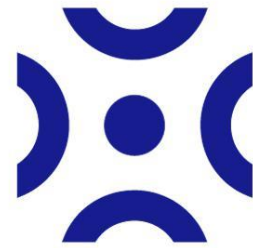


▼ Management of project report

Supervised by: Dr. Sebastian HORL

Elaborated by: Aissaoui Ilhem M2 SIA

Gustave Eiffel University



▼ Climate Change

Global warming analysis & predictions

Huge fires raged this summer on the island of Evia and elsewhere in Greece, Turkey, Morocco, Algeria, Spain, Italy, Siberia, Scandinavia and California, among others, have also been hit hard by forest fires. Because of the drought and rising temperatures, there are more and more mega-fires destroying entire regions and millions of hectares of forests. Many scientists assume that this fire is clearly related to climate change, and these conditions will result in more vegetation drying out, and therefore more intense and harder to control fires. After this giant fire that devastated various regions in the world, and destroyed thousands of hectares of forests, I decided to take a look to the global temperatures and how exactly are they evolving and have been evolving during the years.

Questions

- Is there a global warming?
- When did Global Warming Started?
- What is the trend of temperature change in the world?
- What are the most countries that suffer from temperature increasing ?
- Interactive Map of the countries - Temperature increase over the years

In this project i will analyse The Climate Change Open Data from Kaggle to study the Earth's temperature.

Dataset

I used a open data set (Climate Change: Earth Surface Temperature Data) from Kaggle website, you can find the link below:

- <https://www.kaggle.com/berkeleyearth/climate-change-earth-surface-temperature-data?select=GlobalTemperatures.csv>
- <https://www.kaggle.com/berkeleyearth/climate-change-earth-surface-temperature-data?select=GlobalLandTemperaturesByCity.csv>

I used also the data set of country and continents code (Country Mapping - ISO, Continent, Region)

<https://www.kaggle.com/andradaolteanu/country-mapping-iso-continent-region?select=continents2.csv>

Languages and libraries

In my case i use a **jupyter notebook**, that is an open-source web application that allows you to create and share documents that contain live code, equations, visualizations and narrative text. I run a jupyter in Google Colaboratory, often shortened to "**Colab**", that allows you to write and execute Python code in your browser. It offers the following advantages: No configuration required, free access to GPUs, easy sharing. I used **python** as a programming language. Library **Panda** hat helps you load the data, prepare it and perform some lightweight analysis. I used **Numpy** - a library that lets you run blazing fast computation with vectors, matrices and other tensors. For visualization, i used **matplotlib** library, it allow you to write complicated stuff with convenience (e.g. super-detailed plots or custom animations), **Plotly** and **Seabon** library to make interactive graphs.

Import libraries

Go to colab website <https://colab.research.google.com/>, login with your Google account, and create new notebook File -> new Notebook, after that click + Code , and write the line of code below to import libraries.

▼ Load Dataset

- Download the dataset from Kaggle website with links listed above (in Dataset section). Install
- Drive by clicking into install drive icon in right sidebar of your colab notebook: Files - > install drive icon (in top of sidebar).
- Upload your data under Colab notebooks folder in your drive. or To upload from your local, start with the following code:

It will prompt you to select a file. Click on "Choose Files" then select and upload the file. Wait for the file to be 100% uploaded. You should see the name of the file once Colab has uploaded it.

Finally, type in the following code to import it into a dataframe (make sure the filename matches the name of the uploaded file)

```
from google.colab import files
uploaded = files.upload()
```

Data processing



Let check the missing value

```
data.isna().sum() # there are 1200 missing values for Max, Min and Land&Ocean Average Temp
```

▼ Assumed that, the missing values are not significant in our dataset

- Because data is missing in chunks
 - We are dealing with time series data
- we will drop all rows that have at least one missing value

```
data.dropna(axis = 0, inplace = True)
```

