

# THE CURIOSITY CUP 2024

## A Global SAS® Student Competition

### GLOBAL CLIMATIC CHANGES

#### ABSTRACT

Human influences on climate change today are so significant that they exceed the limits of natural variability. The primary cause of the world's climate change is atmospheric chemical modifications imposed by humans. Whereas chemicals related to energy consumption are the main cause of these disturbances, development & urbanization also play a significant role at local and regional levels. Planning for adapting and minimizing the effects of this change is extremely difficult due to scientific, technical, and institutional snags, despite improvements in monitoring and understanding of the phenomenon. Climate change, with uncertain rates of change, will likely continue for centuries, leading to tangible impacts like extreme temperatures and sea level rise. As we venture into this unknown, the resulting disruptions could be significant.

#### INTRODUCTION

One of the most significant challenges faced by modern society is climate change, which has a substantial global impact on ecosystems, communities, and economies. Gaining an awareness of the essentials of climate change requires an in-depth investigation of everything from significant trends to daily weather patterns. Understanding the complicated mechanisms of climate change requires the use of daily meteorological information, which offers insights into both short- and long-term patterns.

This research utilizes advanced analytics to identify patterns, trends, and possible future directions to investigate the complex relationship between daily meteorological data and climate change scenarios. When we incorporate daily weather data into our studies on climate change adaptation and mitigation, we will be able to make better decisions. A variety of environmental variables, such as temperature, wind speed, air pressure, humidity, and rainfall, are included in daily weather data. For climatologists, policymakers, and other interested parties, these data points offer precise information on cyclical fluctuations in weather patterns.

By analyzing daily weather data, which displays variations in temperature, precipitation, and other meteorological parameters, researchers can spot patterns and trends across time. Daily meteorological data also makes it feasible to identify severe weather conditions (such as heatwaves, storms, and droughts) that are getting worse and occurring more frequently due to climate change. Climate change poses a major threat to human populations, ecosystems, and the global economy. Rising sea levels, changed rainfall patterns,

and rising global temperatures are all signs of climate change. Water resources, food security, public health, and ecosystems are all deeply affected by these impacts.

Potential consequences and new patterns can be projected when daily weather data is studied in the context of climate change scenarios. By examining historical weather patterns and projecting future climate scenarios, we can detect potential risks and vulnerabilities associated with climate change and develop preventive measures for resistance and adaptation.

### **Objectives of the Research:**

- Explore the relationship between daily weather data and climate change scenarios.
- Analyze historical trends and patterns in daily weather data, focusing on temperature, precipitation, and extreme weather events.
- Assess the implications of climate change on ecosystems, societies, and economies, utilizing daily weather data as a lens for understanding.
- Investigate predictive modeling techniques for projecting future climate scenarios based on daily weather data.
- Provide insights and recommendations for leveraging daily weather data in climate change research, policymaking, and adaptation strategies.

This study paper aims to achieve these goals by utilizing advanced analytical techniques and tools to analyze daily meteorological data and decipher the intricate nature of climate change. We want to contribute to the body of knowledge on climate change and enable stakeholders to take informed action towards a more sustainable and resilient future by bridging the gap between long-term climate projections and daily weather observations.

### **TEMPERATURE CHANGES IMPACTING GLOBAL ECOSYSTEM:**

Variations in temperature, especially those that are brought on by climate change and global warming, have a profound effect on the world ecosystems. Sea levels, weather patterns, biodiversity, and ecosystems are just a few of the features of the environment that are impacted by these changes. The following are some significant ways that variations in temperature affect the world ecosystem:

#### **TEMPERATURE:**

Temperature is related to the random motion of particles in a system. When the particles within a substance move faster on average, the temperature is higher, and when they move slower, the temperature is lower. This concept is fundamental in physics and is used to describe the thermal state of matter.

Temperature is the amount of heat or cold in the atmosphere. It is frequently expressed in degrees Celsius or Fahrenheit in environmental studies. Understanding fluctuations in temperature is essential for evaluating climate change, its effects on ecosystems, and possible consequences for human efforts.

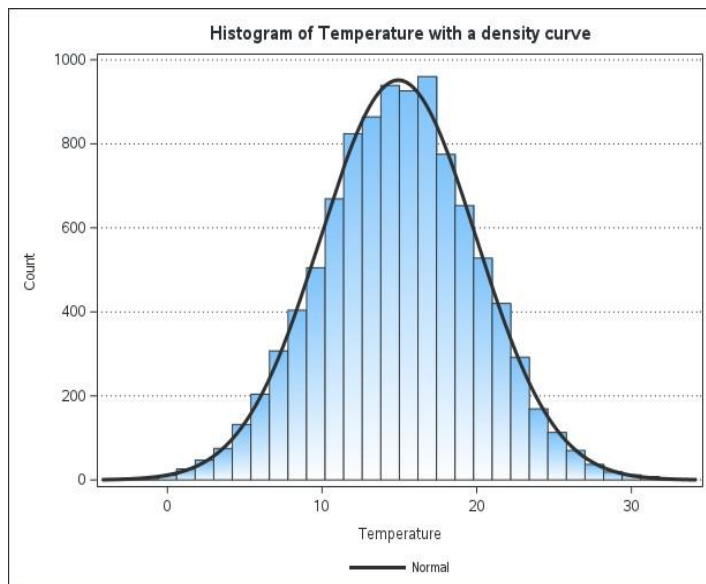
#### **Causes of Global Climate Change:**

