

Rising Temperatures' Effect on the Frequency of Natural Disasters

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Abstract

Temperatures are rising and this is causing an impact on the environment. The effect that rising temperatures have on two natural disasters was determined in this study. The frequency of earthquakes and wildfires were compared to increasing temperatures in California. In Python, the data was plotted and statistical analyses were performed. No correlation was found between the frequency of earthquakes and temperature. A correlation was found between the frequency of wildfires and temperature. In the future, as temperatures continue to increase the frequency of wildfires is expected to increase as well.

Introduction

As the climate is rapidly changing due to anthropogenic influences, there has been a rise in temperatures. Rising temperatures increase the risk of extreme weather events making places more vulnerable (Van Aalst, 2006). A highly susceptible state is California due to its unique geology and weather patterns (Caldwell). California has major earthquakes due to the many fault lines that run throughout the state. Wildfires are caused by California's dry, hot weather allowing landscapes to burn more easily and more intensely (Sönnichsen, 2021). In the US, California has the largest amount of wildfires and the most damaging earthquakes (USGS). An increase in these two natural disasters would result in major damage to the state.

Goals and Hypotheses:

- Wanted to determine if the frequency of natural disasters increase as temperatures increase
- Focused on the frequency of earthquakes and wildfires in California because these two natural disasters have different causes and both affect California
- Predicted that the frequency of earthquakes and wildfires in California would increase
- Will find if there is a correlation between temperatures and earthquakes and temperatures and wildfires

Methods

Average daily max temperature data from Los Angeles, California was uploaded into Jupyter Notebook from The Climate Explorer. The temperature data was plotted from 2000 to 2020.

A dataset including earthquakes above a 4.5 magnitude in the US was uploaded into Jupyter Notebook from USGS. A new dataset was created including only earthquakes from California. Using the groupby function in Python, the annual frequency of earthquakes were found and plotted from 2000 to 2020. To find the correlation between temperature and earthquake frequency data the stats function linregress was used to calculate the slope, intercept, r2 value, and p value and a plot was made showing the results. The groupby function was used to find the annual mean magnitude of earthquakes and a plot was made.

Wildland Fire Location Full History dataset from National Interagency Fire Center was uploaded into Jupyter Notebook. A new dataset was created including only wildfires from California and a new year column was added using the datetime Pandas function. Using the groupby function, the annual frequency of wildfires were found and plotted from 2004 to 2020. To find the correlation between temperature and wildfire frequency data the stats function linregress was used to calculate the slope, intercept, r2 value, and p value and a plot was made showing the results. The groupby function was used to find the annual mean of total acres that were affected by wildfires and the annual mean of acres affected when the wildfire was first discovered and a plot was made.

