# Overview of EO activities and challenges in the EMMENA region


Diofantos Hadjimitsis & Andreas Chrlstofe

**Eratosthenes CoE, Cyprus-Managing Director & Administration Manager**

Cyprus University of Technology-Professor


Chania-Greece 16th of July 2024



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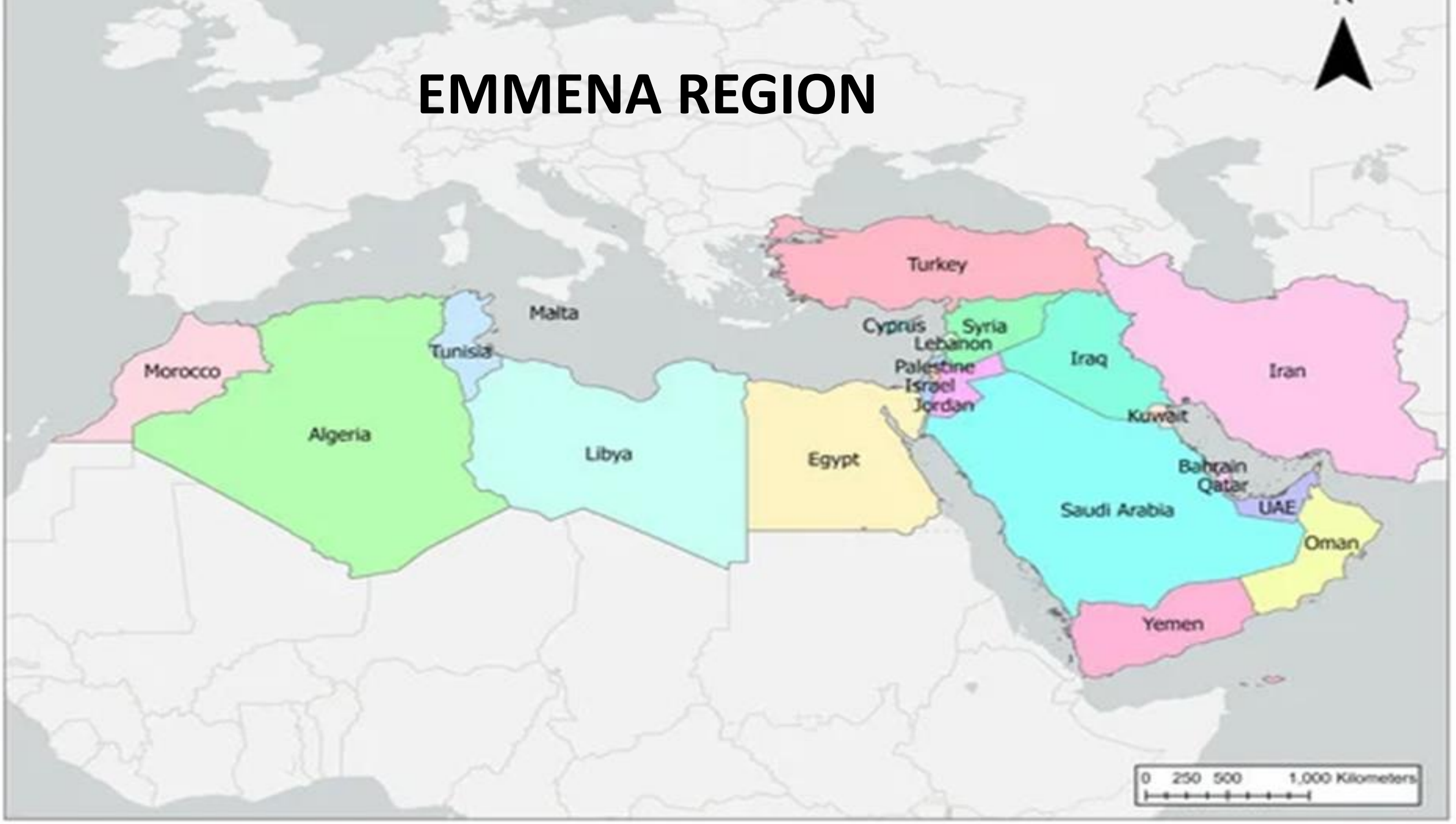
www.cut.ac.cy Cyprus University of Technology, 2007 (2003 by law)

www.excelsior2020.eu EXCELSIOR H2020 Teaming Project (2019): Project:>38 million euros

www.eratosthenes.org.cy ERATOSTHENES CoE (2020): New Entity


Credit: Copernicus Sentinel data (2015)/ESA

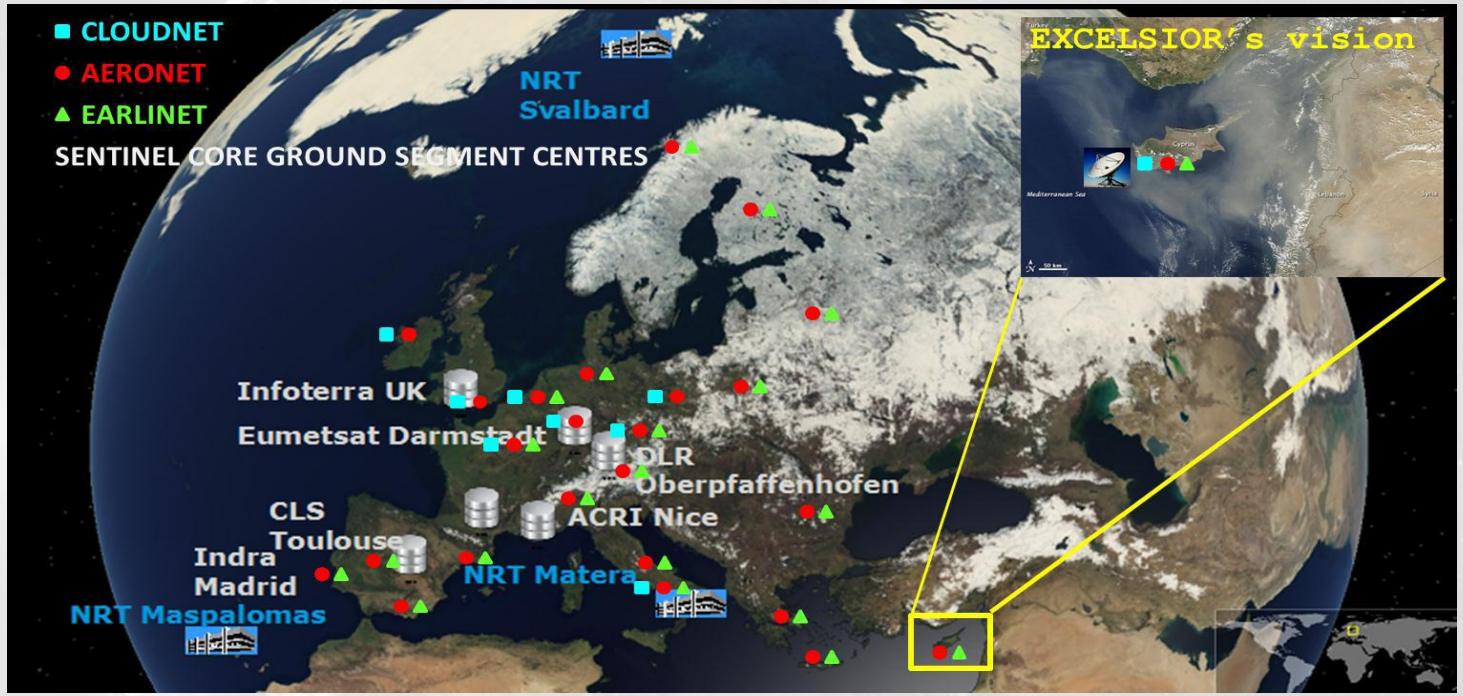
# EMMENA REGION



# Why EO in Cyprus?

Cyprus's **unique geostrategic position** can support Earth Observation from satellite programmes in **three continents** and provide valuable services in the satellite **calibration and validation** processes.

The **ERATOSTHENES CoE** – with its expertise and infrastructure could further **complete the existing network of international ground stations.**




The ***EXCELSIOR's*** vision and the geostrategic position of Cyprus

Cyprus is ideally located to host the ECoE, due to its **climate,** which is characterised by **300 days of sunshine a year,** providing **excellent weather conditions** for **cloud free** satellite images!



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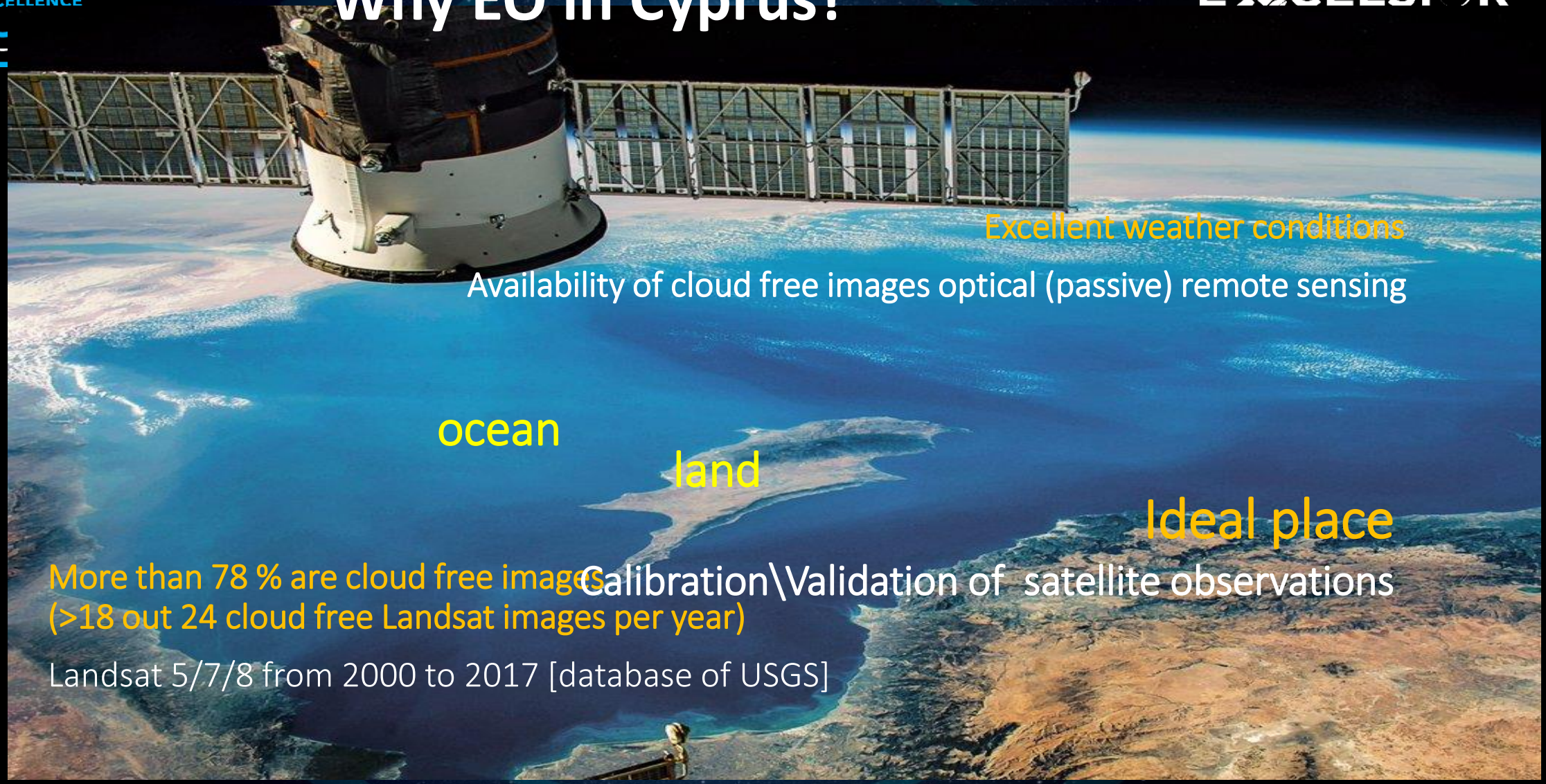
# Why EO in Cyprus?



Excellent weather conditions

Availability of cloud free images optical (passive) remote sensing

ocean

land

Ideal place

Calibration\Validation of satellite observations

More than 78 % are cloud free images
(>18 out 24 cloud free Landsat images per year)

Landsat 5/7/8 from 2000 to 2017 [database of USGS]

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# Needs and opportunities that have motivated us to establish an Earth Observation Centre of Excellence in Cyprus

**Needs:**

- **Aerosol and cloud monitoring superstation in the Eastern Mediterranean, Middle East and North Africa (EMMENA):** strong demand for EO monitoring to provide data to evaluate the extent of pollution and climate change
- **Droughts** and **water shortages** in the EMMENA region
- **Restoration** programmes in EMMENA
- **Disaster Risk Reduction**
- **Regional Digital Innovation Hub** for **Earth Observation** in Cyprus to help space technology companies and innovators

**Opportunities:**

- The ECoE has the potential to become a **catalyst** for facilitating and enabling **Regional, European and International cooperation**.
- Capitalise on the favourable **environmental, weather and climatic conditions of Cyprus** to conduct **cutting-edge research** with impact in various sectors, including **climate change, marine, solar energy**, etc.
- The development of the **Government of the Cyprus space strategy** can be exploited for further EO research and applications
- Create a unique European capacity in Cyprus by mobilizing internal national assets and consolidating European EO capabilities in Cyprus to serve EMMENA. Such, currently missing, assets and infrastructures are: **European Satellite Ground Stations covering EMMENA**.
- Availability of **funding instruments** for EO national and European Level
- **Big Data** management and analytics



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Open Access Review

# Earth Observation in the EMMENA Region: Scoping Review of Current Applications and Knowledge Gaps

by Marinos Eliades [1,*], Silas Michaelides [1], Evagoras Evagorou [1], Kyriaki Fotiou [1], Konstantinos Fragkos [1], Georgios Leventis [1], Christos Theocharidis [1], Constantinos F. Panagiotou [1], Michalis Mavrovouniotis [1], Stelios Neophytides [1], Christiana Papoutsa [1,2], Kyriacos Neocleous [1], Kyriacos Themistocleous [1], Andreas Anayiotos [1,3], George Komodromos [4], Gunter Schreier [5], Charalampos Kontoes [6] and Diofantos Hadjimitsis [1,2]

