

GLOBAL EARTHQUAKE EXPLORER: SPATIAL, DEPTH, AND TEMPORAL PATTERNS



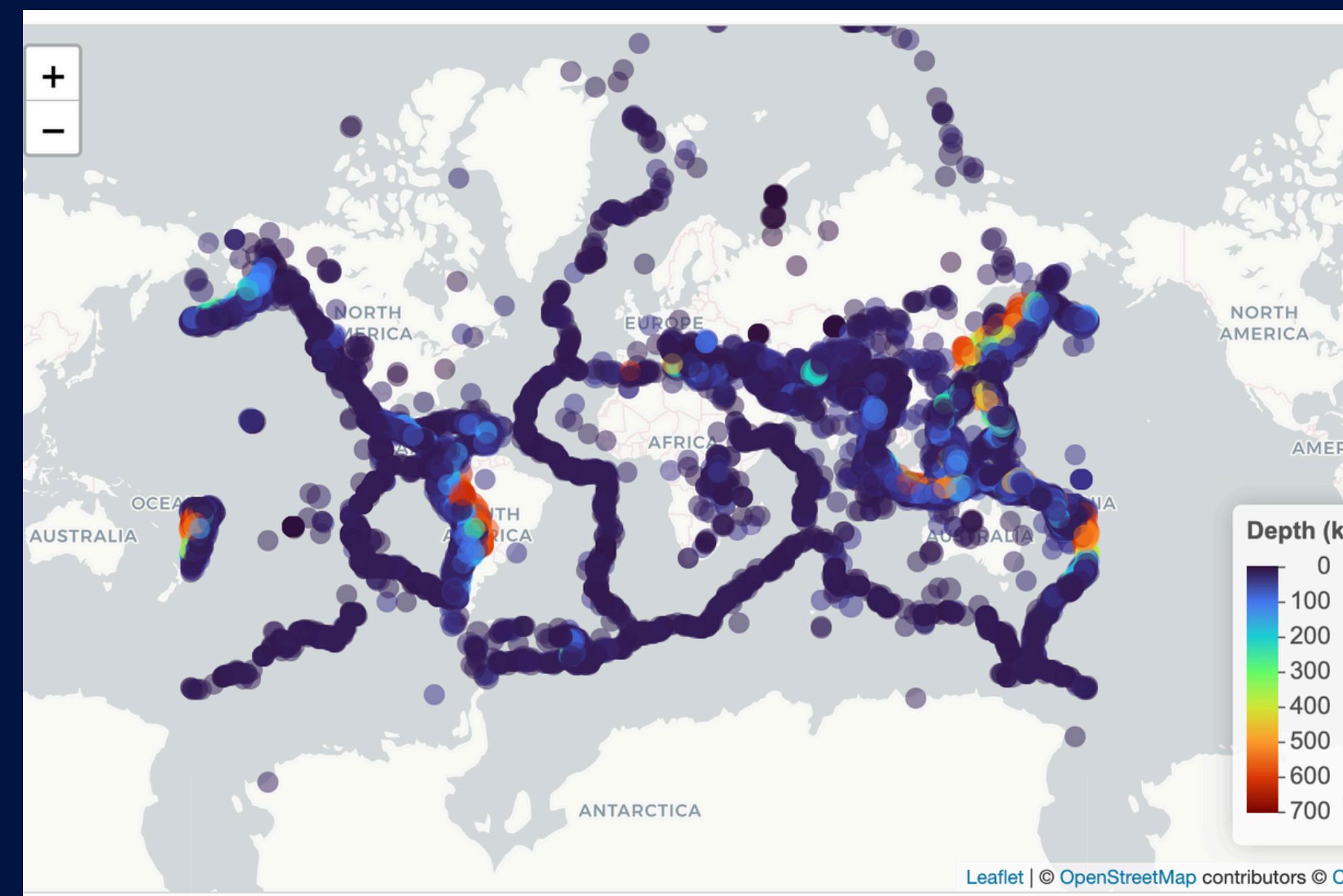
DATASET OVERVIEW

- Source: USGS Earthquake Catalog (global events, Magnitude ≥ 3)
- Time variables created (lubridate): datetime, year, month
- Spatial variables: latitude, longitude
- Earthquake properties: magnitude, depth, type, status, source
- Depth categories:
 1. Shallow (≤ 70 km)
 2. Intermediate (70–300 km)
 3. Deep (> 300 km)
- R packages used: ggplot2, plotly, lubridate, leaflet, dplyr

The dataset contains global earthquakes with date-time, location, magnitude, and depth. Events with a magnitude less than 3 were removed so the visualizations focus on meaningful seismic activity.



