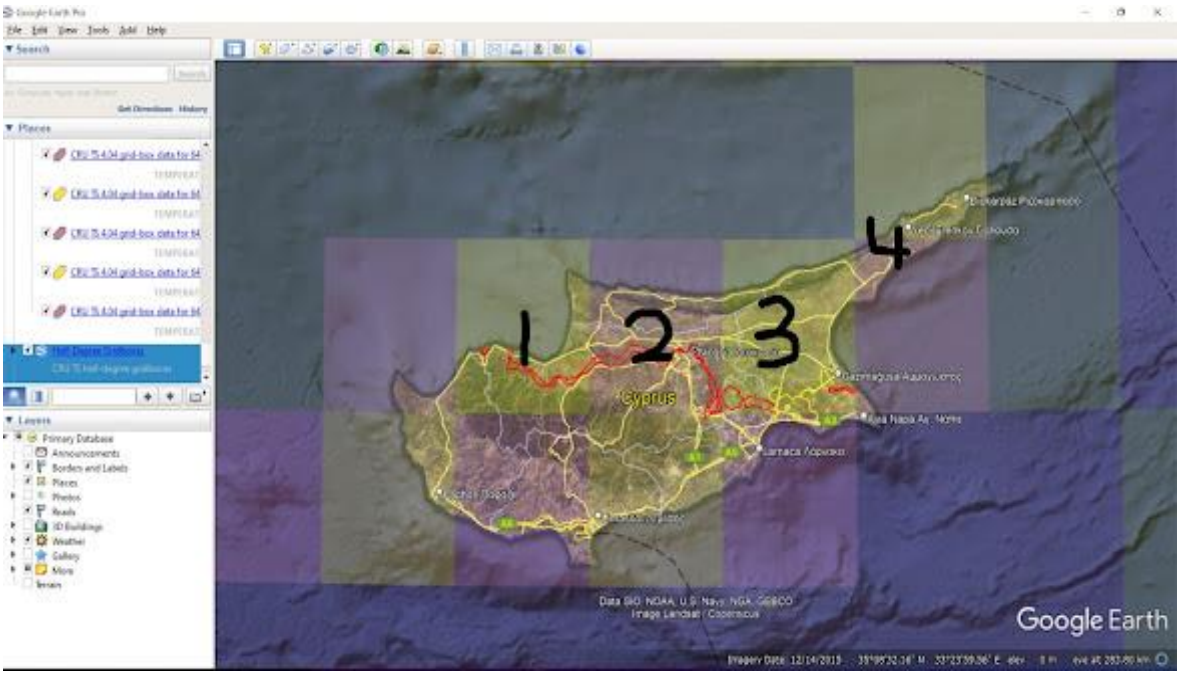
So Close to Point Of No Return…

After spending two winters in Netherlands, it was good to be back in Cyprus. However, I felt a bit different. Weather characteristics seemed a bit odd to me. The first thing I did was to check the Facebook memories. I found lots of pictures of me while doing sports. When I compare some pictures with today's conditions, the picture became more clear. For example, I was wearing a long bike jersey and shorts in 2017 whereas I was wearing short bike jersey and shorts this year, at the same date. This impression turned to be an awarness.

I wrote my Msc thesis on impact of climate change on electricity consumption. I have been aware of the situation for a long time, but I never face it like that. I think that the story can be explained by boiling frog syndrome. Boiling frog syndrome is a metaphor used to describe the failure to act against a problematic situation which will increase in severity until reaching catastrophic proportions. (Wikipedia definition). For my case, if I never leave the island, I probably do not aware of different weather characteristics until it gets the worst point. However, spending 2 winters in a different climate causes me to feel the difference(even it is a small difference). Therefore, I decided to use my data analytical skills for deep understanding of the change in Cyprus. I started the project by searching data sources. After a research on internet, I found Climate

Research Unit Database by University of East Anglia(Website of the unit). It provides mean temperature, temperature range, vapor pressure and precipitation of given grids on Google Earth (Figure 1). Even though this database provides useful variables and a big time range, there are no contributing stations on the island and number of observations for each month are around 8-10. This can be seen two drawbacks of the data but I think that the effect of these drawbacks are small. There are 38 contributing stations on other countries around the island. In addition, from an optimistic view, 8-10 observations mean that they gather data every 3 days in a month which is not that bad at all.



