Personal Statement

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Team Information

Project Name:	Afraid of Commitment	
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https://git.ph.qmul.ac.uk/ap19004/Afraid-of-Commitment.git

My contribution to the project consisted primarily of writing the functions and classes files and implementing these into the main file. I also wrote the comments in these files and tested the classes functions. On more difficult parts, Peter and I collaborated to find the best solution.

Report follows below.

A Graphical Study of Global Temperature

Introduction

This study seeks to determine the trend, if any, of how global temperatures have changed over the past 150 years, including how specific regions have changed with respect to one another. By analysing data collected from a vast catalogue of historical and modern sources, comparisons can be made between temperature changes of different time periods, which may provide some insight into the reality of global warming, and if modern lifestyles are having a negative effect on the climate.

Method

The Climate Research Unit (University of East Anglia) in partnership with the Hadley Centre (UK Met Office) [1] has collected information regarding temperature differences with respect to the average temperature of 1961-1990 from 1850-present. The difference is calculated month by month, mitigating the effect of seasonal changes. With data collected from dedicated weather stations to volunteer vessels out at sea, the coverage varies worldwide. These variations along with other factors are quantified as uncertainties which have noticeably reduced in recent years except in the southern hemisphere datasets due to data not being collected in the Southern Ocean shipping lanes. The datasets presented in this study are a combination of land and sea temperatures, but analysis has also been carried out using separate land and sea datasets.

Python 3.7 with the matplotlib library, was used to both clean and present this data. The files needed to be altered in format to allow for a more general structure of code to be written that could work with any of the available datasets. This general structure was achieved by use of a complex data type called a class which could accept numerous data files in a specific instance, ultimately allowing for the comparison of multiple datasets from multiple regions. In addition to this, the class requires minimal input which reduces the chances of making errors in the analysis.

Results

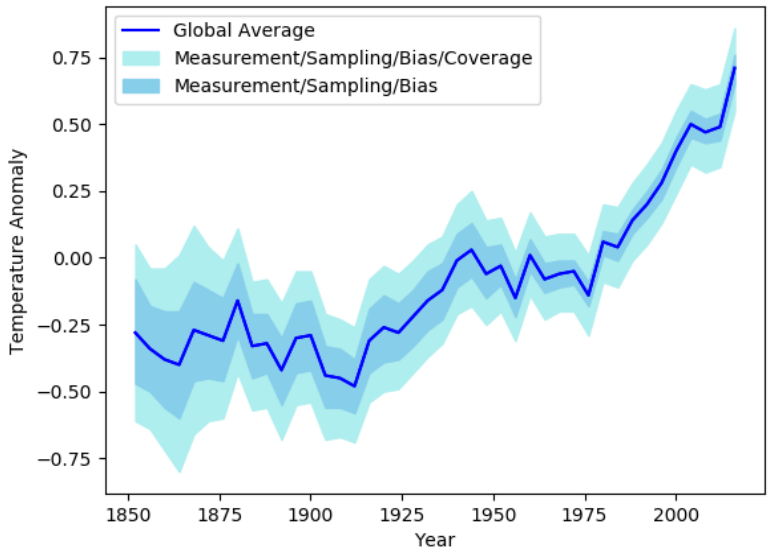

Figure 1: Global average temperature anomaly from 1850-2019 averaged over 48 months showing an increasing anomaly, as well as an increasing rate of growth. A decrease in the uncertainties of measurements over time is also shown.

The global average temperature, as seen in Figure 1, shows a general trend of increasing temperature over time, with a shift from a mostly negative to a mostly positive anomaly after 1950 and a heightened rate of increase most notable after 1975. The average temperature anomaly from 1850 is approximately $T_{1850} = -0.25 \pm 0.3$ and from 2019 is $T_{2019} = 0.70 \pm 0.1$. Therefore, the net gain is $\Delta T = 0.95 \pm 0.32$. This means that on average the global temperature has increased by 1°C, with most of the increase occurring after 1950.

Consideration may be made to different regions to see whether one particular area is producing results significantly higher than the rest, skewing the global average. Investigation of this is shown in Figure 2 between the hemispheres, as well as the southern hemisphere and the tropics. This suggests roughly linear increments of temperature rise globally as the same can be shown of the northern hemisphere compared to the tropics. Whether the increase is independent or if one region influences the others is inconclusive, but it does appear that the northern hemisphere has experienced the largest net increase since 1850. A similar relationship has also been observed between land and sea temperature anomalies.

