



NADI-RISK: Natural Disaster Risk Assessment in Cyprus using Earth Observation and geospatial datasets

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ASI – CEOS WGD International Workshop on “Earth Observation for Disaster Risk Management”, 16 September 2026, Rome, Italy

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This project has received funding from the European Union's "Horizon 2020 Research and Innovation Programme" under Grant Agreement No 857510".



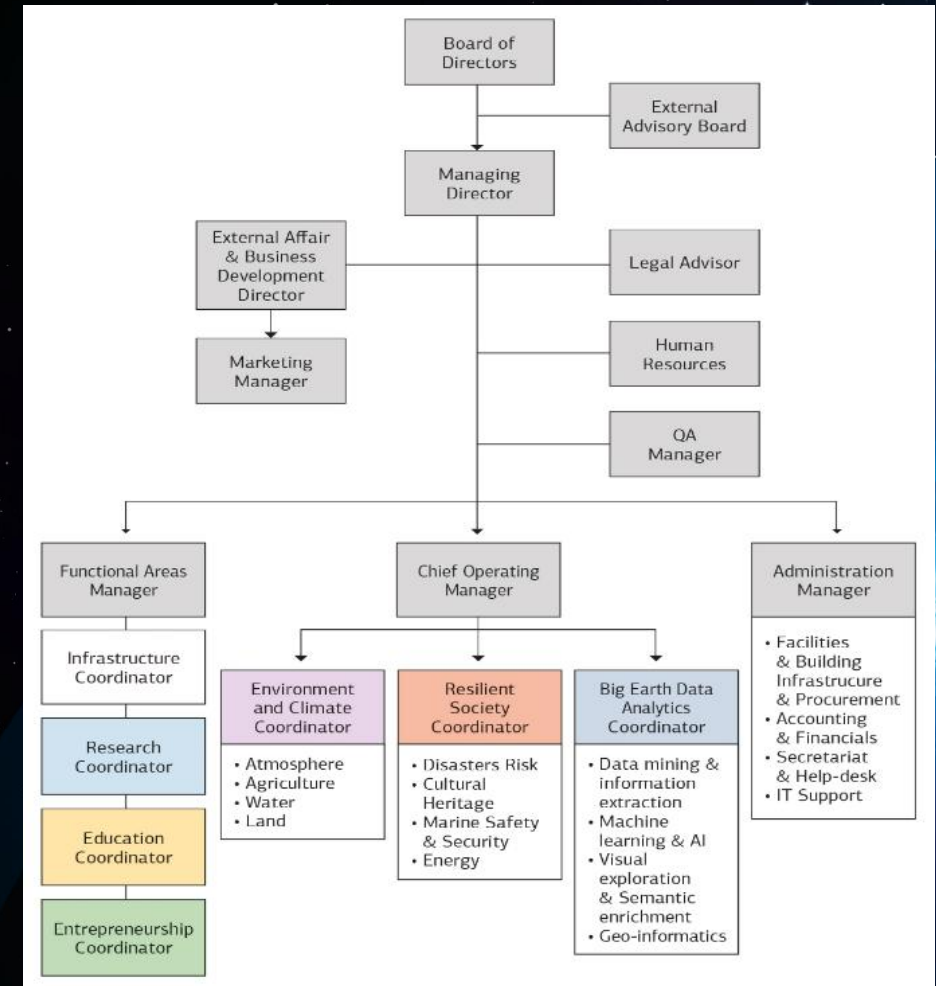
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This project is co-funded by the Cyprus University of Technology.

Overview of the Centre

- A new, autonomous Centre of Excellence, namely ERATOSTHENES Centre of Excellence (www.eratosthenes.org.cy), of the Cyprus University of Technology (CUT) has been established through the EXCELSIOR H2020 Widespread Teaming Phase 2 project (Grant Agreement No. 857510) (www.excelnior2020.eu), by upgrading the existing Remote Sensing and Geo-Environment Lab that has been operating at CUT since 2007.
- Established in February 2020 (registered at the Department of Registrar in Cyprus) as a non-profit company by Guarantee without Share Capital (CUT is the only member).
- The ERATOSTHENES is completely autonomous in its decision-making, and it is managed by its own Board of Directors (7 members).





The ERATOSTHENES consists of three Departments:

- **Environment and Climate**

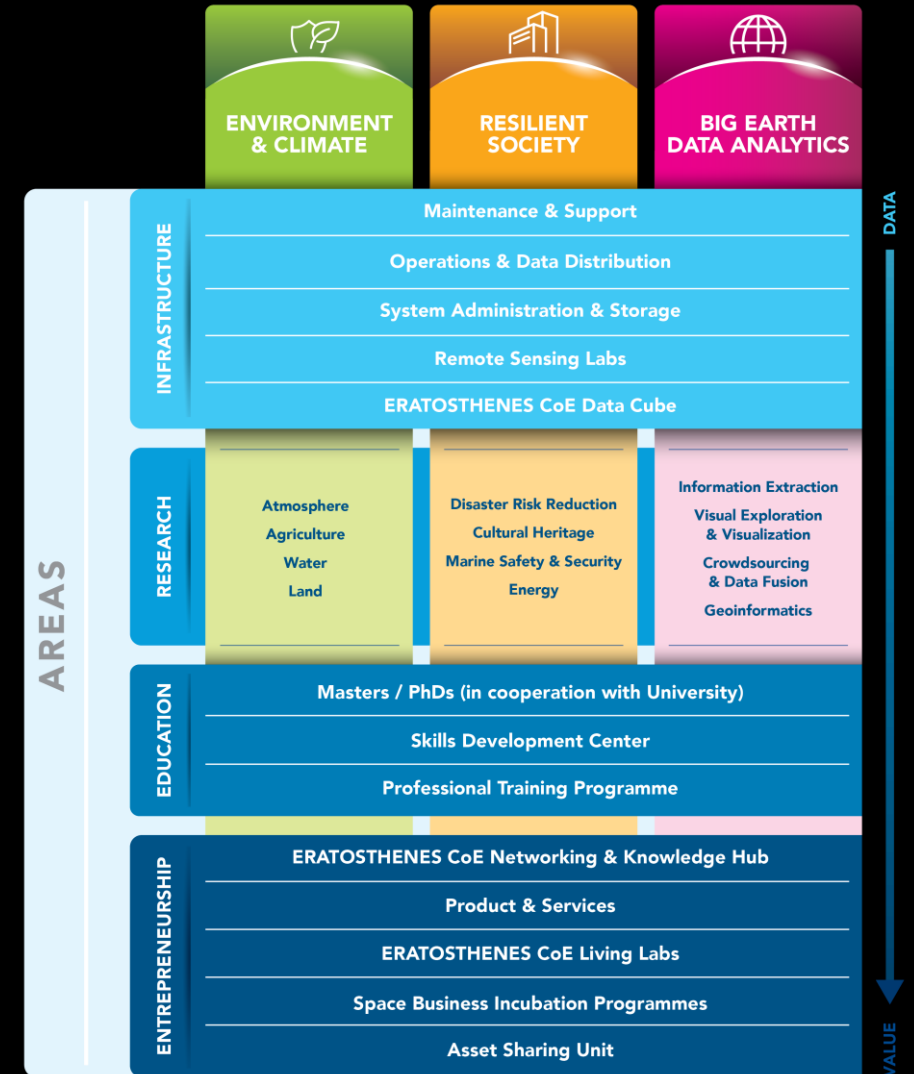
- Atmosphere
- Agriculture
- Water
- Land

- **Resilient Society**

- Disaster Risk Reduction
- Cultural Heritage
- Marine Safety and Security
- Energy

- **Big Earth Data Analytics**

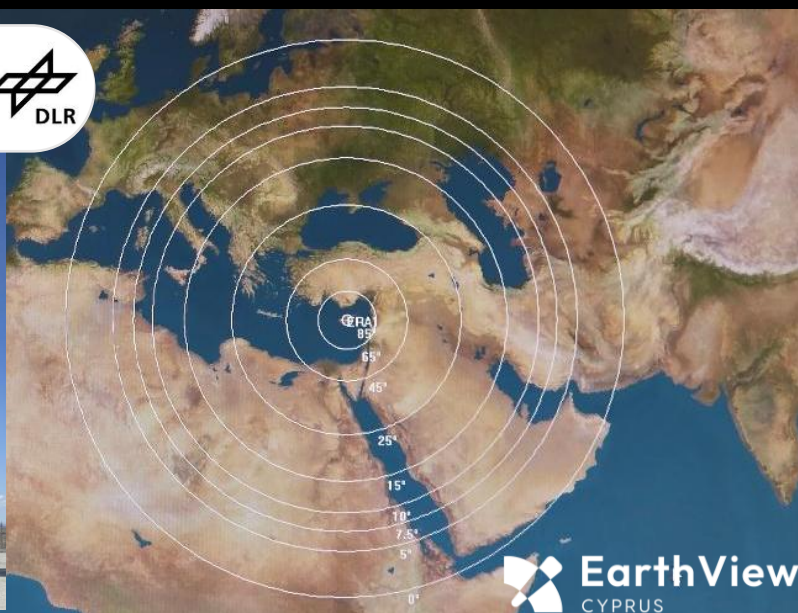
- Information extraction
- Visual exploration & visualization
- Crowd sourcing & data fusion
- Geoinformatics



