Chrisler_Assignment_2

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Climate Study: Yearly Precipitation and Temperature Changes in the United States

I. Motivation

Anthropogenic climate change has become an important issue as there has been a noticeable warming of overall global temperatures as greenhouse gas emissions have increased globally. While temperature is the focused on meteorological variable in regards to anthropogenic climate change, others are impacted as well such as precipitation. Greenhouse gas emissions have been observed to suppress precipitation over tropical regions (Koren, Feingold, and Remer 2010), affect mid-latitude cyclones (Wang 2014), as well as impacting the frequency and strength of extreme weather events such as tropical cyclones (Rosenfeld 2012). While there is much uncertainty of the future impacts of anthropogenic climate change, the current effects can be observed through analysis of weather station data throughout the past century.

II. Data and Analysis

Yearly average values of temperature and total precipitation values from 1950 - 2008 were available for analysis. The precipitation data focused on three states: Ohio, Tennessee, and Alabama, while the temperature data was collected across the entire United States. Only weather stations with at least forty years of data were analyzed as a threshold for determining if there was enough data for a climatological study of a location. The values of these locations were statistically analyzed with linear regression to calculate the yearly change of each variable. These yearly changes were then projected onto maps. The yearly change in precipitation was projected to one regional map of the three states mentioned prior. The yearly temperature changes were projected onto the entire United States, and then regional areas, Hawaii, and Alaska to visually see individual data clearly.

III. Results and Conclusions

A. Yearly Precipitation Change

Overall, ~83.9% or 224/267 locations in the three state analysis have observed an increase in yearly precipitation. Ohio contains the highest frequency of locations with yearly precipitation increases while Alabama and Tennessee seem to be more sporadic in nature. There does seem to be a concentrated region of little to declining yearly precipitation rates (indicated by blue to dark blue) in the eastern half of Tennessee and East Central Alabama. Results are comparable to the results from the National Climate Assessment with some differences observed in Tennessee. (https://nca2014.globalchange.gov/report/our-changing-climate/precipitation-change)

B. Yearly Temperature Change

Overall, ~71.2% or 2,227/3,200 locations in the United States analysis have observed an increase in yearly temperatures. The most significant impacts can be observed in the higher latitudes and western regions of the contiguous United States, as well as Alaska. A concentration of negative to neutral temperature anomalies is observed in the South United States, which can be seen from the higher frequency of blue to dark blue on the regional map compared to other regions.

