




User Guide for SeisQuery







SeisQuery: A Unified Interface for Querying Global Seismological Catalogs with Advanced Spatial Filtering

Overview

SeisQuery integrates global earthquake catalogues (EMSC, IRIS, ISC) into a harmonized framework, enabling advanced spatial queries (circular, directional, polygonal) and robust duplicate resolution. Benchmarks demonstrate significant gains in event detection and efficient runtimes, providing a reproducible pathway to provenance-aware seismic analyses.

 **Note:** This software is currently under peer review. Upon acceptance of the associated research article, the full software package will be made available for download.

Key Features

-  **Unified Database Access:** Query multiple seismological catalogs (EMSC, IRIS, ISC) simultaneously
-  **Advanced Spatial Filtering:**
 - Circular search (radius-based queries)
 - Directional search (azimuth-constrained sectors)
 - Polygon search (user-defined custom regions)
-  **Data Harmonization:** Automatic magnitude standardization and intelligent duplicate reconciliation
-  **User-Friendly Interface:** Intuitive GUI with real-time progress tracking
-  **Reproducible Results:** Provenance-preserving outputs for scientific reproducibility
-  **Standalone Application:** Available as Windows executable (.exe) - no installation required

Examples:

- *Program interface overview* (main dashboard and input fields).
- *Search configuration window* (data sources, filters, and time range).
- *Circular search* (radius-based).
- *Directional search* (azimuth-constrained).
- *Polygon search* (user-defined region).

User Guide

Getting Started

1. **Download** the SeisQuery.exe file (available upon publication)
2. **Run** the executable - no installation needed
3. **Configure** your search parameters using the intuitive interface
4. **Execute** queries and export results

Search Configuration

1. Data Source Selection

Choose one or more earthquake catalogs:

- **EMSC:** European-Mediterranean Seismological Centre
- **IRIS:** Incorporated Research Institutions for Seismology
- **ISC:** International Seismological Centre

 **Tip:** Select multiple sources for comprehensive coverage and cross-validation

2. Spatial Search Methods

Circular Search

Define a circular search area around a central point:

- **Center Point:** Latitude and longitude coordinates
- **Radius:** Distance in kilometers or degrees
- **Use Case:** General regional seismicity studies

Directional Search

Search within specific azimuthal sectors:

- **Reference Point:** Central coordinates
- **Distance:** Maximum search distance
- **Azimuth Range:** Start and end angles (0-360°)
- **Presets Available:** North-East, East-South, etc.
- **Use Case:** Fault-specific or directional seismicity analysis

Polygon Search

Define custom irregular search boundaries:

- **Predefined Regions:** Suez Gulf, Gulf of Aqaba, Red Sea
- **Custom Polygons:** Add/edit vertex coordinates manually
- **Use Case:** Complex geological regions or administrative boundaries

3. Temporal Filtering

- **Date Range:** Start and end dates (YYYY-MM-DD format)
- **Search Intervals:** Split large queries into manageable time chunks
- **Safety Margin:** Prevent data loss between intervals

4. Event Filtering

- **Magnitude Range:** Minimum and maximum magnitude (e.g., 1.0 - 9.0)
- **Depth Range:** Filter by earthquake depth (0-700 km)
- **Enable/Disable:** Toggle depth filtering as needed

Example Use Cases

The figures below illustrate the graphical interface of the SeisQuery software and examples of different query modes:

Red Sea Seismicity Analysis

Objective: Study seismic activity along the Red Sea Rift

- **Method:** Directional search
- **Configuration:** Azimuth 115° to 180°, Distance 200km
- **Result:** Focused analysis of rift-related earthquakes

Eastern Mediterranean Study

Objective: Comprehensive regional seismicity assessment

- **Method:** Polygon search
- **Configuration:** Custom polygon following tectonic boundaries
- **Result:** Detailed seismic characterization of complex tectonic region

Iceland Volcanic Zone

Objective: Monitor volcanic-related seismicity

- **Method:** Circular search with tight magnitude filtering
- **Configuration:** 50km radius, magnitude 2.0+
- **Result:** High-resolution volcanic earthquake catalog



