DSC 465 – DATA VISUALIZATION

Final Project Report

Introduction:

In this technical report, I present our findings from a data visualization project focused on analyzing and visualizing disaster data. The dataset used in our analysis contains information about various disasters, including their types, occurrence dates, locations, fatalities, total damages, insured damages and subsequent calamities, etc. Our goal was to uncover patterns and relationships within the data and communicate them effectively through visualizations. The variables involved in our analysis include disaster type, occurrence date, location, fatalities, and subsequent calamities.

Overview of the Dataset:

The data chosen for the Data Visualization Project is "ALL NATURAL DISASTERS 1970-2021 / EOSDIS". The "ALL NATURAL DISASTERS 1970-2021 / EOSDI" dataset available on **Kaggle.com** is a collection of information about various natural disasters that occurred worldwide between 1970 and 2021.

The dataset provides a wide range of details about various natural disasters like earthquakes, floods, landslides, wildfires, and volcanic eruptions. It includes information such as the date and time of the event, the geographical location (latitude and longitude), the disaster type, the magnitude or severity, and the affected area.

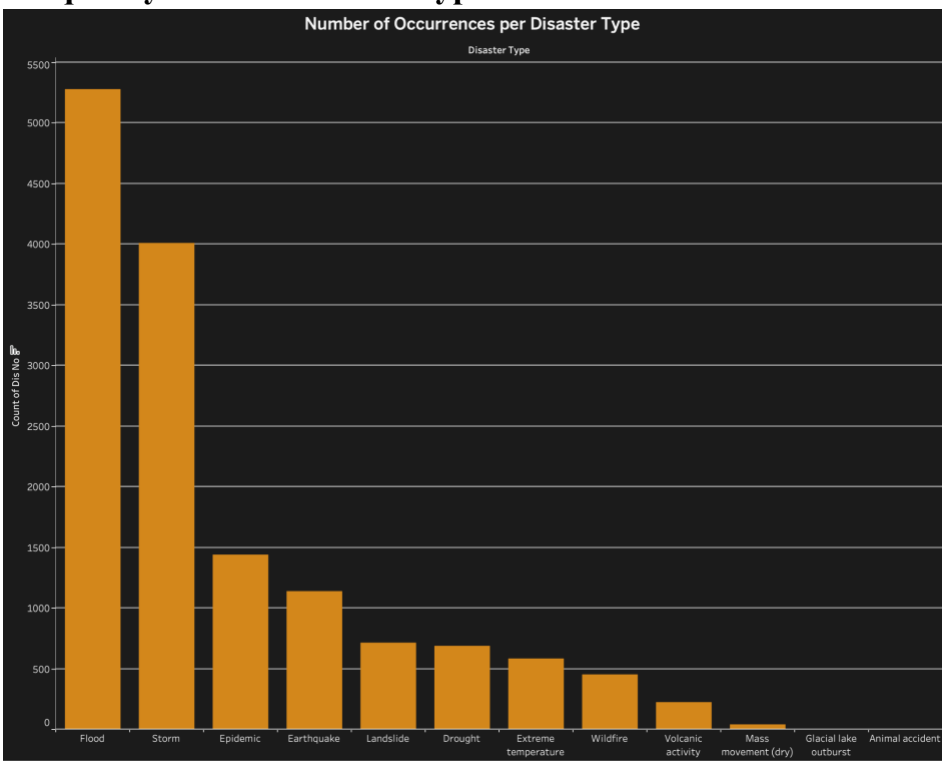
The dataset aims to facilitate research and analysis in the field of natural disaster management, climate change, and related areas. It can be utilized by researchers, and data scientists to study trends, patterns, and impacts of natural disasters over several decades. The dataset enables the exploration of factors like frequency, intensity, geographical distribution, and the types of disasters that have occurred during the specified time frame.

Exploratory Analysis:

During the exploratory phase, I conducted initial analysis and created several exploratory visualizations to gain insights into the dataset. Our analysis involved examining the distributions, correlations, and categorical levels of the variables. I explored the frequency and severity of different disaster types and their impact on human lives, spread of each disaster type across

different continents, where the most disasters have occurred. These initial visualizations provided a foundation for our subsequent analysis and guided us towards the story I wanted to tell.

Frequency of each Disaster Type:



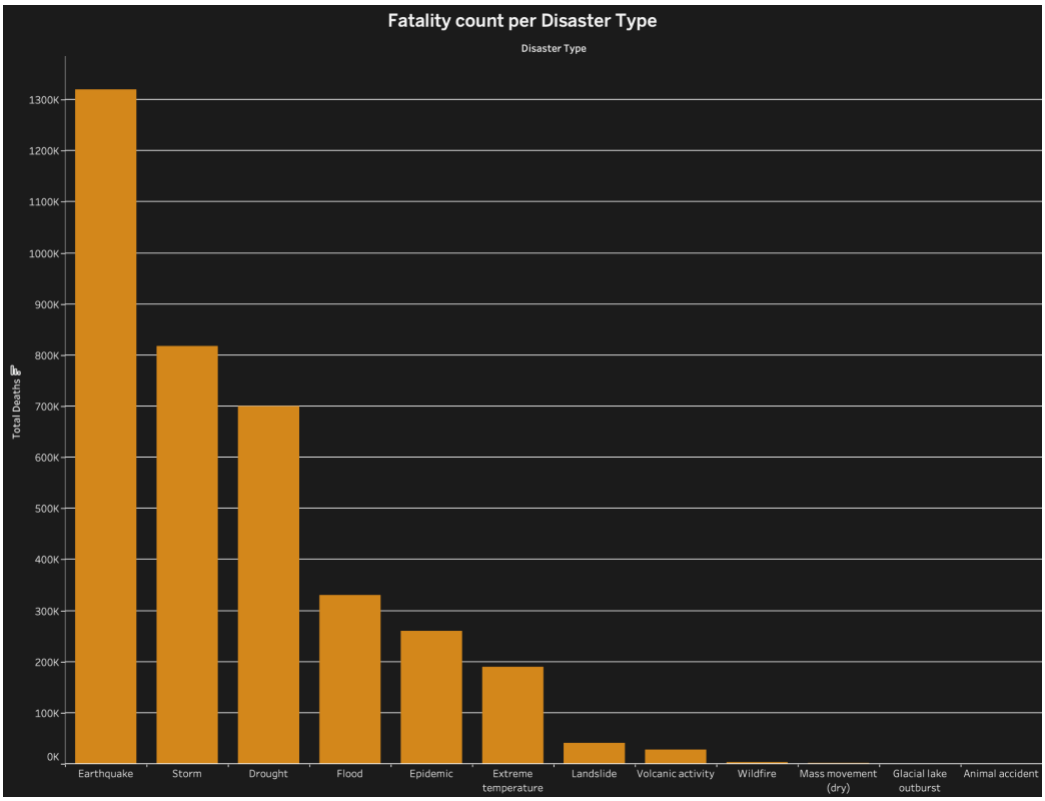
The above bar graph presents a comparative analysis of the occurrence of various natural disasters over a specified period. The graph highlights the frequency of disasters, demonstrating the relative prevalence of each disaster type.
Floods are depicted as the most frequent natural disaster in the dataset, with their bar extending the highest on the graph. This signifies that floods have occurred more frequently than any other disaster during the analyzed period.

