



Climate Change Indicators

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About The data

- **Object Id** : Unique Identifiers given to each Country.
- **Country**: Name of the Country.
- **ISO2** : Gives two-letter country code (ISO 3166-1 alpha-2) for each country.
- **ISO3** : Gives three-letter country code (ISO 3166-1 alpha-3) for each country.
- **Temp _ Indicator** :Category of temperature change being measured related to a specific baseline Global Mean Surface Temperature of 15 degree Celsius.
- **Unit _ of _ Temp** : Unit of measurement for the temperature change in Degree Celsius.
- **Source** :Indicates the organization responsible for collecting and providing the temperature change data.
- **CTS _ Code** : Categorization system related to climate or temperature change.
- **CTS _ Name**: Name of Surface Temperature Change indicator.
- **CTS _ Full _ Descriptor**: Contains a detailed description of the climate or temperature change indicator, providing additional info.
- **Mean _ Temp _ Change** : Gives average temperature change for every Country across specified Columns.
- **Max _ Temp _ Change** : Gives maximum temperature change for each Country.
- **Min _ Temp _ Change** : Gives minimum temperature change for each Country.
- **Total _ Temp _ Change** : Gives sum of Temperature differences with respect to Baseline temperature of 15 degree Celsius for all the years from 2000 to 2022.

Problem Statement

- The objective of this study is to Analyse the distribution of Temperature changes across Countries across the World over the years from 2001 to 2022.
- To try and Identify countries with the highest and lowest average temperature changes and get the difference wrt GMST of 15 degree Celsius for each Year.
- To Calculate the Total temperature change for Each Country across all years.
- By Visualize and Manipulate the data using appropriate Charts to facilitate better understanding and interpretation of the data.
- To Identify the countries with the Highest and Lowest temperature changes for each years.
- To Visualize Temperature change Trends using Bar plots and Line Charts.
- This Dataset can provide valuable insights into how temperature changes varying across Countries and Regions, which can inform decision-makers, researchers, and policymakers in addressing the future challenges posed by climate change.

Descriptive Analysis

```
#Gives summary statistics of Numerical columns of Climate Change dataset  
Climate_df.describe()
```

	Objectld	F2001	F2002	F2003	F2004	F2005	F2006	F2007	F2008	F2009	...	F2013	F2014
count	225.000000	225.000000	225.000000	225.000000	225.000000	225.000000	225.000000	225.000000	225.000000	225.000000	...	225.000000	225.000000
mean	113.000000	0.785920	0.871556	0.802956	0.736356	0.803707	0.837618	0.986191	0.761702	0.857956	...	0.893951	1.070222
std	65.096083	0.505674	0.426329	0.458419	0.401072	0.411579	0.448922	0.569053	0.510197	0.428091	...	0.364300	0.595173
min	1.000000	-0.186000	0.000000	-0.252000	-0.622000	-0.393000	-0.505000	-0.219000	-0.139000	-0.319000	...	0.000000	-0.092000
25%	57.000000	0.459000	0.646000	0.552000	0.505000	0.542000	0.581000	0.650000	0.406000	0.635000	...	0.707000	0.704000
50%	113.000000	0.689000	0.827000	0.822000	0.703000	0.827000	0.810000	0.903000	0.667000	0.869000	...	0.885000	0.960000
75%	169.000000	1.237000	1.123000	1.037000	0.957000	1.047000	1.109000	1.202000	1.090000	1.162000	...	1.182000	1.306000
max	225.000000	1.992000	2.255000	2.328000	2.150000	2.201000	2.343000	2.729000	2.607000	1.774000	...	1.643000	2.704000

8 rows × 23 columns

Descriptive Analysis

Adding Mean Temperature Change Column

```
mean_temp_change = Climate_df[['F2001', 'F2002', 'F2003', 'F2004', 'F2005', 'F2006', 'F2007', 'F2008', 'F2009', 'F2010',  
'F2011', 'F2012', 'F2013', 'F2014', 'F2015', 'F2016', 'F2017', 'F2018', 'F2019', 'F2020', 'F2021', 'F2022']].mean(axis=1)
```

```
# Add the mean temperature change as a new column to the DataFrame
```

```
Climate_df['Mean_Temp_Change'] = mean_temp_change
```

```
# Display the updated DataFrame
```

```
Climate_df.head(2)
```