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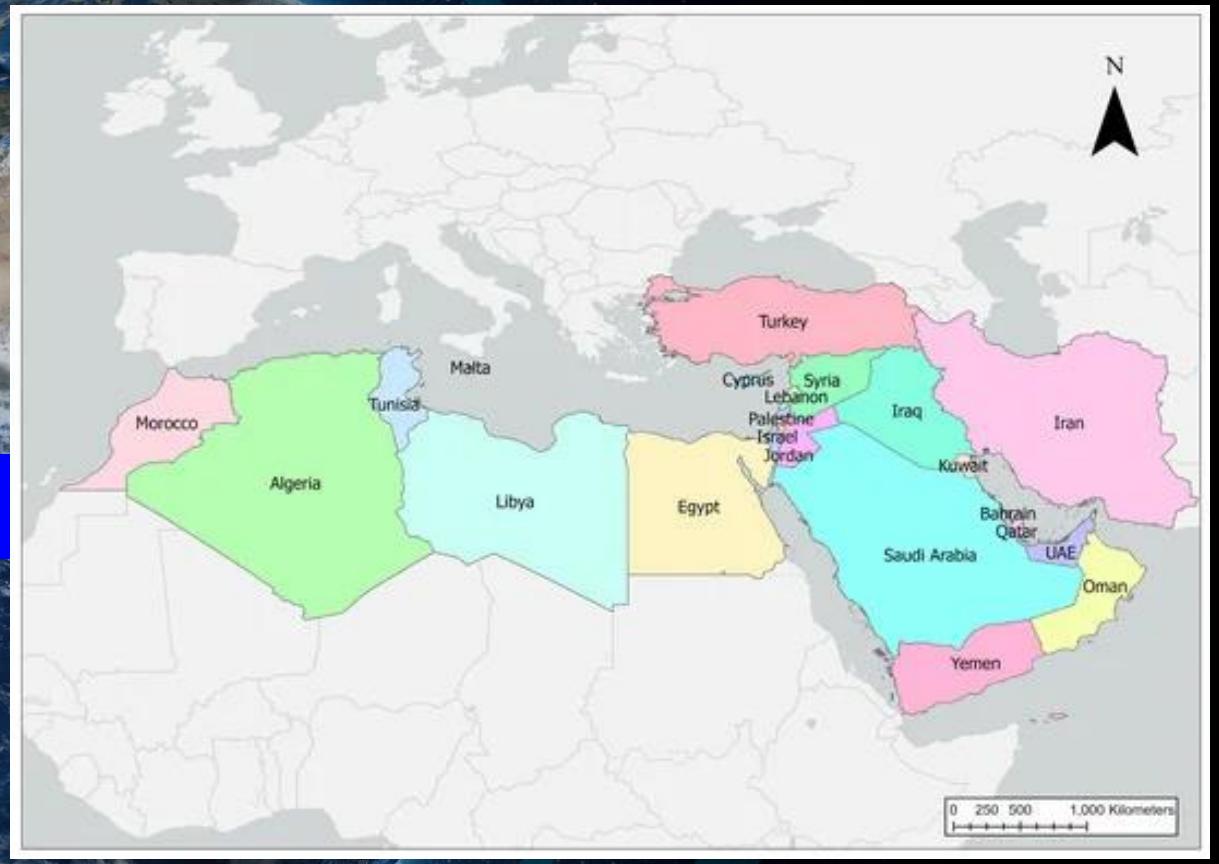
- We define EMMENA as the geographical region which includes the following countries: Algeria, Bahrain, Cyprus, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Malta, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Syria, Tunisia, Turkey, United Arab Emirates, and Yemen

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This work provides an overview of the existing EO applications in the EMMENA region, where 6647 articles were efficiently categorized into the following thematic areas: Atmosphere, water, agriculture, land, disaster risk reduction, cultural heritage, energy, marine safety and security, and other. The big Earth data thematic area was identified as horizontal. A total of 180 articles were further reviewed from the selection of the top 20 highly cited articles per thematic area.

The results from the top 20 articles revealed **a high research interest in the thematic area of disaster risk reduction with almost two times higher number of citations than the second thematic area (water)**. The focus of these articles is limited to floods and landslides. The main knowledge gap was the lack of protocols and the development of early warning systems based on EO. The results also revealed limited research in specific EO applications for the water thematic area, which include water body monitoring through radar altimeters and water quality parameter estimation through thermal and optical satellite data. Also, EO research related to cultural heritage (1.4% of the total number of studies) and marine safety and security (0.9% of the total number of studies) was surprisingly rare. The main research interest in the thematic area of atmosphere was related to precipitation estimates, dust, and the impact of coronavirus on air quality. The thematic area of agriculture covered a wide range of EO applications (evapotranspiration estimation, land suitability for agriculture, irrigation mapping, agricultural land loss, crop monitoring, crop production, yield prediction, crop mapping, stem water potential monitoring, and crop water footprint estimation).

The study has also identified the top authors, research organizations, and funding agencies for the EMMENA region. Sentinel-2 data (60.8%) and Sentinel-1 data (35.4%) are the most widely used among the Sentinel missions. Similarly, Landsat 8 (83.2%) and Landsat 7 (10.0%) are the most widely used data sources among the Landsat missions. The ongoing development of big Earth data techniques and the increasing availability of satellite EO data will enhance the research capabilities in the aforementioned thematic areas.

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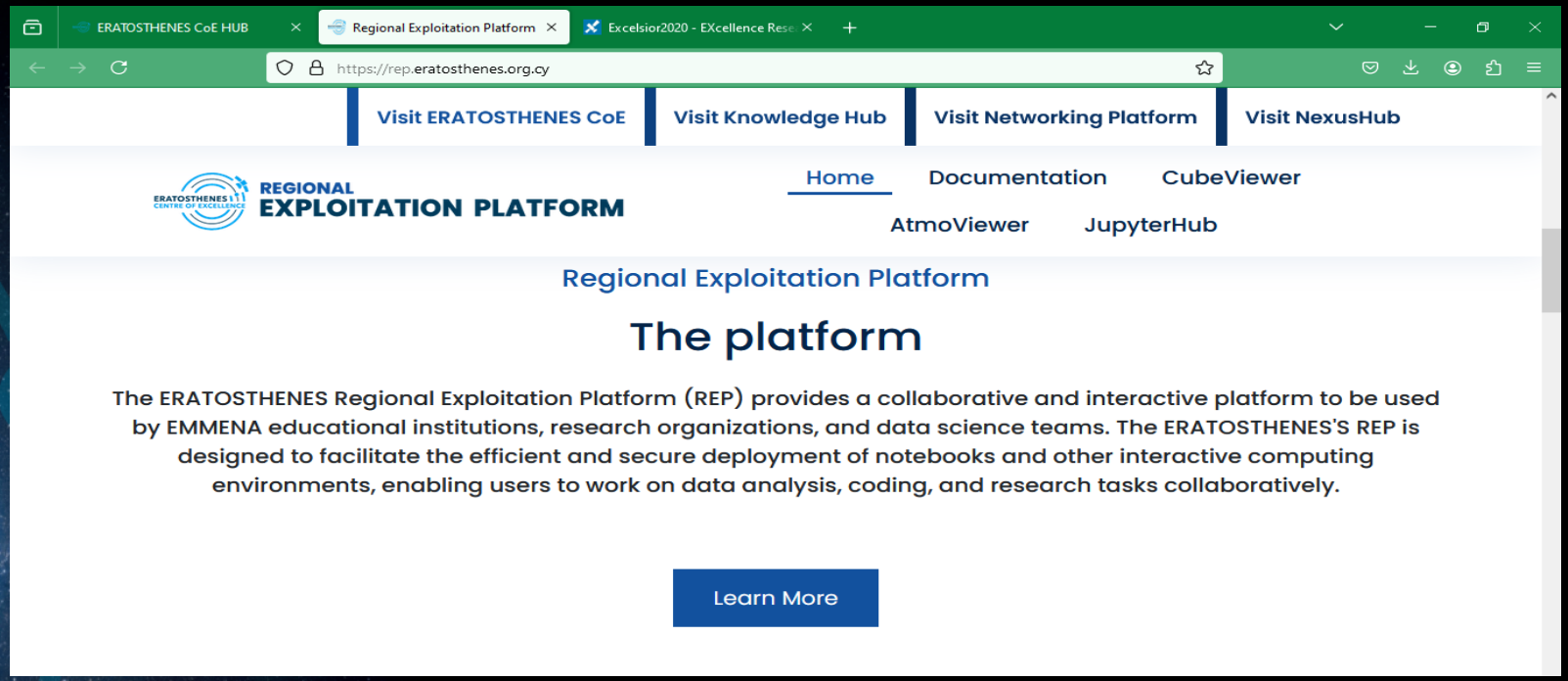
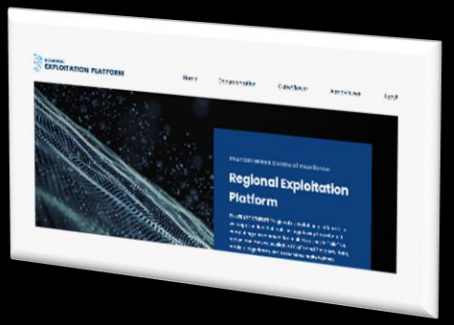
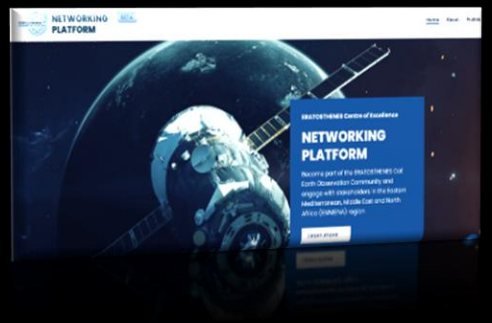
https://ecoehub.eratosthenes.org.cy/




The ERATOSTHENES Regional exploitation platform is a web application that acts as a gateway to a shared computing environment for multiple users in EMMENA region and makes available ECoE's and 3rd party data, models, algorithms etc. to EMMENA stakeholders.

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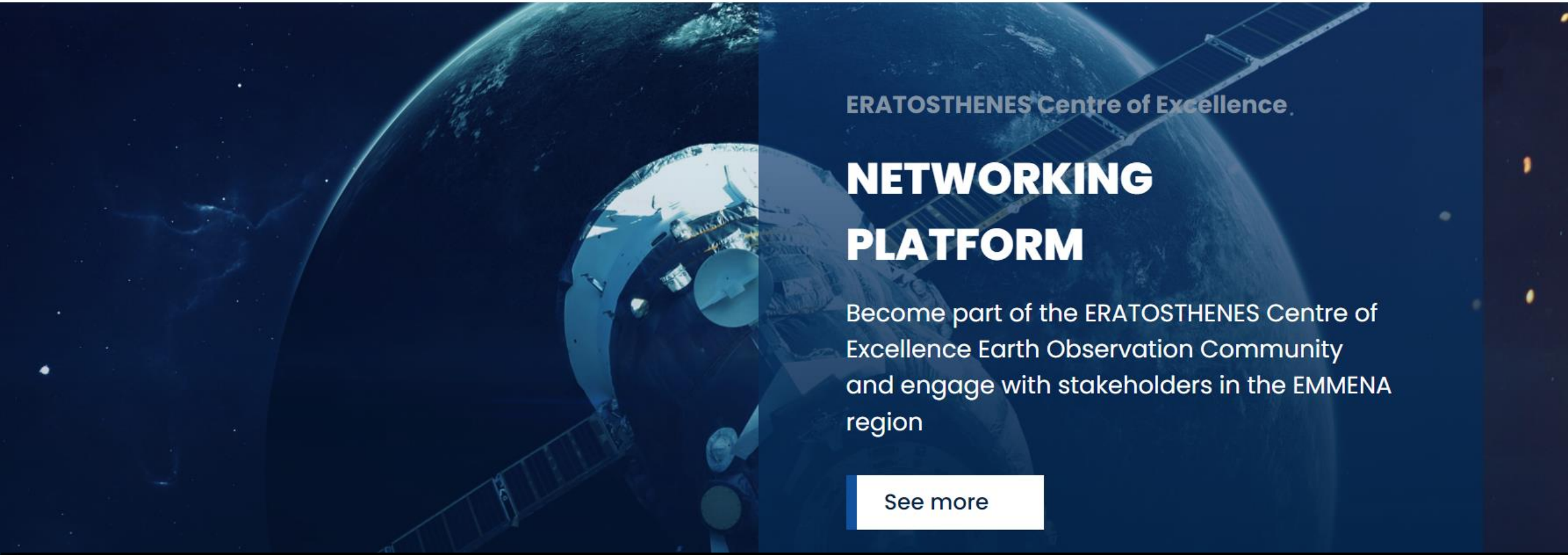
NETWORKING PLATFORM

Home About Profiles Login



ERATOSTHENES Centre of Excellence

# NETWORKING PLATFORM

Become part of the ERATOSTHENES Centre of Excellence Earth Observation Community and engage with stakeholders in the EMMENA region

See more

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# Stakeholders

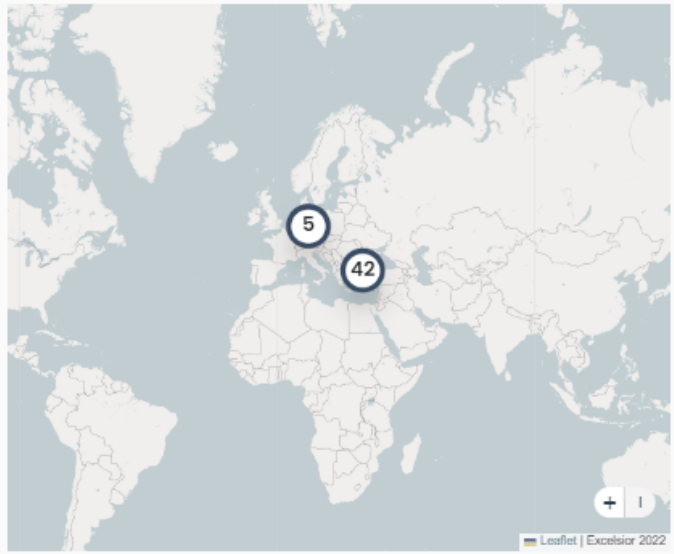
Identify the location of the registered stakeholders by using the map, or the filters

Country

Organization Name

Thematic area of interest

Refresh filters




## Search

Search all of registered stakeholders in the ERATOSTHENES CoE Networking Platform

Search by type or name of organization

If you wish to use more filters for your search, please visit the **Advanced Search Page.**

