Project Report

Table of Contents

1. Introduction:

This project presents a comprehensive analysis of storm event data across the United States, spanning a 23-year period. Utilizing data from NOAA's National Weather Service, this project aims to visually represent and interpret the spatial distribution, frequency, and impact of various storm types. Through interactive data visualizations, including a choropleth map, line charts, and scatter plots, the project seeks to uncover patterns and correlations within storm data, providing insights into trends in meteorological events and their consequences. This endeavor not only enhances understanding of historical storm patterns but also aids in preparedness and response strategies for future weather-related events.

2. Dataset Description:

The dataset includes various attributes such as state, event type, year, direct and indirect injuries and deaths, property and crop damage, and the magnitude of events. The dataset spans several years and allows for the analysis of trends and patterns in storm occurrences and their impacts.

Attributes used for this project:

STATE:

- Type: Categorical
- Semantics: The name of the state where the event occurred (in ALL CAPS).

EVENT_TYPE:

- Type: Categorical
- Semantics: The type of meteorological event leading to fatalities, injuries, damage, etc.

YEAR:

- Type: Quantitative
- Semantics: The four digit year for the event in this record.

INJURIES_DIRECT:

- Type: Ordered (Quantitative)
- Semantics: The number of injuries directly caused by the weather event.

INJURIES_INDIRECT:

- Type: Ordered (Quantitative)
- Semantics: The number of injuries indirectly caused by the weather event.

DEATHS_DIRECT:

- Type: Ordered (Quantitative)
- Semantics: The number of deaths directly caused by the weather event.

DEATHS_INDIRECT:

- Type: Ordered (Quantitative)
- Semantics: The number of deaths directly caused by the weather event.

DAMAGE_PROPERTY:

- Type: Ordered (Quantitative)
- Semantics: The estimated amount of damage to property incurred by the weather event (in dollars).

DAMAGE_CROPS:

- Type: Ordered (Quantitative)
- Semantics: The estimated amount of damage to crops incurred by the weather event (in dollars).

MAGNITUDE:

- Type: Quantitative
- Semantics: The measured extent of the magnitude type, typically used for wind speeds (in knots) and hail size (in inches).

3. Visualization Questions:

This visualization is designed to answer below questions:

1. How are different types of storm events distributed geographically across states and over various years?

2. What are the trends in storm-induced injuries, deaths, and property or crop damages across time?

3. Is there any correlation between the intensity of storms and the severity of their impacts, including injuries, deaths, and damages?

4.Visualization Description:

The project is an interactive data visualization tool that utilizes NOAA's National Weather Service data to analyze and present the geographical distribution and impacts of storm events across the United States over a 23-year period. It features a detailed choropleth map with dynamic user interface elements such as a dropdown menu and a time slider for selecting storm types and years. The tool also integrates line charts and scatter plots to illustrate trends in storm-related injuries, deaths, and property or crop damages, as well as to explore the correlation between storm intensity and these impacts. The design focuses on user interactivity and intuitive data representation, employing color scales and icons for easy understanding of various storm categories.

4.1 Visualization design for question 1:

The project involves creating a choropleth map to visualize the geographical distribution of storm events across various states. This map displays event counts for each state, with darker shades indicating higher frequencies. The map is enhanced by a filter (dropdown menu) allowing users to select specific storm types, and a time slider to observe changes over the last 23 years. The task is designed to identify regions prone to certain storm events and understand their distribution over time, aiding in geographic and temporal analysis of storm patterns.

The project categorizes storm events into six distinct types, each represented by a unique color scale and specific icons on the choropleth map. These categories include Winter Weather and Cold Events, Severe Storms and Wind Events, Heat and Drought Events, Water-Related and Flooding Events, Atmospheric and Visibility Events, and Special and Rare Events. Each category is visually distinguished to aid in the identification and analysis of different storm types and their geographic distribution.

The colors for each storm category were chosen to intuitively represent the nature of the events. For instance, Winter Weather and Cold Events use a cool color scale, while Heat and Drought Events employ warm colors like orange. This intuitive color mapping aids in quickly identifying and differentiating between various storm types on the choropleth map.

4.2 Visualization design for question 2:

This task focuses on analyzing the trends in storm-related impacts using line charts. Specifically, it illustrates the changes in injuries, deaths, property damages, and crop damages over 23 years. These charts, differentiated by colors, allow users to select a specific state and observe how these impacts have evolved in that state over time, offering a focused and detailed analysis of the temporal trends of storm consequences.

