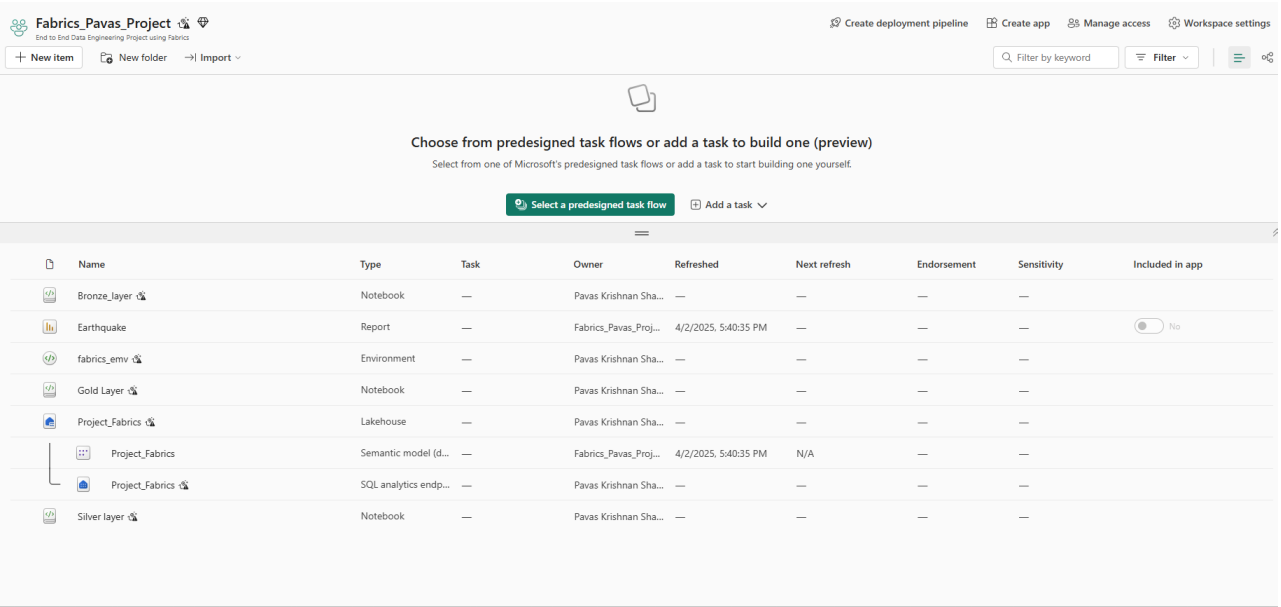
Seismic Signals: Tracking Global Earthquakes with Microsoft Fabric and Power BI

Initializing the Fabric Environment and Lakehouse

I began by setting up a Microsoft Fabric workspace and provisioning a Lakehouse to manage different layers of the data pipeline. This environment serves as the foundation for ingesting, storing, and processing earthquake data efficiently.

