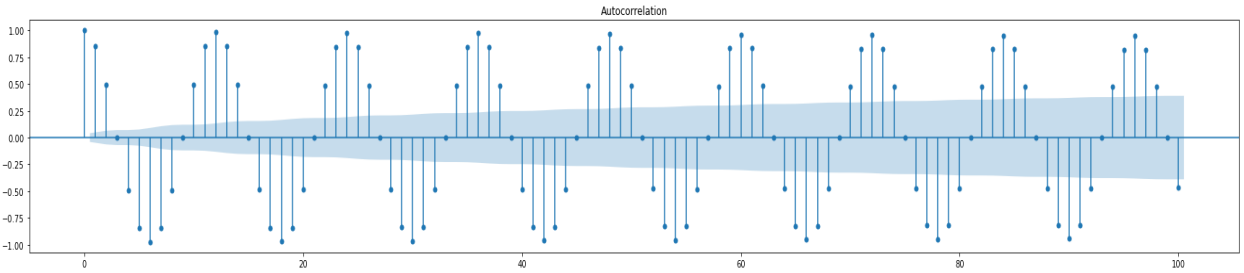
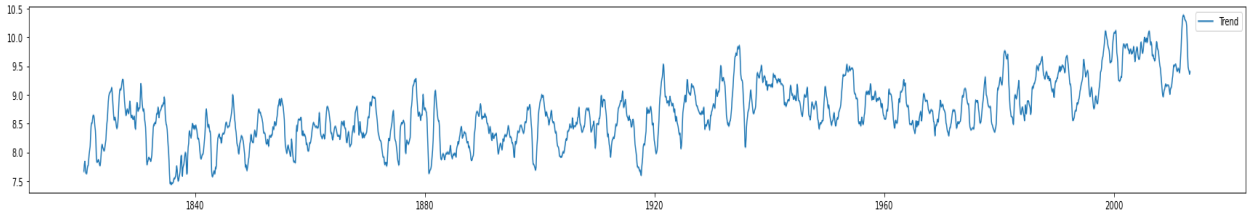
# Global Warming temperature prediction

Some say climate change is the biggest threat of our age while others say it's a myth based on dodgy science. So, I decided to look into the numbers myself. The data used is a compilation of history temperatures from mid-1700's to 2013 by Berkeley Earth, which is affiliated with Lawrence Berkeley National Laboratory.

The dataset combines 1.6 billion temperature reports distributed in the 195 official countries reported at WorldMeters, but the analysis is center in the United States of America. I was able to observe a clear seasonality in the averages temperatures per month in the Unites States, with a strong positive correlation every 12 months and a strong negative correlation on the sixth month of the year.



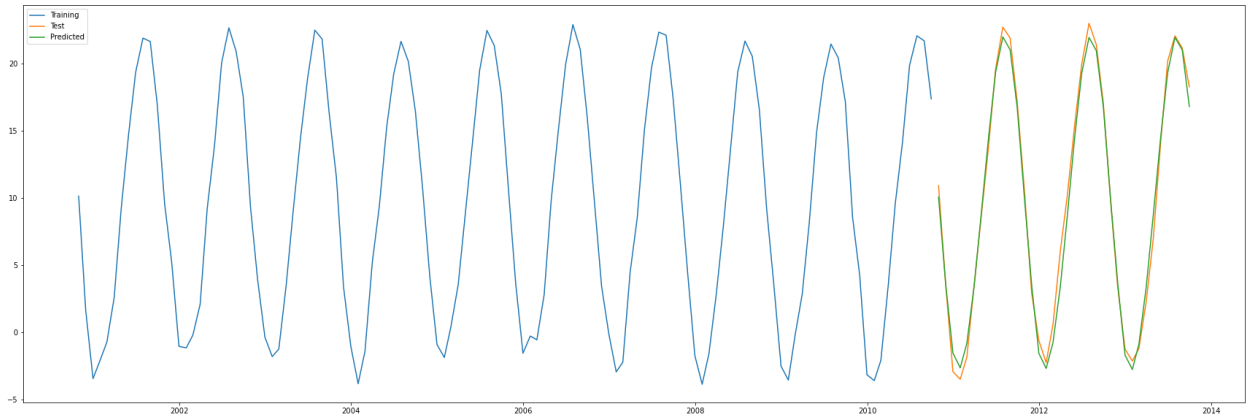

The data did not show only a seasonal pattern, but also stationarity, and additive behavior. Here is the trend of the historic average of the temperatures.



