ERATOSTHENES CENTRE OF EXCELLENCE

EXCELSIOR

ERATOSTHENES Centre of Excellence

Organisation Profile, Research areas and Activities

CONSORTIUM

Cyprus University of Technology · DLR · TROPOS Leibniz Institute for Tropospheric Research · DEC Communications · ERATOSTHENES CENTRE OF EXCELLENCE

AFFILIATED ENTITIES

CYRIC · pmod wrc

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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.

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.excelsior2020.eu), by upgrading the existing Remote Sensing and Geo-Environment Lab that has been operating at CUT since 2007.

Remote Sensing & Geo-Environment Lab
Department of Civil Eng. & Geomatics
2007

ERATOSTHENES
Research Centre
2017

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EXCELSIOR – Upgrade to ERATOSTHENES Centre of Excellence

- **Funded under H2020 & Republic of Cyprus**
- **Pillar:** Spreading Excellence and Widening Participation
- **Work Programme Year:** H2020-2018-2020
- **Call:** H2020-WIDESPREAD-2018-2020
- **Topic:** WIDESPREAD-01-2018-2019 Teaming 2
- **Type of action:** CSA (Coordination and support action)
- **Grant Agreement number:** 857510, Acronym: EXCELSIOR
- **Total Budget:** >38,000,000 € (15 millions from EC+ 15 from Republic of Cyprus+ 8 millions from CUT, etc.)
- **Duration:** 7 Years (EC) + 8 years (Republic of Cyprus/RC)
- **Start:** 1 October 2019 / End: 30 September 2026 (EC) / 30 September 2034 (RC)

For more information visit: https://excelsior2020.eu/ and https://eratosthenes.org.cy/

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Mission and vision

- **Our mission:**

  To **upgrade the existing Remote Sensing & Geo-Environment Lab (ERATOSTHENES Research Centre)**, within the Faculty of Engineering & Technology of the Cyprus University of Technology (since 2007), into a **sustainable, viable and autonomous** Centre of Excellence: **the ERATOSTHENES Centre of Excellence (ECoE).**

- **Our vision:**

  The ERATOSTHENES CoE, becomes a **world-class Digital Innovation Hub (DIH) for EO and Geospatial Information** and develops into the **reference Centre in the Eastern Mediterranean, Middle East and North Africa Region (EMMENA)**.

- The Digital Innovation Hub will create an ecosystem which combines **state-of-the-art remote sensing, data management and processing technologies**, cutting – edge research opportunities, targeted education services and promotion of entrepreneurship. In order to be dynamic and innovative, the Digital Innovation Hub will be based on two major infrastructures, which are a Satellite Ground Receiving Station and a Ground-based atmospheric remote sensing station. ERATOSTHENES Centre of excellence is paving the way for Cyprus to enter the space arena.

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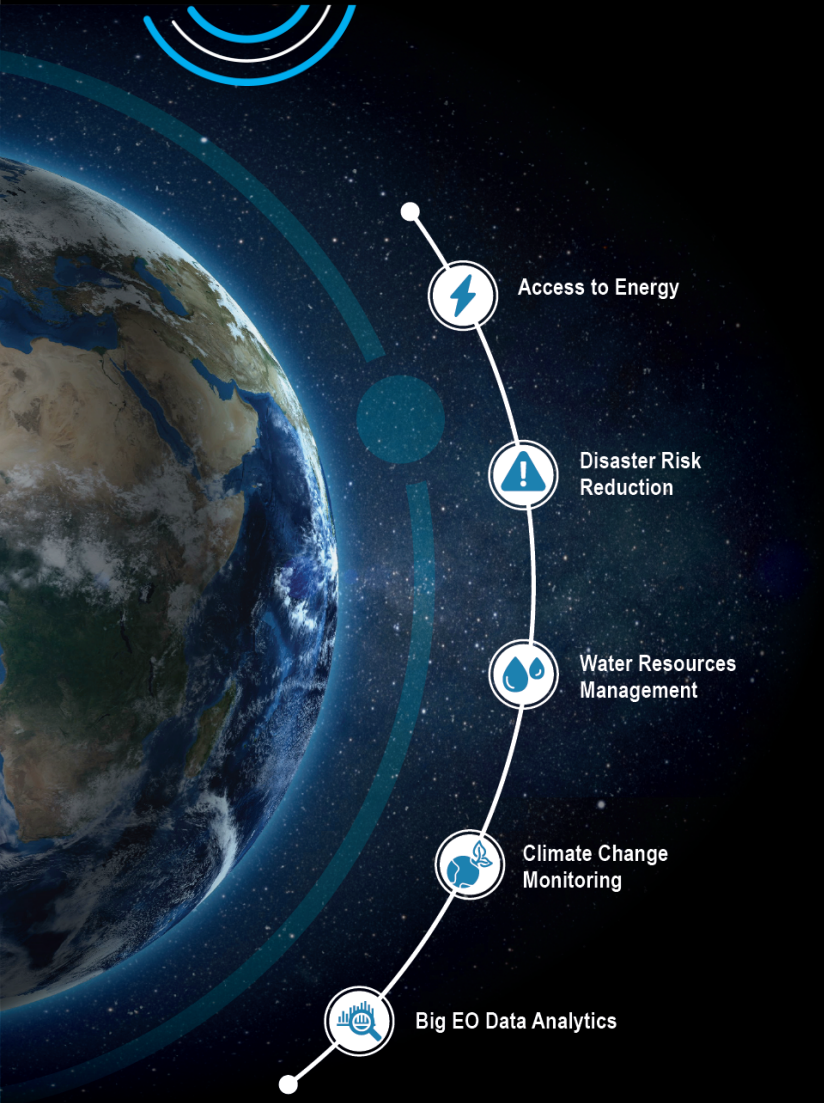
ERATOSTHENES CENTRE OF EXCELLENCE

EXCELSIOR



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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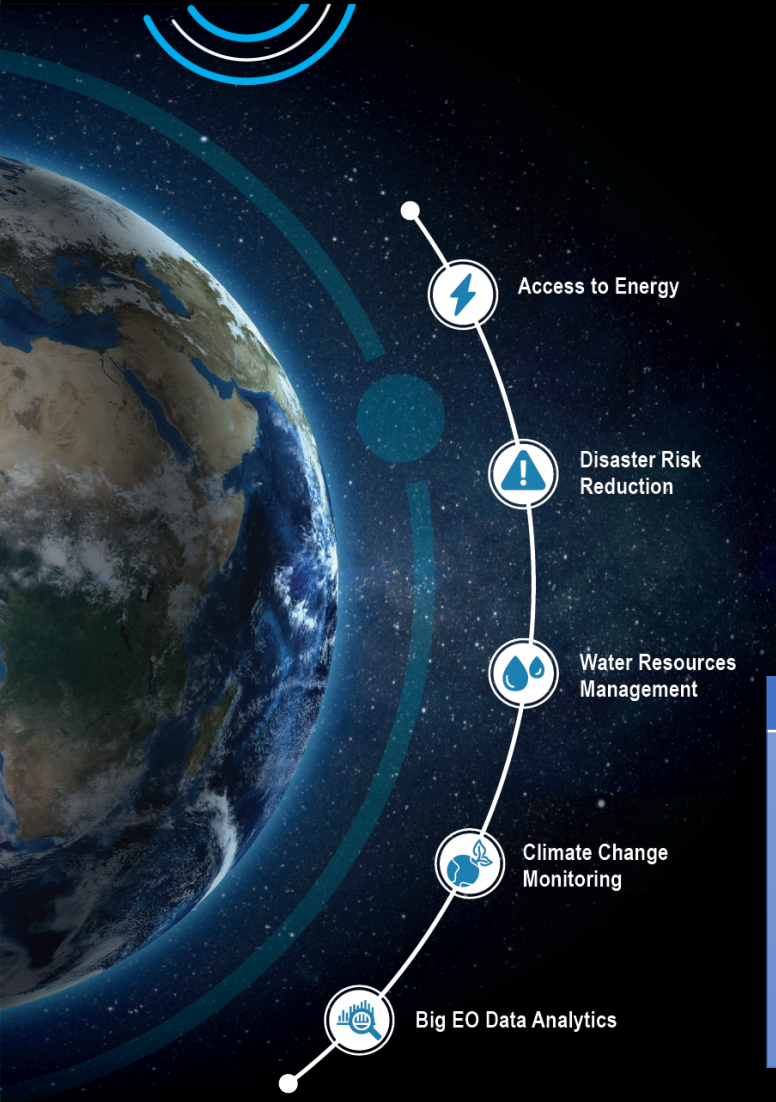
Digital Innovation Hub



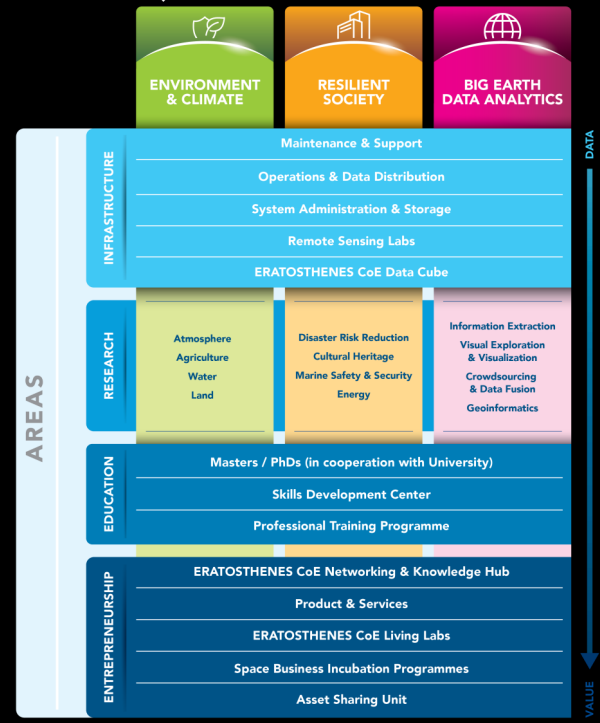
Thematic Clusters

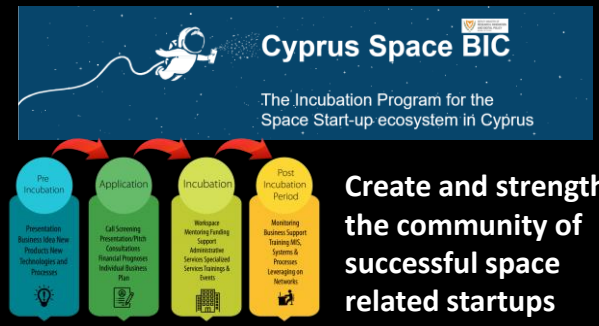
Environment and Climate	Resilient Society	Big Earth Data Analytics
• Atmosphere • Agriculture • Water • Land	• Disasters Risk Reduction • Cultural Heritage • Marine Safety & Security • Energy	• Information extraction • Visual exploration & visualization • Crowd sourcing & data fusion • Geo-informatics

Added Value Functional Areas

Infrastructure	Research	Education	Entrepreneurship
• Infrastructure maintenance & support • Infrastructure integration (operations & data distribution) • Systems administration and storage	• Environment and Climate • Resilient Society • Big Earth Data analytics	• Joint MSc-PhD • Professional Training Programme • Skills Development Centre	• Networking Hub • Space Cluster & Innovation Hub • Incubator Programme • Asset Sharing Unit