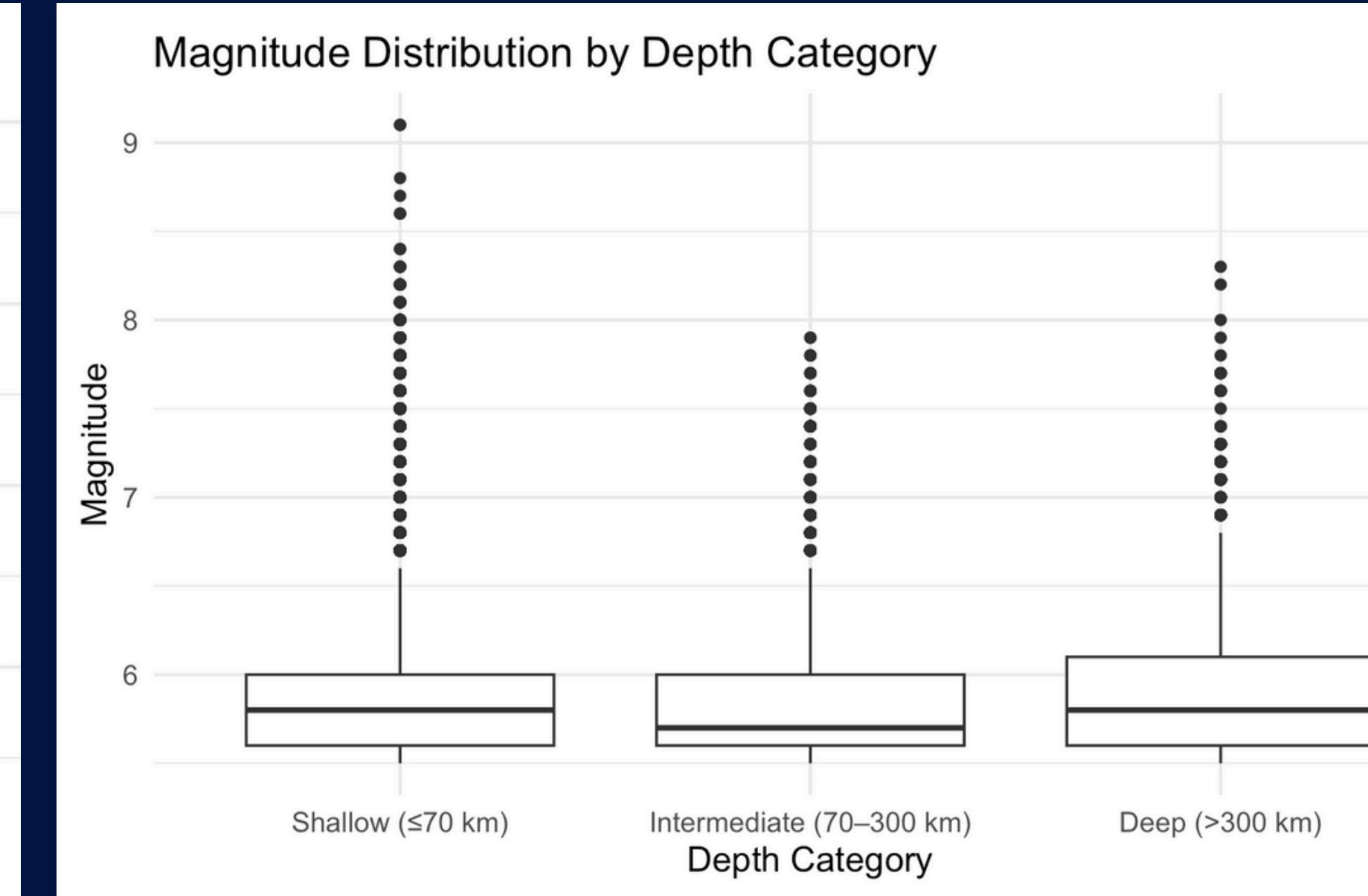
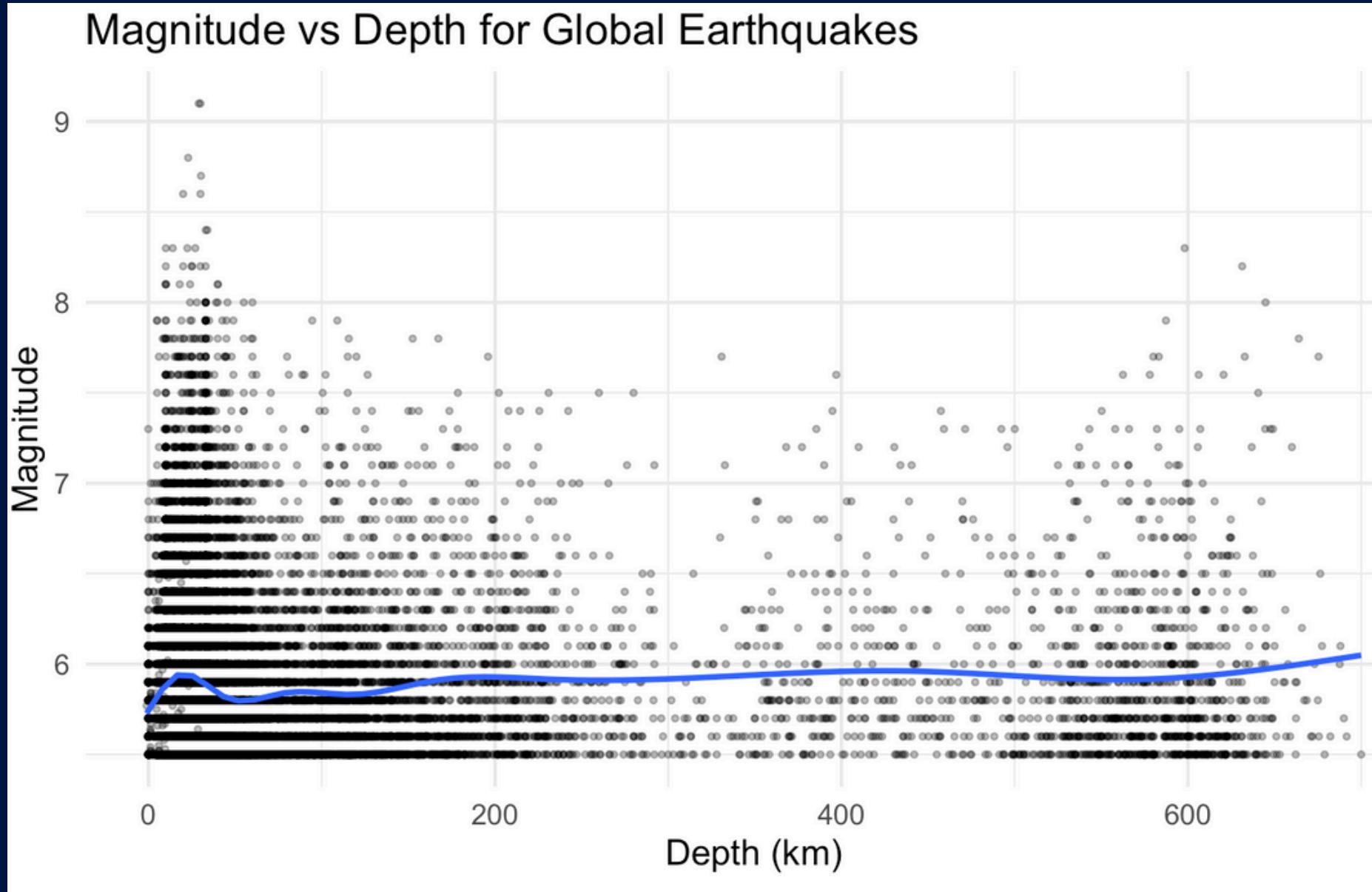
GLOBAL MAP OF EARTHQUAKES (GEOSPATIAL VISUALIZATION)



