Trend Analysis of Climate in Norway

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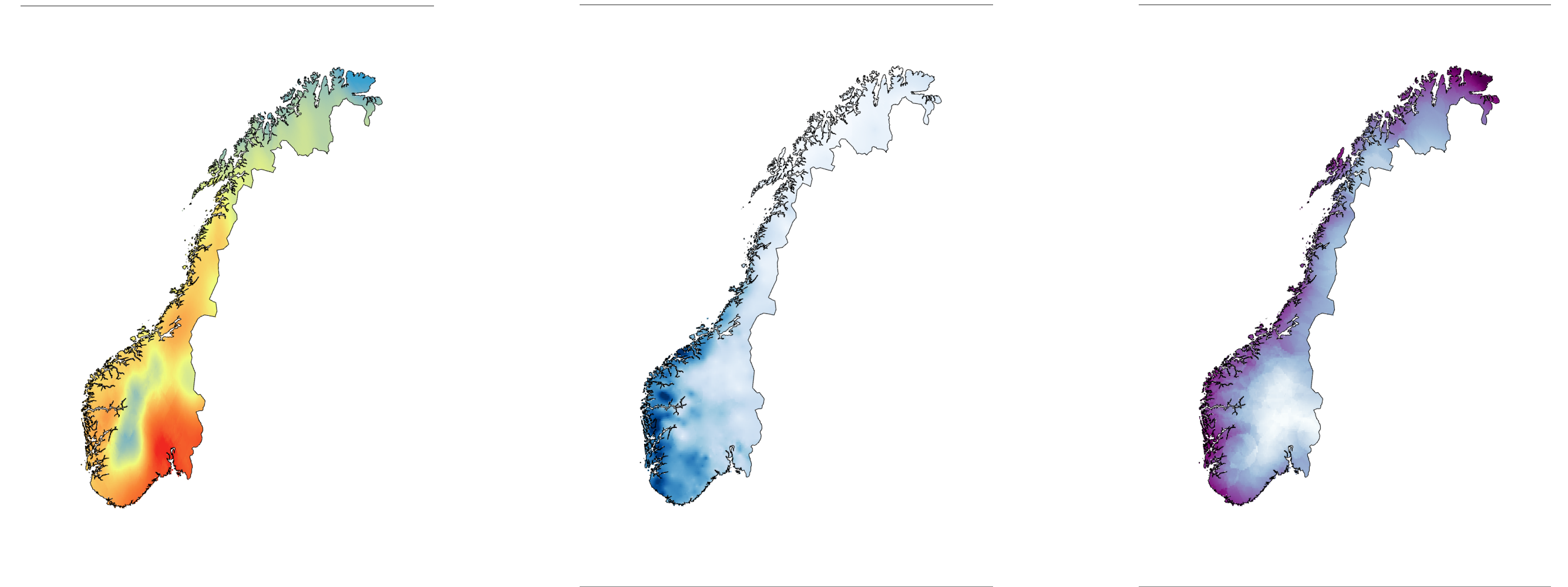nicmunst@nmbu.no, namo@nmbu.no, bipo@nmbu.no

Introduction

Weather condition affects practically every sector of society and is an important element of most people's daily lives. Correct weather forecasts can increase productivity of people and businesses. The Science of weather forecasting has progressed a lot, with new satellites being sent into space every day. However, it is not as accurate and precise as we want it to be. So, there is room for further research into the subject.