Publication Status



Associated Research Article

Title: "SeisQuery: A Unified Interface for Querying Global Seismological Catalogs with Advanced Spatial Filtering"

Status: Currently under peer review

Abstract: [Brief description of the research methodology, validation, and key findings]



Software Availability

- **Current Status:** Development complete, pending publication approval
- **Release Timeline:** Upon acceptance of the research article
- **Distribution:** Direct download from this GitHub repository
- **License:** Will be specified upon release



Contact & Support



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Collaboration

- **Research Collaborations:** Welcome
- **Feature Requests:** Under consideration for future versions
- **Bug Reports:** Please document and report via email



Citations



If you use SeisQuery in your research, please wait for the official publication for proper citation format. Preliminary reference:

SeisQuery: A Unified Interface for Querying Global Seismological Catalogs
with Advanced Spatial Filtering. Taha et al (Under Review, 2025)



Acknowledgments

We gratefully acknowledge:

- **European-Mediterranean Seismological Centre (EMSC)** for data access
- **Incorporated Research Institutions for Seismology (IRIS)** for catalog services
- **International Seismological Centre (ISC)** for comprehensive earthquake data
-  **Coming Soon**
- **Stay tuned for the official release following peer review acceptance!**
-  **Star this repository** to receive notifications about the software release and publication updates

SeisQuery

Current UTC: 2025-09-15 09:24:48

About

Data Source Selection

Data Sources:

☒ EMSC ☒ IRIS ☒ ISC

Search Criteria

Center Point: Lat, Lon

Search Range

☒ Circular Search ☐ Directional Search ☐ Polygon Search

Radius: ☒ Kilometers ☐ Degrees

Date Range

From: To:

Advanced Options

Interval (months): Safety Margin:

Magnitude Range

Min: Max:

Depth Range (km)

☐ Enable Depth Filter Min: Max:

Saving detailed report... ☒

Fig. 1: Graphical interface of the SeisQuery software illustrating the circular search method. The user specifies a central geographic point by latitude and longitude, and defines a search radius in either kilometers or degrees. The system retrieves seismic events within the defined circular area from selected data sources (EMSC, IRIS, ISC). Additional filters such as date, magnitude, and depth ranges can be applied to refine the search.

SeisQuery

Current UTC: 2025-09-15 13:03:09

About

Data Sources:

☒ EMSC ☒ IRIS ☒ ISC

Search Criteria

Center Point: 25.5 Lat, 35.85 Lon

Search Range

☐ Circular Search ☒ Directional Search ☐ Polygon Search

Search Mode:

☒ Preset Directions ☐ Custom Azimuth Range

Preset Directions

☒ North (0°) Distance: 3 ☐ km ☒ ° Range: 90 deg

☒ East (90°) Distance: 3 ☐ km ☒ ° Range: 90 deg

☒ South (180°) Distance: 150 ☒ km ☐ ° Range: 60 deg

☒ West (270°) Distance: 150 ☒ km ☐ ° Range: 60 deg

Date Range

From: 2025-08-15 To: 2025-09-15

Advanced Options

Interval (months): 4 Safety Margin: 1.25

Magnitude Range

Min: 1 Max: 9

Depth Range (km)

☐ Enable Depth Filter Min: 0 Max: 700

Figs. 2(a)

SeisQuery

Current UTC: 2025-09-15 09:24:48 About

Data Sources:

☒ EMSC ☒ IRIS ☒ ISC

Search Criteria

Center Point: Lat, Lon

Search Range

☐ Circular Search ☒ Directional Search ☐ Polygon Search

Search Mode:

☐ Preset Directions ☒ Custom Azimuth Range

Custom Azimuth Range (360° Circle)

Azimuth System: 0°=North, 90°=East, 180°=South, 270°=West

Distance: ☐ km ☒ °

From Azimuth: ° To Azimuth: ° Custom Range

Quick Select: N→E (0→90) E→S (90→180) S→W (180→270) W→N (270→360)

Date Range

From: To:

Advanced Options

Interval (months): Safety Margin:

Magnitude Range

Min: Max:

Depth Range (km)

☐ Enable Depth Filter Min: Max:

Figs. 2(b)

Figs. 2 (a, b): Graphical interface of the SeisQuery software illustrating the directional search method. The user specifies a central reference point by latitude and longitude and defines a search distance in kilometers or degrees. The search region is constrained by azimuthal limits, which can be set using preset quadrants (e.g., north–east, east–south) or a custom azimuth range, thereby allowing retrieval of seismic events along specific directions relative to the reference point. Additional filters for time, magnitude, and depth can be applied to refine the query.