- Earthquakes cluster along major tectonic boundaries
- Strong concentrations around the *Pacific Ring of Fire*
- Dense activity in *Japan, Indonesia, Alaska, and South America*
- Depth coloring shows that most earthquakes are *shallow*
- Deep earthquakes* appear mainly in *subduction zones*

MAGNITUDE & DEPTH RELATIONSHIP

MAGNITUDE-DEPTH PATTERNS

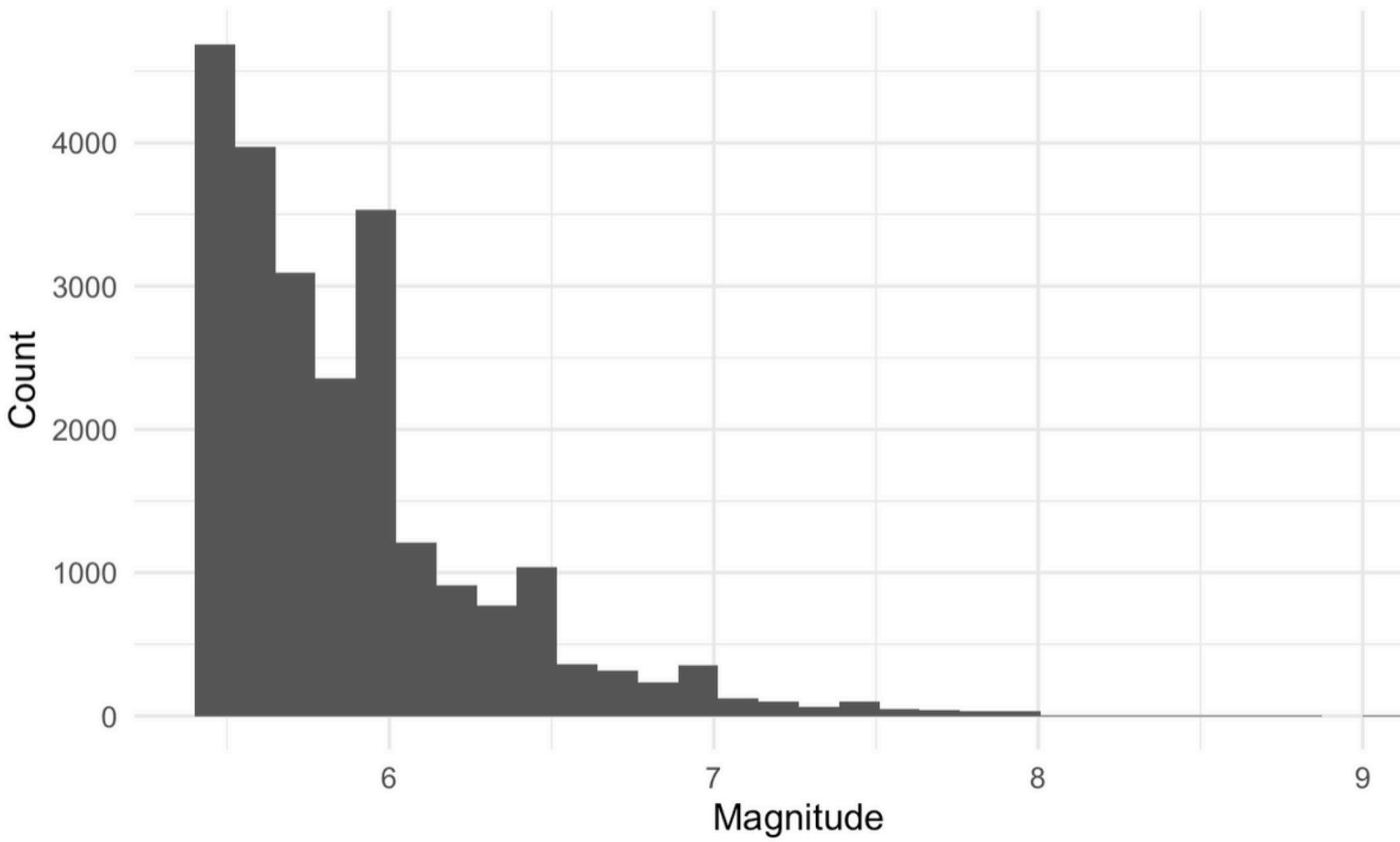


- Scatterplot shows most earthquakes are shallow (depth < 70 km)
- Magnitudes are mostly between 3 and 6, with only a few very large events
- The smooth line is nearly flat \rightarrow no strong relationship between magnitude and depth

- Boxplots show similar median magnitude across depth categories
- Intermediate and deep earthquakes are less common but have slightly wider spread in magnitude