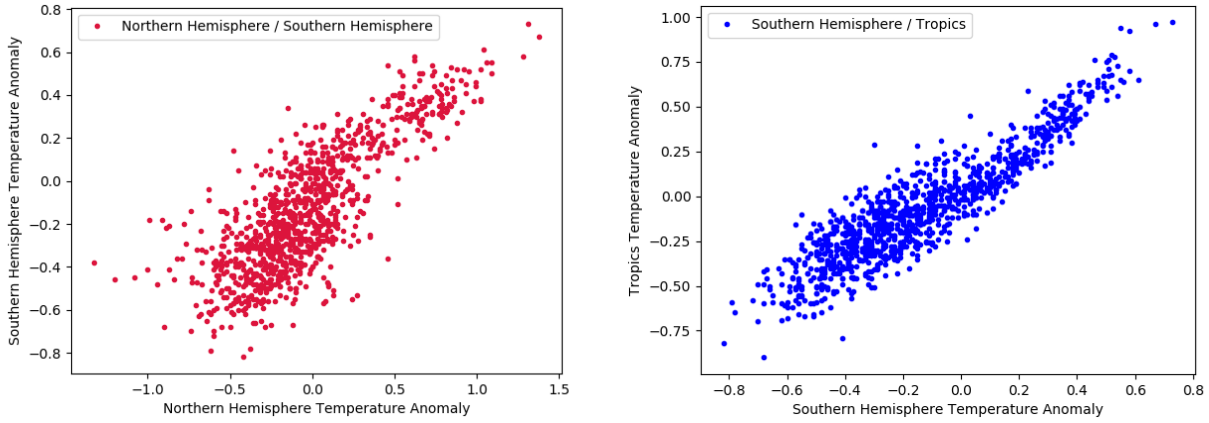

Figure 2: Correlation between northern and southern hemisphere (red), and the southern hemisphere and the tropics (blue), temperature anomalies since 1850 with a 2-month resolution showing an increase in both comparatively.

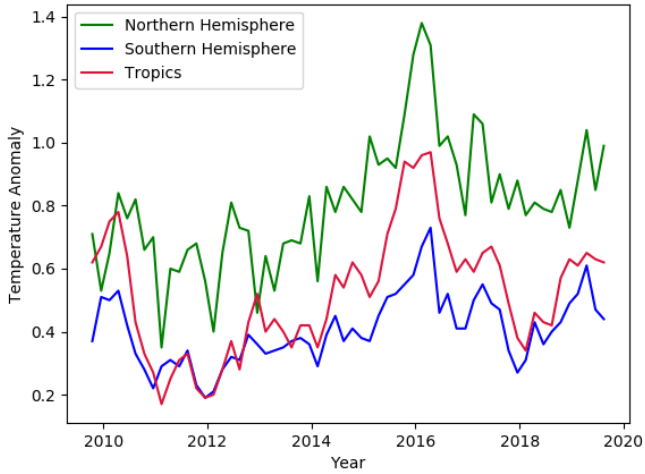

Figure 3: Close up of temperature anomaly for the last 10 years with a resolution of 2 months for the northern hemisphere, southern hemisphere and tropics. All three regions showing consistently positive anomalies.

Following this, a close-up of the last 10 years was analysed. From Figure 3 two observations stand out, the first is the large spike in 2016, and the second is that the anomaly is consistently above 0. The former requires more information to explain definitively, but one reason could be due to unexpectedly warm winter months. The latter is consistent with the rest of the findings and is in clear contrast with the temperatures recorded pre-1950.

Conclusions

This study has found consistently and without contradiction, that global land and sea (as well as region specific) temperatures are increasing with a net gain of 0.95 ± 0.32 since 1850. In fact, the rate at which temperatures are rising has been shown to be increasing significantly in recent years. This type of behaviour is uncharacteristic when compared to data recorded before 1900 and could suggest that modern day living is influencing global temperature changes.

It is suggested that temperatures around 2016 are investigated more thoroughly to determine a cause for the dramatic rise that year and if this is something likely to occur again. Additionally, efforts should be made to decrease the uncertainty in the southern hemisphere datasets to observe more precisely the temperature changes in this region.

References

[1] https://crudata.uea.ac.uk/cru/data/temperature/