	ObjectId	Country	ISO2	ISO3	Temp_Indicator	Unit_of_Temp	Source	CTS_Code	CTS_Name	CTS_Full_Descriptor	...	F2014	F2015	F2016	F2017
0	1	Afghanistan, Islamic Rep. of	AF	AFG	Temperature change with respect to a baseline ...	Degree Celsius	Food and Agriculture Organization of the Unite...	ECCS	Surface Temperature Change	Environment, Climate Change, Climate Indicator...	...	0.456	1.093	1.555	1.540
1	2	Albania	AL	ALB	Temperature change with respect to a baseline ...	Degree Celsius	Food and Agriculture Organization of the Unite...	ECCS	Surface Temperature Change	Environment, Climate Change, Climate Indicator...	...	1.198	1.569	1.464	1.121

2 rows × 33 columns

Descriptive Analysis

Max and Min Temperature Countries of Year 2022

```
: # Find the index of the maximum temperature change for the year 2022  
max_temp_index_2022 = Climate_df['F2022'].idxmax()  
  
# Get the country with the highest temperature change in 2022  
country_max_temp_2022 =Climate_df.loc[max_temp_index_2022, 'Country']  
  
print("Country with the highest temperature change in 2022:", country_max_temp_2022)
```

Country with the highest temperature change in 2022: Andorra, Principality of

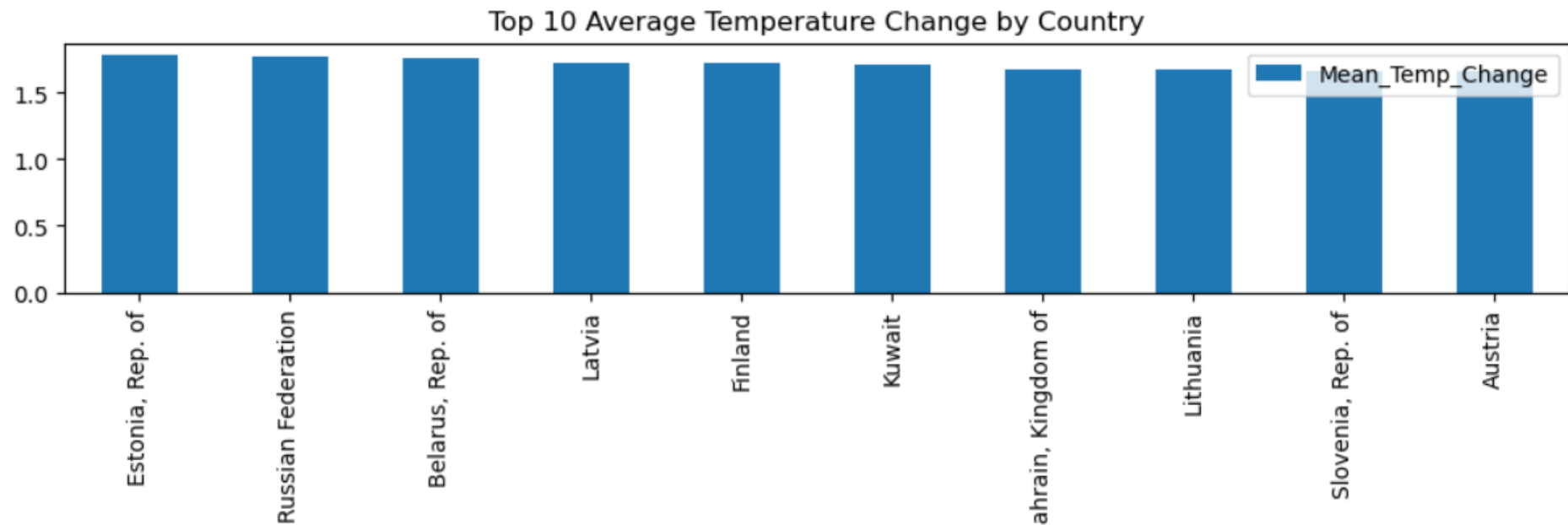
```
: # Find the index of the minimum temperature change for the year 2022  
min_temp_index_2022 = Climate_df['F2022'].idxmin()  
  
# Get the country with the lowest temperature change in 2022  
country_min_temp_2022 =Climate_df.loc[min_temp_index_2022, 'Country']  
  
print("Country with the lowest temperature change in 2022:", country_min_temp_2022)
```

