

Disasters in Context: World Disaster Events Mapping and Analysis

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Introduction

- Since 2000, over 15,000 disaster events have occurred worldwide causing over 1.7 million direct deaths. These events are often unpredictable until it is too late and are thus unpreventable.
- However, despite disasters being unpreventable, officials can limit disasters' impact through preparation and knowledge of risk. To understand the risk of a disaster in a certain place, disaster statistics need to be placed in the context of that place.

Objective

- This analysis aims to combine world disaster event data with World Bank country indicator data to place historical disaster events in a given country's developmental context. Understanding historical disasters by their type, impact, and development level is crucial to gain information about how different disasters affect different countries.

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Datasets



EM-DAT

The International Disaster Database
Centre for Research on the Epidemiology of Disasters

- The EM DAT database contains impact and location data for every world mass disaster event since 1900. For this project, only data from the year 2000 onward will be used.
- Biases: Geographic, Accounting, Threshold, and Time



THE WORLD BANK

- The World Bank Development Indicator database contains internationally comparable statistics about global development by country. For this project, the variables GDP per capita, infant mortality rate, life expectancy, electricity percentage, and tonnes of CO2 emitted are used.

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Methods-Development Score

Development Score captures a country's overall development in a given year compared to the rest of the world. For this project, the following equation is used to calculate development score, where D is the decile function:

$$\begin{aligned}\text{Development Score} = & D(\text{Life Expectancy}) + D(\text{Infant Mortality, decreasing}) \\ & + D(\text{Carbon Dioxide Emitted}) + D(\text{Electricity Percentage}) \\ & + D(\text{GDP Per Capita})\end{aligned}$$

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Methods-FEMA's Risk Score

FEMA's National Risk Index calculates risk index by US counties and disaster type using the formula below. It gives the overall risk of certain disaster types occurring in a given county.

$$\text{Risk Index} = \frac{\text{Expected Annual Loss} \times \text{Social Vulnerability}}{\text{Community Resilience}}$$



This project's risk score model is based on FEMA's risk index, but the calculation has been slightly altered given the data available in this project.

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Methods-Risk Score

Risk Score captures a country's risk of a certain disaster type based on historical disaster events in this country and the country's development. For this project, the equation below is used to calculate Risk Score.

$$\text{Risk Score} = .5 \times \text{Impact} + .25 \times \text{Inverted Development Score} + .25 \times \text{Frequency}$$

