WARMER WATERS, STRONGER STORMS?

An investigation into hurricane trends in Gulf of Mexico from 1982 to 2024

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AGENDA

01 ABSTRACT

Summarizing key points in our research and provide our hypothesis

02 INTRODUCTION & BACKGROUND

Introducing our topic and providing context regarding it

03 Data Collection/Preprocessing

Detailing data sources and processing steps

04 DATA VISUALIZATION

Displaying various graphs and maps related to the topic

05 CONCLUSION & FURTHER RESEARCH

Summarizing key findings presented, and proposing ideas for further research

01

Abstract

ABSTRACT

- This research analyzes hurricane trends within the Gulf of Mexico area between 1982 to 2024
- Dataset involved:
+ International Best Track Archive for Climate Stewardship (IBTrACS)
+ Optimum Interpolation Sea Surface Temperature (OISST)
- Hypothesis: Sea surface temperature contributes to stronger hurricane intensity

02
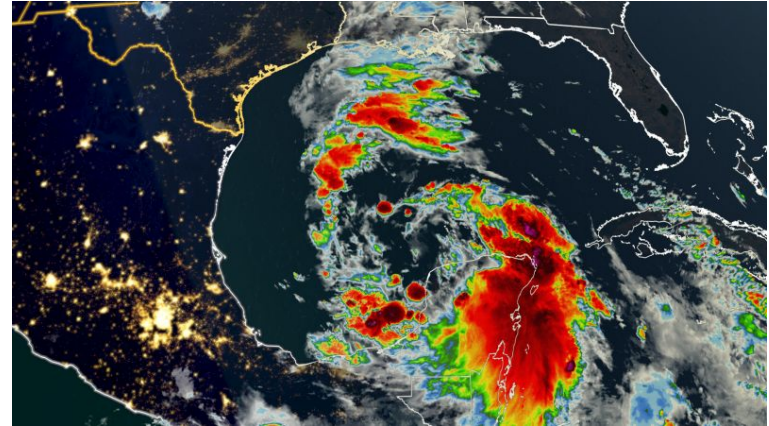
Introduction & Background

INTRO ABOUT GULF OF MEXICO

- Gulf of Mexico - A crucial hub for economic activity in the North America region
- Provides support for industries such as tourism, fishing, oil production
- However, the area is also susceptible to severe weather events, especially hurricanes, and it causes destruction to many places in both the United States and Mexico
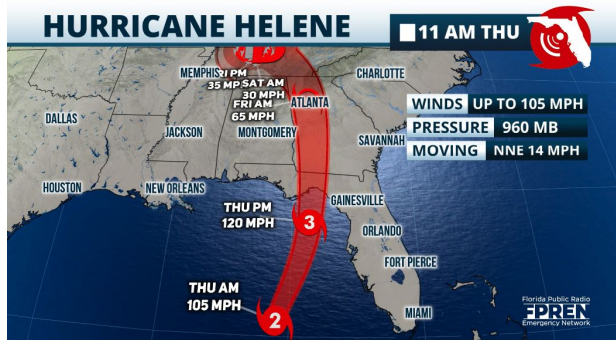
MAJOR HURRICANES IN GULF OF MEXICO
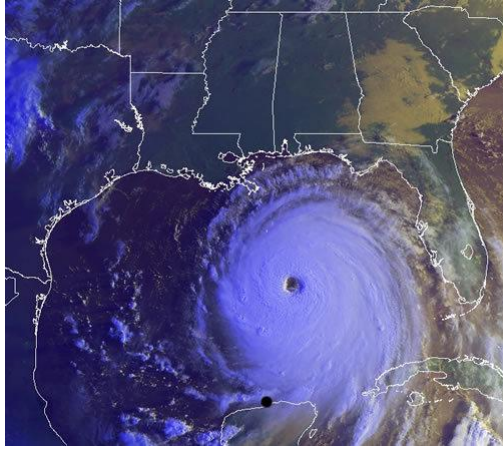