▼ Convert dt column elements to datetime object

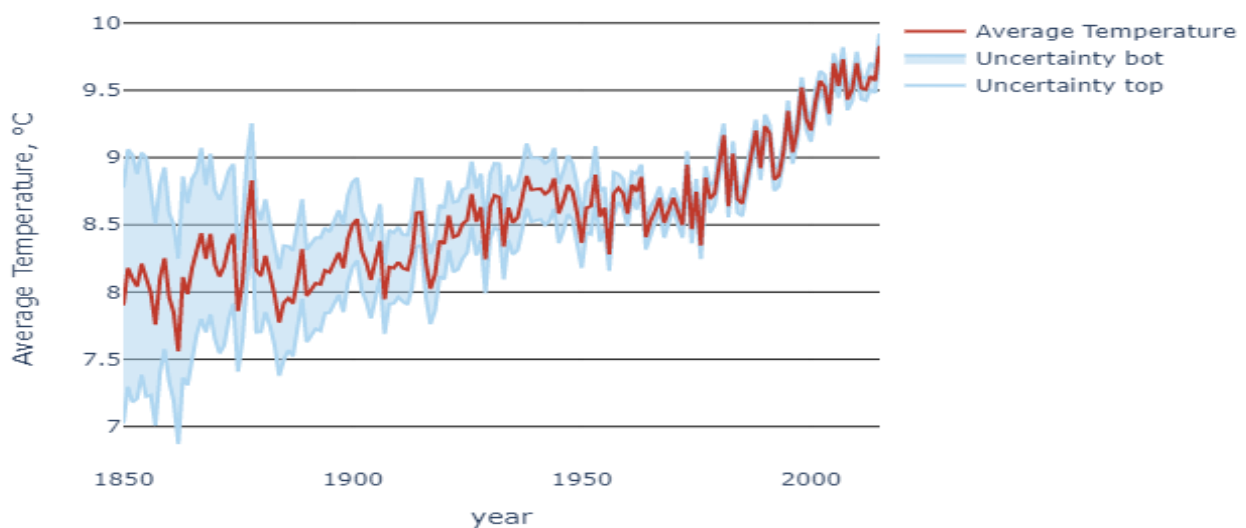
```
data.dt = pd.to_datetime(data.dt, format='%Y-%m-%d') # converted all dates to the same form
```

Data analysis

▼ I. Is there a global warming?

We began with variable **Land Average Temperature**, this variable is going so far in time, it helps us to show the change of temperature in years. I extract the year from the date, after that I plot the land average temperature and I fill the average uncertainty temperature to the top line and the bot line.

Land Average Temperature in the world from 1850 to 2015



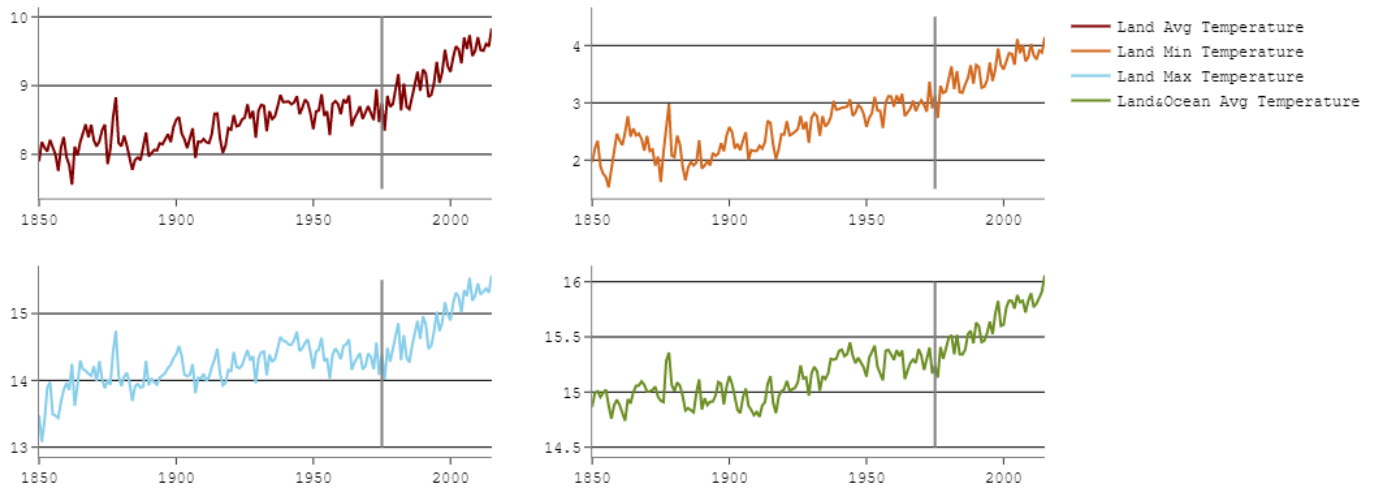
From the charts you'll see, that there's worldwide warming these days. The average temperature of Soil surface has the most noteworthy esteem within the fnal three centuries. The quickest temperature development happened within the fnal 30 a long time! This charts to have certainty interims, which appears that estimation of temperature has gotten to be more precise within the final flew a long time.

