

# GLOBAL NATURAL DISASTERS

A 40+ YEAR ANALYSIS

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UNIVERSITY OF WESTERN AUSTRALIA  
DATA ANALYTICS BOOTCAMP - 2023



# Project Description

## ANALYSTS

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## SCOPE

**This data analysis project analyses the relationship between global natural disaster data, and local & global temperature data spanning over 44 years (from 1979 to 2023).**

The project scope will remain within the bounds of these two variables, with the intention of identifying any significant trends and/or correlations between them by answering the following questions:

- 1. What is the influence of geographic coordinates on the frequency of natural disasters?**
- 2. Does the Northern or Southern Hemisphere experience greater or fewer natural disasters?**
- 3. What is the correlation between natural disaster frequency and average temperatures over time?**
- 4. What category of disaster is more likely to occur during specific seasons?**
- 5. Are there global hotspots for specific disaster categories?**
- 6. Are there any noticeable trends in different types of disasters (e.g., hurricanes, earthquakes, wildfires) over time?**
- 7. Which countries might be the ‘safest’, or most ‘at risk’?**

# Sources



## EM-DAT - THE INTERNATIONAL DISASTER DATABASE

*EM-DAT contains data on the occurrence and impacts of over 26,000 mass disasters worldwide from 1900 to the present day. The database is compiled from various sources, including UN agencies, non-governmental organizations, reinsurance companies, research institutes, and press agencies.*



## OPEN WEATHER MAPS API

*OpenWeather is a team of IT experts and data scientists that has been practising deep weather data science. For each point on the globe, OpenWeather provides historical, current and forecasted weather data via light-speed APIs.*

**History API for Timestamp:** *this product provides historical weather data for any timestamp from 1st January 1979 till now. Data are available for any coordinate on the globe.*



## GISS

*GISS is NASA's Goddard Institute for Space Studies.*

*A key objective of GISS research is the prediction of atmospheric and climate changes in the 21st century. This analysis references the Combined Land-Surface Air and Sea-Surface Water Temperature Anomalies Table, which contains data ranging from 1880 up to the current month.*

## DEFINITIONS

### **'Natural Disasters'**

*EM-DAT defines ‘disasters’ as situations or events which overwhelm local capacity, necessitating a request for external assistance at the national or international level. Disasters are unforeseen and often sudden events that cause significant damage, destruction, and human suffering.*

The raw data includes disasters that were not useful to this analysis and have been removed. These include:  
*Animal Accident, Complex Disasters (eg: famine), Glacial Lake Outburst, Impact, Industrial Accident (eg: chemical spill), Insect Infestation (eg: locust), Mass Movement (Dry), Miscellaneous Accident (eg: explosion), Transport Accident*

The term ‘Natural Disasters’ refers generally to the disasters chosen to be included in this analysis. These include:  
**Drought, Earthquake, Epidemic, Extreme Temperature, Flood, Landslide, Storm, Volcanic Activity and Wildfire**

### **'Seasons'**

Specific months used for calculations of seasons are as follows:

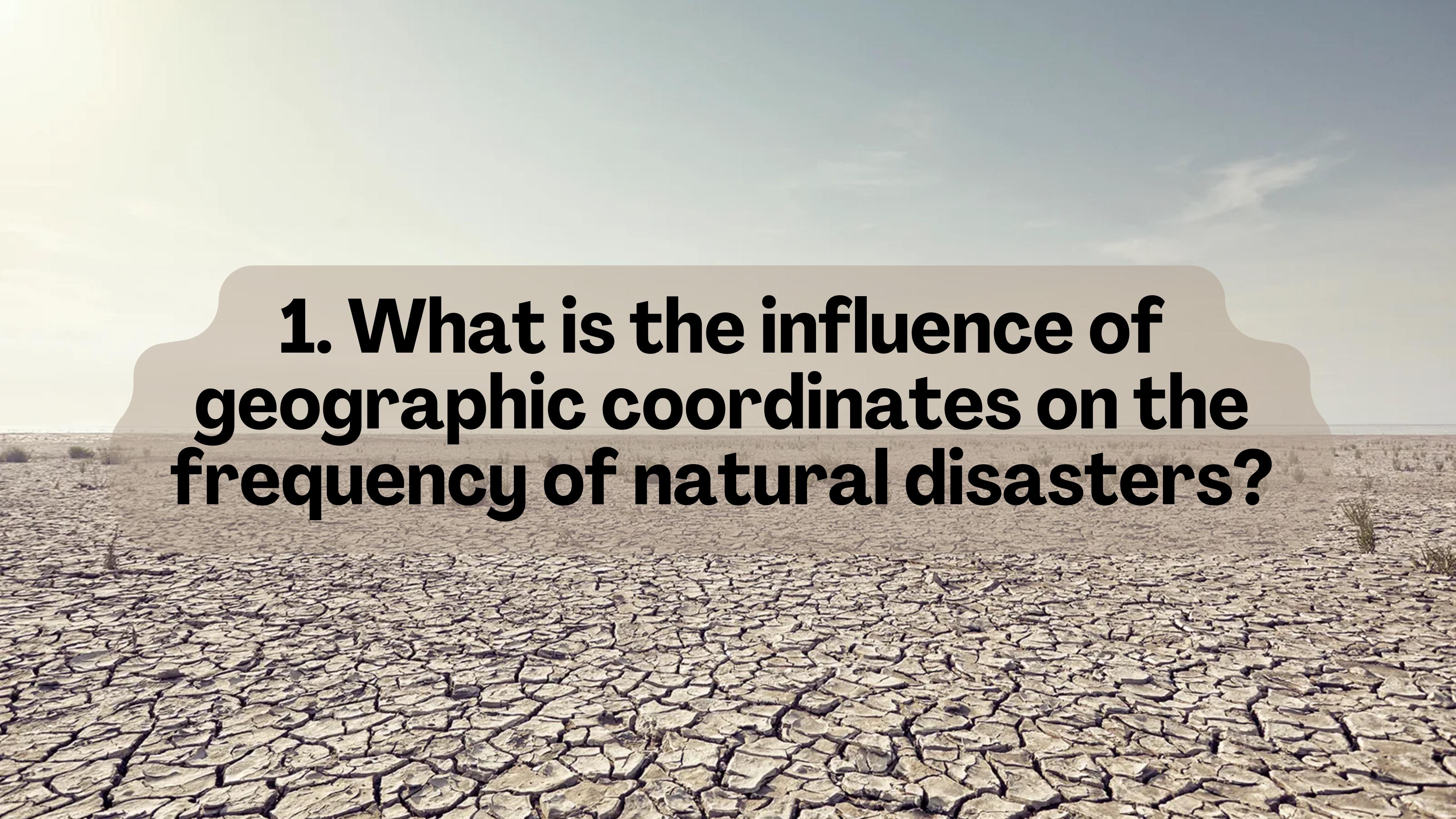
Summer : Dec, Jan, Feb  
Autumn : Mar, Apr, May  
Winter : Jun, Jul, Aug  
Spring : Sep, Oct, Nov

### **'Local Temperatures'**

The average temperature for the date of a recorded disaster, drawn down using the OpenWeather API using specific coordinates.

### **'Global Temperatures'**

The average surface temperature for the year of a recorded disaster, taken from the GISS dataset, measured on a global scale.



**1. What is the influence of geographic coordinates on the frequency of natural disasters?**

# Dataframe Before

	Dis No	Year	Seq	Glide	Disaster Group	Disaster Subgroup	Disaster Type	Disaster Subtype	Disaster Subsubtype	Event Name	...	Reconstruction Costs, Adjusted ('000 US\$)	Insured Damages ('000 US\$)	Insured Damages, Adjusted ('000 US\$)	Total Damages ('000 US\$)	Total Damages, Adjusted ('000 US\$)	CPI	Adm Level	Admin1 Code	Admin2 Code	Geo Locations
0	1979-0094-GTM	1979	94	Nan	Natural	Geophysical	Earthquake	Ground movement		Nan	Nan	...	Nan	Nan	Nan	Nan	24.798841	Nan	Nan	Nan	Nan
1	1979-0113-COL	1979	113	Nan	Natural	Geophysical	Earthquake	Ground movement		Nan	Nan	...	Nan	Nan	8000.0	32260.0	24.798841	Nan	Nan	Nan	Nan
2	1979-9200-HKG	1979	9200	Nan	Natural	Climatological	Drought	Drought		Nan	Nan	...	Nan	Nan	Nan	Nan	24.798841	Nan	Nan	Nan	Nan
3	1979-0185-AIA	1979	185	Nan	Natural	Meteorological	Storm	Tropical cyclone		Nan	Frederic	...	Nan	Nan	Nan	Nan	24.798841	Nan	Nan	Nan	Nan
4	1979-0039-ALB	1979	39	Nan	Natural	Geophysical	Earthquake	Ground movement		Nan	Nan	...	Nan	Nan	Nan	Nan	24.798841	Nan	Nan	Nan	Nan
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23247	2023-0095-ZWE	2023	95	Nan	Natural	Meteorological	Storm	Tropical cyclone	Nan	Tropical cyclone 'Freddy'	...	Nan	Nan	Nan	Nan	Nan	Nan	Nan	Nan	Nan	Nan
23248	2023-0466-SRB	2023	466	Nan	Natural	Meteorological	Storm	Convective storm	Severe storm	Nan	...	Nan	Nan	Nan	Nan	Nan	Nan	Nan	Nan	Nan	Nan
23249	2023-0022-SRB	2023	22	Nan	Natural	Hydrological	Flood	Riverine flood	Nan	Nan	...	Nan	Nan	Nan	Nan	Nan	Nan	Nan	Nan	Nan	Nan
23250	2023-0460-SRB	2023	460	Nan	Natural	Meteorological	Storm	Convective storm	Nan	Nan	...	Nan	Nan	Nan	Nan	Nan	Nan	Nan	Nan	Nan	Nan
23251	2023-0140-SSD	2023	140	EP-2023-000039	Natural	Biological	Epidemic	Bacterial disease	Nan	Cholera	...	Nan	Nan	Nan	Nan	Nan	1	37021	Nan	Upper Nile (Adm1).	

