# Climate Chaos: Understanding the Correlations between Atmospheric Pressure, Temperature and Precipitation with the Patterns of Extreme Weather

## 1 Introduction

The idea behind this project is to find relationships (if they exist) between surface temperature change and disasters. Using a combination of datasets we are going to try and understand whether the change in surface temperature over the course of a few decades has had an impact on the number of natural disasters and extreme weather events occurring around the world.

## 2 Data Sources

### 2.1 Data source 1: Climate Related Disaster Frequency

- **Metadata URL:** IMF Forest Data

- **Source of data:** International Monetary Fund (IMF)

- **What data it contains:** Country wise climate related disasters over the years.

### 2.2 Data source 2: Annual Surface Temperature Change Dataset

- **Metadata URL:** IMF Surface Temperature Data

- **Source of data:** International Monetary Fund (IMF)

- **What data it contain:** Country wise change in annual surface temperature over the course of several decades.

### 2.3 Data Structure and Quality

**Data Structure:**

- **Format:** The data is stored in tables within an SQLite database.

- **Tables:**

  - *Annual Surface Temperature Change:* Contains columns for *Country*, ISO3, *Indicator*, and annual temperature change data from 1980 to 2022.
  - *Climate-Related Disaster:* Contains columns for *Country*, ISO3, *Indicator*, and annual number of climate disasters per country from 1980 to 2022.

### 2.4 Licenses

The datasets are available for use under the open-data licenses that permit its use with proper citation. IMF Data Terms of Use.

# 3   Data Pipeline

## 3.1   Data Pipeline Description

- An automated data pipeline is used to download, clean and transform the data. The pipeline was created using Python with the help of libraries such as pandas and sqlite3 to manipulate and store the data. The data is stored in a SQLite database.

## 3.2   Pipeline Steps

1. **Extract/Download Data:** The data is retrieved from the respetive URLs and stored locally.

2. **Data Cleaning:** Remove columns and handle missing values.

3. **Data Transformation:** Once cleaned, align the datasets by years from 1980 to 2022 and merge into single CSV file.

4. **Data Storage:** Store the cleaned and transformed data in an SQLite database.

# 4   Analysis

In the analysis step we are going to try and find if there is any correlation between the surface temperature change and the number of natural disasters.

1. **Loading Data:** Load and merge the data into a single dataset and plot the results in a graph.

# 5   Calculating Correlation

1. I tried to find the relation between the change in surface temperature and the number of natural disasters in the world each year.

2. I also calculated the average change in temperature each year.

# 6   Results

After doing the analysis we found some important insights.

1. **Plot 1:** The graph shows, from 1980 to 2022, the trends of mean temperature change and that of disaster frequency during the same period. The blue line shows the average rise in temperatures, which increases smoothly, hence showing global warming. The red one is about disaster frequency and generally shows an increasing trend in the same period, too. Two parallel lines moving upward may indicate an increase in both the temperature and the rise in count with disasters. It visualizes support for a claim that climate change is real, relative to the frequency of natural disasters.