C. Precipitation Maps

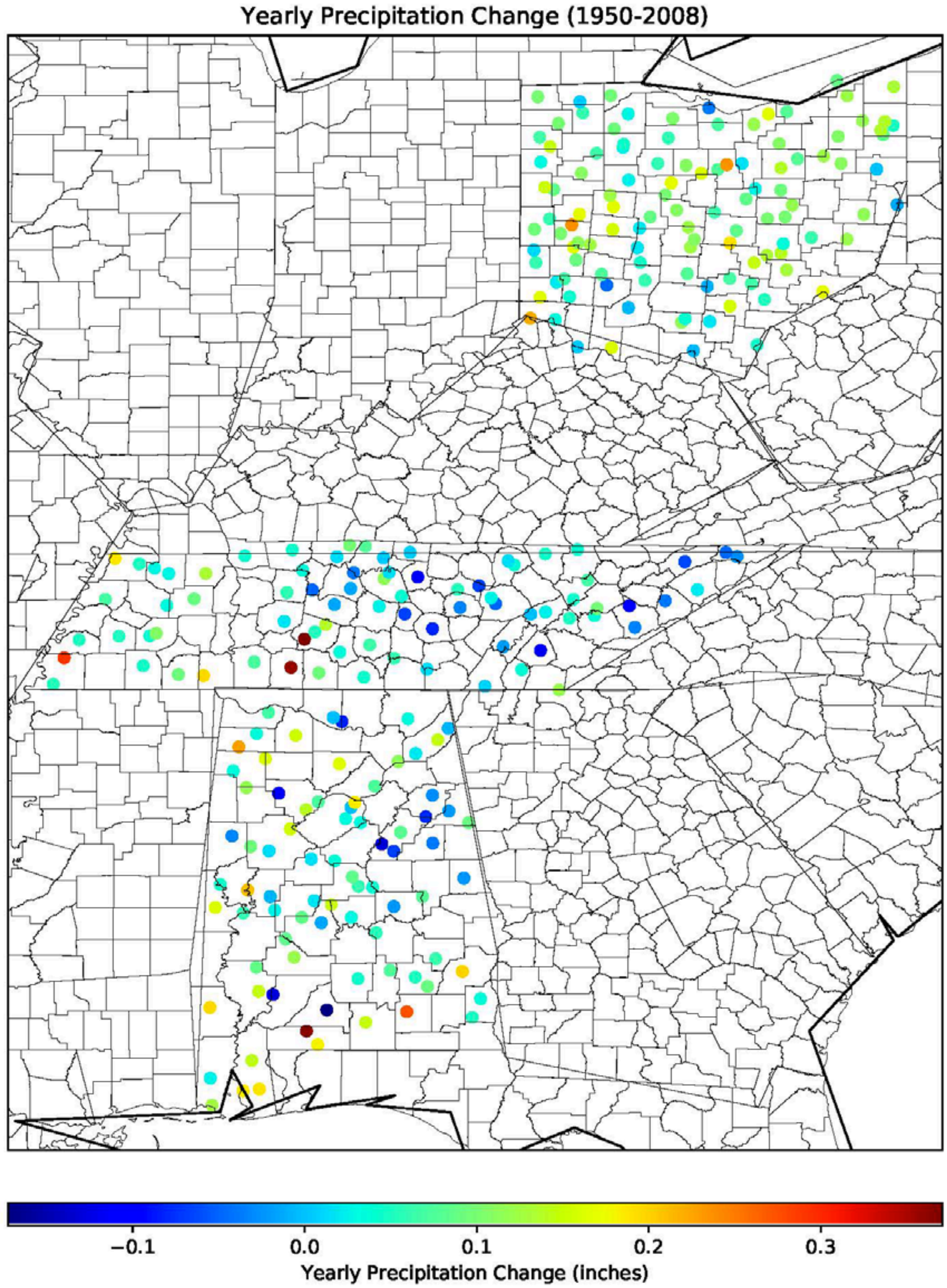

Figure 1: Yearly precipitation change in inches for locations in Ohio, Tennessee, and Alabama.

D. Temperature Maps

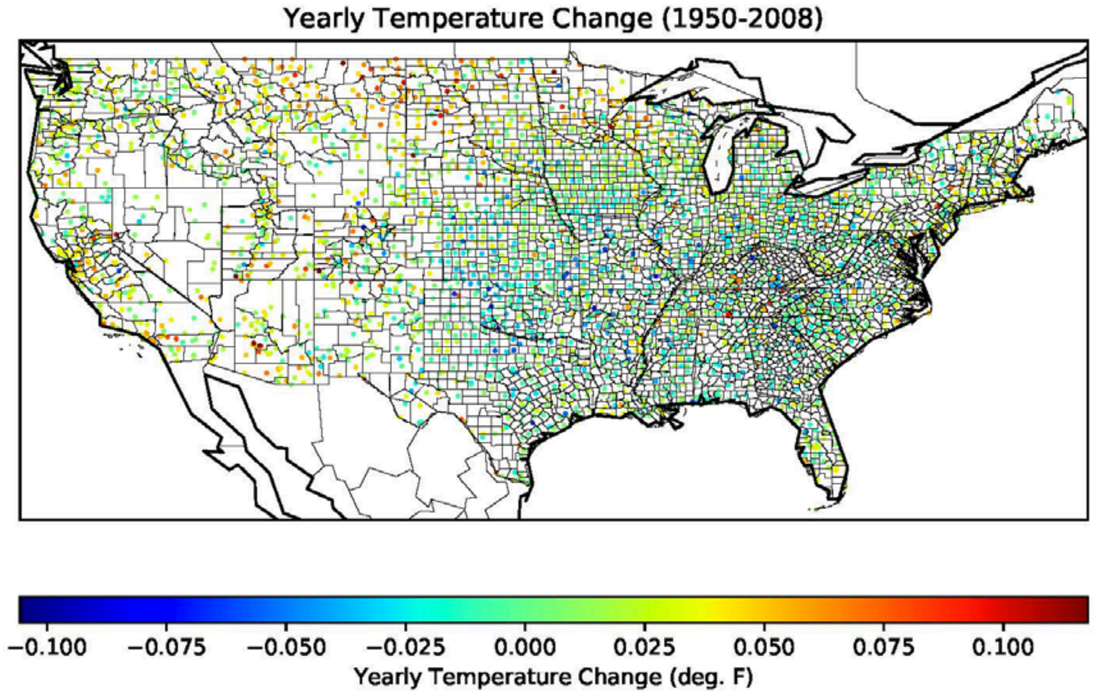

Figure 2: Yearly temperature change in degrees Farenheit for the contiguous United States.