ERATOSTHENES Centre of Excellence – Critical infrastructure

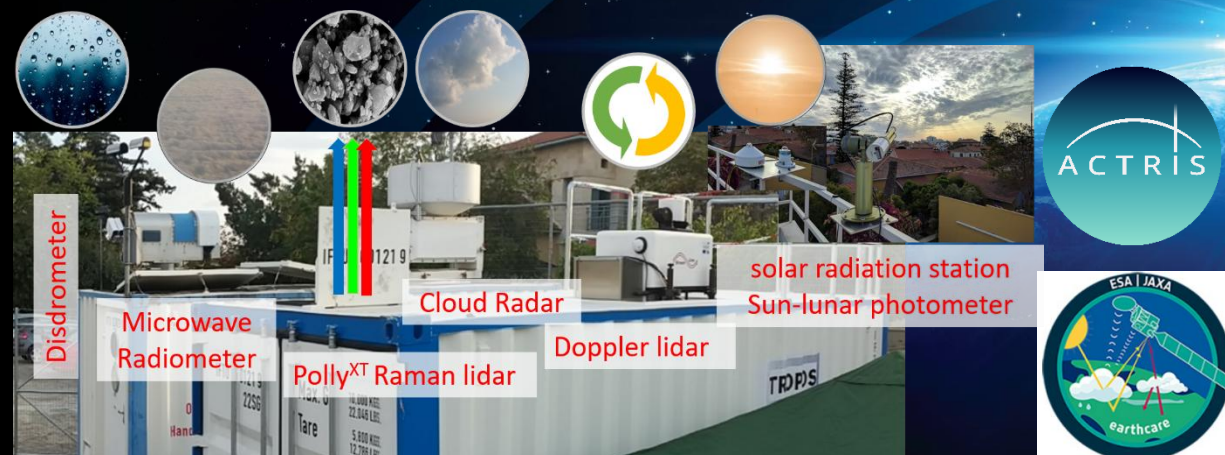
EO Satellite Data Acquisition Station (sDAS)

- Cyprus **first & only EO sDAS** fully operational in one of CYTA's teleports end to end solutions (loc.& int.).
- **Simultaneous 3-band low-orbit satellite data reception** (S, X and Ka) making it suitable to **support current and future missions** with 9.3m reflector diameter.



Ground-based Remote Sensing Station (GBS)

- **National facility** consisting of **high-quality instruments** to obtain **long-term measurements** of **cloud and aerosol properties, precipitation**, and related **atmospheric characteristics** in Cyprus.
- **Unique** with the **latest modern standards** and it is only available in few regions globally.
- Participated in the **calibration of the EarthCARE Satellite Mission**.



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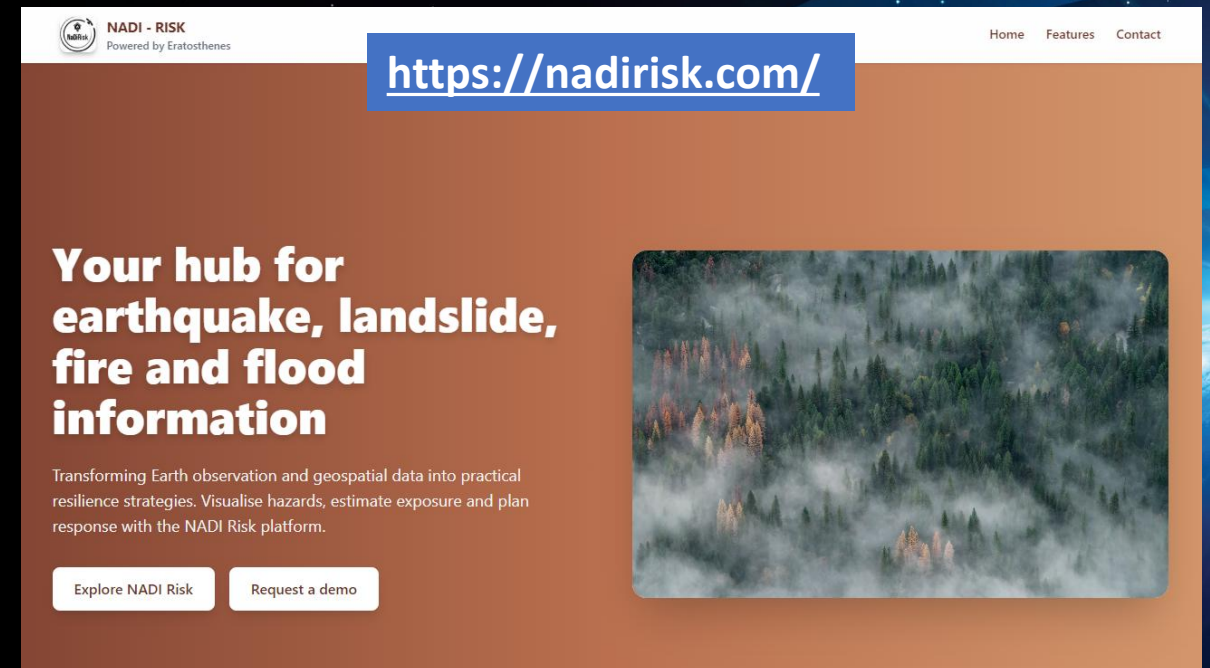
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NADI-RISK R&D team

- Dr. Marios Tzouvaras (Overall supervision & landslide risk)
- Prof. Nicholas Kyriakides (Earthquake risk)
- Dr. Kyriaki Fotiou (Landslide risk)
- Dr. Maria Prodromou (Fire risk)
- Dr. Constantinos Panayiotou (Flood risk)
- Mr. Thomas Nikidiotis (Software development)



Product Description

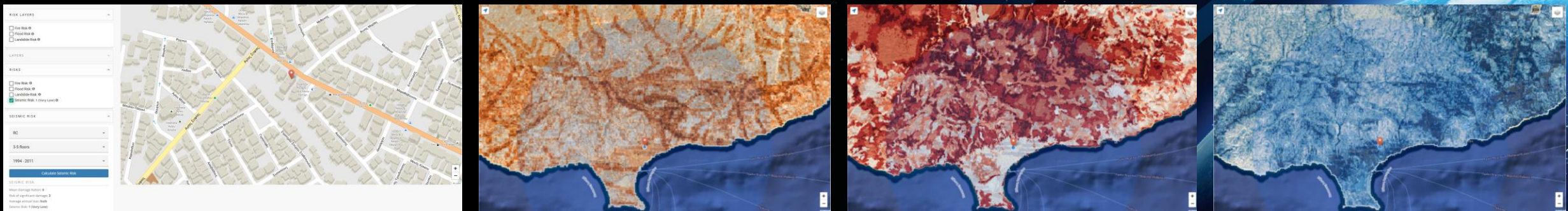
A GIS-based tool and an interactive geospatial map that provides the automatic natural disaster hazard and vulnerability risk index of a building and postal sector for:

- Earthquakes
- Landslides/Geohazards
- Floods
- Fires
- Other natural catastrophes
- Other indices



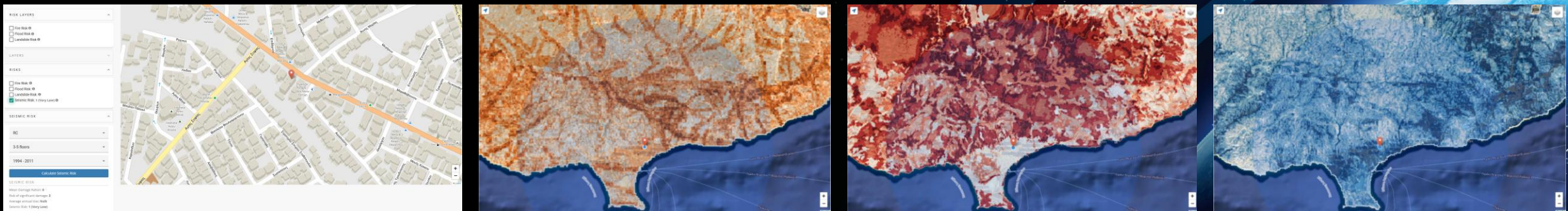
Why is the content of this tool important?

- This tool helps to identify potential vulnerable-to-earthquakes, landslides, floods and fires areas using satellite-derived indicators and geospatial datasets.
- It enhances decision-making by combining biophysical and anthropogenic criteria with real environmental data.
- Understanding where hazards are likely to start is crucial for:
 - prevention planning,
 - early warning,
 - and resource allocation.



Which sectors are affected and can benefit from this tool?

