

# An Analysis into Phenomena in the United States/Poles to Identify Trends in Extreme Weather

Sriram Elango

Palmyra Cove Institute for Earth Observations

## Introduction

Throughout the world, concerns revolving around the frequency of extreme weather events are discussed, further ignited by “once in a million years” events appearing in the dozen each decade. During the past century, human activities have been fueling a rapid acceleration of pollution and thermal output, releasing large amounts of greenhouse gasses into the atmosphere where it envelops the Earth, enabling energy to be trapped and thus, causing global temperatures to warm. This warming has been correlated with the rising frequency of extreme weather, though many throughout the world continue to deny the mathematical relationships and correlations.

The importance of this fundamental issue regarding extreme weather events and climate change as well as polar linkages cannot be understated, with more destructive events affiliated with changing polar conditions being experienced each year. Its ubiquity can be observed through events such as the February 2021 North American winter storm, where major and violent winter/ice storms had widespread impact and resulted in over 170 million Americans experiencing various extreme winter weather events. The relevance of this issue to the local and international community is ever more present, shaping and affecting the lives of billions due to the engendering of extreme weather events that continue to claim lives.

## Acknowledgements

- NASA, NOAA, Goddard
- The GLOBE Program
- Palmyra Cove Institute for Earth Observations

## Methodology

### Data Collection/Analysis Procedures:

A large amount of data was required for this project because of the complex topic. GLOBE data was utilized from schools in Texas about air temperature. The data was then imported and filtered into Google Colaboratory and Google Sheets. Google Colaboratory was used for machine learning through neural network modeling and Google Sheets was used to create graphs and other displays. There were multiple artificial intelligence and machine learning models that were used and each has different uses. Linear Regression, Logistic Regression, Decision Trees, Naive Bayes, K-nearest neighbor, and Neural Networks were used. Overall, many different types of mathematics were used to come to a conclusion about the world's climate.

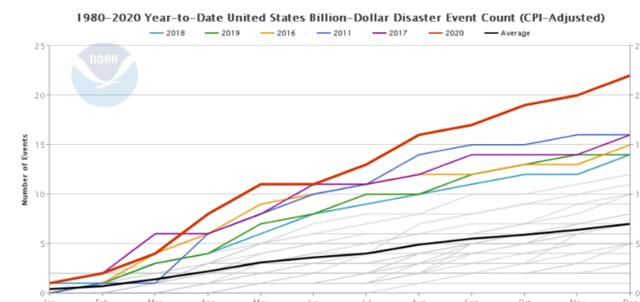
After this step, literature reading of several scholarly articles(i.e. Google Scholars, NASA, etc) and data sets obtained by satellites(such as ICESat) was used to further explain other atmospheric anomalies and identify mathematical trends. Additional data visualization tools were used to understand intriguing phenomena, such as weakened polar vortexes, and heavily altered polar jet streams(NOAA). Existing models were also identified and obtained from national and international government agencies in order to further explain and comprehend Arctic correlations to domestic weather.

### Example Data Analysis Code:

```
global_warming_model_1 = Sequential()
global_warming_model_1.add(Dense(4, input_shape = (3,), activation = 'relu'))
global_warming_model_1.add(Dense(2, activation = 'softmax'))
global_warming_model_1.compile(loss='categorical_crossentropy',
                               optimizer = 'adam',
                               metrics = ['accuracy'])
global_warming_model_1.predict_classes([[100,-4,-2]])
```

## Results

Collective throughout the data obtained over all aspects of climatic events, a vital connection can be made, demonstrating the extreme significance the Arctic and Polar regions have on the entirety of global climate and life itself. The data visualization and research show that impacts on polar temperatures and ice mass greatly affect the rest of the world, with more extreme events occurring more frequently and that climate change as a whole is strengthening these formed storms into destructive forces.



## Conclusion

Through intense data analysis and interpretation by utilizing plots, scientific journals, and custom artificial intelligence models, it is evident that the trends identified indicate a possible profound correlation between rising global temperatures and effects on the Arctic, thus leading to increased extreme climatic/weather events. With temperature differences(gradient) decreasing between the polar regions and the tropics, anomalies within the jet stream occur, possibly forming more “wavy” jets streams that enable storms to do more destruction and cause cold Arctic air to reach past its normal/predicted borders. Furthermore, the data also suggests that the Arctic’s weather and Northeastern United States region’s weather correspond greatly, for when Arctic temperatures are high, the Northeast gains extremely cold temperatures. Additionally, other weather events were found to be created and intensified as a result of climate change and temperature anomalies, such as the intensification of hurricanes and the creation of floods(which further ties back to decreasing ice mass within both polar regions).

These conclusions and results illustrate the grave danger Earth currently is in, with more frequent extreme weather events occurring every year, leading to ecosystems destroyed and lives lost for preventable issues. With climate change penetrating daily life, causing land and houses to be lost to sweeping waves, and hurricanes to destroy entire states and cities, it is important and vital to advance scientific knowledge and research within this domain. The identification of connections that are foundational to this global crisis will permit a greater comprehension of activities that may contribute to global warming as well as Arctic disturbances, allowing the possible prevention of those activities to save the current state of the environment.