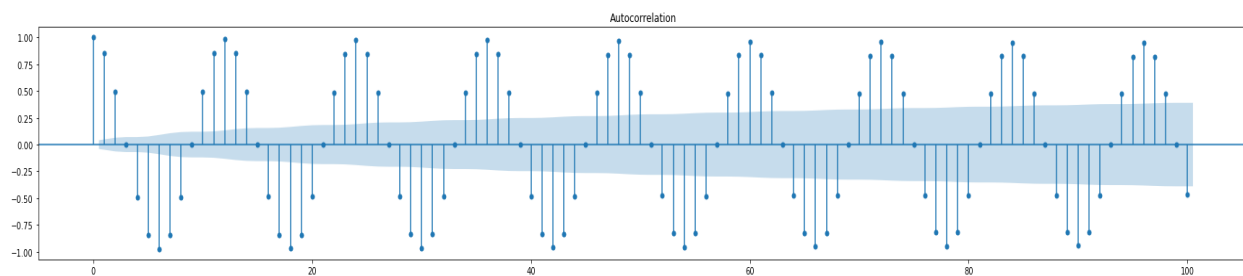


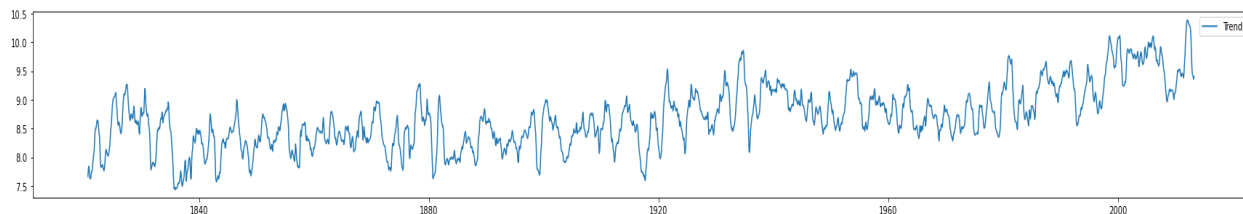
Global Warming temperature prediction

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 United States, with a strong positive correlation every 12 months and a strong negative correlation on the sixth month of the year.



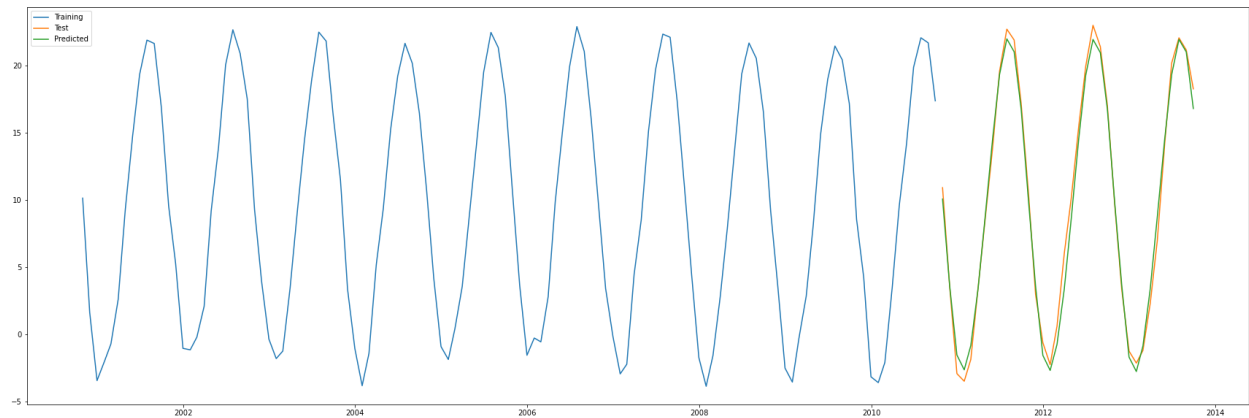
The data did not show only a seasonal pattern, but also stationarity, and additive behavior. Here is the trend of the historic average of the temperatures.