The climate of Earth changes constantly. Warming and cooling cycles brought on by variations in the amount of sunlight that reaches Earth have been a recurring theme in the planet's

climatic history. Certain solar cycles, such as the four major glacial-interglacial fluctuations that have occurred in the last 400,000 years, can have amplitudes of up to 5°C or 6°C and cover extremely long periods. The world has been through a warm interglacial phase for the past 10,000 years of a cycle like this. Other natural causes of climate change include variations in ocean currents and large eruptions of volcanoes. Still, for thousands of years, the Earth's atmosphere has changed very little. Temperature and the balance of heat-trapping greenhouse gases have remained just right for humans, animals, and plants to survive. But maintaining this balance is becoming more and more difficult. We are increasing the amount of greenhouse gases in the atmosphere by using fossil fuels to generate energy, heat our homes, power our automobiles, and make a wide range of other things. We have increased the natural greenhouse effect's capacity to warm by producing more of these gases. Because it has the potential to warm the globe at a rate never seen in human history, the human-induced amplified greenhouse effect is the source of environmental worry.

### Source code from the dataset taken for the climatic changes:

```
proc sgplot data=WORK.'CLIMATIC CHANGES' n; title height=11pt
"Histogram of Temperature with a density curve"; histogram
Temperature / scale=count fillattrs=(color=CX7DC3FC)
filltype=gradient;
density Temperature; yaxis
grid;
run;
```



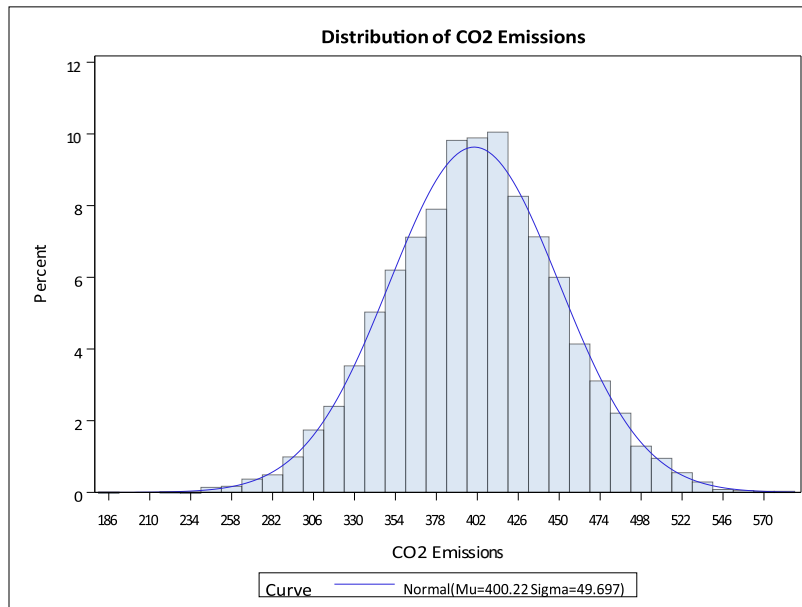
### Temperature changes influencing agriculture, water resources, and food security:

Rising temperatures cause major changes in agricultural methods and the availability of water resources, which in turn affect the results of food security.

According to this theory, there will be noticeable modifications to agricultural practices as temperatures rise, such as different planting and harvesting seasons, modified crop varieties, and a greater use of climate-resilient crops. Water resources will be impacted by these changes, which may result in changes to river flow, a rise in the danger of saline intrusion, or dry spells. Affected regions' crop yields, local markets, and general food accessibility will all be directly impacted by the combined effects of these temperature-induced changes in agricultural and water resources.