SeisQuery

Current UTC: 2025-09-15 09:24:48

About

Data Source Selection

Data Sources:

☐ EMSC ☐ IRIS ☒ ISC

Search Criteria

Center Point: 35.27 Lat, 31.56 Lon

Search Range

☐ Circular Search ☐ Directional Search ☒ Polygon Search

Select Region: E-M. Sea Add / Edit Polygons

Date Range

From: 2021-01-01 To: 2025-01-01

Advanced Options

Interval (months): 6 Safety Margin: 1.25

Magnitude Range

Min: 1 Max: 9

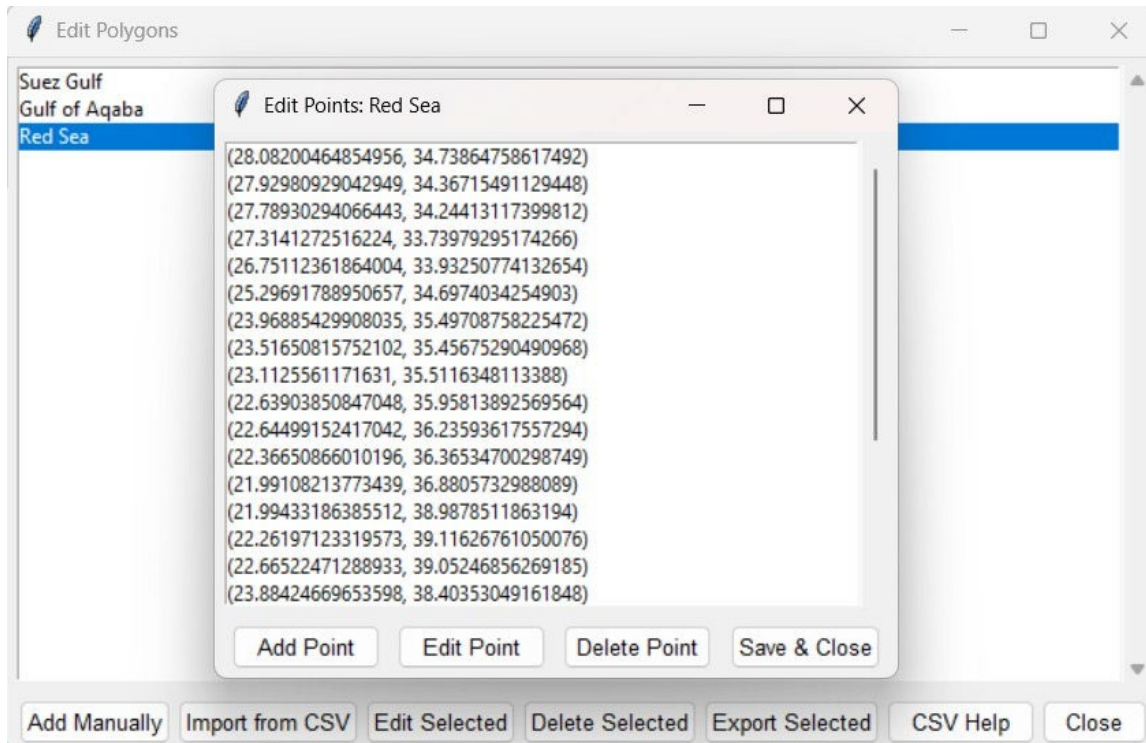
Depth Range (km)

☐ Enable Depth Filter Min: 0 Max: 700

Fetching ISC data: 2021-01-01 to 2021-07-01

Search Cancel

(a) Polygon search interface



(b) Add/Edit polygons dialog

Fig. 3: SeisQuery polygon search workflow. (a) Users select predefined regions (e.g., Suez Gulf, Gulf of Aqaba, Red Sea) or invoke custom region tools. (b) The Add/Edit Polygons dialog exposes vertex coordinates for precise creation, modification, and deletion of polygon boundaries.

