

# Analyzing local climate data to determine systematic changes in magnitude and frequency of extreme weather events due to climate change

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## Abstract

In recent years, climate change has become the environmental issue of this generation. Human-produced emissions have caused our global temperature to increase, sea levels to rise, and extreme weather events to increase. Systematic changes in magnitude and frequency of extreme events are happening in the Midwest. Many farmers are experiencing the impacts of increases in maximum temperatures, precipitation, and weather variation. The purpose of our research was to determine if large scale climate changes are being exhibited through local climate patterns. We obtained data from Dubuque Lock & Dam 11 through the National Oceanic and Atmospheric Administration (NOAA). The data were analyzed through pivot tables to find the maximum and minimum temperatures along with maximum and sum amounts of precipitation, both monthly and seasonally. The data were then graphed for visual representation and tested for statistical significance using regression analysis. Our results determined an increase in autumn and winter minimum temperatures and an upward trend in spring and summer average temperatures. There are also significant increases in precipitation in October, April, May, and June. Lastly, winter snow increased, but we saw a decrease in spring seasonal snow.

## Introduction

Our global climate is changing, and human-produced emissions having caused our global temperature to rise, in turn causing sea levels to rise. This has had a plethora of negative effects and has a correlation to an increase in extreme weather events seen in recent decades. According to the National Oceanic and Atmospheric Administration (NOAA), extreme events are defined as outliers in the upper or lower 10 percent of a region's weather history, "most unusual events". Extreme weather can include everything from small to large scale: temperature, droughts, precipitation, flooding, tornadoes, and hurricanes. Return periods are then the estimate between the occurrence of these events of defined magnitude or intensity.

According to the World Meteorological Organization (WMO), a key part in preventing natural hazards is being able to determine the return periods of extreme events, ones that have large socioeconomic impacts. If the government (local through federal) can give accurate warnings for extreme events to prepare people for hazards, then disasters that cause material and human losses can be prevented.