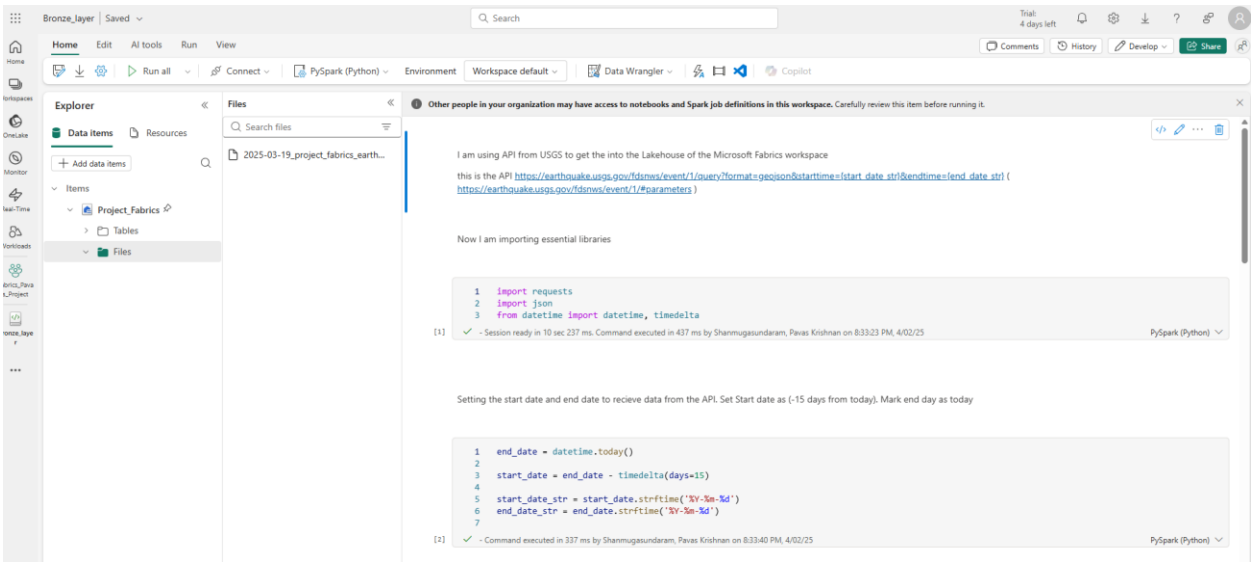


Reviewing the USGS Earthquake API

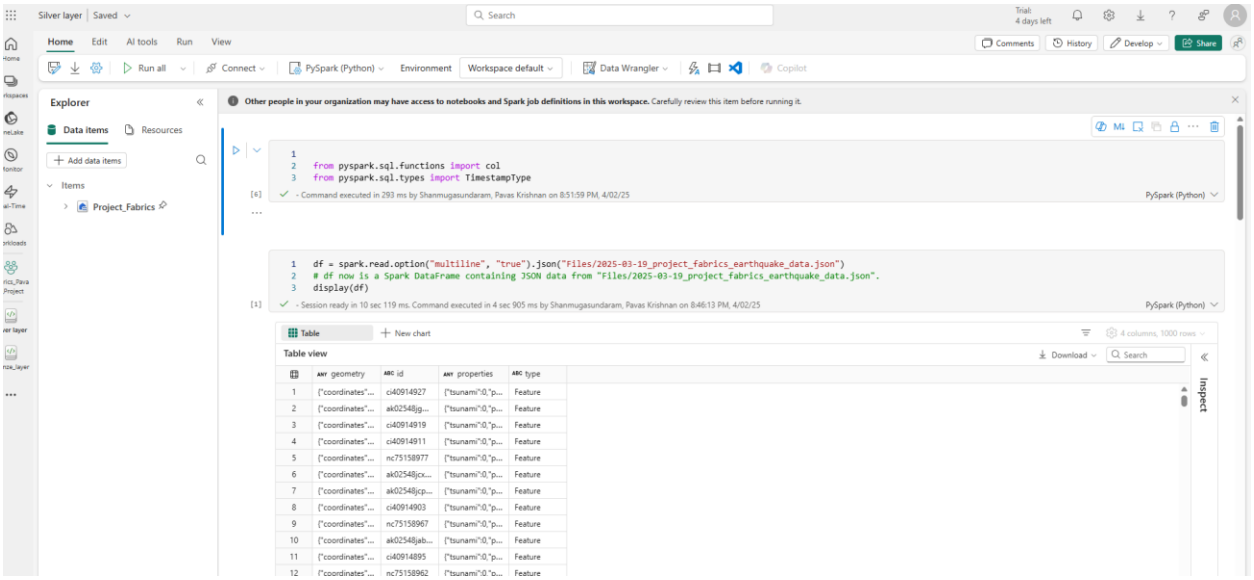
The primary data source for this project is the **USGS Earthquake Catalog API**, a rich repository of global seismic activity. I explored the API's documentation thoroughly to understand its structure, available filters, and response formats. This allowed me to tailor the data extraction process effectively for my use case.