- Emergency Response Units (Civil Defence)
- Rehabilitation authorities
- Environmental monitoring agencies (Department of Forests, Water Development Department, Geological Survey Department, etc.)
- Department of Planning and Housing (Update of urban planning zones and building permits)
- Insurance and reinsurance companies (pricing, and claims preparation)
- Real estate agencies (valuation of land and buildings)



Seismic Risk Assessment tool

Prof. Nicholas Kyriakides

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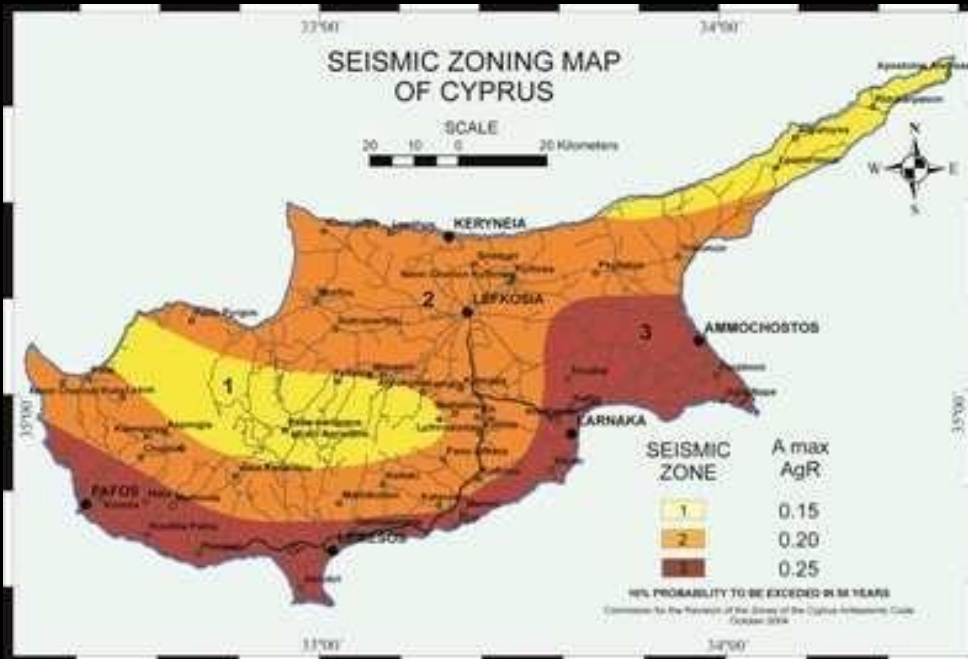


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Earthquakes – Risk Assessment Technology



- The seismic vulnerability of a building and postal sector is considered automatically in the assessment through a GIS tool.
- Building location/postal sector provided on interactive map (connected with seismic zones, soil conditions, building material and other relevant info).

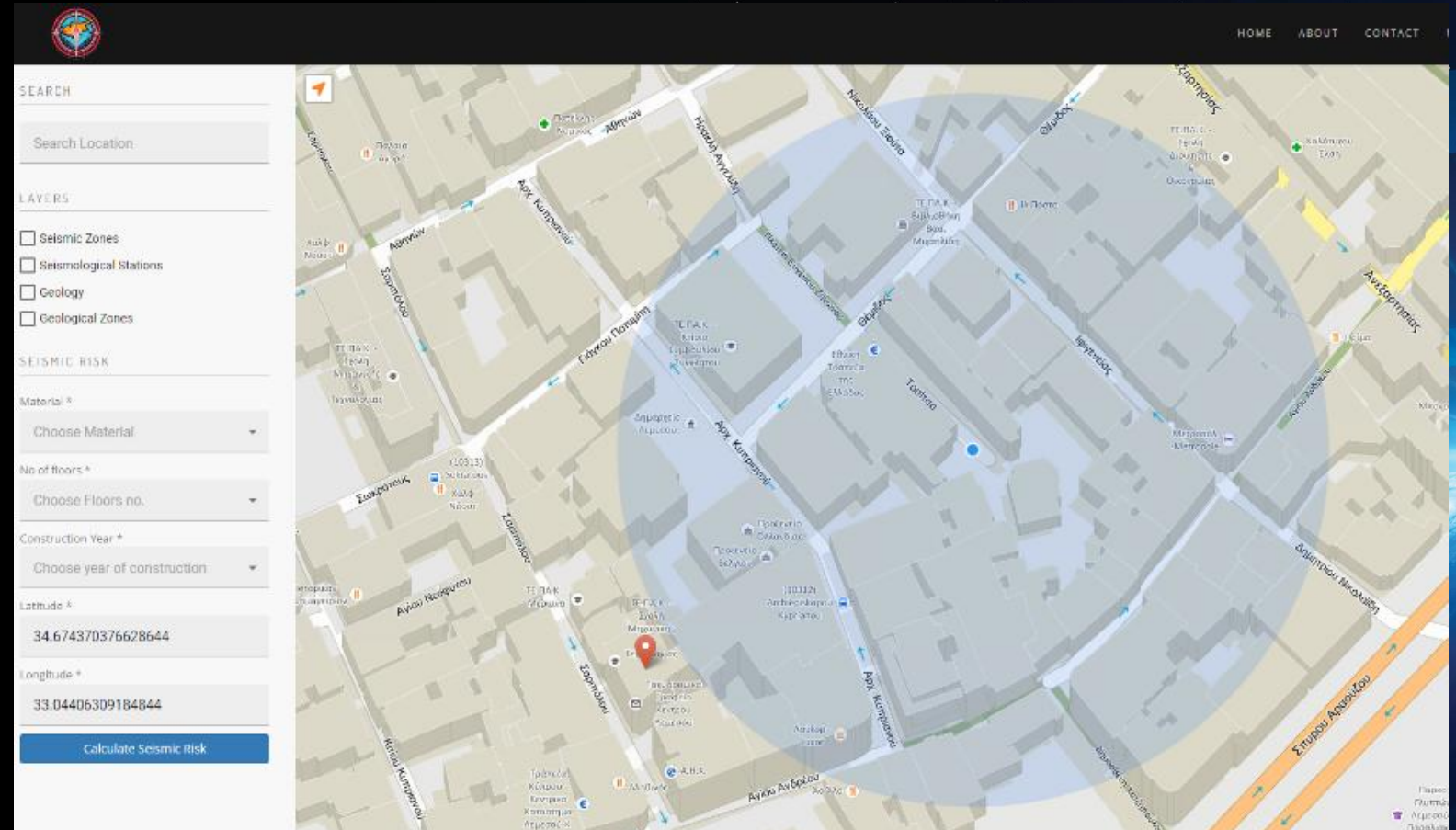
Upon selection of location

- Average expected annual loss per building across Cyprus per construction period is provided
- The vulnerability of the building or postal sector to the specific earthquake event is estimated as a **RISK ASSESSMENT INDEX**

Earthquake Risk calculation – Step 1

The user selects the building location:

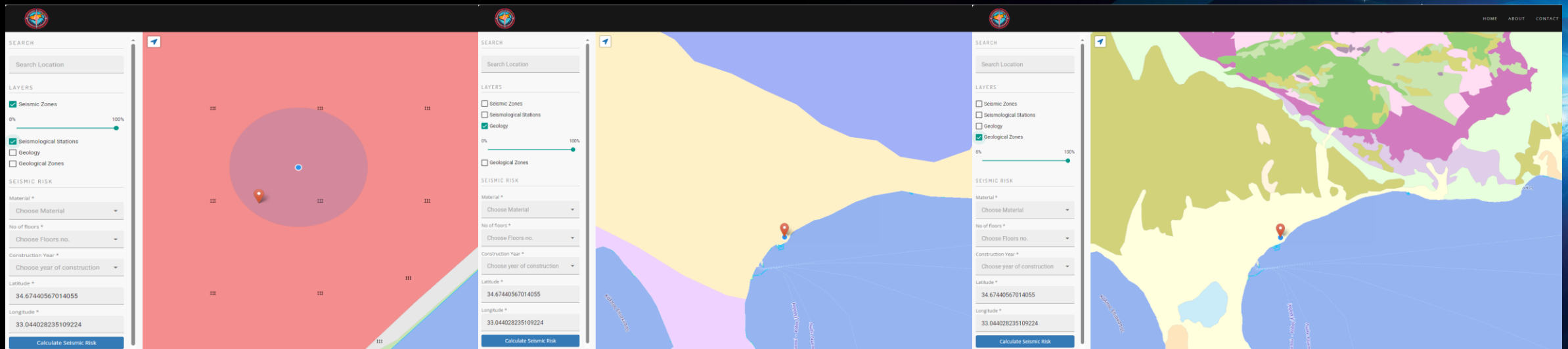
- This can be done either directly by placing a pin on the map or by inserting coordinates or address.



Earthquake Risk calculation – Step 2

The user can see in the area of interest:

- The seismic zone
- The geology
- The geological zone



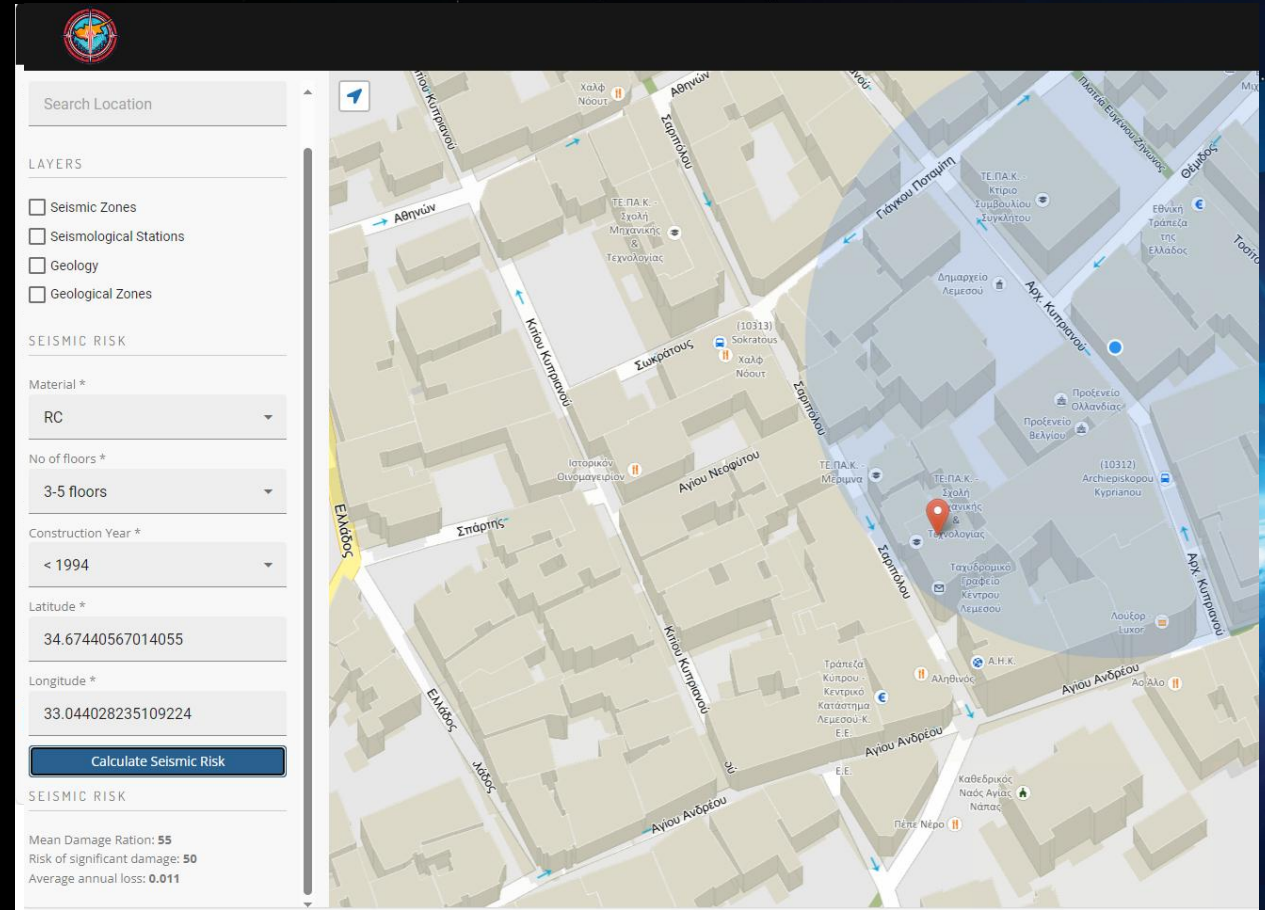
Earthquake Risk calculation – Step 3

The user selects:

- The construction material
- The number of floors
- The construction year

By clicking on the “Calculate Seismic Risk” button:

- Mean Damage Ratio
- Risk of significant damage
- Average annual loss



The interface displays a map of a city area with various landmarks and streets. The sidebar on the left contains the following fields and results:

- Search Location:** (Empty text box)
- LAYERS:**
 - ☐ Seismic Zones
 - ☐ Seismological Stations
 - ☐ Geology
 - ☐ Geological Zones
- SEISMIC RISK:**
 - Material *:** RC
 - No of floors *:** 3-5 floors
 - Construction Year *:** < 1994
 - Latitude *:** 34.67440567014055
 - Longitude *:** 33.044028235109224
 - Calculate Seismic Risk** (Button)
- SEISMIC RISK Results:**
 - Mean Damage Ratio: 55
 - Risk of significant damage: 50
 - Average annual loss: 0.011

Results

The results that will be provided to the customer will be presented in the form of a report that will include:

1. **Mean damage ratio**: The fraction of expected damage for the total of expected earthquakes in relation to the cost of replacement of the building (55% of its replacement cost).
2. **Risk of significant damage**: The probability (50%) that the building sustains serious damage and will have to be evacuated. Serious damage means that the building will need significant time for large scale repairs in its structure.
3. **Average annual loss**: The minimum premium as a fraction of the total value of the building that will have to be charged for the insurance of the building (1.1%).

Building Name	9 Petrompei Mavromichali, 4047, Germasogeia, Limassol
Building location	The building is located close to the coastline (1-2km to the north) of Limassol in the Yermasoyia area on moderately soft soils (need to clarify whether there is basement or not).
Structural type	Built in 2018 with modern seismic code design using Eurocode 8 for the seismic zone III
Structural Material	Reinforced Concrete
Number of floors	4 (mid-rise building)
Foundation type/soil type	No basement-the building is supported by medium soft soils
Seismic Zone	The seismic zone where the building is located is characterized as III by the Cyprus Seismic Code included in Eurocode 8-1. This corresponds to a peak ground design acceleration for a new building of 0.25g
Seismic scenario for 500y	8-12% loss of current replacement value. Probability of collapse = 15%
Seismic scenario for 100-200y	5% loss of current replacement value. Probability of collapse = 5%
Seismic scenario for 50-100y	3% loss of current replacement value Probability of collapse = 1%
Seismic Risk factor (scale 1-5)	1 (very low risk)
Average Annual loss ratio (premium calculation)	0.04% of the current values of the building

Landslide Risk Assessment tool

Dr Marios Tzouvaras / Dr Kyriaki Fotiou

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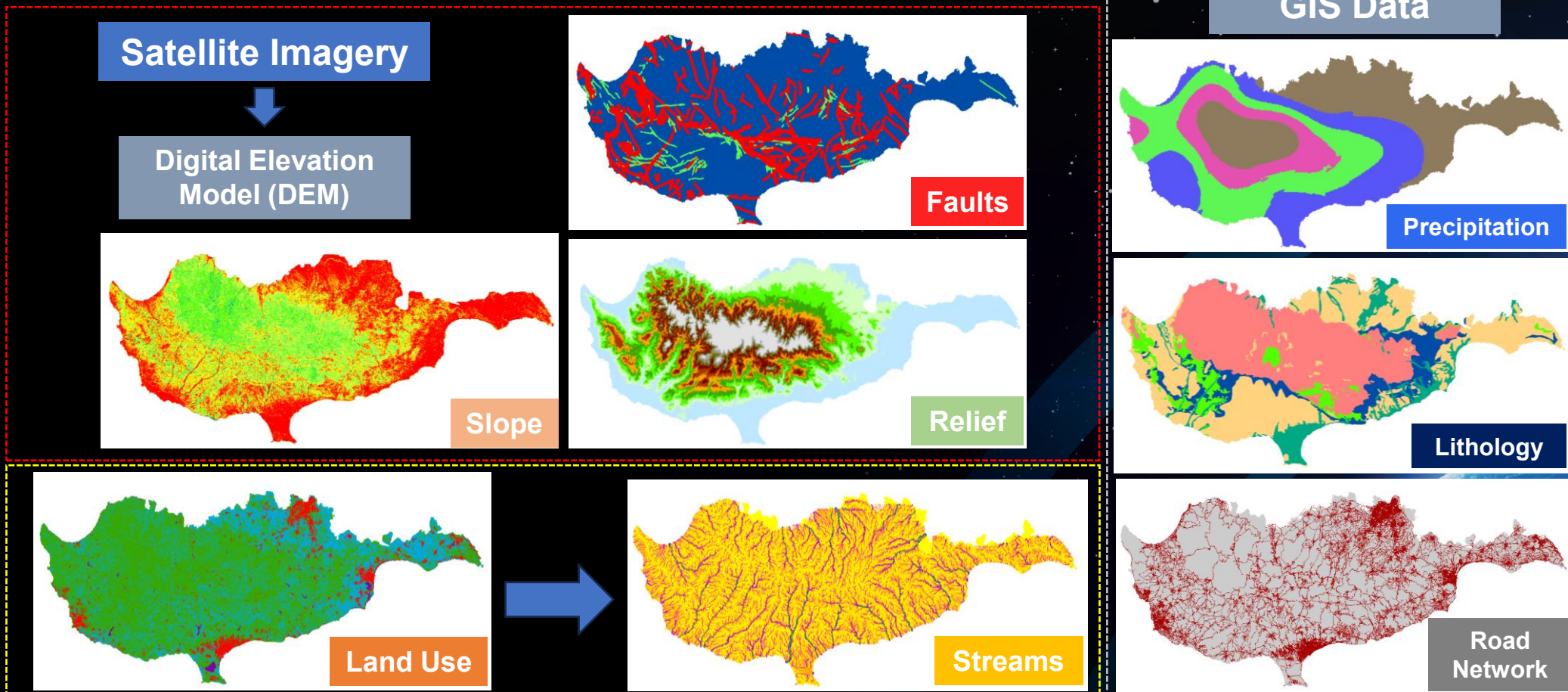


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Landslide Risk Assessment – Data used