EXCELSIOR





Create and strengthen the community of successful space related startups

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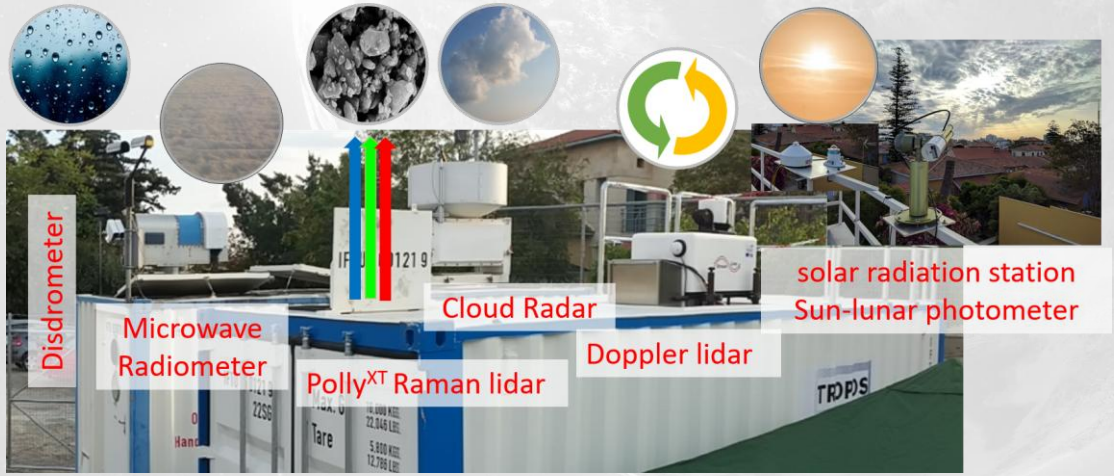
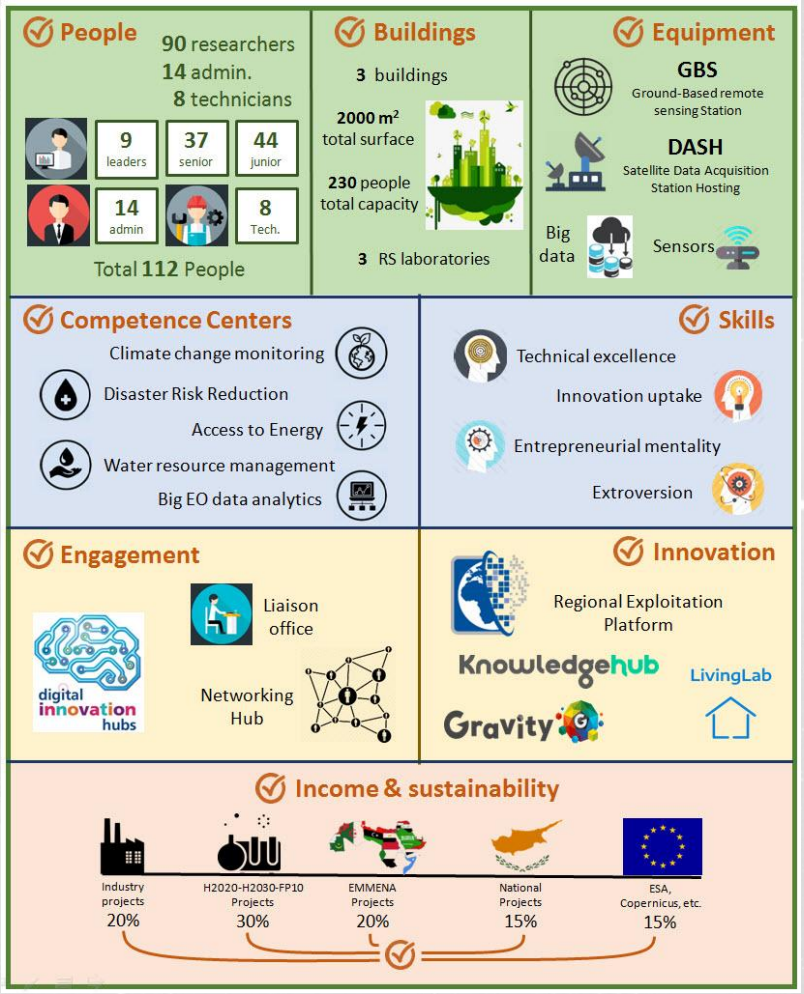
Investment

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





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Collaborations

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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>64 MoU agreements

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

National Support and Commitment from 19 Governmental Departments

WDD TAY · ΤΠΟ · Invest Cyprus · ρυθμιστική αρχή ενέργειας κύπρου cyprus energy regulatory authority · ΤΜΗΜΑ ΔΑΣΩΝ · DEPARTMENT OF ENVIRONMENT · Cyprus in your heart · 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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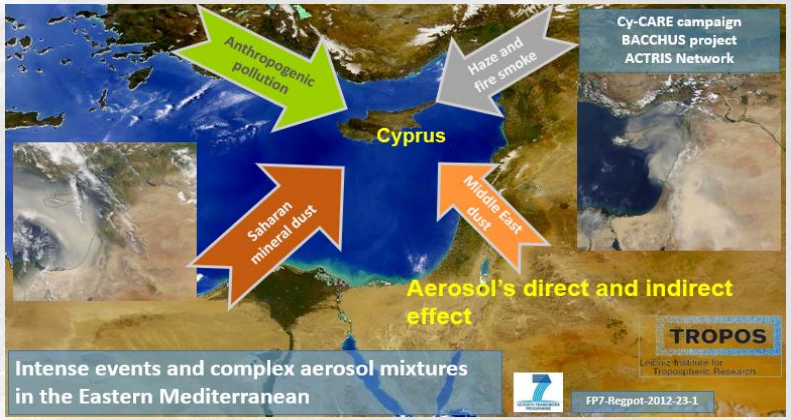
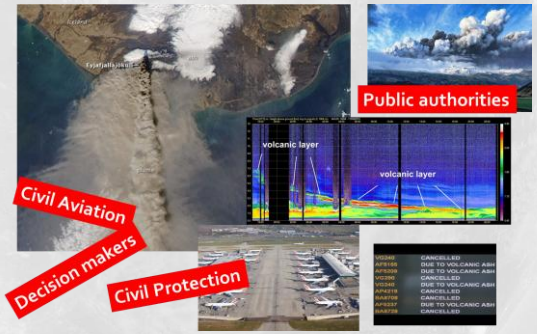
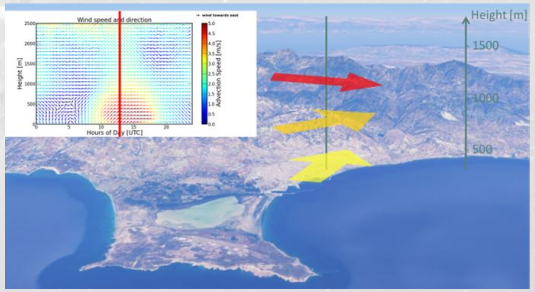
ATMOSPHERE – Activities

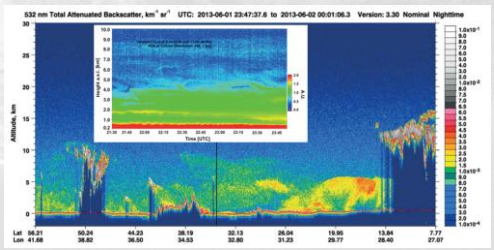
- Air Quality and Air pollution monitoring
- Aerosol-Clouds-Precipitation Interaction
- Atmospheric Dynamics and Wind
- Monitoring of Extreme Atmospheric Events
- Dust storms and Dust intrusion
- Climate change monitoring
- Atmospheric model Validation & Assimilation
- CAL/VAL Activities for Satellite Mission
- Planning ACTRIS National Facilities
- Aerosol and Cloud Remote Sensing

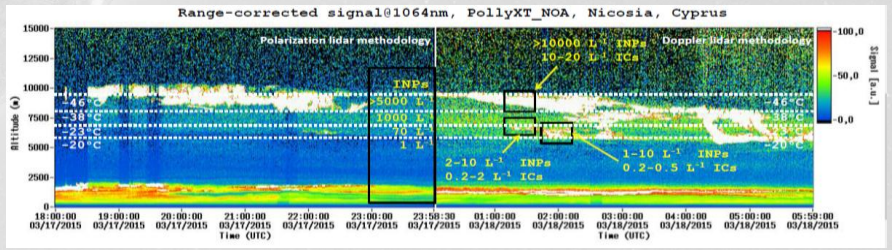
Observational Platforms











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ATMOSPHERE – Experience (Relevant projects):

- **ILATIC (Cyprus RPF-PENEK):** Integrated use of lidar Techniques for the study of Air pollution and optical properties of the Atmosphere in Cyprus
- **AIRSPACE (Cyprus RPF):** Air Pollution Monitoring from Space in Cyprus
- **WEBAIR (EUREKA):** Web and 3G mobile phone-based air quality management: particulates, public health, co-benefits, https://www.webair2.com/
- **BACCHUS (FP7):** Impact of Biogenic versus Anthropogenic emissions on Clouds and Climate: towards a Holistic Understanding, https://www.bacchus-env.eu/
- **ACTRIS (H2020-INFRASTRUCTURES):** Aerosol, Cloud and Trace Gases Research Infrastructures, https://www.actris.eu/
- **SIROCCO (Cyprus RIF/EXCELLENCE HUBS):** "Study of Precipitation, Aerosol and Clouds in a Coastal Area", https://sirocco.cut.ac.cy/
- **AQ-SERVE (Cyprus RIF/INTEGRATED):** Air Quality Services in Cyprus, https://aqserve-project.com/
- **ACCEPT (Norway Grants):** Assessment of Climate Change Effects on Pollution Transport in Cyprus", https://accept.cyi.ac.cy/?p=387

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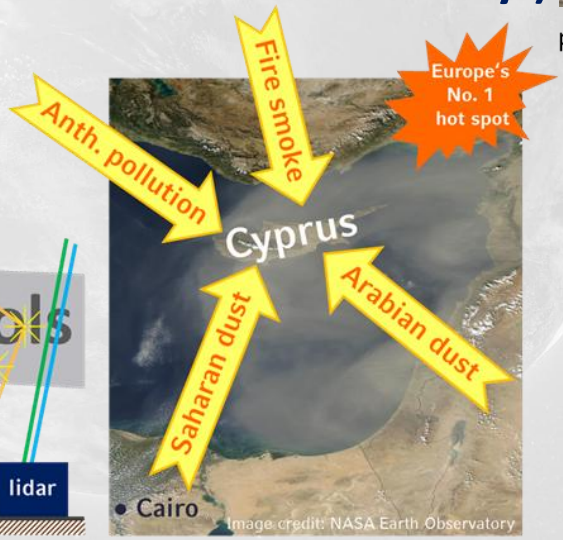
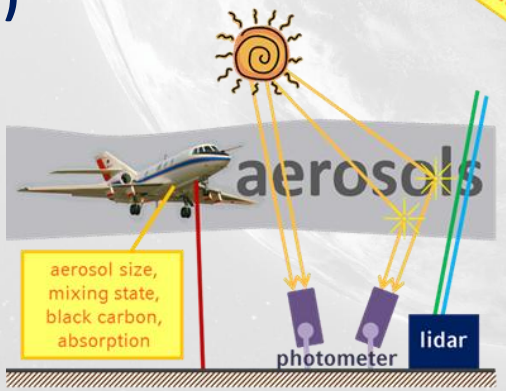
ATMOSPHERE – Experience (International collaborations & field campaigns):

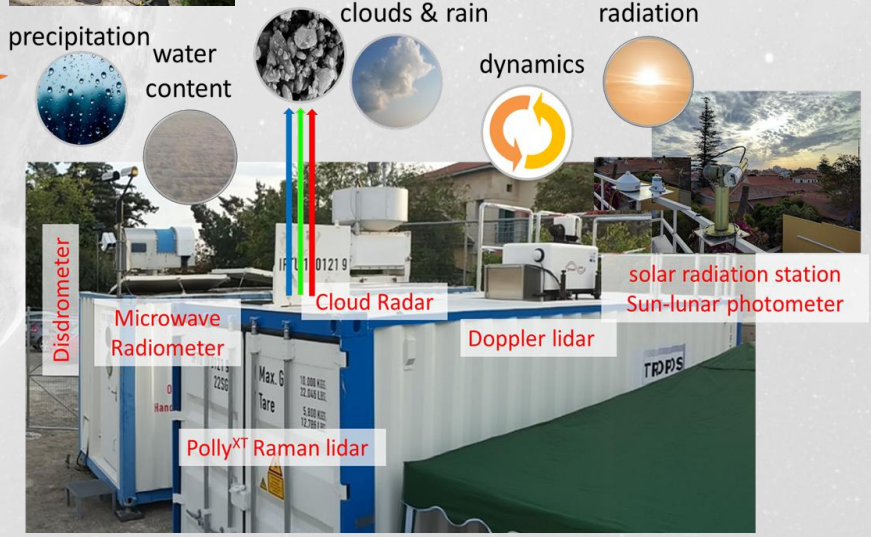
- **BACCHUS-CHARMEX campaign (CUT-TROPOS-CyI)**

A-LIFE (CUT-TROPOS-UVienna- DLR- CyI)





CREATE campaign (CUT-FMI)



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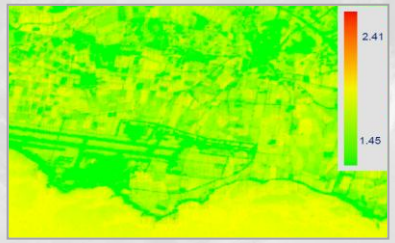
AGRICULTURE – Activities