For this project, I focused on the date range **from March 19th, 2025 to April 4th, 2025**. This specific window was chosen because several **significant earthquakes occurred in the**

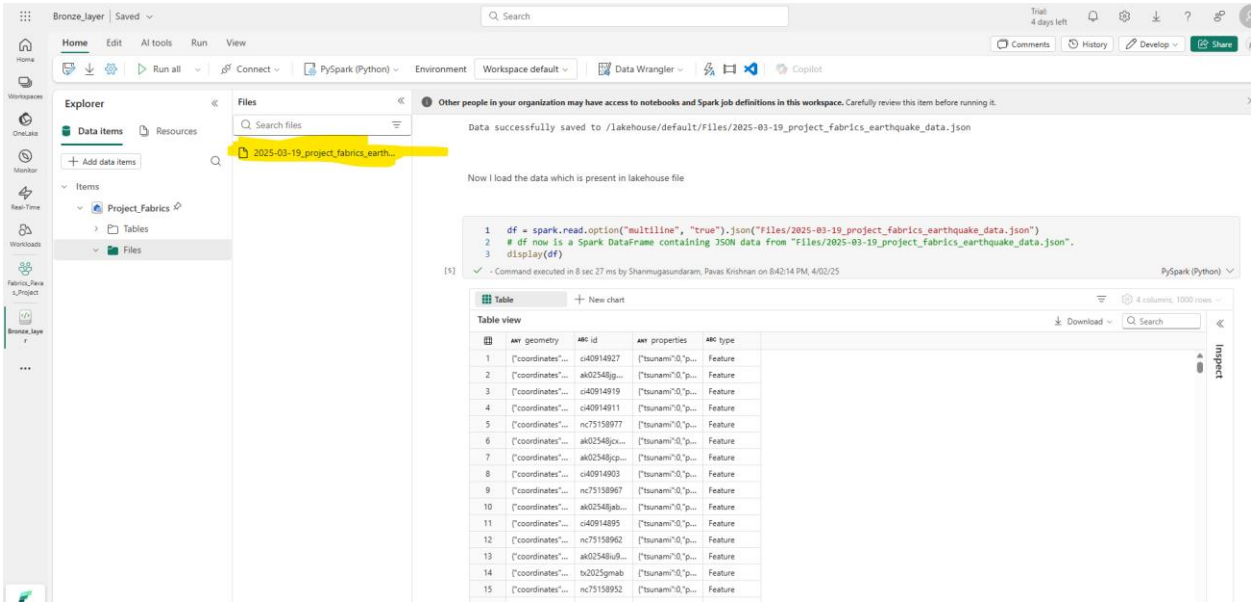
Myanmar-Thailand region during this period. The intent behind selecting this timeframe was to raise awareness about seismic risks in Southeast Asia and provide insights to help audiences better understand the patterns and impact of these natural events.



Leveraging the Python integration within Fabric notebooks, I pulled data directly from the USGS API. Using the requests library, I fetched the earthquake data and saved it as a JSON file in the Lakehouse. This file became the base "Bronze" layer containing unprocessed raw data.