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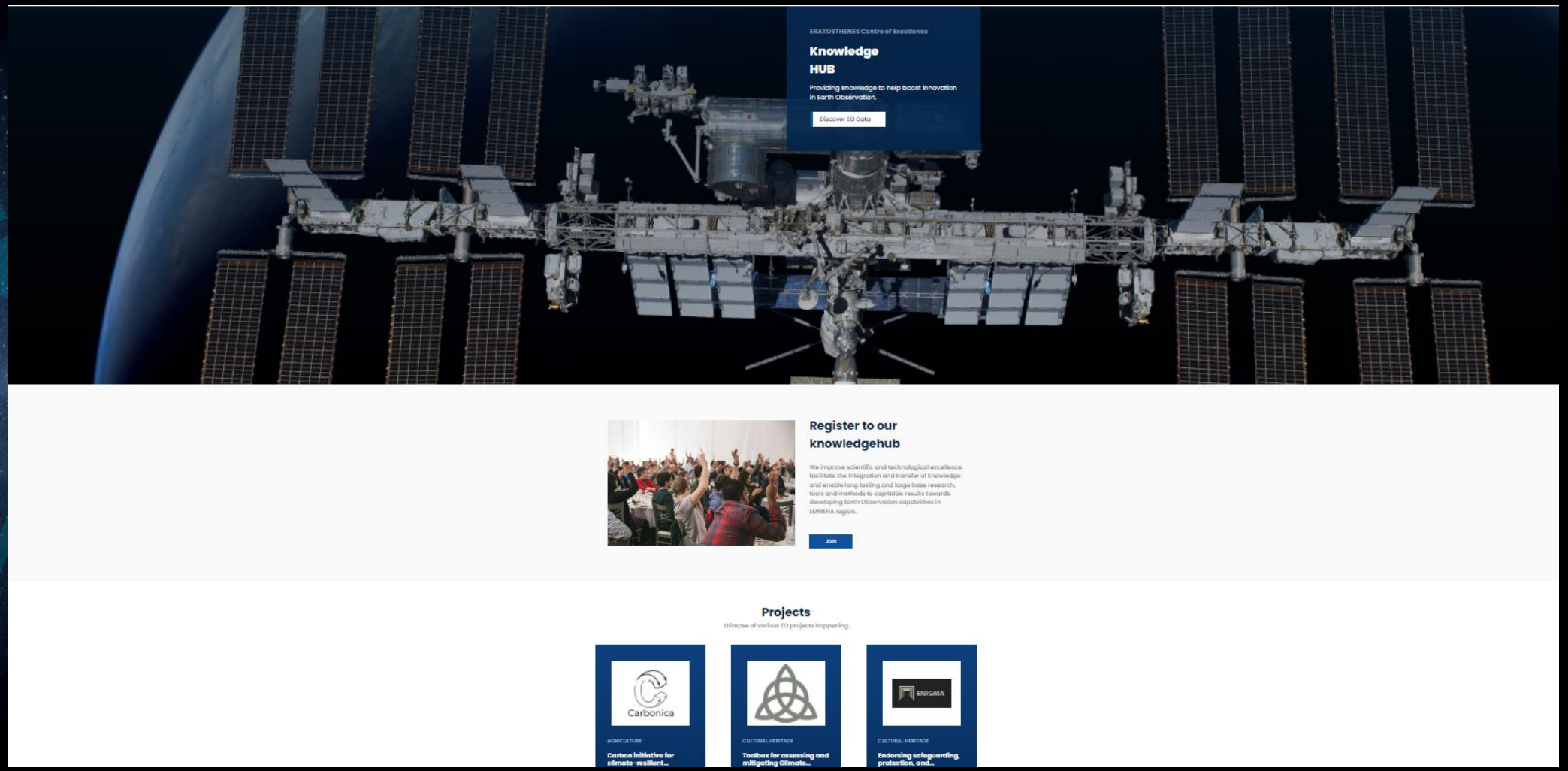
https://ecoehub.eratosthenes.org.cy/knowledge-hub/



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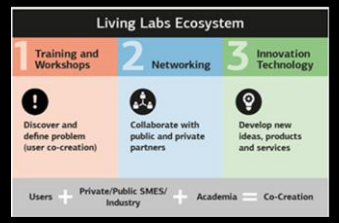
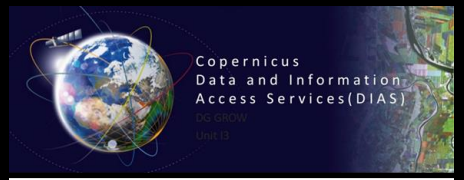
# Multi-actor approach

The ECoE as a Digital Innovation Hub provides the following distinct Multi-Actor features:

- **Skills Development Programmes**
- **Professional Training Programmes**
- **Networking and Knowledge Hubs**
- **Regional Exploitation Platform**
- **Living Labs and Business Incubation Programmes**





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# CYPRUS EO DATA CUBE: Next steps
# Expansion to EMMENA

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# Cyprus EO Data Cube

EODC is a powerful tool that allows users to analyse vast amounts of satellite imagery and other EO data.

## Data Cube Acquisition Sources

1. ESA's Sentinel-1 and Sentinel-2
2. NASA's MODIS (in total 15 different products) examples:
    a) Vegetation Indices 16-Day L3 Global 250 m.
    b) Leaf Area Index/FPAR 8-Day L4 Global 500 m.
    c) Burned Area Monthly L3 Global 500 m.
    d) Net Evapotranspiration 8-Day L4 Global 500m



Expected to be operational by the end of July 2024.
Expansion to EMMENA region by 2025.

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## Production of Analysis Ready Data (ARD) and Pre-Processing

- Resampling at 10m of Sentinel-2 data using GDAL software (python).
- Sentinel-1 are pre-processed using snappy (ESA SNAP python API).
- MODIS' HDF files are converted into GeoTIFFs using rasterio python package.
- All the data are reprojected to EPSG:32636 and converted into Cloud Optimized GeoTIFFs (COGs).
    - Converting to COGs is crucial because it makes data analysis easier and faster.

## Preparation of Data Cube Environment

- Open Data Cube python API set up
- Connection with postgreSQL database (with postGIS extension)

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## Product and Dataset Preparation

- Documenting each type of satellite as product according to eo2 metadata type in yaml files.
- Documenting each image as dataset according to eo2 metadata type in yaml files.
- Datasets are arranged hierarchically under products.

## Finalization of Data Cube

- Indexing of images/dataset in Data Cube using python and Open Data Cube.
- Set-up of Jupyter notebook which serves as an interface to access, analyse and visualize data.
- Documentation material will be provided in Regional Exploitation Platform.

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# Efficiency of Cyprus Data Cube

| Data Source | Bandwidth | Processing Time |
|---|---|---|
| Sentinel-1 | 11 MBps | 234.1 seconds/image |
| Sentinel-2 | 11 MBps | 121.3 seconds/image |
| MODIS | Traffic-regulated | 27.3 seconds/pre-processing |

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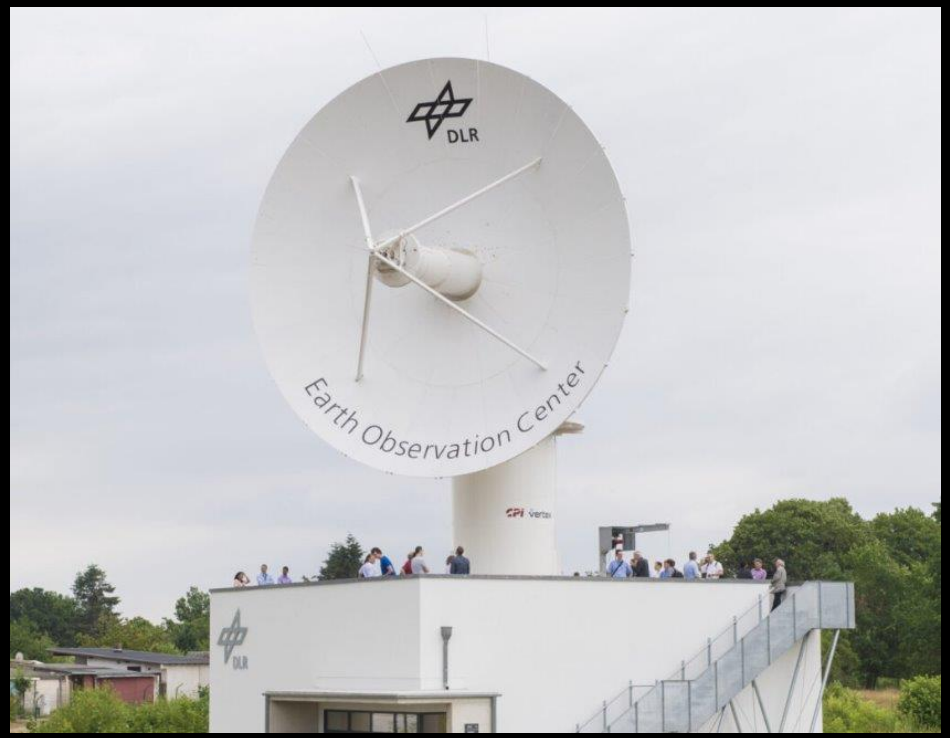
# Data Acquisition System




*DLR's Earth observation data acquisition station located in Neustrelitz, Germany.*

| Feature | Description |
|---|---|
| **Feed Type** | Three-band |
| **Reception** | Simultaneous reception of S, X, and Ka bands |
| **Mission Suitability** | Supports current and future missions |
| **Reflector Size** | Meets stringent criteria for service availability and reception margins |
| **Tracking** | Tracks and acquires data from satellites at low Earth orbit (400 km) |



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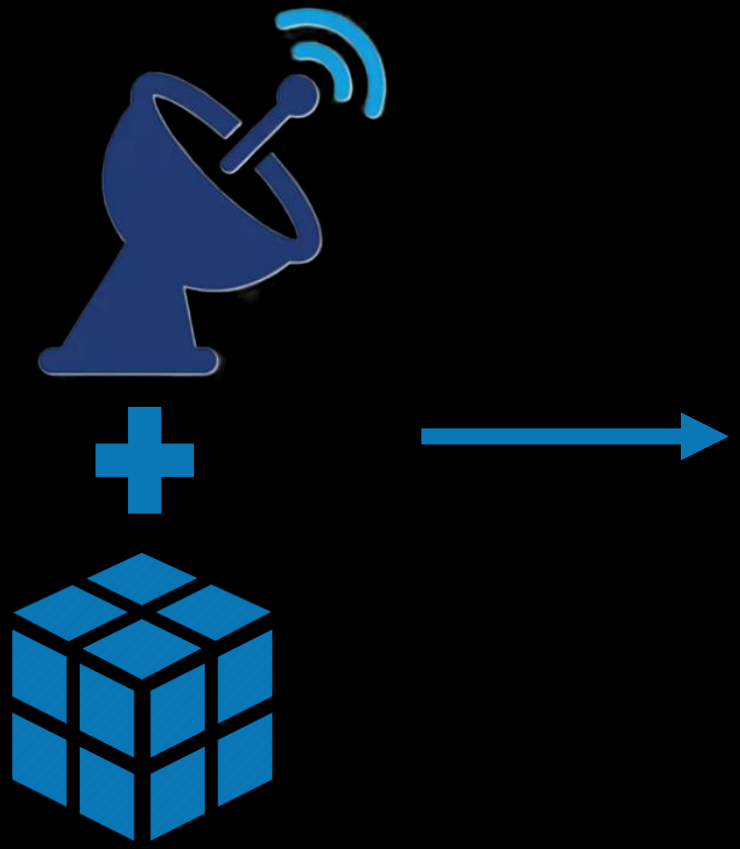
# Integration with Data Acquisition System



**Near Real-Time ARD to serve EO data provision, support numerous of EO downstream applications and researchers around the region and the rest of world.**



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# Demonstration (calculating the water extent of Kouris dam in Cyprus)



```
In [4]:
data = dc.load(product="s2_preprocessed_cy
data
Out[4]:
xarray.Dataset
▸ Dimensions:        (time: 54, y: 6742, x: 6718)
▾ Coordinates:
    time             (time)  datetime64[ns] 2020-01-04 ... 2020-09-30
    y                (y)     float64 4.197e+06 4.197e+06 ... ...
    x                (x)     float64 3.551e+06 3.551e+06 ... ...
    spatial_ref      ()      int32 3857
▾ Data variables:
    B02              (time, y, x)  uint16 dask.array<chunksize=(1...
    B03              (time, y, x)  uint16 dask.array<chunksize=(1...
    B04              (time, y, x)  uint16 dask.array<chunksize=(1...
```

**Time-Series data loading**

```
# MNDWI = (Green - SWIR) / (Green + SWIR)
data2['MNDWI'] = (data2.B03 - data2.B11) / (data2.B03 + data2.B11)
```

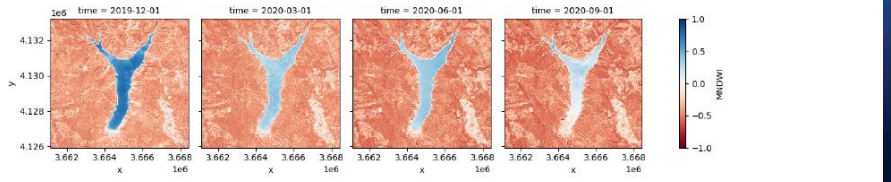
**Spectral Index calculation**

```
%%time
sample_frequency="QS-DEC"  # quarterly starting in DEC, i.e. seasonal

#resample using medians
print('calculating MNDWI seasonal medians...')
mndwi = data2['MNDWI'].resample(time=sample_frequency).median().compute()

calculating MNDWI seasonal medians...

/root/anaconda3/envs/dcagri/lib/python3.9/site-packages/rasterio/warp.py:3
44: NotGeoreferencedWarning: Dataset has no geotransform, gcps, or rpcs. T
he identity matrix will be returned.
  _reproject(

CPU times: user 5min 36s, sys: 2min, total: 7min 36s
Wall time: 21.9 s
```

**Calculating quarter seasonal composites**

**Visualize time-series**

```
In [9]:
mndwi.plot(col='time', col_wrap=4, cmap='RdBu', vmax=1, vmin=-1);
```




**1 year time-series composites were calculated in 21.9s (wall time.)**

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ndvi_time_se... - JupyterLab

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Apps | smokin_pafos - Alb... | Adobe Edge Animat... | Add a one-time-use... | Interacting with a S... | Learn to build dece... | (192) 02. Solidity Va... | Master Dissertation | What is Ethereum?... | Ethereum Develope... | Mobile Computing | All Bookmarks

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Filter files by name

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| Name | Last Modified |
|---|---|
| work | 4 days ago |
| datacube.c... | yesterday |
| ndvi_time_s... | 1 minute ago |
| Untitled.ipy... | yesterday |

ndvi_time_series.ipynb

Code | Open in... | Python 3 (ipykernel)

# Cyprus Earth Observation Data Cube (CEODC)

CEODC contains numerous products of NASA's Moderate Resolution Imaging Spectroradiometer (MODIS) and satellite imagery data from ESA's satellite missions.

A demonstration app for plotting NDVI time series using MOD13Q1 product over Cyprus of the last 24 years.