- 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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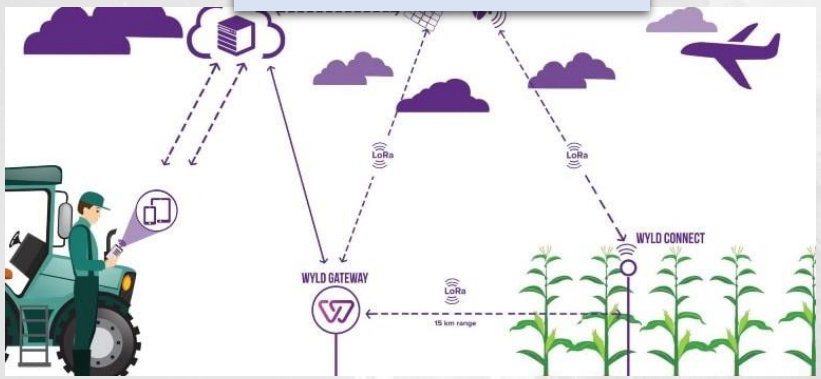
AGRICULTURE – Living Labs

Technology-enhanced Agriculture

Smart Water Resources Management for Irrigation & Precision Agriculture



- ECOSYSTEM to co-design, monitor and evaluate new and existing agricultural practices and technologies
- AIMING to improve their effectiveness and early adoption
- BRINGING TOGETHER: Farmers, Scientists, Policymakers, the Agri-food industry and other interested Private and Public Actors

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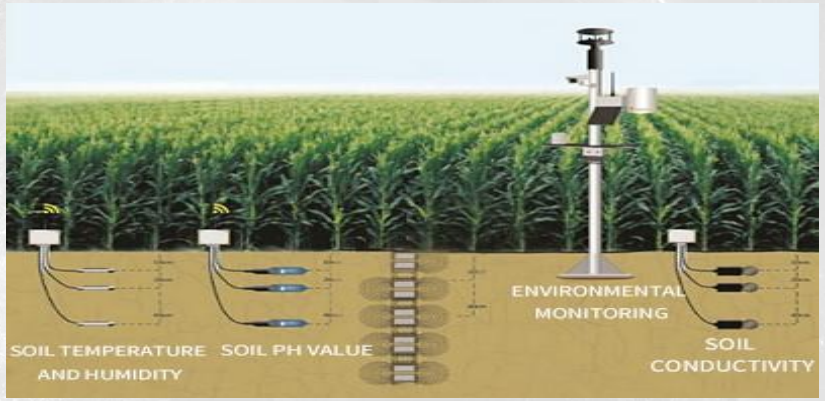
AGRICULTURE – Living Labs

Smart Water Resources Management for Irrigation & Precision Agriculture

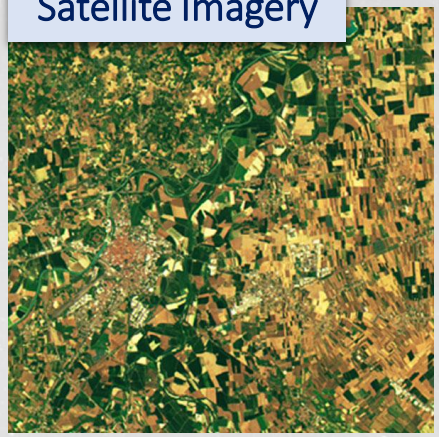
UAV Imagery

Cloud Computing Infrastructure
Real-Time Data
Meteorological Data



Precise Agriculture through Living Labs

Satellite Imagery



Spectral Signatures

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AGRICULTURE – Experience (Relevant projects):

- **CARBONICA (Horizon Europe):** Carbon Initiative for Climate-resilient Agriculture
- **GreenCarbonCY (Cyprus RIF):** Transitioning to Green agriculture by assessing and mitigating Carbon emissions from agricultural soils in Cyprus
- **SWSOIP (ESA PECS):** Smart Watering System for Optimising Irrigation Process, https://www.swsoip.com/
- **CROSS (ESA PECS):** Identification of arable CROps and CAP monitoring in cypruS through the adoption of Sen4CAP-CROSS II
- **CROSS II (ESA PECS):** Identification of arable CROps and CAP monitoring in cypruS through the adoption of Sen4CAP-CROSS, http://cross-cap.eu/
- **CASCADE (FP7):** CAtastrophic Shifts in drylands: how CAn we prevent ecosystem DEgradation?, https://cordis.europa.eu/project/id/283068
- **RedScale (Cyprus RPF):** Development Of An Automated System For Monitoring Redscale Population Using Image Analysis, Wireless Networks And GIS Technologies
- **ETc (Cyprus RPF - PENEK):** Estimation of Evapotraspiration in irrigated crops using satellite remote sensing and wireless sensors

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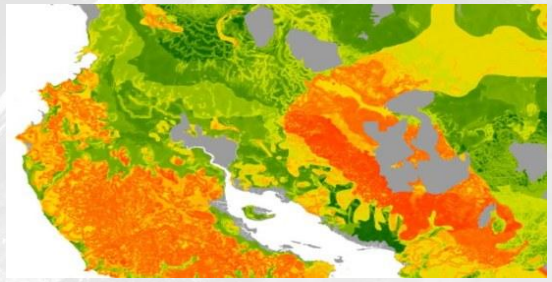
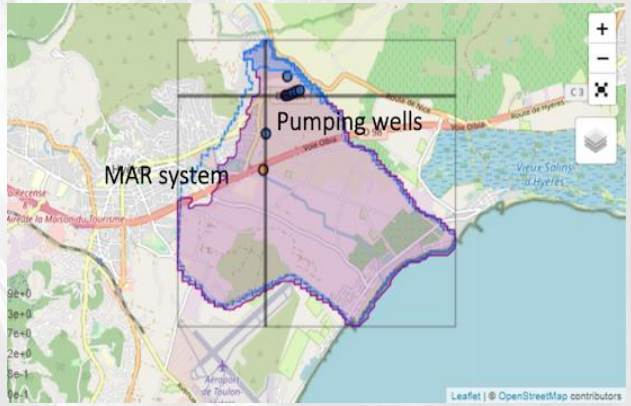
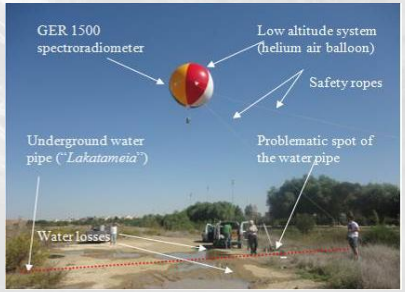
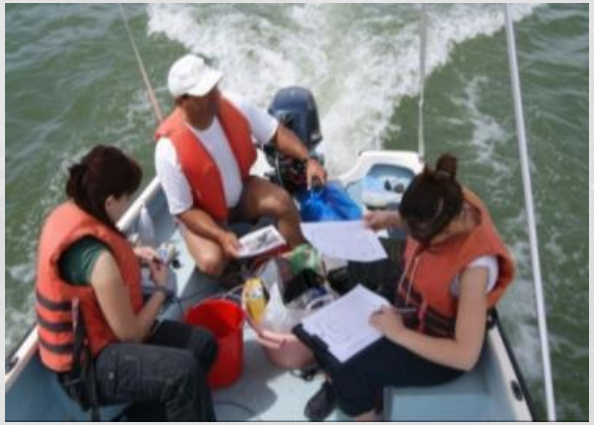
WATER – Activities

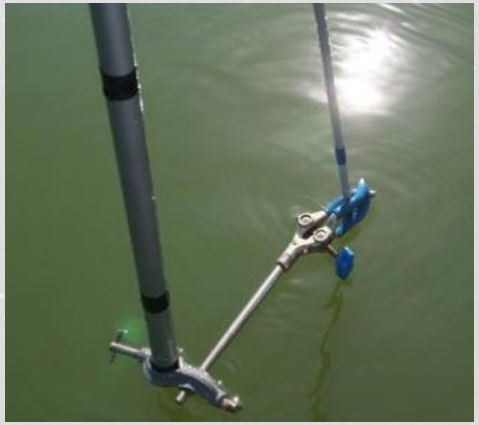
- Water quality monitoring
- Water resource management
- Microbial risk assessment
- Water leak detection
- Managed aquifer recharge
- Hydrogeological modeling
- Groundwater modeling
- Feasibility mapping











agreeMAR
PRIMA PARTNERSHIP FOR RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA

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WATER – Experience (Relevant projects):

- **AGREEMAR (PRIMA):** Adaptive agreements on benefits sharing for managed aquifer recharge in the Mediterranean region, https://agreemar.inowas.com
- **WATERLEAKS (Cyprus RIF):** Combining satellite imagery, in-situ spectroradiometric data and radar techniques for the identification of water leakages in the water supply network in rural areas in Cyprus, http://www.cyprusremotesensing.com/waterleaks/
- **SATFLOOD (Cyprus RIF):** Combined use of satellite remote sensing and hydraulic simulation for flood risk assessment at catchment scale in Cyprus, http://www.cyprusremotesensing.com/research-grants/integrated-use-of-satellite-remote-sensing-and-hydraulic-modeling-for-the-flood-risk-assessment-at-a-catchment-scale-in-cyprus
- **SATCOAST (Cyprus RIF):** Monitoring and observation of coastal water quality in Cyprus using remote sensing techniques, http://www.cyprusremotesensing.com/research-grants/coastal-water-quality-using-earth-observation-in-cyprus
- **HYDROGIS (Cyprus RIF):** Upgrade of the hydraulics laboratory for the modeling of water supply networks & design and operation optimization study, http://www.cyprusremotesensing.com/hydrogis/
- **SEO-DWARF (H2020/MSCA-RISE):** Semantic EO Data Web Alert and Retrieval Framework, https://cordis.europa.eu/project/id/691071

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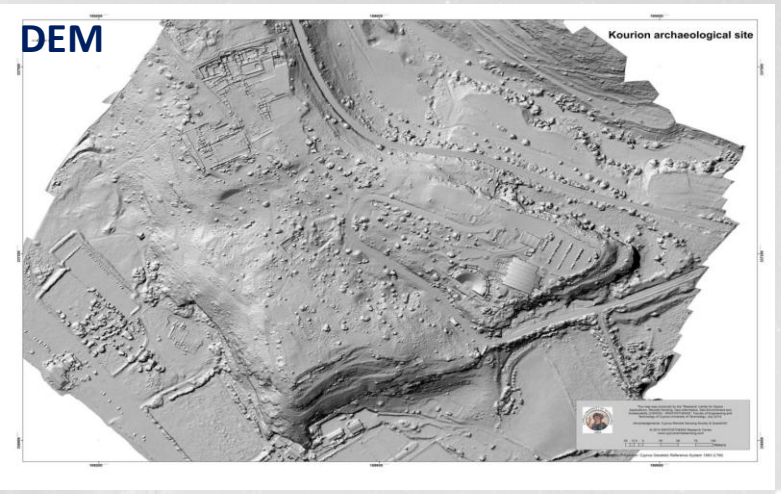
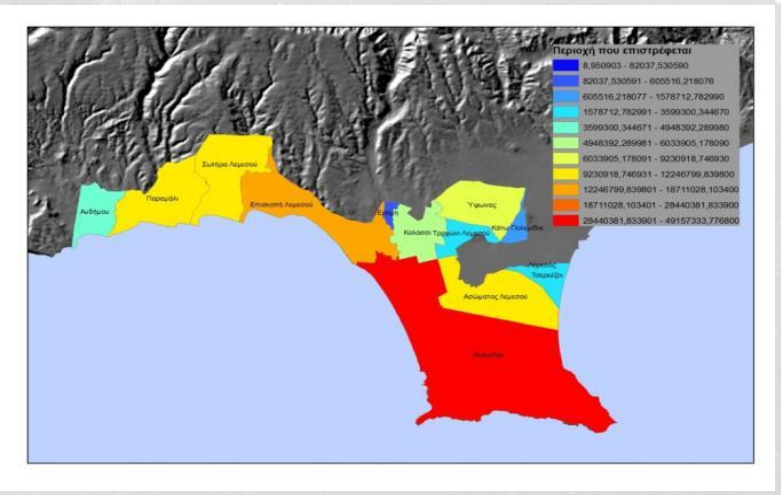
LAND – Activities

- Land Cover/ Land Use changes
- Urban sprawl monitoring
- Real Estate
- Heat island
- Spatial planning
- Urban and regional planning
- Land Management Information systems
- DEM generation
- Photogrammetric applications