Results

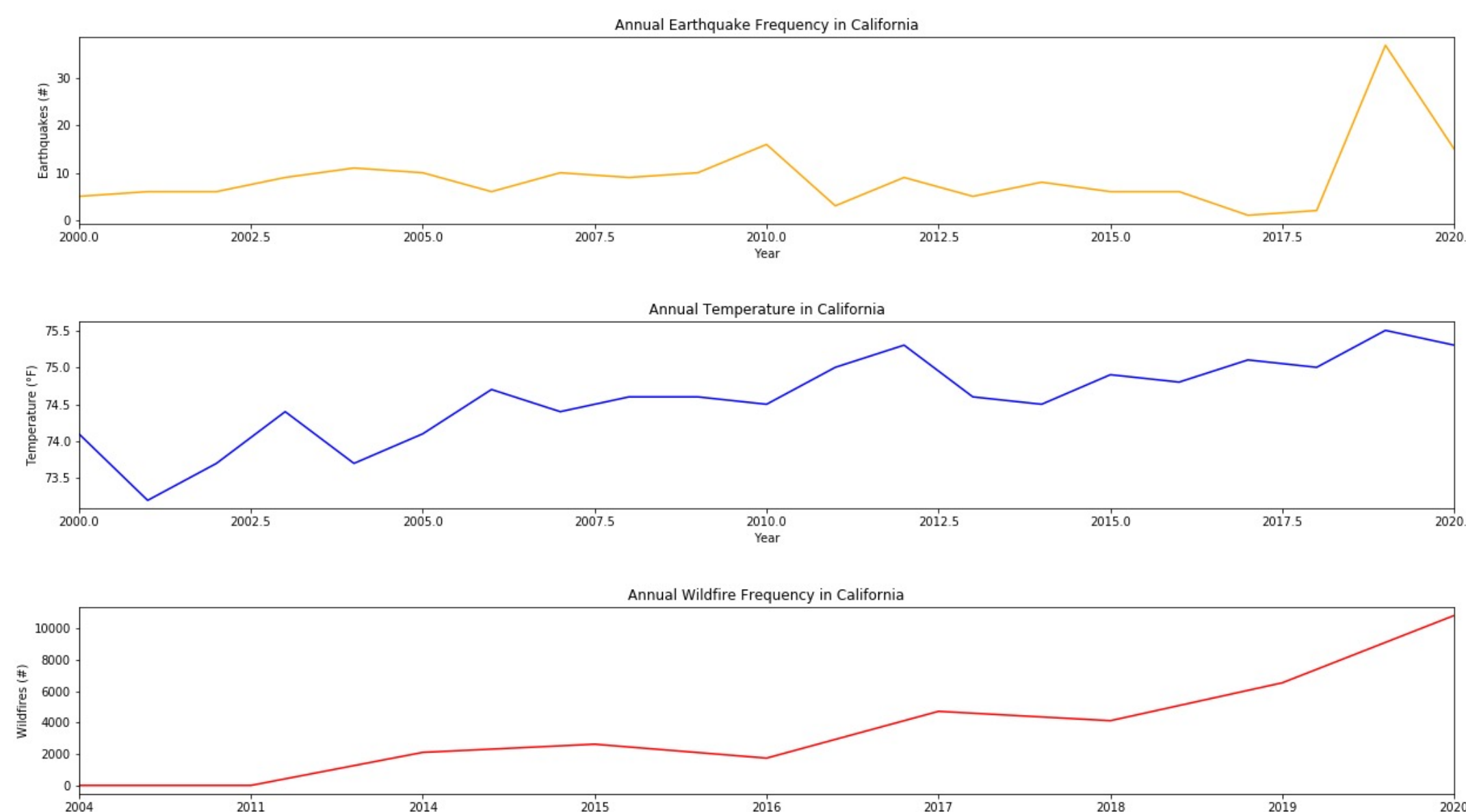


Figure 1: The number of earthquakes in California is plotted from 2000 to 2020. The frequency of earthquakes fluctuates from year to year with the highest number of earthquakes in 2019. The average daily max temperature in Los Angeles, CA is plotted from 2000 to 2020. There is a steady upward trend in temperature peaking in 2019. The number of wildfires in California is plotted from 2004 to 2020. The frequency of wildfires has increased steadily with the highest amount in 2020.