### Import of necessary python packages

```
[ ]: %matplotlib inline
import datacube
import numpy as np
import xarray as xr
from datacube.utils.geometry import Geometry
import matplotlib.pyplot as plt
from matplotlib.colors import ListedColormap
from matplotlib.patches import Patch
```

### Connection to EODC and initialization of a demo application

```
[ ]: dc = datacube.Datacube(app='ndvi_time_series')
```

### Set up of time range

```
[ ]: start_time, end_time = '2000-01-01', '2023-12-30'
```

### Set up of query to search for satellite images to the EODC

```
[ ]: query = {'output_crs': ('EPSG:32636'), 'resolution': (-250,250), 'time': (start_time,end_time), 'dask_chunks':{}}
```

### Query the EODC's database and load the images

```
[ ]: data = dc.load(product='CYPRUS_MOD13Q1',**query)
```

Simple 0 1 Python 3 (ipykernel) | Idle

Mode: Command Ln 2, Col 16 ndvi_time_series.ipynb 1

16°C Mostly cloudy

Search

4:35 pm 12/01/2024


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The ERATOSTHENES CoE consists of three Departments:

- **Environment and Climate**
  - Atmosphere
  - Agriculture
  - Water
  - Land
- **Resilient Society**
  - Disaster Risk Reduction
  - Cultural Heritage
  - Access to Energy
  - Marine Safety and Security
- **Big Earth Data Analytics**
  - Information extraction
  - Visual exploration & visualization
  - Crowdsourcing & data fusion
  - Geoinformatics


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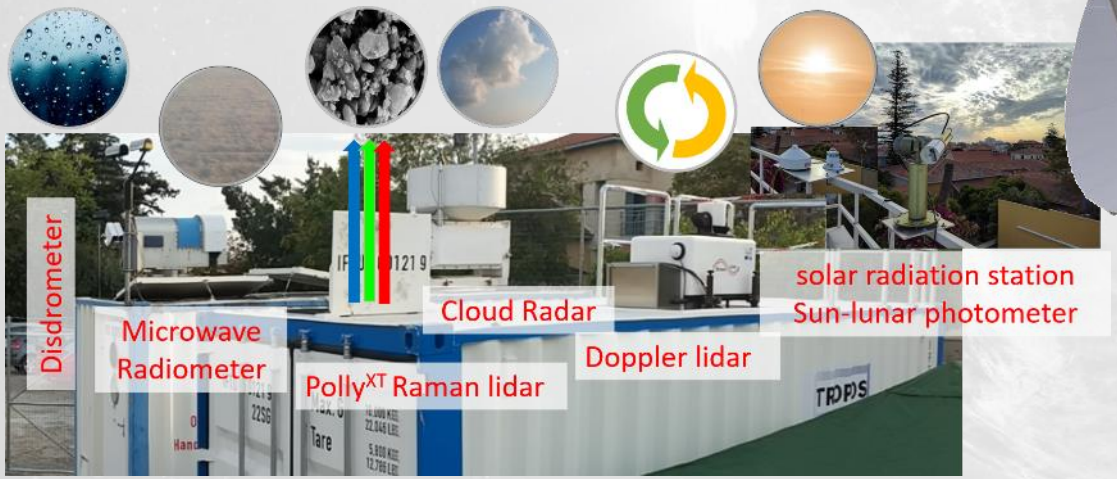
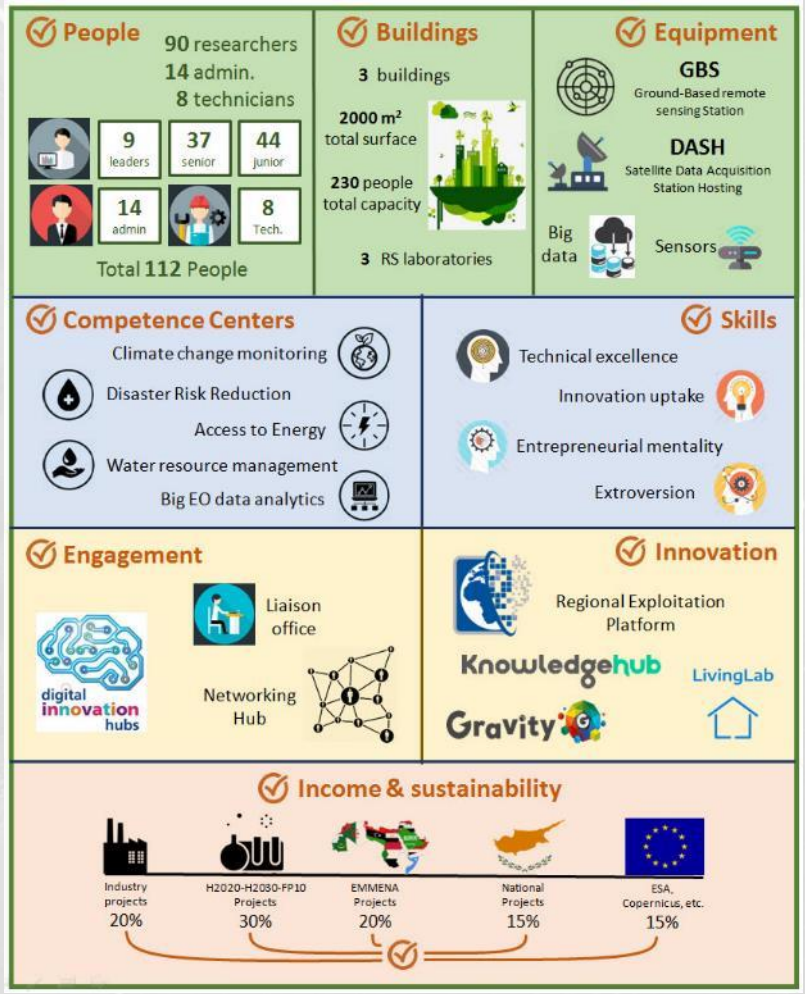
# Investment

- **112** Personnel **in 7 years**, **132 in 15 years**
- **2000m²** Offices and Research Laboratories
- **State-of-the-art-Remote Sensing Research Infrastructure**




Ground based station (GBS)

Data Acquisition Station (DAS)

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# Data Acquisition Station (DAS)

Through governmental funding ECoE has acquired key infrastructure and equipment that will directly contribute to the Research Excellence and Service capacity of the ECoE such as the Data Acquisition Station (DAS).

**The DAS is being purchased and will be operational offering Commercial Services for international Business Customers in December 2025**

Within EXCELSIOR, ECoE is supported – amongst others – by the **German Aerospace Center (DLR)** in establishing DAS

**CYTA** – as strategic partner of ECoE – will host and operate DAS

cyta

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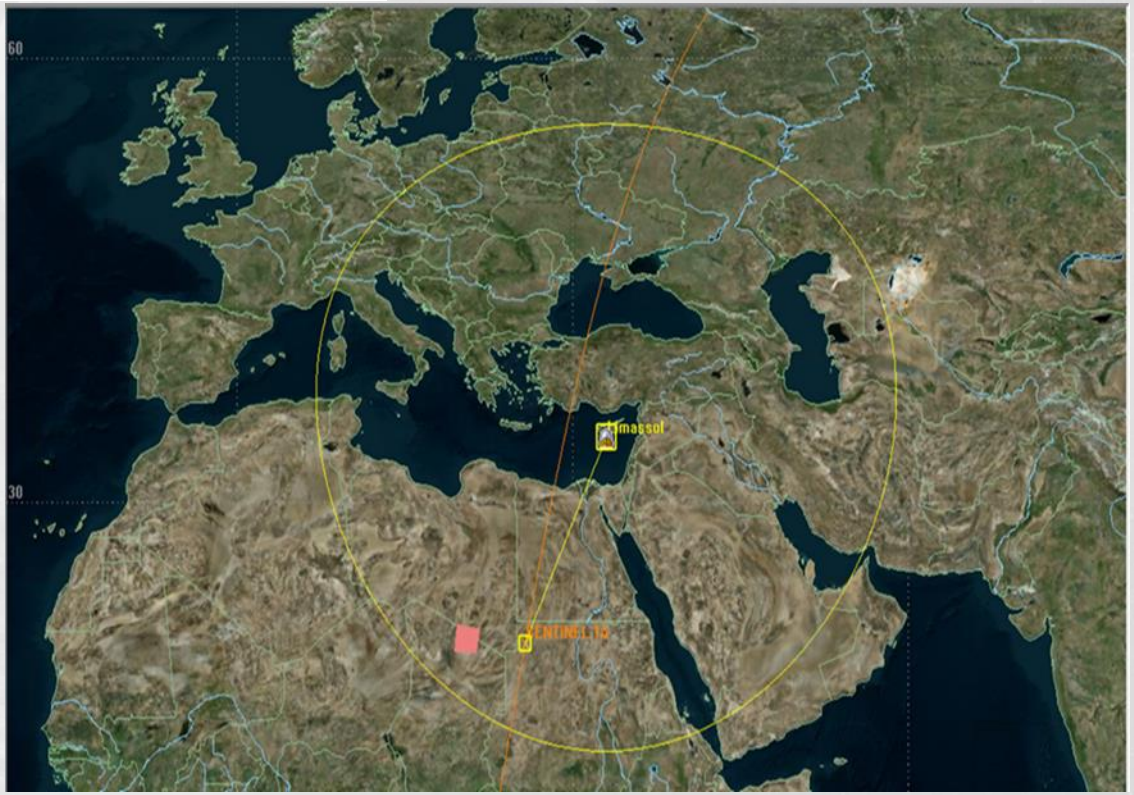
DLR Deutsches Zentrum für Luft- und Raumfahrt
German Aerospace Center



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# Technical Description of the Data Acquisition Station



- 9m full-motion Triband Antenna from Safran -France
- To be installed at 35°.049 longitude & 33°.284 latitude
- Simultaneous Reception in S, X & Ka Bands
- Tracking satellites orbiting as low as 400km
- Horizon visibility down to 5° elevation
- Transmit capability in S-Band (both RHCP & LHCP) for TT&C services
- Transmit EIRP up to 60dBW per polarization
- Pointing accuracy:< 0,045° rms
- Tracking accuracy: < 0,015° rms
- Cortex Low & High Data Rate Baseband equipment
-

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# GBS ATMOSPHERIC REMOTE SENSING STATION IN LIMASSOL: Fully operational





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# Collaborations: > 700 Partners (Collaboration with more than 60 MedRIN members)

## EXCELSIOR consortium

Cyprus University of Technology
Eratosthenes Centre of Excellence
DEC Department of Electronic Communications
IAASARS
DLR Deutsches Zentrum für Luft- und Raumfahrt German Aerospace Center
TROPOS Leibniz Institute for Tropospheric Research

## Affiliated partners

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NGI
L-Università ta' Malta
POLITECNICO MILANO 1863
CYRIC
MARITIME CYPRUS
LIMASSOL CHAMBER OF COMMERCE & INDUSTRY
motus
ECECT
GEOFEM
cellock
Geomatic TECHNOLOGIES
UNIForest AUTH.GR
ΤΑΜΕΙΟ ΔΙΟΙΚΗΣΕΩΣ ΚΑΙ ΔΙΑΧΕΙΡΙΣΕΩΣ ΠΑΝΕΠΙΣΤΗΜΙΑΚΩΝ ΔΑΣΩΝ
ρυθμιστική αρχή ενέργειας κύπρου cyprus energy regulatory authority
European University Cyprus
CERIDES
NOVATEX SOLUTIONS.EU

## National Support and Commitment from 19 Governmental Departments

WDD TAV
Invest Cyprus
DEPARTMENT OF ENVIRONMENT
CYPRUS DEPARTMENT OF METEOROLOGY

## Networks

isprs
NASA
opernicus Academy
ACTRiS
EARLINET
nereus
EARSeL
FAB SPACE 2.0
EARSC
GEO GROUP ON EARTH OBSERVATIONS

## CYTA, the national telecommunication authority, provided also a significant commitment for hosting the ground satellite receiving antenna in their land for 15years (10,000 sq.m land with LoC of 200K€)

cyta

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# ECoE Technology Applications

## TECHNOLOGY APPLICATIONS – MATURE/IN PILOT STUDIES

| | | |
|---|---|---|
| • Agri-Nexus-Hub tool for agricultural applications | (TRL5) | (ECoE) |
| • UVI Risk assessment tool for health and agricultural applications | (TRL4) | (ECoE - PMOD/WRC – NOA) |
| • Earthquake risk assessment tool | (TRL4) | (CUT –ECoE – U Sheffield) |
| • Earth Observation for Cultural Property Documentation and Protection | (TRL4) | (ECoE – DLR ) |

## TECHNOLOGY APPLICATIONS AT THE EARLY STAGES OF DEVELOPMENT

| | | |
|---|---|---|
| • Cyprus Geohazards Observatory (Landslides/Earthquakes) | (TRL4) | (ECoE – NOA) |
| • Earth Observation for Cultural Property Documentation and Protection | (TRL4) | (ECoE – DLR ) |
| • Allocation of Electric Vehicle Charging using GIS | (TRL4) | (ECoE-FOSS) |
| • Sowing & Harvesting tool for agricultural applications | | (ECoE - NOA) |
| • Carbon Farming Platform | | (ECoE) |
| • Cyprus Fire and Flood Observatory (Disaster Risk Reduction Fires, Floods) | | (ECoE – NOA) |
| • Atmosphere Identification Tools (GBS infrastructure) | | (ECoE – TROPOS) |
| • Marine Identification System (Early Warning System) | | (ECoE - DLR) |
| • Marine Pollution Monitor | | (ECoE - DLR) |
| • Digital tools for risk assessment of CH sites | | (ECoE – DLR ) |
| • Digital technology tool for identifying unknown buried archaeological sites | | (ECoE – DLR ) |

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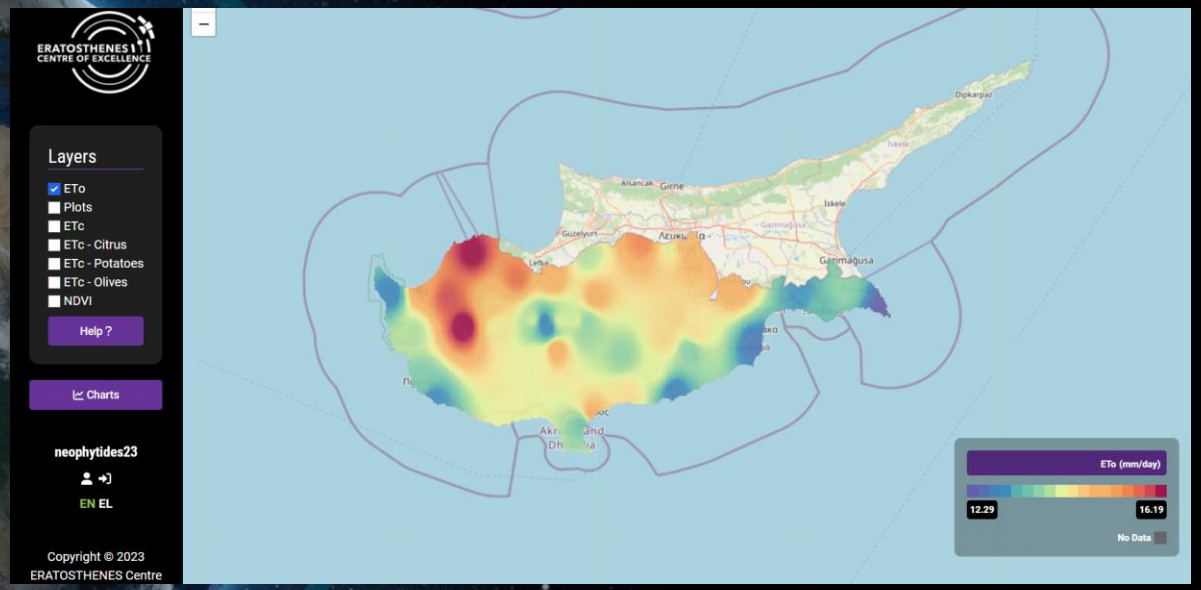
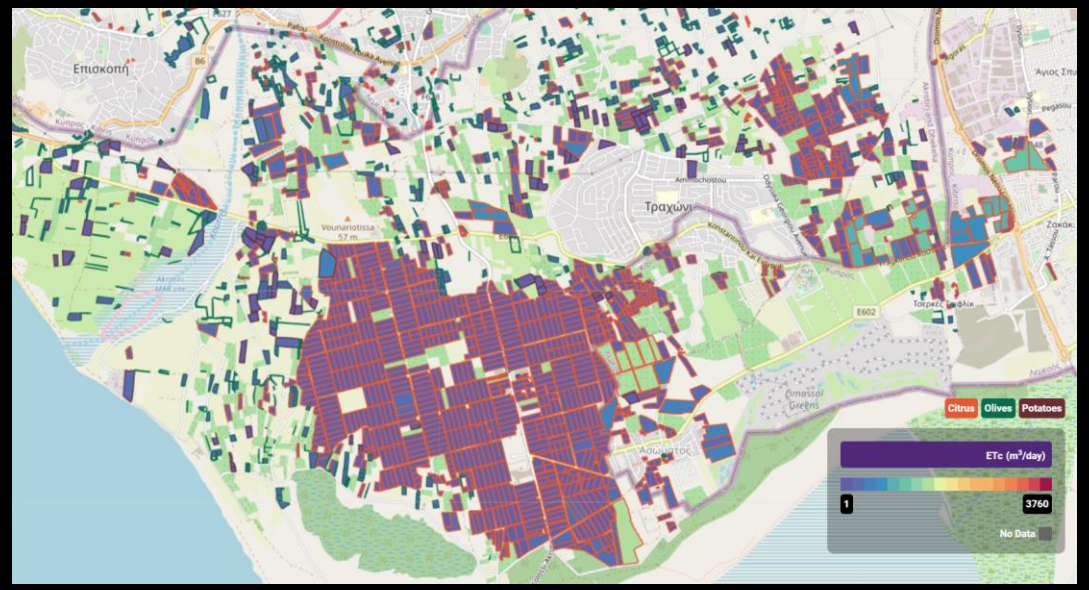
# Agri Nexus Hub Platform at a glance