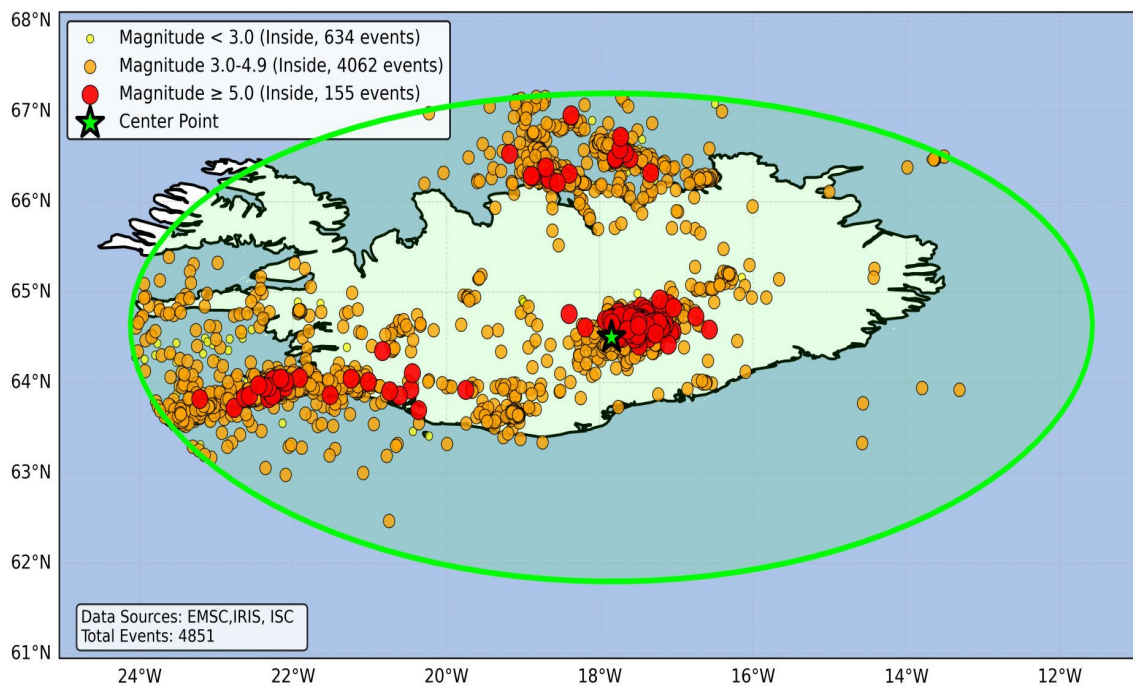