II. When did Global Warming Started?



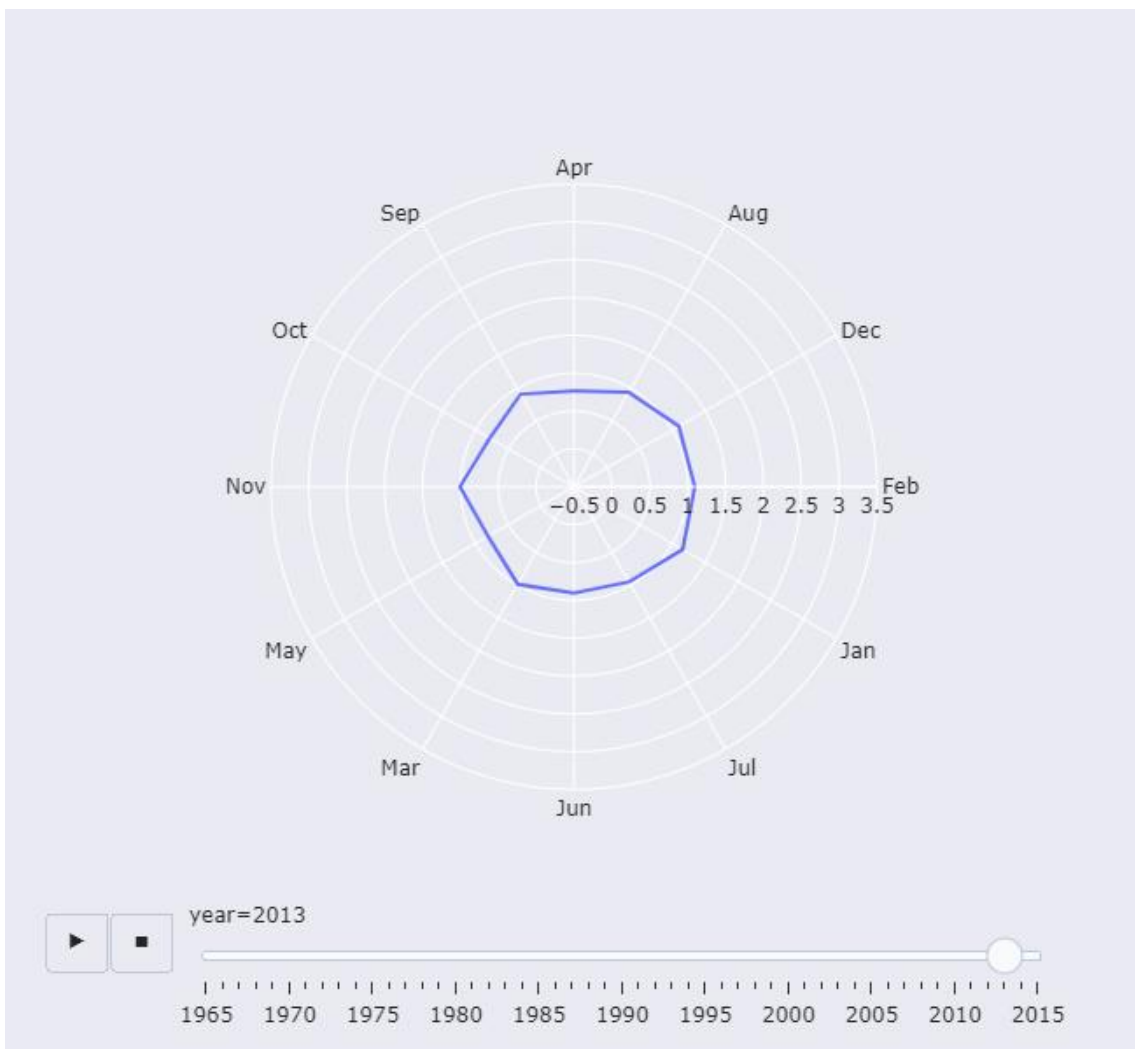
I make the graph with subplot to visualize the difference average mesure(land average temperature, land min temperature, land max average temperature and ocean average temperature) over the years. The increase on all levels, in both land and ocean almost mirror one another. No doubt the Industrial Revolution had an effect between 1900 and 1975, but combining with the **population increase** that started to surge somewhere in 1975 (from ~2.5 bill in 1950 to 5 bill in 2000) created a much bigger **negative contribution** to the overall global warming state.