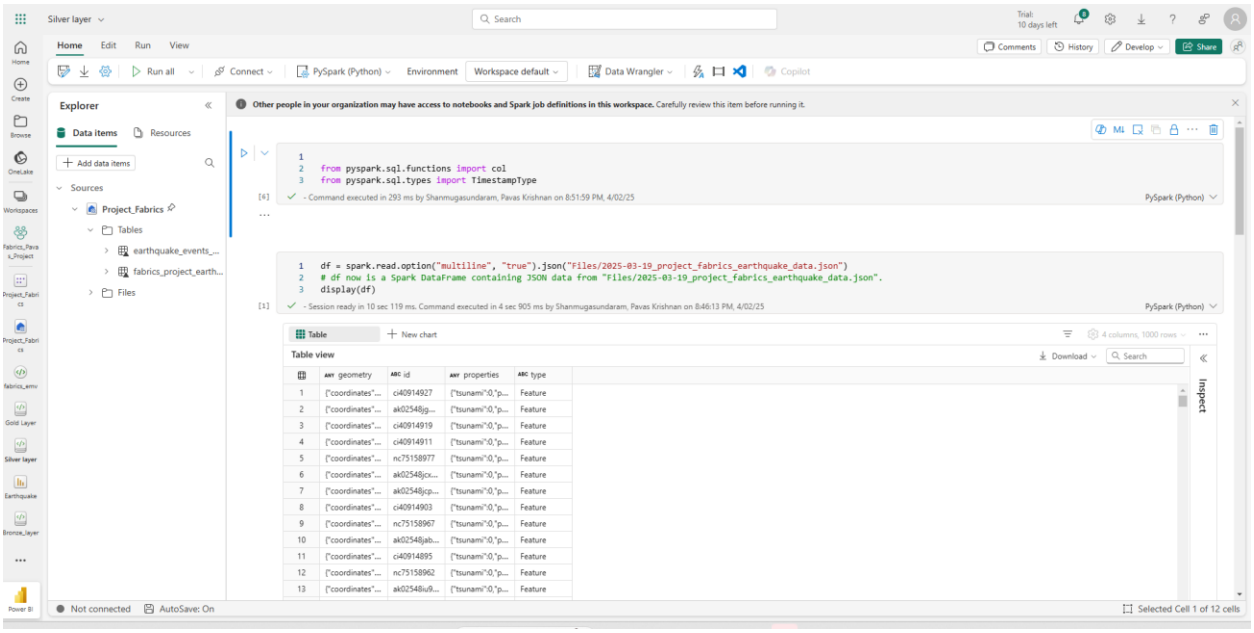
I saved the output of the bronze layer in file format inside the Lakehouse.



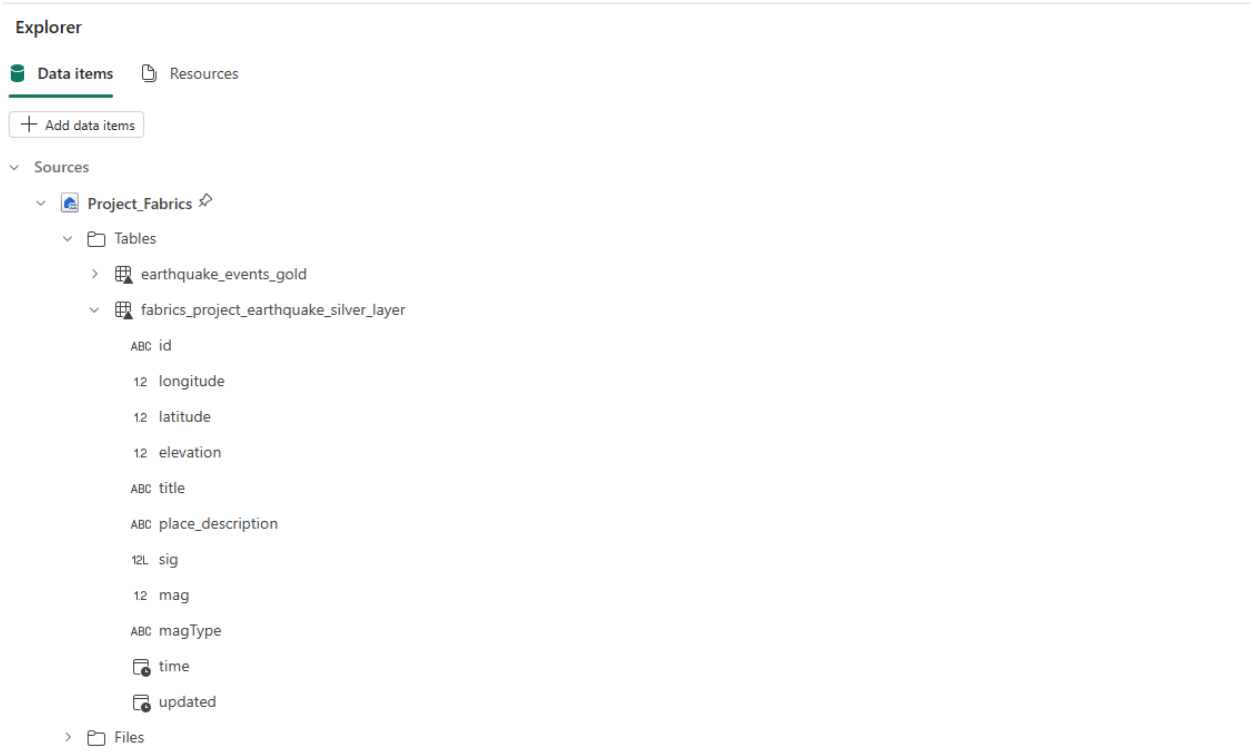
Cleaning and Structuring in the Silver Layer
In this step, I refined the raw data to prepare it for analysis. The transformations included:

Selective Feature Extraction: Only essential fields were retained from the raw JSON structure.

Time Conversion: The original timestamps were in Unix time (milliseconds). I converted them into standard readable datetime format.



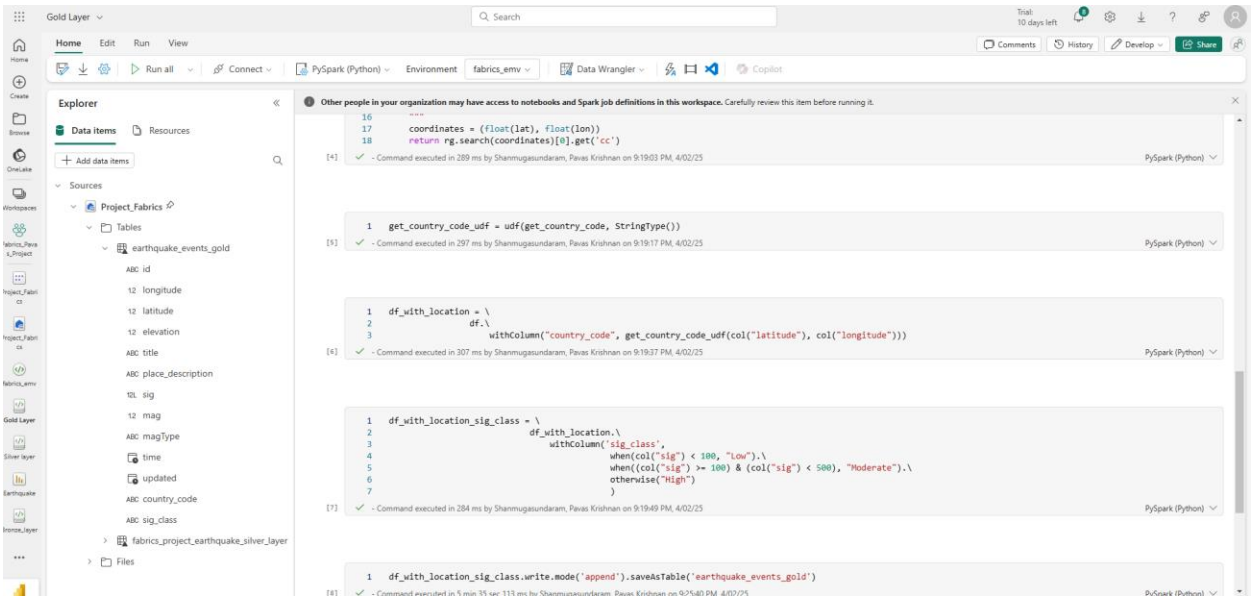
Incremental Loading: The cleaned dataset was appended to a table format using append mode, enabling future incremental updates.