23252 rows × 50 columns

Number of original rows: 23,252

# Dataframe After

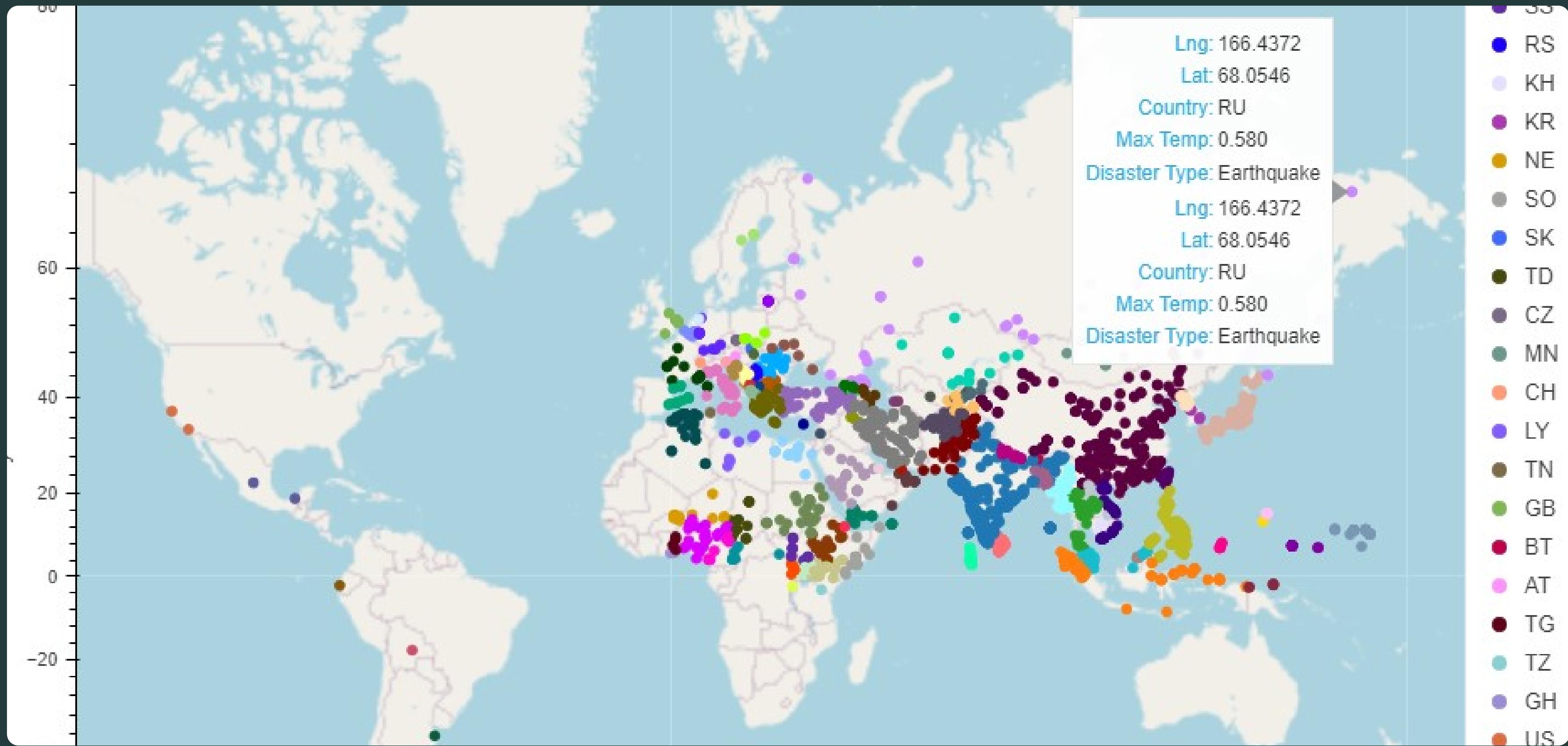
	Disaster Number	Year	Disaster Group	Disaster Subgroup	Disaster Type	Country	ISO	Region	Continent	Latitude	Longitude	Start Month	Start Day	Total Deaths	Full Date	Unix Timestamp
0	1979-0094-GTM	1979	Natural	Geophysical	Earthquake	Guatemala	GTM	Central America	Americas	14.321	90.082	10	9	NaN	9/10/1979	308246400.0
1	1979-0113-COL	1979	Natural	Geophysical	Earthquake	Colombia	COL	South America	Americas	1.598	79.358	12	12	579.0	12/12/1979	313776000.0
4	1979-0039-ALB	1979	Natural	Geophysical	Earthquake	Albania	ALB	Southern Europe	Europe	42.096	19.209	4	15	35.0	15/4/1979	292953600.0
22	1979-0063-CHN	1979	Natural	Geophysical	Earthquake	China	CHN	Eastern Asia	Asia	31.452	119.241	7	9	42.0	9/7/1979	300297600.0
23	1979-0082-CHN	1979	Natural	Geophysical	Earthquake	China	CHN	Eastern Asia	Asia	41.145	108.129	8	25	NaN	25/8/1979	304358400.0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23190	2023-0189-PNG	2023	Natural	Geophysical	Earthquake	Papua New Guinea	PNG	Melanesia	Oceania	4.326	143.159	4	2	8.0	2/4/2023	1680364800.0
23203	2023-0054-SYR	2023	Natural	Geophysical	Earthquake	Syrian Arab Republic	SYR	Western Asia	Asia	38.055	36.51	2	6	4500.0	6/2/2023	1675612800.0
23204	2023-0091-SYR	2023	Natural	Geophysical	Earthquake	Syrian Arab Republic	SYR	Western Asia	Asia	36.159	36.034	2	20	NaN	20/2/2023	1676822400.0
23212	2023-0237-TJK	2023	Natural	Geophysical	Earthquake	Tajikistan	TJK	Central Asia	Asia	39.383	69.881	3	23	NaN	23/3/2023	1679500800.0
23217	2023-0091-TUR	2023	Natural	Geophysical	Earthquake	Turkey	TUR	Western Asia	Asia	36.159	36.034	2	20	6.0	20/2/2023	1676822400.0

2277 rows × 16 columns

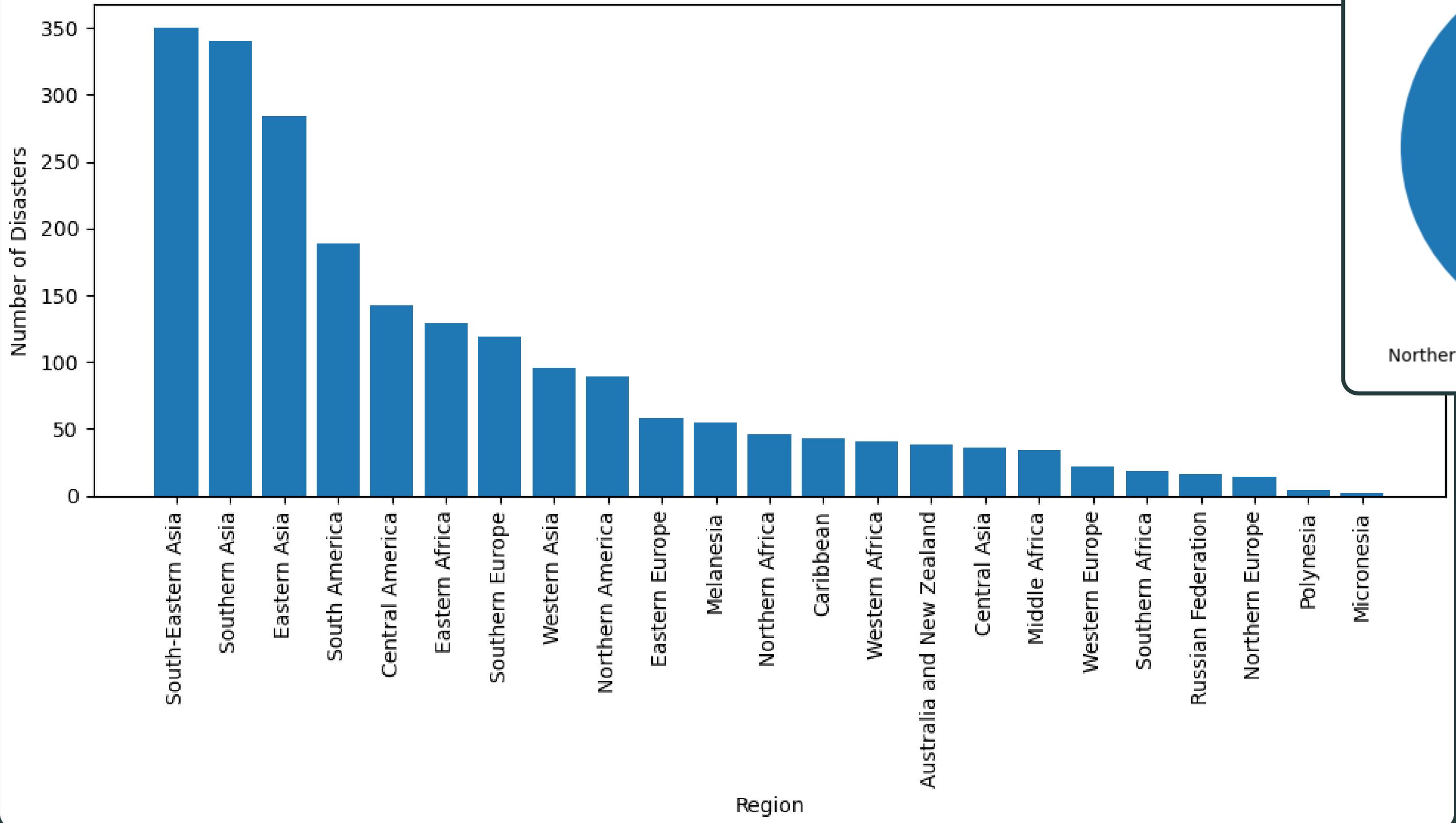
Number of original rows: 23,252

Number of rows after applying API query temperature data: 2,277

We generated a city list from coordinates in our raw data and used the OpenWeatherMap API to enrich our analysis with temperature data