Since my home is at the North-West of the island, I decided to pick 4 areas on the same latitude. Therefore, the areas include Morhpou-Lefka(1), Nicosia-Kyrenia (2), Famagusta-Mesaoria-Akanthou (3) and Karpasia-Vokoldia (4).

Before the visualization process in Tableau, I prepared the data in Python.

Data Preparation Process

I gathered data from the Goole Earth extension of CRU TS 4.0.4 (Data Source). Then, I used Python for merging datasets, assigning variables and making visualizations for checking. Firstly, I merged 4 different datasets which are for each variable for each region using outer join. Then, I assigned a date variable, and edit names of other variables. Finally, I made time series visualizations for checking any error possible. You can check the code from my Github.

Main Story

I am using 4 dashboards to tell the story. Figure 3 is the first and main one whereas Figure 4,5 and 6 are side ones. Figure 3 aims to show the change in variables over time. On the other hand, Figure 4,5 and 6 aim to show the relationship between variables in every area. Although images are small, you can zoom, visit my Tableau profile from Link or click the link below the figures.

To begin with, statistics came up as expected. Mean temperature shows an increease around 2 degrees celcius compared to begining of 20th century for all areas. More specifically, the hottest area is Nicosia-Kyrenia. It is followed by Famagusta-Mesaoria-Akanthou. Then, Morphou-Lefka and Karpasia-Vokoldia are very close to each other. There is almost 0.5 celcius degrees difference between Nicosia-Kyrenia and Morphou-Lefka and Karpasia-Vokoldia.

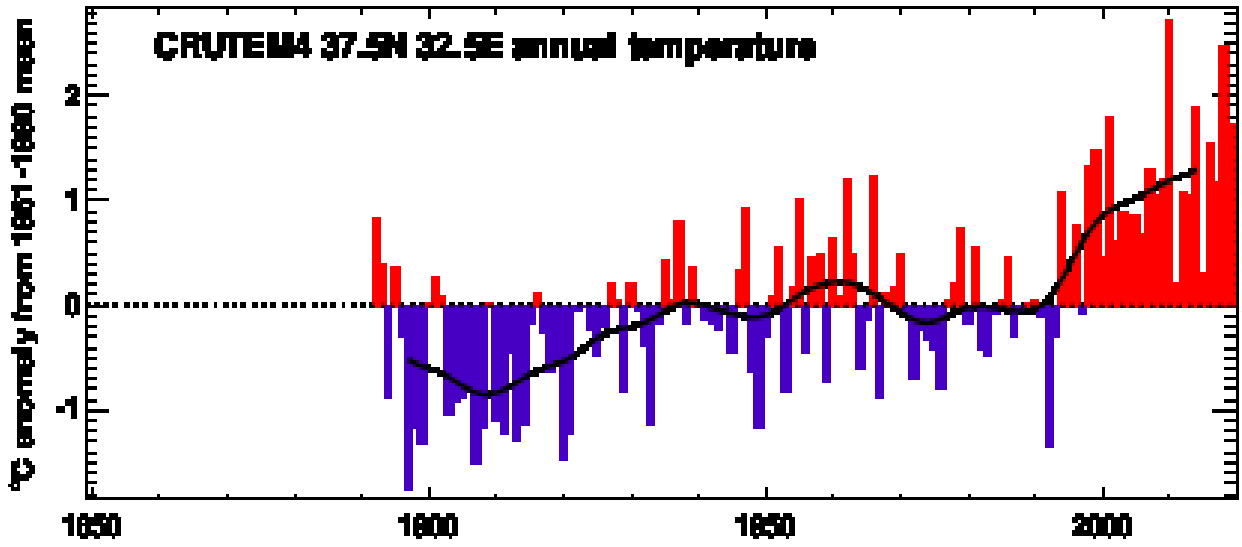


Figure 2
CRUTEM 4

Figure 2 shows the temperature anomaly based on 1800-1880 mean temperature. It should be noted that data of this figure covers the some parts of other countries and the island, including areas used in this project. A sharp increase can be seen after 2000. There are also 2 outliers above 2°C.This indicates how Cyprus got warmer after 2000.