- A day-to-day informational tool for farmers to optimize irrigation management
- Daily Potential Evapotranspiration calculations
- Citrus, Potatoes and Olives

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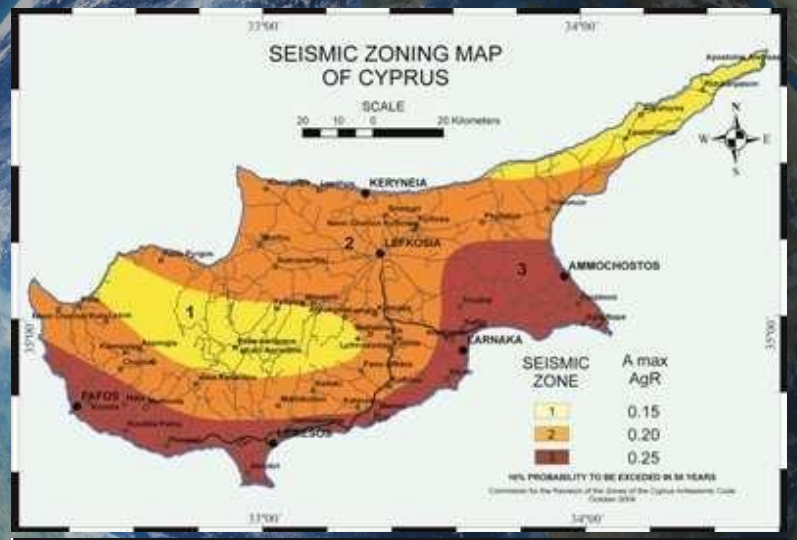
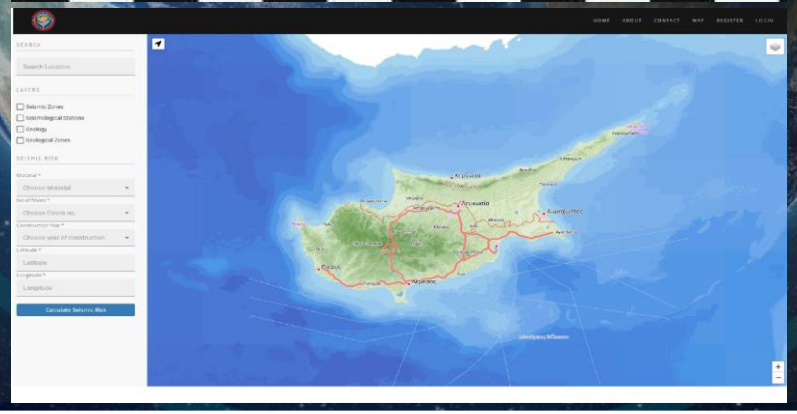
# Disaster Risk Reduction EARTHQUAKES

## Platform Development -Seismic Risk Assessment

- The seismic vulnerability of a building is considered automatically in the assessment through a GIS tool
- User selects location of building on interactive map of Cyprus (connected with seismic zones and soil conditions)
- Upon selection of location, the vulnerability of the building to the specific earthquake event is estimated.



Strategic Partner:
GEOMATIC TECHNOLOGIES LTD
(Nicosia, Cyprus)



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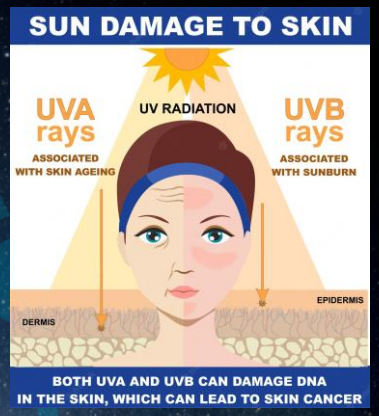
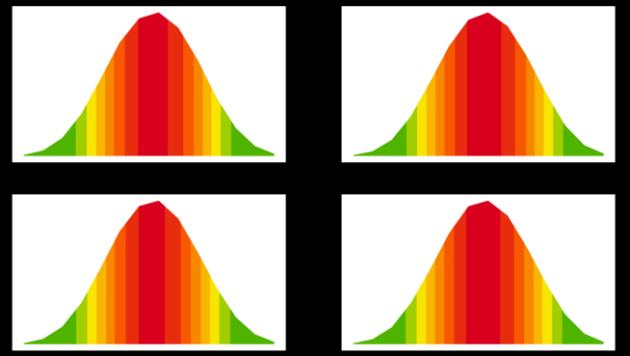
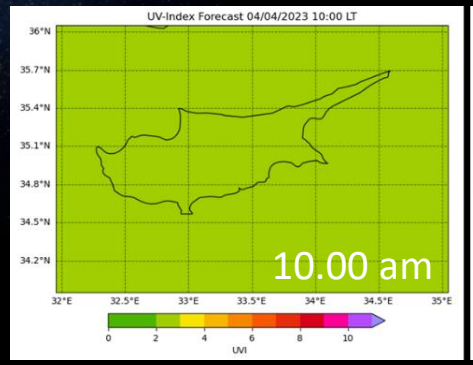
# UV-Index in Cyprus

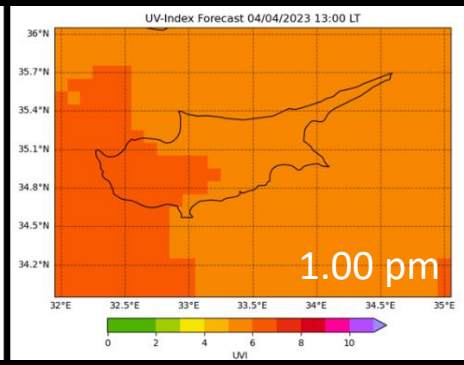


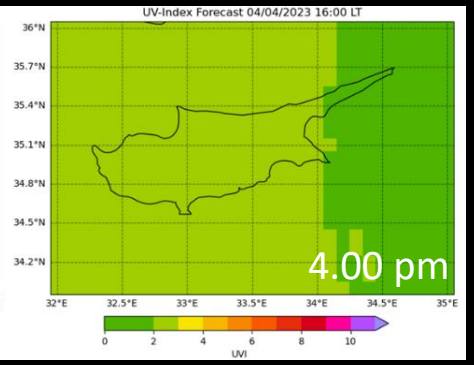

| EXPOSURE CATEGORY | UVI RANGE |
|---|---|
| LOW | < 2 |
| MODERATE | 3 TO 5 |
| HIGH | 6 TO 7 |
| VERY HIGH | 8 TO 10 |
| EXTREME | 11+ |

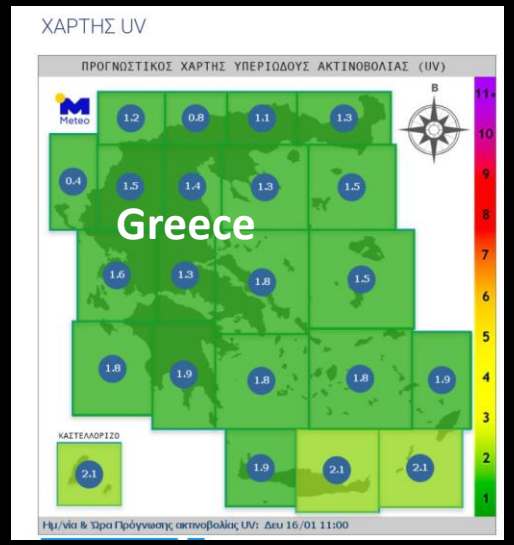


UV-Index forecast over Cyprus on 04-04-2023

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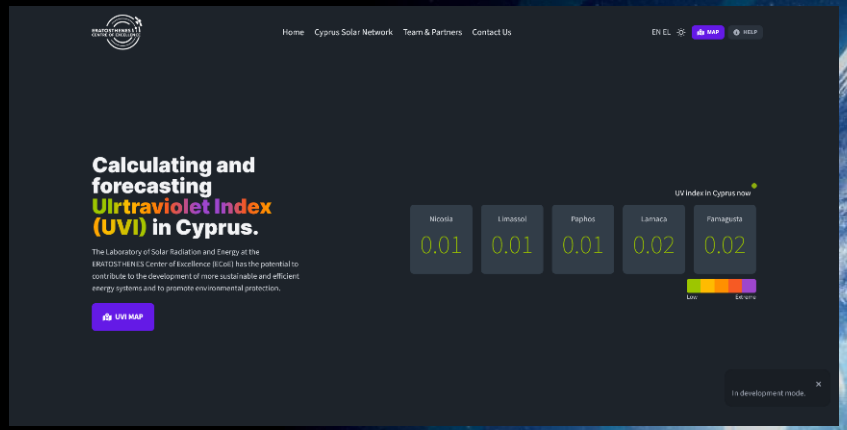
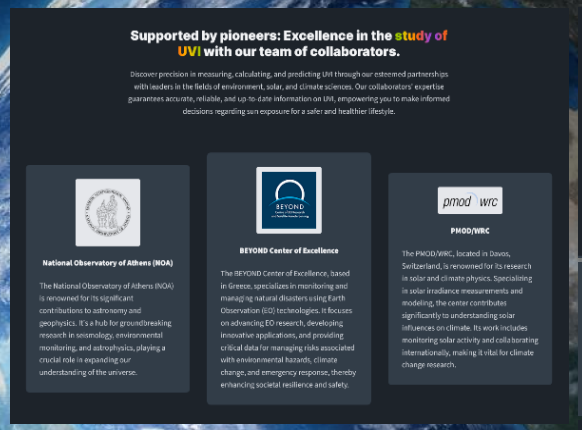
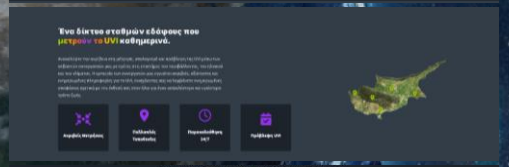
# UVI-Risk Assessment Platform Environment

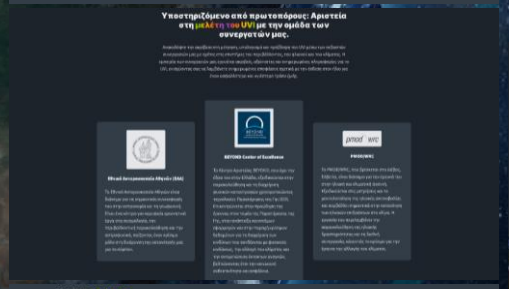


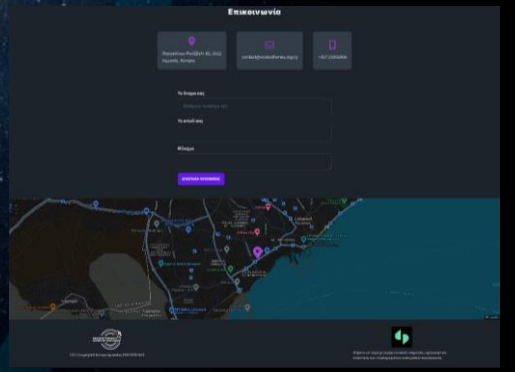


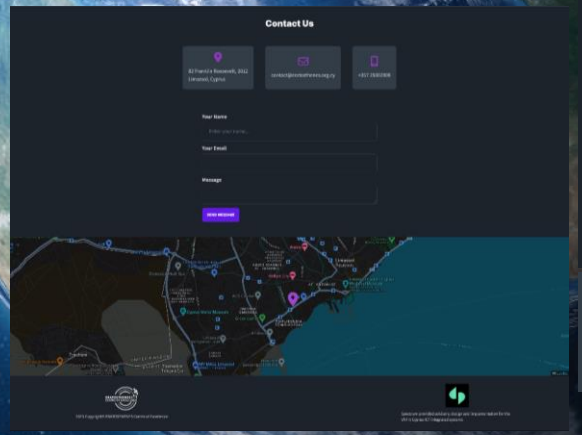



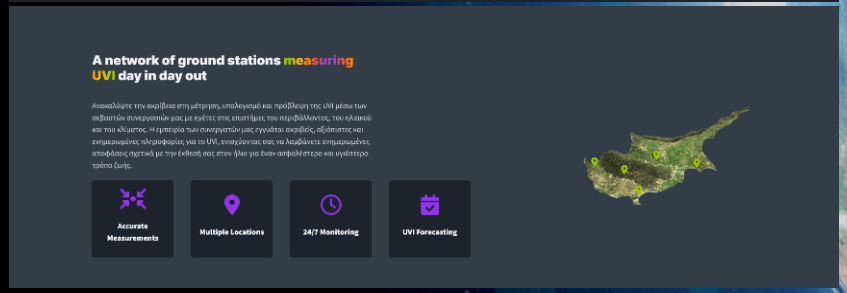






UV PROTECTION

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# Supported by pioneers: Excellence in the study of UVI with our team of collaborators.

Discover precision in measuring, calculating, and predicting UVI through our esteemed partnerships with leaders in the fields of environment, solar, and climate sciences. Our collaborators' expertise guarantees accurate, reliable, and up-to-date information on UVI, empowering you to make informed decisions regarding sun exposure for a safer and healthier lifestyle.

**National Observatory of Athens (NOA)**

The National Observatory of Athens (NOA) is renowned for its significant contributions to astronomy and geophysics. It's a hub for groundbreaking research in seismology, environmental monitoring, and astrophysics, playing a crucial role in expanding our understanding of the universe.

**BEYOND Center of Excellence**

The BEYOND Center of Excellence, based in Greece, specializes in monitoring and managing natural disasters using Earth Observation (EO) technologies. It focuses on advancing EO research, developing innovative applications, and providing critical data for managing risks associated with environmental hazards, climate change, and emergency response, thereby enhancing societal resilience and safety.

**PMOD/WRC**

The PMOD/WRC, located in Davos, Switzerland, is renowned for its research in solar and climate physics. Specializing in solar irradiance measurements and modeling, the center contributes significantly to understanding solar influences on climate. Its work includes monitoring solar activity and collaborating internationally, making it vital for climate change research.

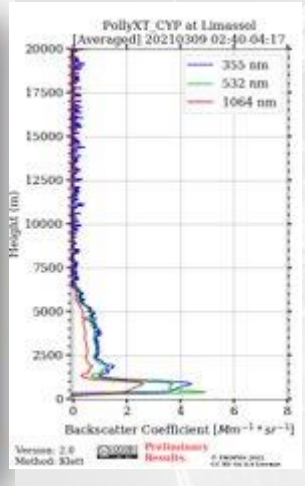
# UV-Index Application in Cyprus

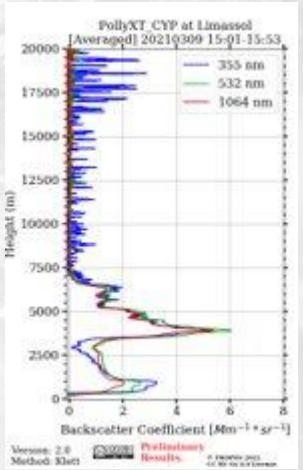
## What is the Ultraviolet Index (UVI)?