Number of Disasters per Region



Disaster % by Hemisphere

Southern Hemisphere

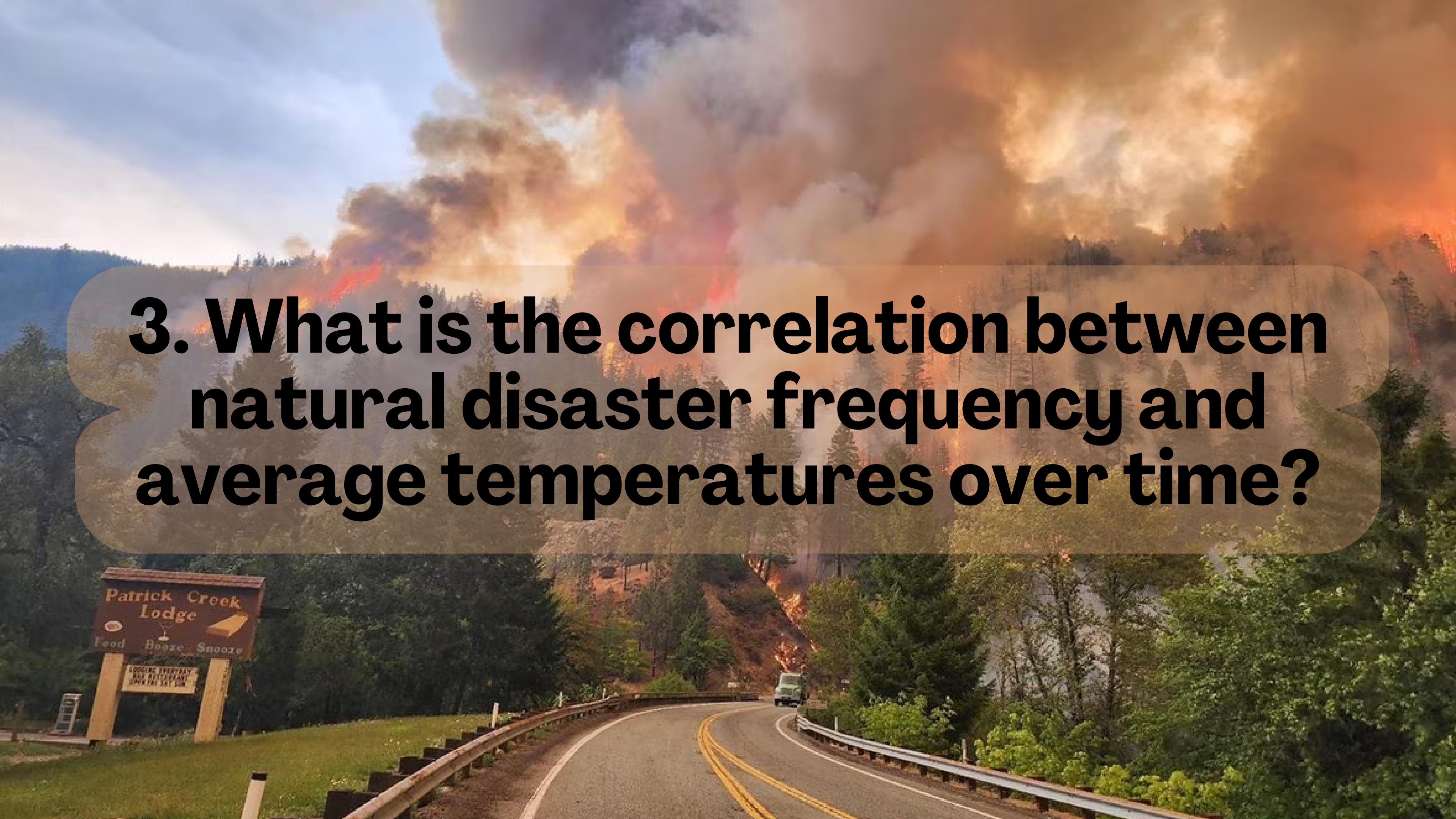
1.6%

98.4%

Northern Hemisphere



2. Does the Northern or Southern Hemisphere experience greater or fewer natural disasters?

A photograph of a massive forest fire. Thick, orange and grey smoke billows across the sky, obscuring the sun. In the foreground, a two-lane asphalt road curves through a forest of green trees. On the left side of the road, there is a wooden sign for "Patrick Creek Lodge" which also lists "Food Booze Snooze".

**3. What is the correlation between natural disaster frequency and average temperatures over time?**

# Dataframe Sample

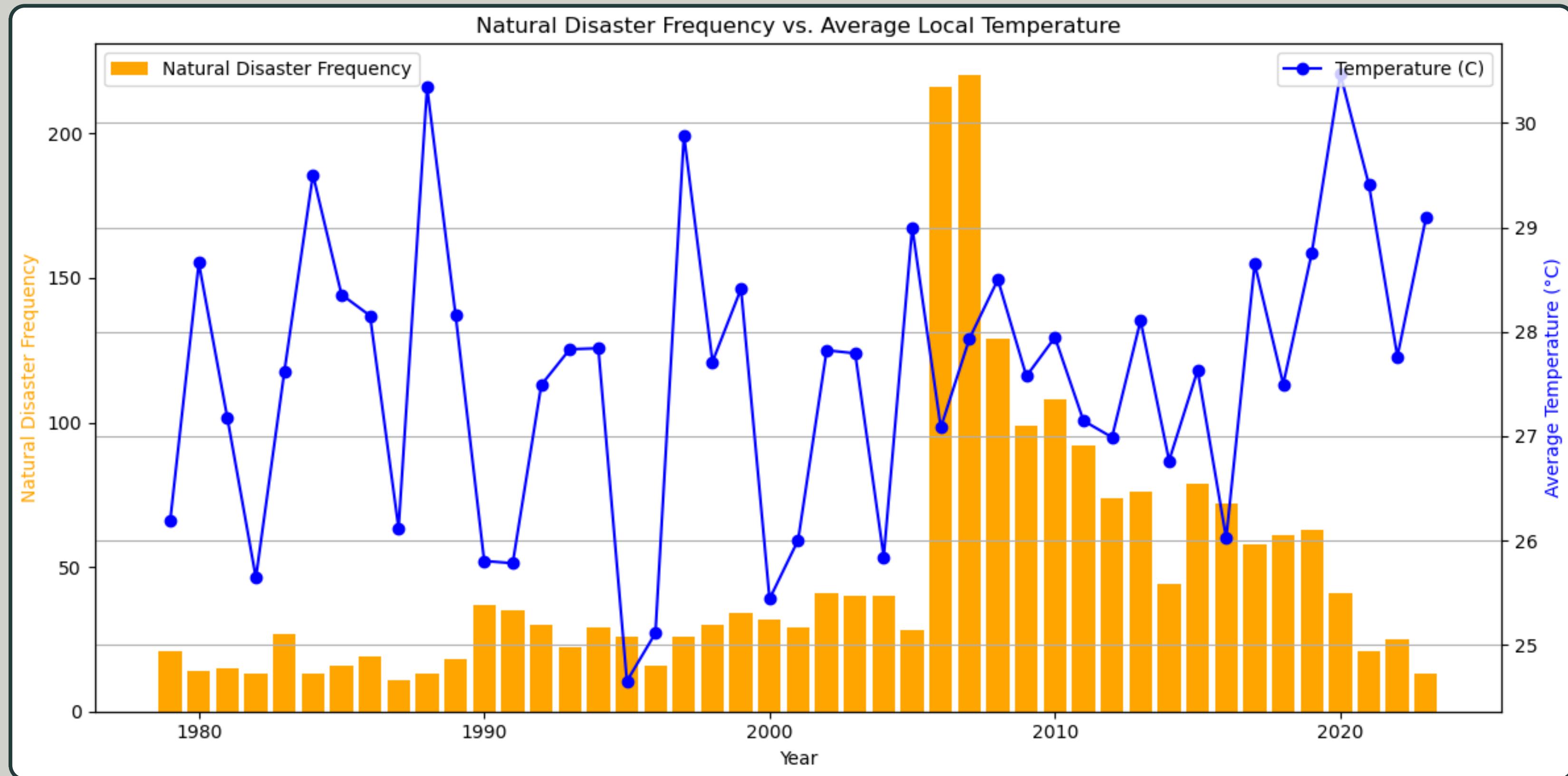
	Disaster Number	Year	Disaster Group	Disaster Subgroup	Disaster Type	Country	ISO	Region	Continent	Latitude	Longitude	Start Month	Start Day	Total Deaths	Full Date	Unix Timestamp
0	1979-0094-GTM	1979	Natural	Geophysical	Earthquake	Guatemala	GTM	Central America	Americas	14.321	90.082	10	9	NaN	9/10/1979	308246400.0
1	1979-0113-COL	1979	Natural	Geophysical	Earthquake	Colombia	COL	South America	Americas	1.598	79.358	12	12	579.0	12/12/1979	313776000.0
4	1979-0039-ALB	1979	Natural	Geophysical	Earthquake	Albania	ALB	Southern Europe	Europe	42.096	19.209	4	15	35.0	15/4/1979	292953600.0
22	1979-0063-CHN	1979	Natural	Geophysical	Earthquake	China	CHN	Eastern Asia	Asia	31.452	119.241	7	9	42.0	9/7/1979	300297600.0
23	1979-0082-CHN	1979	Natural	Geophysical	Earthquake	China	CHN	Eastern Asia	Asia	41.145	108.129	8	25	NaN	25/8/1979	304358400.0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23190	2023-0189-PNG	2023	Natural	Geophysical	Earthquake	Papua New Guinea	PNG	Melanesia	Oceania	4.326	143.159	4	2	8.0	2/4/2023	1680364800.0
23203	2023-0054-SYR	2023	Natural	Geophysical	Earthquake	Syrian Arab Republic	SYR	Western Asia	Asia	38.055	36.51	2	6	4500.0	6/2/2023	1675612800.0
23204	2023-0091-SYR	2023	Natural	Geophysical	Earthquake	Syrian Arab Republic	SYR	Western Asia	Asia	36.159	36.034	2	20	NaN	20/2/2023	1676822400.0
23212	2023-0237-TJK	2023	Natural	Geophysical	Earthquake	Tajikistan	TJK	Central Asia	Asia	39.383	69.881	3	23	NaN	23/3/2023	1679500800.0
23217	2023-0091-TUR	2023	Natural	Geophysical	Earthquake	Turkey	TUR	Western Asia	Asia	36.159	36.034	2	20	6.0	20/2/2023	1676822400.0