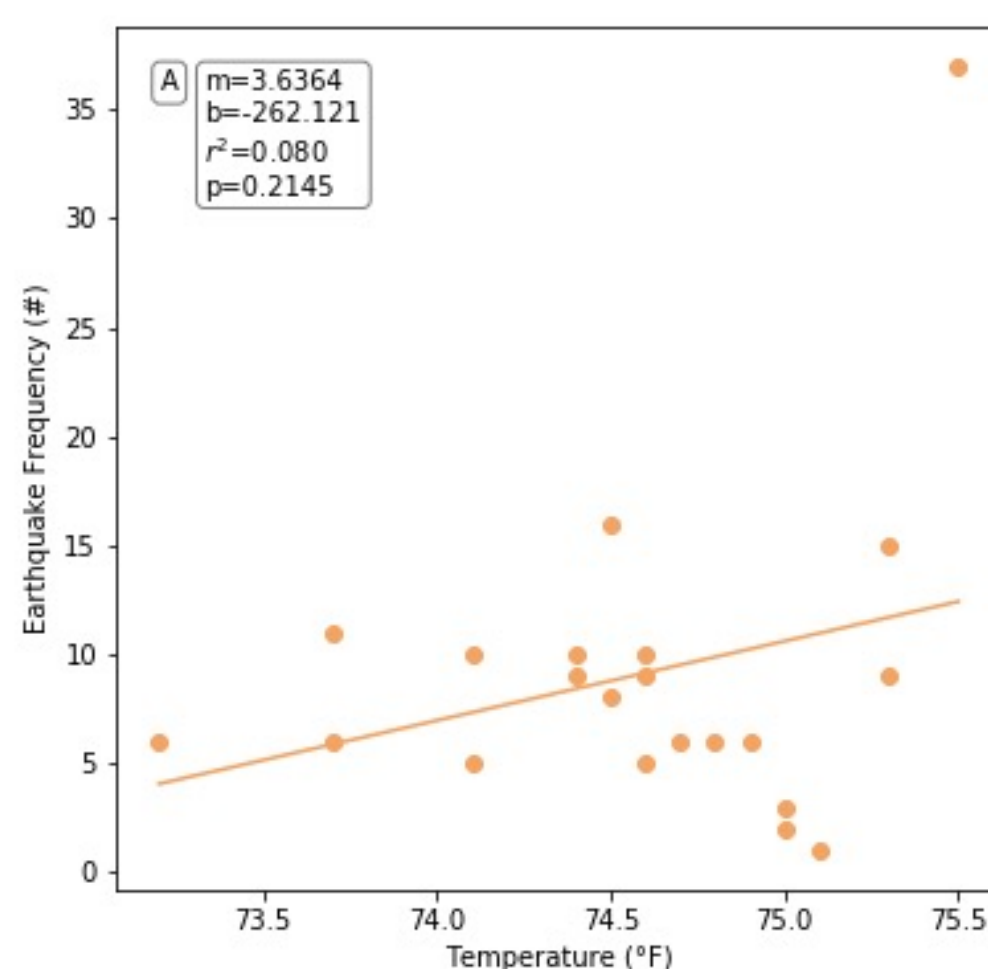


Figure 2: Earthquake frequency and temperature in California is plotted. A correlation was run between earthquake frequency and temperature. The line of best fit is shown. The p value is above 0.05.

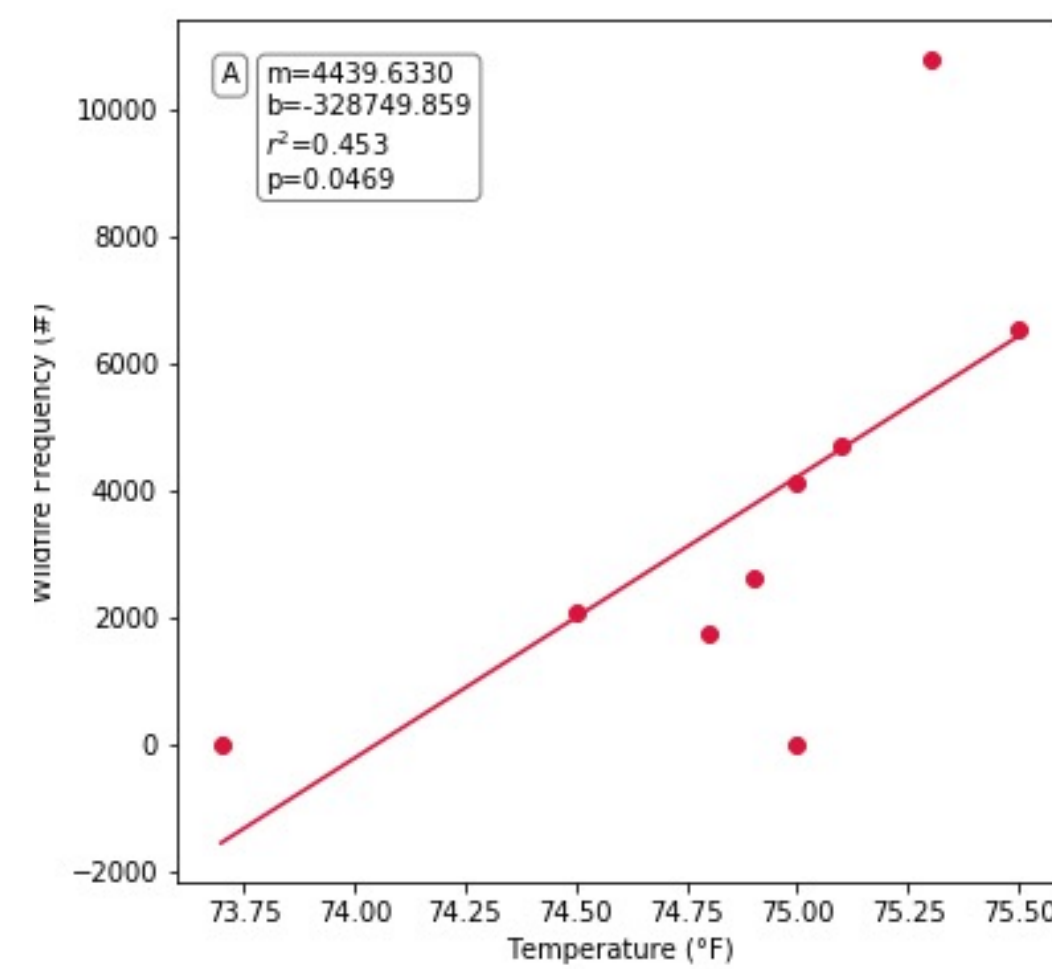


Figure 3: Wildfire frequency and temperature in California is plotted. A correlation was run between wildfire frequency and temperature. The line of best fit is shown. The p value is less than 0.05.