4.3 Visualization design for question 3:

This task involves the use of scatter plots to explore the relationship between the intensity of storms and their impact. This task includes two types of scatter plots: one showing the correlation between storm intensity (like wind speed or heat temperature) and the number of injuries and deaths, and another depicting the relationship between storm intensity and the extent of property and crop damage. This approach helps in visually identifying patterns and understanding how the severity of storms affects their impact on people and property.

The project incorporates interactive elements allowing users to engage dynamically with the visualization. Users can select specific storm types from a dropdown menu and adjust the time slider to view data from different years. Each state displays its frequency values, and hovering over the map reveals state names. Additionally, clicking on a state on the choropleth map updates the line charts and scatter plots to display data relevant to that state, enhancing the user's ability to perform focused, state-specific analyses of storm patterns and impacts.

4.4 Marks and Channels:

In the project, the following marks and channels are used to convey the data:

Choropleth Map:

Marks: Geographic shapes of states.

Channels: Color intensity to represent storm event frequency.

Line Charts:

Marks: Lines indicating trends.

Channels: Vertical position for impact metrics, horizontal position for time.

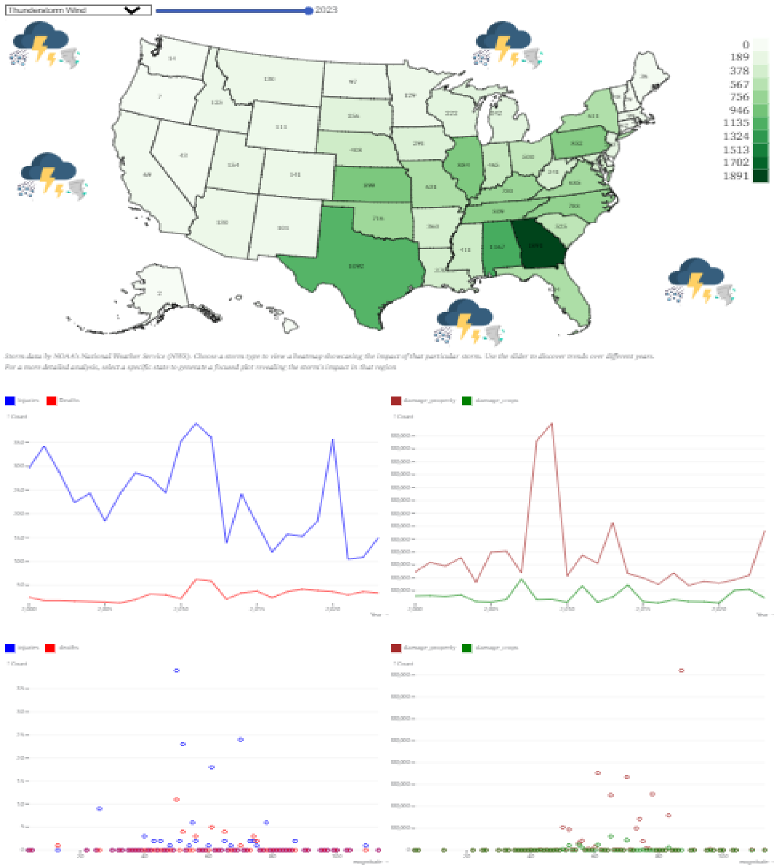
Scatter Plots:

Marks: Dots for individual data points.