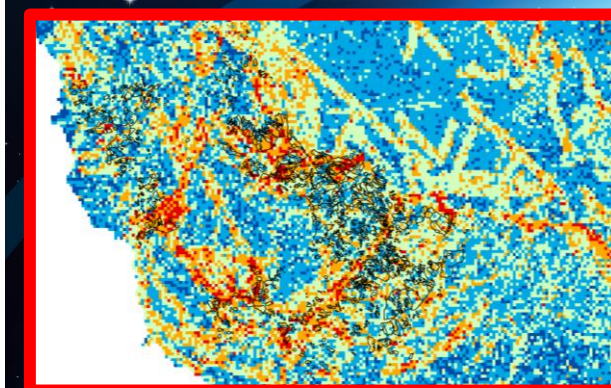


Landslide Risk Assessment – Validation of results

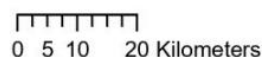
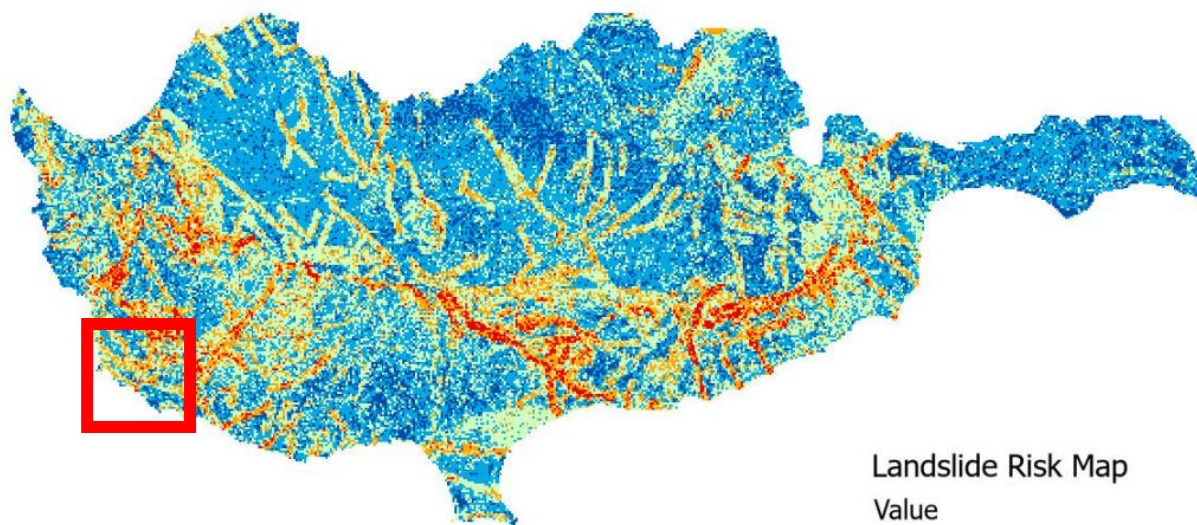
Validation



Landslide
Inventory by GSD



Multi-criteria decision analysis (MCDA)

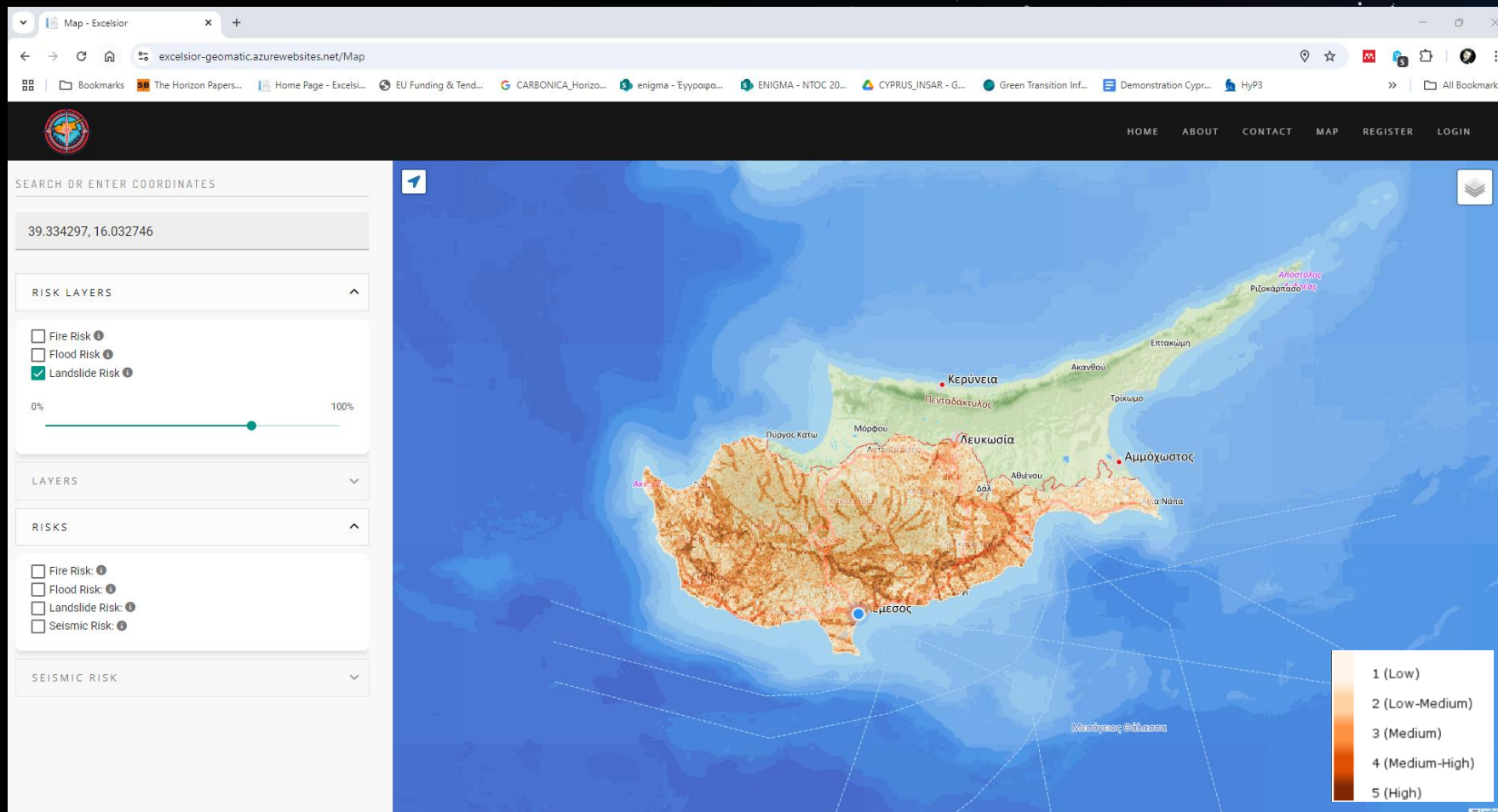


AHP Analysis



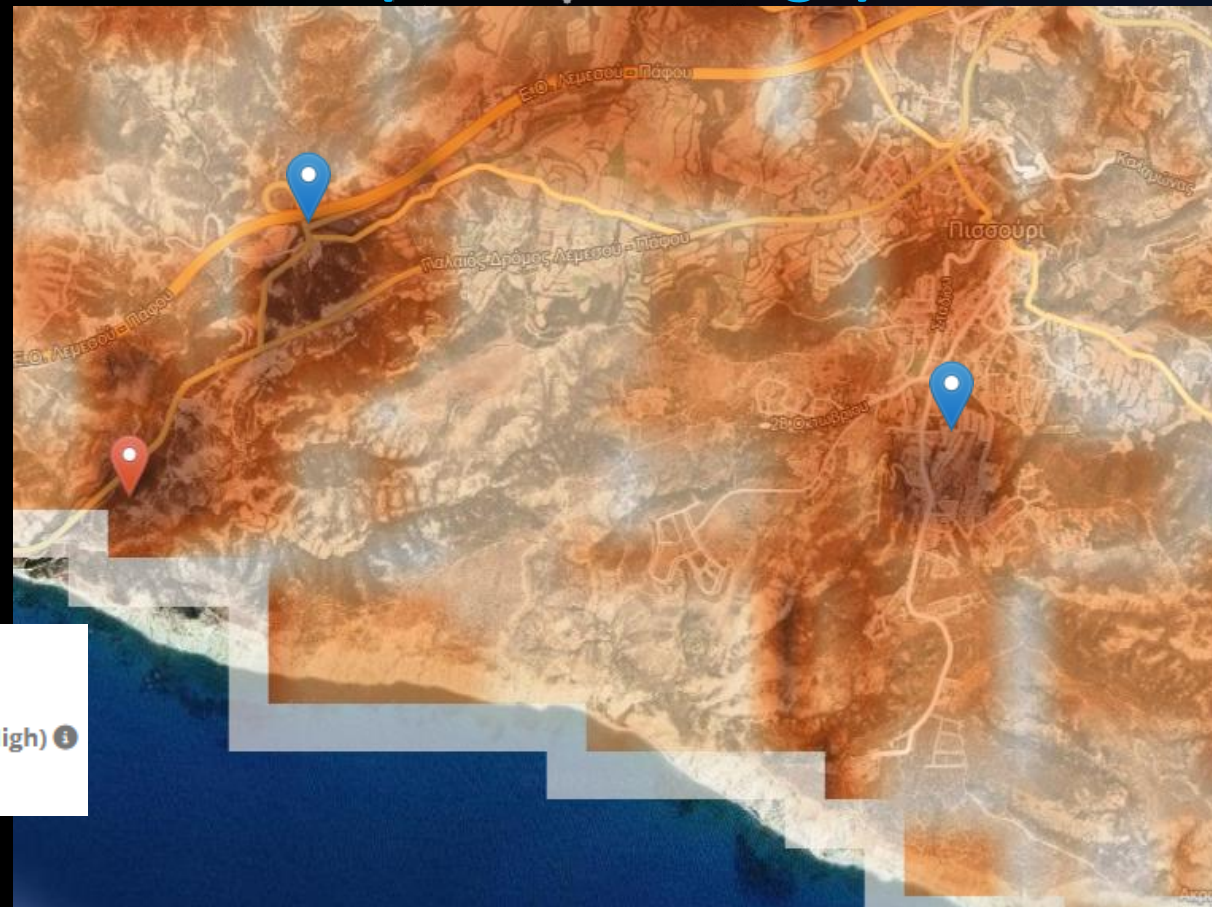
Demonstration

Landslide Risk Assessment Tool



Landslide Risk Assessment tool – Demonstration (Pissouri village)

Coordinates	Landslide risk
34.661381, 32.654885	5 (High)
34.661452, 32.699446	5 (High)
34.670347, 32.665440	5 (High)



- ☐ Fire Risk: ⓘ
- ☐ Flood Risk: ⓘ
- ☒ Landslide Risk: 5 (High) ⓘ
- ☐ Seismic Risk: ⓘ

