Report

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TITLE: ANALYSIS AND VISUALISATION OF GLOBAL CHANGES

MOTIVATION: Since last few decades our earth has undergone many changes .Temperature of globe is raising observably and it has caused many changes like melting of ice in arctic and Antarctic regions which has led to raising of sea levels these are causing climate changes.it is important to concern ourselves with this global phenomenon and predict the massive consequences that can occur in future.

PROBLEM STATEMENT: Our objective is to analyse and visualise the global changes like increase of temperature, rise of sea levels,melting of arctic and Antarctic ice, increase of level of co2 in atmosphere and also to find the correlation between temperature and global warming gases like co2, hcfcs,no2, ch4.

CONTRIBUTION:

OBJECTIVE 1: To find the correlation between temperature and global warming gases.

DATA COLLECTION:

we collected the following two datasets of excel type from Kaggle.

1) pollution data set-https://www.kaggle.com/berkeleyearth/climate-change-earth-surface-temperature-data

2)temperature data set-https://www.kaggle.com/berkeleyearth/climate-change-earth-surface-temperature-data

First dataset comprises of observed values of concentrations of global warming gases co2,no2,hcfcs,ch4 corresponding to place and date.

Second dataset comprises of observed values of temperature corresponding to place and date.

DATA PREPROCESSING:

We cleaned the two datasets and dropped the unnecessary columns and deleted the rows and columns with NAN values. we did some processing to convert “data local” column in dataset to pandas data time format so that I can treat the values in columns as date time objects.

PROCESSING:

The pollution dataset comprises of observed values co2, no2 , ch4, hcfcs at different cities for different days .we decided to find correlation between temperature and global warming gases only for new York city. So we wanted to create a new data frame comprising values of co2,no2,ch4,hcfcs,temperature and corresponding year only of new York city. So we extracted the data from two datasets by cleaning dropping and merged them into a data frame.

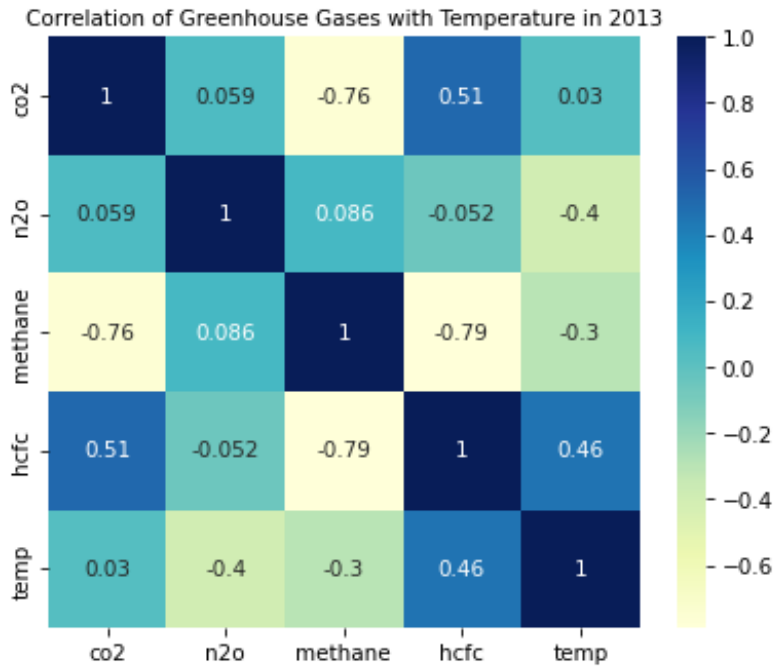
We normalised all the values in data frame by using min-max method.

$$X\ (normalised)=x\text{-}x(min)/x(max)\text{-}x(min)$$

Then we used pearson correalation coffecient for finding the correlation between each of global warming gases and temperature .

Pearson correlation coffecient is a number lying between -1 to 1.This number describes to what extent and how two variables are related.A positive coefficient(negative) indicates that two variables are positively(negative) correleated that is increase in one variable is associated with increase in other variable.

For easy understanding we visualised the correalations using heatmap.



HEATMAP OF CORREALATIONS

OBJECTIVE 2: To visualise the global changes

DATA COLLECTION:

1) Global Annual mean temperature - https://climate.nasa.gov/

2) Sea levels- https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level

3) Global co2-https://gml.noaa.gov/obop/mlo/aboutus/aboutus.html

4) methane- https://gml.noaa.gov/ccgg/trends_ch4/

5)Artic ice - https://climate.nasa.gov/

6)Antarctic ice - https://climate.nasa.gov/

7)ocean temperature- https://www.climate.gov/news-features/understanding-climate/climate-change-ocean-heat-content

We collected all this data corresponding to years of measurement from kaggel.