Following floods, storms are the next most common natural disaster depicted in the bar graph. Storms are represented by a slightly lower bar height, indicating their occurrence with a frequency second only to floods.

Epidemics are depicted by a comparatively shorter bar on the graph. While less frequent than floods and storms, epidemics have still occurred with notable occurrences during the analyzed period.

Followed by Epidemic I have EarthQuake, Landslide, Drought, Extreme temperature, Wildfire, Volcanic Activity and Mass movement with slight differences in the count of occurence.

Deaths caused by each disaster:



The bar graph illustrates a comparison of the fatality counts resulting from different types of natural disasters over a specified period. The graph highlights the relative severity of disasters in terms of the number of fatalities caused by each disaster.

Earthquakes are depicted as having the highest fatality count per disaster, with their bar extending the highest on the graph. This indicates that earthquakes have resulted in a greater loss of life compared to other natural disasters during the analyzed period. But from the previous graph (Number of Occurrence per Disaster Type) , I could see that the earthquakes have occurred comparatively less to the occurrences of flood, storm and epidemic.

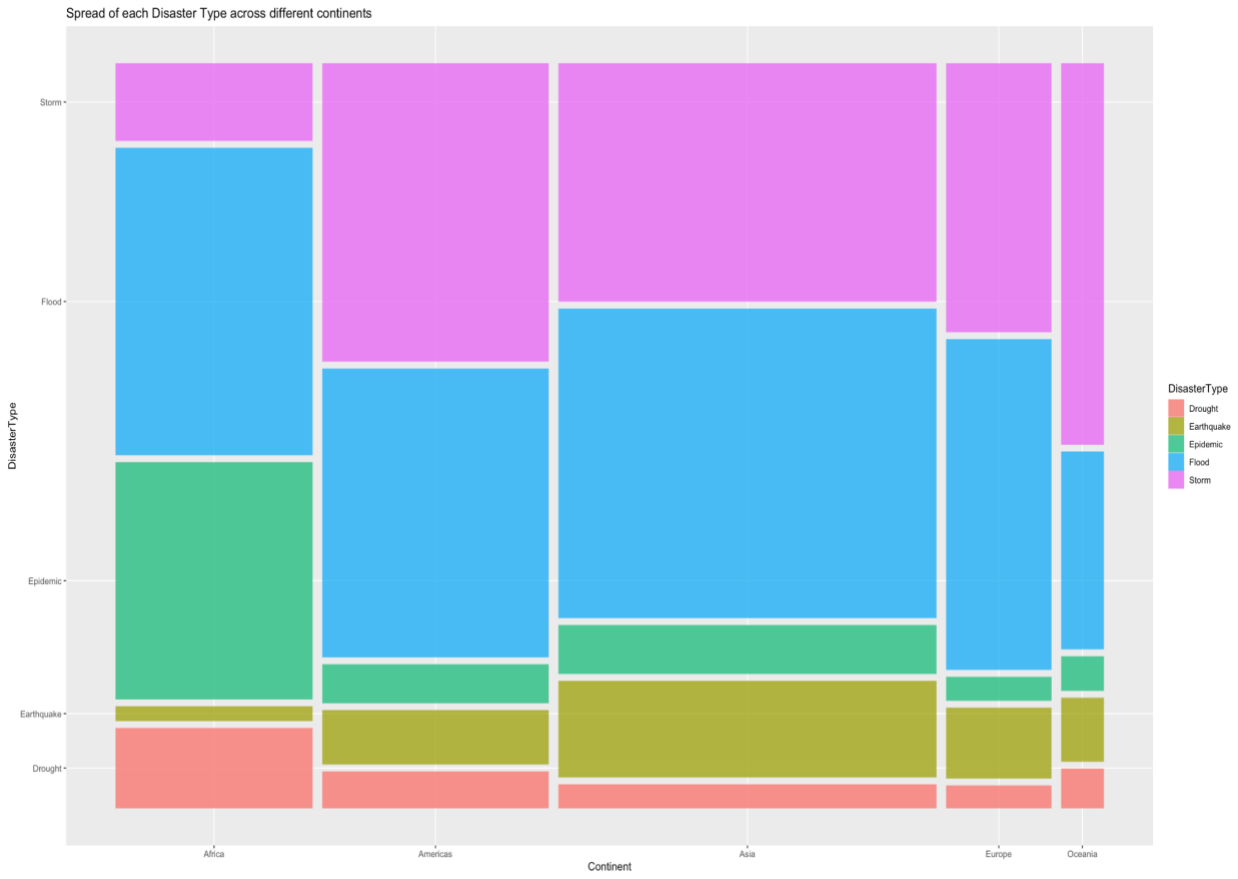
Following earthquakes, storms are represented by a bar of slightly lower height. Storms have resulted in a significant number of fatalities, although relatively lower compared to earthquakes. Droughts are depicted by a bar of moderate height on the graph, indicating a notable but lower fatality count compared to earthquakes and storms

Following drought, I have the Flood which accounted for the maximum number of occurrences in the previous graph. Therefore, it is clear from this graph that the death caused by floods is comparatively lower.

Then I have the Epidemic slightly lower than flood. Followed by Landslide and Volcanic activity with minute differences.