Country with the lowest temperature change in 2022: Botswana

Descriptive Analysis

Bar Chart for Top 10 Largest Mean Temperature by Countries

```
top_10_mean_temp_change = Climate_df.nlargest(10, 'Mean_Temp_Change')  
top_10_mean_temp_change.plot(kind='bar', x='Country', y='Mean_Temp_Change', figsize=(12, 2), title='Top 10 Average Temperature
```

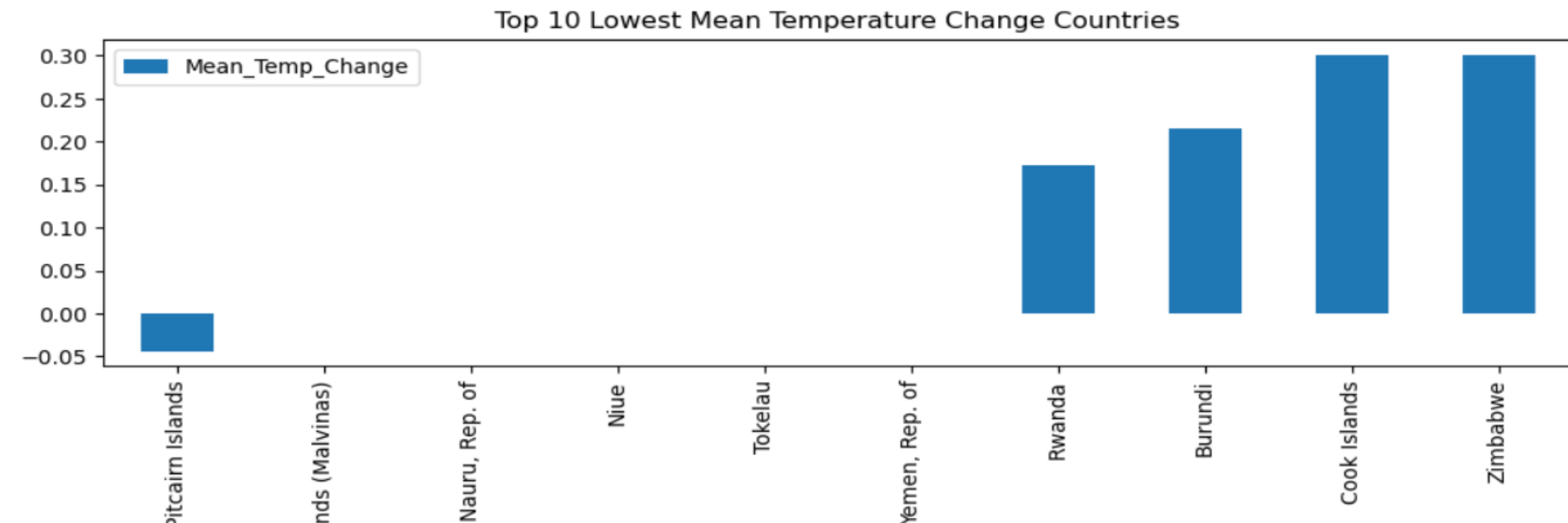


Descriptive Analysis

Bar Chart for Top 10 Lowest Mean Temperature Change Countries

```
top_10_min_mean_temp_change = Climate_df.nsmallest(10, 'Mean_Temp_Change')  
top_10_min_mean_temp_change.plot(kind='bar', x='Country', y='Mean_Temp_Change', figsize=(12, 3), title='Top 10 Lowest Mean Tempe
```

```
<Axes: title={'center': 'Top 10 Lowest Mean Temperature Change Countries'}, xlabel='Country'>
```