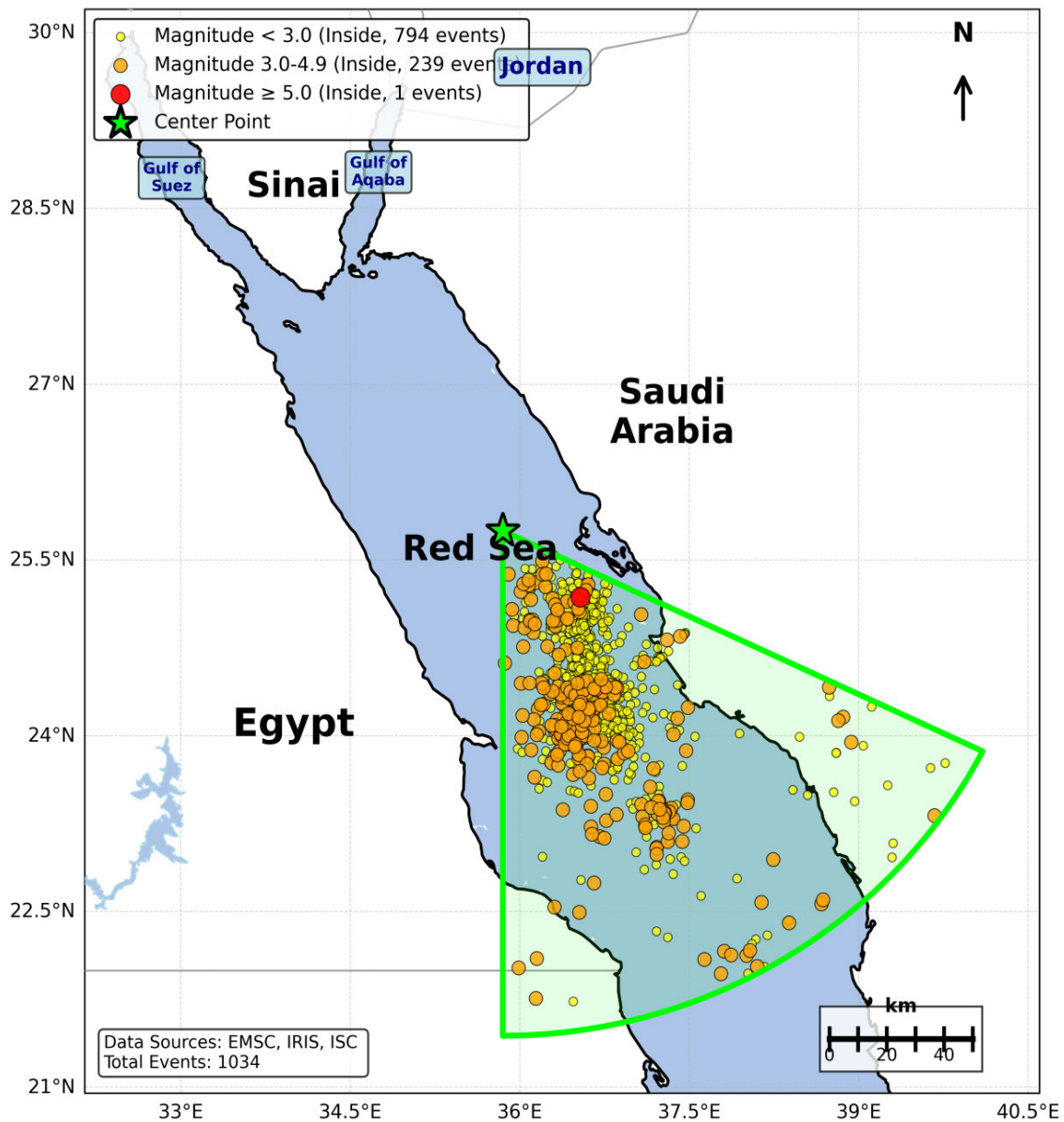