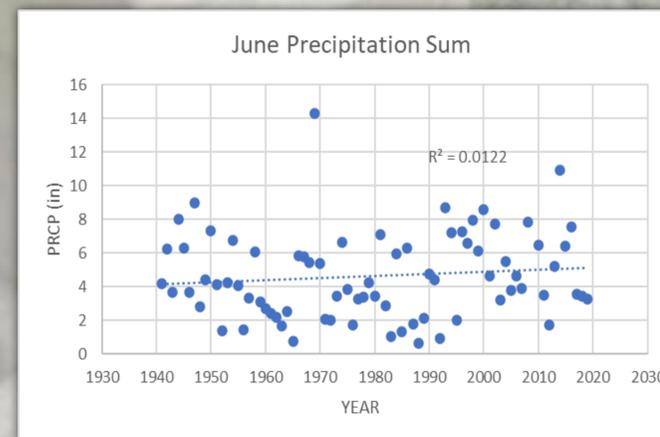
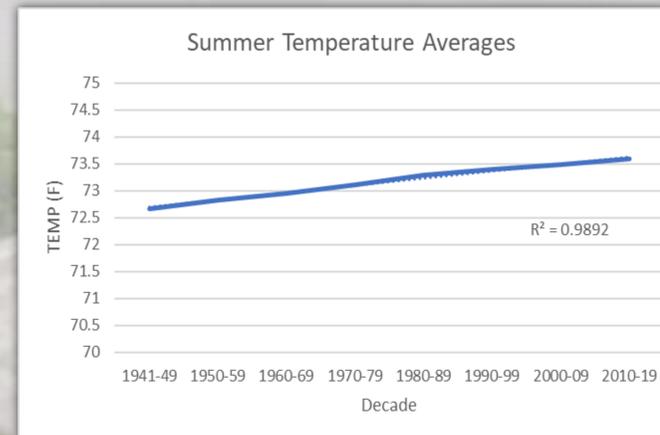
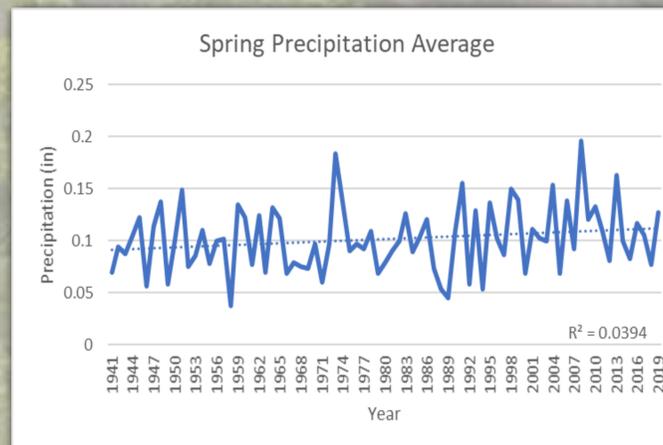
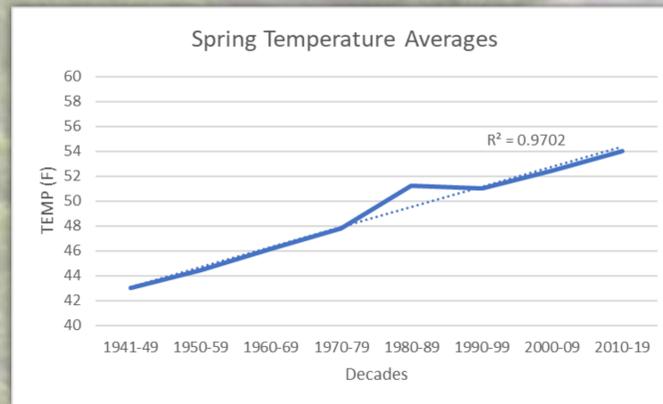
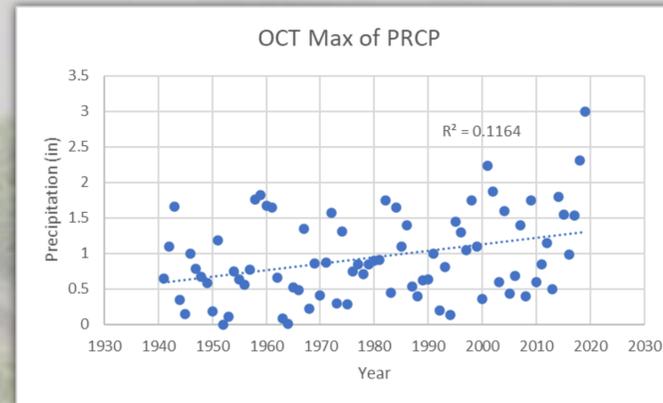
The purpose of our research was to determine if large scale climate changes are being exhibited through local climate patterns in Dubuque County.

## Methods

Our weather data was obtained from the NOAA National Weather Service and the Dubuque Regional Airport weather log.

- The data was analyzed through pivot tables to find the maxim, minima, sum, and averages both monthly and seasonally, for temperatures and precipitation.
- The data was then graphed for visual representation and tested for statistical significance using regression analysis.

## Results



## Discussion

Our results determined an increase in autumn and winter minimum temperatures and an upward trend in spring and summer average temperatures. There are also significant increases in precipitation in October, April, May, and June. Lastly, winter snow increased, but we saw a decrease in spring seasonal snow.

These climate changes can have a specific impact for the Midwest. Iowa uses 85% of its land for agriculture, and increased variability in weather patterns can hinder crop yields in several ways. A large amount of rain, or multi-day rain events in October can have a negative effect on crops before harvest, and an increase in rain creates a smaller window for harvesting crops. Growing season in the summer months could also be affected by an increase in the average temperature, coupled with May and June seeing an increase in precipitation. Another emerging problem is minimum temperatures in the winter increasing, possibly leading to insects not dying in these months – leading to an increase in the spring.

Citizens of Dubuque will also be affected by these local climate changes. A large increase in precipitation for April, May, and June is leading to large flooding events that adds stress to people and infrastructure in Dubuque. Overall, there's an increase in variability for temperatures and precipitation events that if left unchecked may harm the people, agriculture, and ecosystems in Iowa.

## Acknowledgements

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## References

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