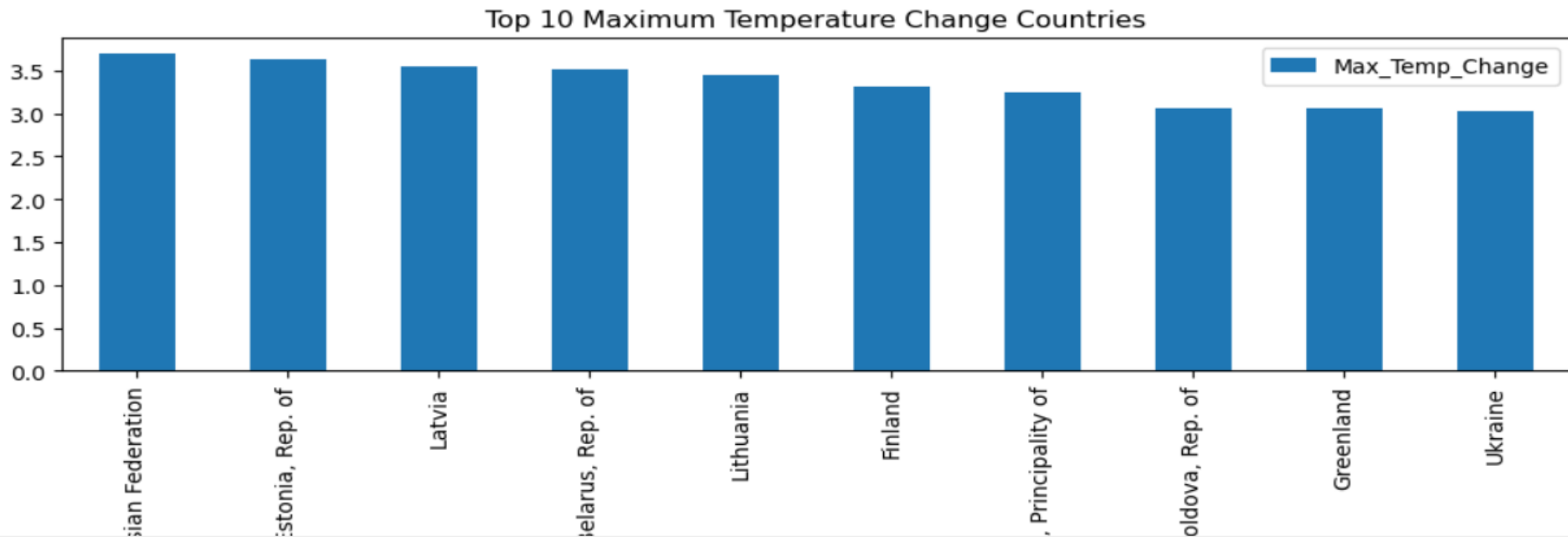


Descriptive Analysis

Bar Chart for Maximum Temperature Change

```
top_10_max_temp_change = Climate_df.sort_values(by='Max_Temp_Change', ascending=False).head(10)
top_10_max_temp_change.plot(kind='bar', x='Country', y='Max_Temp_Change', figsize=(12,3), title='Top 10 Maximum Temperature Change Countries')
```

```
<Axes: title={'center': 'Top 10 Maximum Temperature Change Countries'}, xlabel='Country'>
```

