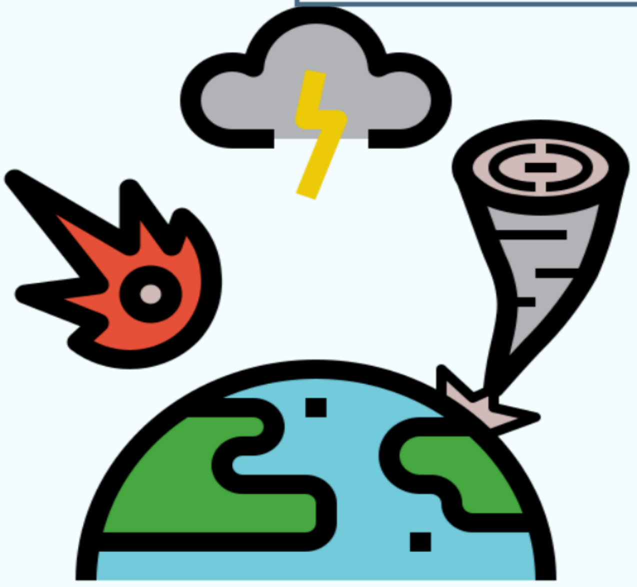
# GLOBAL DISASTERS IMPACT 1976-2024

TECHNICAL REPORT

HAMEEDA EBRAHIM - DAB 16

# TABLE OF CONTENT:





## Introduction:

Natural disasters represent one of the most significant threats to human life, infrastructure, and economic stability worldwide. As climate change accelerates and populations grow in hazard-prone areas, the frequency and impact of disasters have become increasingly important to monitor and understand. Governments, humanitarian agencies, and researchers rely on data-driven insights to identify vulnerable regions, evaluate risk levels, and develop strategies that reduce disaster losses.

In this project, a comprehensive dataset of global disaster events is analyzed to explore how different hazards—such as earthquakes, floods, storms, wildfires, and other natural events—have affected populations across time and regions. The dataset provides detailed information including the type of disaster, start date, geography, severity indicators (such as total deaths or total affected), and in some cases additional measures like magnitude or intensity. This collection of variables allows for in-depth evaluation of both the occurrence of disasters and their human impact.

The aim of this analysis is to transform raw data into meaningful insights by examining long-term trends, seasonal patterns, severity classifications, and regional differences. Through techniques such as frequency analysis, and ratio calculations, the report highlights which areas are most at risk, which hazards are becoming more common, and how the impact on communities changes over years and quarters. These findings provide valuable knowledge that can support disaster preparedness, improve resilience, and contribute to more effective decision-making in risk management.

## Problem Statement:

From 1976 until 2024, The number of people affected per disaster shows a clear seasonal pattern, peaking sharply in Summer and Autumn months. This indicates that disasters occurring in these seasonal months tend to have significantly higher human impact.

## Objectives:

1. Which natural disasters occur most? (Frequency & Trend Analysis)
2. Is there seasonal pattern for flood disasters? (Frequency & Trend Analysis)
3. Is there seasonal pattern for storm disasters? (Frequency & Trend Analysis)
4. Which country has high risk index due to flood disasters? (Geographic Risk Analysis)
5. Which country has high risk index due to storm disasters? (Geographic Risk Analysis)
6. Which country has high risk index due to earthquake disasters? (Geographic Risk Analysis)
7. Does magnitude of earthquake affect the number of deaths? (Earthquake Analysis)
8. Which tectonic plates are more affected by earthquakes? (Earthquake Analysis)
9. Which region has the highest number of disasters? (Geographic Risk Analysis)
10. Does response reduce deaths? (Response Efficiency Analysis)
11. Are some regions underserved? (Response Efficiency Analysis)

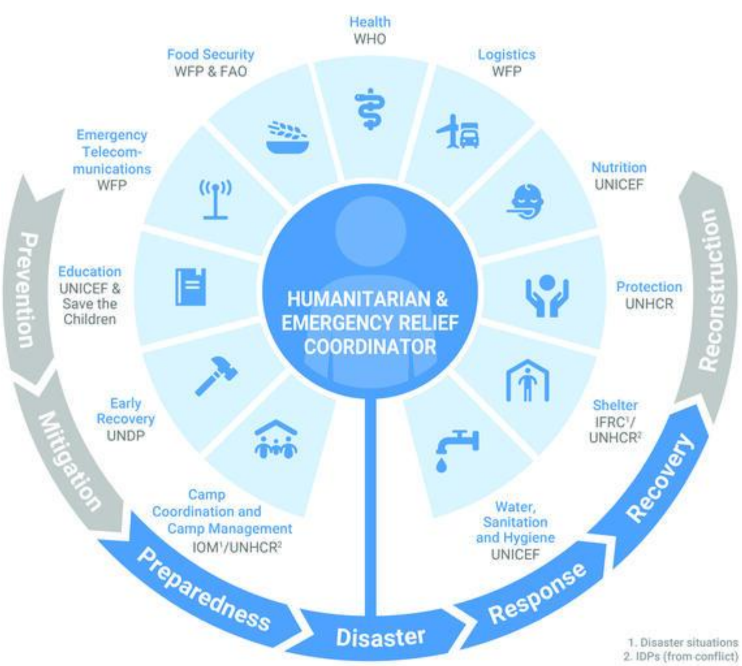
## Target Audience:

Organization: United Nations (UN).

Department: Office for the Coordination of Humanitarian Affairs (OCHA).

Target: Emergency Relief Coordinator (ERC).

Why: The ERC leads the Inter-Agency Standing Committee (IASC) and coordinates the overall UN international humanitarian response to all types of emergencies and disasters globally.



## Data Dictionary:

| Column Name | Type | Description |
|---|---|---|
| DisNo. | ID, Mandatory | A unique 8-digit identifier including the year (4 digits) and a sequential number (4 digits) for each disaster event (i.e., 2004-0659). In the EM-DAT Public Table, the ISO country code is appended. |
| Historic | Yes/No, Mandatory | Binary field specifying whether or not the disaster happened before 2000, using the Start Year. Data before 2000 should be considered of lesser quality. |
| Classification Key | ID, Mandatory | A unique 15-character string identifying disasters in terms of the Group, Subgroup, Type and Subtype classificati on hierarchy. |
| Disaster Group | Name, Mandatory | The disaster group, i.e., "Natural" or "Technological." |
| Disaster Subgroup | Name, Mandatory | The disaster subgroup. |
| Disaster Type | Name, Mandatory | The disaster type. |
| Disaster Subtype | Name, Mandatory | The disaster subtype. |
| External IDs | IDs List, Optional | List of identifiers for external resources (GLIDE, USGS, DFO, HANZE), in the format "<source>:<identifier>" and separated by the pipe character ("\|"). |
| Event Name | Optional | Short specification for disaster identification, e.g., storm names (e.g., "Mitch"), plane type in air crash (e.g., "Boeing 707"), disease name (e.g., "Cholera"), or volcano name (e.g., "Etna"). |
| ISO | ID, Mandatory | The International Organization for Standardization (ISO) 3-letter code referring to the Country. The ISO 3166 norm is used. |
| Country | Name, Mandatory | Country where the disaster occurred and had an impact, using names from the UN M49 Standard. See Spatial Information and Geocoding. If multiple countries are affected, each will have an entry linked to the same DisNo.. |
| Subregion | Name, Mandatory | Subregion where the disaster occurred based on UN M49 standard, automatically linked to the Country field. |
| Region | Name, Mandatory | Region or continent where the disaster occurred based on UN M49 standard, automatically linked to the Country field. |
| Location | Text, Optional | Geographical location name as specified in the sources, e.g., city, village, department, province, state, or district. Used to identify corresponding GAUL Admin. |