Enriching the Dataset in the Gold Layer

To provide more analytical value, I enriched the silver data in the Gold layer with additional context:

- **Geolocation Mapping:** By using the Reverse Geocoder library, I translated latitude and longitude coordinates into country codes to localize each event.
- **Significance Grouping:** Earthquake significance scores were categorized into three levels—low, moderate, and high—facilitating easier visual analysis


Gold Layer
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Copilot
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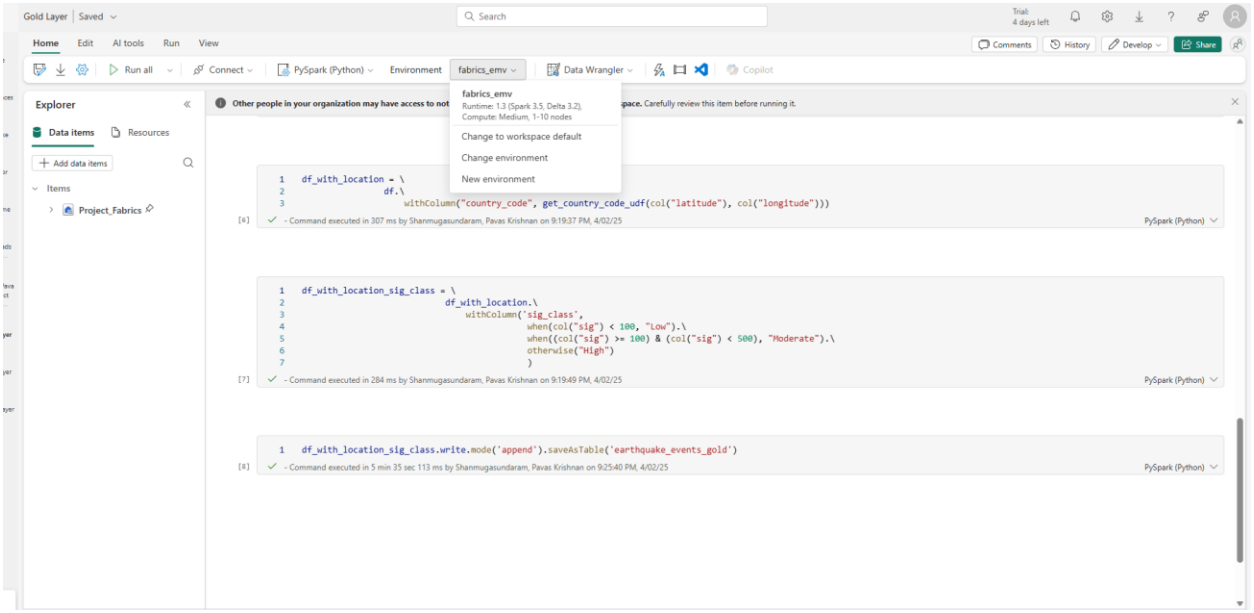
Files
Other people in your organization may have access to notebooks and Spark job definitions in this workspace. Carefully review this item before running it.
coordinates = (float(lat), float(lon))
return rg.search(coordinates)[0].get('cc')
- Command executed in 289 ms by Shanmugasundaram, Pavas Krishnan on 9:19:03 PM, 4/02/25
PySpark (Python)
get_country_code_udf = udf(get_country_code, StringType())
- Command executed in 297 ms by Shanmugasundaram, Pavas Krishnan on 9:19:17 PM, 4/02/25
df_with_location = \
df.\
withColumn("country_code", get_country_code_udf(col("latitude"), col("longitude")))
- Command executed in 307 ms by Shanmugasundaram, Pavas Krishnan on 9:19:37 PM, 4/02/25
df_with_location_sig_class = \
df_with_location.\
withColumn('sig_class',
when(col("sig") < 100, "Low").\
when((col("sig") >= 100) & (col("sig") < 500), "Moderate").\
otherwise("High")
)
- Command executed in 284 ms by Shanmugasundaram, Pavas Krishnan on 9:19:49 PM, 4/02/25
df_with_location_sig_class.write.mode('append').saveAsTable('earthquake_events_gold')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PySpark (Python)