Landslide Risk Assessment tool – Demonstration (Maroni village)

Coordinates	Landslide risk
34.750992, 33.355003	5 (High)



- ☐ Fire Risk: ⓘ
- ☐ Flood Risk: ⓘ
- ☒ Landslide Risk: 5 (High) ⓘ
- ☐ Seismic Risk: ⓘ

Fire Risk Assessment tool

Dr Maria Prodromou

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Fire risk assessment

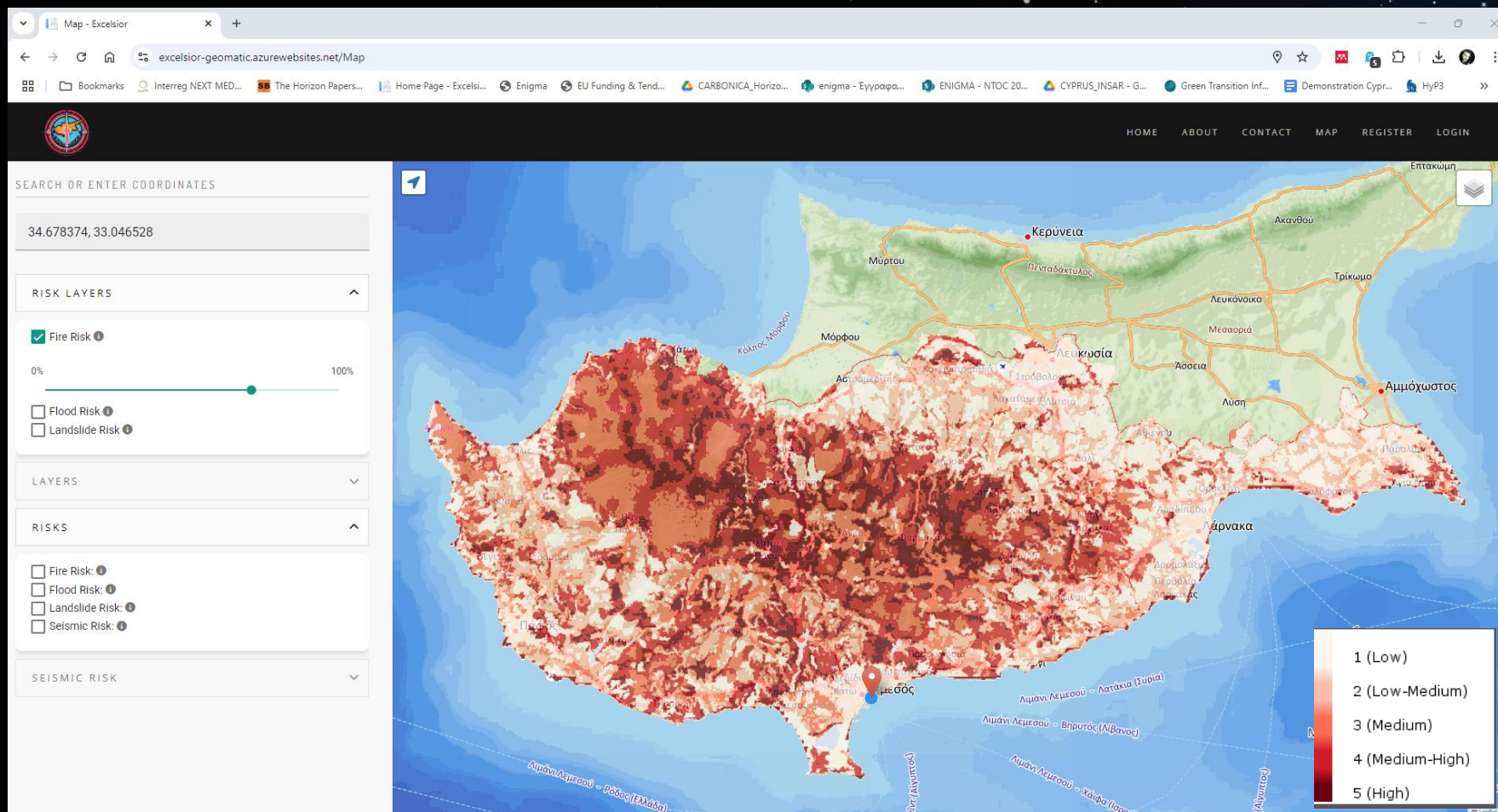
- The conditions determined by physical, social, economic and environmental factors or processes that increase the susceptibility to the impacts of hazards.
- This model combines biophysical, ecological, and anthropogenic factors using remote sensing data and multicriteria analysis to assess the fire vulnerability index.
- High-risk areas are identified based on temperature, vegetation dryness, land use, and proximity to human activity.
- Picnic and recreational sites, along with historic fire events, are strong predictors of ignition potential.





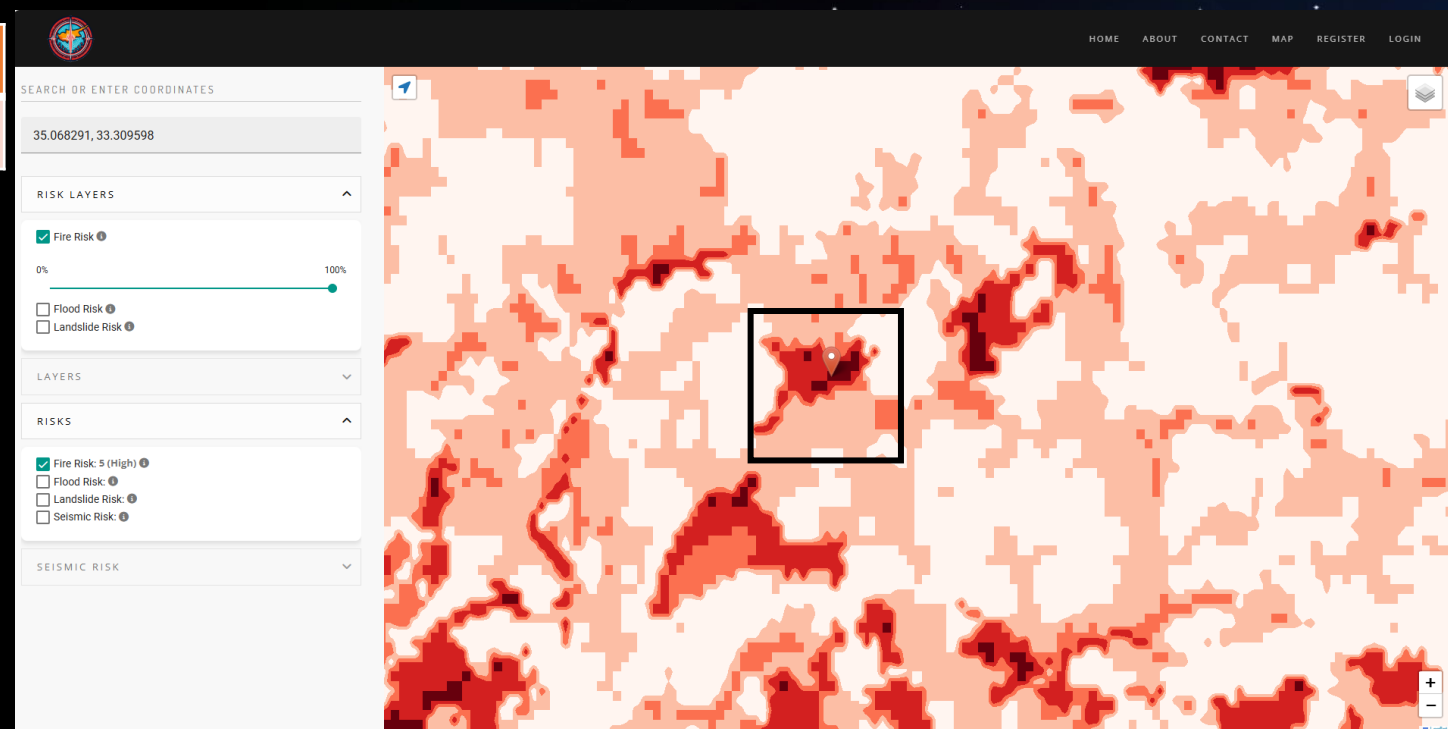
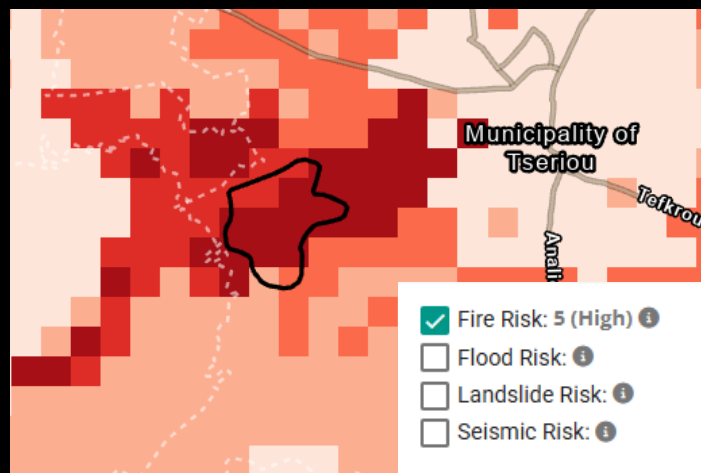
Demonstration

Fire Risk Assessment Tool



Fire Risk Assessment tool – Demonstration (Fire events 2024)