MAGNITUDE-DEPTH PATTERNS

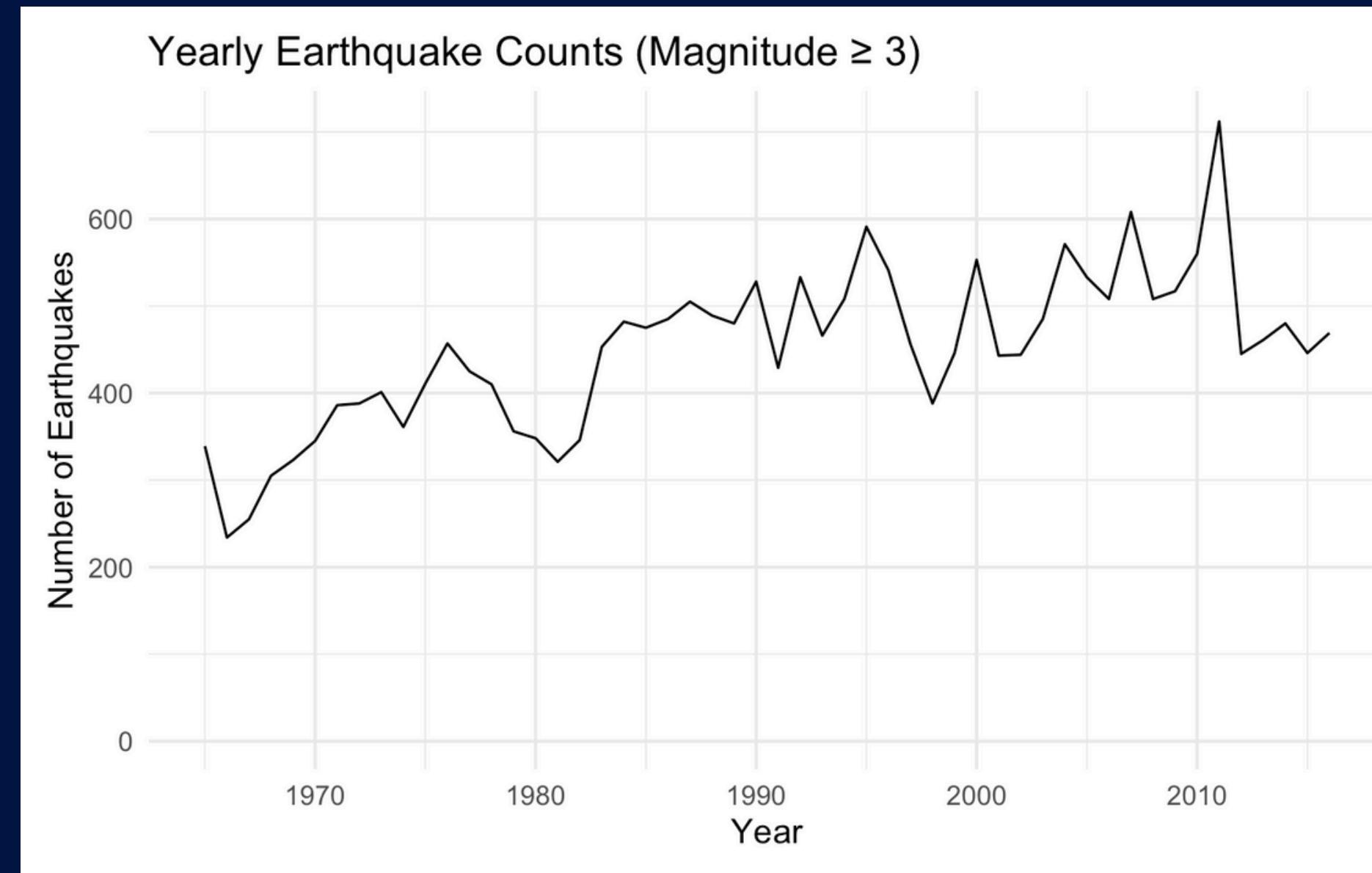
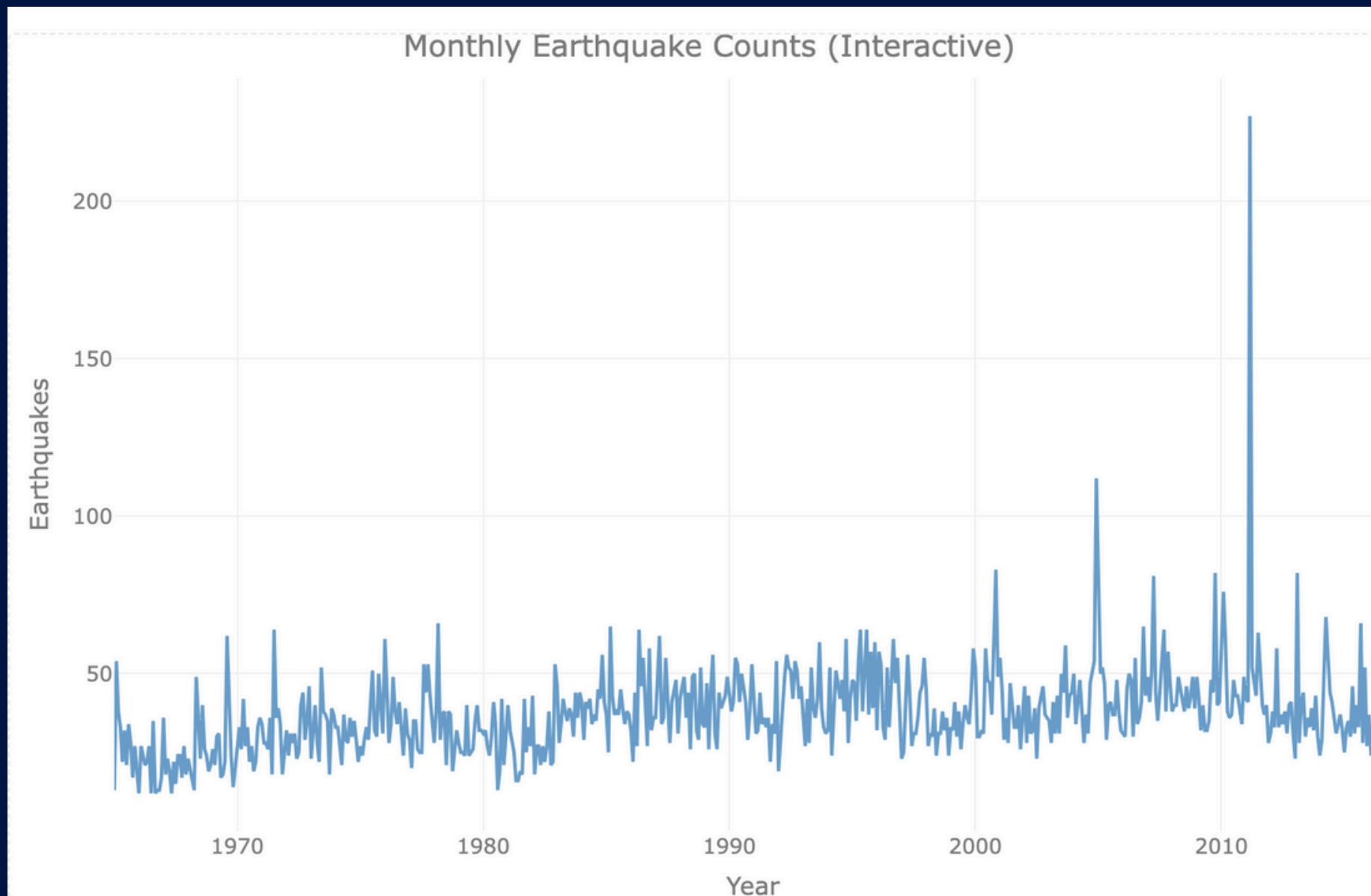
Histogram of Earthquake Magnitudes ($M \geq 3$)



- Most earthquakes in the dataset are moderate in size
- Counts are highest for magnitudes just above the cutoff (around 3–5)
- The distribution is right-skewed – as magnitude increases, counts drop sharply
- Strong earthquakes (≈ 7 and above) are very rare compared to moderate events

TEMPORAL PATTERNS (TIME-SERIES)

EARTHQUAKE ACTIVITY OVER TIME



- Monthly counts show irregular spikes in activity
- No repeating seasonal pattern
- Yearly counts reveal *no strong long-term trend
- Global seismicity remains *relatively stable* over time
- Short-term variability is high; long-term behavior is steady

CONCLUSION

- Earthquakes align strongly with global plate boundaries
- Shallow events dominate worldwide activity
- Deep earthquakes occur primarily within subducting slabs
- Magnitude distribution shows many moderate events and few strong ones
- Time-series shows variable short-term activity but stable long-term levels



THANK YOU