| | | |
|---|---|---|
| Origin | Text, Optional | Additional specifications on the contextual factors that led to the event, e.g., “heavy rains” for floods, or “drought” for a forest fire. |
| Associated Types | Names List, Optional | List of secondary disaster types cascading from or co-occurring aside from the main type (optional), e.g., a landslide following a flood or an explosion after an earthquake. Separated by the pipe character ("\|"). |
| OFDA/BHA Response | Yes/No, Mandatory | Binary field specifying whether or not the (former) Office of US Foreign Disaster Assistance (OFDA) or the Bureau of Humanitarian Assistance (BHA) responded to the disaster. |
| Appeal | Yes/No, Mandatory | Binary field specifying whether or not there was a request for international assistance from the affected country. |
| Declaration | Yes/No, Mandatory | Binary field specifying whether a state of emergency was declared in the country. |
| AID Contribution (‘000 US$) | Unadjusted Monetary Amount (‘000 US$), Optional | The total amount (in thousands of US$ at the time of the report) of contributions for immediate relief activities to the country in response to the disaster, sourced from the Financial Tracking System of OCHA (1992 to 2015). Not maintained after 2015 due to a lack of availability of information. |
| Magnitude | Disaster-Type-Dependent, Optional | The intensity of a specific disaster. |
| Magnitude Scale | Disaster-Type-Dependent, Optional | The associated unit for the Magnitude column. |
| Latitude | Degrees [-90;90], Optional | North-South coordinates mainly for earthquakes and volcanic activity. Sometimes reported for floods, landslides, and storms (mostly when associated with floods). |
| Longitude | Degrees [-180;180], Optional | East-West coordinates mainly for earthquakes and volcanic activity. Sometimes reported for floods, landslides, and storms (mostly when associated with floods). |
| River Basin | Text, Optional | Name of affected river basins, typically used for floods. |
| Start Year | Numeric, Mandatory | Year of occurrence of the disaster. |
| Start Month | Numeric, Optional | Month of occurrence of the disaster. For sudden-impact disasters, this field is well defined. For disasters developing gradually over a longer time period (e.g., drought) with no precise onset date, this field can be left blank. |

| | | |
|---|---|---|
| Start Day | Numeric, Optional | Day of occurrence of the disaster. For sudden-impact disasters, this field is well defined. For disasters developing gradually over a longer time period (e.g., drought) with no precise onset date, this field can be left blank. |
| End Year | Numeric, Optional | Year of disaster conclusion. |
| End Month | Numeric, Optional | Month of conclusion of the disaster. For sudden-impact disasters, this field is well defined. For disasters developing gradually over a longer time period (e.g., drought) with no precise end date, this field can be left blank. |
| End Day | Numeric, Optional | Day of conclusion of the disaster. For sudden-impact disasters, this field is well defined. For disasters developing gradually over a longer time period (e.g., drought) with no precise end date, this field can be left blank. |
| Total Deaths | Numeric, Optional | Total fatalities (deceased and missing combined. |
| No. Injured | Numeric, Optional | Number of people with physical injuries, trauma, or illness requiring immediate medical assistance due to the disaster. |
| No. Affected | Numeric, Optional | Number of people requiring immediate assistance due to the disaster. |
| No. Homeless | Numeric, Optional | Number of people requiring shelter due to their house being destroyed or heavily damaged during the disaster. |
| Total Affected | Numeric, Optional | Total number of affected people (No Injured, No Affected, and No Homeless combined. |
| Reconstruction Costs (‘000 US$) | Unadjusted Monetary Amount (‘000 US$), Optional | Costs for replacement of lost assets in thousands of US dollars (‘000 US$) relative to Start Year, unadjusted for inflation. |
| Reconstruction Costs, Adjusted (‘000 US$) | Adjusted Monetary Amount (‘000 US$), Optional | Reconstruction Costs (‘000 US$), adjusted for inflation using the Consumer Price Index (CPI column). |
| Insured Damage (‘000 US$) | Unadjusted Monetary Amount (‘000 US$), Optional | Economic damage covered by insurance companies, in thousands of US dollars (‘000 US$), relative to Start Year, unadjusted for inflation. |
| Insured Damage, Adjusted (‘000 US$) | Adjusted Monetary Amount (‘000 US$), Optional | Insured Damage (‘000 US$) adjusted for inflation using the Consumer Price Index (CPI column). |
| Total Damage (‘000 US$) | Unadjusted Monetary Amount | Value of all economic losses directly or indirectly due to the disaster, in thousands of US dollars (‘000 |

| | | |
|---|---|---|
| | (‘000 US$), Optional | US$), relative to Start Year, unadjusted for inflation. |
| Total Damage, Adjusted (‘000 US$) | Adjusted Monetary Amount (‘000 US$), Optional | Total Damage (‘000 US$) adjusted for inflation using the Consumer Price Index (CPI column). |
| CPI | Conversion Ratio, Optional | Consumer Price Index from OECD used to adjust US$ values for inflation relative to Start Year. |
| Admin Units | JSON Array of Objects, Optional | Collection of impacted Administrative Units from the FAO GAUL 2015 referential (Global Administrative Unit Layers 2015). Individual objects correspond to Level-1 or Level-2 Administrative Units, with the corresponding fields adm1_code, adm1_name or adm2_code, adm 2_name providing the unique identifier to the geometry in the GAUL layer and the name of the unit, respectively. Geocoding is maintained for non-biological natural hazards from 2000 onwards . |
| Entry Date | Date, Mandatory | The day on which the event record was created in EM-DAT. |
| Last Update | Date, Mandatory | The last modification of the event or one of its associated records in EM-DAT. This may not result in a modification of the information in the EM-DAT Public Table as modifications to private fields are recorded as well. |
| Date | Date | The full start date of the disaster. |

## Data Handling:

Please refer to the Jupiter Notebook.

## Analysis and Findings:

The disasters in the dataset are divided into two groups which are:

1. Natural disasters.
2. Technological disasters.

The following chart shows the frequency of each group over time.