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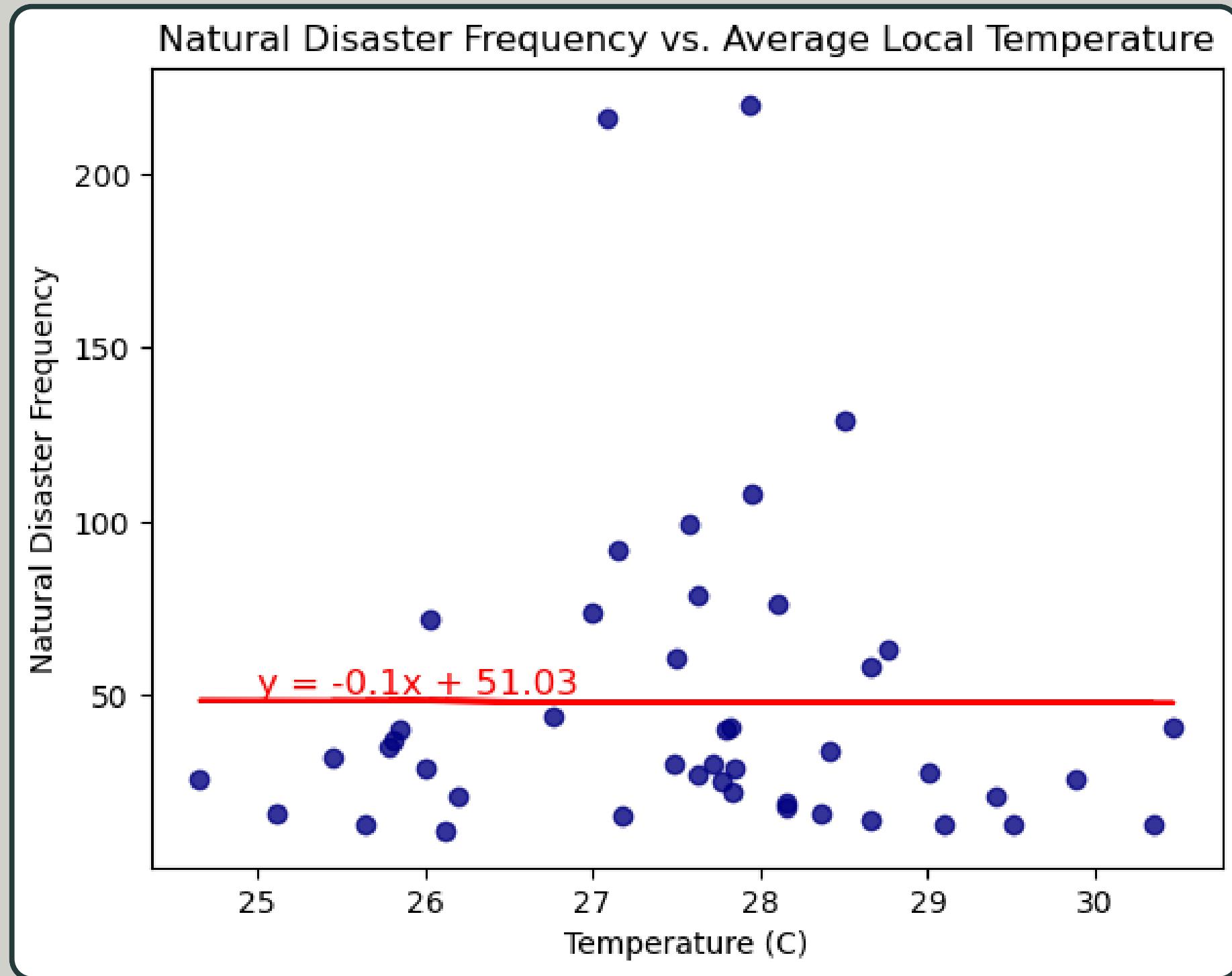
Number of original rows: 23,252

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## Local Data - Open Weather API



## Local Data - Open Weather API



The r-value is -0.0

This indicates a very weak, negative correlation between average local temperature and frequency of natural disasters occurring.

# Dataframe Sample

	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	...	Dec/Jan/Feb (Summer)	Mar/Apr/May (Autumn)	Jun/Jul/Aug (Winter)	Sep/Oct/Nov (Spring)	Disaster Number	Disaster Group	Disaster Type	Country	Region	Start Month
0	1979	0.09	-0.10	0.19	0.15	0.04	0.14	0.04	0.17	0.25	...	0.02	0.13	0.11	0.27	1979-0094-GTM	Natural	Earthquake	Guatemala	Central America	10.0
1	1979	0.09	-0.10	0.19	0.15	0.04	0.14	0.04	0.17	0.25	...	0.02	0.13	0.11	0.27	1979-0113-COL	Natural	Earthquake	Colombia	South America	12.0
2	1979	0.09	-0.10	0.19	0.15	0.04	0.14	0.04	0.17	0.25	...	0.02	0.13	0.11	0.27	1979-9200-HKG	Natural	Drought	Hong Kong	Eastern Asia	10.0
3	1979	0.09	-0.10	0.19	0.15	0.04	0.14	0.04	0.17	0.25	...	0.02	0.13	0.11	0.27	1979-0185-AIA	Natural	Storm	Anguilla	Caribbean	9.0
4	1979	0.09	-0.10	0.19	0.15	0.04	0.14	0.04	0.17	0.25	...	0.02	0.13	0.11	0.27	1979-0039-ALB	Natural	Earthquake	Albania	Southern Europe	4.0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14196	2022	0.91	0.89	1.05	0.83	0.84	0.92	0.93	0.95	0.90	...	0.89	0.91	0.94	0.86	2022-0569-ZWE	Natural	Epidemic	Zimbabwe	Eastern Africa	4.0
14197	2022	0.91	0.89	1.05	0.83	0.84	0.92	0.93	0.95	0.90	...	0.89	0.91	0.94	0.86	2022-0465-SRB	Natural	Extreme temperature	Serbia	Southern Europe	5.0
14198	2022	0.91	0.89	1.05	0.83	0.84	0.92	0.93	0.95	0.90	...	0.89	0.91	0.94	0.86	2022-0465-MNE	Natural	Extreme temperature	Montenegro	Southern Europe	5.0
14199	2022	0.91	0.89	1.05	0.83	0.84	0.92	0.93	0.95	0.90	...	0.89	0.91	0.94	0.86	2022-0201-TLS	Natural	Epidemic	Timor-Leste	South-Eastern Asia	1.0
14200	2022	0.91	0.89	1.05	0.83	0.84	0.92	0.93	0.95	0.90	...	0.89	0.91	0.94	0.86	2022-0650-SSD	Natural	Flood	South Sudan	Northern Africa	8.0