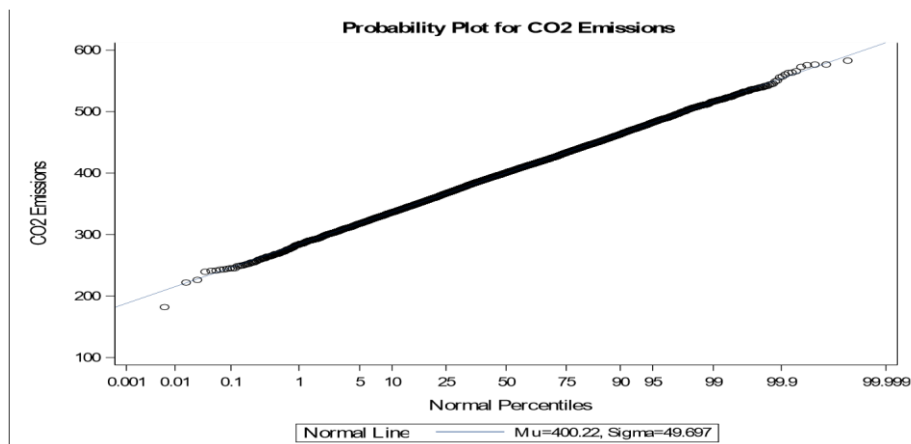
## PRIMARY SOURCES OF CO2 EMISSIONS:

Carbon dioxide (CO<sub>2</sub>) emissions come from a variety of primary sources that are caused by different human activities. Global warming and climate change are caused by an increase in greenhouse gases in the Earth's atmosphere, which is a result of several causes. Primary CO<sub>2</sub> emissions fall into the following key categories **Energy Production, Transportation, Industrial Processes, Deforestation and Land Use Changes, Waste Management, Residential and Commercial Heating, Agriculture and Wastewater Treatment**. Addressing and mitigating these primary sources of CO<sub>2</sub> emissions is crucial for global efforts to combat climate change. Strategies involve transitioning to renewable energy sources, improving energy efficiency, adopting sustainable land-use practices, and promoting technological innovations that reduce reliance on fossil fuels. Global cooperation and policy initiatives are essential for achieving meaningful reductions in CO<sub>2</sub> emissions and mitigating the impacts of climate change.



### Efforts to reduce CO2 emissions involve a multifaceted approach :

encompassing policy measures, technological advancements, and changes in individual and corporate behavior. Transitioning to renewable energy sources, such as solar, wind, and hydropower, is a fundamental strategy to replace fossil fuel-dependent energy production. Embracing energy efficiency measures in industries, transportation, and buildings helps minimize carbon footprints. The widespread adoption of electric vehicles, improvements in public transportation, and the development of sustainable urban planning contribute to mitigating emissions from the transportation sector. Carbon capture and storage technologies aim to capture CO2 emissions from industrial processes, preventing their release into the atmosphere. Reforestation initiatives and sustainable land-use practices act as natural carbon sinks, offsetting emissions. International agreements, like the Paris Agreement, encourage global collaboration and commitment to emission reduction targets. Consumer awareness and advocacy for sustainable practices further drive the demand for environmentally friendly products and behaviors. These combined efforts are essential in addressing the global challenge of reducing CO2 emissions and mitigating climate change.



## CONCLUSION:

In conclusion, climatic changes represent a complex and urgent global challenge with far-reaching impacts on ecosystems, societies, and economies. Scientific consensus, as highlighted in reports from the Intergovernmental Panel on Climate Change (IPCC) and other reputable sources, underscores the unequivocal role of human activities, particularly the emission of greenhouse gases, in driving current climate trends. Rising global temperatures, altered precipitation patterns, more frequent and severe extreme weather events, and shifting ecosystems are among the observed consequences. The implications for human health, food security, water resources, and biodiversity are substantial. Urgent and collective action is imperative to mitigate the extent of climate change, adapt to its inevitable impacts, and transition to a more sustainable and resilient future. International cooperation, robust policies, technological innovation, and individual efforts all play pivotal roles in addressing the root causes and consequences of climatic changes. As we navigate the challenges ahead, a commitment to sustainable practices, conservation, and the pursuit of a low-carbon future becomes integral to ensuring the well-being of current and future generations on a rapidly changing planet.

## REFERENCES:

### **Intergovernmental Panel on Climate Change (IPCC) Reports:**

The IPCC releases comprehensive assessment reports that summarize the latest scientific knowledge on climate change, its impacts, and adaptation/mitigation strategies. The reports are available on the IPCC website: [IPCC](https://www.ipcc.ch/).

### **National Climate Assessment (NCA) - United States:**

The NCA is a comprehensive report produced by the U.S. Global Change Research Program, providing insights into the current and future impacts of climate change in the United States. Visit [NCA](https://www.nca2014.org/).

### **World Meteorological Organization (WMO) Reports:**

WMO releases reports on the State of the Climate, providing global overviews of climate trends and extremes. Explore WMO publications on their official website: [WMO](https://www.wmo.int/).

### **NASA Global Climate Change: Vital Signs of the Planet:**

NASA's website provides an array of resources and data related to climate change, offering visualizations and summaries of key climate indicators. Visit [NASA Global Climate Change](https://climate.nasa.gov/).