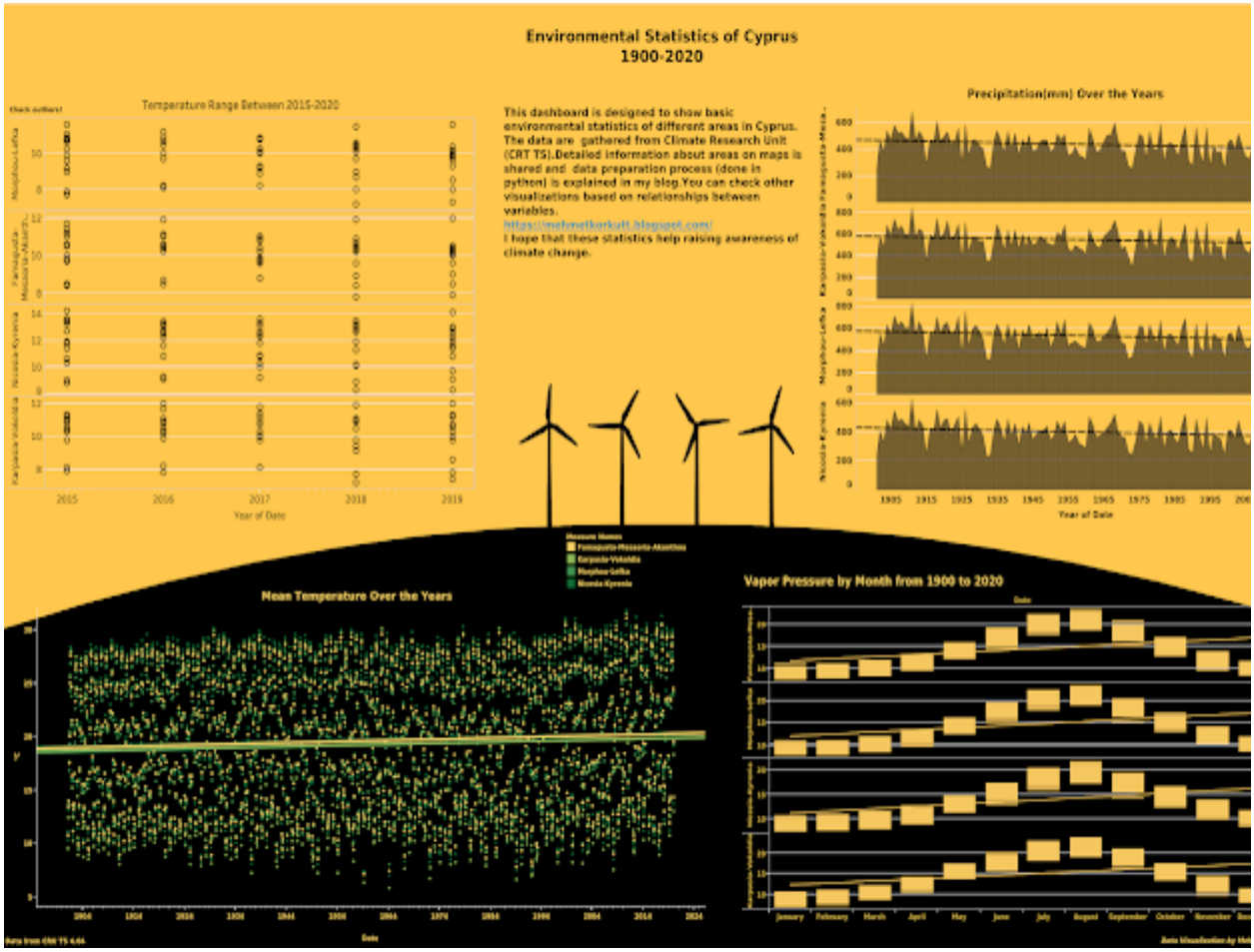


Figure 3(Link)