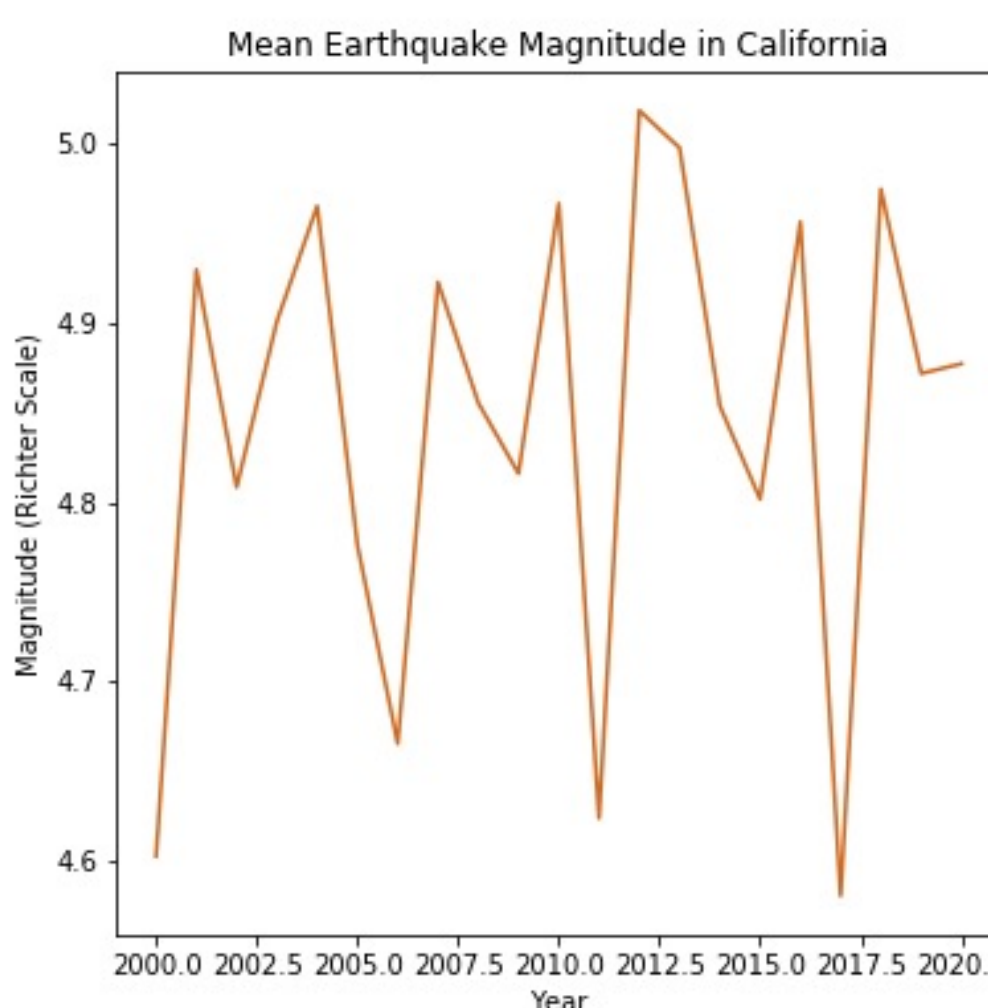


Figure 4: The mean magnitude of earthquakes in California each year from 2000 to 2020 is shown. There are fluctuations in mean magnitude each year. The lowest magnitude occurred in 2017 at a magnitude of 4.58 and the highest magnitude occurred in 2012 at a magnitude of 5.02.