We used plotly for visualizing and drawing insights from data.

Findings:

For objective 1:

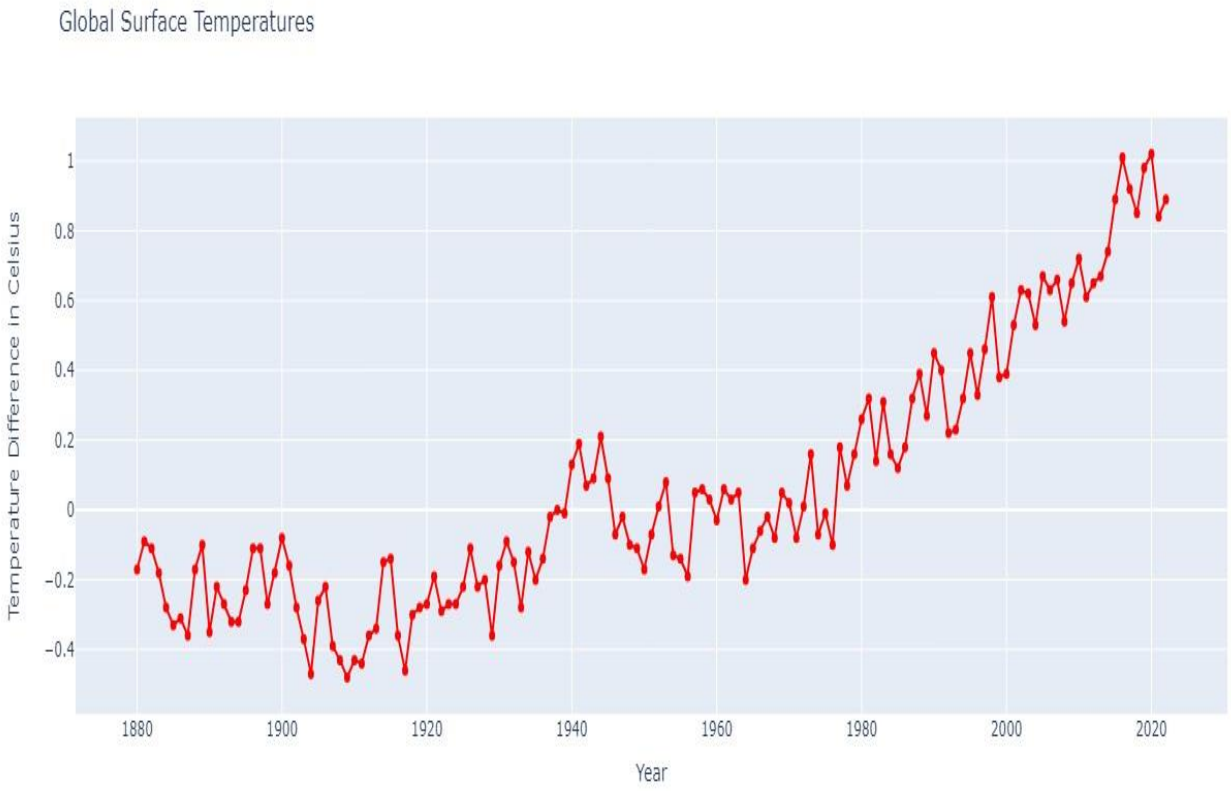
1)CO2, hcfcs are positively correlated with respect to temperature for our data with 0.03,0.46 as correlation coffecients respectively.

2) No2, Ch4 are negatively correlated with respect to temperature for our data with -0.4,-0.3as correlation coffecients respectively.

3)Among all global warming gases hcfcs are highly correlated to temperature.