The graph on the top left of the dashboard shows temperature range of each region in the past 5 years. You may ask what temperature range is. It is the difference between maximum and minimum temperature in a day. In this graph, monthly temperature range is shown. Therefore, long-term mean of daily difference between maximum and minimum air temperature is used.

Since all of these graphs are connected to each other, you can associate the numbers in this graph to other figures. For instance, according to top left graph, Nicosia-Kyrenia area has the highest temperature range (14.6). On the other hand, it has also highest mean temperature and lowest precipitation. The reason why I put statistics of the past 5 years is to show outliers for every area in different years. If you look at closely, you can see the different characteristics of every area in terms of values.

The graph on the top right shows the total precipitation from 1900 to 2020. It has volatility so we cannot talk about a continuous trend here. However, the trend line demonstrates the decrease over the years. In the past decade, Karpasia-Vokoldia was the most rainy area whereas Morphou-Lefka followed it by a deficit around 70-100 mm.

Finally, the graph on the bottom left shows the vapor pressure of every month from 1900 to 2020. I am not an expert on this subject but I know that when the vapor pressure

is low, the air is free to rise into atmosphere. Then, it cools and condenses so water vapor in clouds falls as rain. In other words, when vapor pressure is high, there is no rain, vice versa. The graph supports this argument. According to the graph, summer months has higher vapor pressures. It should be bearing in mind that trend line shows an increase over the years. This inference can also be made from precipitation graph which shows diminishing rain.

Relationships

Dashboards in this section are made to analyze relationship between variables and to compare this relationship between areas.

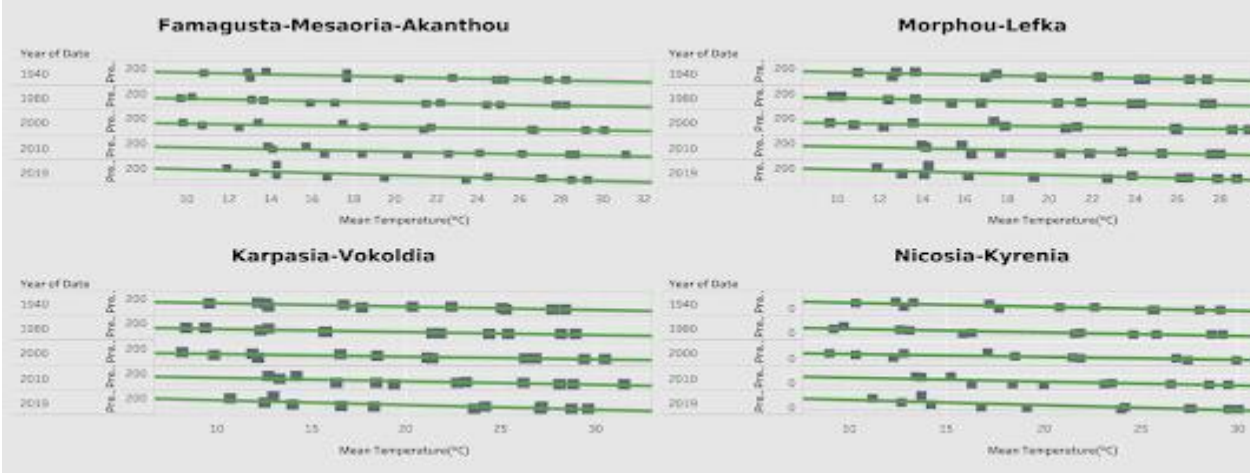


Figure 4 (Link)