The UVI is a measurement of the level of ultraviolet radiation. UVI values range from zero and upwards. The higher the UVI, the greater the potential risk of harm to the skin and eyes, and the less time it takes for damage to occur in humans. The UVI is an important tool to alert people to the need for sun protection.

# NRT aerosol profiles provision to CAMS

## CAMS 21b ACTRIS-A pro CAMS Provision of ACTRIS Aerosol Observations - (Profiles)



The **PollyXT-Cyp Lidar system** of the ERATOSTHENES CoE participated through the PollyNET to the first phase of ACTRIS-CAMS21b pilot contract with the Copernicus Atmosphere Monitoring Service (CAMS), aiming at designing, testing and setting up the provisioning to CAMS of quality controlled ACTRIS aerosol-related data products in Near Real Time (NRT).

For the first time, atmospheric aerosol profiles by ground based multiwavelength Raman lidars for a group of 9 stations assuring a good geographical coverage of the European continent, fully documented, traceable and of high quality are provided to the CAMS.

Around 58k files, of which about **3800 NRT aerosol optical properties profiles were provided from Cyprus to CAMS** in the provision period (Oct 2020- Sept 2021). The amount and distribution of all the data provided to CAMS demonstrates that the pilot system for the NRT and Level 2 data provision is well implemented and working efficiently also for not automatic lidars.

This project has received funding from the European Union's "Horizon 2020 [illegible] Programme" [illegible]

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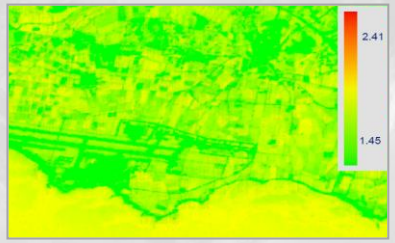
# AGRICULTURE – Activities

- Precision Agriculture
- Smart Irrigation water resources management
- Carbon footprint calculations
- Hydrogeological modeling
- Common Agricultural Policy applications
- Soil health
- Pest/disease control
- Food security / Food safety
- Early warning systems
- Damage assessment and mitigation strategies for extreme weather events

Carbonica

Green Carbon CY

SWSOIP

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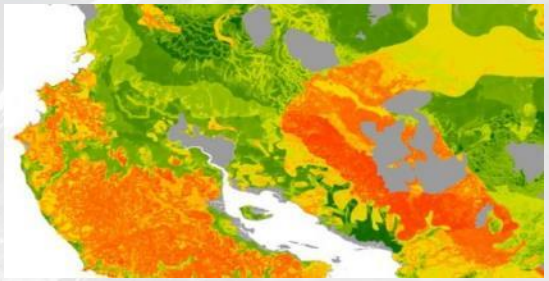
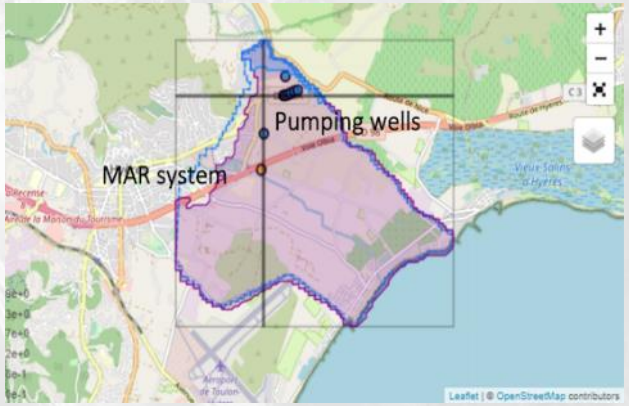
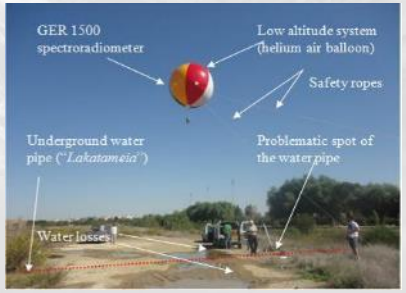
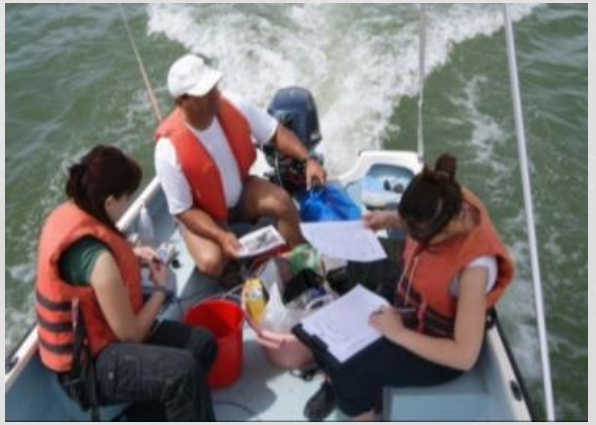
# WATER – Activities

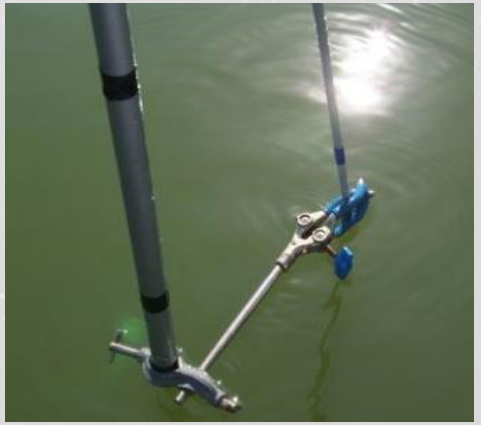
- Water quality monitoring
- Water resource management
- Microbial risk assessment
- Water leak detection
- Managed aquifer recharge
- Hydrogeological modeling
- Groundwater modeling
- Feasibility mapping







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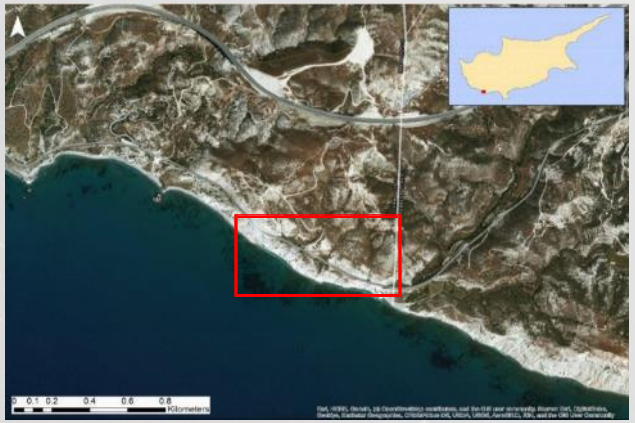
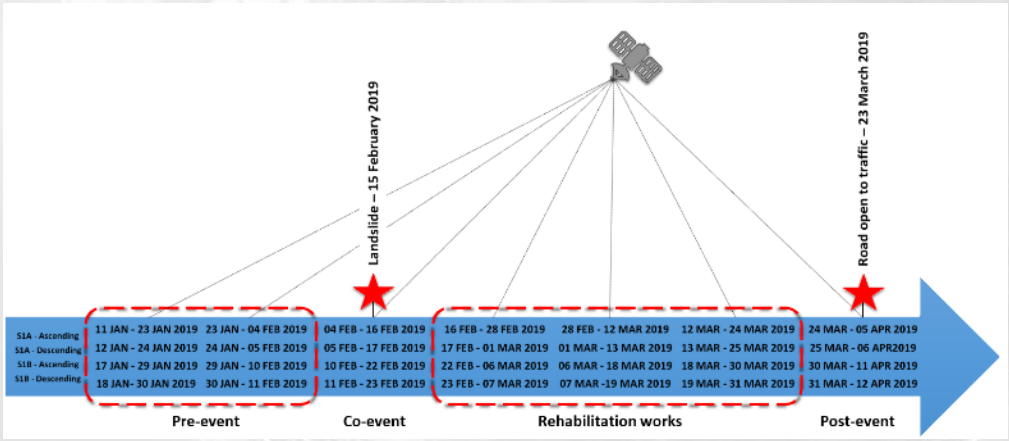
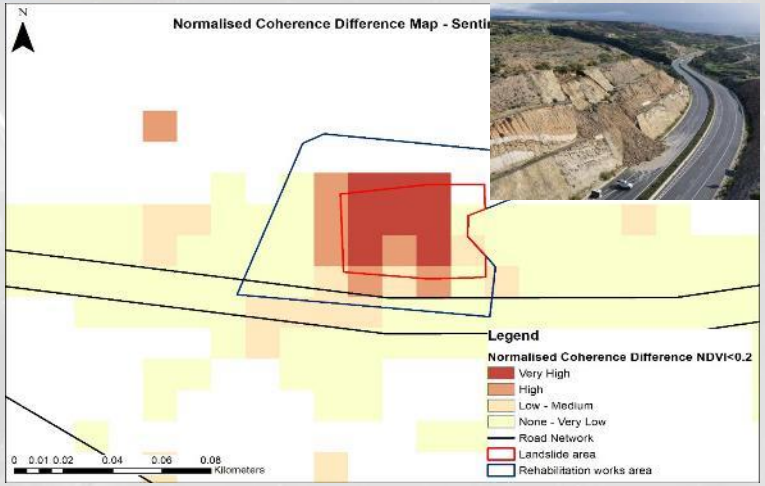
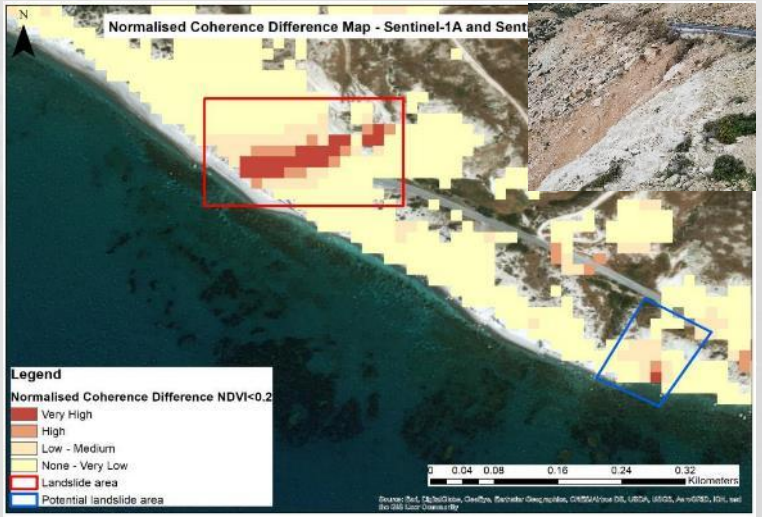
# DISASTER RISK REDUCTION – Earthquakes/Landslides



- **Landslide detection and mapping after rainfall events using time series satellite image processing**

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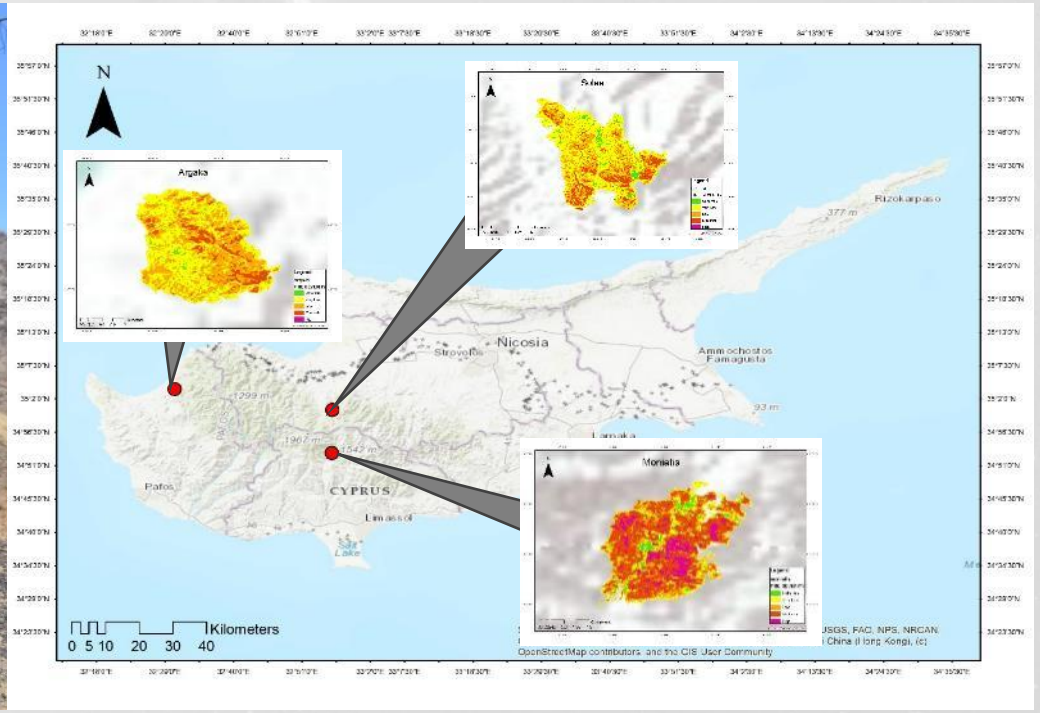
# DISASTER RISK REDUCTION – Forest Fires