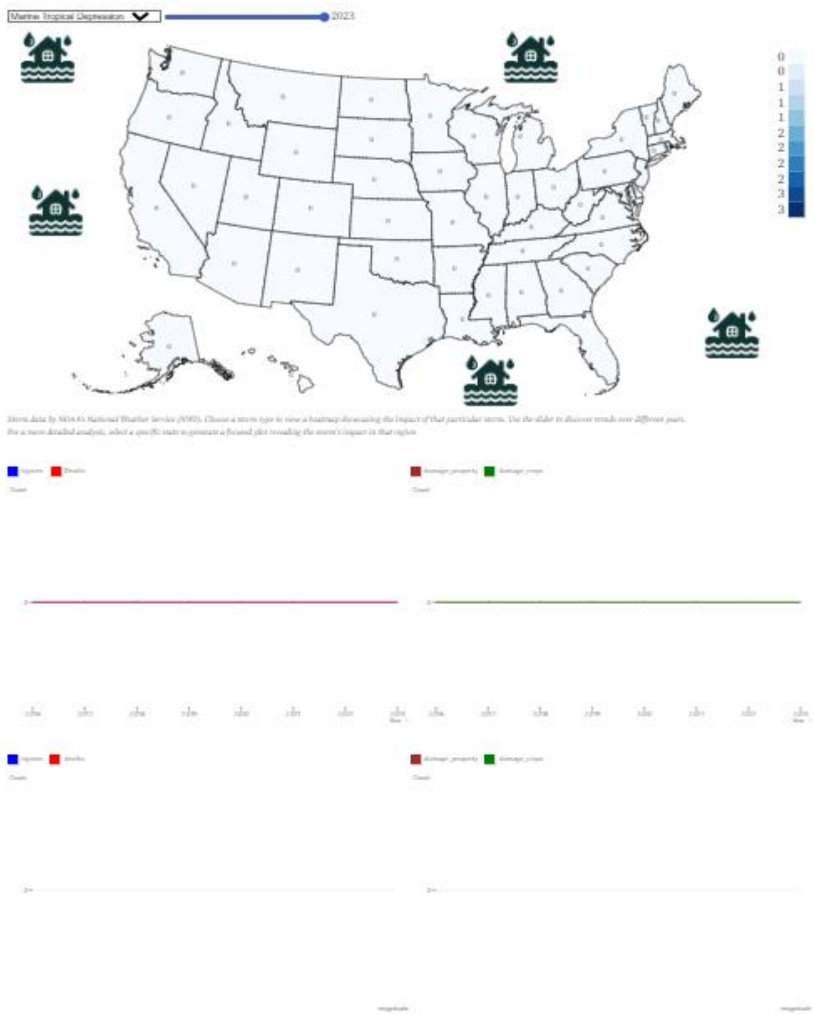
Channels: Horizontal position for storm intensity, vertical position for impact severity (injuries, deaths, damages).

Observations:

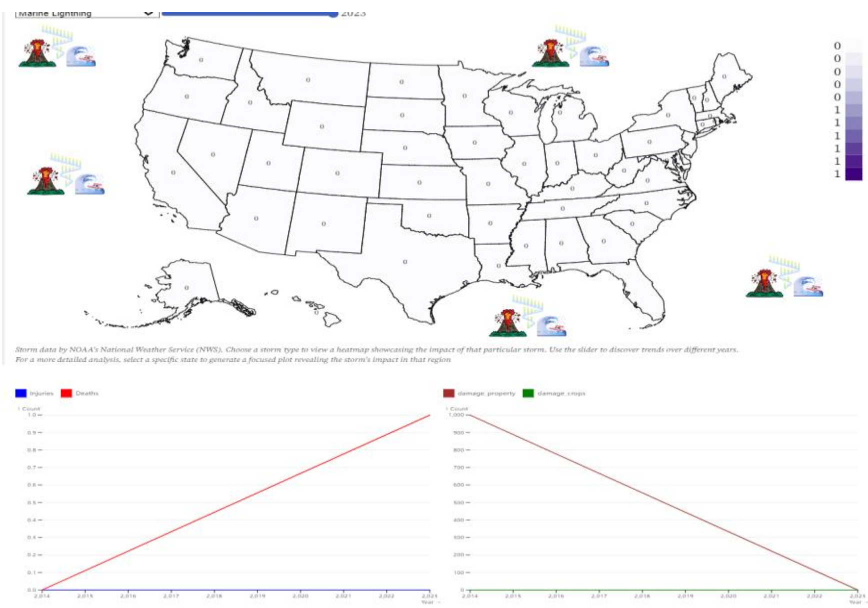
Below is the image when the storm type “Thunderstorm Wind” is selected



Below is the image when “Marine Tropical Depression” is selected as storm type.



Below is the image when “Marine Lighting” is selected as storm type.



Thunderstorms and hail, represented in the visualizations with varying shades and icons, show significant effects such as injuries and property damage in many states. In contrast, Marine Tropical Depression and Marine Lightning, despite their potential severity, show little to no impact in the data, implying such events either occur less frequently or do not have as severe consequences when they do occur. These distinctions validate the need for regionally adapted preparedness plans, as the risk and impact of storm events are not uniform across the country.

Conclusion:

The series of visualizations from the storm data project provide a compelling narrative about the varied impacts of different storm types across the United States. The choropleth maps, line charts, and scatter plots collectively indicate that while some storm types, such as thunderstorms and hail, show a range of impacts from injuries to significant property damage, others like Marine Tropical Depression and Marine Lightning have minimal recorded effects. These findings underscore the complex nature of storm impacts and highlight the importance of specific, localized approaches to storm preparedness and response strategies. Overall, the data visualizations emphasize the necessity for nuanced analysis in meteorological studies and disaster management plans.

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