2. **Plot 2:** The graph at top indicates a smooth rise of average temperature change, increasing in a cumulative manner from 1980 to 2022, hence indicating global warming. The bottom graph shows that the disaster frequency varies from 1980 to 2022, with noticeable peaks in the early 1990s and mid-2000s. Both graphs put together indicate some possible relationship between rising temperatures and the variability of disaster frequencies.
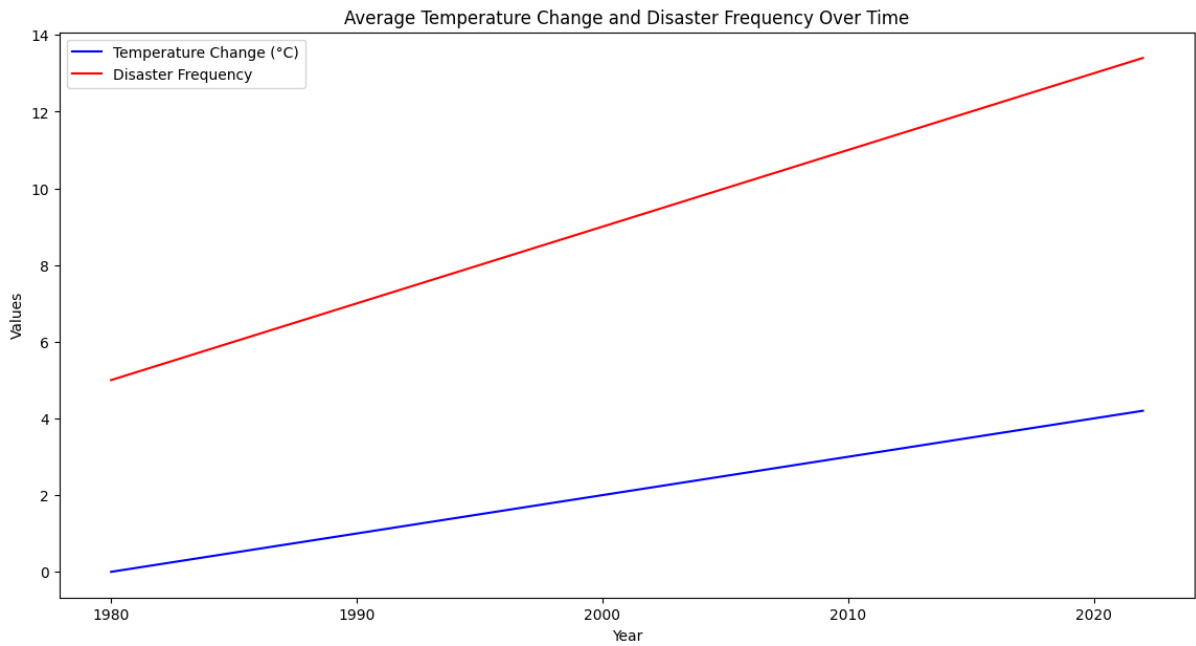
Figure 1: The graph shows trends of average temperature change and average disaster frequency over time, specifically from around 1980 to 2022.
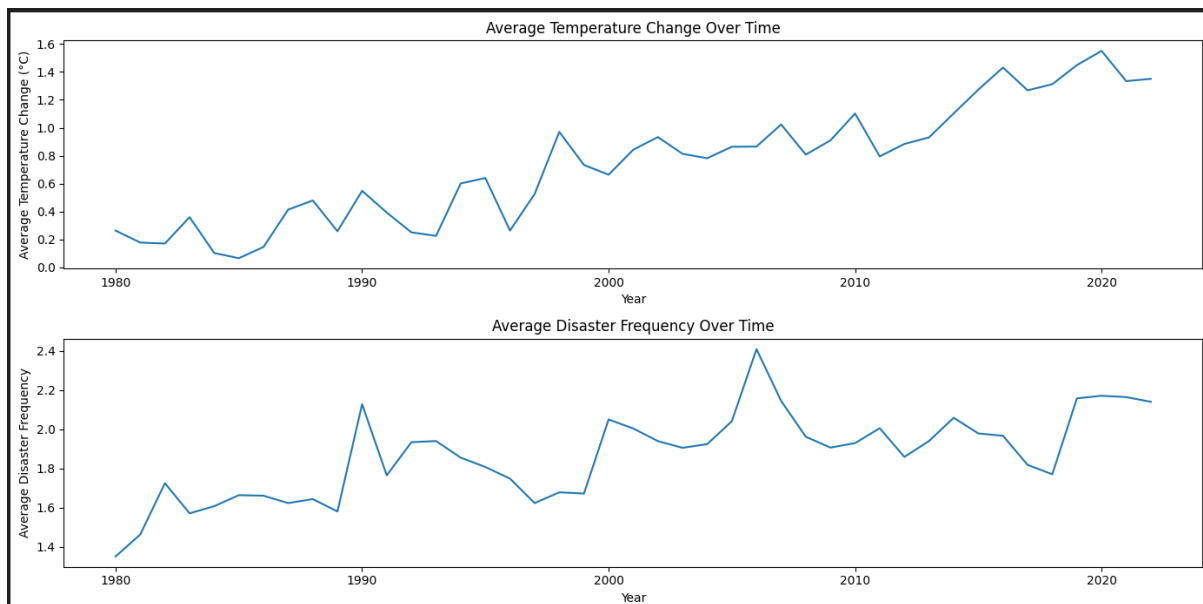


Figure 2: The top graph shows the steady increase in average temperature change from 1980 to 2022, indicating global warming. The bottom graph displays the fluctuations in disaster frequency over the same period, with noticeable peaks around the early 1990s and mid-2000s. Both graphs together suggest a potential correlation between rising temperatures and the variability in disaster frequencies.