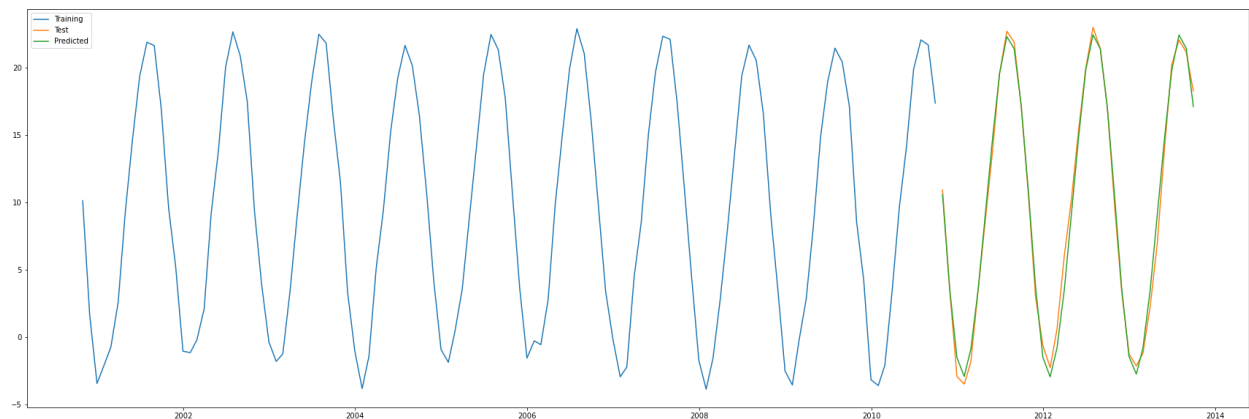
In this graph we can appreciate that indeed the temperatures in the US are rising, not by much, we are talking about less than 2°C from the first temperature rise in the early 1800's.

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).

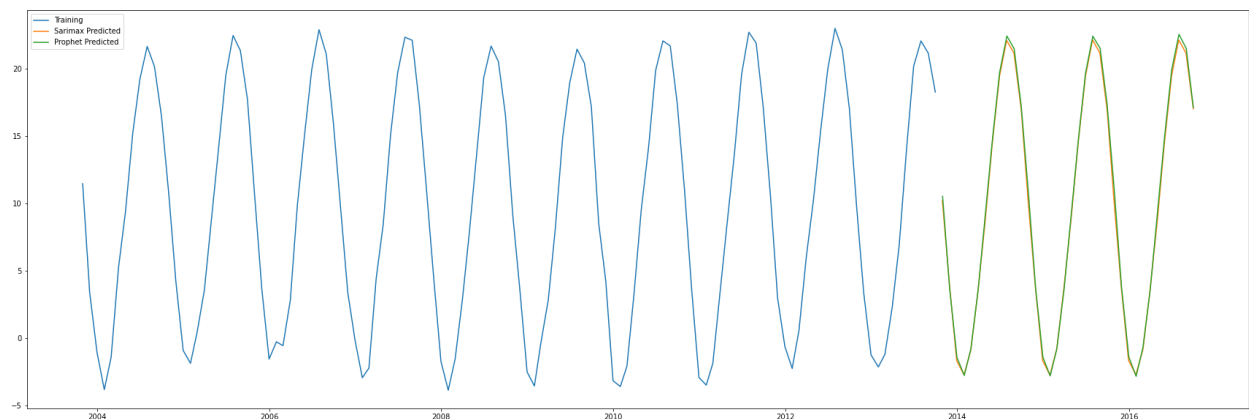
The best model AIC value was given by the ARIMA model was with the parameters (1,0,4)(1,0,3). After forecasting the temperatures from the last 3 years, I was able to see a MAE of 0.74.



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).