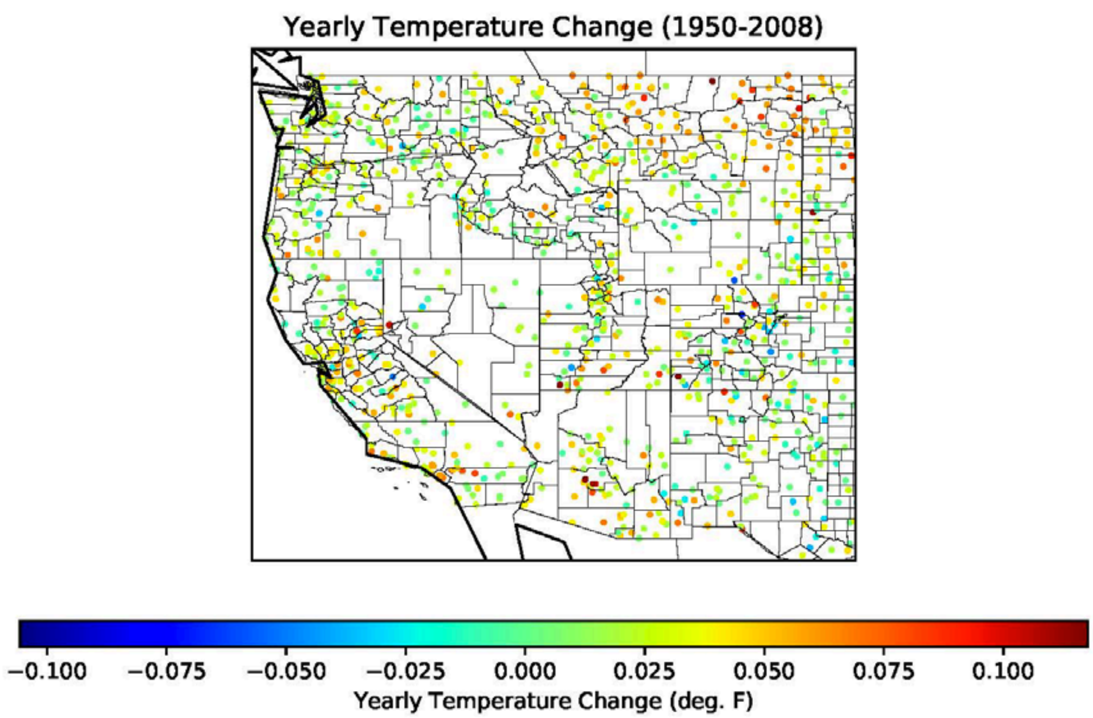

Figure 3: Yearly temperature change in degrees Farenheit for the West United States.

