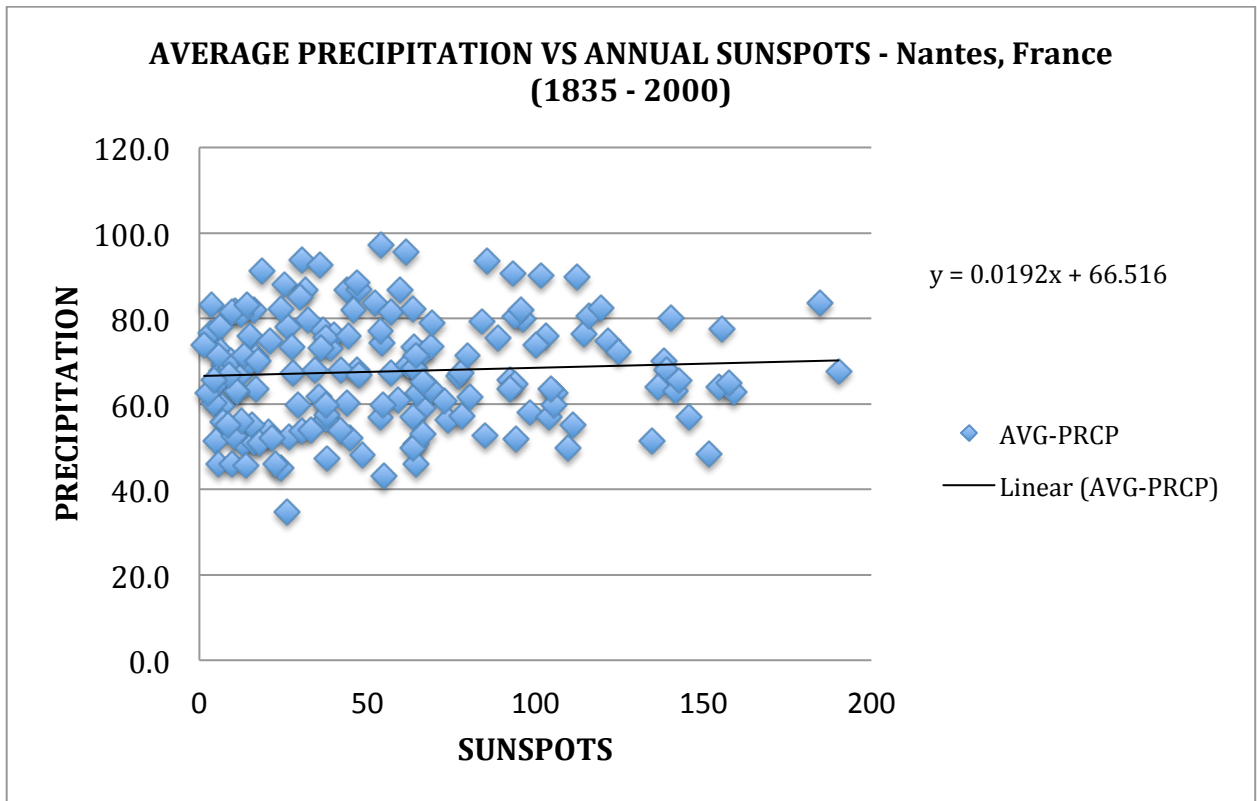
In Moscow U of ID, USA from 1892-2000 we have found temperature slightly increases as higher sunspot activity is observed. The very low R-value for the linear trend line shows that this may or may not have direct correlation with sunspots and temperature.



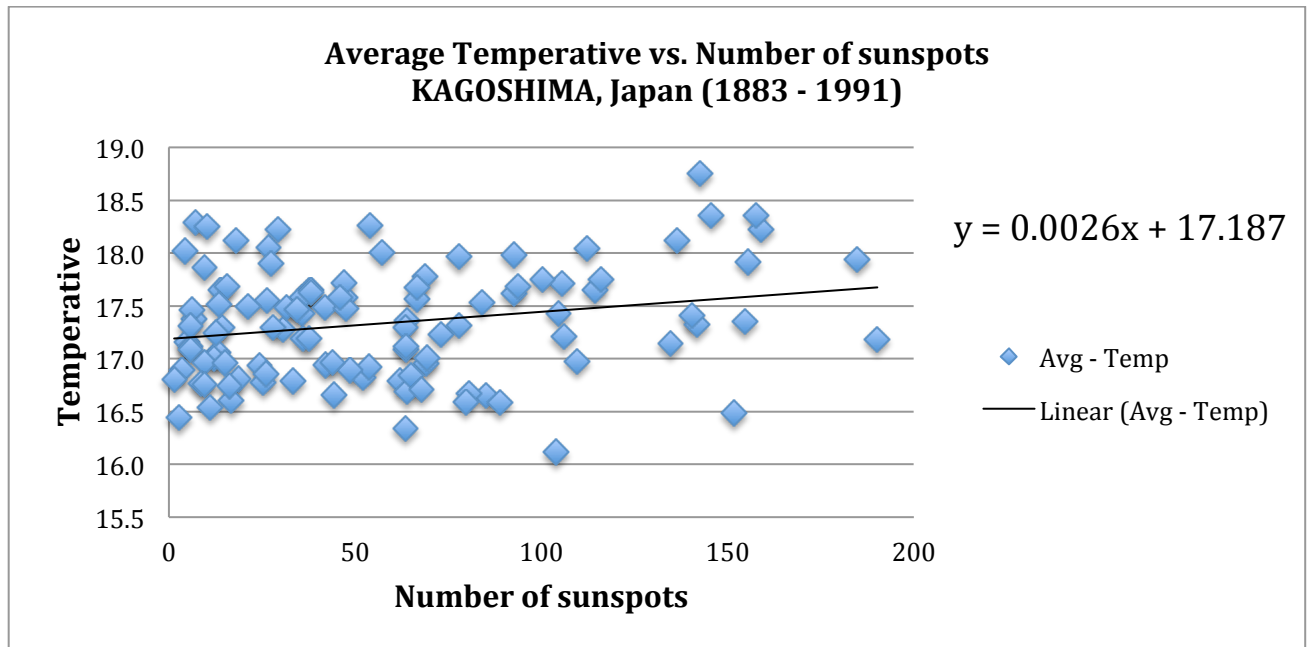
In Moscow U of ID, USA data collected from 1892 to 2000 shows practically no correlation between sunspots and precipitation because the R-value is 0.0133.