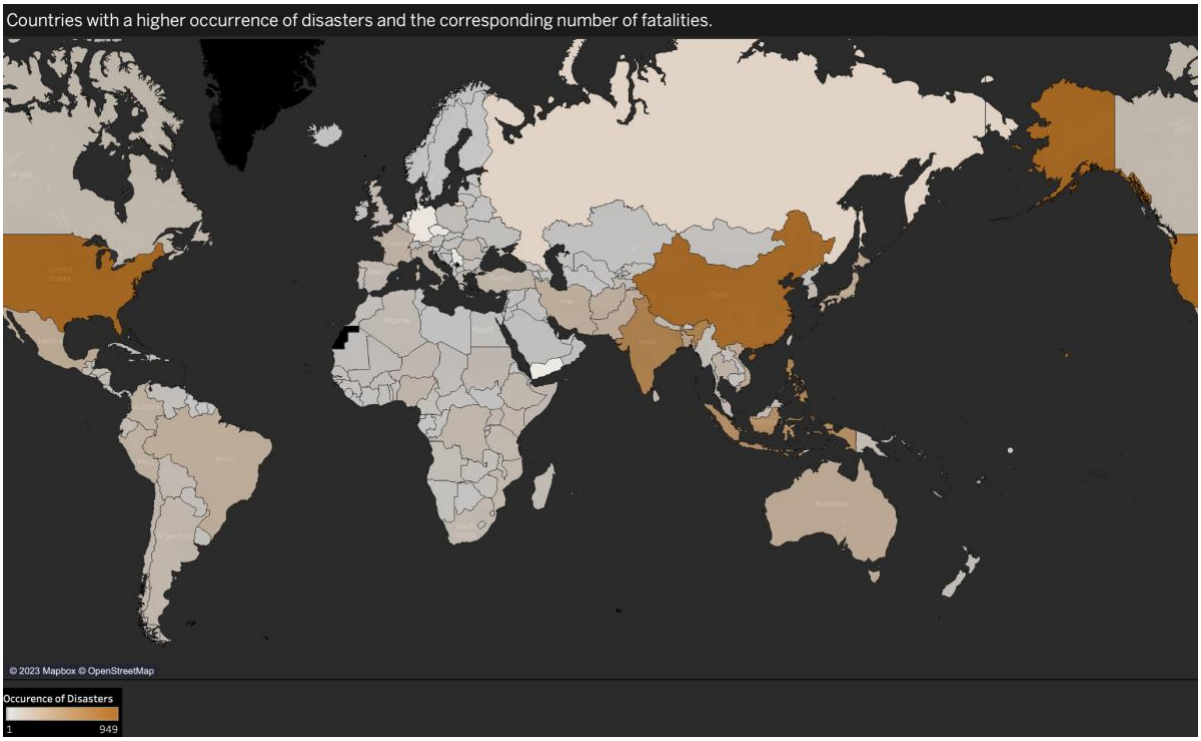
Disasters across each Continent:

For this plot, I have taken the top 5 disasters and plotted them. From this mosaic plot, I could see that more disasters have occurred in the Asian continent and very less disasters in Oceania (Australia). Flood is the major disaster across all the continents, followed by Storm, Earthquake, Epidemic and drought.



Frequency of Disasters across the countries:

I plotted this choropleth to understand the spread of the disasters across the globe. I could see that the Asian continent has the most disasters, which correlates with our previous mosaic plot.



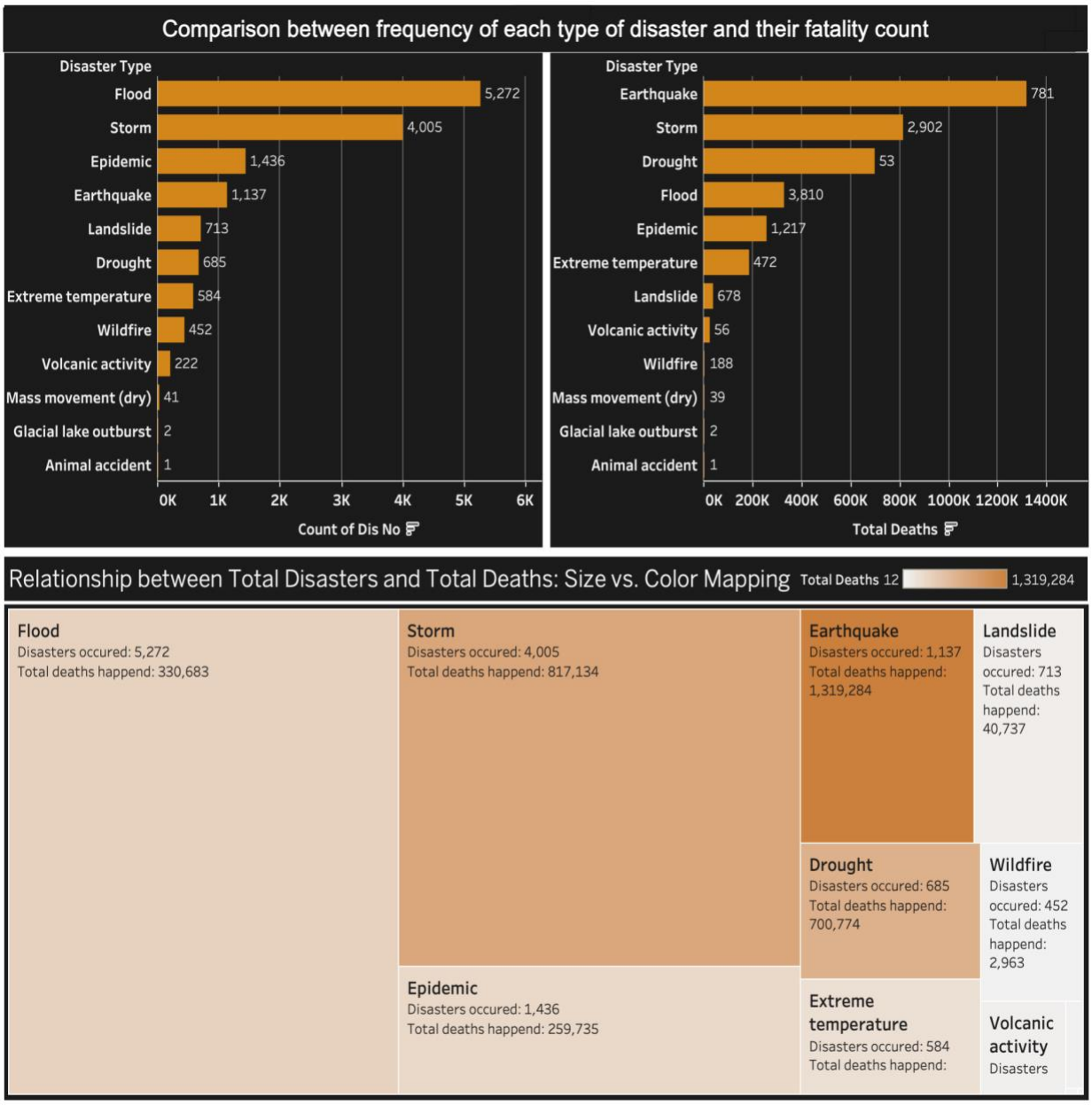
Visualizations:

Design Criteria followed throughout the visualization:

I have followed an orange color palette with black background for the visualizations. The combination of orange and black provides a high contrast, making it easier for viewers to distinguish between different elements in the visualization. This can enhance readability and ensure that the information is easily understandable. I have followed white color for the labels and text, which increases the visibility of the labels. And the opacity of the grid lines is adjusted wherever required to increase readability.