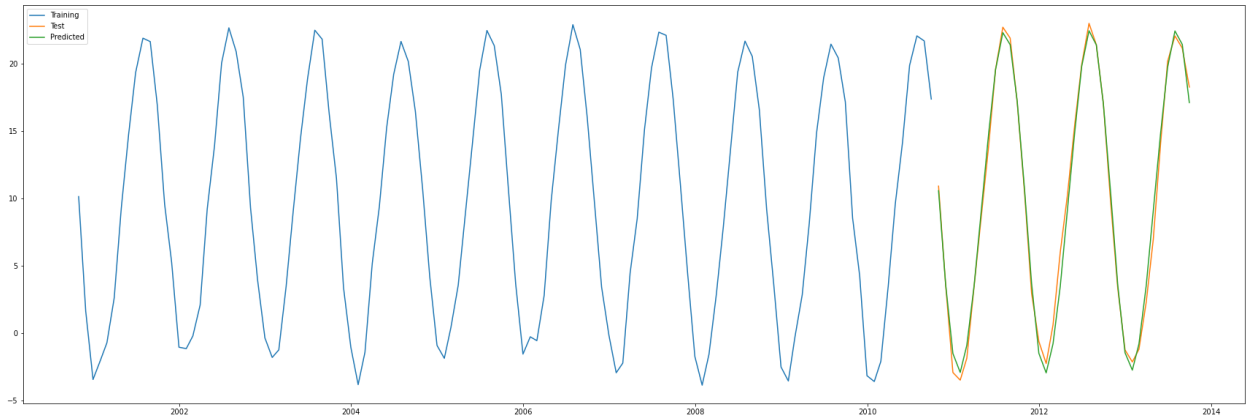

In this graph we can appreciate that indeed the temperatures in the US are rising, not by much, we are talking about less than 2°C from the first temperature rise in the early 1800's.

In order to test the predictions, I took the last 3 years of existing data (36 months) as my test data and trained two different models, the ARIMA model and the Prophet model, with the rest of the data (2289 months).

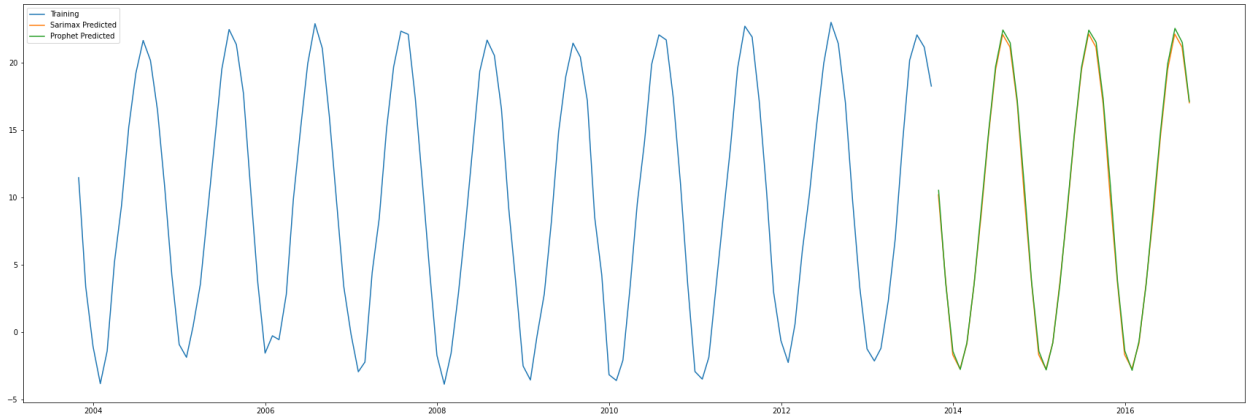
The best model AIC value was given by the ARIMA model was with the parameters (1,0,4)(1,0,3). After forecasting the temperatures from the last 3 years, I was able to see a MAE of 0.74.




I also predicted the following 3 years of temperatures with the Prophet model, this model gave me a MAE of 0. 0.68, which is closer to the real observed temperatures in the test dataset.