Although climate models indicate that rising temperatures will strengthen Earth's water cycle which leads to increasing evaporation, it also contributes to drying over some land areas. Therefore, storm-affected areas are likely to experience increases in precipitation and increased risk of flooding , while areas located far away from storm tracks are likely to experience less precipitation and increased risk of drought, says NASA. Since there is a negative relationship between mean air temperature and precipitation on graph above, we can say that Cyprus is located away from storm tracks (at least most of the year)has a high possibility of drought.
The question which should be asked here is : Which area has the strongest relationship in this case? Karpasia-Vokoldia and Morphou-Lefka had a strong battle for first place. Although Morphou-Lefka area kept first place for a long time, Karpasia-Vokoldia won the battle in 2019. However, it should be noted that they are very close to each other. The other question should be ask here can be "Why this relationship has gotten stronger over the years?". Before my opinion, I would like to explain what getting stronger is in this case. It means that an increase in mean temperature causes precipitation to decrease more and more while years were passing. From my point of view, the effect of increasing mean temperature overcame the decrease in precipitation and this lead to higher negative slope on trend line.

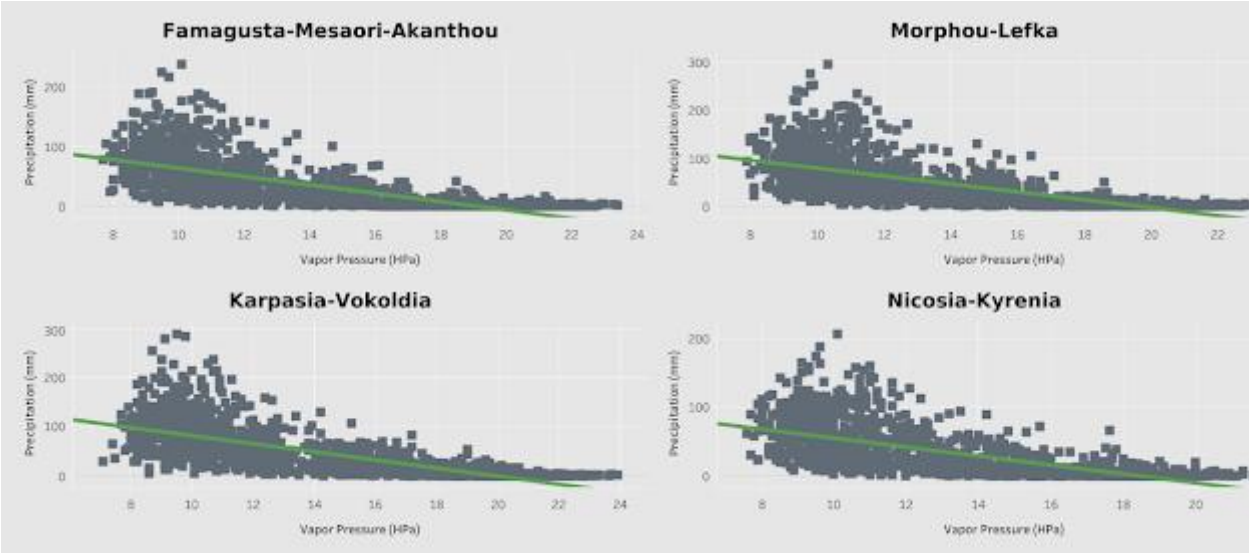


Figure 5 (Link)

When water vapour pressure is low, air is free to rise into atmosphere where it cools and condenses. This condensation forms clouds made of water droplets and ice crystals around dust particles in the sky. Eventually the water vapor in the clouds condenses and falls as rain (Morgan L,2018,link). Figure 5 is the proof of this explanation. Most of the squares with high precipitation numbers are at the left of graph where vapor pressure is pretty low.