When the global warming started?



▼ III. What is the trend of temperature change in the world?

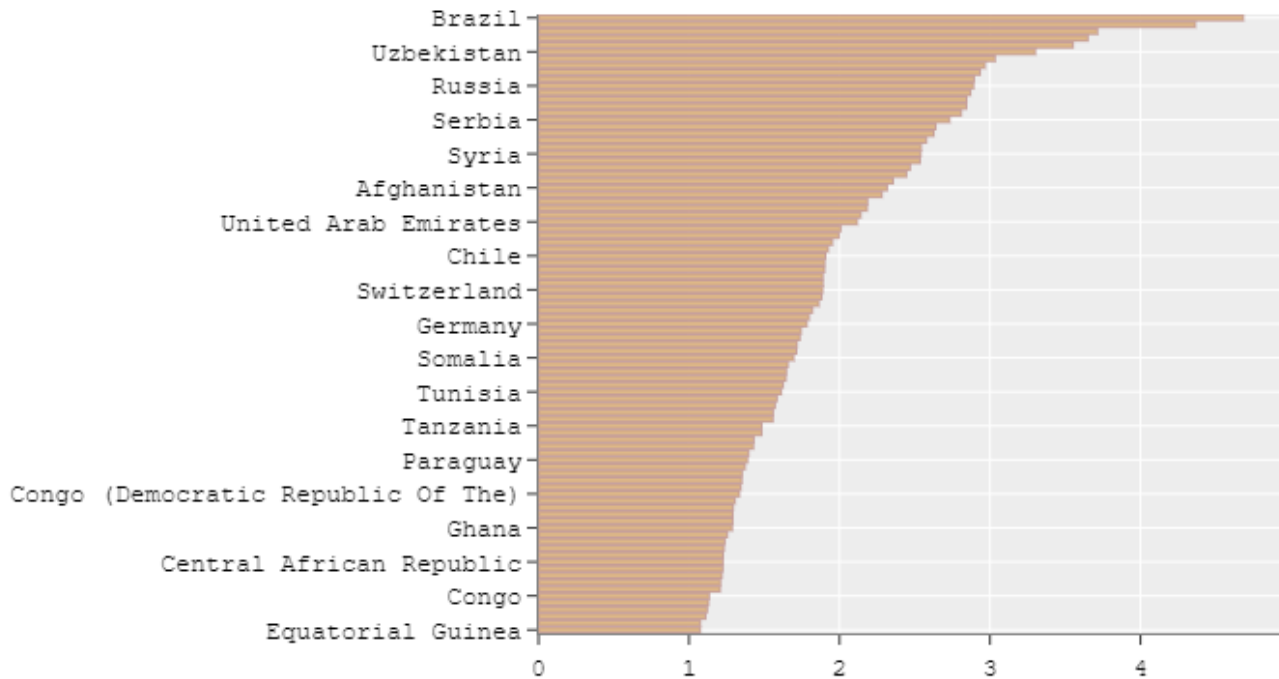
I wanted to investigate how many historical records had in this decade to learn if global warming more rapid last decade. I selected 'World' records from 'Country Name' column. Then, I chose only monthly basis temperature change values and whole world records. Result shows that already eight of the ten years in the current decade (2010–2015) were among the ten hottest years on record in terms of mean annual temperatures. Additionally, Radar chart clearly shows how temperature change increased day by day.