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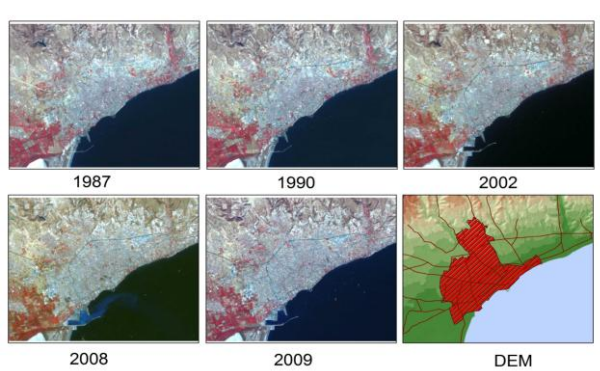
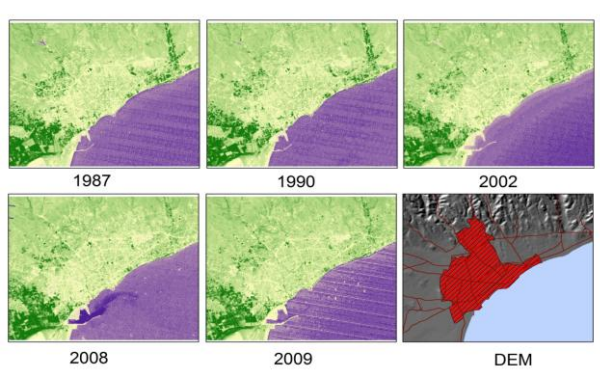
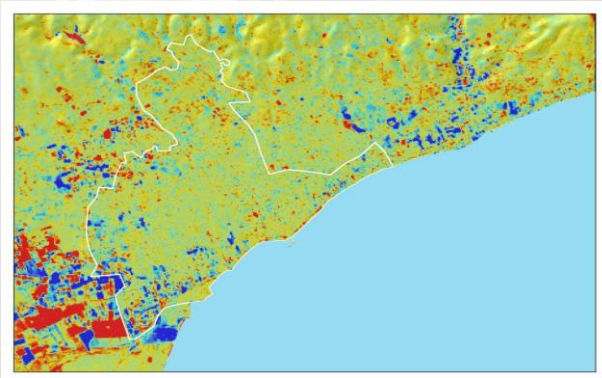
LAND – Examples

Limassol District Area Land Cover Changes (1987– 2009)







Study the urban heat island effect in Cyprus based on both multi-temporal satellite and meteorological data

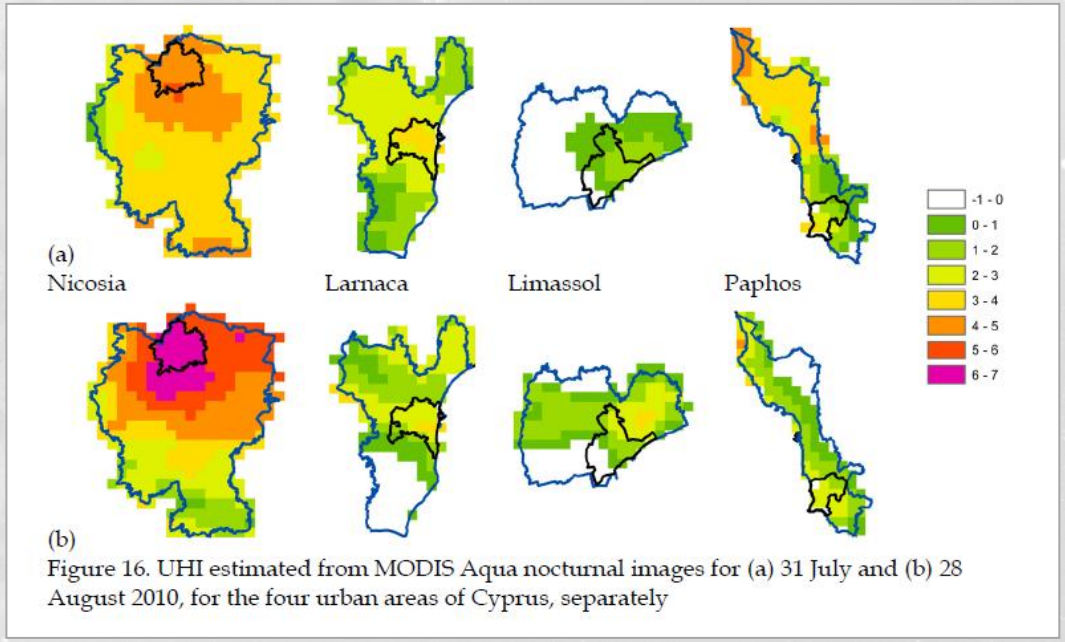


Figure 16. UHI estimated from MODIS Aqua nocturnal images for (a) 31 July and (b) 28 August 2010, for the four urban areas of Cyprus, separately

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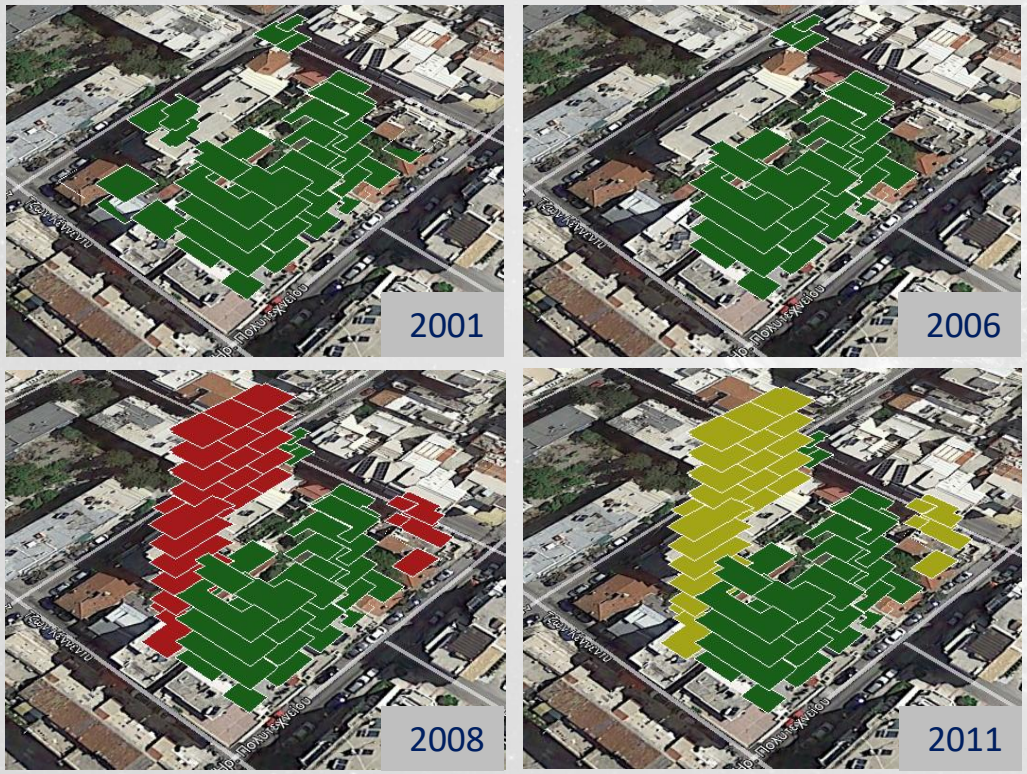
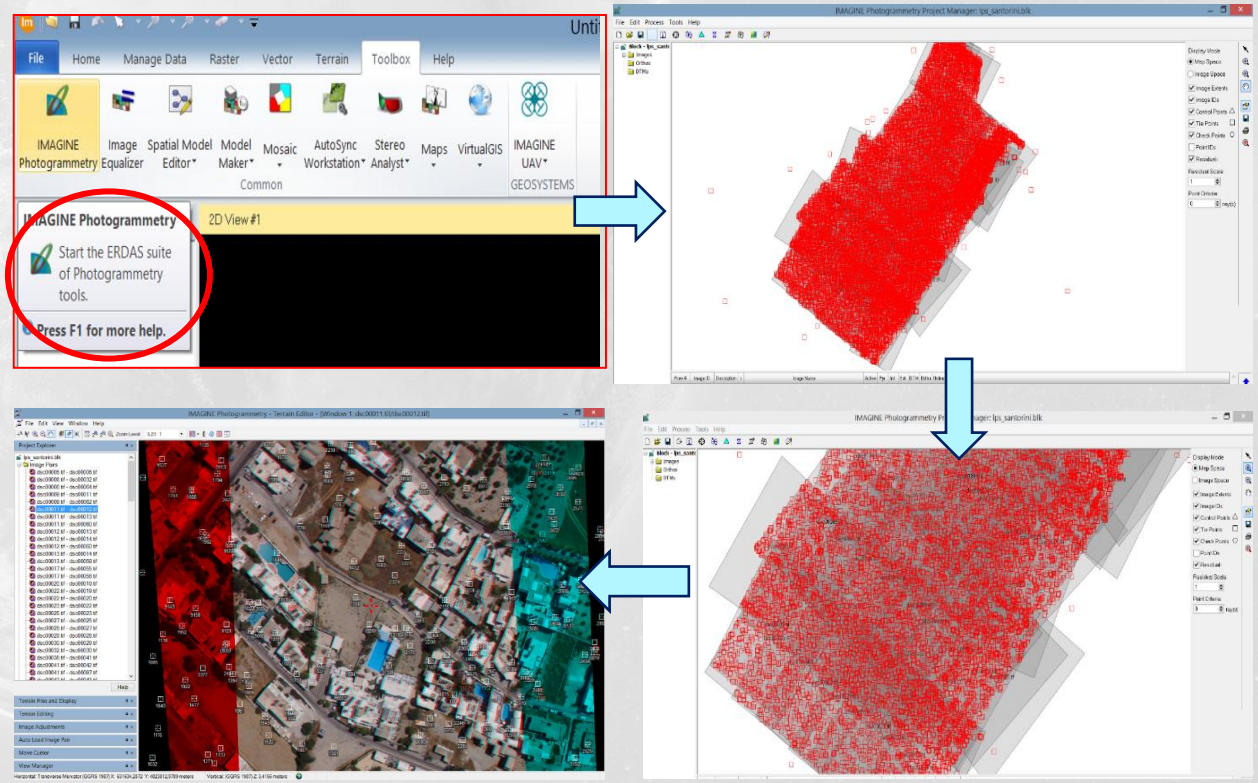
LAND – Examples

Land Management Information Systems



Mapping of semi-urban areas



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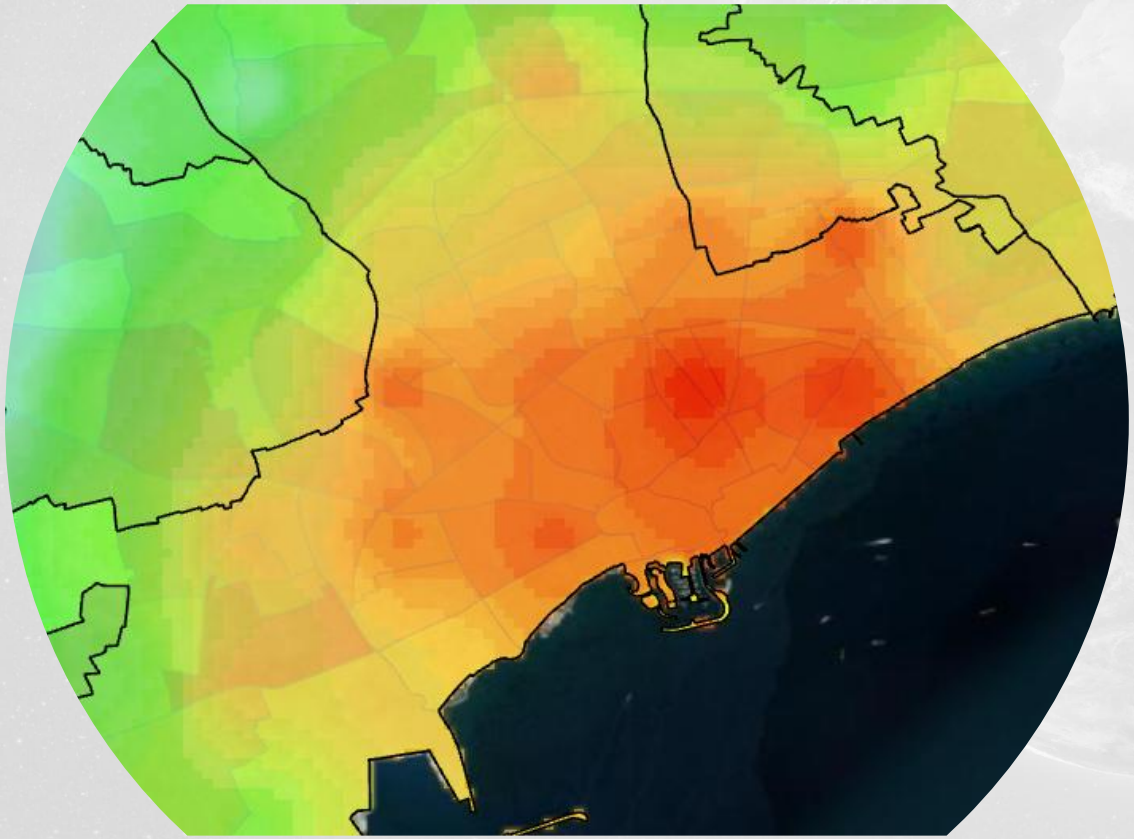
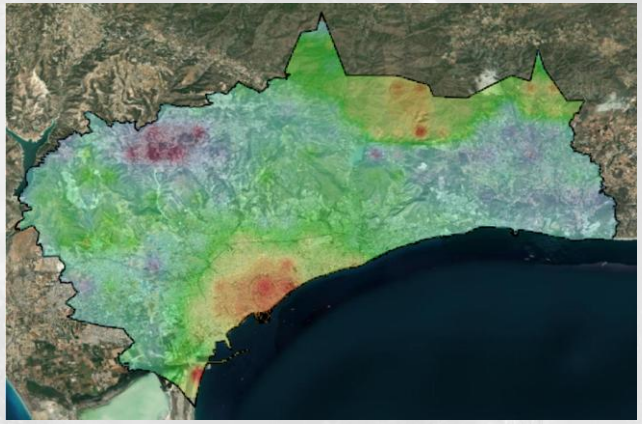
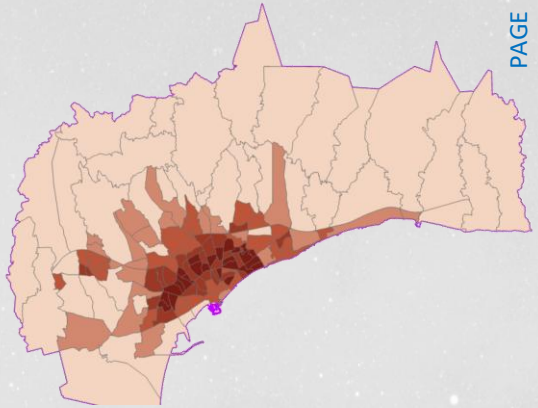
LAND – Examples