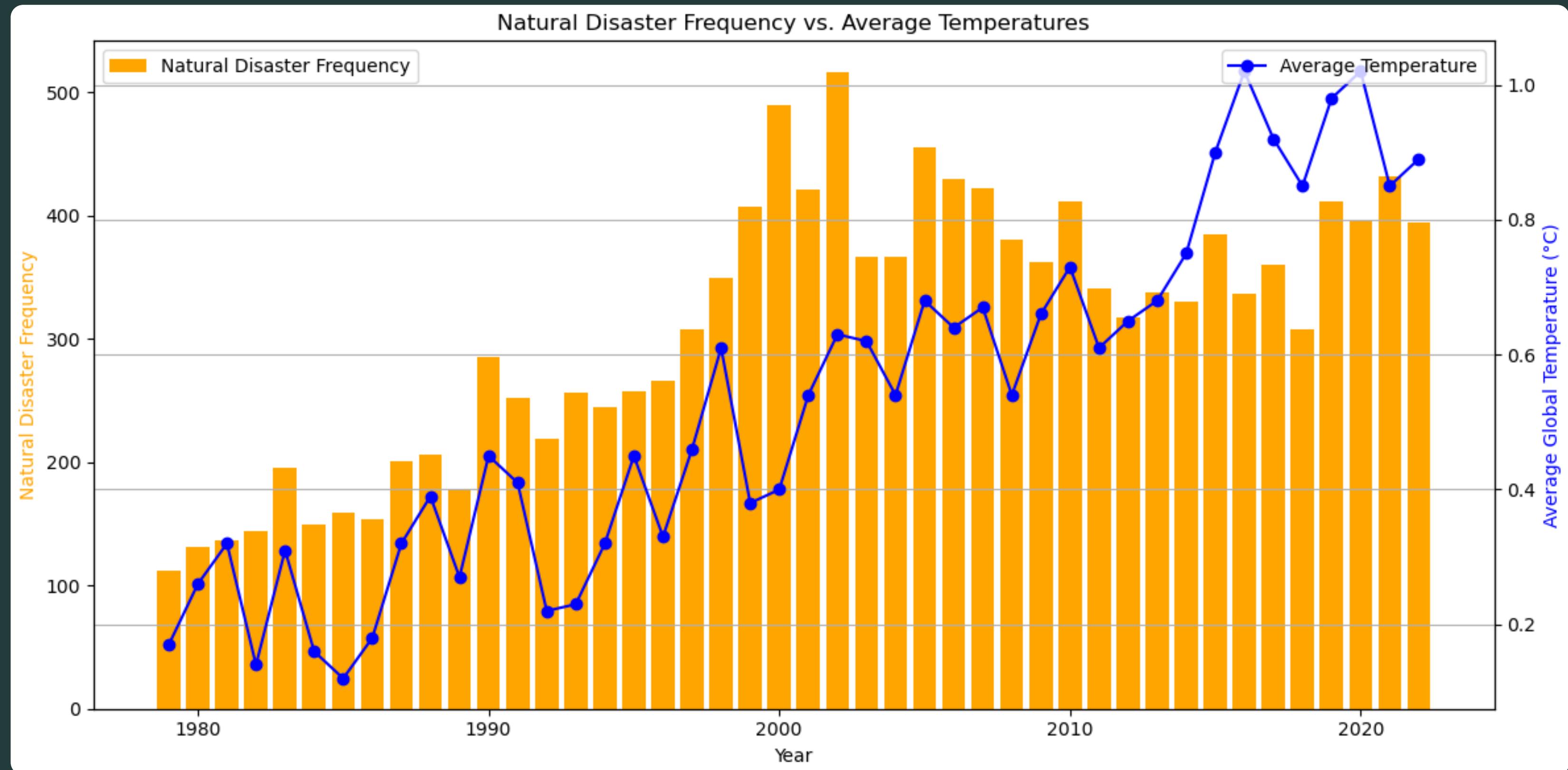
13982 rows × 24 columns

Number of original rows: 23,252

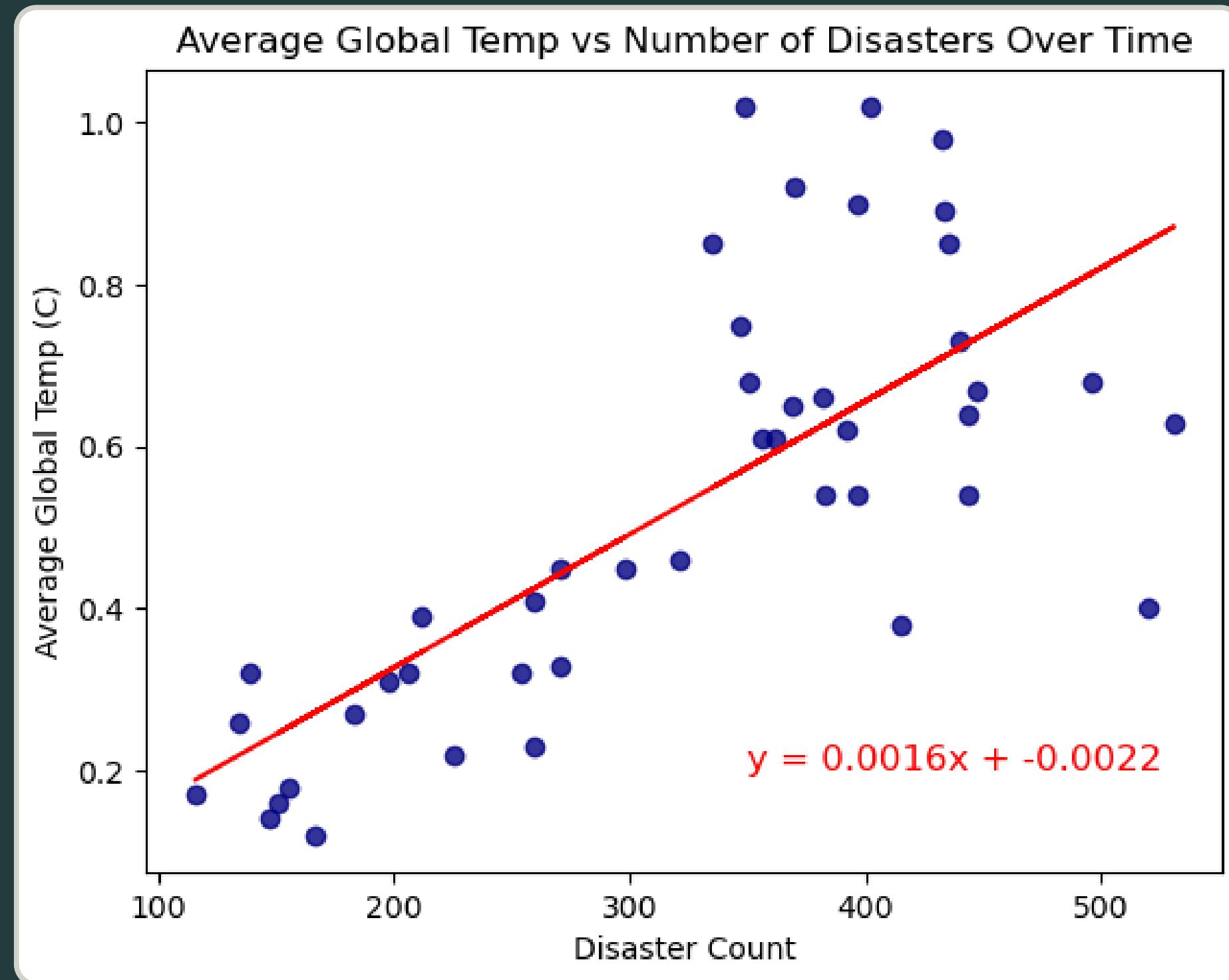
Number of rows after merging with GISS temperature dataset: 13,982

\*2023 is not included in this dataset because data is not available from September - December

## Global Data - GISS Temperature Data



## Global Data - GISS Temperature Data



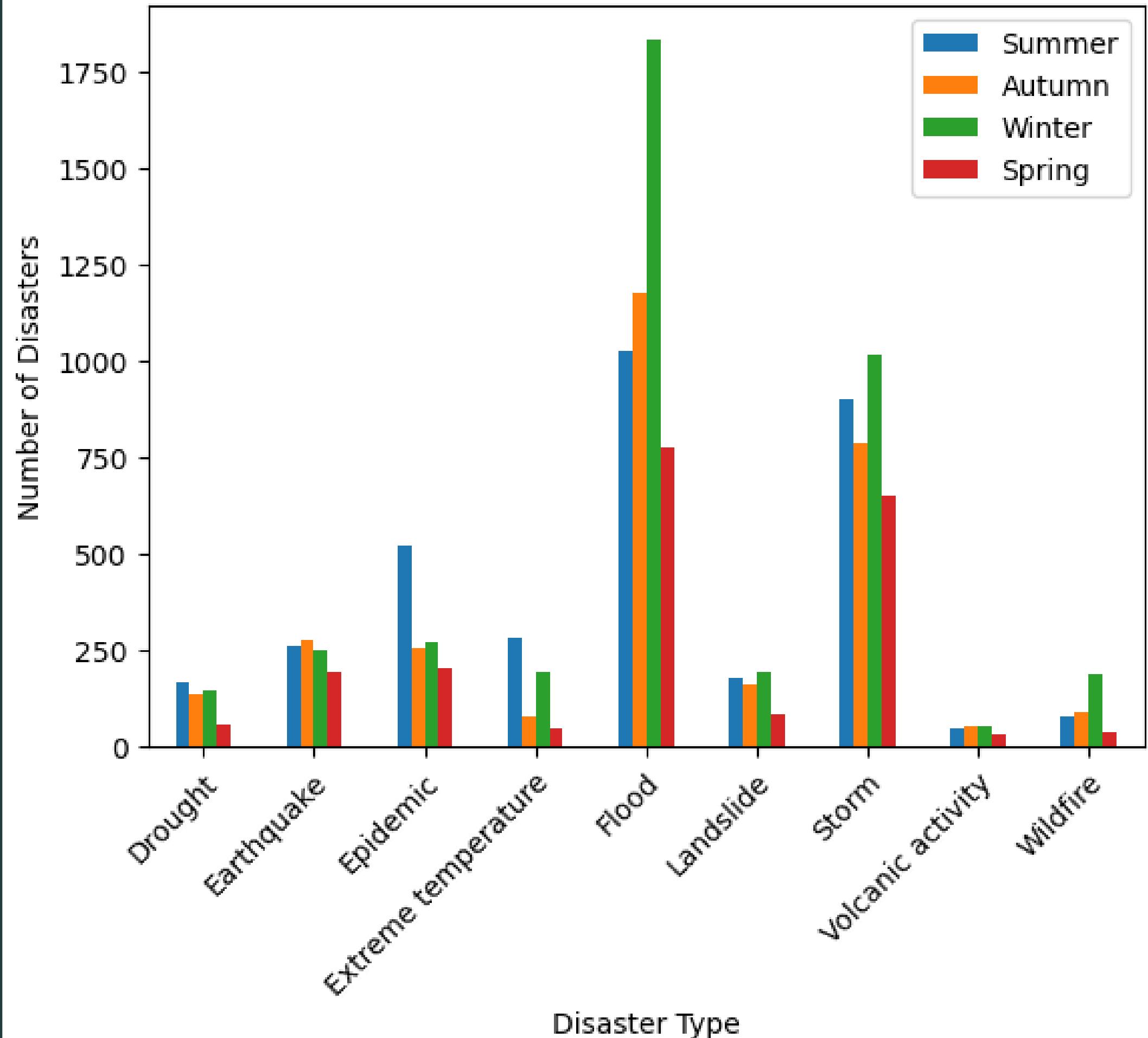
The r-value is 0.73

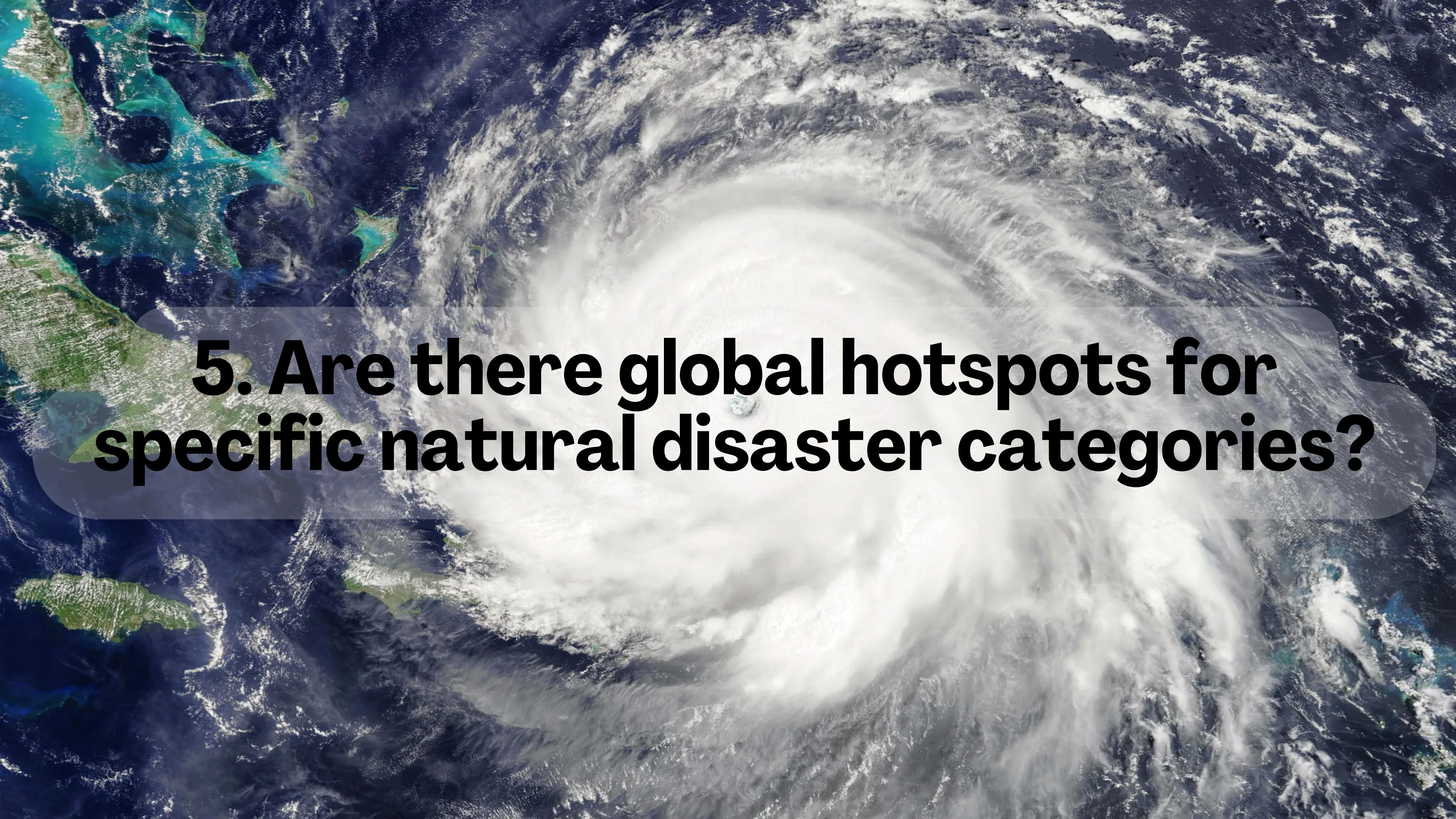
This indicates a high, positive correlation between average global temperature and frequency of natural disasters occurring.