Comparison of various disasters happened between 1970 to 2021:

The below graph comparing the various disasters and their fatality rate gives a clear picture on the impact of each disaster irrespective of their frequency. The side-by-side comparison of the number of occurrences per disaster type and the fatality count per disaster provides valuable insights into the relative frequency and severity of different types of disasters that occurred between 1970 and 2021. By visually comparing the data through horizontal bar graphs, I can identify the most common types of disasters and the ones with the highest fatality counts. The horizontal bar on the right shows that Flood is the most common disaster that has occurred but the bar graph on the right shows us floods have caused very less impact when compared to the earthquake irrespective of the frequency.

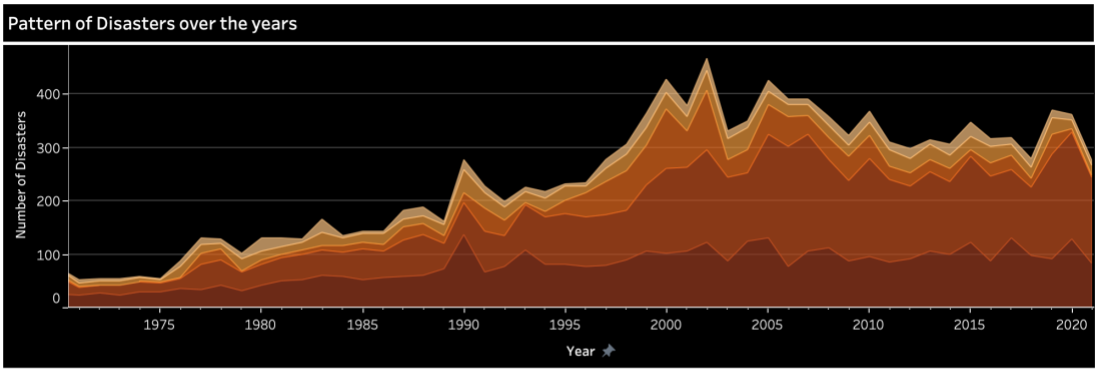


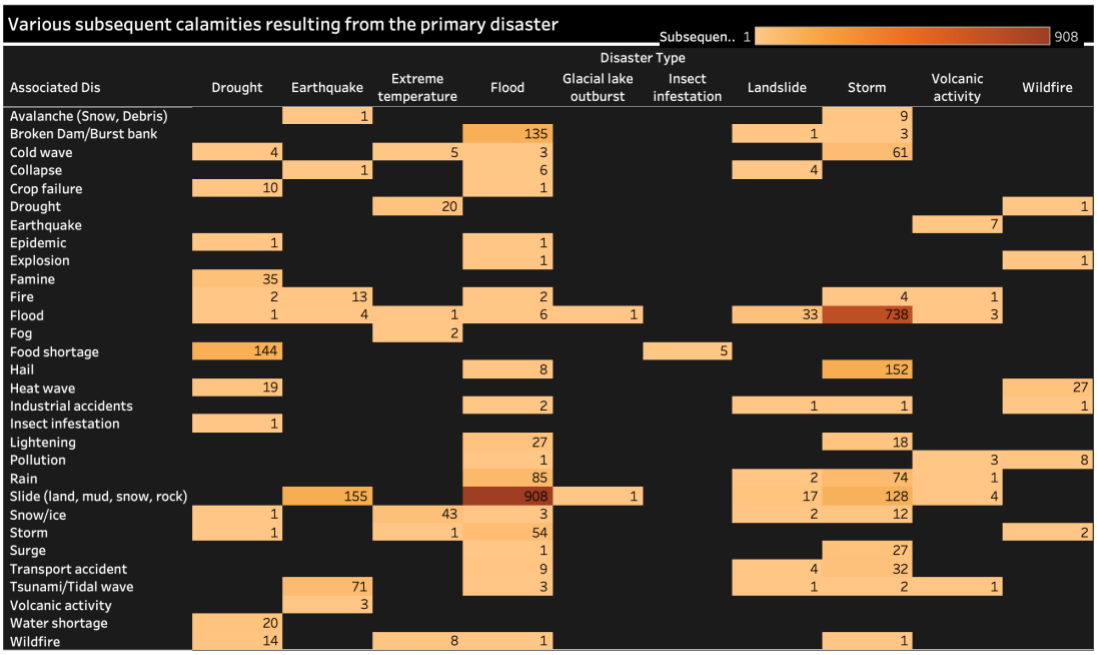
The treemap represents the relationship between the total number of disasters and the total number of deaths. Each data point is plotted using size and color mapping, allowing us to visualize the magnitude of the disasters in terms of both frequency and fatalities. This analysis helps us understand the correlation between the occurrence of disasters and their overall impact.

From the treemap, I could see the top 5 disasters in terms of Frequency and Impact were Earthquake, Storm, Drought, Flood and Epidemic.

Pattern of the Top 5 disasters by Impact and the subsequent calamities caused by various disasters:

The below graph shows the trend of each disaster from 1970 to 2021.