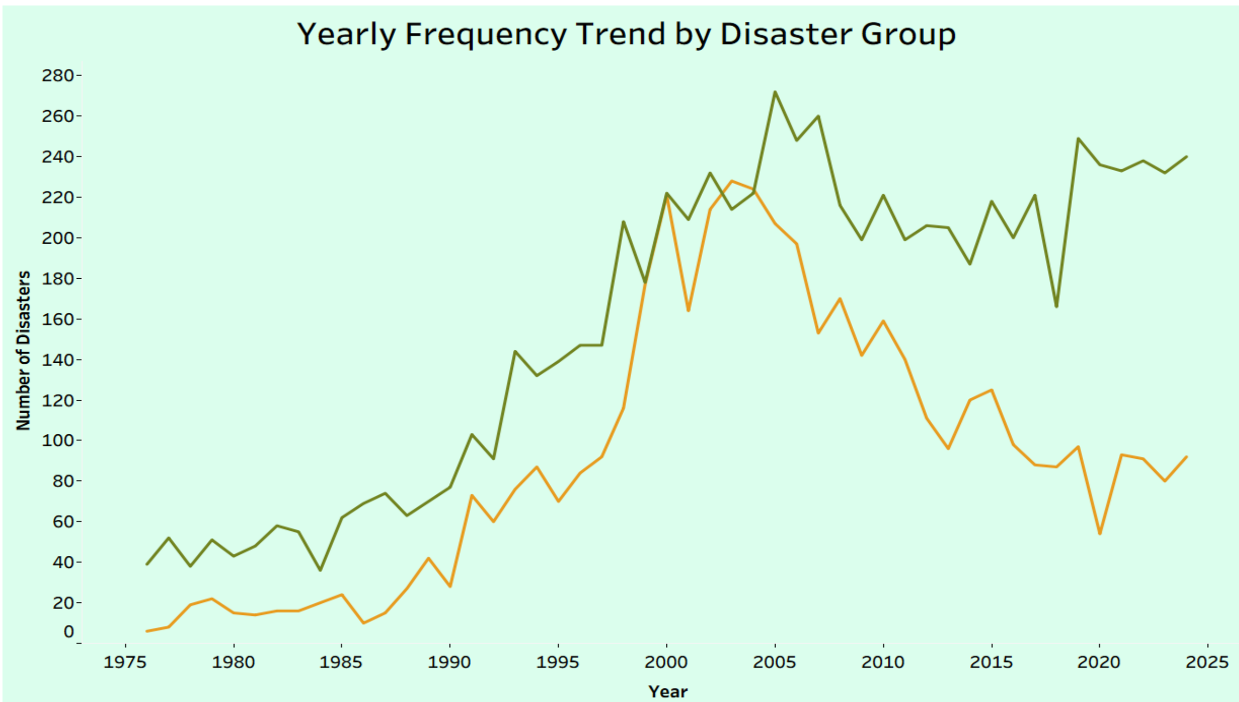



**Figure 1: Yearly frequency trend for natural and technological disasters.**

From the chart, natural disasters have increased over time, while technological disasters rose at first and then sharply declined. In recent years, natural hazards continue to dominate global disaster frequency.

The increase in natural disasters may reflect improved reporting and greater population exposure, whereas the decline in technological events may be linked to stricter safety regulations and better risk management.

Therefore, I will focus on natural disasters.

So, which natural disasters have mostly occurred from 1976 until 2024?

The following charts will show first the frequency of the subgroup of the disasters then the most frequent disasters.

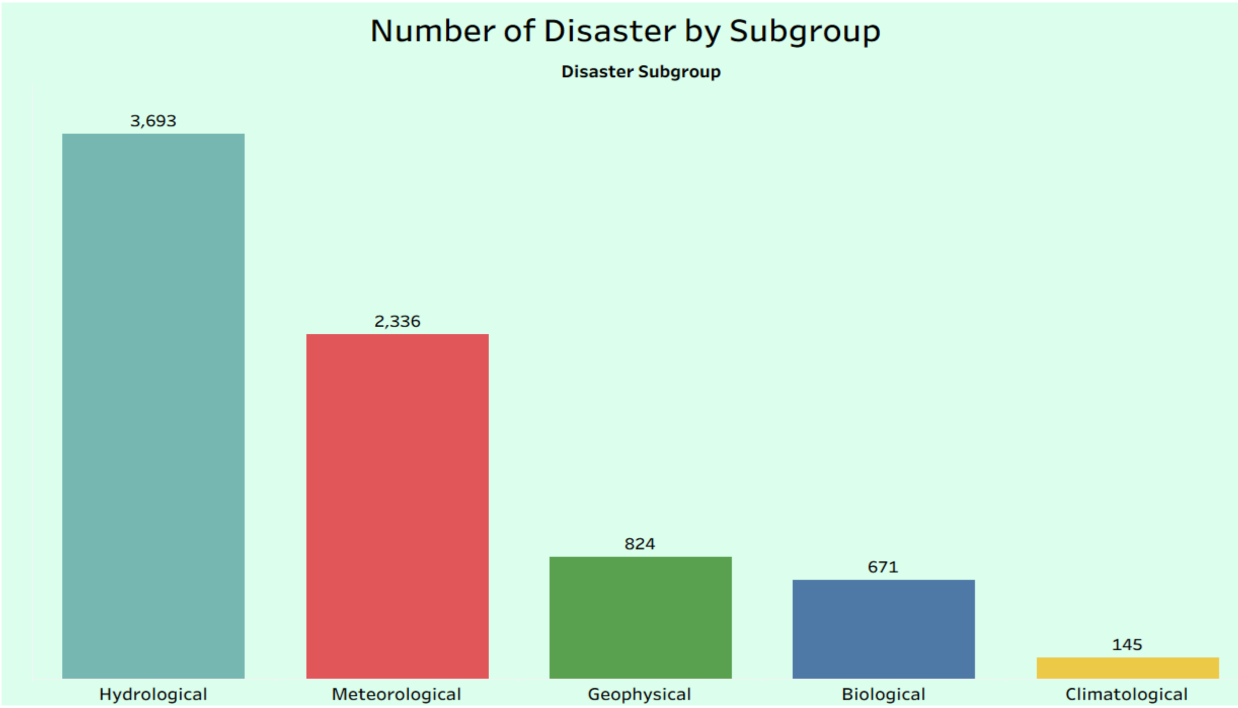



**Figure 2: Number of disasters by subgroup.**

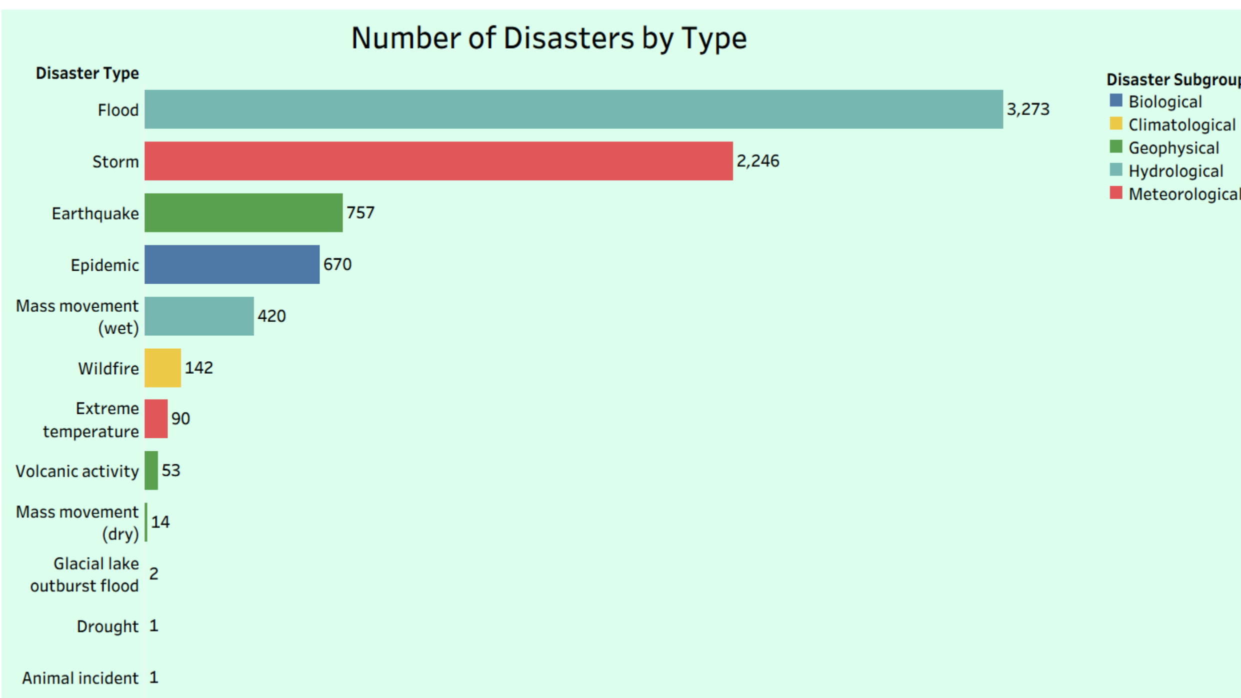



**Figure 3:Most natural disasters.**

According to Figure 3, it is clear that the top 3 natural disasters are:

1. Flood.
2. Storm.
3. Earthquake.

So, I will focus especially on these disasters.