## Field measurements for the estimation of the Composite Burn Index (CBI)

## Fire severity estimation using Differenced Normalized Burn Ratio (dNBR)

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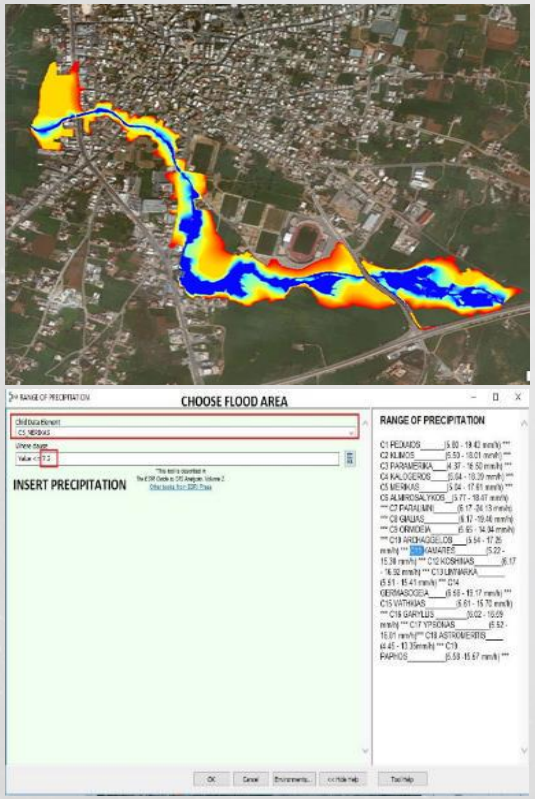
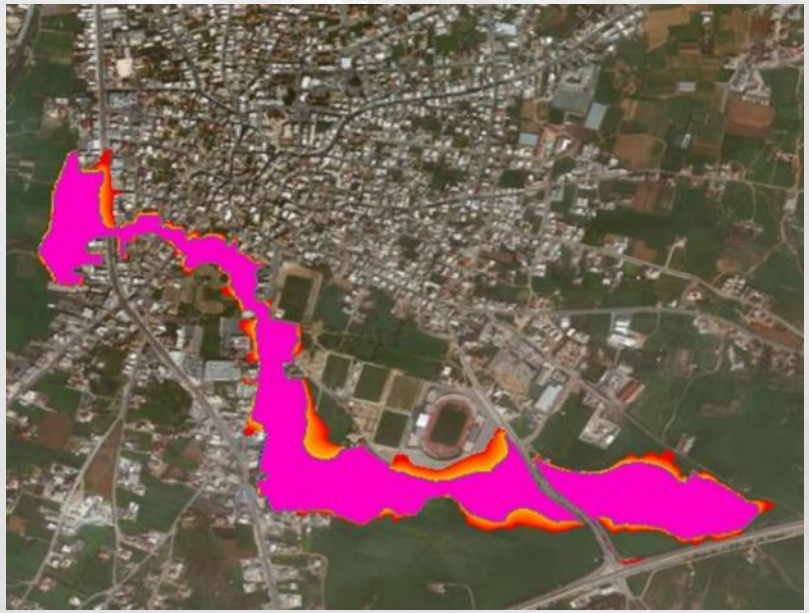
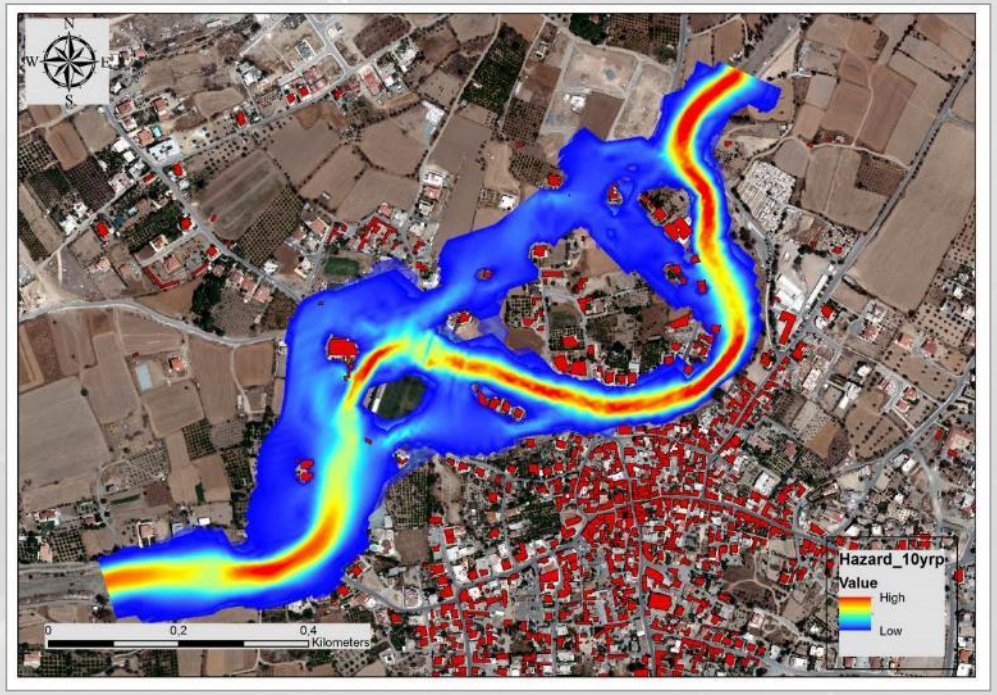
# DISASTER RISK REDUCTION – Floods

## Dynamic flood models



## Integrated Use Of Satellite Remote Sensing And Hydraulic Modeling For The Flood Risk Assessment At a Catchment Scale In Cyprus

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# Exploitation and commercialisation

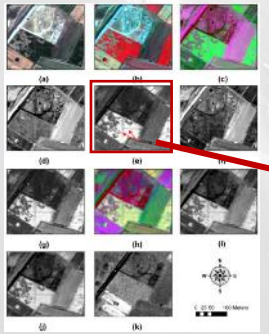
| Identification of user needs and data collection | EO Big Data AI management platform | AI-EO risk assessment of environmental hazards in Cyprus | Commercialisation of the exploratory project's outputs |
|---|---|---|---|
| • Meetings with local stakeholders<br>• User needs<br>• Concept design of the EO Big Data AI management platform<br>• Data collection | • Handle multi-source data EO inputs<br>• APIs<br>• Monitor and assess the data in real time, through visualizations and dashboards | • Earthquakes, landslides, soil erosion, forest fires, floods, marine pollution<br>• AI-assisted data fusion techniques | • First combined AI-EO products<br>• AI-OBSERVER final workshop to stakeholders/public<br>• Roadmap towards commercialisation |

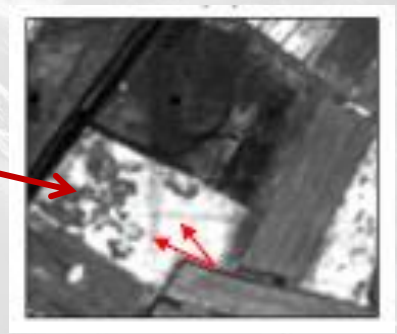
Funded by the European Union
Grant Agreement No. 101079468

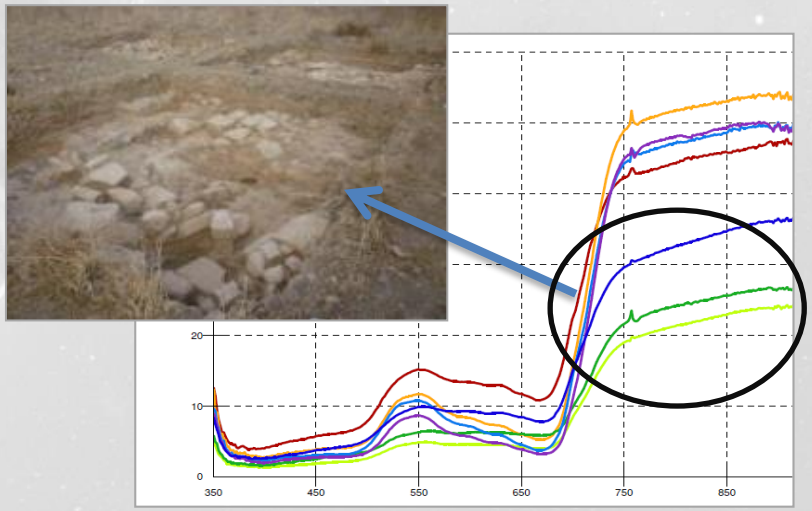
# CULTURAL HERITAGE – Activities

- Risk assessment of Cultural Heritage from natural and anthropogenic hazards
- Protection of Cultural Heritage
- Cultural Heritage digitization (3D models)
- Archaeolandscape assessment and modelling
- Study of unexcavated areas (Earth Observation and geophysical prospection surveys)
- UAV photogrammetric applications


## *Fusion of Remote Sensing data*



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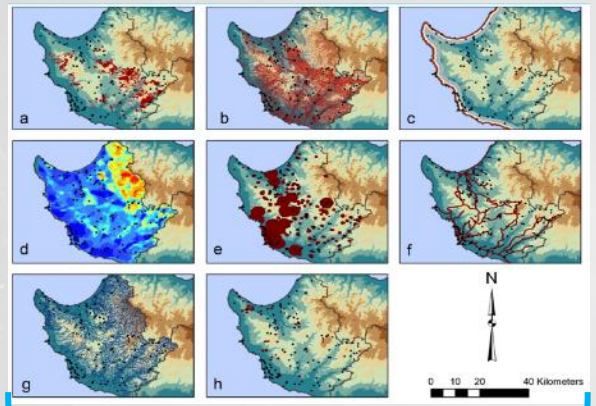
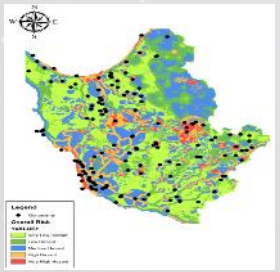
# CULTURAL HERITAGE – Examples

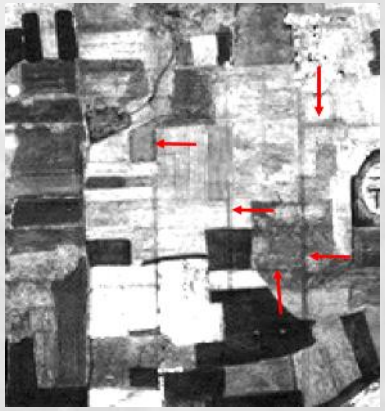
## Risk assessment of CH

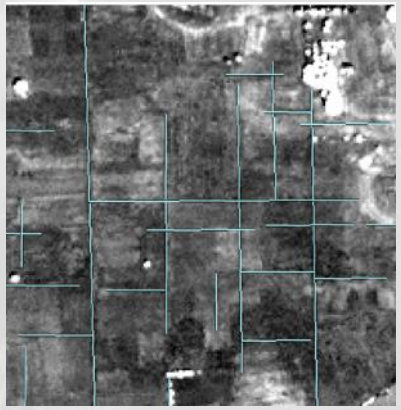



Assessment of multi-risks exposure on Cultural Heritage sites

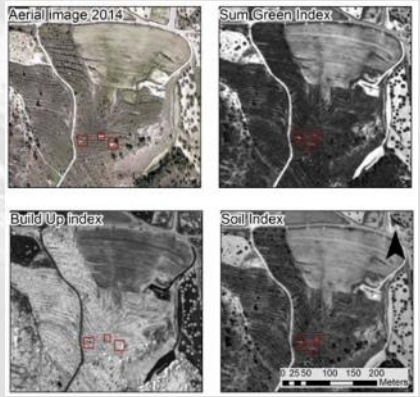


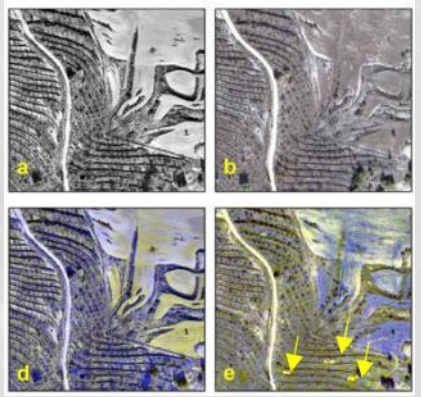
## EO on Cultural Heritage





Detection of unexcavated structures on cultural heritage sites using vegetation indices derived from EO services.




Looting of cultural heritage sites based on indices derived from multispectral images.

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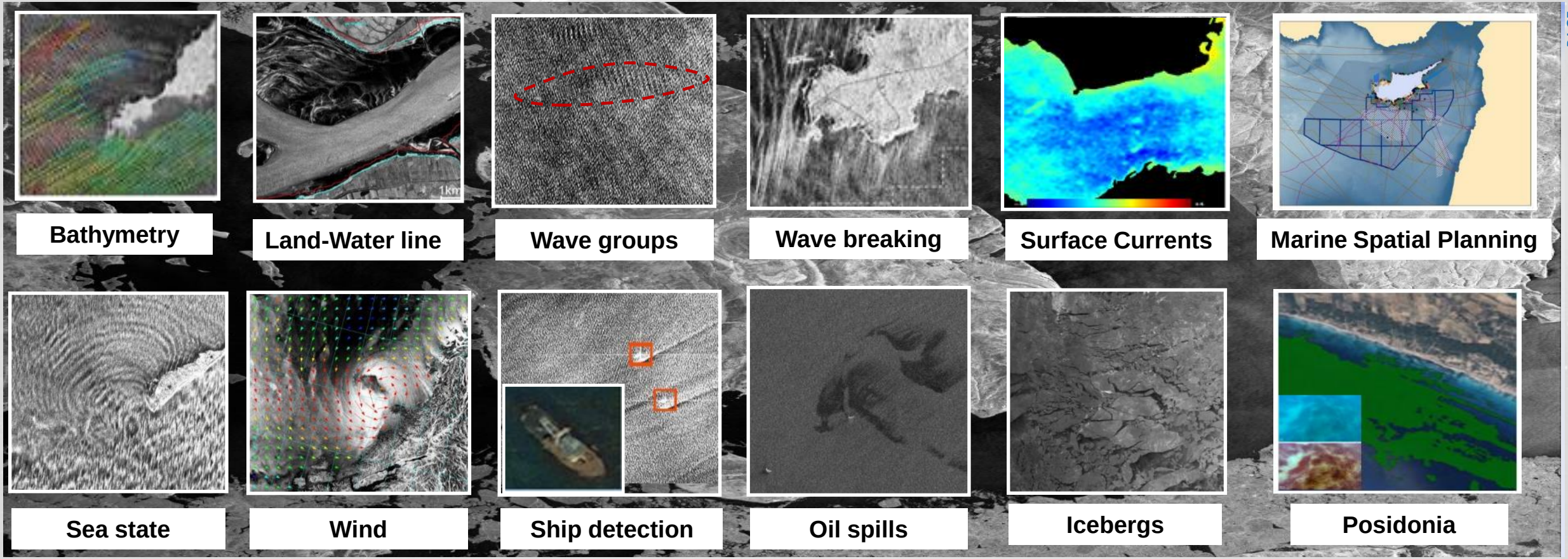
# MARINE SAFETY AND SECURITY – Activities