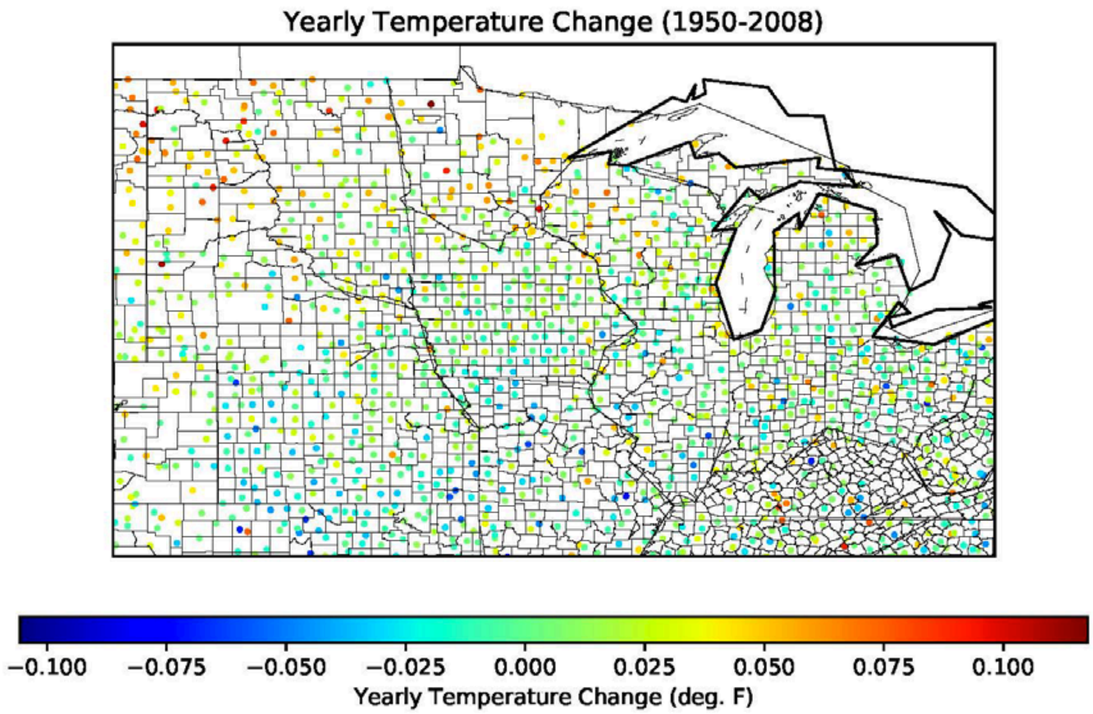

Figure 4: Yearly temperature change in degrees Farenheit for the Midwest United States.

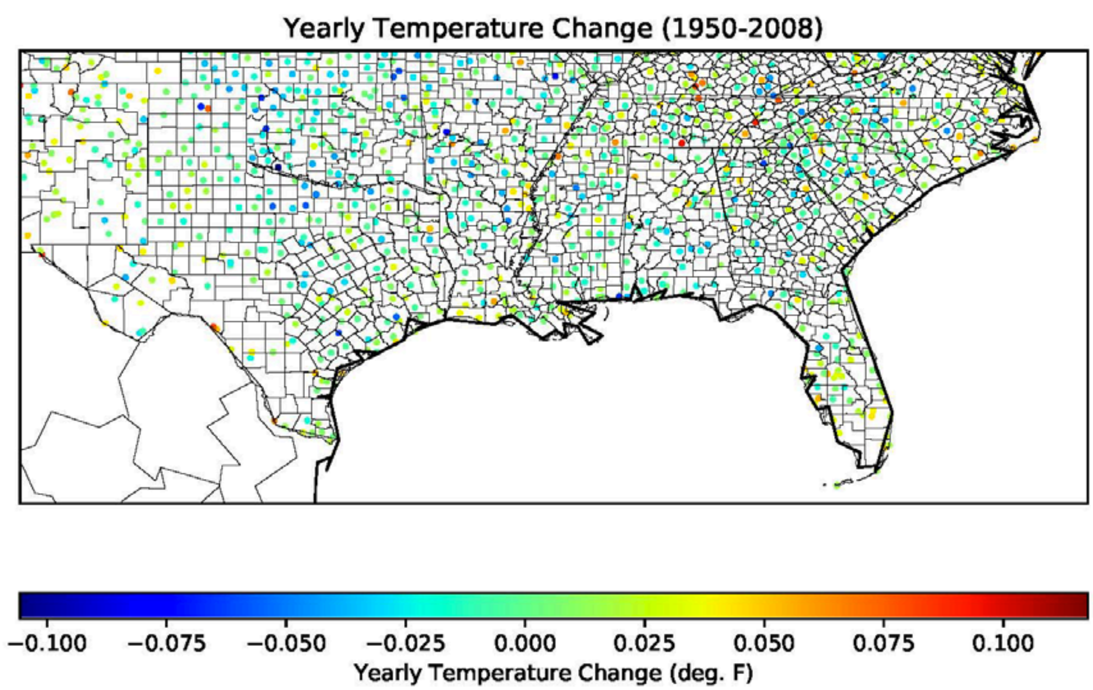

Figure 5: Yearly temperature change in degrees Farenheit for the South United States.