I. Flood Analysis:

In this section, I will focus on two things which are:

a. Seasonality of flood:

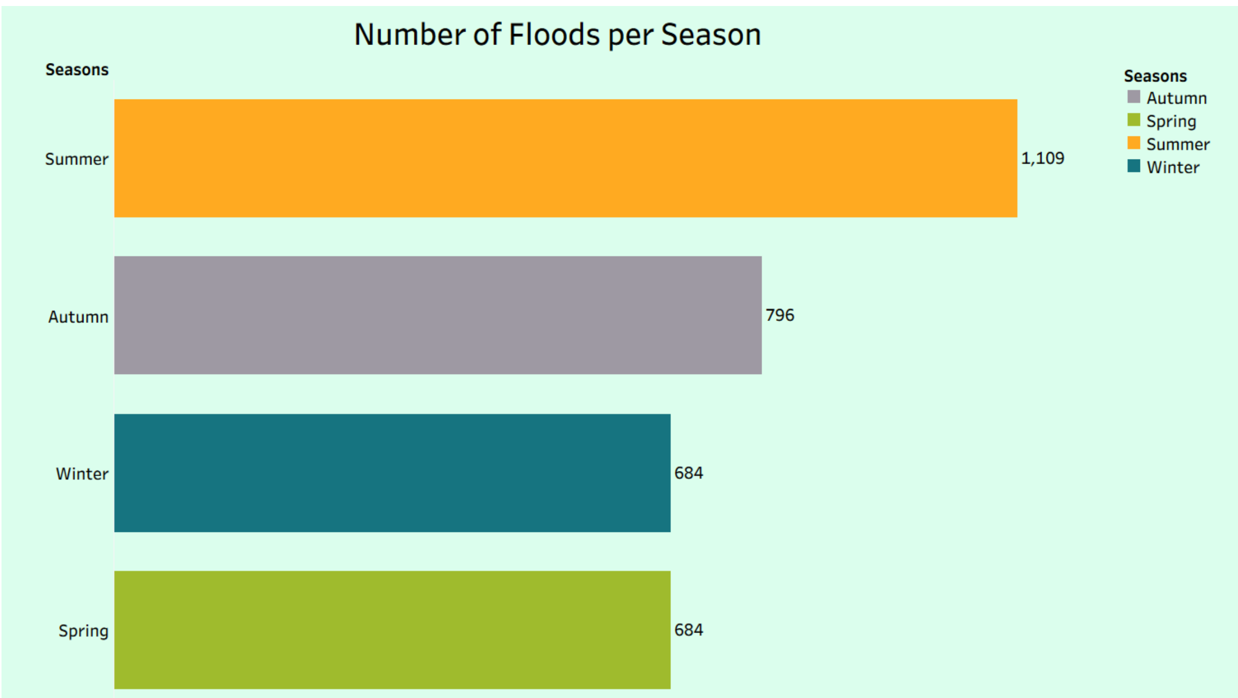



**Figure 4: Frequency of flood disaster for each season.**

Figure 4 shows that floods occur most often during the summer season. This happens for several reasons, the most important of which are:

1. When the weather becomes very hot, water evaporates more rapidly, increasing the likelihood of forming heavy rain clouds. These clouds can grow and concentrate quickly.
2. Large shifts in air pressure at different levels of the atmosphere can also contribute to intense rainfall and flooding. [1]

b. Top countries had highest risk index:

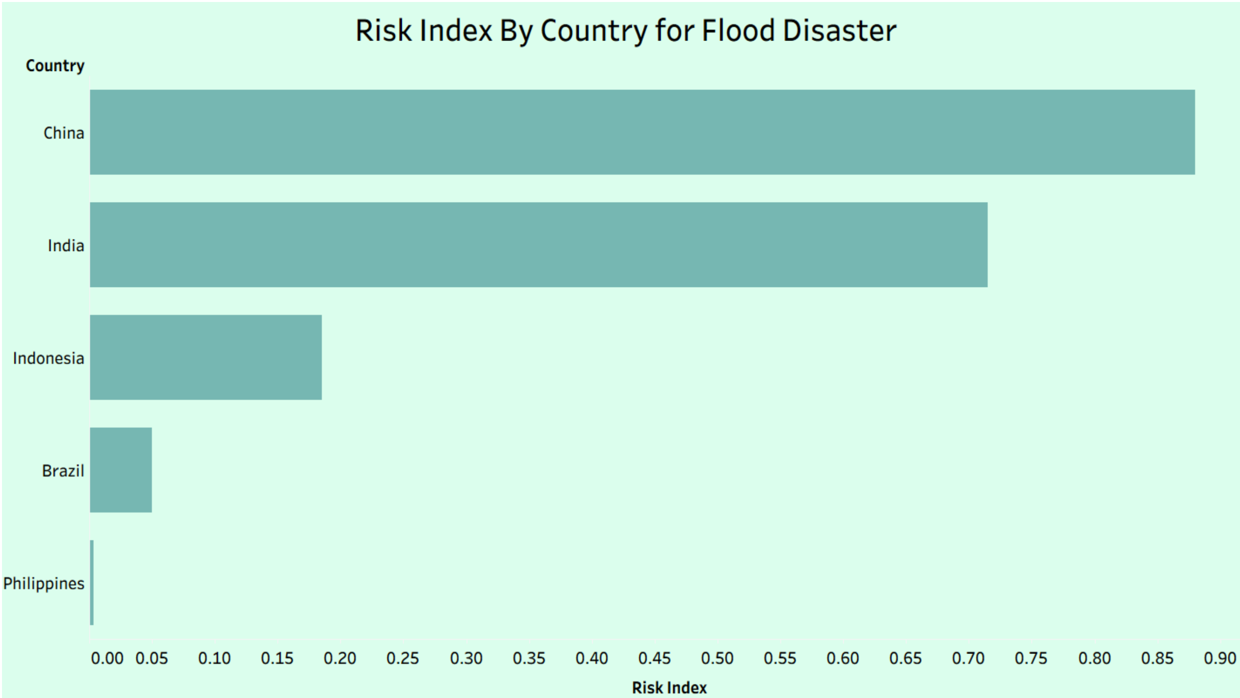



**Figure 5: Top 5 countries that have highest risk index due to floods.**

Figure 5 shows that China has the highest risk index. So, what are the reasons that make China more affected by floods?

1. Geographical: China lies along the western Pacific Ocean, a region prone to tropical cyclones and rising sea levels.
2. Climatic environment: The monsoon climate causes uneven spatial and temporal distribution of precipitation across China, increasing the likelihood of severe flooding. [2]

II. Storm Analysis:

Here again, I will focus on two things which are:

a. Seasonality of storms:

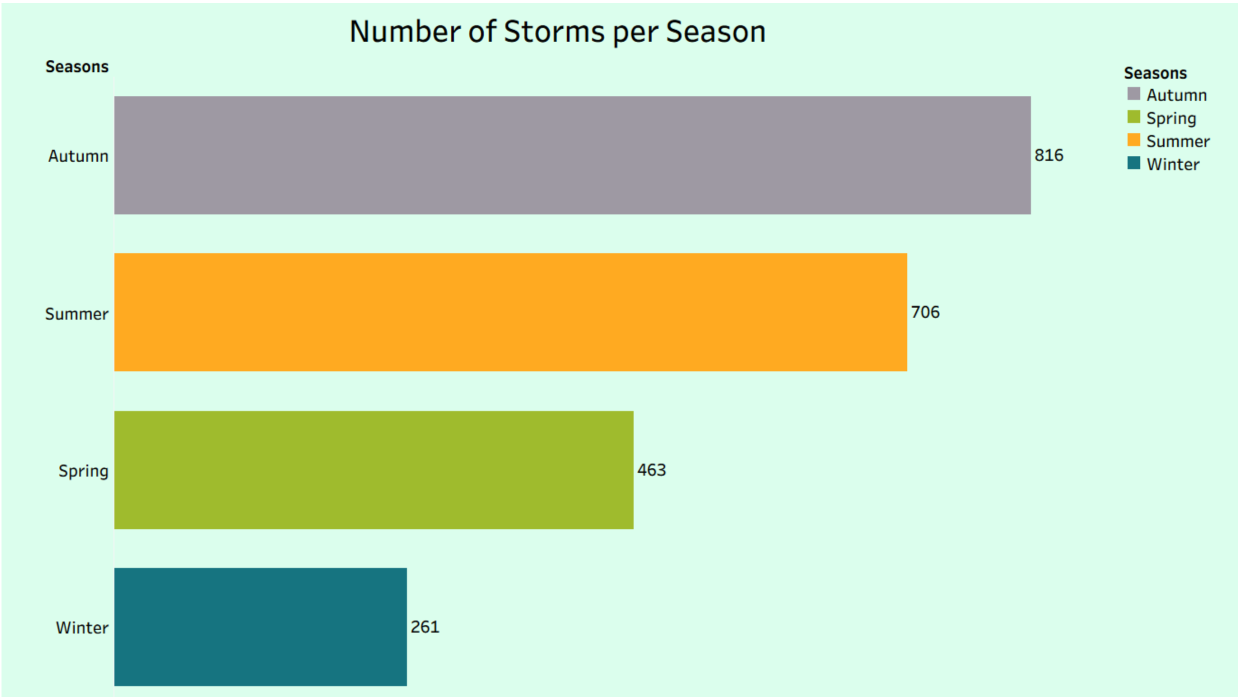



**Figure 6: Frequency of storm disaster for each season.**

Figure 6 shows that storms occur most often during the autumn season. This happens for several reasons, the most important of which are:

1. Warm ocean waters (at least 26°C or 80°F).
2. A tropical atmosphere that can easily trigger convection (i.e., thunderstorms).
3. Low vertical winds shear in the troposphere.
4. A substantial amount of large-scale atmospheric spin, provided either by the monsoon trough or by easterly waves. [3]

b. Top countries had highest risk index:

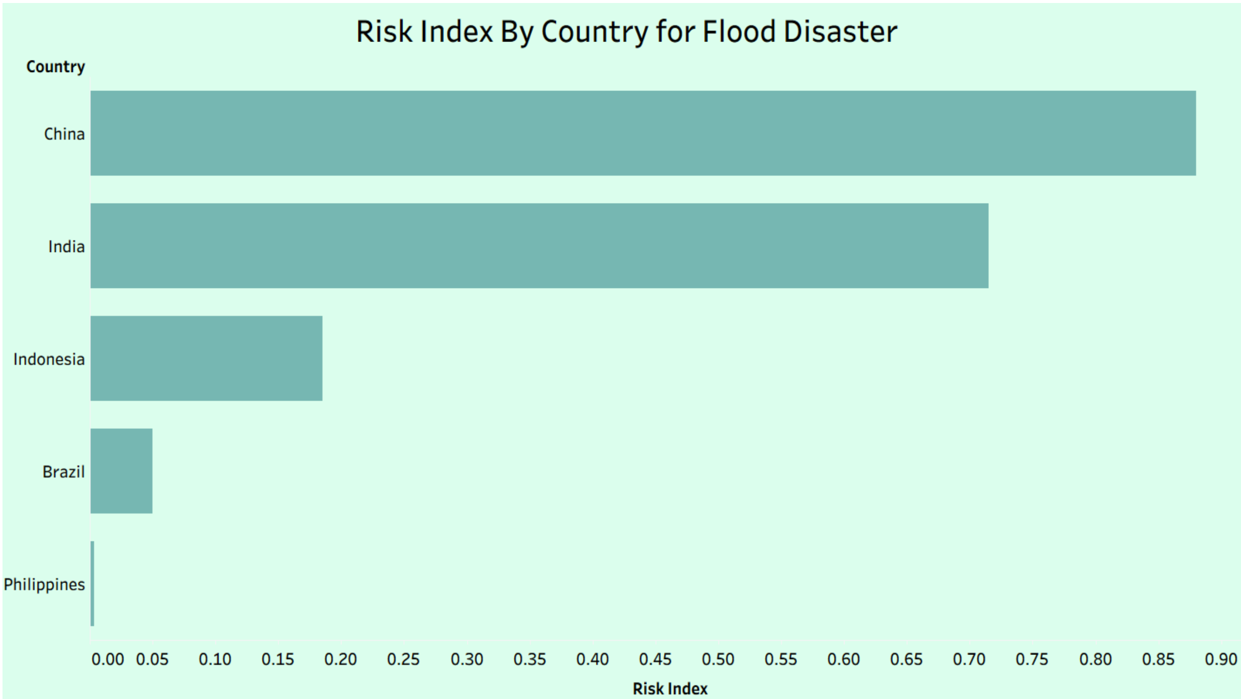



**Figure 7: Top 5 countries that have highest risk index due to storms.**

Figure 7 shows that the Philippines has the highest risk index. So, what are the reasons that make the Philippines more affected by storms?

1. Pacific Typhoon Belt: The Philippines experiences many typhoons because it is located in the Pacific Typhoon Belt, an area where nearly one-third of the world's tropical cyclones form.
2. Extreme weather: Similar to hurricanes, typhoons have extremely strong wind speeds that cause significant damage, and the storm surges they generate can flood coastal areas. The intensity of these storms has greatly increased in recent years, largely due to rising sea temperatures caused by global warming, which makes typhoons less frequent but much more powerful. [4]

III. Earthquake Analysis:

In this section, I will focus on four things, which are:

a. Seasonality of earthquakes:

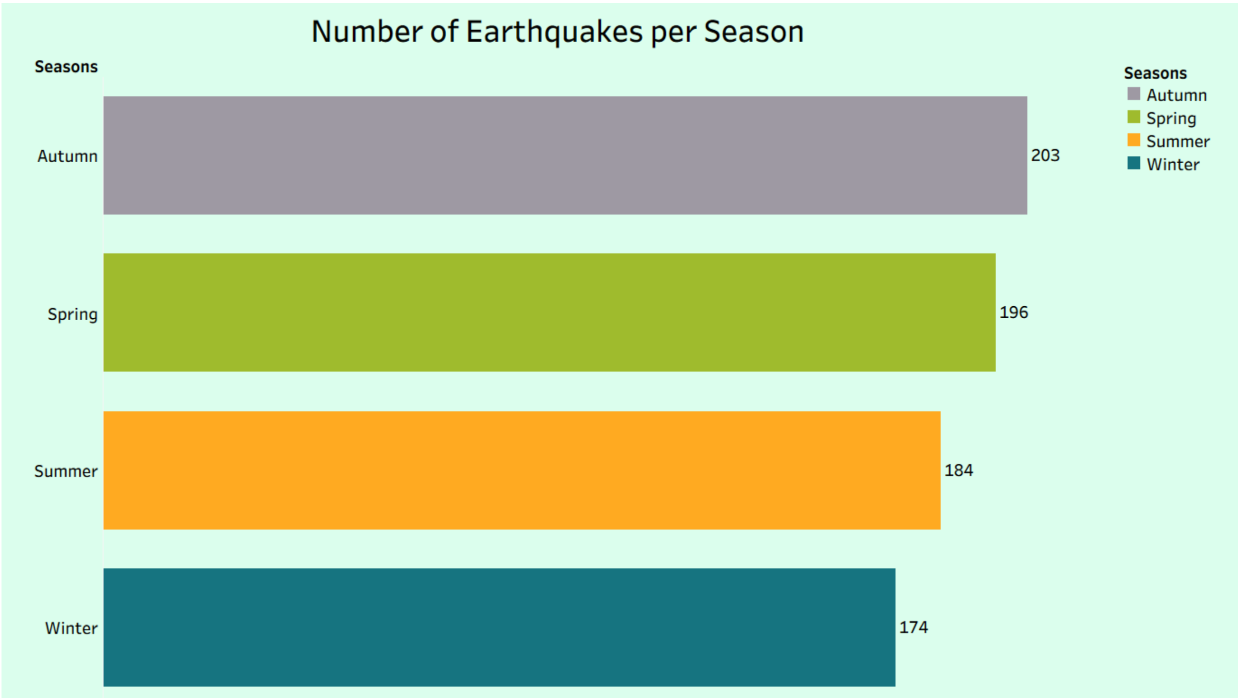



**Figure 8:Frequency of earthquake disaster for each season.**

It is clear from Figure 8 that earthquake disasters do not show any seasonality.