Urban monitoring: Heat Island Effect







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LAND – Experience (Relevant projects):

- **CORINE Land Cover 2018:** Mapping of Land Use changes for Cyprus in 2018 for the development of Corine Land Cover 2018 data in the framework of the Copernicus Programme (Global Monitoring for Environment and Security)
- **Heat Island (Cyprus RPF):** Study of the urban heat island effect in Cyprus.
- **ValPro (ERACOBUILD/ Cyprus RPF):** Value Driven Procurement in Building and Real Estate Sector, https://valpro.eu/
- **ArcLand (EC - Culture 2007-2013):** Archaeolandscapes Europe, http://www.arcland.eu/
- **SEO-DWARF (H2020/MSCA-RISE):** Semantic EO Data Web Alert and Retrieval Framework, https://cordis.europa.eu/project/id/691071

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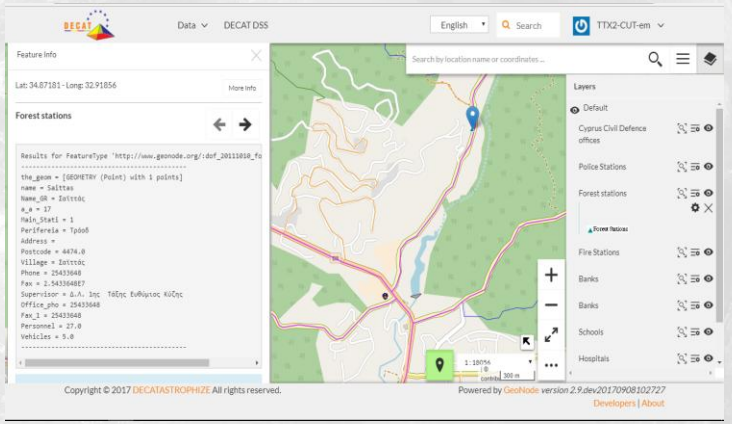
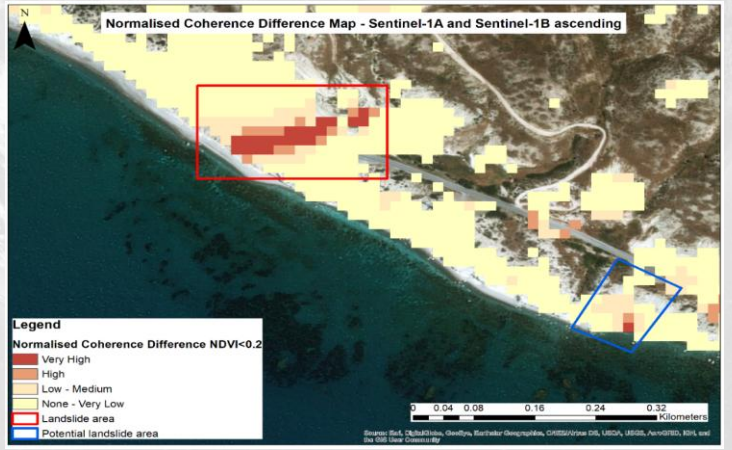
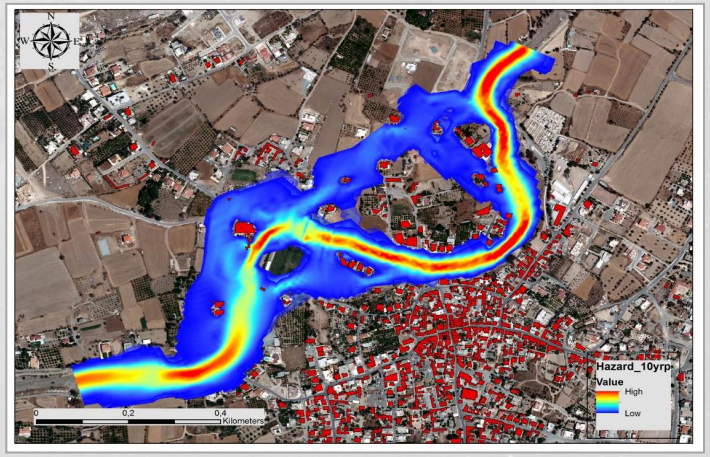
DISASTER RISK REDUCTION – Activities

AI OBSERVER

- Forest fire monitoring
- Burnt area mapping
- Systematic monitoring of geohazards
- Soil erosion detection
- Soil degradation/desertification
- Floods monitoring
- Epidemics/Health
- Impact assessment
- Disaster management
- Early Warning Systems
- Decision Support Systems







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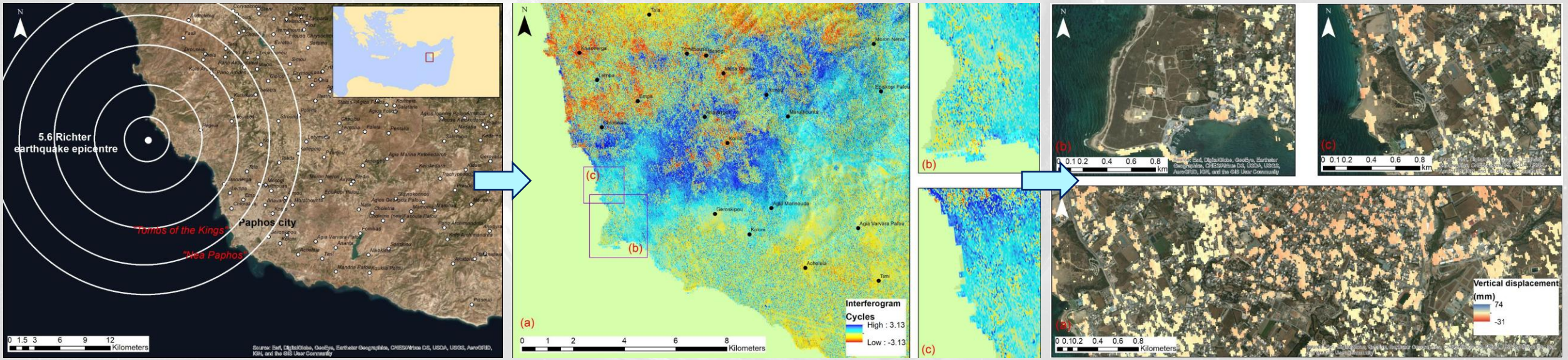
DISASTER RISK REDUCTION – Earthquakes/Landslides

- **Earthquake impact assessment and mapping after seismic events using satellite data such as Sentinel-1, Sentinel-2, Landsat-8, etc.**



~cm- to mm-level relative land displacement and velocity determination

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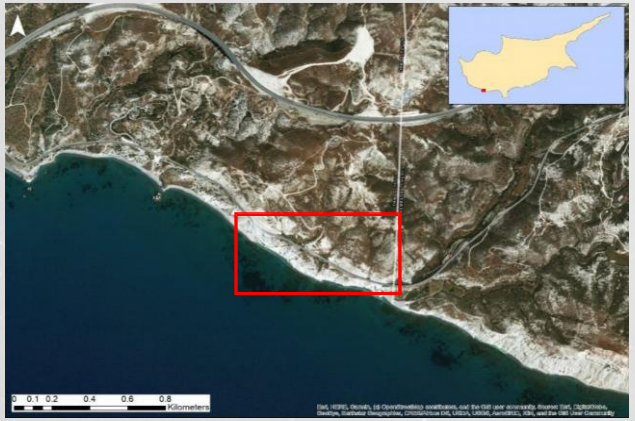
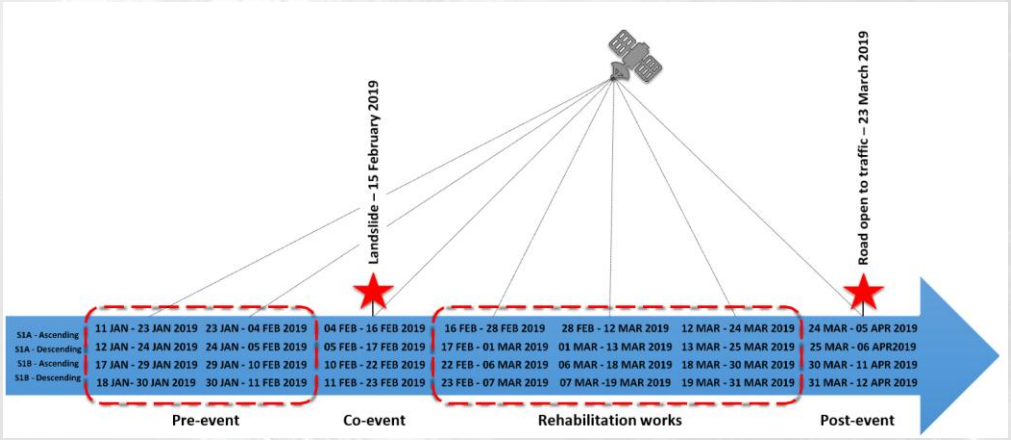
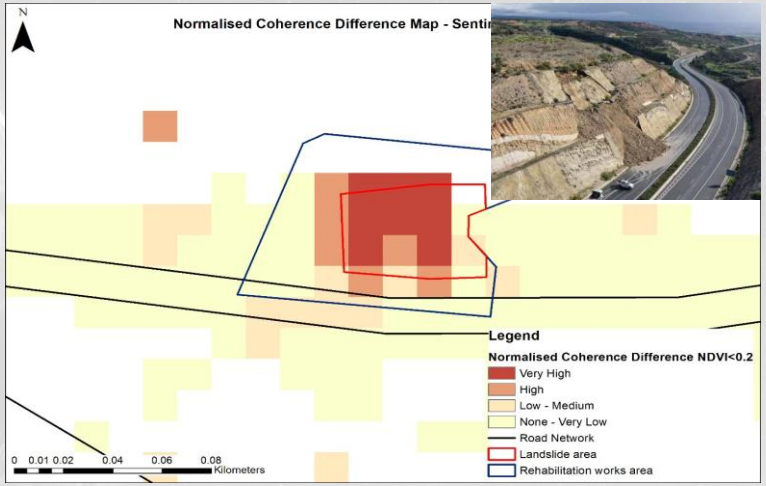
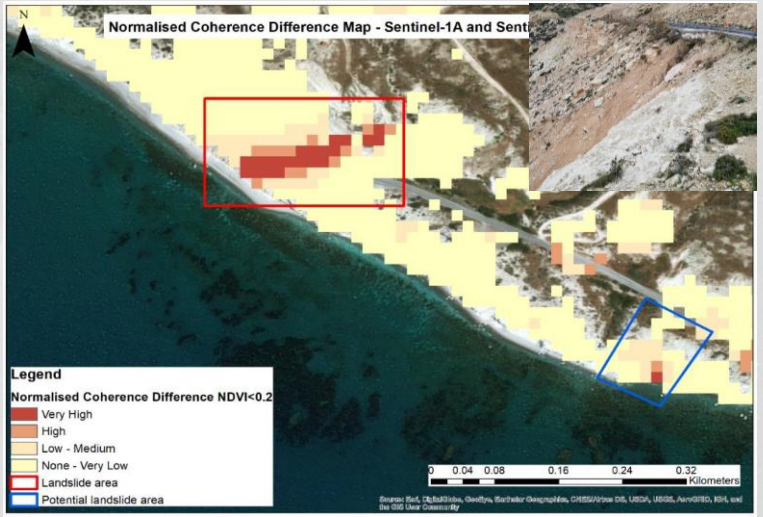
DISASTER RISK REDUCTION – Earthquakes/Landslides