Weather in Norway is unpredictable due to varying topography. Therefore, further research is important to find patterns in these inconsistencies. Here, we look at historical data of temperature and precipitation which is important to predict future trends. We also look at the differences between the major cities, as well as comparing with global CO2 emissions.
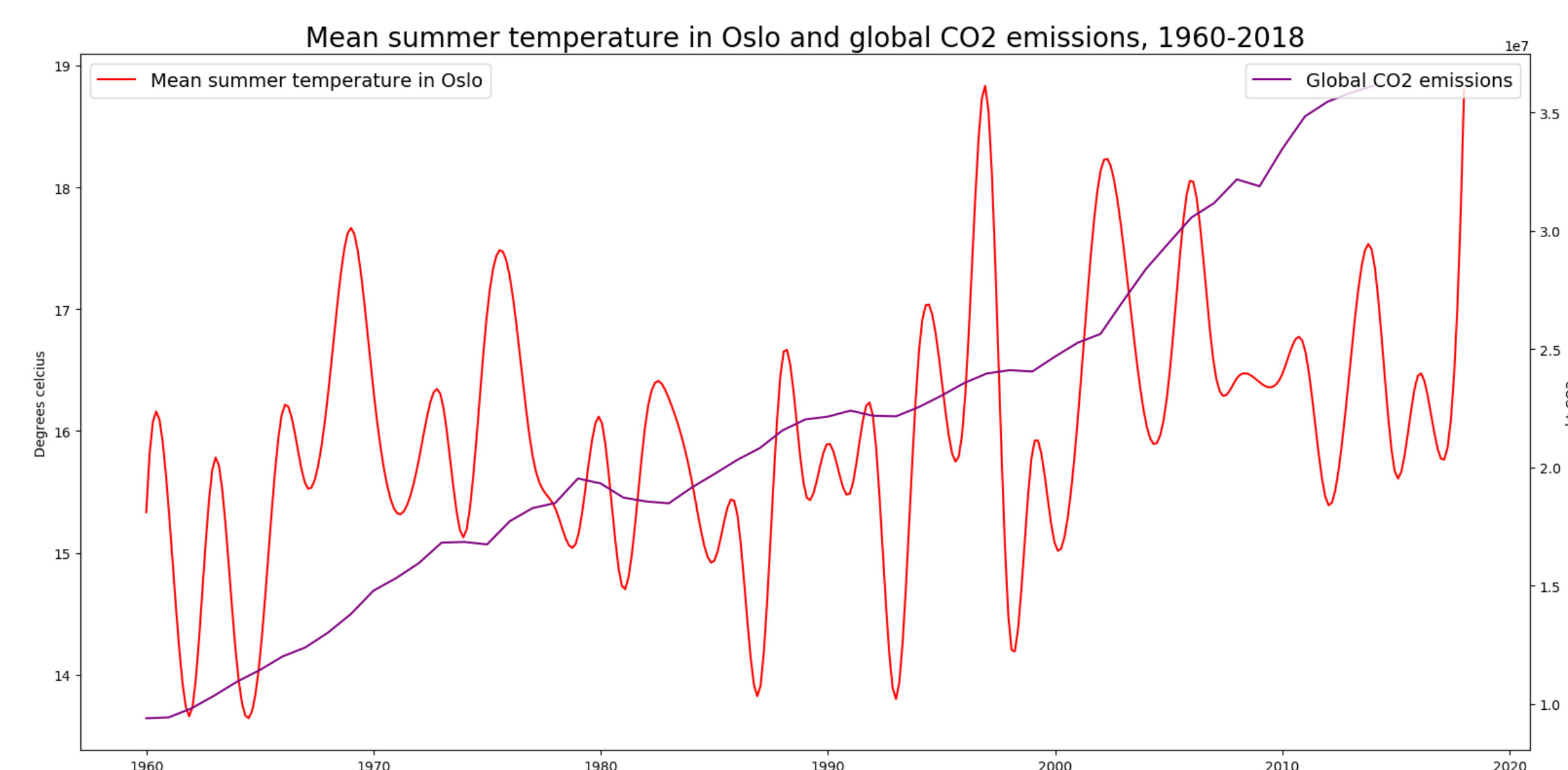
It is known that, like the rest of the world, the Norwegian climate has become warmer. Climate change is being observed on all continents and in all the major oceans. We test this hypothesis by collecting data from various sources and plotting them in python.

Maps showing mean temperature, precipitation, and humidity for July 2019, throughout Norway.