**4. What category of natural disaster is more likely to occur during specific seasons?**

## Frequency of Disaster Types per Season

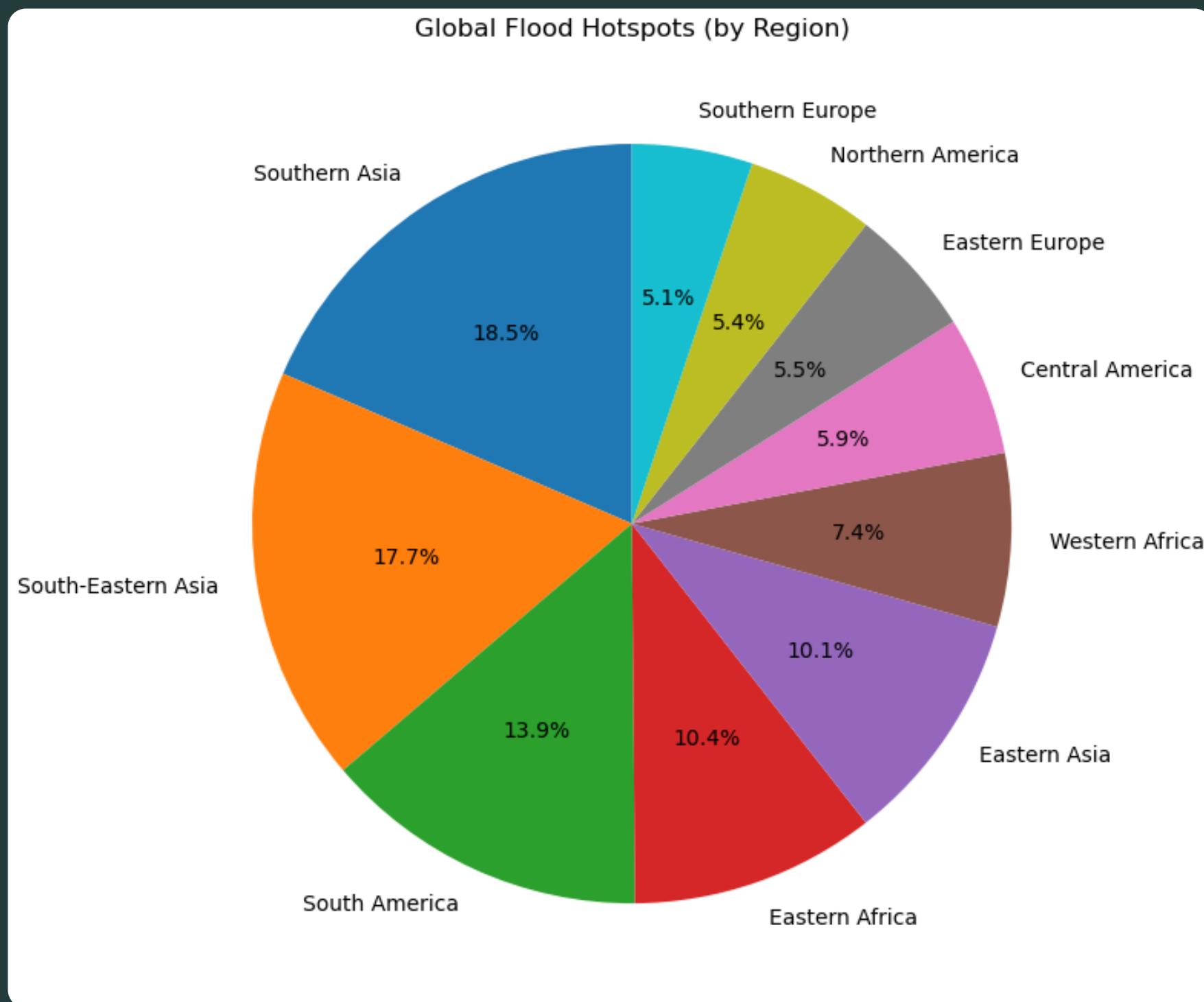




**5. Are there global hotspots for specific natural disaster categories?**

## FLOODS

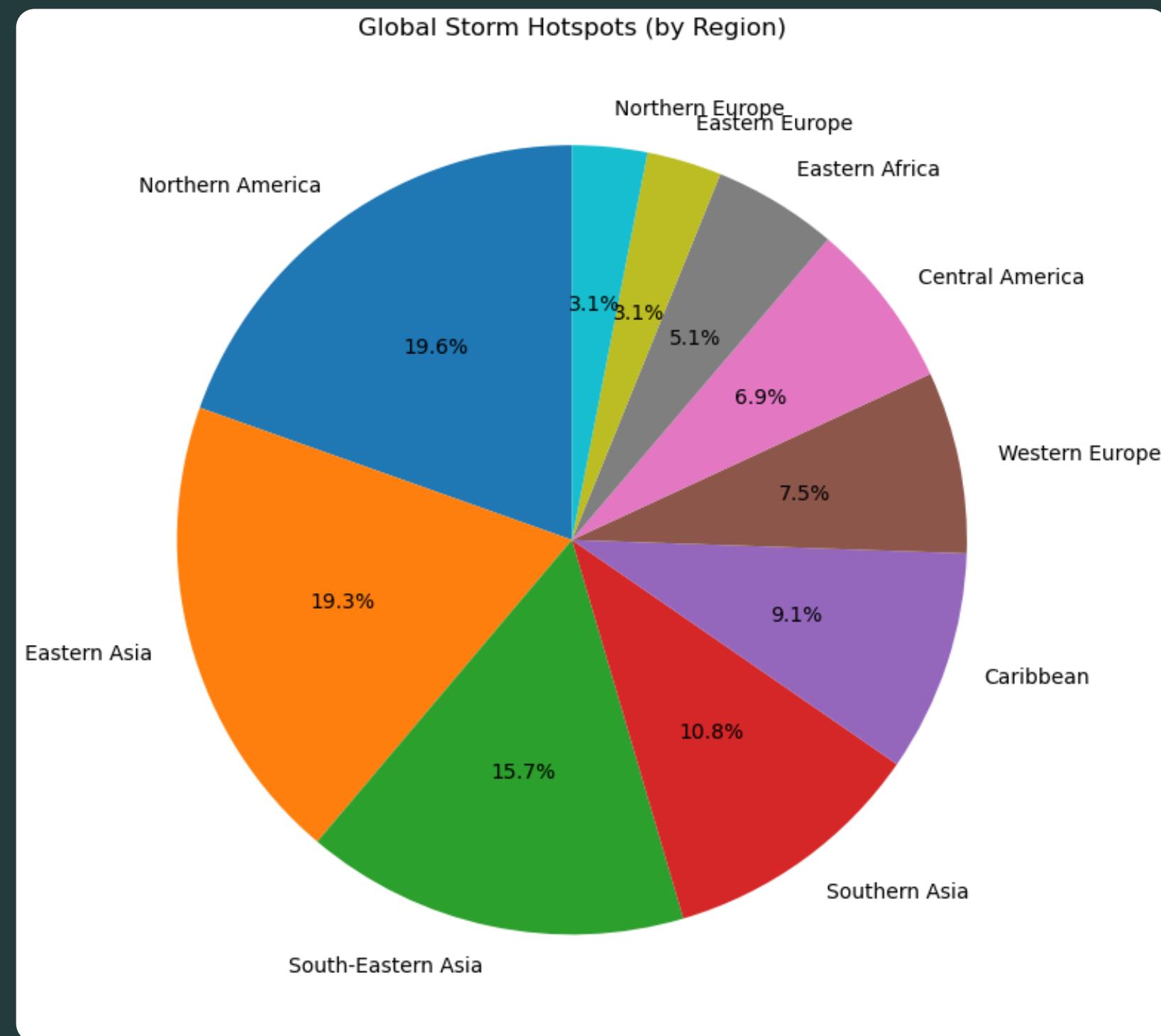
Most frequently occurring



**Top 3 Hotspots:**  
Southern Asia, South-Eastern Asia & South America

## STORMS

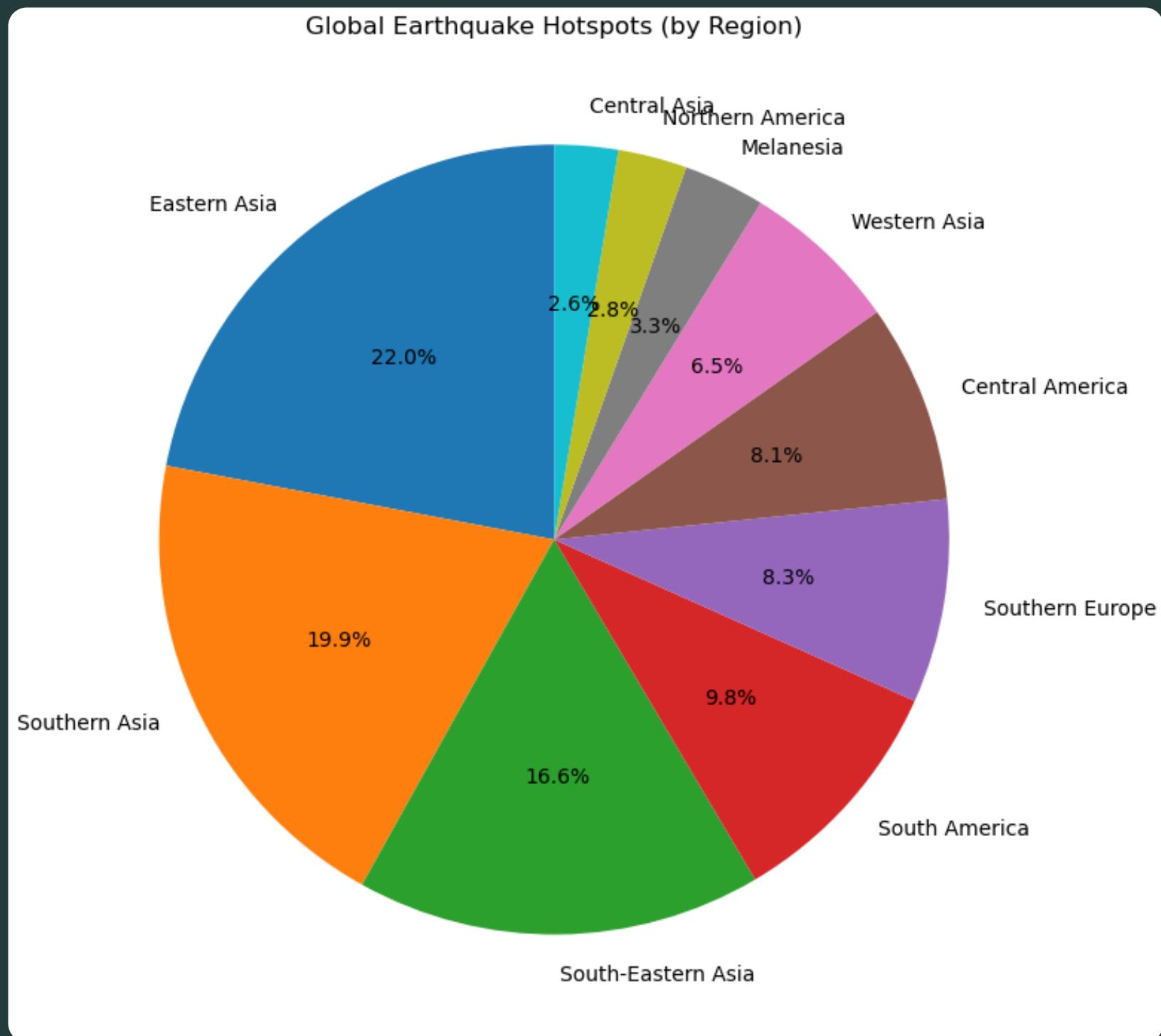
Second most frequently occurring



