Carbon Emissions Worldwide: Report

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This case study leverages two comprehensive datasets to explore the global impact of carbon emissions. The first dataset, **Annual Surface Temperature Change**, provides temperature anomalies across various countries relative to a baseline, measured in degrees Celsius. The dataset spans from 1960 to 2022 and includes annual observations, offering a temporal perspective on how global temperatures have shifted over decades. Key features include country names and temperature change values for each year.

The second dataset, **Monthly Atmospheric CO₂ Concentrations**, includes global CO₂ measurements from 1958 to 2024. The data is represented in parts per million (ppm), with monthly observations that allow for detailed temporal analysis. The primary features include the date of measurement and CO₂ concentration values. Together, these datasets provide a robust foundation for analyzing climate trends and understanding the link between carbon emissions and global warming.

Problem

The central challenge of this case study is to understand and address the impacts of carbon emissions on global temperatures. Climate change, driven by rising CO₂ levels, has emerged as a critical issue, prompting the need for actionable insights that can guide policy decisions. The key objectives are to identify historical trends, detect anomalies, and simulate future scenarios to evaluate potential policy outcomes.

First, it is crucial to examine historical data to understand how CO₂ concentrations and temperature anomalies have evolved over time. By identifying long-term trends and correlations, the analysis can uncover the direct relationship between these variables. This includes understanding how industrialization and other anthropogenic factors have influenced climate patterns.

Second, detecting anomalies in temperature and CO₂ levels can reveal significant events that deviate from expected patterns. Such anomalies might point to natural phenomena, such as volcanic eruptions, or anthropogenic events, like spikes in industrial emissions. Understanding the causes of these outliers can provide insights into the drivers of climate variability.

Finally, the study aims to simulate “what-if” scenarios to predict the impact of changes in CO₂ concentrations on global temperatures. For instance, what happens if CO₂ levels increase or decrease by a specific percentage? These simulations can offer a quantitative basis for climate policies, emphasizing the importance of reducing emissions to mitigate global warming. By understanding these patterns, governments and organizations can make data-driven decisions to address climate change effectively.

We are using two datasets:

1. **Temperature Data**: Annual temperature anomalies measured in degrees Celsius across decades.
2. **CO₂ Data**: Monthly global atmospheric CO₂ concentrations in parts per million (ppm).

**STATISTICAL ANALYSIS: -**

**({'Mean': 0.5377713483146068, 'Median': 0.47, 'Variance': 0.4294524831504378},  
 {'Mean': 180.71615286624203,  
 'Median': 313.835,  
 'Variance': 32600.00200469294})**

The mean temperature change is approximately **0.54°C**, with a median of**0.47°C** and a variance of **0.43**, indicating slight variability in temperature anomalies. For CO₂ concentrations, the mean is**180.72 ppm**, the median is significantly higher at **313.84 ppm**, and the variance is**32,600**, which reflects substantial variability in CO₂ levels over the dataset’s timeframe. This highlights the stronger fluctuation in CO₂ data compared to temperature changes.

**TIME SERIES ANALYSIS: -**