b. Top countries had highest risk index:

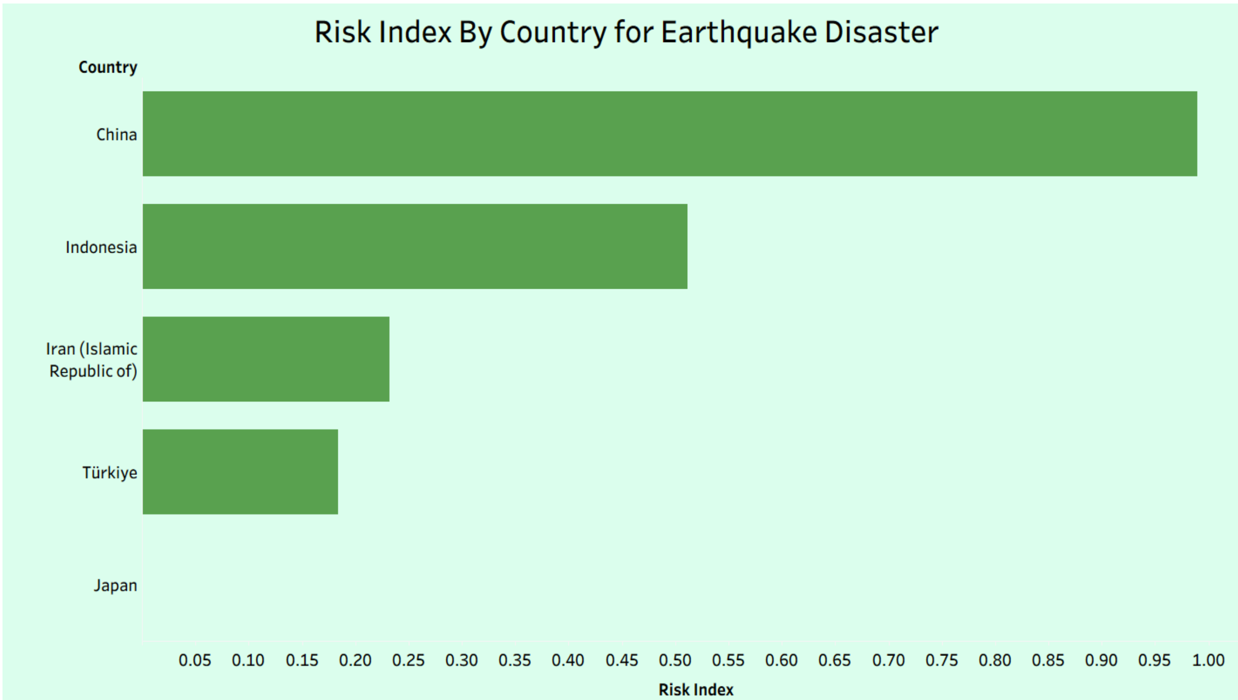



**Figure 9:Top 5 countries that have highest risk index due to earthquakes.**

Figure 9 shows that China has the highest risk index. So, what are the reasons that make China more affected by earthquakes?

1. Location: China lies in a region where the Eurasian, Pacific, and Indian plates meet. Because these plates are still actively moving, the country experiences frequent earthquakes.
2. Mountainous terrain: Many areas in China are mountainous or hilly, making them highly vulnerable to secondary hazards such as collapses, landslides, and debris flows during earthquakes.
3. The Tan-Lu (Tancheng–Lujiang) Fault Zone: This major fault zone passes through the region. Detailed studies show that it consists of five major faults, three of which are Late Quaternary active faults that remain seismically active today. [5]

c. Magnitude Classification:

Classification of earthquakes by magnitude [6]:

Table 1: The earthquake classification.

| Magnitude | Classification Description |
|---|---|
| 1-1.9 | Micro |
| 2-2.9 | Minor |
| 3-3.9 | Slight |
| 4-4.9 | Light |
| 5-5.9 | Moderate |
| 6-6.9 | Strong |
| 7-7.9 | Major |
| 8-8.9 | Great |
| 9-9.9 | Extreme |

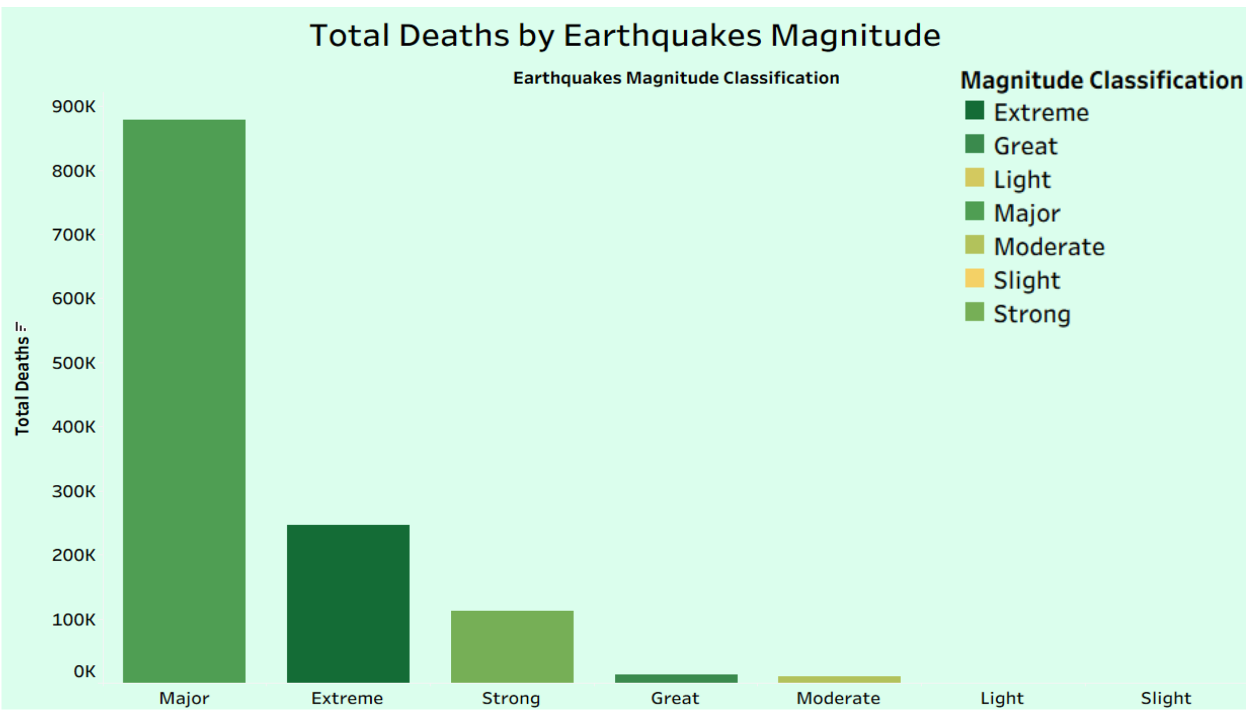



**Figure 10The earthquake magnitude classification vs. frequency and total number of deaths.**

Figure 10 shows that strong earthquakes occur more frequently, while major earthquakes result in a higher number of deaths. So, what explains this difference?