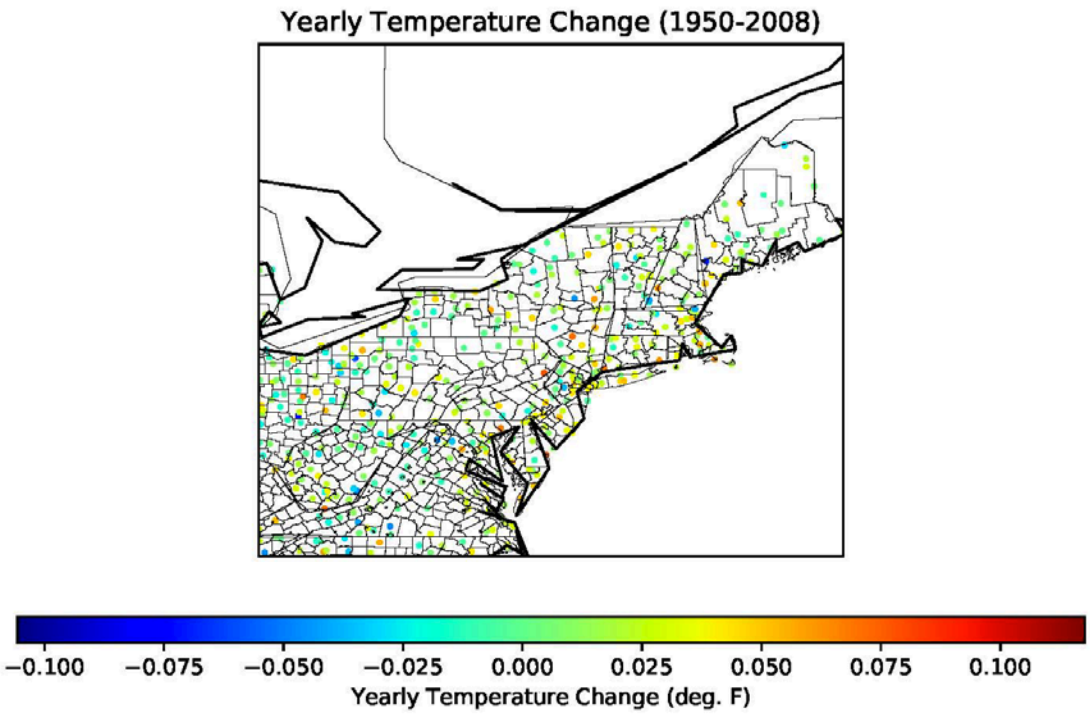

Figure 6: Yearly temperature change in degrees Farenheit for the Northeast United States.