Methods

Temperature and precipitation data for Norway were extracted from *eklima.met.no* for relevant time frame and weather stations. Also, global natural disasters data from the International Disaster Database (http://www.emdat.be) and global CO_2 emissions from world bank (https://data.worldbank.org/indicator/en.atm.co2e.pc). We downloaded the files as .csv and did the initial data cleaning in Excel.
Data transformation, plots and regression analysis were done in Python. We also used ArcGIS for visualization of the map-based plots.
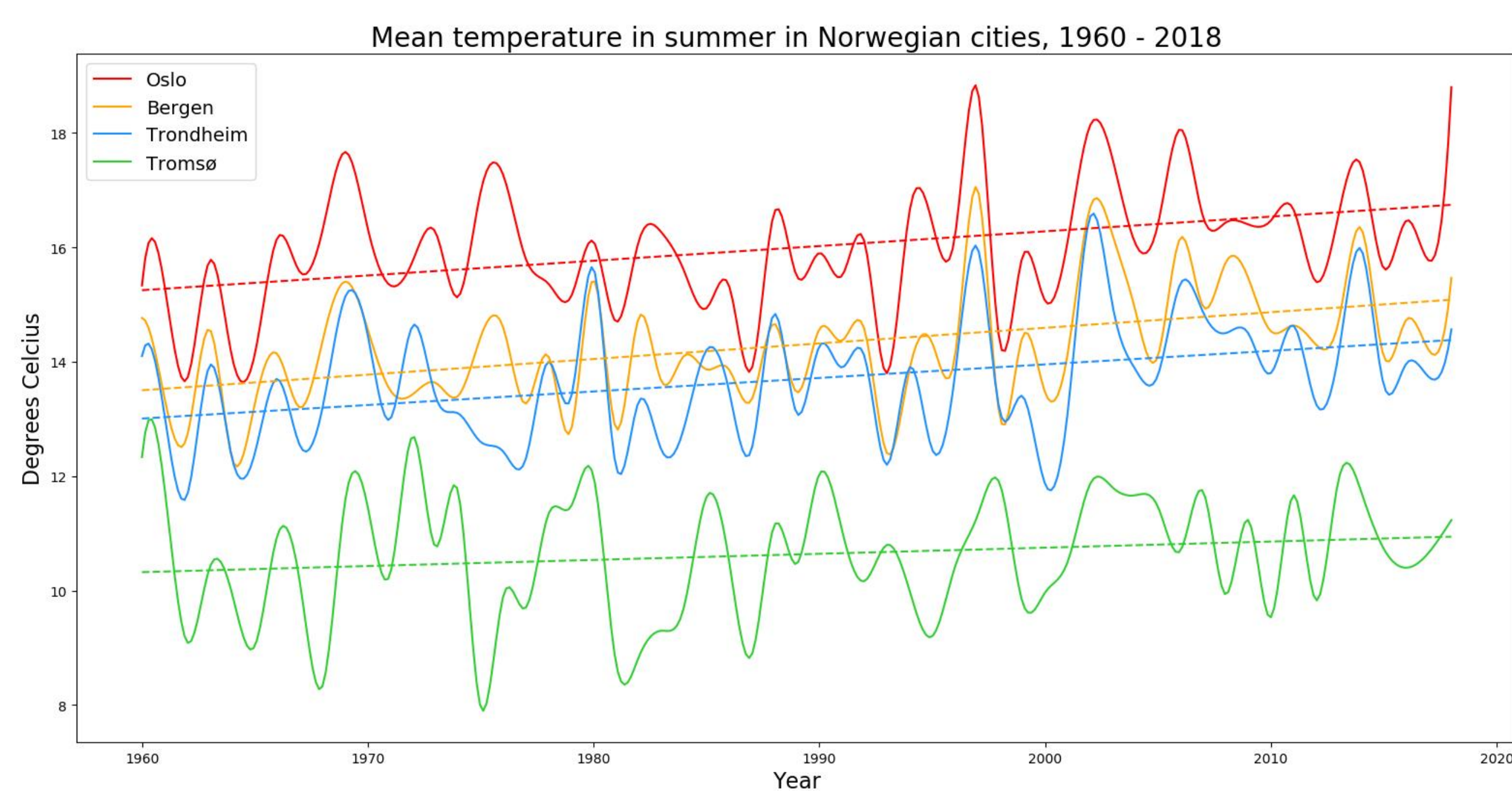

Results

Plot showing mean summer temperature in Oslo, Bergen, Trondheim and Tromsø in the time period 1960-2018. The dotted lines are the estimated regression lines.