Date	Coordination	Fire risk
24/7/2024	35.068291, 33.309598	5

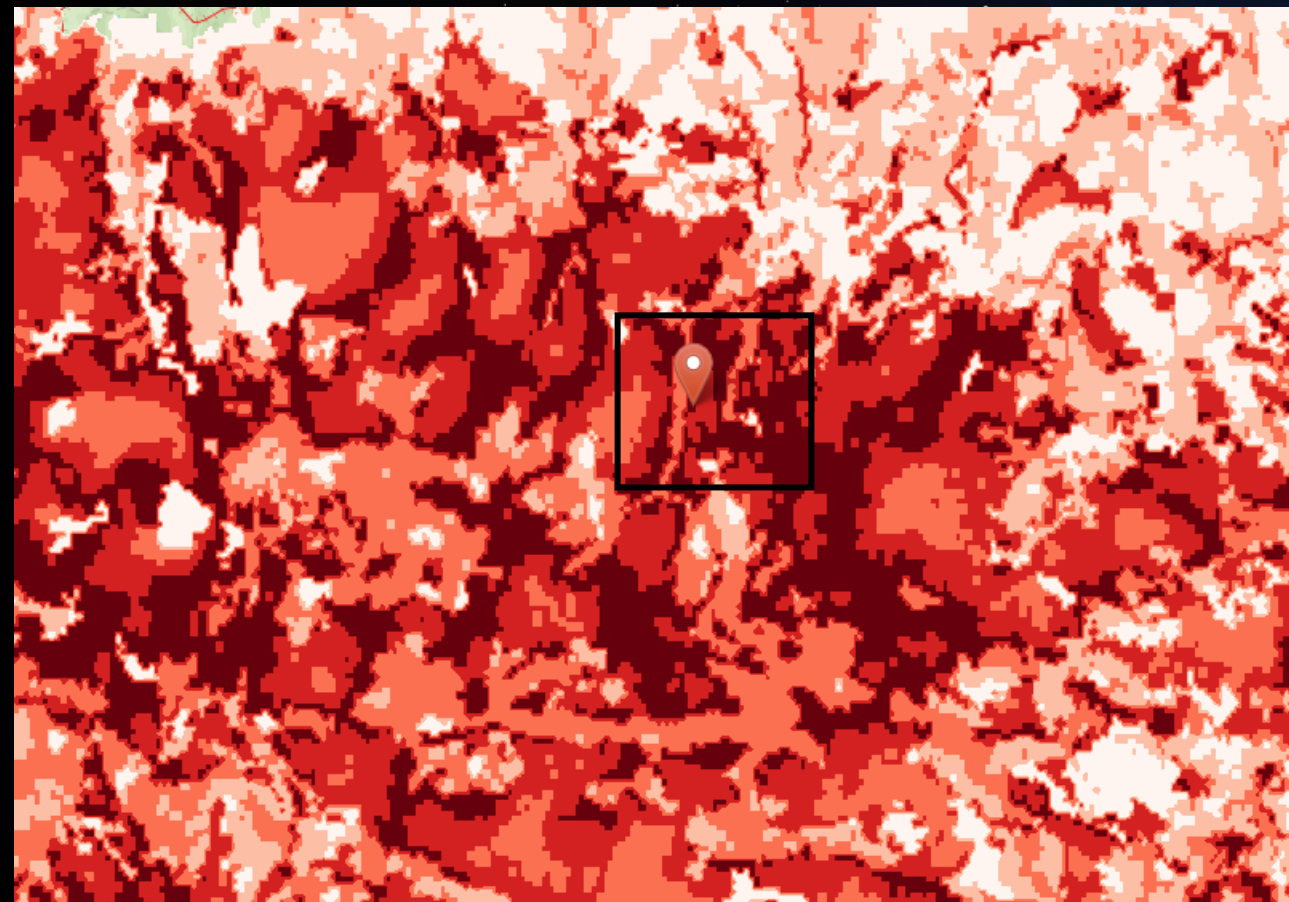


Fire Risk Assessment tool – Demonstration (Fire events 2024)

Date	Coordination	Fire risk
20/6/2024	34.960246, 33.132006	5



- ☒ Fire Risk: 5 (High) ⓘ
- ☐ Flood Risk: ⓘ
- ☐ Landslide Risk: ⓘ
- ☐ Seismic Risk: ⓘ



Flood Risk Assessment tool

Dr Constantinos Panagiotou

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Flood Risk Assessment – Data used

Details of the collected data from multiple sources.

Criteria*	Data type	Data description	Data Source
TE	Numeric	Digital Elevation Model with 25 m resolution	Department of Land and Surveys
RI	Numeric	Daily precipitation values from 90 ground-based stations for period 2011–2023	Department of Meteorology
FA	Numeric	Flow accumulation is derived from Terrain Elevation (TE)	Department of Land and Surveys
DD	Numeric	Distance from the entire river network	Water Development Department
TS	Numeric	Gradient of the terrain elevation (TE)	Department of Land and Surveys
LULC	Nominal	Spatial distribution of 35 LULC classes with 100 m resolution for 2018	Corine Land Monitoring Service
Soil	Nominal	Spatial distribution of soil depth and texture	Department of Geological Survey


Water Development Department Geoportal



Earthstar Geographics Powered by Esri

floodplains

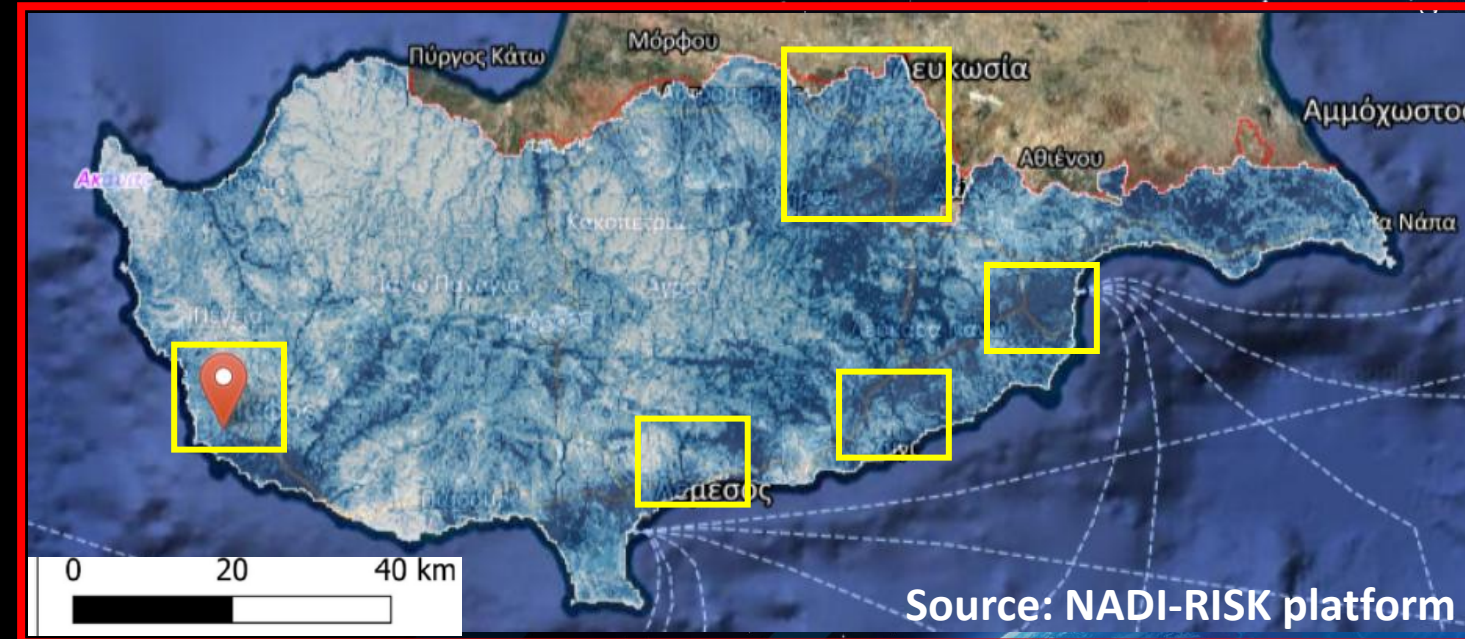
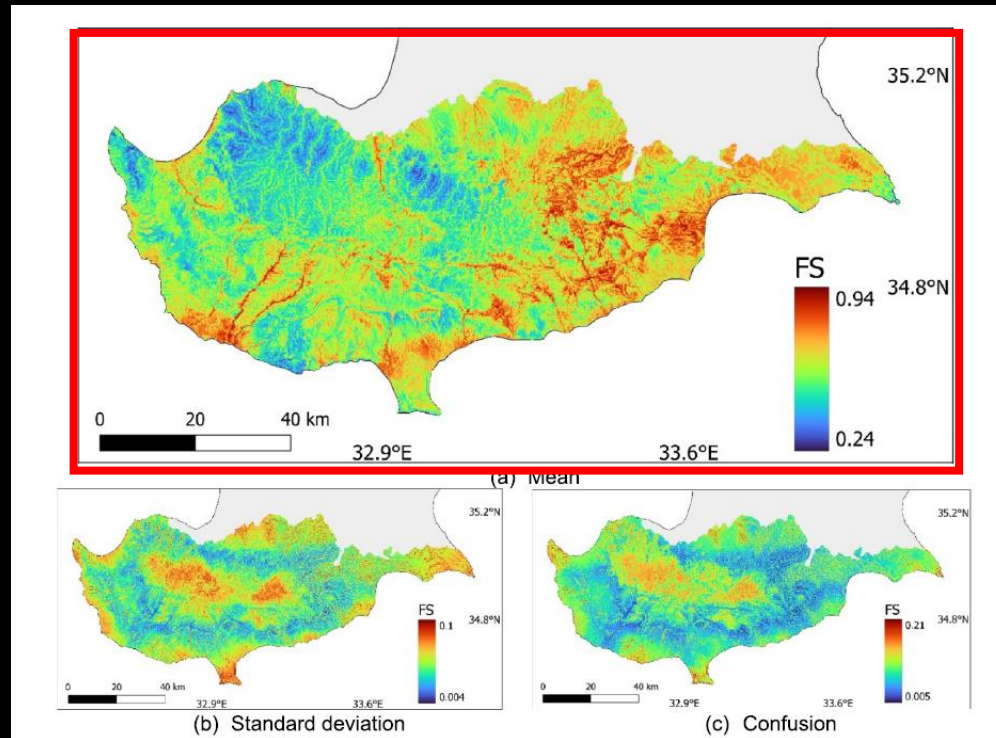
Private Member 1
Private Organization 1