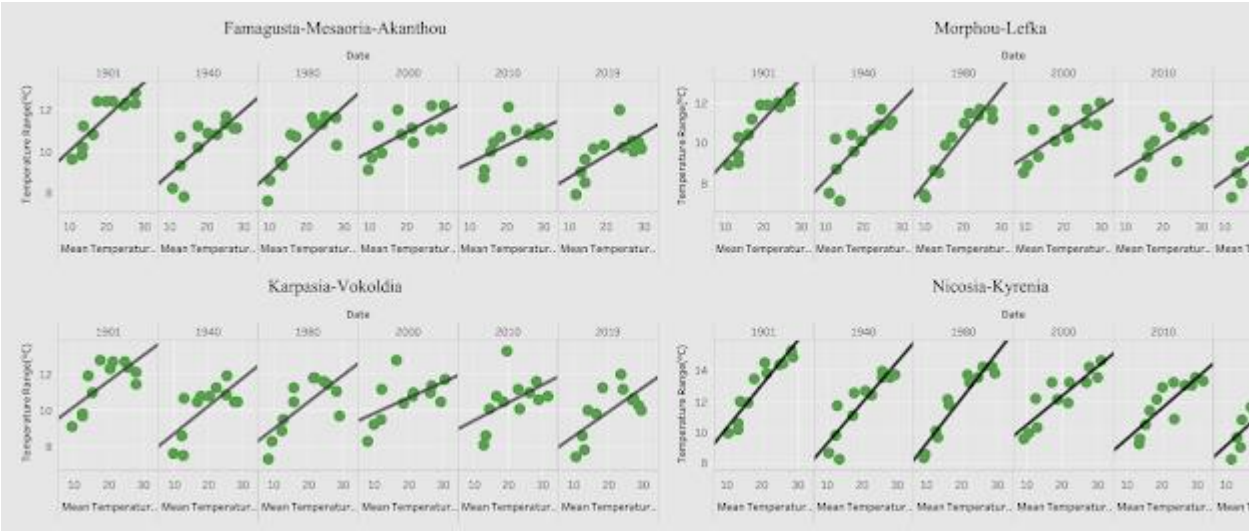


Figure 6 (Link)

When you see Figure 6, first thing come to your mind might be reproaching. You may think that putting this graph here does not make any sense. However, we can get something out of it. We all think that when there is an increase in mean temperature, this opens the range of temperature. In other words, it causes temperature range to increase as well. I think this is true. It should be bearing in mind that there are three possibilites for bigger temperature range. First one includes higher maximum temperature with a minimum temperature which has an increase lower than maximum

temperature or is same. Second one includes lower minimum temperature with a maximum temperature which has a decrease lower than minimum temperature or is same. We can eliminate second possibility because it decreases mean temperature but we have higher mean temperatures over the years. Third possibility is that we have an increase at maximum temperature and decrease in minimum temperature at the same time. This is another strong possibility that might happened. I explained this to make you think a little bit. If we come back to our graph, let's ask a question : Why the relationship between temperature range and mean temperature became less stronger between 1980 and 2010? (It should be noted that the 2019's relationship level is close to 1980's). Let's answer this question with our beloved possibility. Since there are some outliers between 1980-2010, we have an increase in maximum temperature. (Please check graphs in detail from the link below Figure6). On the other hand, minimum temperature is higher or still the same. This is a situation from the first possibility. It can be explained with the fact that the power of maximum temperature's higher effect (compared to minimum temperature's effect) on temperature range decreased between those years. If we look at the variation of data points, they vary less in 2000 and 2010. Therefore, this keeps mean temperature higher because they are like a group at the middle of the graph. When mean temperature is more closer to maximum temperature, the effect of maximum temperature for moving mean temperature decreases. Consequently, slope of the graph decreases. In other words, we have a less steeper trend line.
Note : I wrote this part immediately after thinking about the details in graph. It can be partly true or wrong. What I want you to do is to think and examine my thoughts and tell my mistakes. The right information grows as we share our views and question everything.