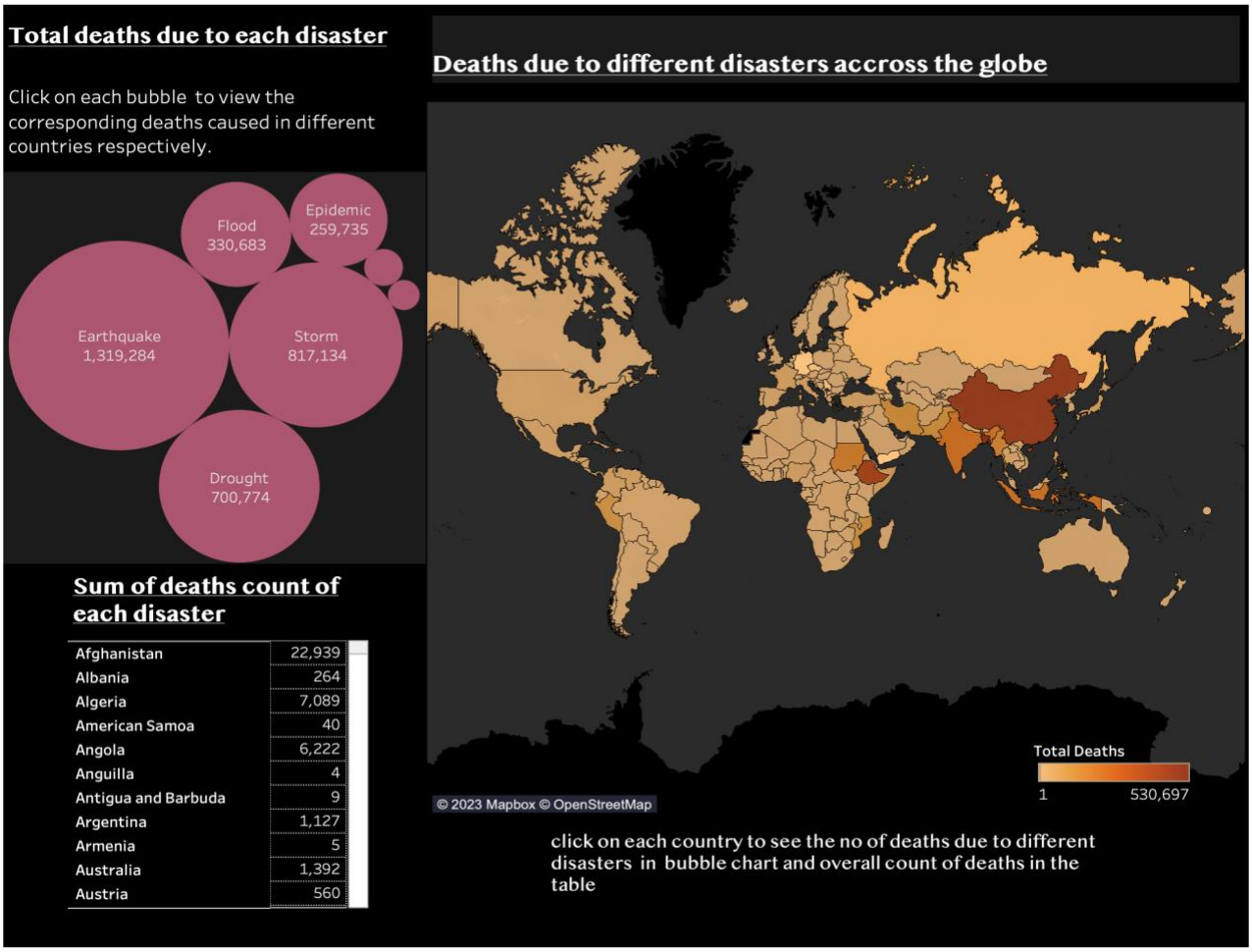
This graph depicts the pattern of disasters over the years, providing an overview of their occurrence and intensity. By analyzing the data, I can identify trends, cycles, or shifts in the frequency and severity of disasters. This information aids in long-term disaster planning, resource allocation, and policy development.

The below heat map illustrates the subsequent calamities resulting from primary disasters. By examining the darkness of the color, I can identify the pattern and frequency of the secondary disasters triggered by the initial events.

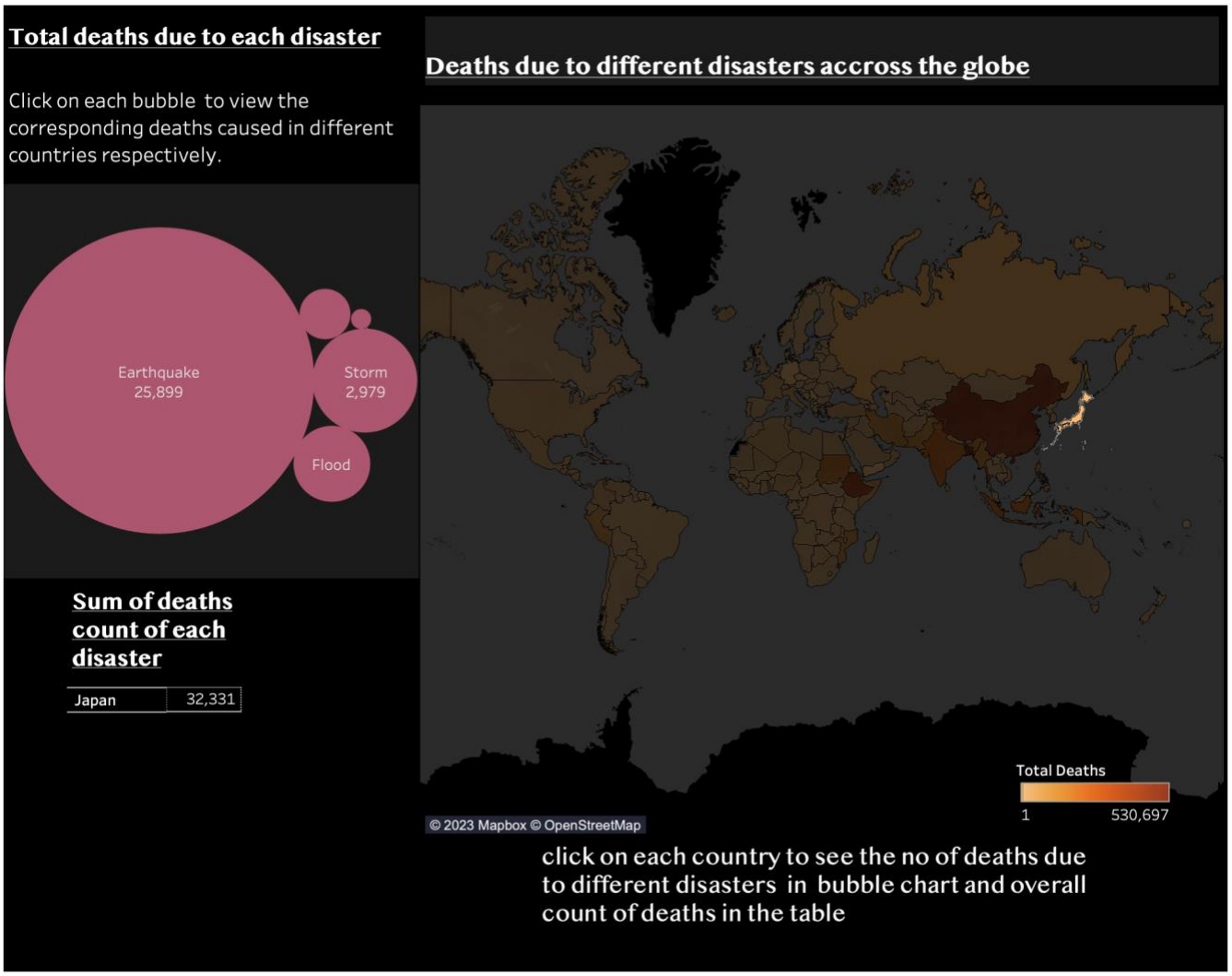
Lives Lost in Catastrophic Disasters:

The visualization presented illustrates the total number of deaths resulting from various disasters. To represent the interactivity between countries and the death toll, I employed a geographic map

and a packed bubble chart. The size of each bubble in the chart corresponds to the total number of deaths attributed to a specific disaster. In the map, a color gradient is utilized to depict the range of death occurrences, with darker shades indicating higher death counts. By clicking on a country, the associated death count is displayed in a table, and the bubble chart adjusts accordingly to reflect the changes. Attaching the video link of :[Interactive visualization of deaths due to different visualization]



The visualizations presented demonstrate the interplay between specific disasters, countries, and death counts. By selecting the "earthquake" disaster, the map highlights the respective death counts in various countries, which are also listed in a table. Furthermore, when clicking on a specific country, the bubble chart showcases the corresponding disasters and their associated death counts in that country, while the table displays the total death count for that country. From these visualizations, it highlights that earthquakes are the most devastating disasters.



Unmasking the Most Deadly Culprit:

To further explore earthquakes, I have conducted an in-depth analysis. Our approach involved utilizing a heat map and a geographic map to depict the number of earthquakes that occurred in each continent during each decade leading up to 2021. The magnitude table provides information on the minimum and maximum magnitudes of earthquakes in specific countries. In the heat map, a color gradient represents the range of earthquake counts, with darker shades indicating a higher frequency of occurrences. The visualization offers interactivity by allowing users to click on individual decades or countries. When a particular decade is selected, corresponding changes are observed in the geographic map and the magnitudes table. For a comprehensive understanding of the visualization, a video link is provided : Interactive visualization of Earthquakes

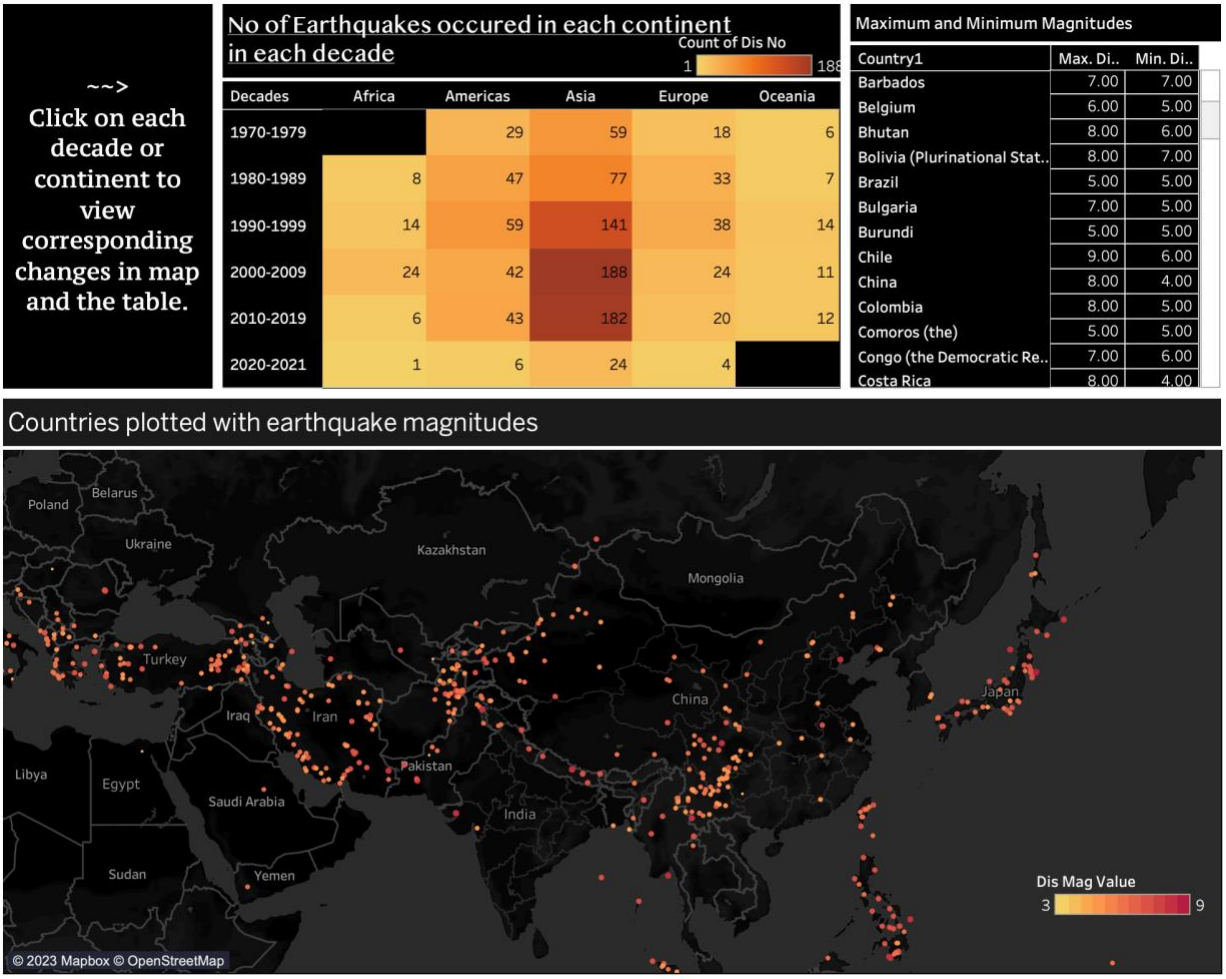


Fig 1

The visualizations provided offer valuable insights when explored from different angles. In the first visualization, clicking on the continent Asia in the heat map selects the column(fig2) and reveals earthquakes in that specific continent .After selecting China in the min and max magnitude(fig3) table reveals the number of earthquakes that occurred in the country between 1970 and 2021. This analysis helps us observe a significant trend: the deadliest earthquakes characterized by high magnitudes are observed in the map with respect to country , continent..
Further Moving on to the fourth visualization, by selecting the decade 2000-2009 from the heat map and the map dynamically presents the earthquakes that occurred in China during that specific time frame. This interactive approach enables a more focused analysis of earthquake data for various continents, providing valuable insights into the seismic activities that took place in different regions during specific decades.

These visualizations offer a deeper understanding of earthquake occurrences and their magnitudes, allowing users to explore the data from different perspectives. By leveraging the interactive features, users can identify patterns, examine magnitudes, and gain valuable insights into earthquake dynamics in various countries/continents and time periods.