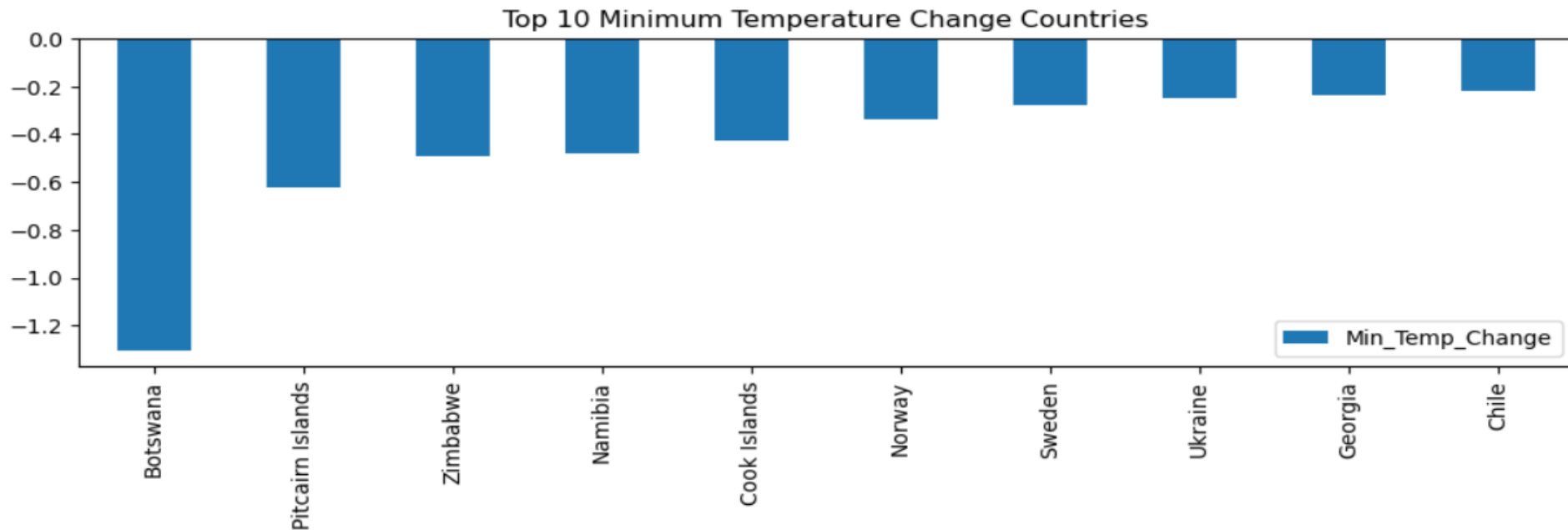


Descriptive Analysis

Bar Chart for Minimum Temperature Change

```
top_10_min_temp_change = Climate_df.sort_values(by='Min_Temp_Change').head(10)  
top_10_min_temp_change.plot(kind='bar', x='Country', y='Min_Temp_Change', figsize=(12,3), title='Top 10 Minimum Temperature Change Countries')
```

```
<Axes: title={'center': 'Top 10 Minimum Temperature Change Countries'}, xlabel='Country'>
```