An earthquake releases energy across many frequencies, and calculating its total energy requires considering all of them throughout the event. Each whole-number increase in magnitude represents a tenfold increase in measured amplitude but 32 times more energy released.

Therefore, based on Table 1, major earthquakes have a higher magnitude than strong earthquakes. As a result, they release significantly more energy, which leads to more severe destruction and a higher number of deaths compared with strong earthquakes. [7]

d. Tectonic Plates Classification:

If we look at the pattern of where earthquakes occur around the world, it is clear that most of the activity is concentrated in a number of distinct earthquake belts, for instance the edge of the Pacific Ocean, or in the middle of the Atlantic Ocean. Over 80 per cent of large earthquakes occur around the edges of the Pacific Ocean, an area known as the 'Ring of Fire'; this where the Pacific plate is being subducted beneath the surrounding plates. The Ring of Fire is the most seismically and volcanically active zone in the world.

The following chart shows that most earthquakes are concentrated around the Pacific Plate.

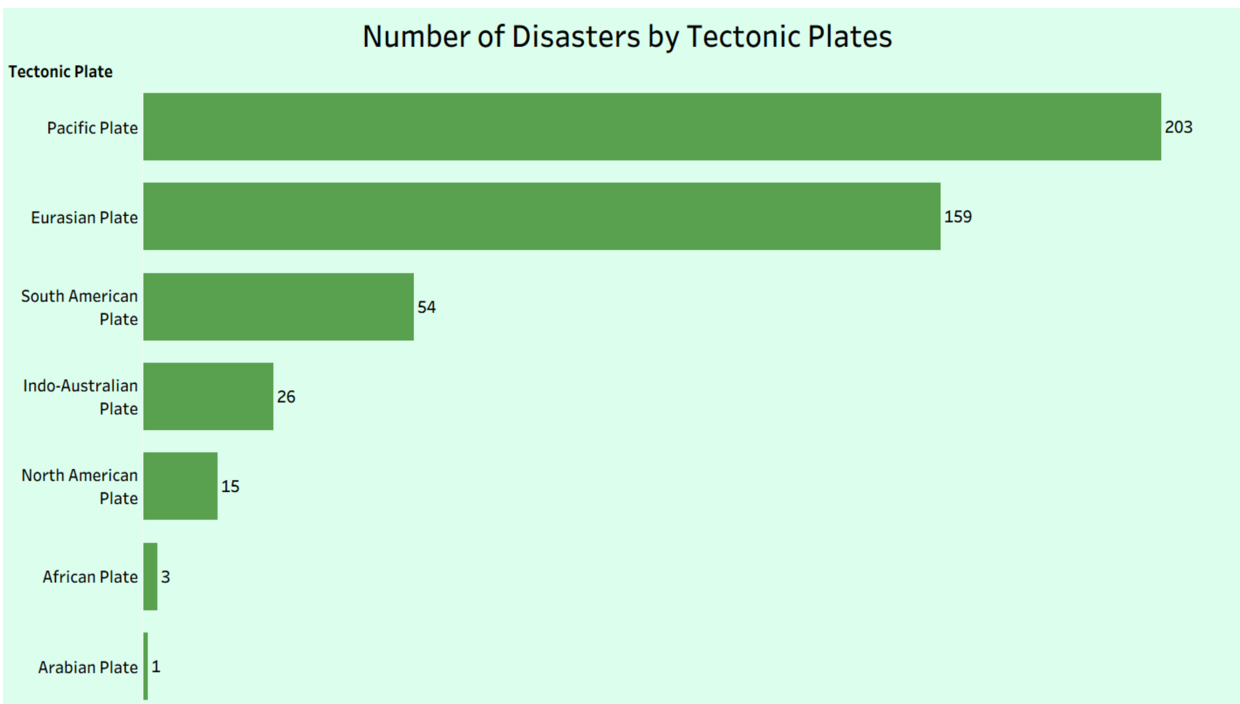



**Figure 11: The distribution of earthquakes across tectonic plates.**

So, what are the reasons for these concentrations of earthquakes?

1. Subduction zones: Along much of the Ring of Fire, the Pacific Plate is subducted beneath other plates. This process generates friction and builds stress as one plate forces its way beneath another. When the stress exceeds the strength of the rock, it is released suddenly, causing large earthquakes.

2. Transform boundaries: In areas like the boundary between the Pacific and North American Plates, plates move horizontally past each other. These transform faults accumulate tension when the plates get stuck, and the sudden release of this energy results in earthquakes.
3. Plate boundaries: The Pacific Plate is a massive tectonic plate surrounded by numerous other plates in constant motion. Collisions, sliding, and separations at these boundaries drive the high level of geologic activity.
4. Divergent boundaries: Even where plates pull apart, such as at the East Pacific Rise, earthquake activity occurs. Seafloor spreading creates new crust and generates earthquakes in these regions as well. [8]

## IV. Regions & Response Analysis:

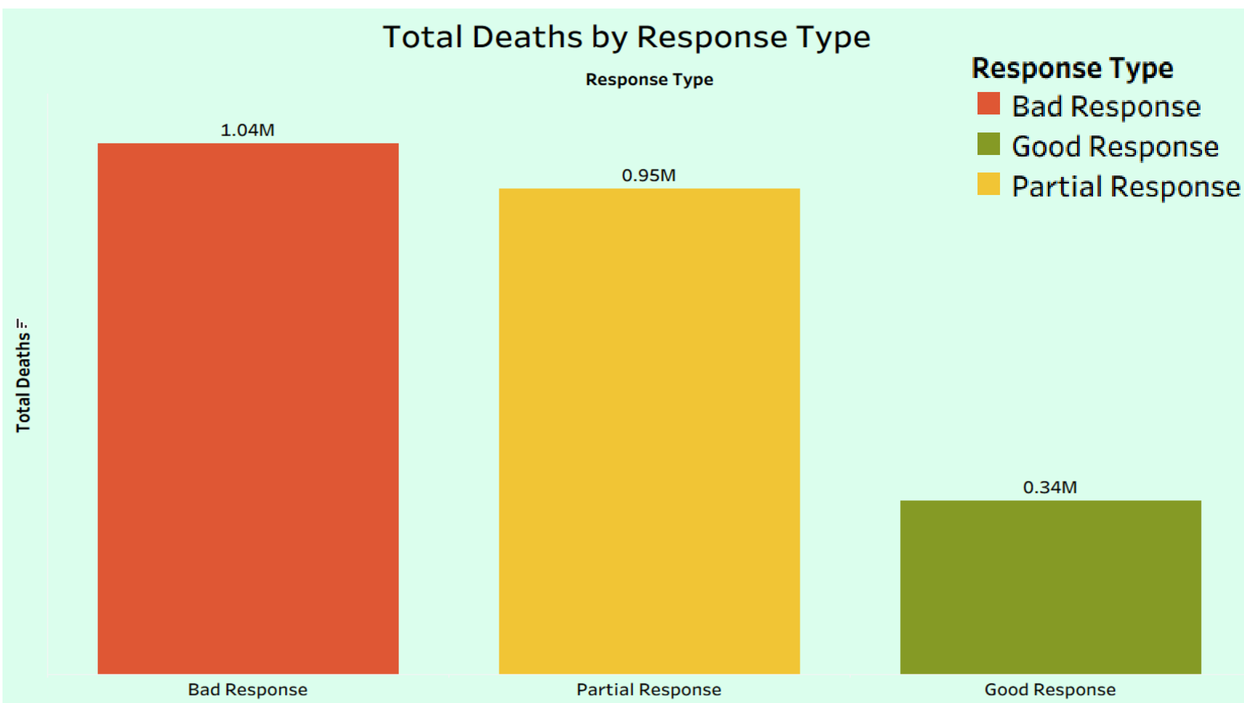



**Figure 12:Total deaths per response type.**

Figure 12 shows that the response affects the number of deaths.