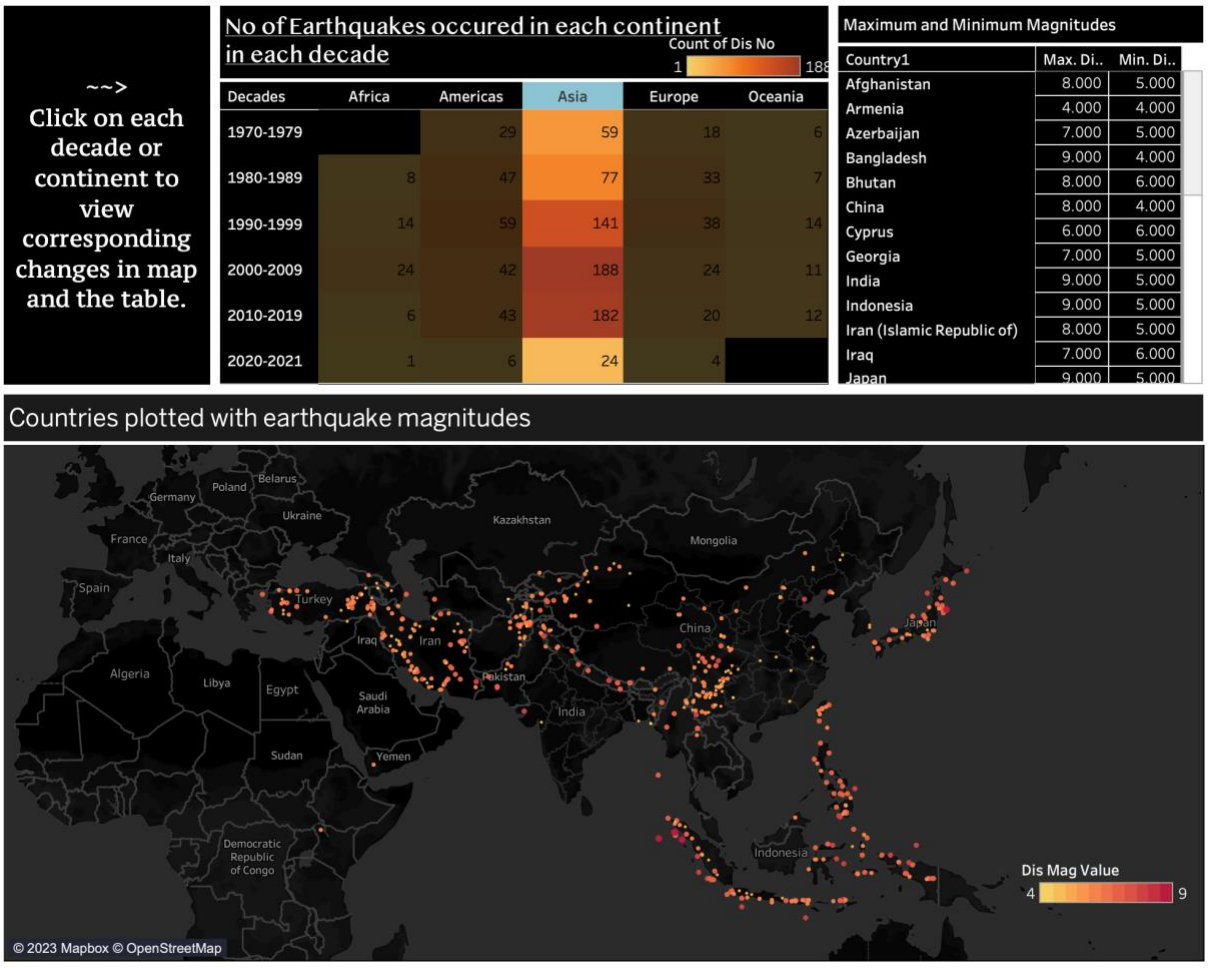
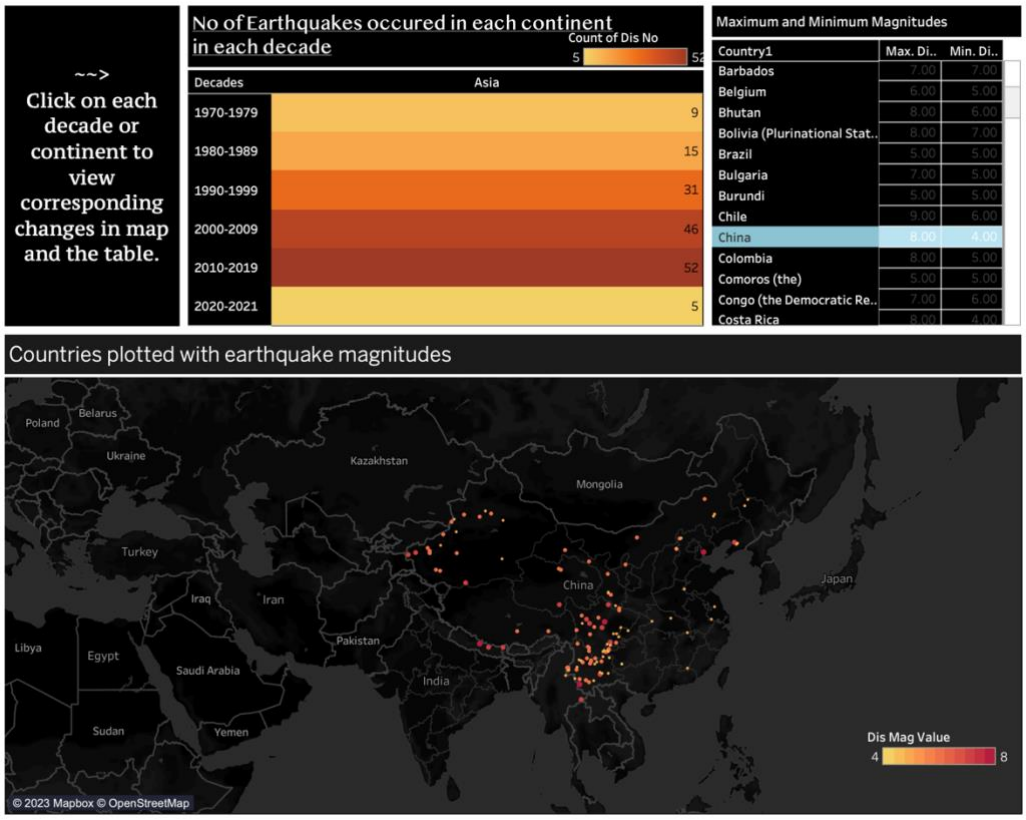