Last Words and Lessons to be Learned

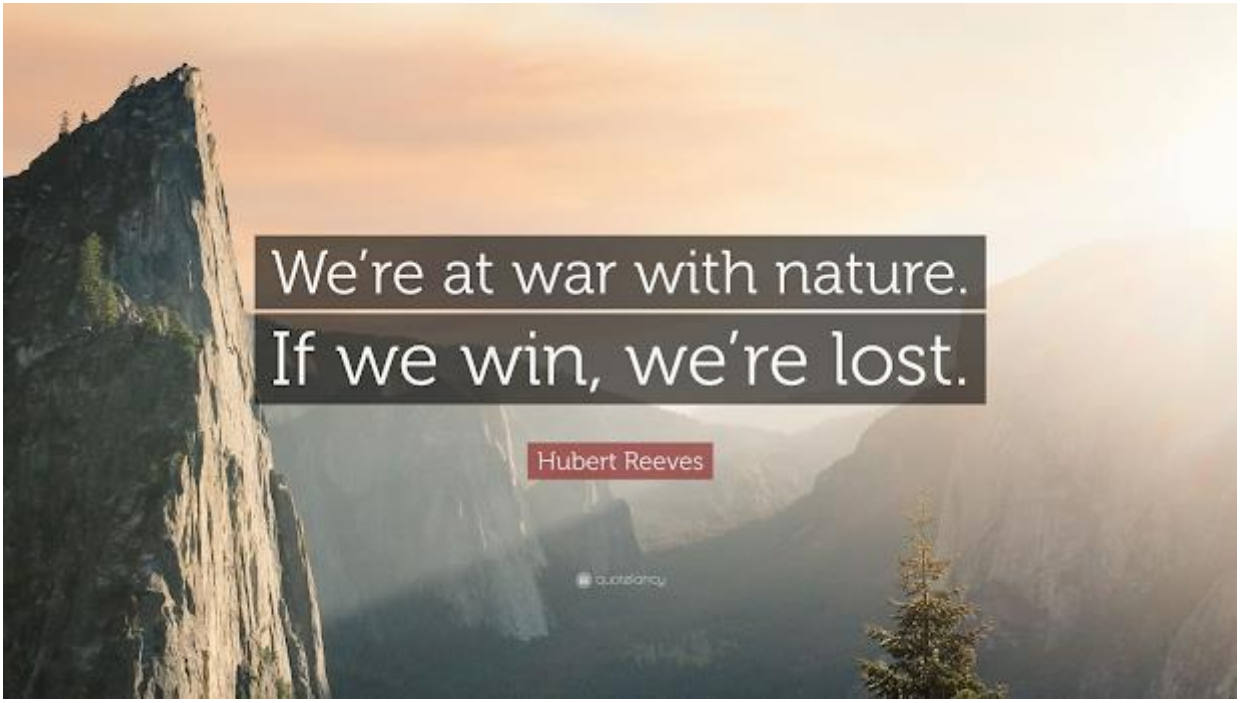
I know that there are a lot of information on visualizations to write about for pages and pages. However, I did this project and kept it small for several reasons. Firstly, I wanted to satisfy my curiosity by checking numbers. Secondly, I wanted to practice data analytics, especially Tableau because I learnt it recently. Thirdly, I want to help for awakening people about this situation. If I want to make them read, I shouldnt bore them. That is why I give links to graphs for better analysis.

In my opinion, we are very close to point of no return. Next decade is very cruical. If everyone behave more responsible every day, this might be a big step. On the other hand, governments must implement green policies based on data. I am planning to write another blog post about what policies governments can implement and why. For example, I read that Hungarian government aimed to convert all public transport wehicles to electric vehicles. I know that there are panels which governments participate for finding solution to climate crisis. I am following these very closely.

Before telling something about Cyprus, I want to say that numbers do not lie. Our island's situation is worse than I thought. Immediate actions should be taken by government and citizens. I hope that this will happen in future. I hope that his blog post makes you think and act about climate change.

If there are any questions,suggestions or criticsm in your mind or you see mistakes, please let me know.

Thank you for reading!



Source suggestions (You can add extra sources to the comments!)
https://climate.nasa.gov/vital-signs/global-temperature/
https://www.ipcc.ch/report/sixth-assessment-report-working-group-ii/