Summary
Flood plains (Floods Directive)

Layers 4

[Όριο Πλημμύρας Περίοδου Επαναφοράς 20 ετών](#)
[Όριο Πλημμύρας Περίοδου Επαναφοράς 100 Ετών](#)
[Όριο Πλημμύρας Περίοδου Επαναφοράς 500 Ετών](#)
[Όριο Πλημμύρας 2080 \(κλιματικής αλλαγής\)](#)

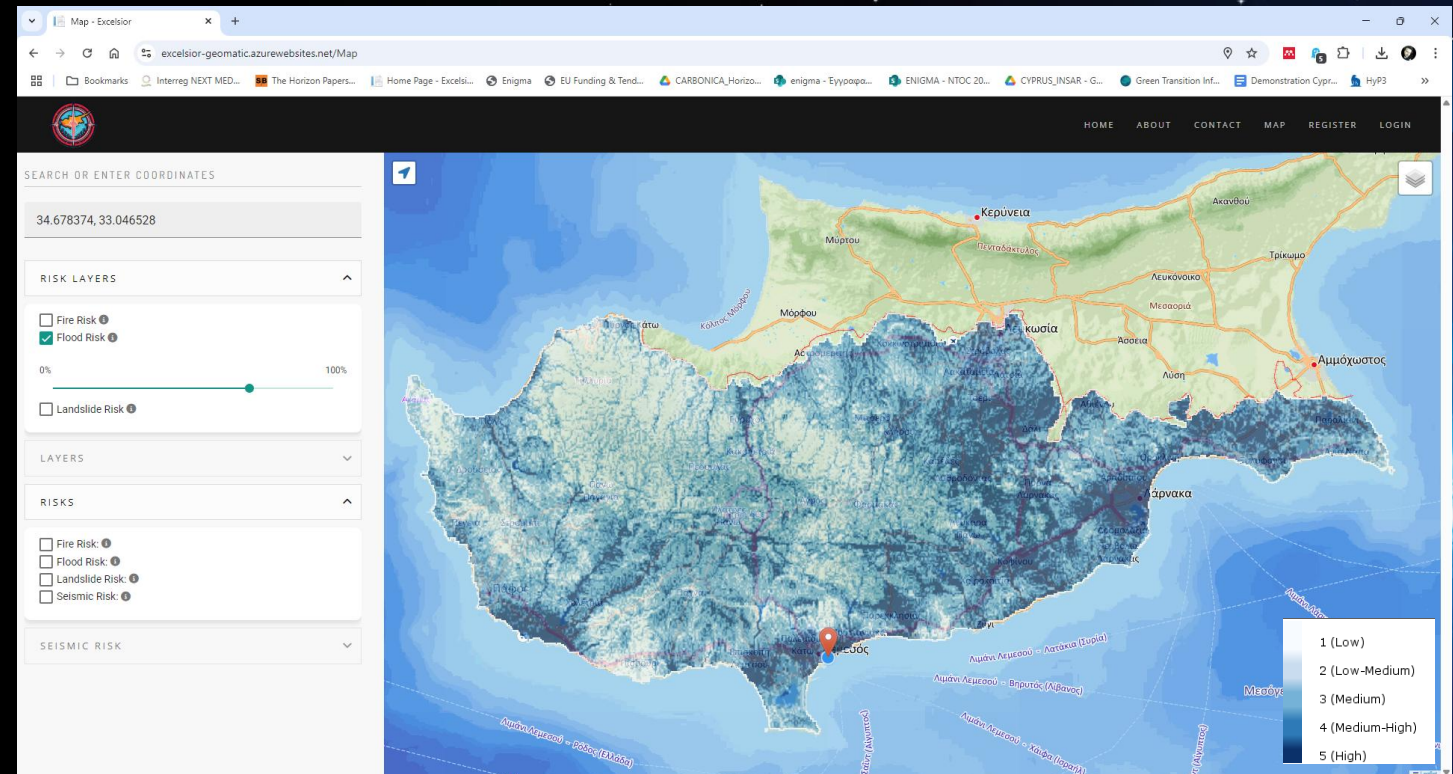
Flood Risk Assessment – Results and high-risk regions



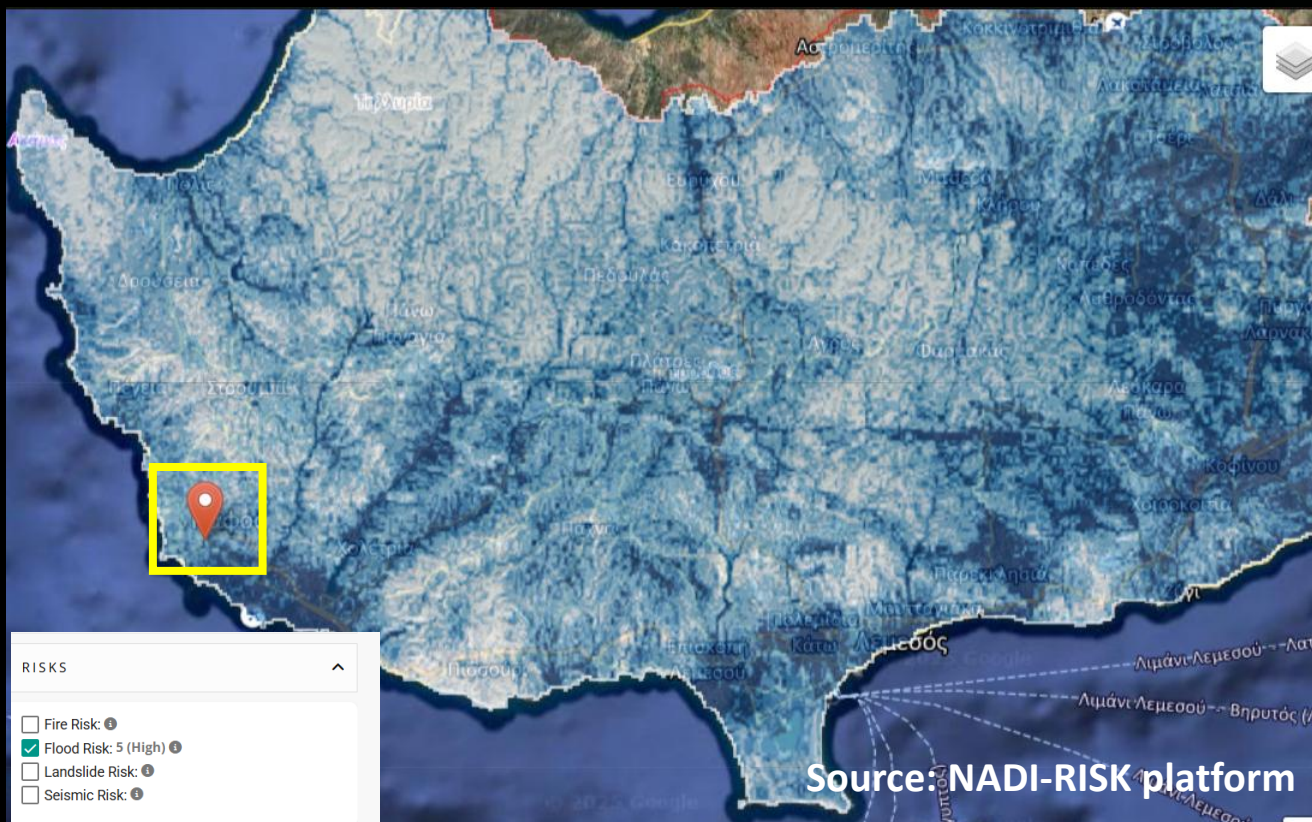
Yellow boxes: high-risk regions according to the water authorities (92% accuracy of the flood risk map in NADI-RISK platform)

Flood Risk Assessment tool – Demonstration

- Estimates the probability for flood occurrence within the entire dominion of the (non-occupied part) Republic of Cyprus
- Takes into account several topographical, soil, and meteorological factors that are strongly connected with the occurrence of flood events in regions similar to Cyprus (i.e., semiarid, strong variation of topographical properties, small watersheds).
- Estimations that achieve high agreement with the flood hazard maps of the water authorities.
- **The water authorities already agreed to consider the resulting maps into the forthcoming Flood Management Plan for Cyprus.**



Flood Risk Assessment tool – Demonstration (Recent flood event in Paphos)



Thank you!!!

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