Differences From FEMA's Score: Additivity and Weights

QR Code For interactive Graphs

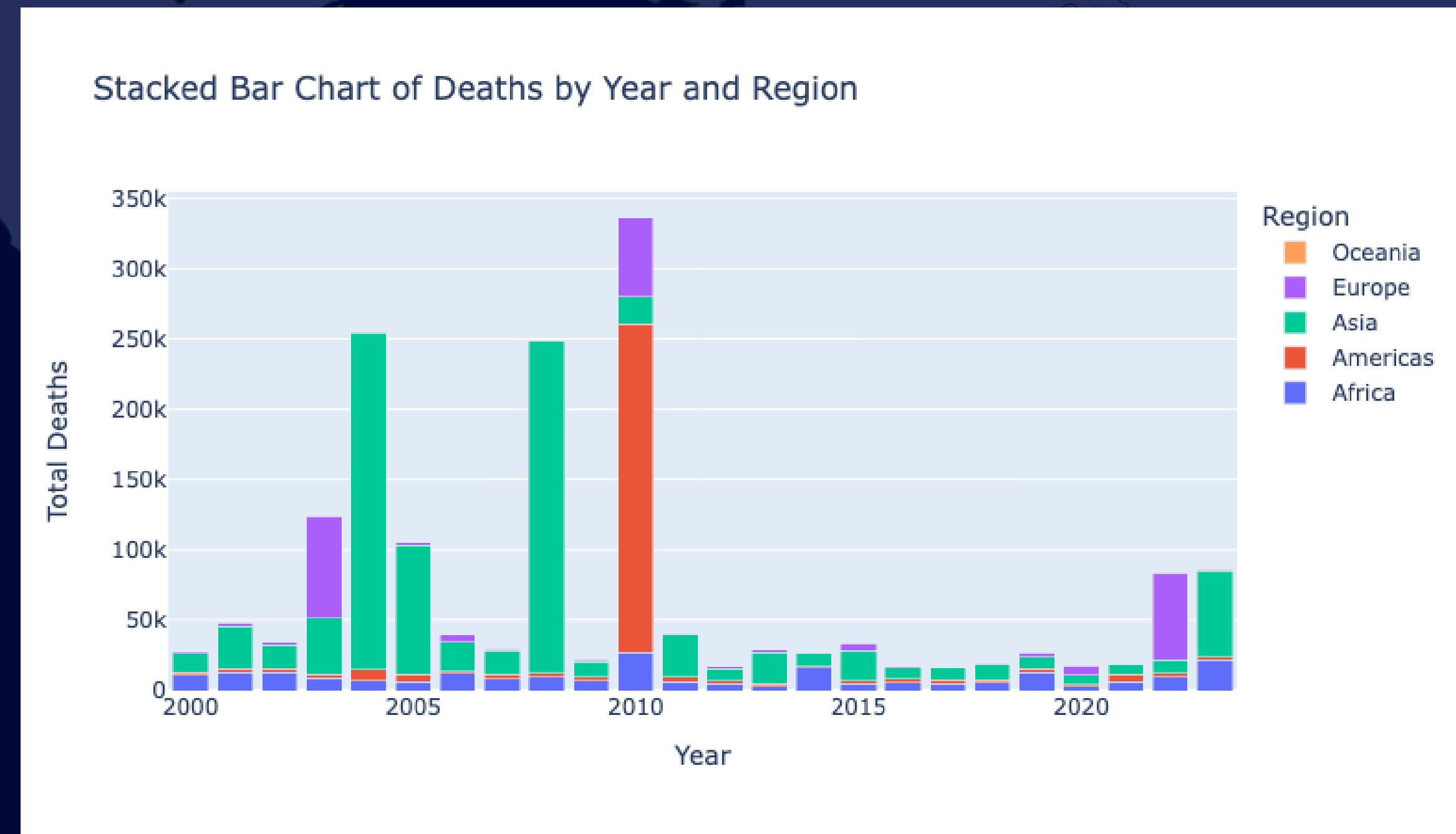


<https://disastersanalysis.streamlit.app/>

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Mapping + Analysis

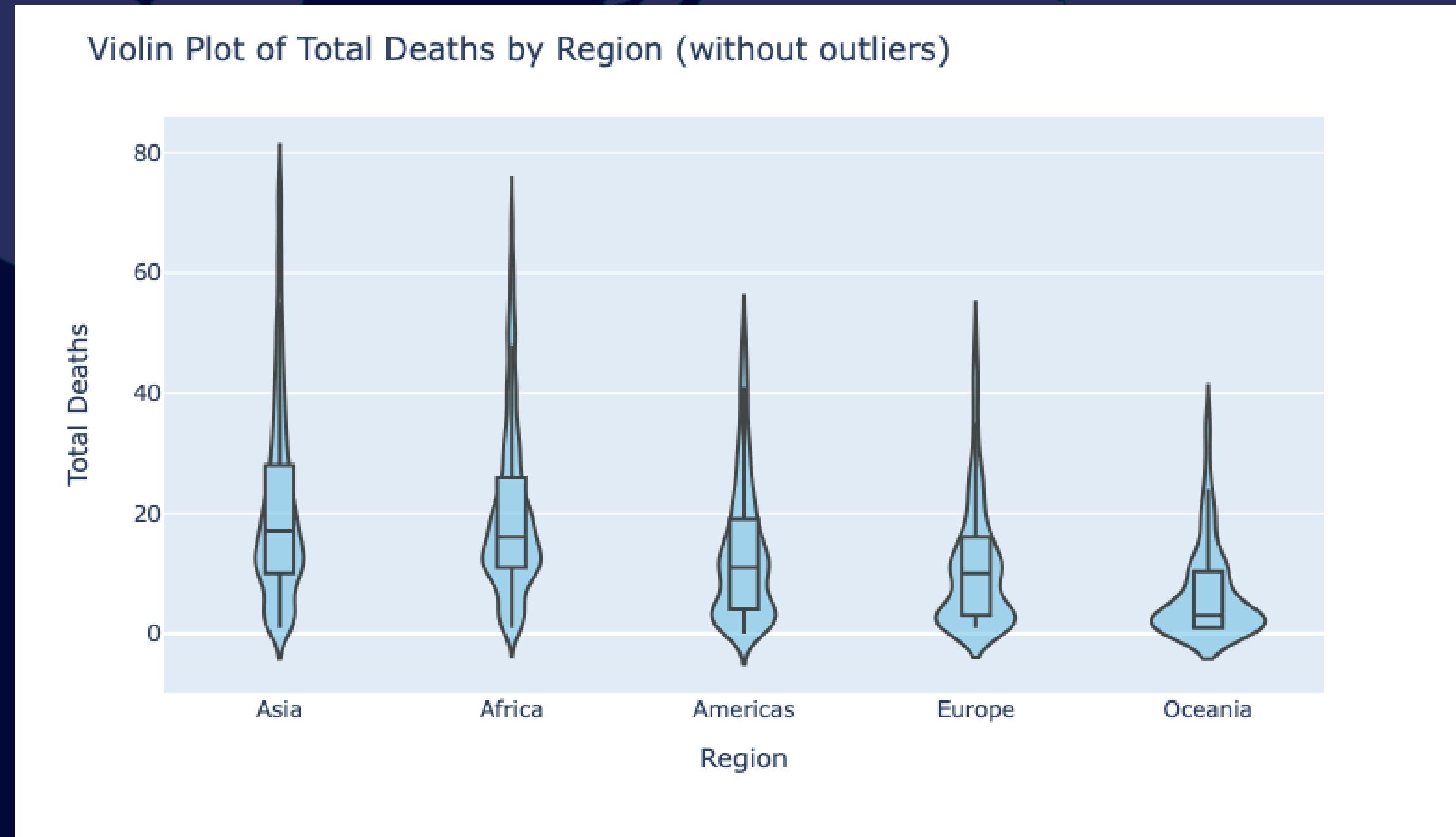
- The stacked bar chart shows disaster deaths by year and region.