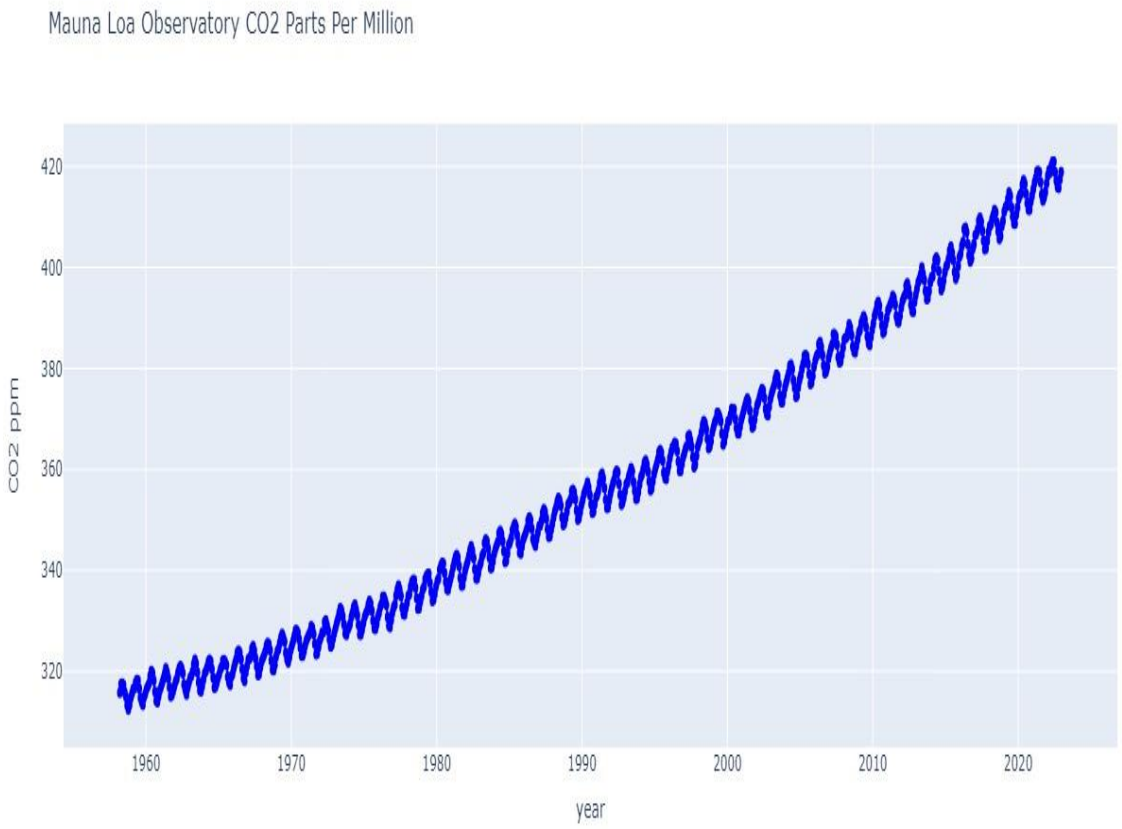
For objective 2:

1) From the plot of global temperature change where we plotted the change in global temperature compared to long term average from 1951-1980 corresponding to each year we found that change remained negative from 1880 to 1940
2) Temperature difference is mostly positive after 1940 and has increased.
3) Temperature difference has reached its maximum i.e 1 degree Celsius around 2020.