Plot showing winter precipitation in Oslo, Bergen, Trondheim and Tromsø in the time period 1960-2018. The dotted lines are the estimated regression lines. The results show increase in both temperature and precipitation in all four cities.
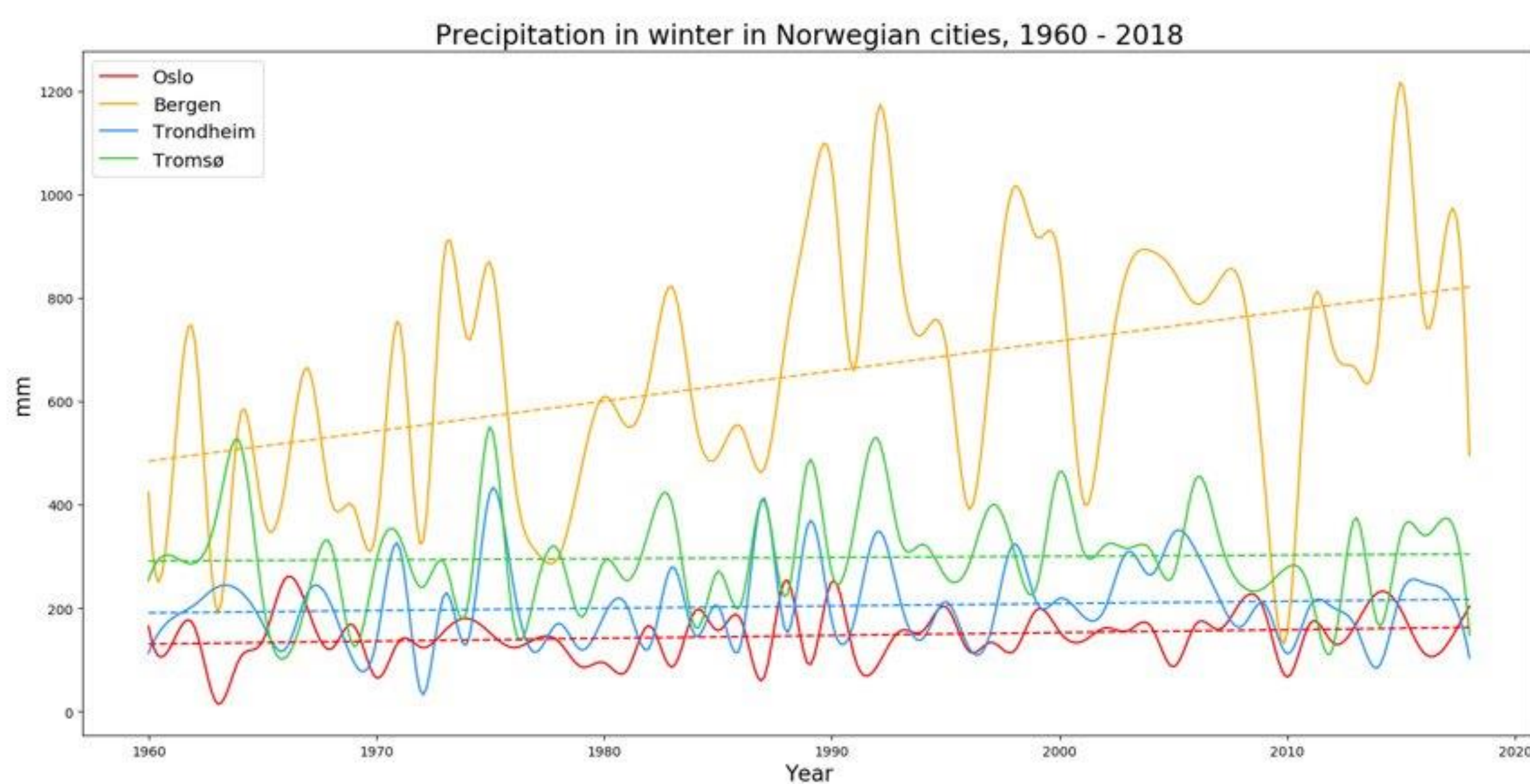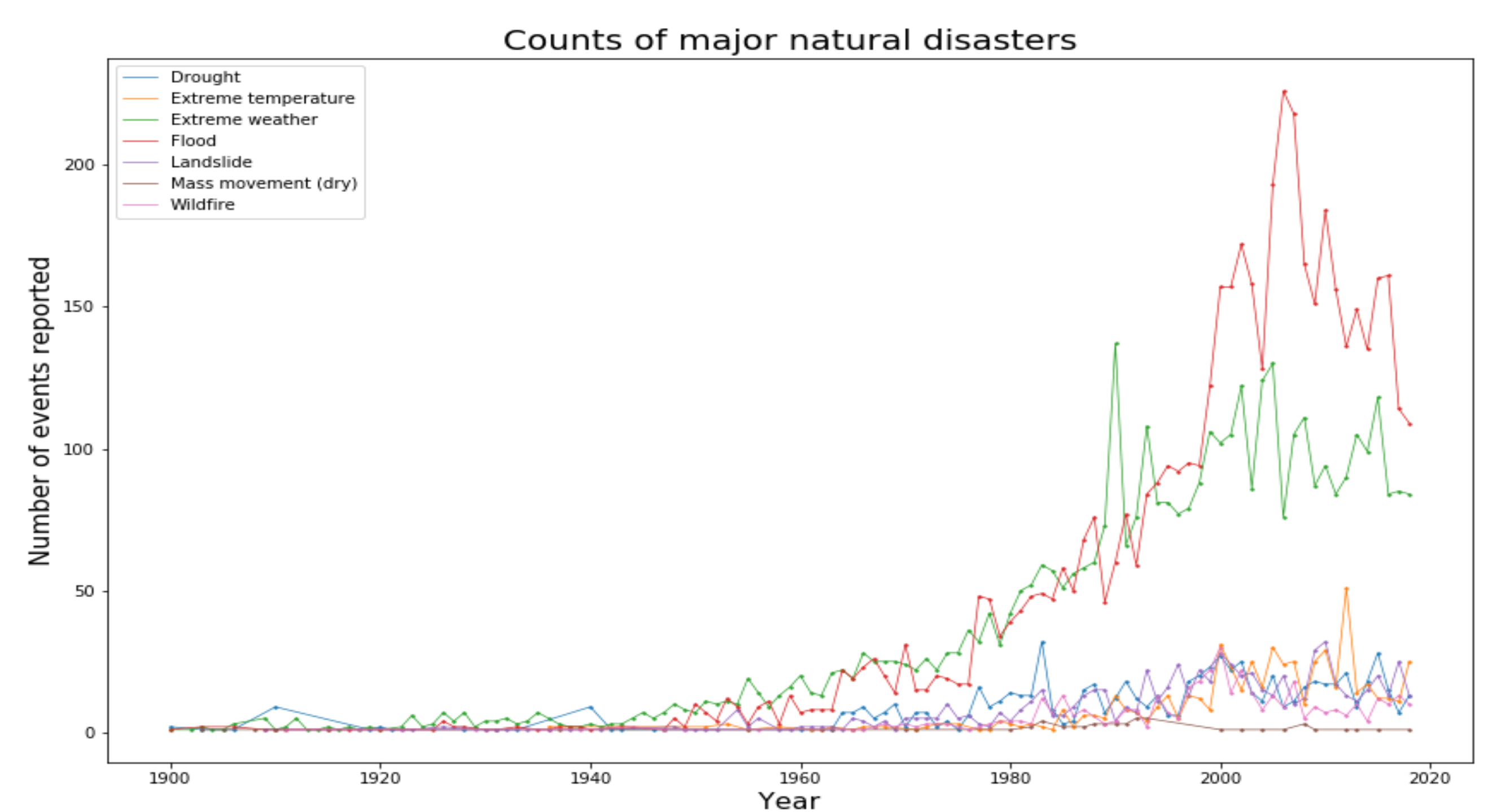

The plot shows correlation between summer temperature in Oslo and global CO2 emission. There is some correlation, but it is not perfect. The correlation coefficient was 0.32.

This plot shows that there is a positive correlation between global natural disaster and temperature. Temperature rise also results in more floods and extreme weather

Discussion

The results generally confirmed our expectations. We observed an increase in both temperature and precipitation across Norway. The temperature increase was correlated with increased CO_2 emissions, but not as much as we might have expected. This may be because climate is a very complicated process, and the variation in temperature is a result of many different processes.

Oslo was shown to be the warmest city of the four analyzed, and Bergen was the wettest. The maps showed that Southeastern Norway was warmest, and that Western Norway was wettest and most humid.

We can expect higher temperatures and more precipitation in Norway in the future. This will affect nearly every aspect of society and will increase the frequency of natural disasters. We will therefore need to take actions in order to be prepared for the consequences of these changes.

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