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







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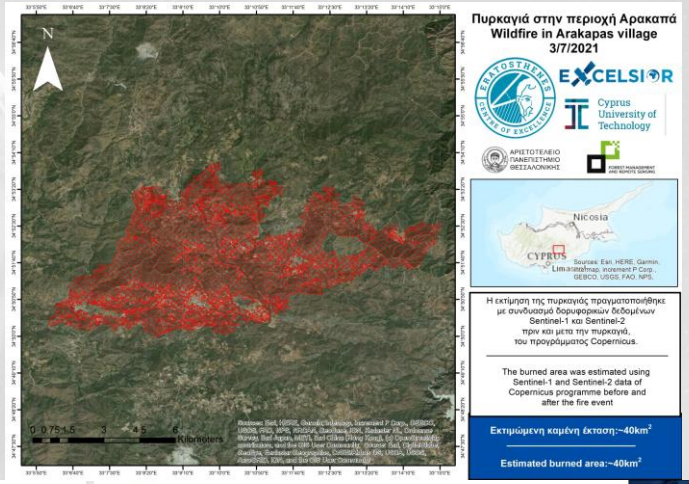
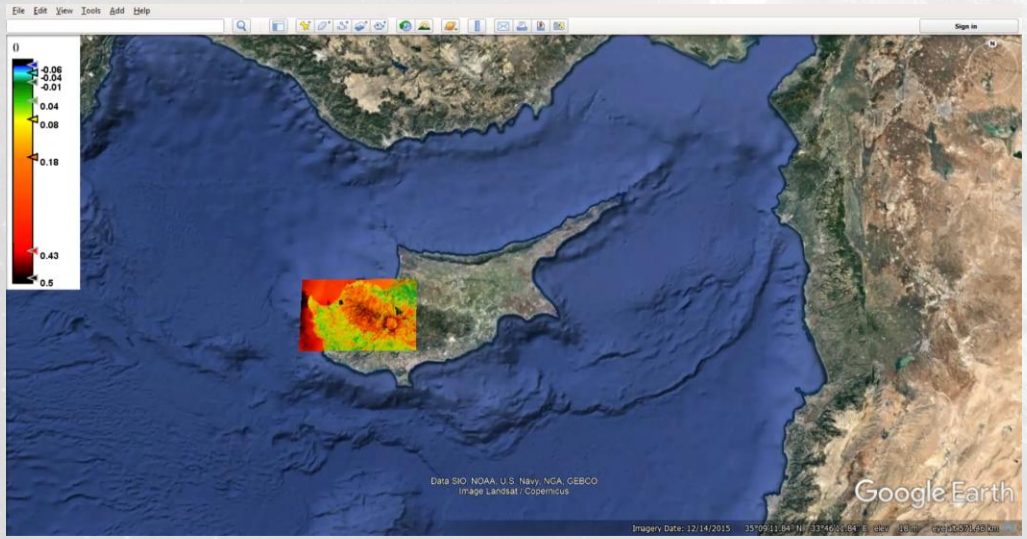
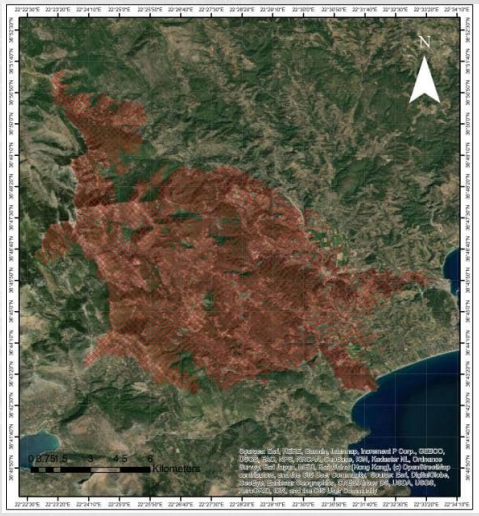
DISASTER RISK REDUCTION – Forest Fires

- **Burnt area estimation and mapping after fire events using satellite data such as Sentinel-1, Sentinel-2, Landsat-8, Planet etc.**







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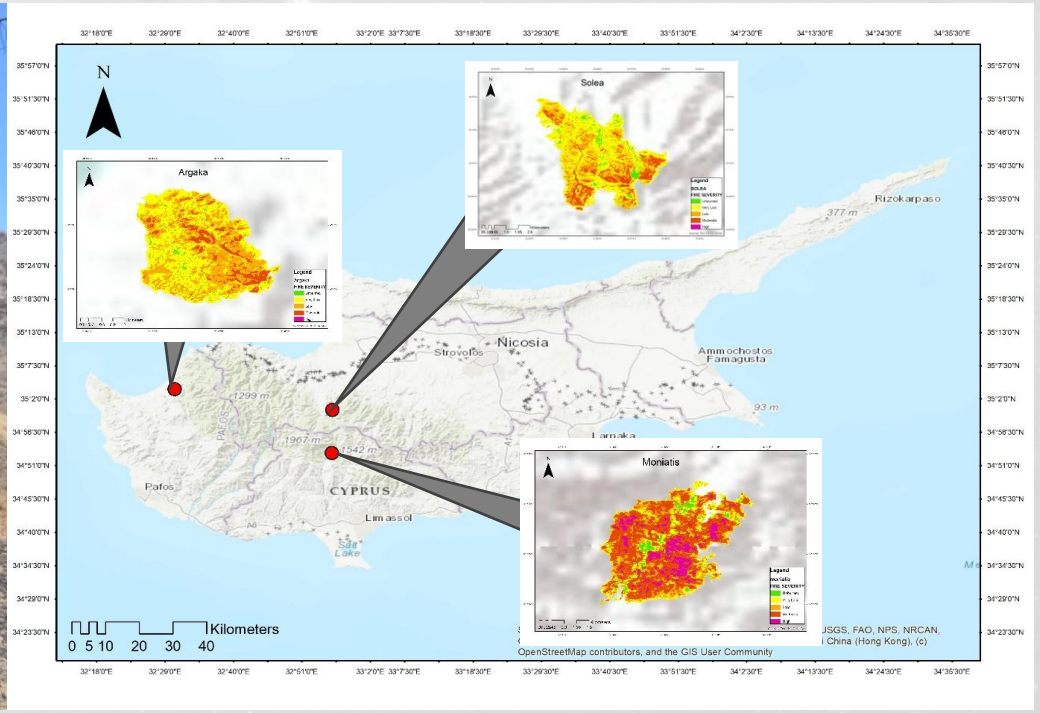
DISASTER RISK REDUCTION – Forest Fires

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

Fire severity estimation using Differenced Normalized Burn Ratio (dNBR)



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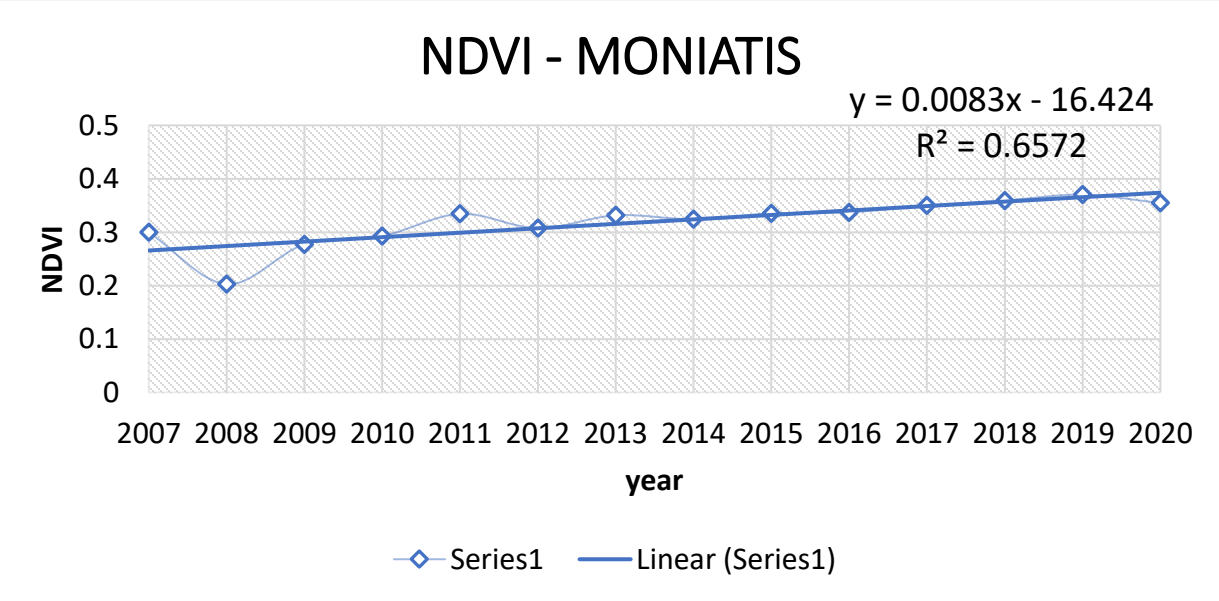
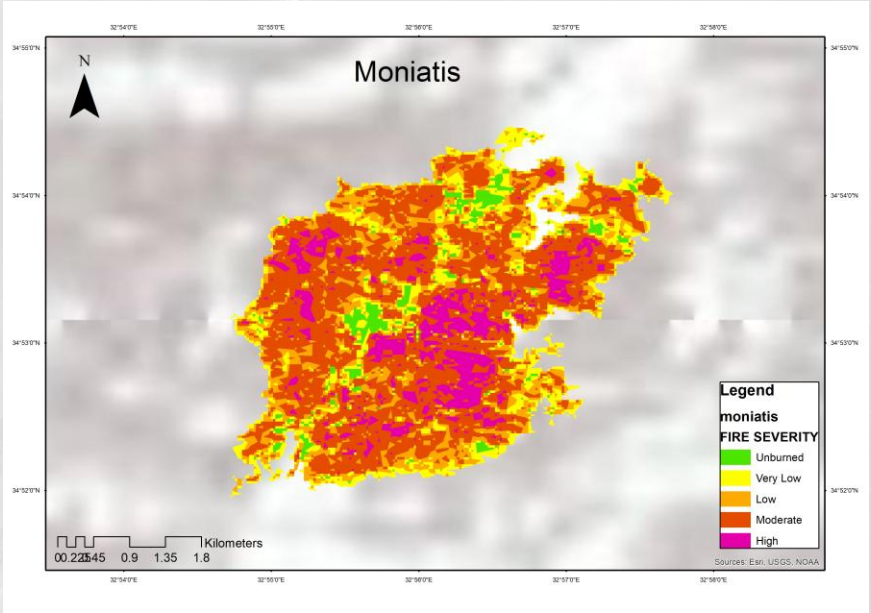
DISASTER RISK REDUCTION – Forest Fires

Time series analysis for the estimation of the forest regeneration after fire events