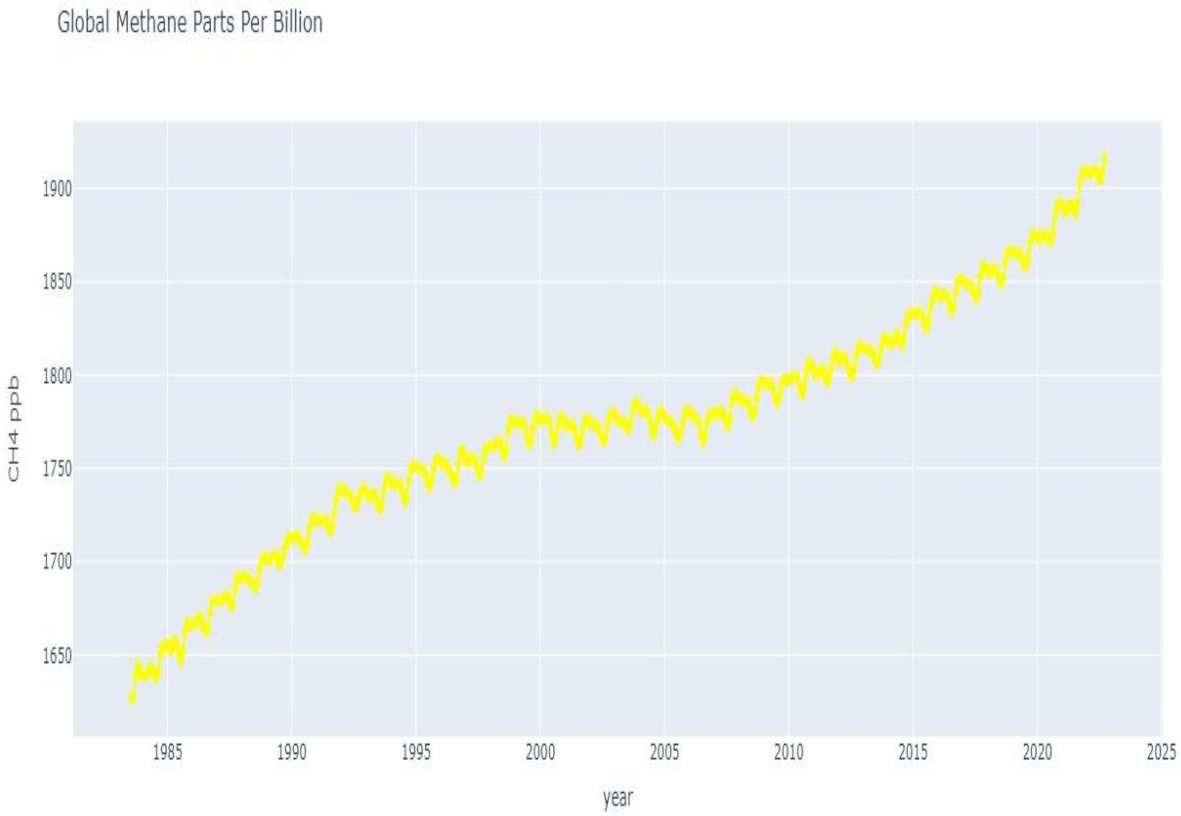


4)From the plot of global co2 vs year we found that co2 concentration in atmosphere has drastically increased

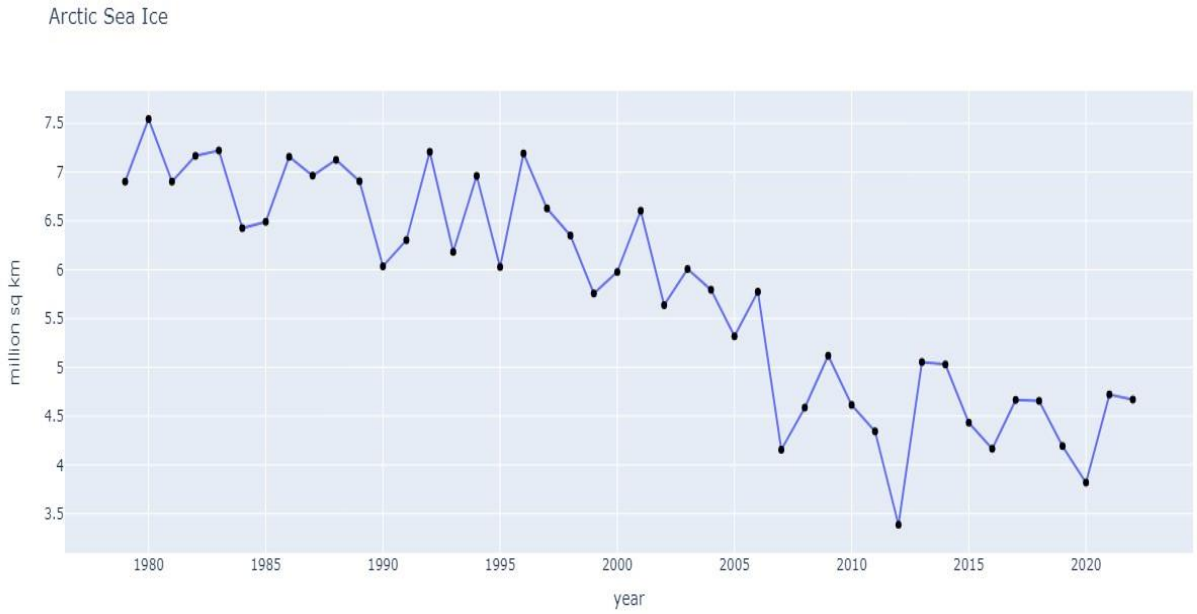
from320ppm in 1960 to 420 ppm in 2020.