▼ IV. What are the most countries that suffer from temperature increasing?

To realize this analysis, I make a join the continents dataset with average temperature by country, i groupe the data by country, year, latitude and longitude, after that i calculate the difference between the max and the mean to show the degree of the increase of temperature.

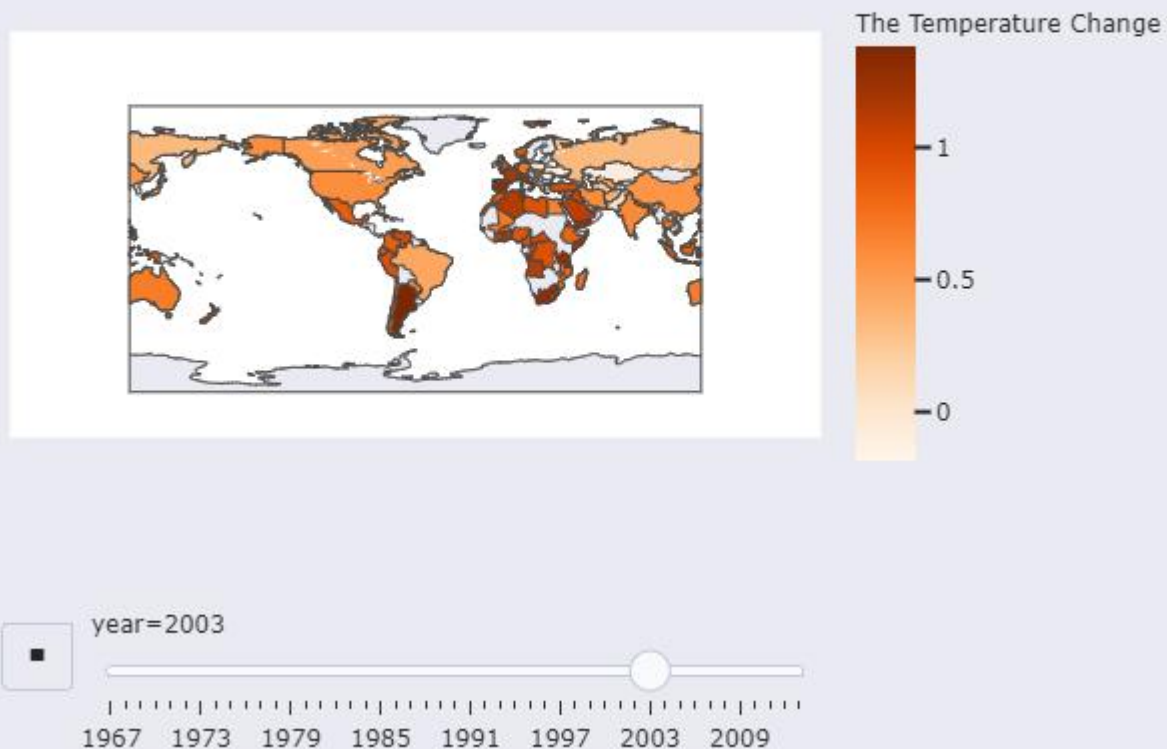
Difference in Temperature (Countries) between the mean and the max



▼ IV. Interactive Map of the countries - Temperature increase over the years

The standard metric of temperature change is the level associated with devastating impacts. We have 1.5° C the level associated with less devastating impacts than higher levels of global warming beyond 1.5°C increasingly severe and expensive impacts. To get this value from our dataset, I calculate the difference of average temperature between the year and the next year group by countries. I make a interactive map of countries to better visualize the change over the years.

Temperature Change - 1967 - 2015



Conclusion

In this the project, I examined how global surface temperature change between 1860 to 2015. According to my guiding question answers, when examining the top areas that have the highest temperature change in the last decade are mostly industrialized countries. Additionally, I found that temperature increased every ten decades, and the last decade can count as the hottest decade. Finally, I tried to show how temperature is increasing worldwide as a proof of global warming.