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Data Wrangler
Copilot
fabrics_emv
Runtime: 1.3 (Spark 3.5, Delta 3.2)
Compute: Medium, 1-10 nodes
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Other people in your organization may have access to not
pace. Carefully review this item before running it.
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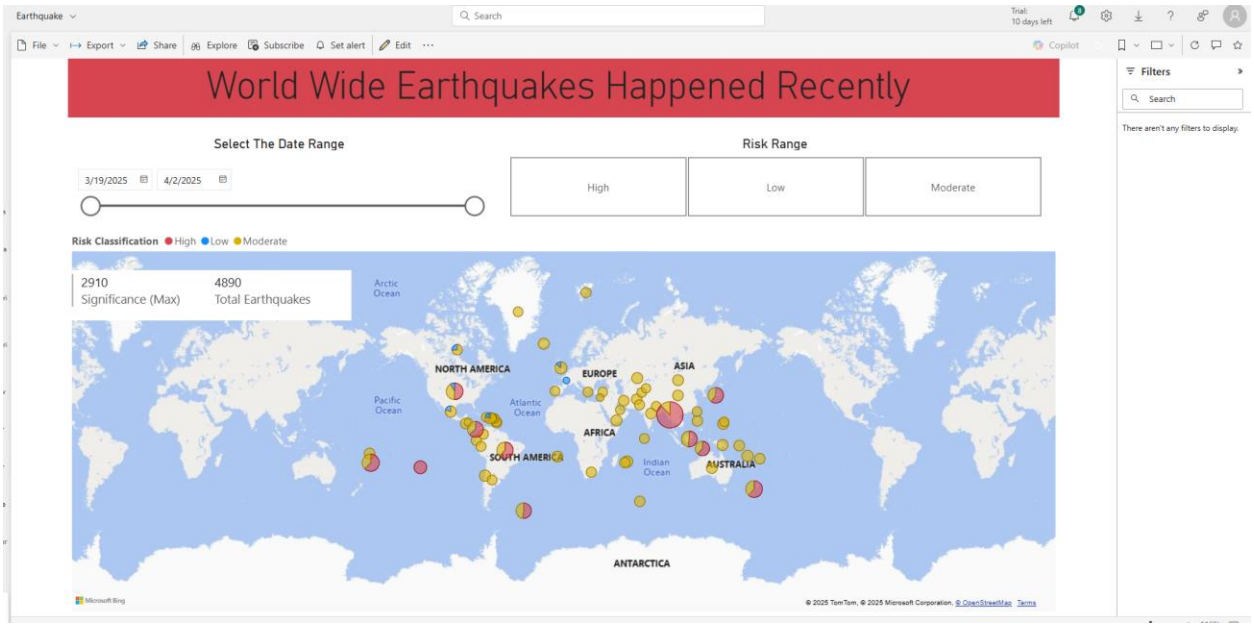
otherwise("High")
)
- Command executed in 284 ms by Shanmugasundaram, Pavas Krishnan on 9:19:49 PM, 4/02/25
PySpark (Python)
df_with_location_sig_class.write.mode('append').saveAsTable('earthquake_events_gold')
- Command executed in 5 min 35 sec 113 ms by Shanmugasundaram, Pavas Krishnan on 9:25:40 PM, 4/02/25
PySpark (Python)

Creating the Earthquake Visualization Report

Using Power BI, embedded within Microsoft Fabric, I built an interactive dashboard to display the processed earthquake data. Due to account restrictions (trail version) that limited the use of map visuals, I utilized bar charts to represent earthquake occurrences across time periods and significance categories.

Despite its simplicity, the dashboard effectively allows users to explore and filter global earthquake events by date and magnitude range.


Earthquake
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Copilot
Filters
Search
There aren't any filters to display.
World Wide Earthquakes Happened Recently
Select The Date Range
3/19/2025
4/2/2025
Risk Range
High
Low
Moderate
Risk Classification High Low Moderate
2910
Significance (Max)
4890
Total Earthquakes
Arctic Ocean
NORTH AMERICA
EUROPE
ASIA
Pacific Ocean
Atlantic Ocean
AFRICA
SOUTH AMERICA
Indian Ocean
AUSTRALIA
ANTARCTICA
Microsoft Bing
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