Next, we will examine the effect of the response by region. But first, we need to look at the number of disasters in each region.

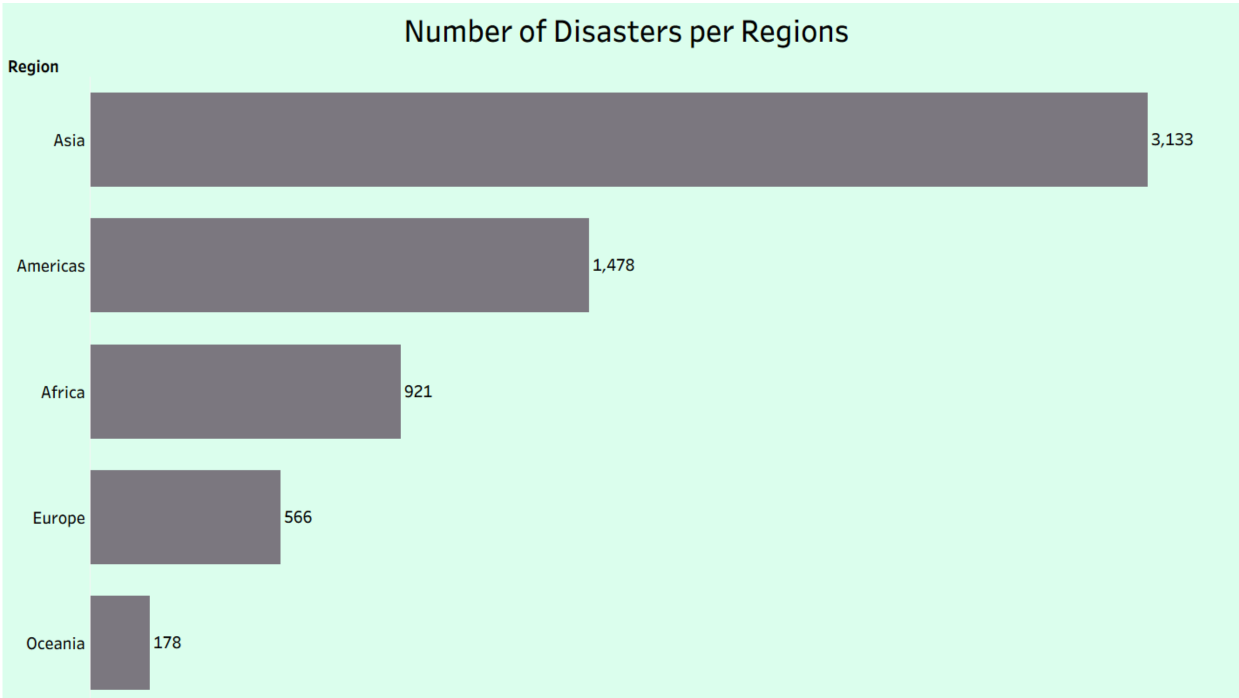



**Figure 13:Number of disasters per regions.**

Now, let's examine the response in each region and determine if any regions are underserved.

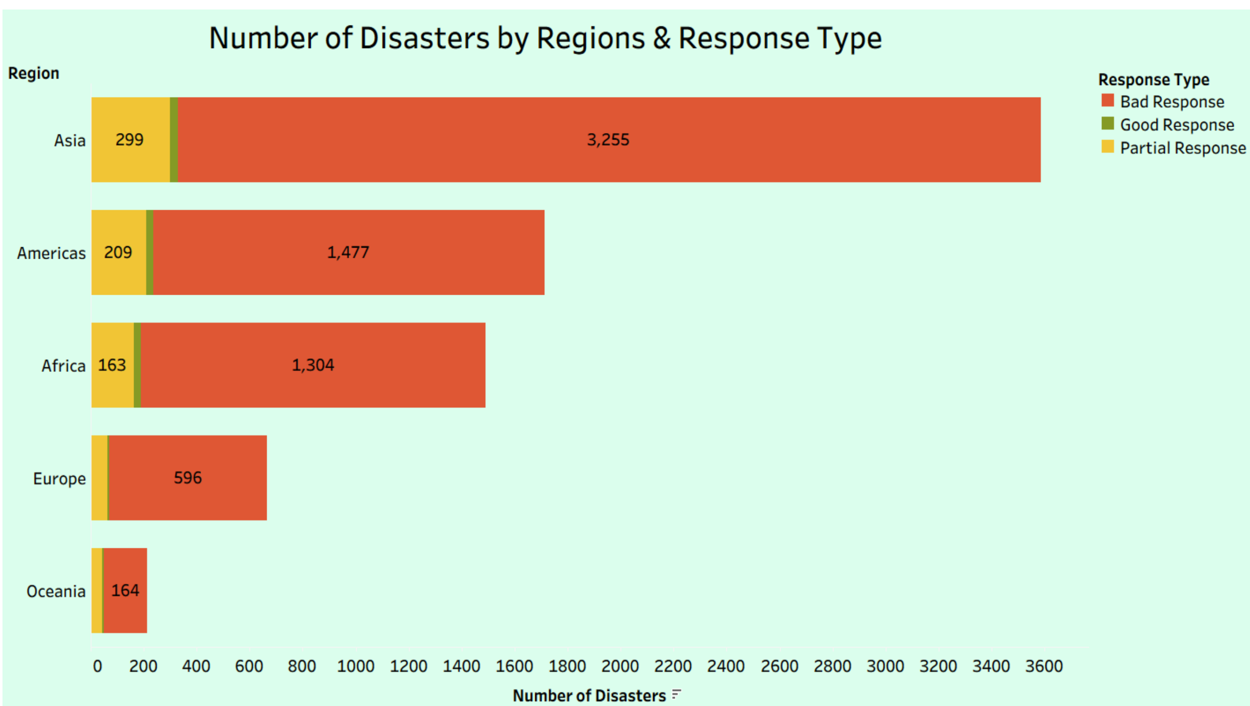



**Figure 14: Response per regions.**

It is clear from Figure 14 that although Asia experiences more disasters, the response is very poor, making this region underserved.
So, what are the main reasons that make Asia face significant challenges in disaster response?

1. Rapid population growth and high population density.
2. Economic constraints: Many developing countries in Asia face financial limitations, which affect their ability to build resilient infrastructure and provide adequate support for their populations. This also reduces the capacity of households to meet basic needs after a disaster.
3. Lack of infrastructure: Insufficient or poorly maintained infrastructure hinders effective disaster response and recovery. [9]

## Recommendations:

a. For flood disasters:
    1. Strengthen early-warning and evacuation systems.
    2. Improve drainage, riverbank reinforcement, and urban water flow.
    3. Prioritize high-risk countries for seasonal preparedness.
b. For storm disasters:
    1. Develop region-specific seasonal forecasting and communication.
    2. Enhance coastal protection and shelter infrastructure.
    3. Develop preparedness efforts.
    4. Expand community-level training and early-alert coverage.
c. For earthquake disasters:
    1. Implement and enforce seismic-resistant building standards.
    2. Prioritize regions with high deaths per event.
    3. Expand public awareness programs and emergency drills.
d. For response:
    1. Improve response coordination: Countries and organizations should enhance disaster response planning to ensure rapid mobilization after appeals.
    2. Prioritize high-risk areas: Use historical disaster data to identify regions with frequent disasters and high affected numbers, and allocate resources proactively.
    3. Strengthen early warning systems: Especially for floods and storms, improved forecasting and communication can reduce casualties.
    4. Capacity building: Train local authorities and volunteers in emergency response to improve response effectiveness.

## Limitations:

1. Missing data in some important columns like magnitude, start day.
2. Missing or Uneven Data Across Years.
3. Affected Population Can Be Reported Inconsistently.
4. Response Efficiency May Not Reflect True Response Quality.

## References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