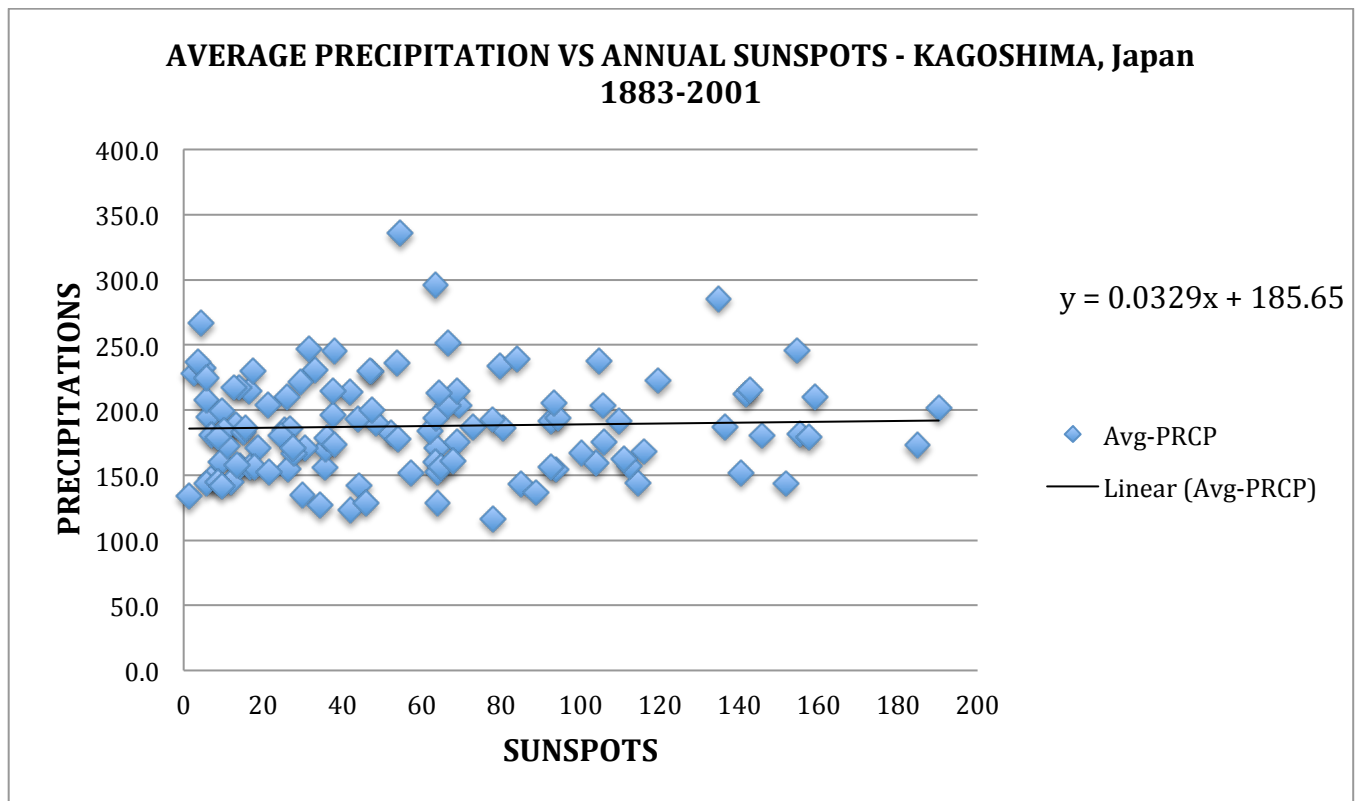
Similar to the other locations, France did not experience any temperature increases due to sunspots.



This graph shows the average precipitation vs. annual sunspots in Nantes, France from 1835-2000. Once again, there is no strong indication of a correlation between sunspots and precipitation in this region.



The number of sunspots does not show any correlation with temperature because of the low R-value.



In KAGOSHIMA, Japan from 1883- 2001 there doesn't seem to be any correlation between sunspots and precipitations, the linear trend line has no slope.

Discussion of Results

The results of the four locations observed showed almost no correlation between sunspots and temperature or sunspots and precipitation. These results coincide with the modern research found by experts. The debate continues amongst experts because it is hard to determine if small relationship found is due to sunspots or one of the other activities found.

Conclusion

Since the time of their discovery we have found a lot of information about sunspots, however determining their effects on earth's climate still seems to be a challenge scientist's face. The data based on four different locations on the earth showed relatively no significant correlation between temperatures and sunspots nor correlation between precipitation and sunspots.

WORKS CITED

Wanner, Noel. "Sunspots: Credits." *Sunspots: Credits*. Exploratorium, n.d. Web. 07 Feb. 2014.