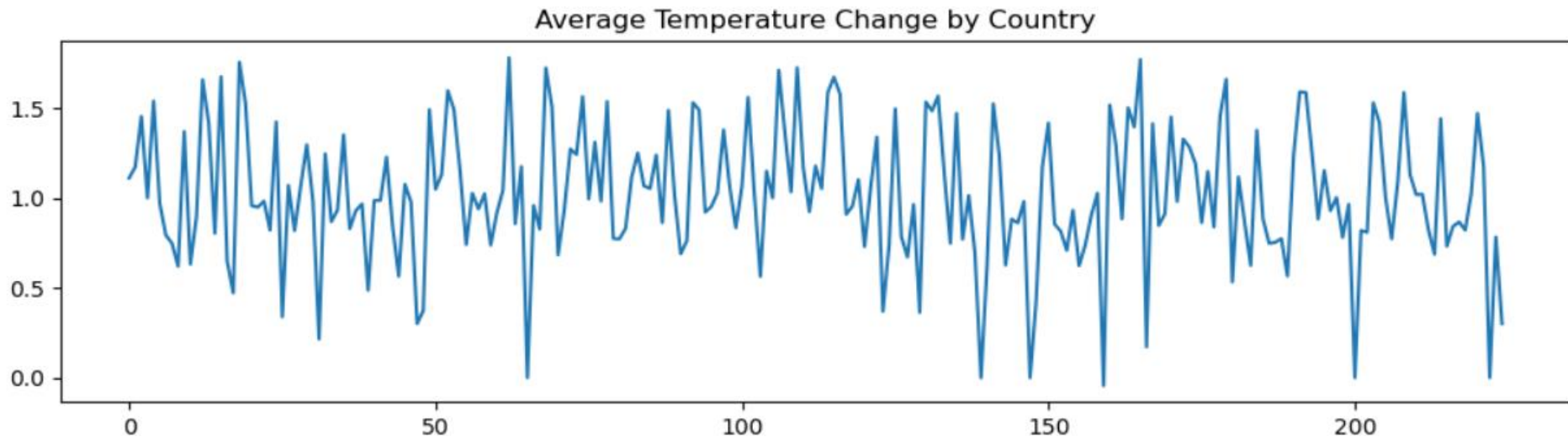


Descriptive Analysis

Line Chart for Mean Temperature Change

```
Climate_df['Mean_Temp_Change'].plot(kind='line',x='Country', figsize=(12, 3), title='Average Temperature Change by Country')
```

```
<Axes: title={'center': 'Average Temperature Change by Country'}>
```



Descriptive Analysis

Pivot Table :

#Making a Pivot Table with Column as Country and giving values of 4 Columns of Numerical datatype

```
Climate_df.pivot_table(index='Country',values=[ 'Mean_Temp_Change','Total_Temp_Change','Max_Temp_Change','Min_Temp_Change'])
```

	Max_Temp_Change	Mean_Temp_Change	Min_Temp_Change	Total_Temp_Change
Country				
Afghanistan, Islamic Rep. of	2.012	1.112727	0.223	24.480
Albania	2.028	1.174955	0.189	25.849
Algeria	2.330	1.456682	0.945	32.047
American Samoa	1.539	1.002273	0.000	22.050
Andorra, Principality of	3.243	1.542500	0.471	33.935
...
Western Sahara	2.204	1.474182	0.903	32.432
World	1.711	1.177773	0.834	25.911
Yemen, Rep. of	0.000	0.000000	0.000	0.000
Zambia	1.450	0.784045	0.105	17.249

Descriptive Analysis

Observations :

- We found the the country with the highest mean temperature change is **Estonia** with **1.784 degree celsius** rise from baseline. We found the country with the lowest mean temperature change is **Pitcairn Islands** with **-0.043727 degree celsius** fall from baseline.
- The **Maximum temperature change** for the year **2022** is of Country **Andorra**.
- The **Minimum temperature change** for the year **2022** is of Country **Botswana**.
- The Top 10 Average Maximum Temperature by Country which were most affected were:
Estonia,Russia,Belarus,Latvia,Finland,Kuwait,Bahrain,Lithuania,Slovenia,Austria
- The Top 10 Average Minimum Temperature by Country which were least affected were: **Pitcairn Islands,Falkland,Nauru,Niue,Yemen,Rwanda,Burundi,Cook Islands,Zimbabwe**
- Top 10 Countries where max Temperature change across past 22 Years:
Estonia,Russia,Belarus,Latvia,Finland,Andorra,Moldova,Lithuania,Greenland,Ukraine
- Top 10 Countries where min Temperature change across past 22 Years: **Pitcairn Islands,Botswana,Namibia,Norway,Sweden,Ukraine,Georgia,Chile,Cook Islands,Zimbabwe**

Descriptive Analysis

Conclusion :

- There is a significant variation in temperature changes across different countries and regions. Some areas have experienced considerable increases in temperature, while others have seen more moderate changes or even decreases.
- It's notable that the mean temperature change across all countries is positive, indicating a general trend of warming temperatures globally.
- The maximum and minimum temperature changes provide insights into the range of variation within each country or region.
- Further analysis could involve investigating correlations between temperature changes and other factors such as geographical location, population density, and economic activities to better understand the drivers of climate change impacts.
- The data highlights the urgent need for global action to mitigate climate change and its associated impacts, as rising temperatures can have significant consequences for ecosystems, agriculture, water resources, and human well-being.