**Top 3 Hotspots:**  
Northern America, Eastern Asia & South-Eastern Asia

## EARTHQUAKES

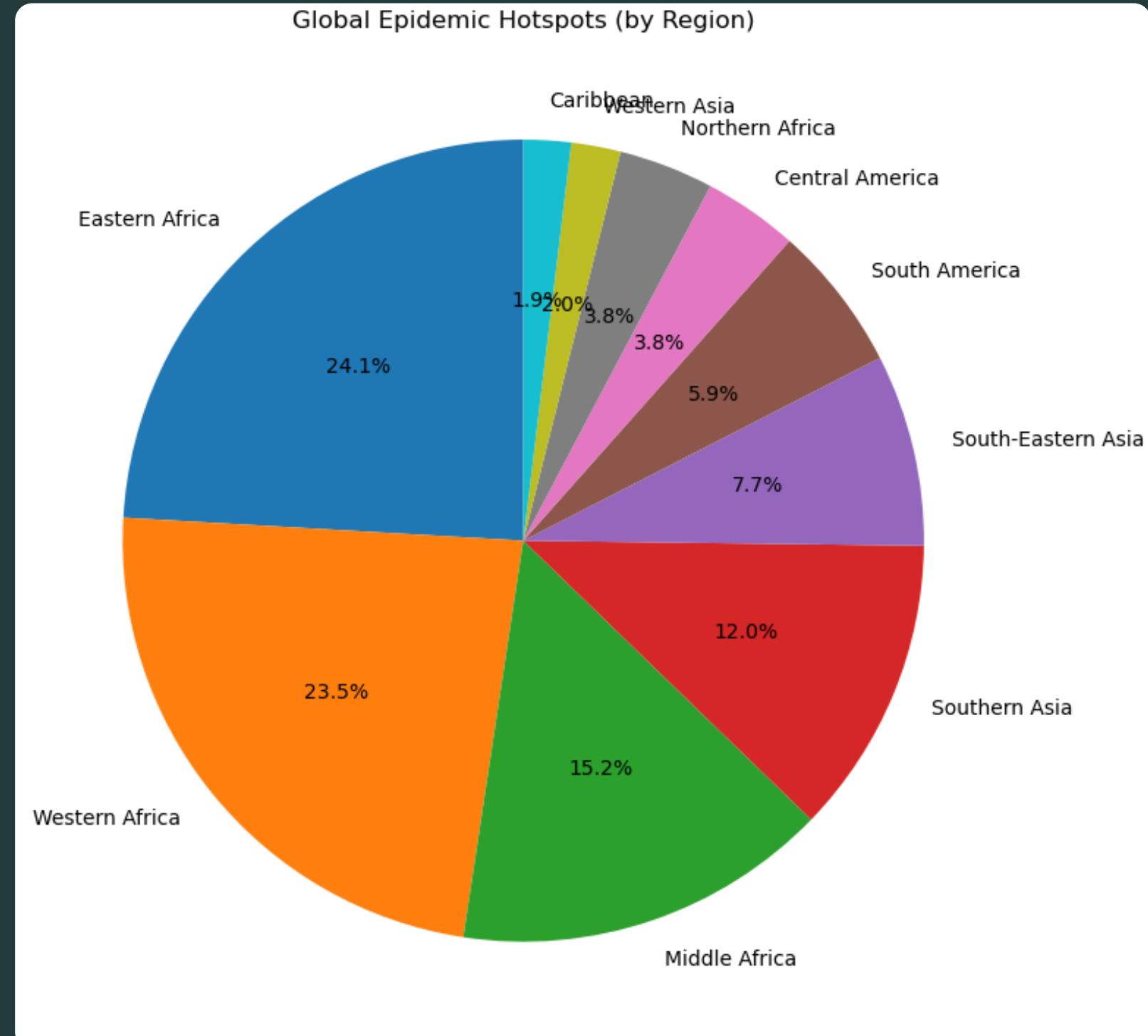
Third most frequently occurring



**Top 3 Hotspots:**  
Eastern Asia, Southern Asia & South-Eastern Asia

## EPIDEMICS

Fourth most frequently occurring

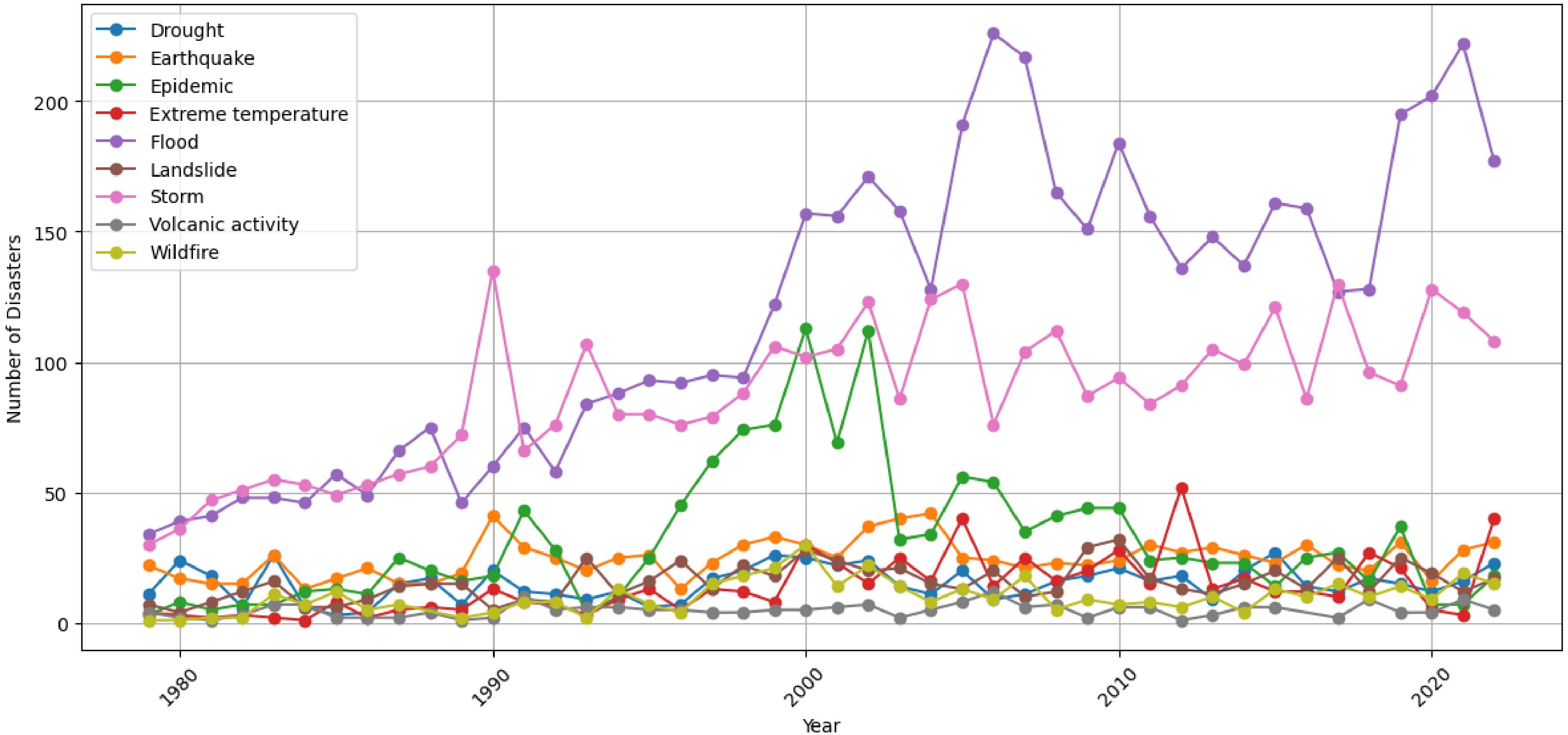


**Top 3 Hotspots:**  
Eastern Africa, Western Africa & Middle Africa



**6. Are there any noticeable trends in different types of natural disasters (e.g., storms, earthquakes, wildfires) over time?**