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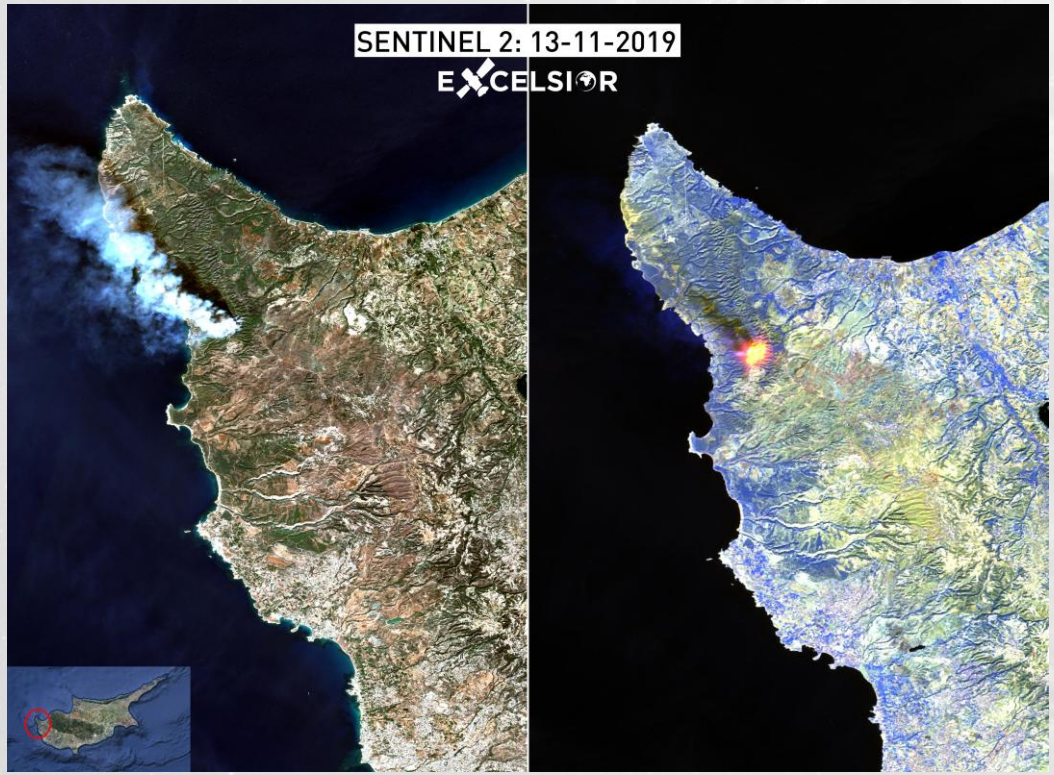
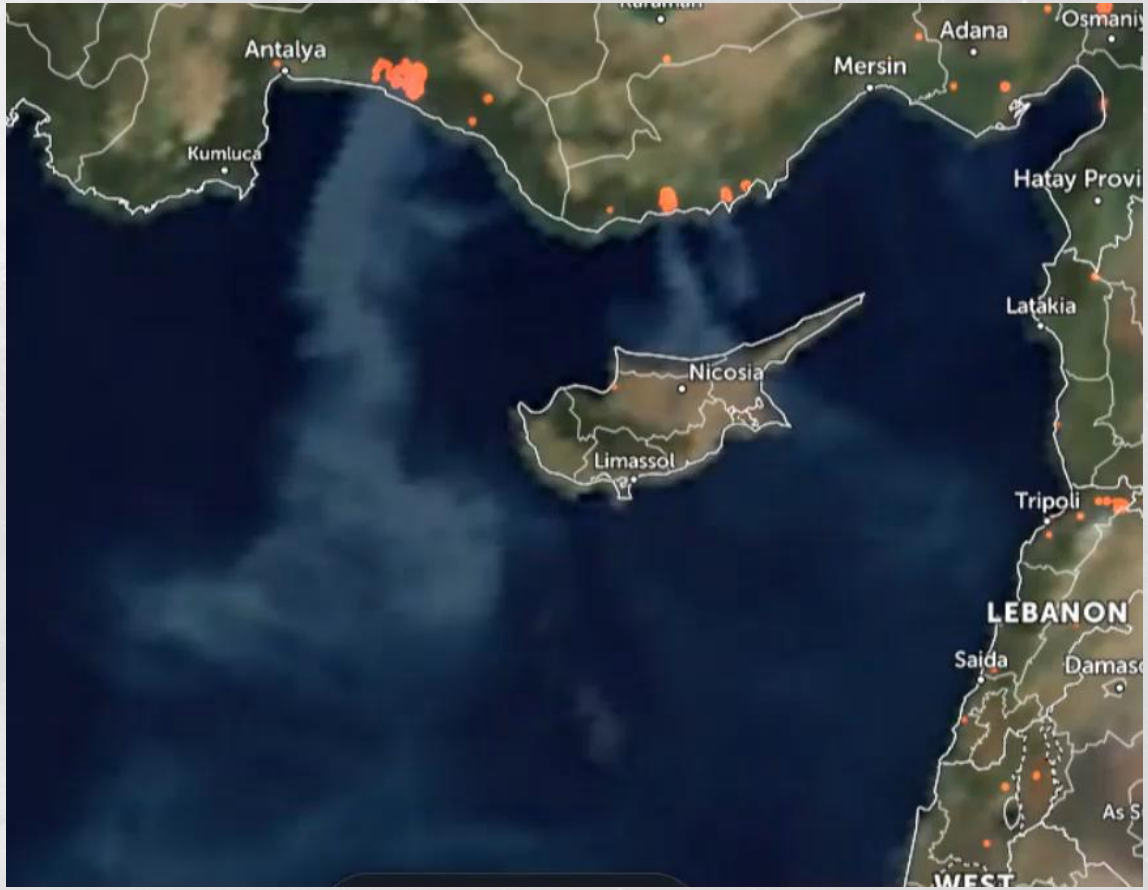
DISASTER RISK REDUCTION – Forest Fires

Active fire Detection





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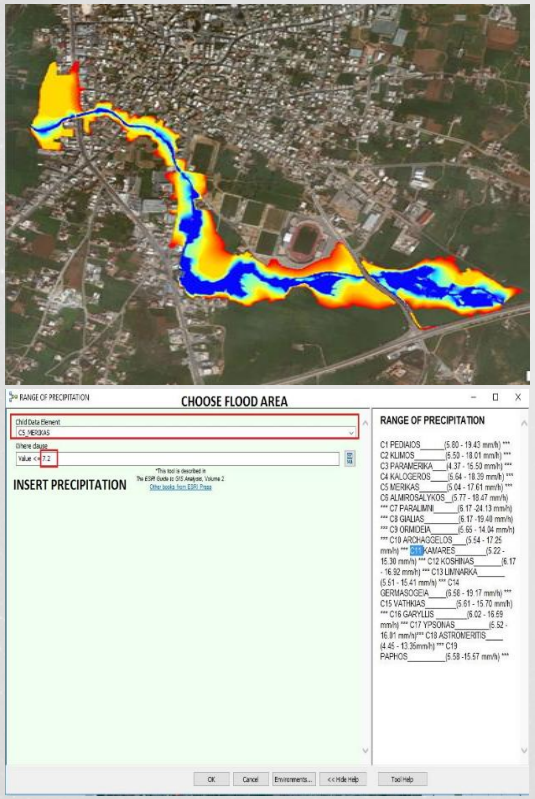
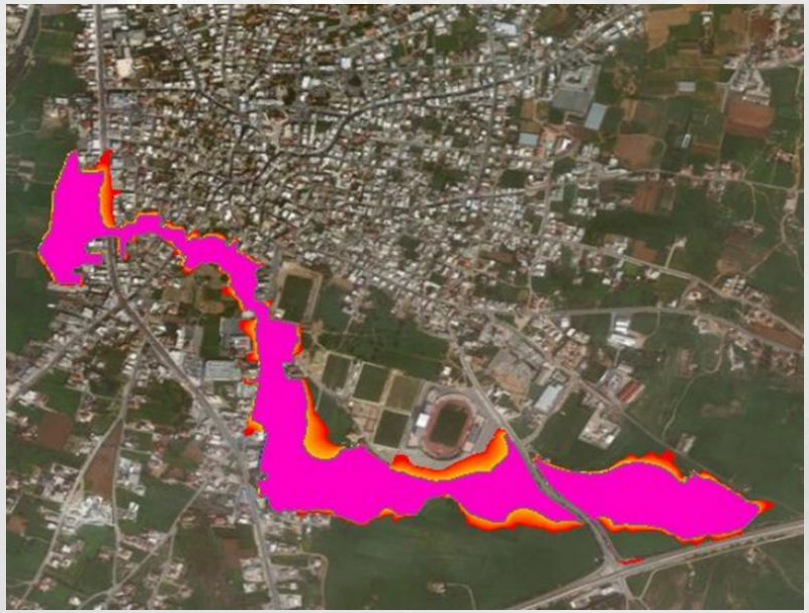
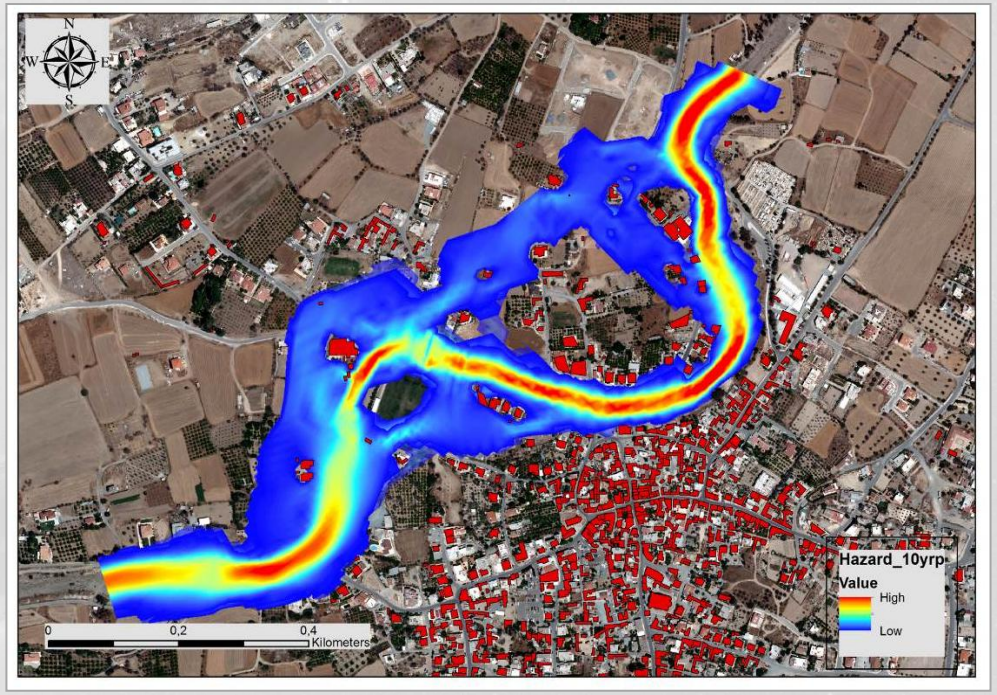
DISASTER RISK REDUCTION – Floods

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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DISASTER RISK REDUCTION – Experience (Relevant projects):

- **AI-OBSERVER (Horizon Europe):** Enhancing Earth Observation capabilities of the Eratosthenes Centre of Excellence on Disaster Risk Reduction through Artificial Intelligence, https://cordis.europa.eu/project/id/101079468
- **Green-HIT (Cyprus RIF):** A Green - Holistic IoT platform for Forest Management and Monitoring
- **National Risk Assessment:** Coordinated the development of the National Risk Assessment for the Republic of Cyprus (NRA-CY) in 2018, contracted by the Cyprus Civil Defense of the Ministry of Interior, Cyprus, https://civildefence.com.cy/wp-content/uploads/NRA_CYPRUS_2018.pdf
- **DECATASTROPHIZE (DG ECHO):** Towards Better Protection of Citizens against Disaster Risks: Strengthening Early Warning Systems in Europe, https://decatastrophize.eu/
- **SATFLOOD (Cyprus RIF):** Combined use of satellite remote sensing and hydraulic simulation for flood risk assessment at catchment scale in Cyprus, http://www.cyprusremotesensing.com/research-grants/integrated-use-of-satellite-remote-sensing-and-hydraulic-modeling-for-the-flood-risk-assessment-at-a-catchment-scale-in-cyprus
- **RISKA (Cyprus RIF):** Real time monitoring and assessment using an integrated methodology combining of satellite / LIDAR and surface data under a GIS environment, http://www.cyprusremotesensing.com/riska/
- **CLIMA (JPI-CH):** Cultural Landscape risk Identification, Management and Assessment, http://www.clima-project.eu/
- **PROTHEGO (JPI-CH):** Protection of European Cultural Heritage from Geo-hazards, http://www.prothego.eu/

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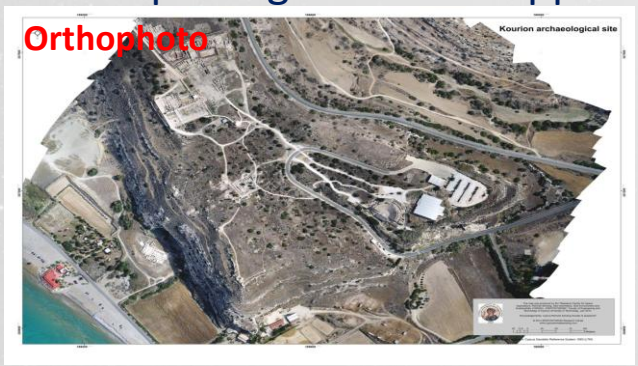
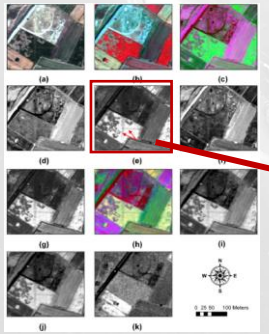
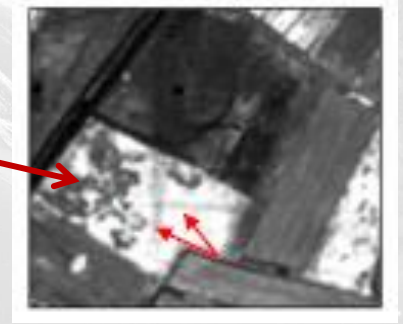
CULTURAL HERITAGE – Activities