5)From the plot of concentration of methane corresponding to measured years we found that level of methane in atmosphere has drastically increased from 1650ppb in 1985 to 1990ppb in 2020

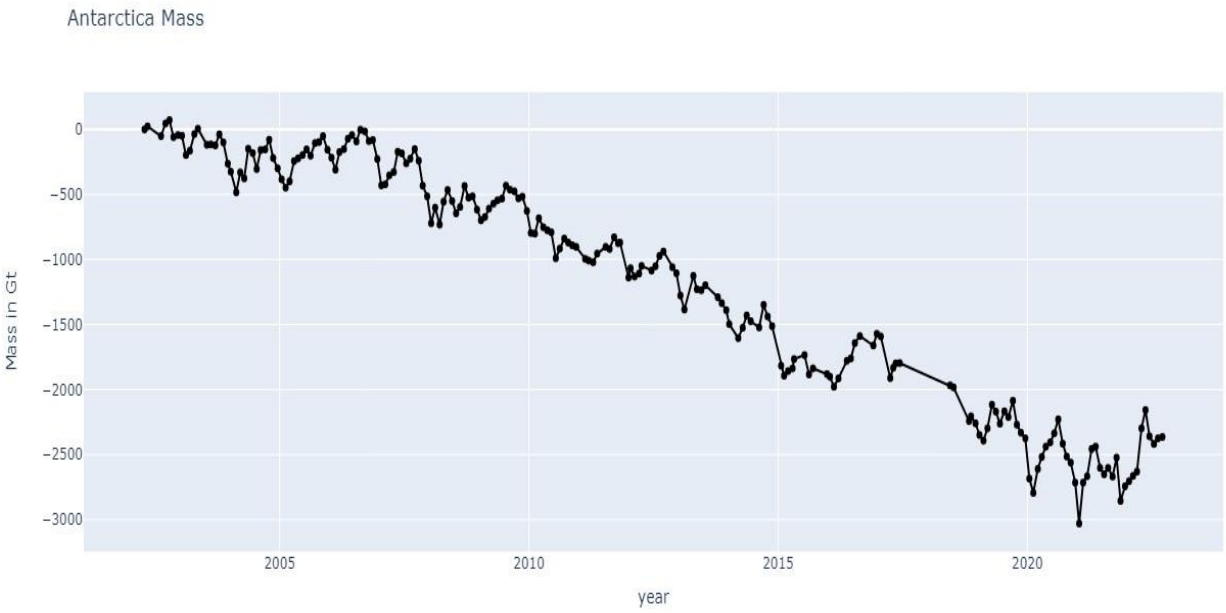


6)From the plot of arctic ice area vs year we found that from 1980 to 2020 area of ice varied between 3.5 to 7.5 million sq metresand and Area of ice has decreased over the past decades.Minimun area occurred between 2010-2015 and is less than 3.5 million sqm.we found that arctic ice has rapidly melted over the past years.