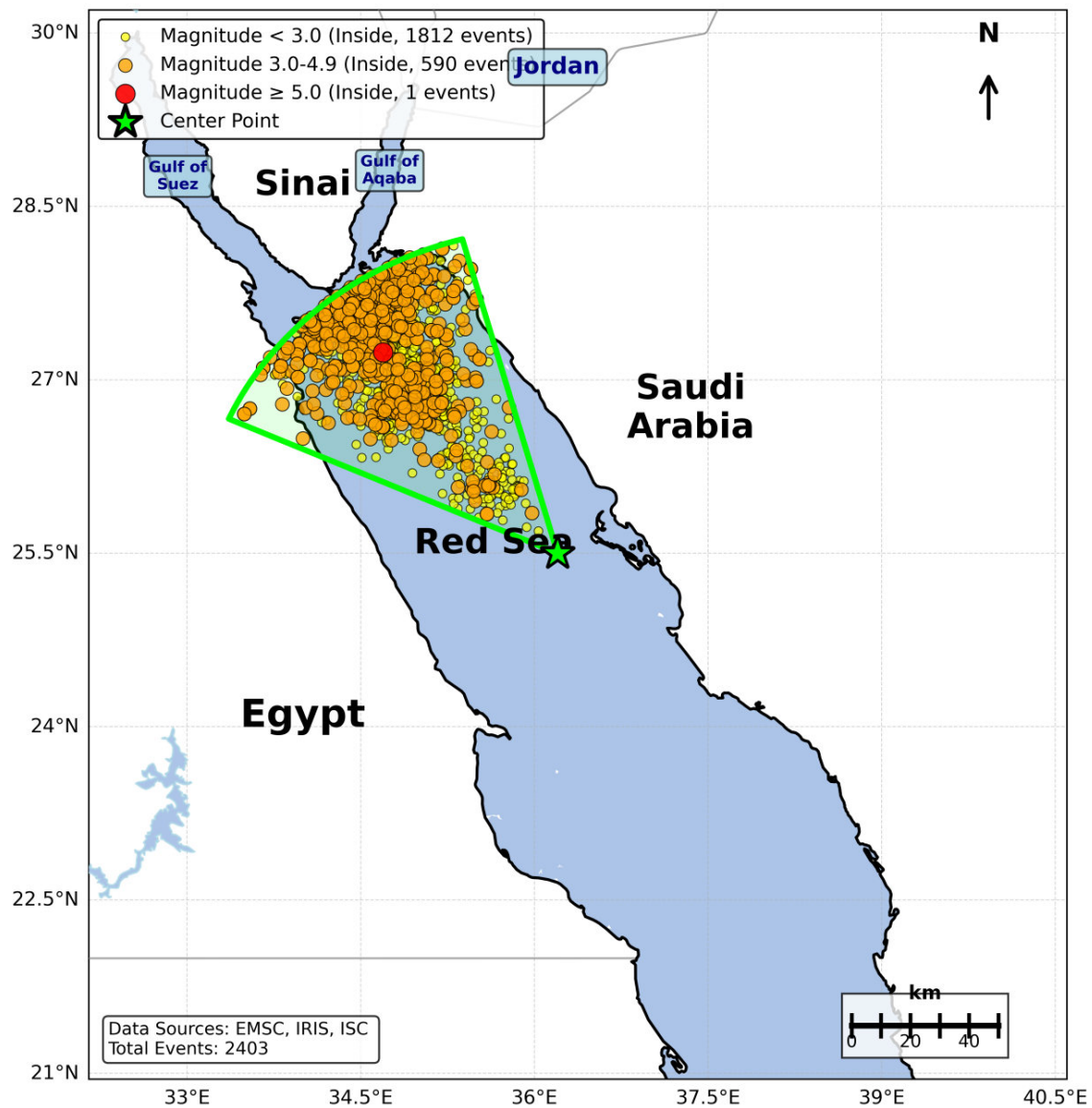