Katrina (2005)
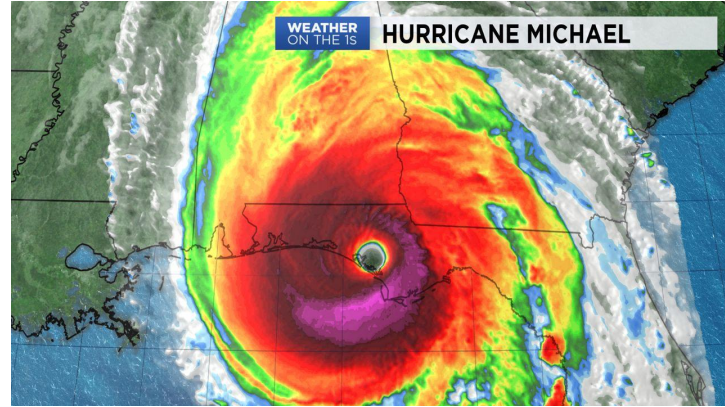
Michael (2018)

Helene (2024)

Milton (2024)

WHY DO THIS RESEARCH?

- In recent years, concerns over climate change and its impacts have grown quickly, with many saying humans are on the verge of the point of no return
- Warmer sea temperatures could produce more powerful storms, which leads to even more catastrophic damages
- This research helps better understanding trends and contribute to informed decision making for hurricane preparedness.

03
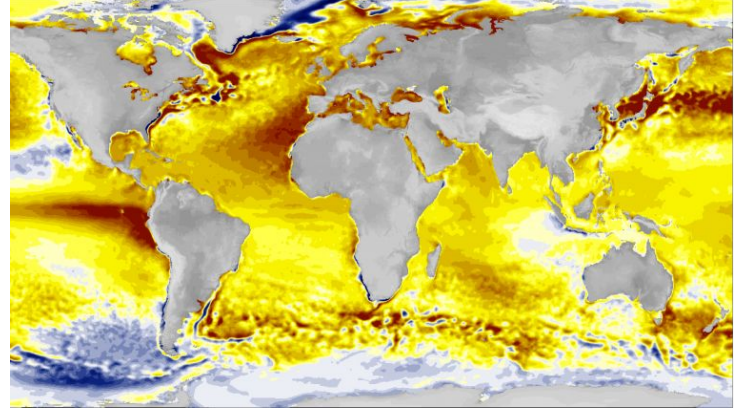
Data Collection & Preprocessing

Data Collection/Preprocessing

- Two major data sources used:
  - International Best Track Archive For Climate Stewardship (IBTrACS) - Hurricane data
  - NOAA Optimum Interpolation Sea Surface Temperature (OISST) - Sea Surface Temperatures

- IBTrACS: Over 10,000 rows of information on hurricanes from 1980-present,
  - Contains columns for hurricane positions, wind speed, pressure, time of occurrence

- OISST: Average SST data for the Gulf of Mexico for every month 1982-2023

Data Collection/Preprocessing

- Data Processing Steps:
  - Filtered dataset down to Gulf of Mexico hurricanes using longitude/latitude range
  - Assigned unique IDs to all hurricanes
  - Created avg wind speed/pressure column for all unique IDs
  - Created a time column containing month and year for all hurricanes → matching column in the OISST dataset
  - Merged both datasets into one → all hurricanes have matching SST values for month of occurrence
  - Done using Python

04

Data Visualization

Data Visualization

- All visuals created using Tableau
- Visuals focused on finding trends over time and correlations between the two data sets
  - Scatterplots
  - Stacked bar charts
  - Line charts
  - Map

05

Conclusion/Further Research

Conclusion

- **No Significant Correlation**: Sea surface temperatures do not significantly impact hurricane intensity in the Gulf of Mexico.

- **Rising Sea Temperatures**: Despite an upward trend in sea temperatures, no effect on hurricane categories was observed.

- **Increase in High-Category Hurricanes**: Data shows a rise in higher category hurricanes, especially Category 2, in the region.

- **Climate Change Impacts**: The observed trends highlight the need for further research into other potential climate change effects.

Further Research

- **Impact of Atmospheric Conditions**: Analyze meteorological factors like wind shear and humidity to understand their role in hurricane intensification.

- **Climate Patterns**: Investigate the influence of El Niño and La Niña on hurricane frequency and characteristics.

- **Hurricane Characteristics**: Explore correlations between climate phases and factors like storm surge, rainfall, and wind shear patterns.

- **Improved Forecasting**: Use insights from additional research to enhance hurricane forecasting methodologies.