## Disaster Types Over Time

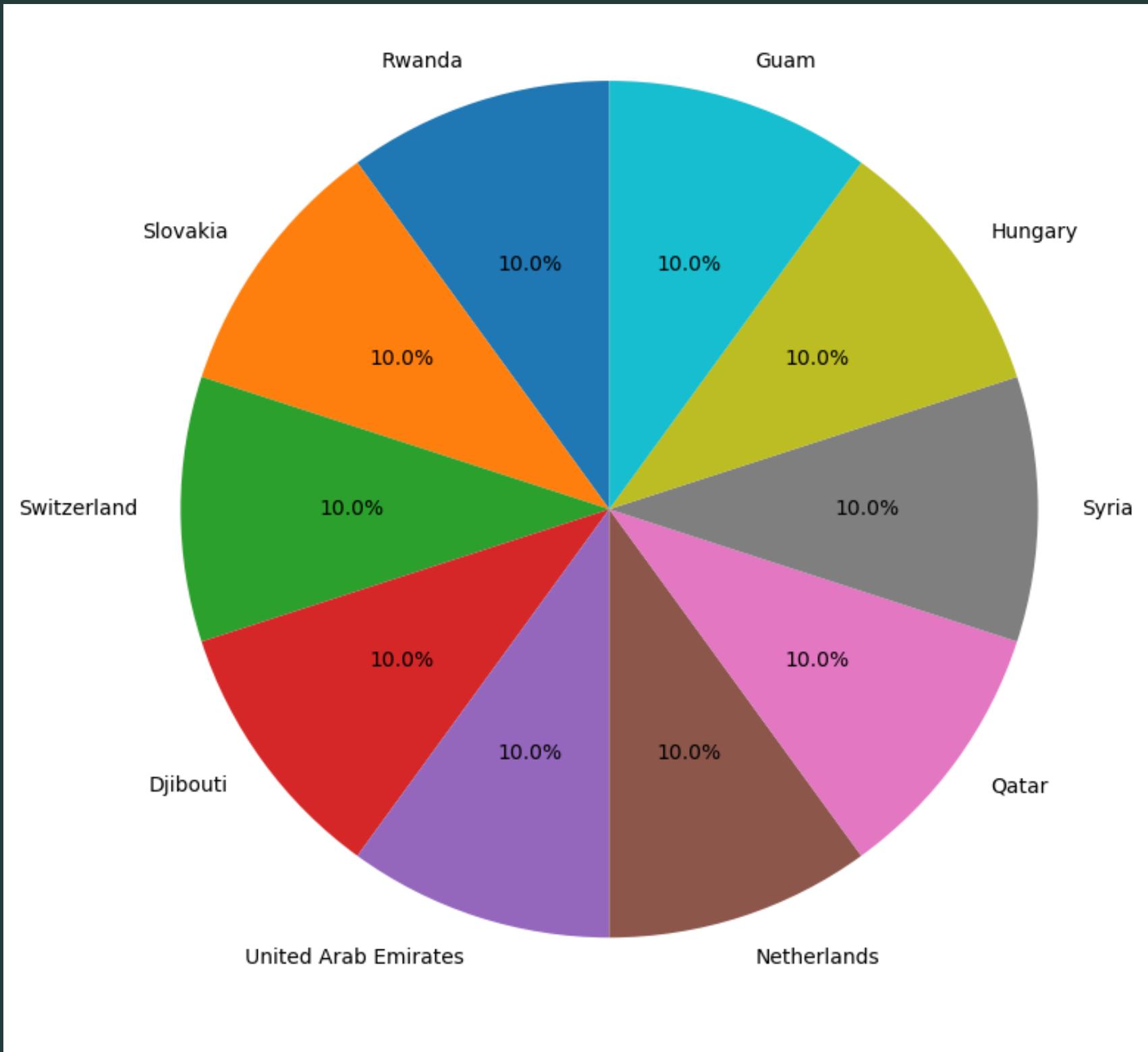




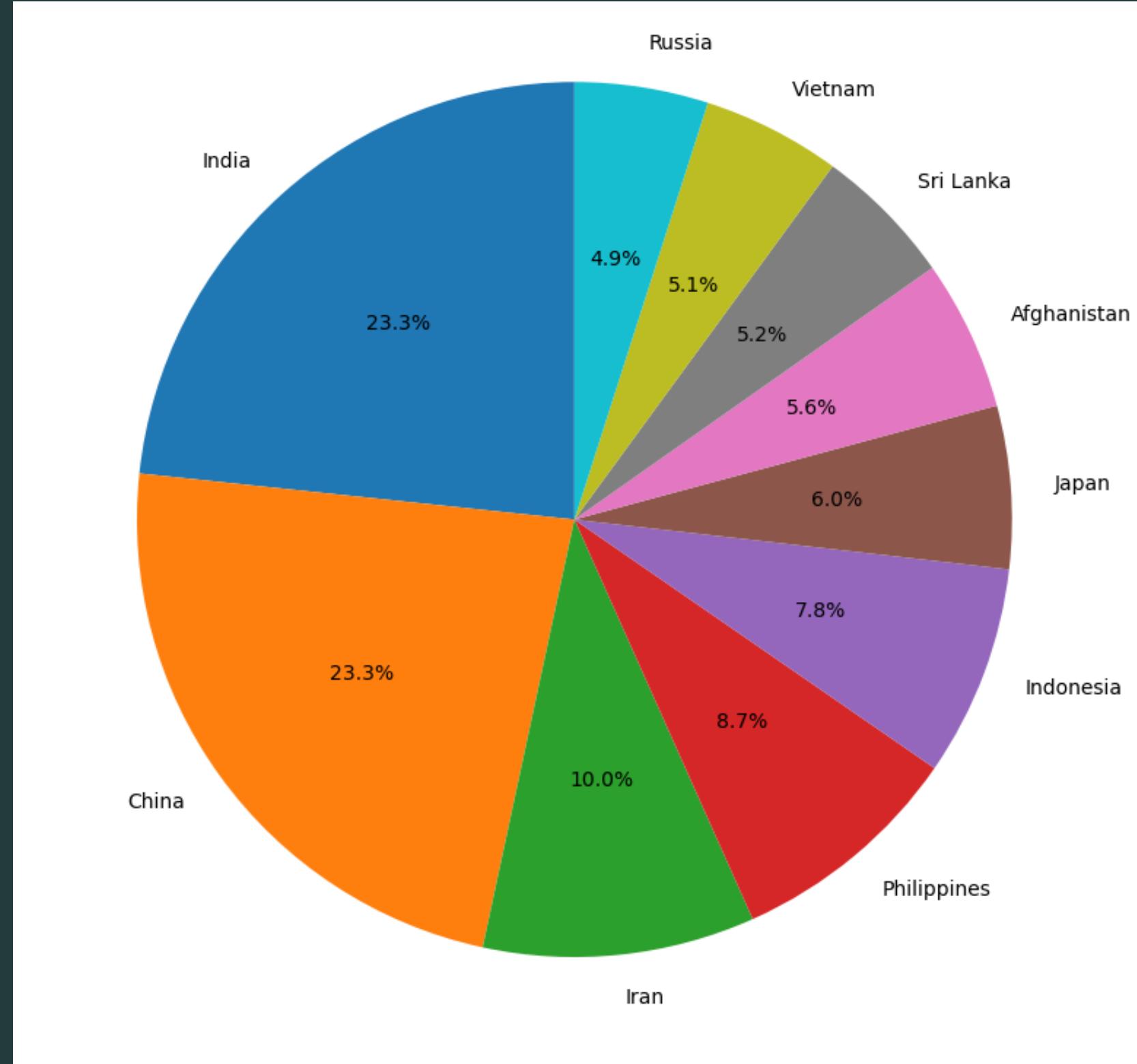
**7. Which countries might be the  
'safest' from, or most 'at risk' of  
natural disasters?**

## TOP 10 COUNTRIES

Fewest Disasters

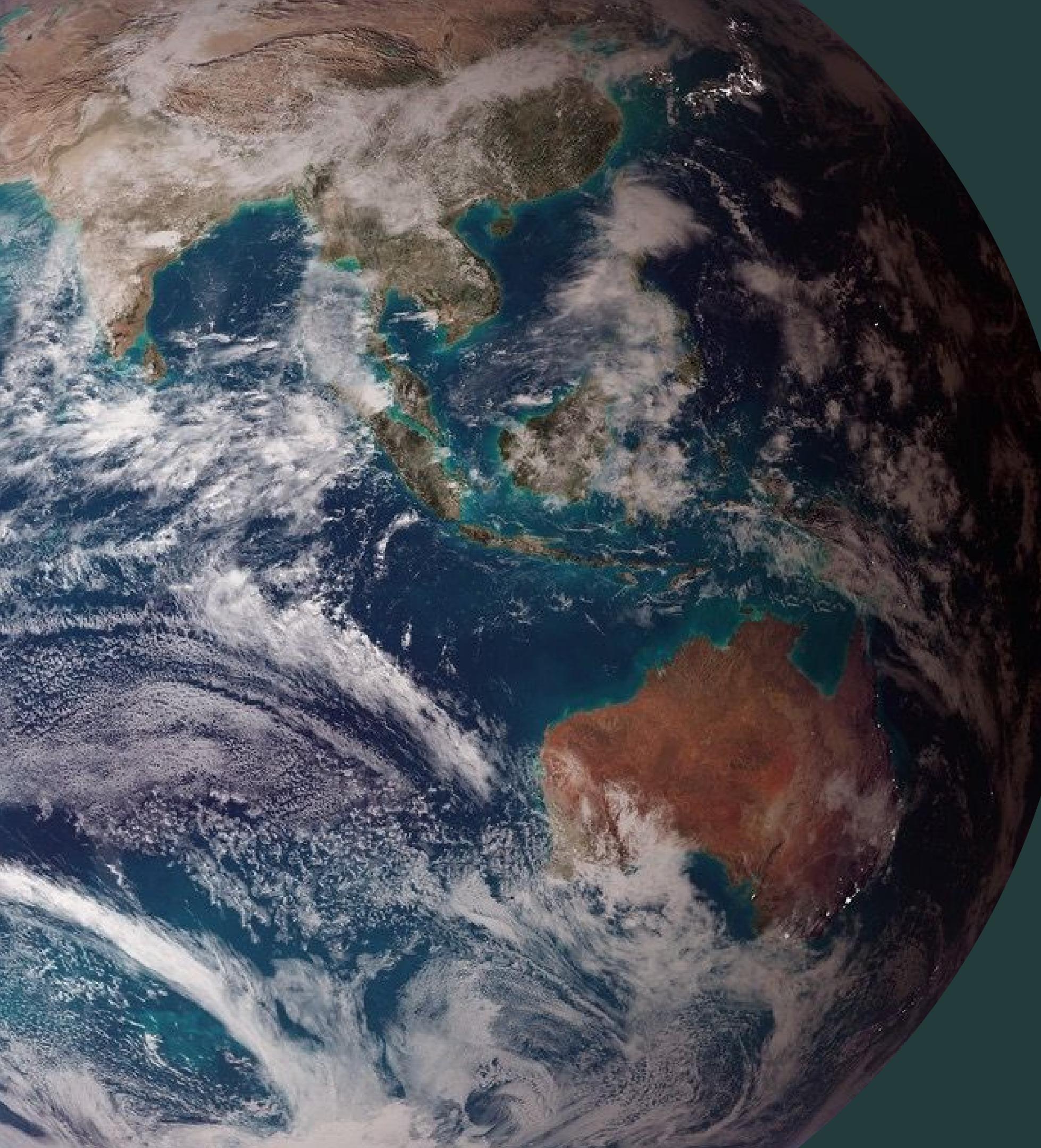


Most Disasters



# Conclusion

In conclusion, and considering all limitations, we can see that a positive correlation exists between temperature change and natural disasters occurring when looking at a global scale. The findings in this analysis are just the tip of the iceberg, but it is clear that a relationship does exist.



# Thank you

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HOSSEIN, HIEU, RYAN AND DOMINIQUE

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