Fig. 4: Seismicity of Iceland volcanic zone

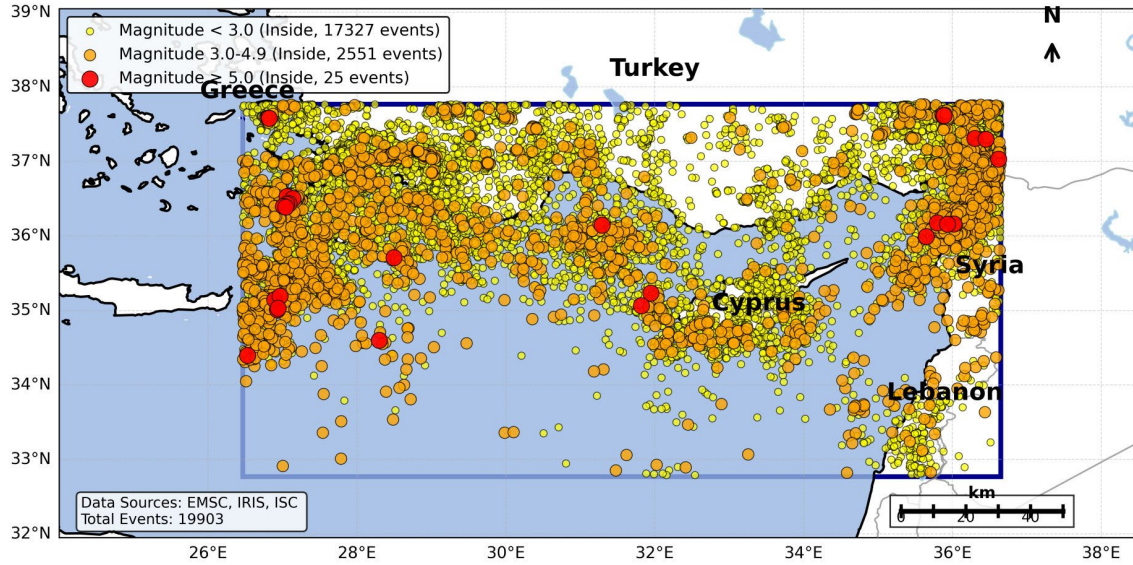


(a) Directional Search From Azimuth 115° To 180°

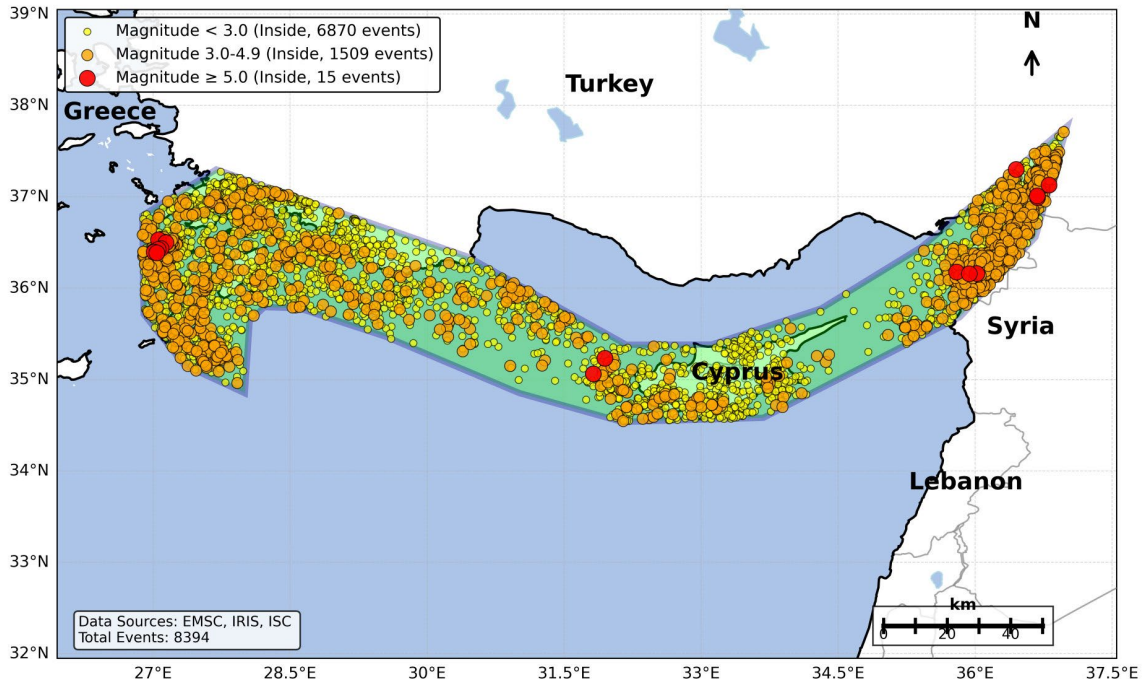


(b) Directional Search Report From Azimuth 295° To 345°

Fig. 5: Comparison of directional earthquake search results for seismic activity in the Red Sea region, illustrating two distinct spatial query configurations: (a) directional search constrained to an azimuthal sector between 115° and 180°; (b) directional search constrained to an azimuthal sector between 295° and 345°.



(a) Symmetrical Polygon Search



(b) Unsymmetrical Polygon Search

Fig. 6: Comparison of polygonal earthquake search results for seismic activity in the Eastern Mediterranean Sea region, illustrating two distinct spatial query configurations: (a) a symmetrical polygon search, designed with evenly distributed vertices to approximate a regular geometric boundary and provide a balanced representation of seismicity across the study area; (b) an asymmetrical polygon search, constructed with irregularly spaced vertices to follow geological and tectonic features more closely, thereby capturing localized seismic patterns and boundary effects with higher fidelity.