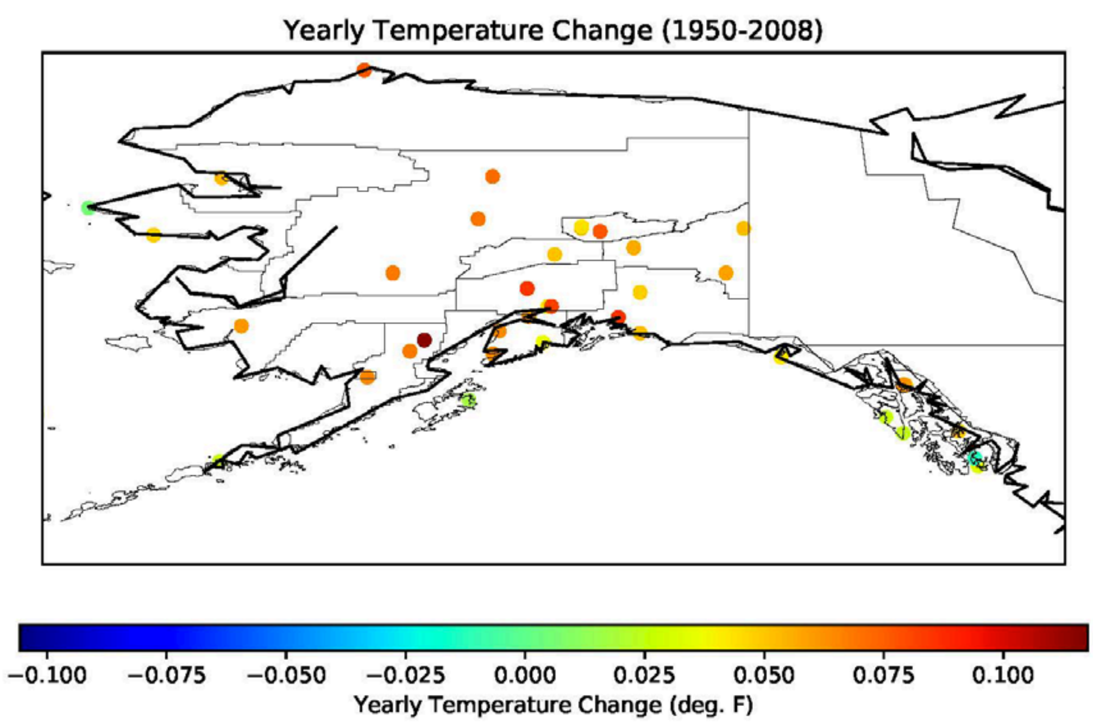

Figure 7: Yearly temperature change in degrees Farenheit for Alaska.

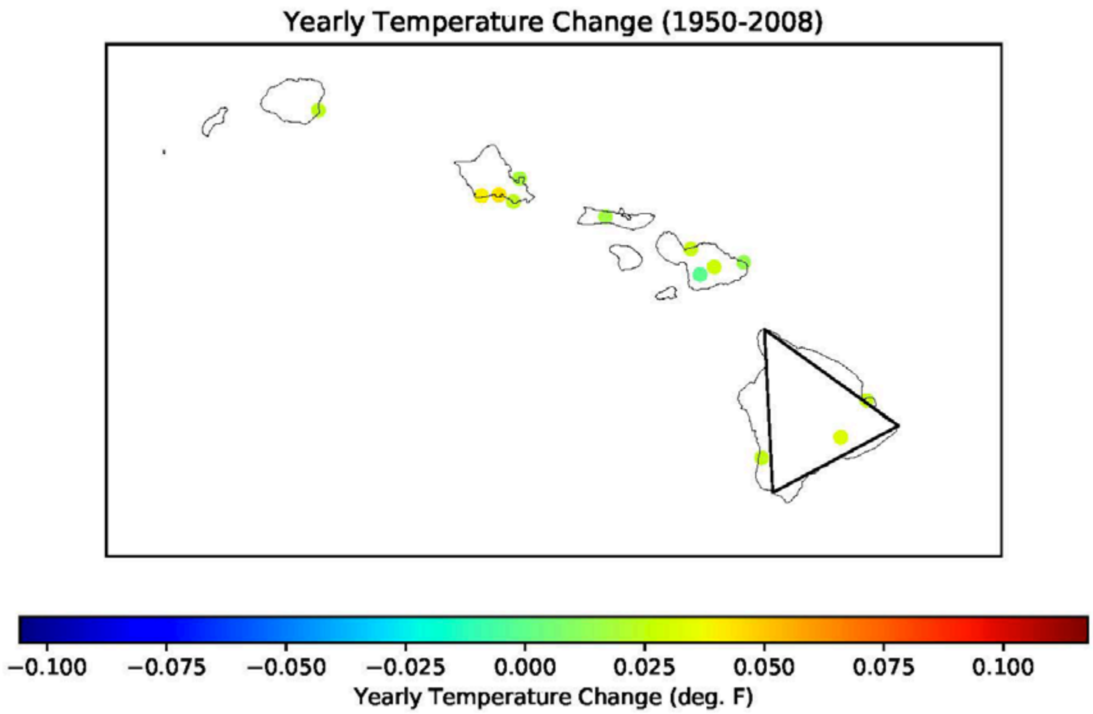

Figure 8: Yearly temperature change in degrees Farenheit for Hawaii.

IV. References

Koren, I., G. Feingold, and L. A. Remer. 2010. "The Invigoration of Deep Convective Clouds over the Atlantic: Aerosol Effect, Meteorology or Retrieval Artifact?" *Atmos. Chem. Phys.* 10: 8855–72. www.atmos-chem-phys.net/10/8855/2010/doi:10.5194/acp-10-8855-2010.

Rosenfeld, et al., D. 2012. "Aerosol Effects on Microstructure and Intensity of Tropical Cyclones." *BAMS*, 987–1001. doi:10.1175/BAMS-D-11-00147.1.

Wang, et al., Y. 2014. "Assessing the Effects of Anthropogenic Aerosols on Pacific Storm Track Using a Multiscale Global Climate Model." *PNAS* 111 (19). www.pnas.org/cgi/doi/10.1073/pnas.1403364111.