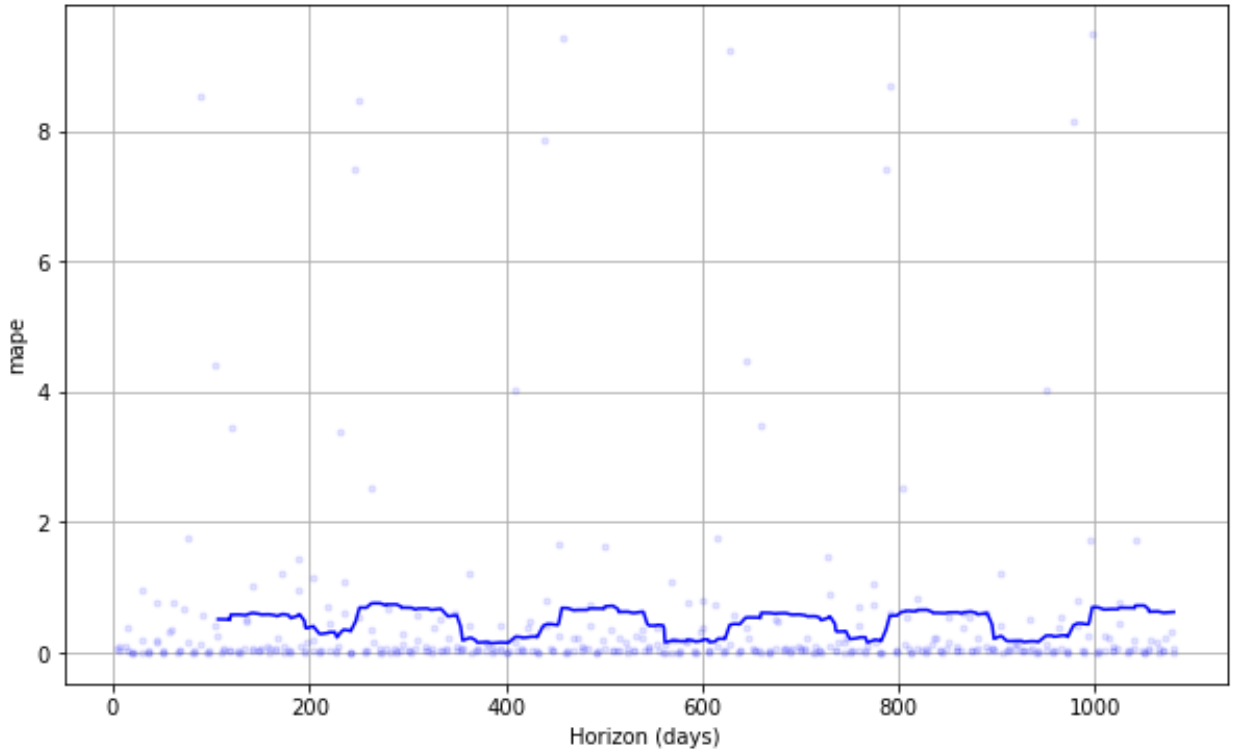

I used both models to predict the next 3 years of temperatures (which are unknown to the dataset).



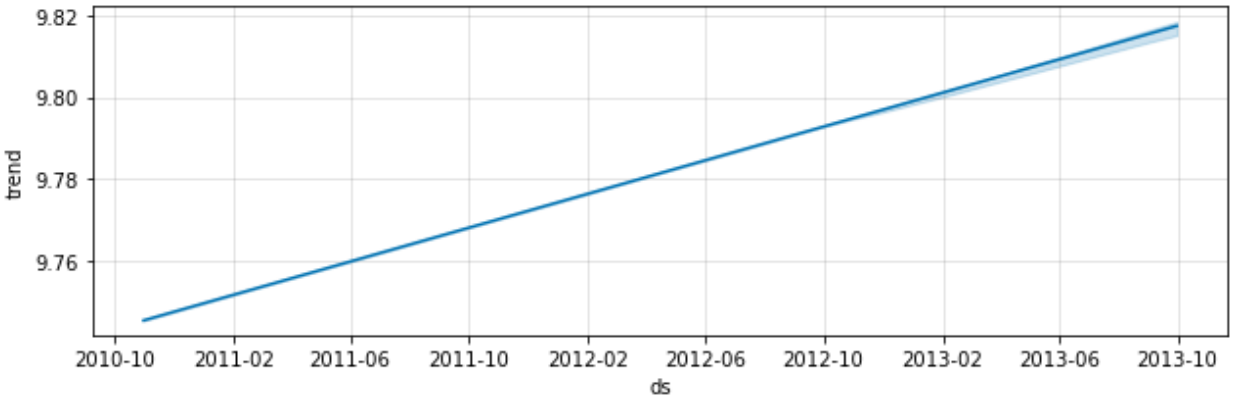

Here is the performance over the model on the prediction:

| | horizon | mse | rmse | mae | mape | mdape | smape | coverage |
|---|---|---|---|---|---|---|---|---|
| **0** | 104 days | 0.522325 | 0.722721 | 0.550878 | 0.510745 | 0.029786 | 0.253408 | 0.918367 |
| **1** | 107 days | 0.529061 | 0.727366 | 0.562365 | 0.514078 | 0.031619 | 0.257039 | 0.918367 |
| **2** | 111 days | 0.532920 | 0.730014 | 0.569768 | 0.514936 | 0.040073 | 0.257875 | 0.918367 |
| **3** | 112 days | 0.533094 | 0.730133 | 0.570836 | 0.514991 | 0.040073 | 0.257930 | 0.918367 |
| **4** | 113 days | 0.518989 | 0.720409 | 0.558780 | 0.513072 | 0.031619 | 0.256122 | 0.918367 |

And the graph of the mape column




Based on the Prophet model, we can confirm the temperatures are indeed rising every year and we need to take actions as habitants of this planet to slow it or stop it before it is too late.




We are still on time to make a change.