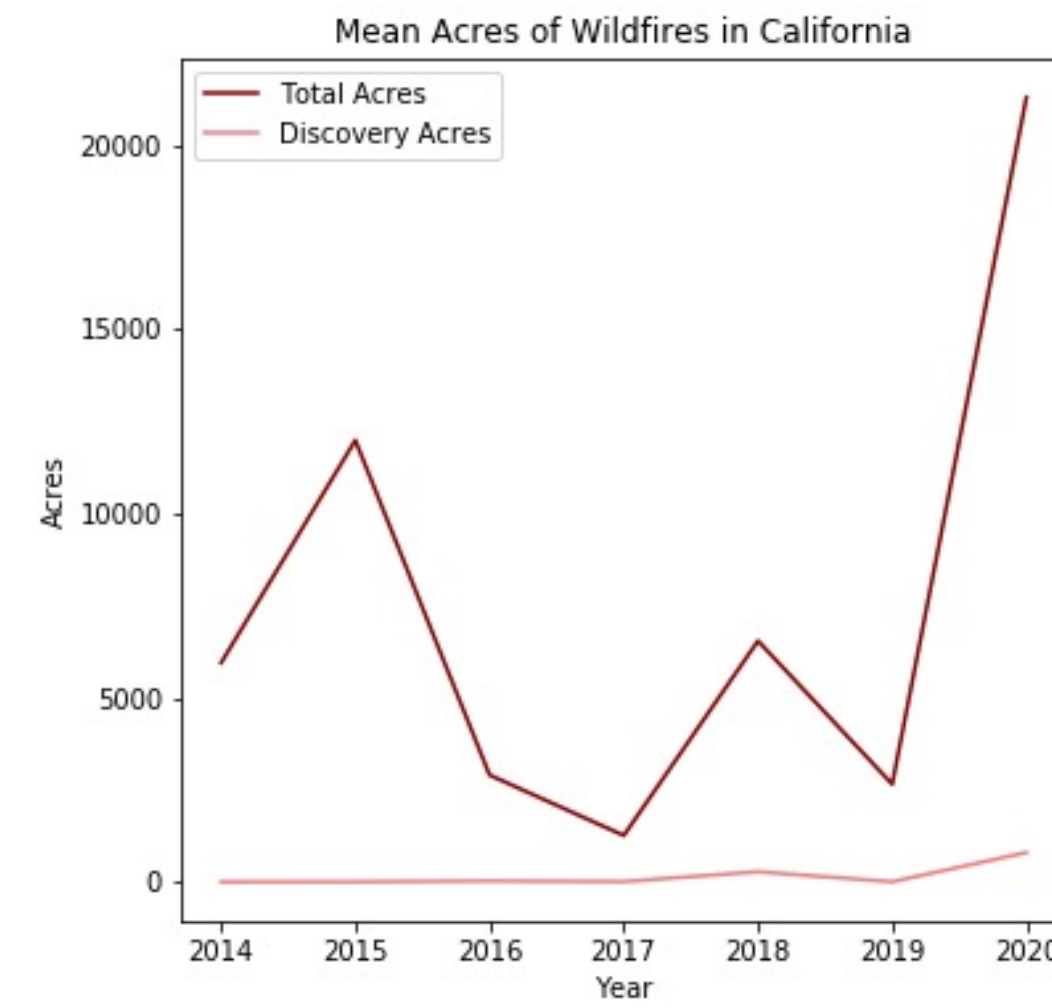


Figure 5: The mean total acres of wildfires in California from 2004 to 2020 is shown by the darker line. The mean acres affected by wildfires when the wildfire is discovered is shown by the lighter line. The total acres varies with the most affected acres in 2020. The discovery acres has small fluctuations peaking in 2018 and 2020.

Conclusions

Temperature and wildfire frequency has been increasing in California (Fig. 1). However, earthquake frequency has not been increasing similarly to temperatures and wildfire frequency (Fig. 1). The statistical analysis determined if there was a correlation between the variables and for there to be a correlation the p value needs to be less than 0.05. The statistical analysis showed that there is a correlation between temperature and wildfire frequency but there is not a correlation between temperature and earthquake frequency (Fig. 2 and Fig. 3).

Rising temperatures do not affect the frequency of earthquakes since there was no correlation (Fig. 2). The mean magnitude of earthquakes does not rise steadily like temperature so there is another variable that causes earthquakes and impacts their severity (Fig. 4). Earthquakes occur due to the movement of tectonic plates which is caused by gravity and does not depend on temperature (USGS).

The positive correlation between temperature and wildfire frequency means that as temperatures' rise so will the frequency of wildfires (Fig. 3). Temperature impacts weather patterns and higher temperatures result in dryer, hotter weather allowing more acres to catch fire and burn more intensely (Sönnichsen, 2021). The total acres that are burning due to wildfires increased greatly in 2020 (Fig. 5). The more acres that are affected the more damage the wildfires cause. Since temperatures are steadily increasing due to anthropogenic influence California needs to prepare to effectively mitigate and fight wildfires to reduce this natural disaster's possible destruction.

References

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