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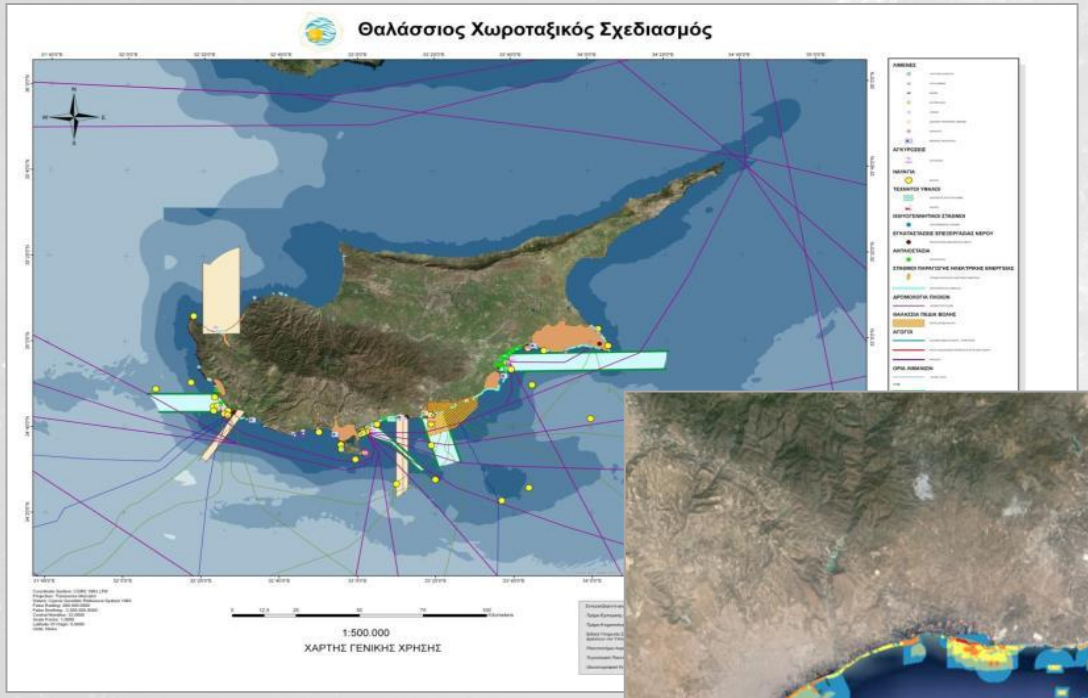
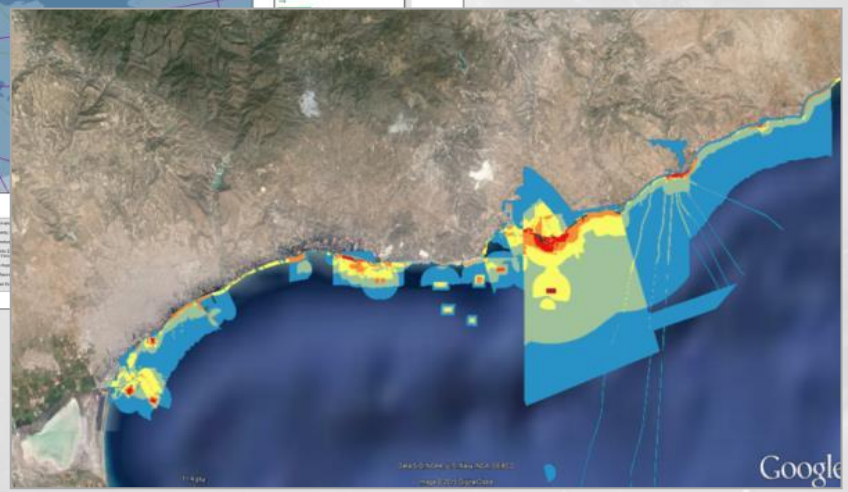
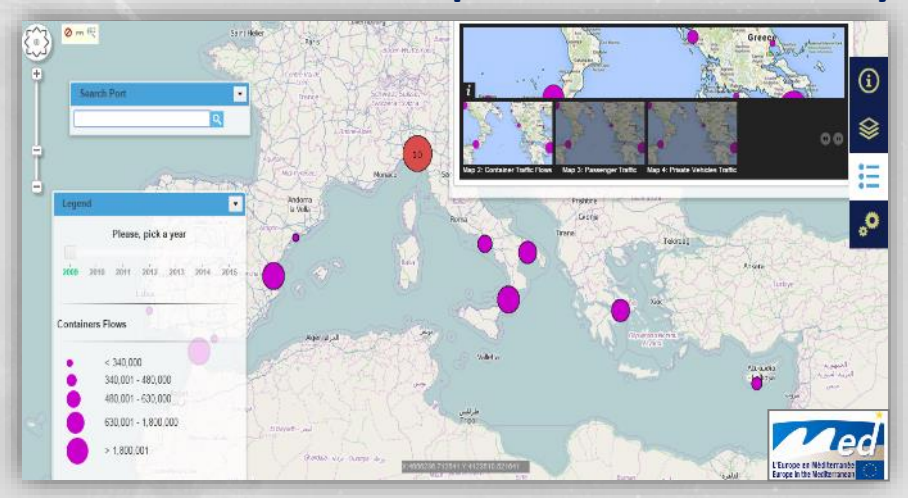
# MARINE SAFETY AND SECURITY – Examples:




## Marine Spatial Planning




## Mediterranean Port Operations Observatory




## Bathymetry using multispectral and SAR remote sensing data-SIMONA

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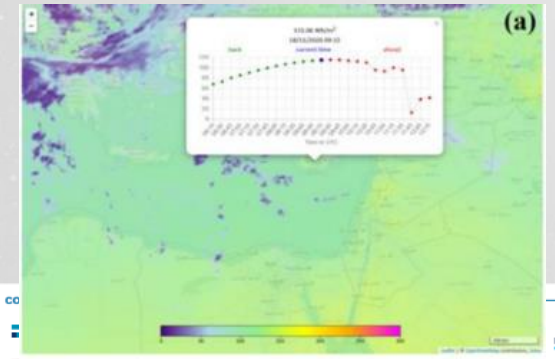
# ENERGY – Activities

## Establishment of the Solar Radiation/Energy Laboratory of ERATOSTHENES CoE (Under development)

- **Procurement for the purchase of instrumentation for the Cyprus Solar Network - CSN**


- **Solar irradiance nowcasting and short-term forecasting system (nextSENSE), optimized for the Cyprus needs**




**Monitoring of the solar energy and solar ultraviolet (UV) radiation**

**Validation of the CySENSE forecasting model products**

**CSN to be used as assimilation tool, to further improve the CySENSE products**

**Development of the CySENSE forecasting model**

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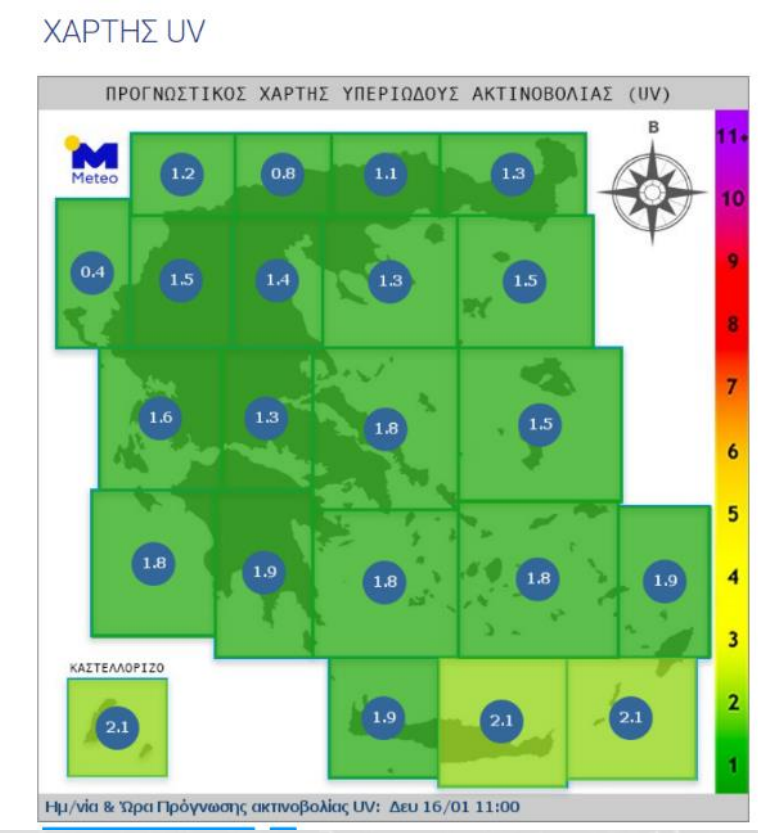
# NRT model for climatological analysis and forecasting of high UV radiation areas




## Users in Cyprus and the EMMENA Region

- National Environmental/Health agencies
- Tourism agencies/organizations
- Private Companies
- Weather forecast agencies



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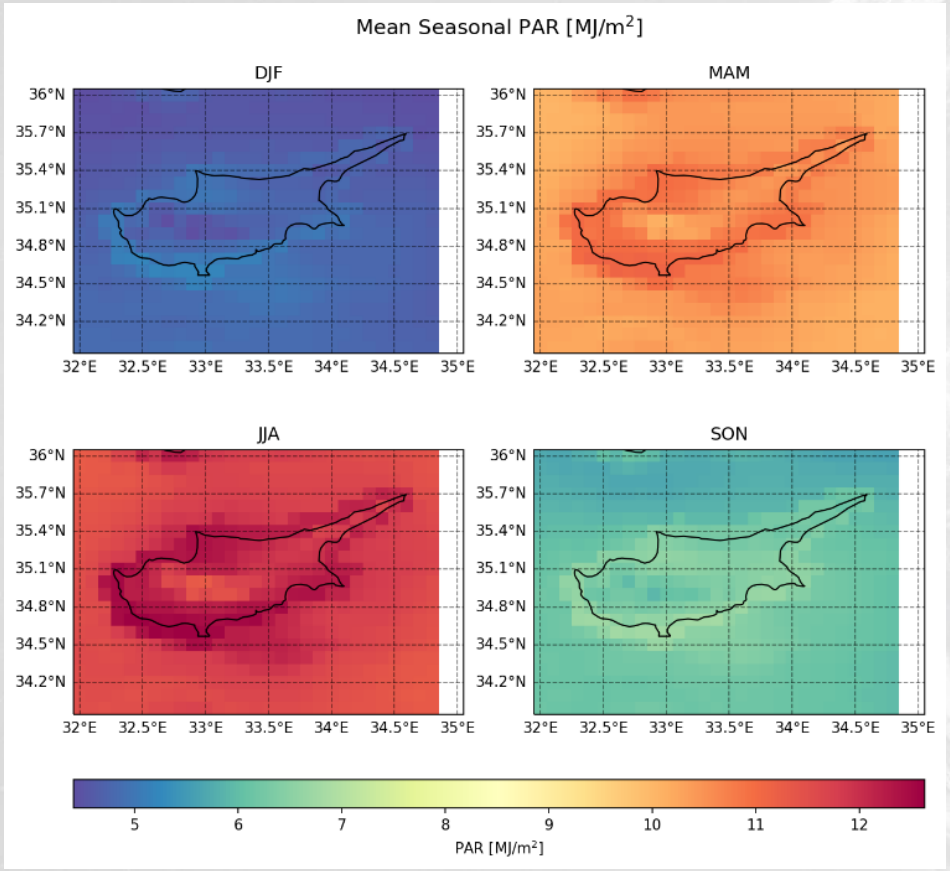
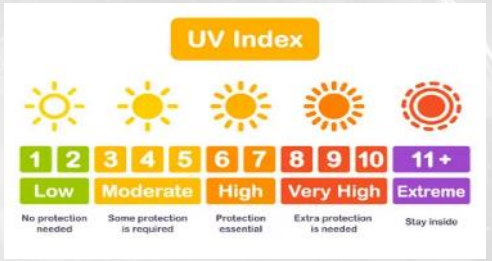
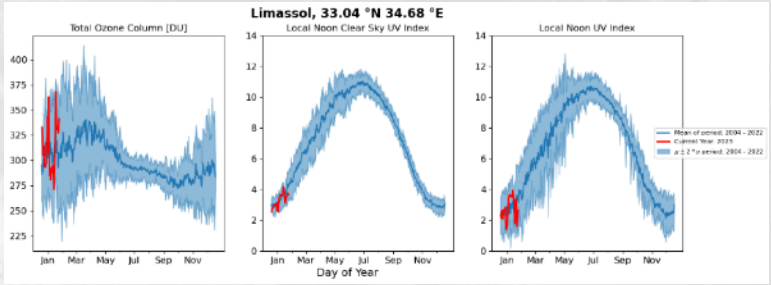


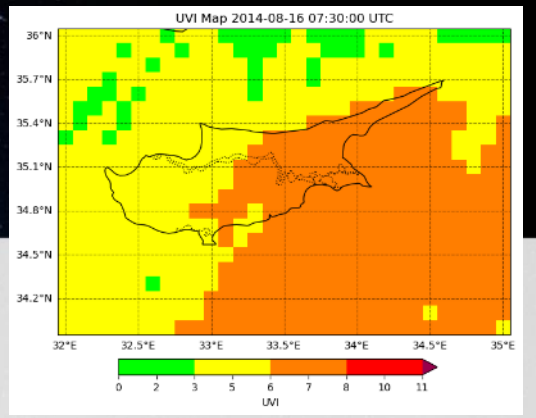

PAR climatology 2004 – 2021

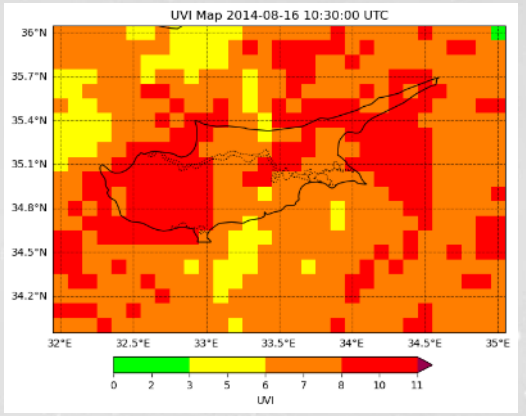


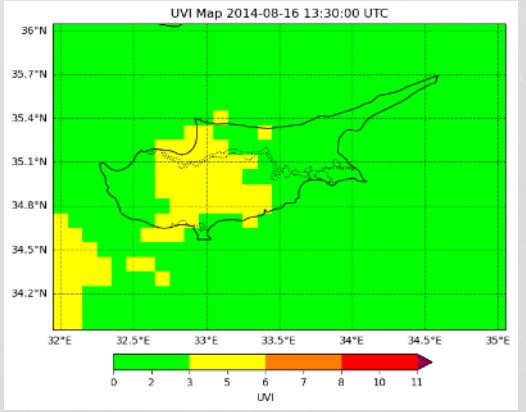

UV-Index Maps over Cyprus




Satellite UV and Ozone

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This project has received funding from the Government of the Republic of Cyprus through the "Directorate General for European Programmes, Coordination and and Development".
Cyprus University of Technology
This project is co-funded by the Cyprus University of Technology.

# New funded projects: ERATOSTHENES CoE are the coordinators (2024, 2025): 23 million euros!

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# Nostradamus



**Call:** HORIZON-CL6-2023-GOVERNANCE-01 - **Innovative governance, environmental observations and digital solutions in support of the Green Deal**

**Topic:** GOVERNANCE-01-13 **Open-source solutions for edge, cloud and mixed model applications to strengthen production and administrative capacities in agriculture**

**Project title:** **Data Cube and Copernicus data for Food Security and European Independence**

**Acronym:** **Nostradamus**

**No. Partners:** **16**

**ERATOSTHENES CoE role:** **Coordinator**

**Total budget:** **€7,888,667.50**

**ERATOSTHENES CoE budget:** **€1,241,850.00**

NOSTRADAMUS

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# LandShift



**Call:** HORIZON-CL6-2024-CLIMATE-01- **Land, oceans and water for climate action**

**Topic:** CLIMATE-01-4 **Land use change and local / regional climate**

**Project title:** **Community-Led Creation of Living Spaces in Shifting Landscapes for Climate-Resilient Land Use Management and Supporting the New European Bauhaus**

**Acronym:** **LandShift**

**No. Partners:** **26**

**ERATOSTHENES CoE role:** **Coordinator**

**Total budget:** **€8,402,633.75**

**ERATOSTHENES CoE budget:** **€754,500.00**

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# AfroGrow



**Call:** HORIZON-CL6-2024-FARM2FORK-01- **Fair, healthy and environmentally-friendly food systems from primary production to consumption**

**Topic:** FARM2FORK-01-10 **EU-African Union cooperation on agroforestry management for climate change adaptation and mitigation**

**Project title:** **Informed Decision-Making for Agroforestry Systems in Africa through a Network of Living Labs**

**Acronym:** **AfroGrow**

**No. Partners:** **26**

**ERATOSTHENES CoE role:** **Coordinator**

**Total budget:** **€8,006,756.25**

**ERATOSTHENES CoE budget:** **€787,812.50**

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# Thank you



## CONSORTIUM

Cyprus University of Technology

DLR

TROPOS
Leibniz Institute for Tropospheric Research

ERATOSTHENES CENTRE OF EXCELLENCE

DEC
DEPARTMENT OF ELECTRONIC COMMUNICATIONS

## AFFILIATED ENTITIES

CYRIC pmod wrc

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# Thank you

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## AFFILIATED ENTITIES

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