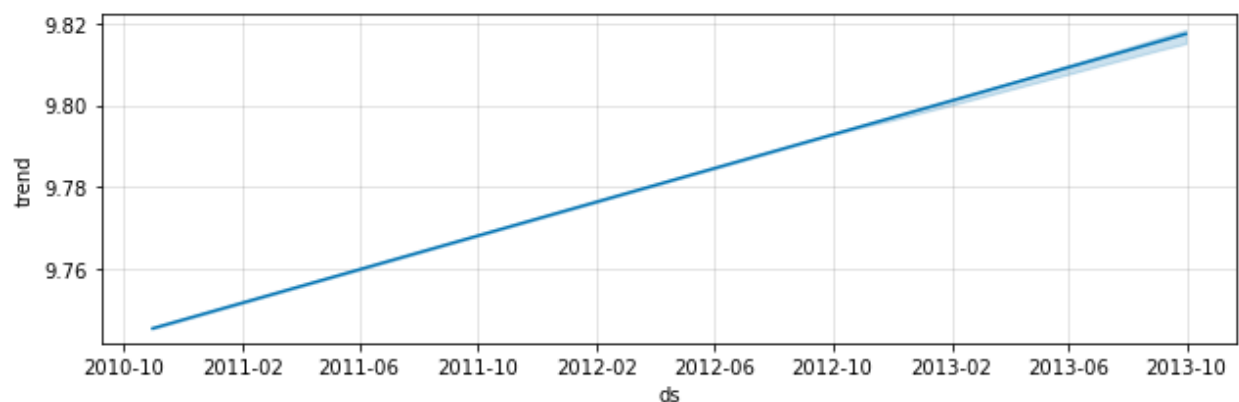


Here is the performance over the model on the prediction based on the mdape metric. The metric was divided by month and then grouped in order to appreciate that the prediction increases the error when the prediction is further:

	mse	rmse	mae	mape	mdape	smape	coverage
horizon							
3	0.525622	0.724983	0.563127	0.511065	0.036188	0.255061	0.918367
4	0.588917	0.767238	0.612162	0.525419	0.046787	0.272290	0.900227
5	0.611614	0.781818	0.633979	0.507895	0.052462	0.263032	0.879121
6	0.662100	0.813192	0.651975	0.321038	0.049871	0.218641	0.860544
7	0.843742	0.917848	0.719089	0.336405	0.056022	0.227880	0.804082
8	1.073124	1.035311	0.803684	0.644579	0.060299	0.316882	0.736549
9	1.026855	1.012546	0.774759	0.620587	0.055531	0.310718	0.764378
10	0.870651	0.932371	0.725106	0.566395	0.053043	0.293334	0.824675
11	0.744300	0.861560	0.691638	0.329211	0.052085	0.219036	0.876623
12	0.612655	0.782638	0.635383	0.149140	0.048724	0.148081	0.900000
13	0.652138	0.807329	0.649787	0.219463	0.047173	0.159522	0.876531
14	0.762625	0.869171	0.669375	0.444707	0.045068	0.213383	0.846011
15	0.978738	0.988905	0.723936	0.608233	0.049560	0.266525	0.840816
16	1.048089	1.023727	0.765112	0.625922	0.053670	0.292009	0.824176
17	1.033942	1.016382	0.748050	0.515870	0.056486	0.280504	0.830612
18	0.800975	0.893252	0.669578	0.262974	0.054854	0.201724	0.855442

19	0.619266	0.786807	0.597010	0.213016	0.047468	0.185315	0.905896
20	0.732264	0.855458	0.645056	0.351080	0.047573	0.212432	0.890023
21	0.644036	0.801182	0.624733	0.510479	0.044744	0.249770	0.912536
22	0.600192	0.774678	0.626587	0.527172	0.046562	0.263399	0.918367
23	0.568123	0.753451	0.604042	0.470983	0.046902	0.236025	0.916797
24	0.528857	0.726850	0.567495	0.253405	0.041303	0.176308	0.912698
25	0.635242	0.796198	0.611066	0.250663	0.047702	0.162486	0.867347
26	0.848501	0.920464	0.692839	0.545401	0.049487	0.247908	0.785714
27	0.825449	0.908112	0.683857	0.543927	0.059045	0.256817	0.803340
28	0.781209	0.883680	0.685702	0.537594	0.063688	0.269065	0.823980
29	0.716298	0.845247	0.671424	0.316256	0.063255	0.221826	0.875696
30	0.645132	0.803067	0.649407	0.173330	0.055934	0.169815	0.897959
31	0.742730	0.861447	0.685285	0.246170	0.053612	0.183144	0.869202
32	0.887768	0.938362	0.708990	0.493457	0.053058	0.238831	0.843228
33	1.080020	1.038890	0.758450	0.626131	0.047742	0.275868	0.818182
34	1.103092	1.049959	0.777360	0.634417	0.051483	0.292090	0.808673
35	1.045706	1.022211	0.742871	0.531511	0.049635	0.277115	0.827458
36	1.161032	1.077512	0.783844	0.439583	0.053150	0.257426	0.816327

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.