~~>
Click on each decade or continent to view corresponding changes in map and the table.
No of Earthquakes occured in each continent in each decade
Count of Dis No
1
188
Decades
Africa
Americas
Asia
Europe
Oceania
1970-1979
29
59
18
6
1980-1989
8
47
77
33
7
1990-1999
14
59
141
38
14
2000-2009
24
42
188
24
11
2010-2019
6
43
182
20
12
2020-2021
1
6
24
4
Maximum and Minimum Magnitudes
Country1
Max. Di..
Min. Di..
Afghanistan 8.000 5.000
Armenia 4.000 4.000
Azerbaijan 7.000 5.000
Bangladesh 9.000 4.000
Bhutan 8.000 6.000
China 8.000 4.000
Cyprus 6.000 6.000
Georgia 7.000 5.000
India 9.000 5.000
Indonesia 9.000 5.000
Iran (Islamic Republic of) 8.000 5.000
Iraq 7.000 6.000
Japan 9.000 5.000
Countries plotted with earthquake magnitudes
Germany
Poland
Belarus
Ukraine
France
Italy
Spain
Kazakhstan
Mongolia
Turkey
Iraq
Iran
China
Japan
Algeria
Libya
Egypt
Saudi Arabia
Pakistan
India
Sudan
Yemen
Democratic Republic of Congo
Indonesia
Dis Mag Value
4
9
© 2023 Mapbox © OpenStreetMap

Fig 2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Click on each decade or continent to view corresponding changes in map and the table.
No of Earthquakes occured in each continent in each decade
Count of Dis No
5
52
Decades
Asia
1970-1979
9
1980-1989
15
1990-1999
31
2000-2009
46
2010-2019
52
2020-2021
5
Maximum and Minimum Magnitudes
Country1
Max. Di..
Min. Di..
Barbados
Belgium
Bhutan
Bolivia (Plurinational Stat..
Brazil
Bulgaria
Burundi
Chile
China
Colombia
Comoros (the)
Congo (the Democratic Re..
Costa Rica
Countries plotted with earthquake magnitudes
Poland
Belarus
Ukraine
Kazakhstan
Mongolia
Turkey
Iraq
Iran
China
Japan
Pakistan
Libya
Egypt
Saudi Arabia
India
Sudan
Yemen
Dis Mag Value
4
8
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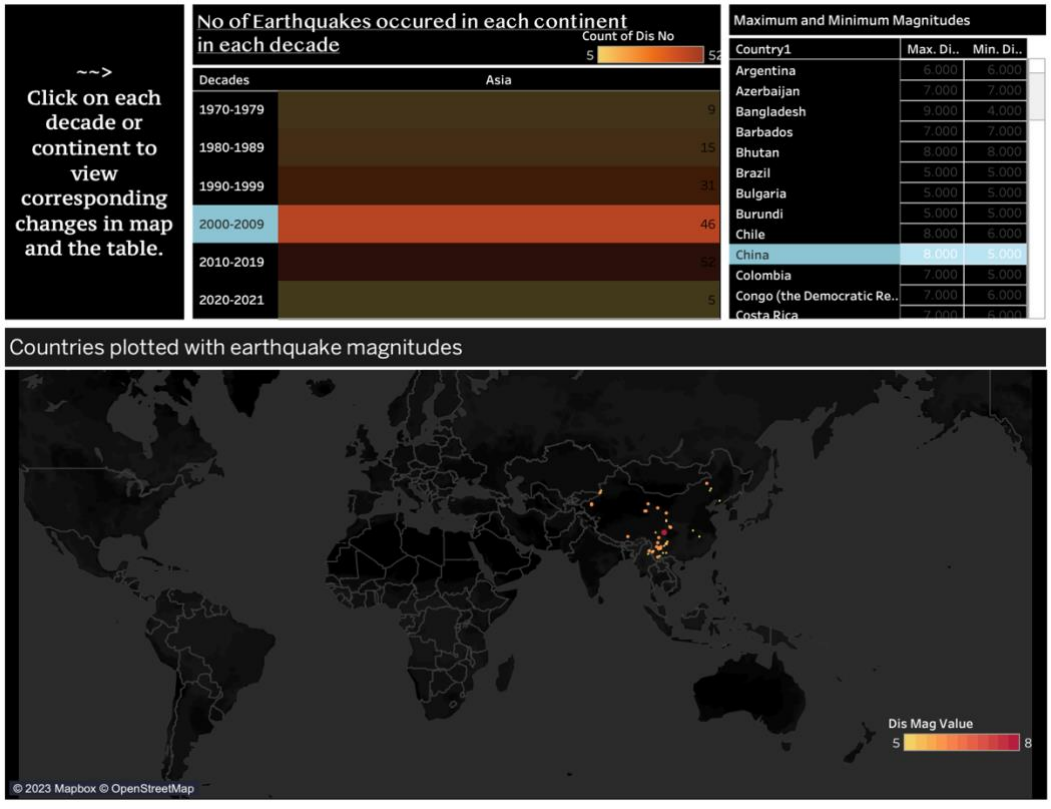
Fig 3: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Count of Dis No
5
52
Decades
Asia
1970-1979
9
1980-1989
15
1990-1999
31
2000-2009
46
2010-2019
52
2020-2021
5
Maximum and Minimum Magnitudes
Country1
Max. Di..
Min. Di..
Argentina
Azerbaijan
Bangladesh
Barbados
Bhutan
Brazil
Bulgaria
Burundi
Chile
China
Colombia
Congo (the Democratic Re..
Costa Rica
Countries plotted with earthquake magnitudes
Dis Mag Value
5
8
© 2023 Mapbox © OpenStreetMap

Fig 4:

Analysis:

After carefully analyzing the data and examining the visualizations, several interesting findings have emerged. Firstly, focusing on the total number of disasters from 1970 to 2021, our analysis and visualizations reveal that floods, storms, epidemics, and earthquakes are the most prevalent types of disasters. Moreover, it is evident that earthquakes, storms, droughts, floods, and epidemics have caused a significant number of deaths.

The mosaic plot provides insights into the impact of these disasters on different continents, with Asia being the most affected region. Additionally, when studying the pattern of disasters over time, there is a noticeable upward trend, indicating an increase in the frequency and intensity of calamities. To further investigate the impact of disasters, I specifically delved into the deaths caused by each type of disaster in various countries. Remarkably, the analysis highlights that earthquakes stand out as the deadliest disaster.

To gain a comprehensive understanding, I conducted in-depth analyses by navigating through each decade and continent, examining the magnitudes associated with earthquakes. These insights shed light on the severity and distribution of earthquakes, contributing to a deeper comprehension of their impact on different regions and time periods.