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Mapping + Analysis

- The violin plot shows median disaster event deaths are higher in Asia and Africa.



5

Mapping + Analysis

- The line graph shows the median death toll for disaster events by country development score. A downward trend is observed, indicating more developed countries have fewer deaths in a typical disaster event.

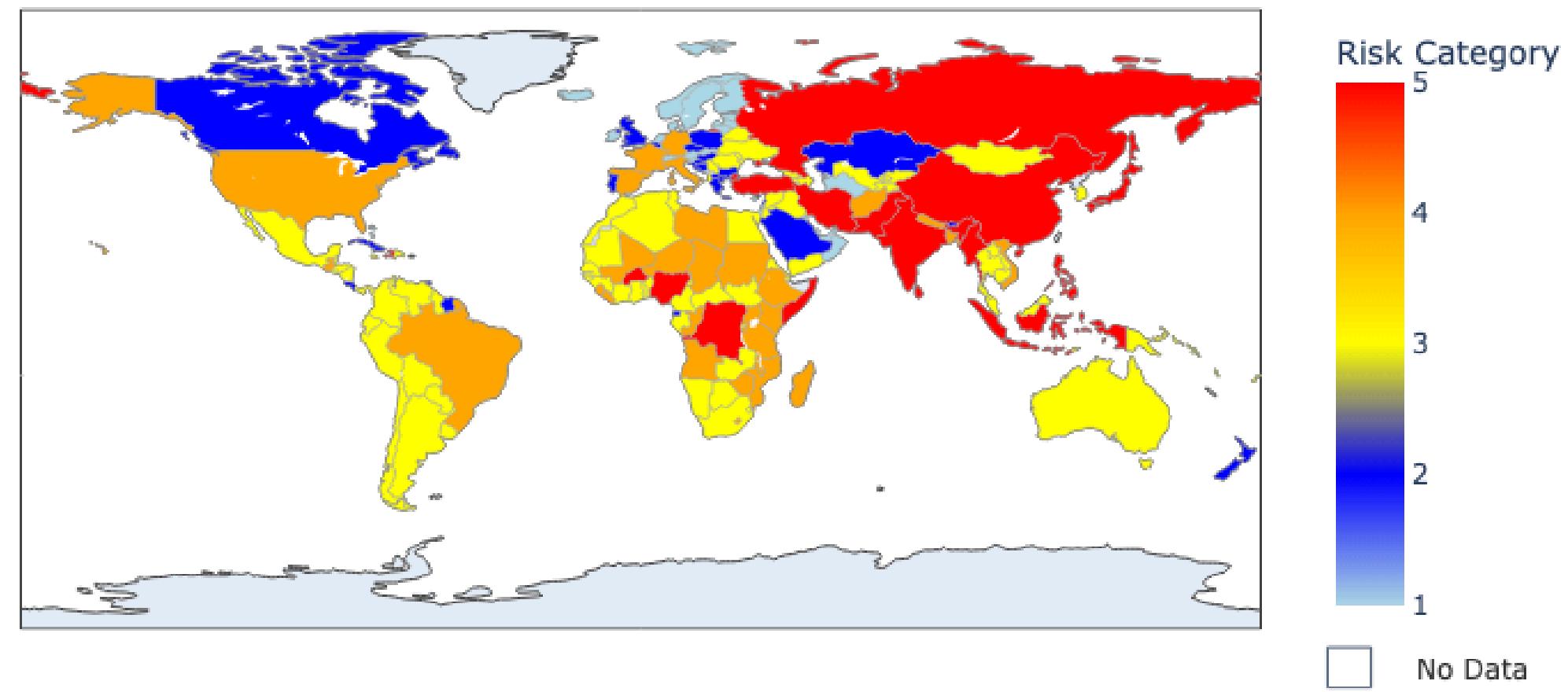


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Mapping + Analysis

- The risk score map reflects the highest risk score disaster type in each country. The scores have been binned into different risk categories as indicated by the color scale.

Risk Score by Country (Top Disaster Type From Each Country)



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Conclusion

- Disaster events are common but overall death toll is dominated by mass disaster events such as the 2010 Haiti Earthquake or the 2004 Boxing Day Tsunami.
- Disaster events have higher typical death tolls in specific regions, like Asia and Africa.
- Median Death toll for disaster events is at least 3 times higher in the least developed countries compared to the most developed countries.
- The Risk Score map shows disaster types and determines their relative risk compared to other countries.

Sources

- Centre for Research on the Epidemiology of Disasters (CRED). (2024). EM Dat - The International Disaster Database.
<https://www.emdat.be/>
- FEMA. (2024). Determining risk. Determining Risk | National Risk Index. <https://hazards.fema.gov/nri/determining-risk>
- The World Bank. (2024). World development indicators. WDI - Home.
<https://datatopics.worldbank.org/world-development-indicators/>