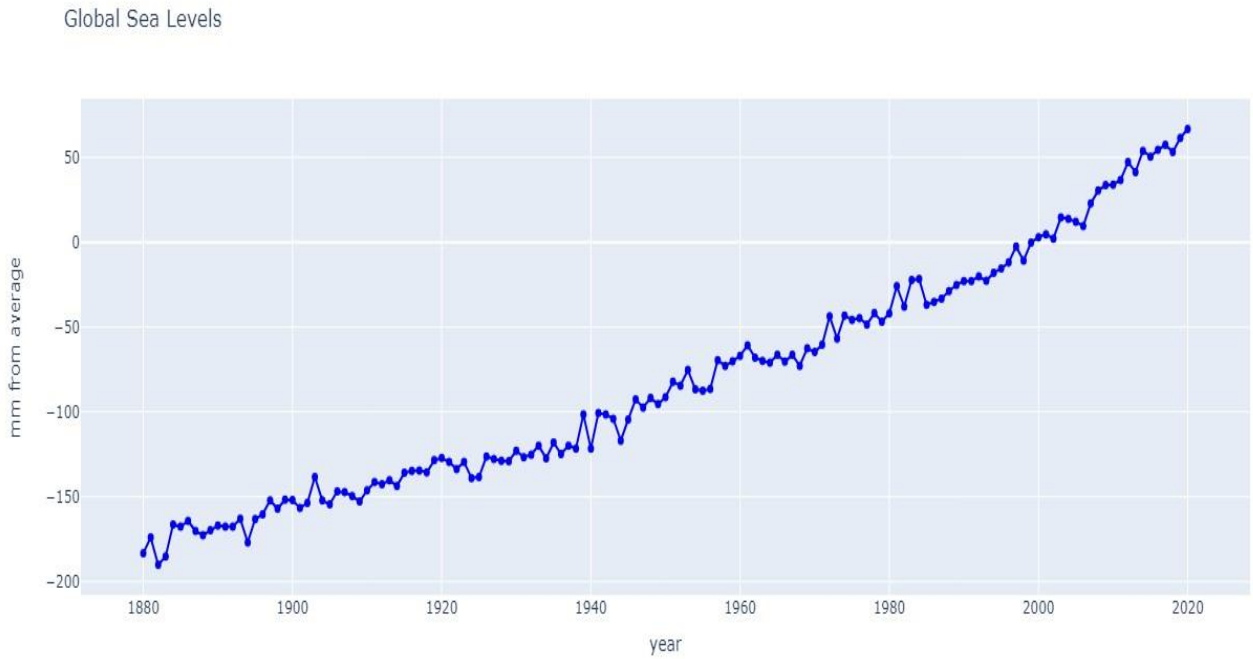


7)From the plot of antarctica mass loss(measured in gigatons)over years we found that measurements are always negative which is ice mass has always decreased and never once increased from 2002 to 2020.the mass loss has ranged btween 500 to 3000 gigatons and the

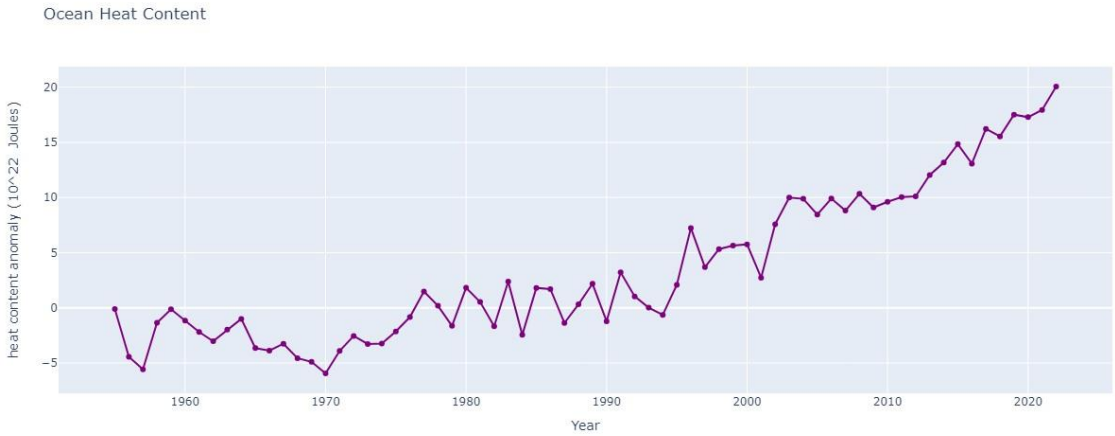
maximun loss of mass 3000 gigatons occurred after 2020.



8)From the plot of change of sea level(measured in mm)with respect to a reference point we found that change is negative from 1880 to 2000.After 2000 the change in sea level is always positive and has rapidly increased from 0 to 50 mm.



9)From the plot of change of heat content in oceans relative to the average of heat content measured from 1955 to 2006 we found that heat content is mostly negative till 1980.After 1995 heat content was always positive and has increased with years.



SUMMARY

This report titled "Analysis and Visualization of Global Changes" explores the important environmental changes occurring on Earth over the past few decades. Motivated by the observable rise in global temperatures and its consequences such as melting ice in the Arctic and Antarctic regions, leading to elevated sea levels and climate changes, the report aims to analyse and visualize key indicators, including temperature, global warming gases (CO2, HCFCS, NO2, CH4), and various environmental parameters. The first objective focuses on finding correlations between temperature and global warming gases, utilizing datasets from Kaggle, normalizing values, and employing Pearson correlation coefficients. The results indicate positive correlations between CO2 and HCFCS with temperature, while NO2 and CH4 show negative correlations. The second objective involves visualizing global changes using data collected from sources such as NASA, NOAA, and climate.gov. Findings reveal a historical negative trend in global temperature until 1940, followed by a consistent positive trend with a peak around 2020. Additionally,

alarming increases in atmospheric CO2 and methane concentrations, Arctic ice decline, Antarctic ice mass loss, rising sea levels, and ocean heat content highlight the urgent need for global attention to mitigate the impacts of climate change.