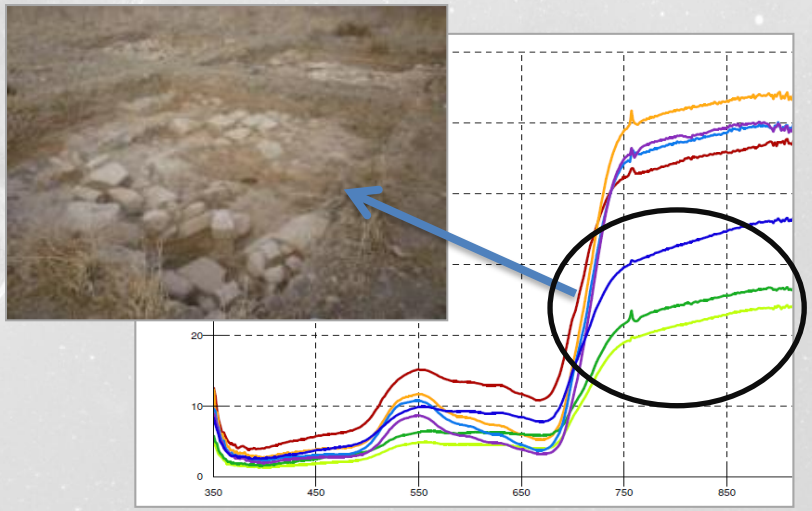
- Risk assessment of Cultural Heritage from natural and anthropogenic hazards
- Protection of Cultural Heritage
- Cultural Heritage digitization (3D models)
- Archaeolandscape assessment and modelling
- Study of unexcavated areas
- UAV photogrammetric applications

Fusion of Remote Sensing data









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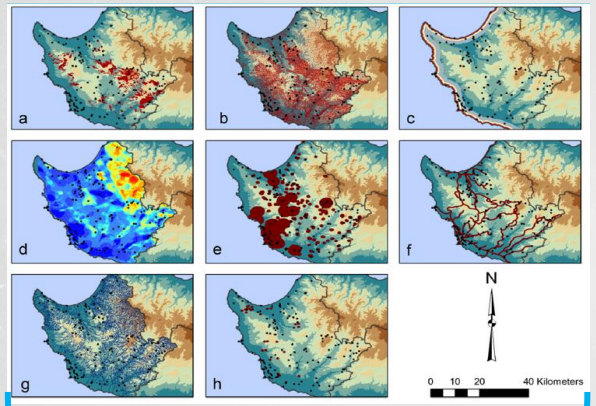
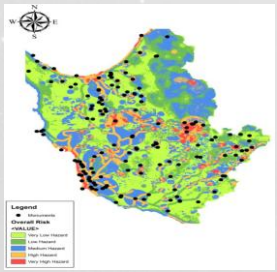
CULTURAL HERITAGE – Examples

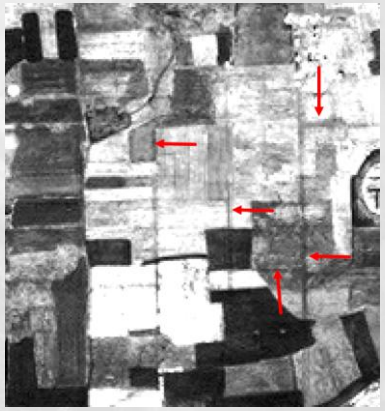
Risk assessment of CH



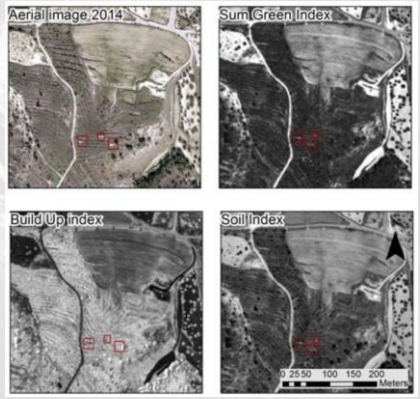
Assessment of multi-risks exposure on Cultural Heritage sites

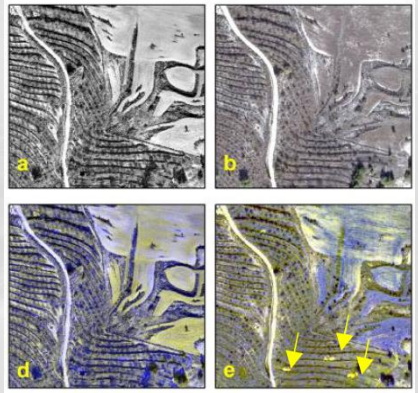


EO on Cultural Heritage



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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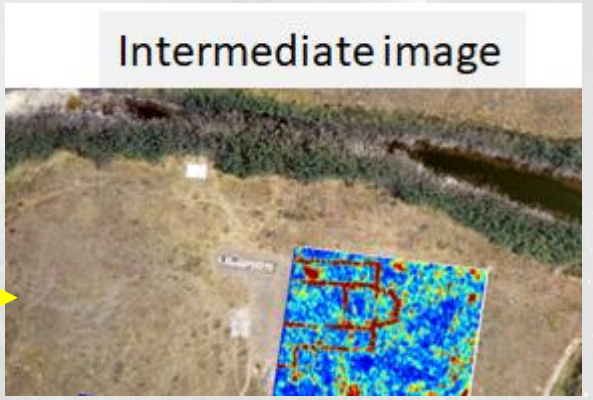
CULTURAL HERITAGE – Examples

Monitoring excavation and non-destructive mapping of Cultural Heritage sites

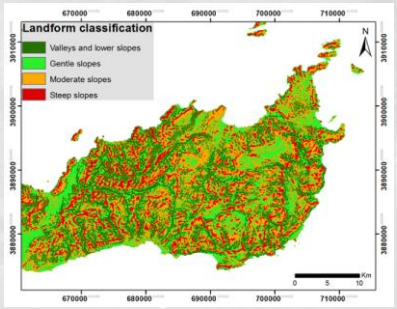
Non excavated archaeological site

Excavated archaeological site

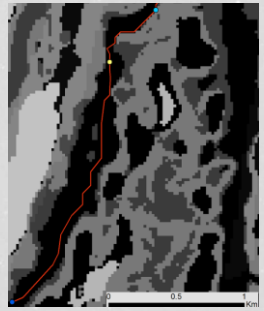


Geophysical prospection for the identification of buried sub-structures to be excavated

Water management planning of Cultural Heritage sites



Conjunction of geomorphometric information (e.g. landform types) and ancient water resources (e.g. cisterns, aqueducts) to model ancient water routes.



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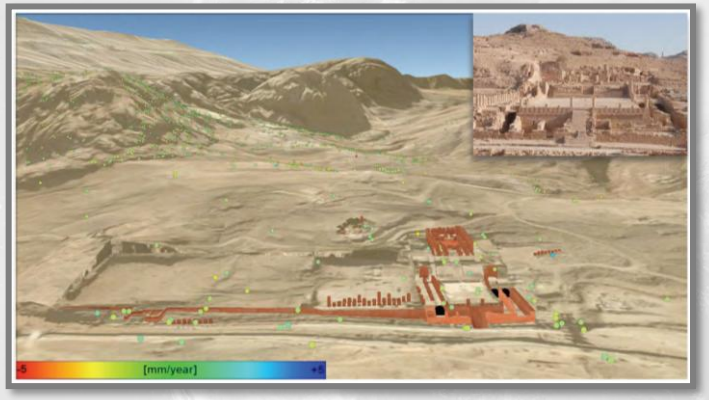
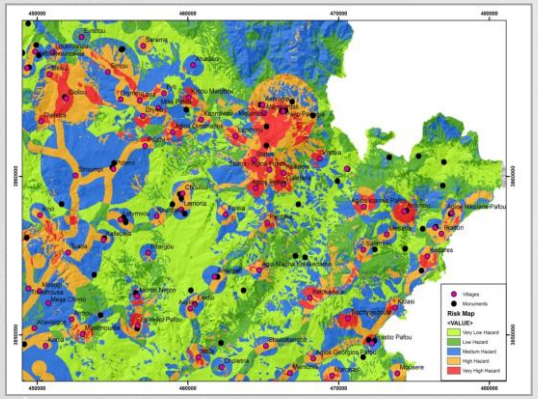
CULTURAL HERITAGE – Examples

Protection of European CH from Geo-hazards

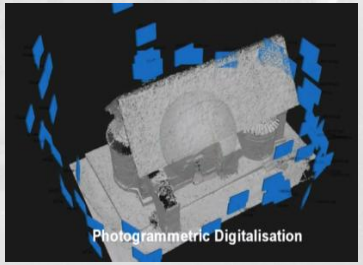


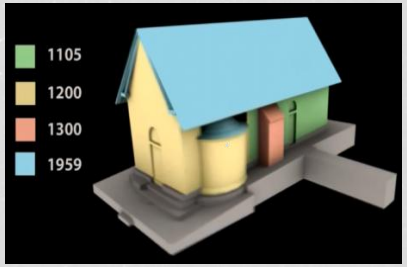
CH management



Study of unexcavated areas

3D Models from UAV





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CULTURAL HERITAGE – Experience (Relevant projects):

- **TRIQUETRA (Horizon Europe):** Toolbox for assessing and mitigating Climate Change risks and natural hazards threatening cultural heritage
- **ENIGMA (Horizon Europe):** Endorsing safeguarding, protection and provenance management of Cultural Heritage
- **SATFLOOD (Cyprus RIF):** Combined use of satellite remote sensing and hydraulic simulation for flood risk assessment at catchment scale in Cyprus, http://www.cyprusremotesensing.com/research-grants/integrated-use-of-satellite-remote-sensing-and-hydraulic-modeling-for-the-flood-risk-assessment-at-a-catchment-scale-in-cyprus
- **RISKA (Cyprus RIF):** Real time monitoring and assessment using an integrated methodology combining of satellite / LIDAR and surface data under a GIS environment, http://www.cyprusremotesensing.com/riska/
- **CLIMA (JPI-CH):** Cultural Landscape risk Identification, Management and Assessment, http://www.clima-project.eu/
- **PROTHEGO (JPI-CH):** Protection of European Cultural Heritage from Geo-hazards, http://www.prothego.eu/

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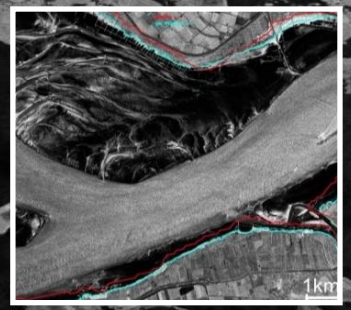
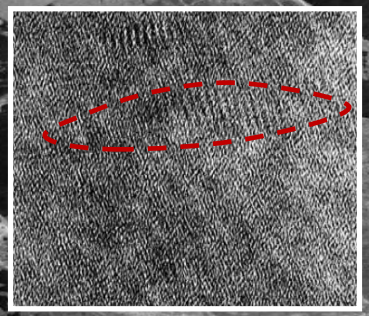
MARINE SAFETY AND SECURITY – Activities

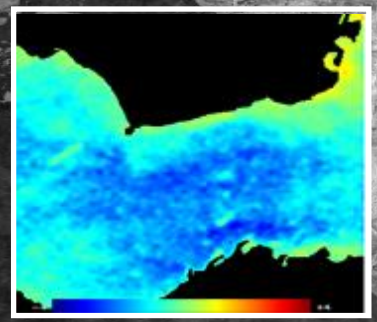

Bathymetry

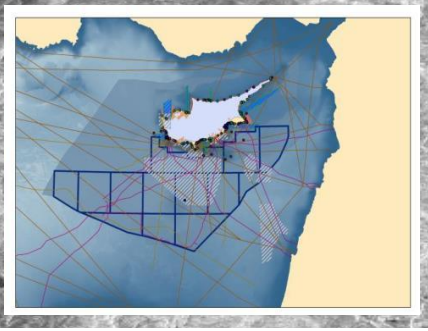


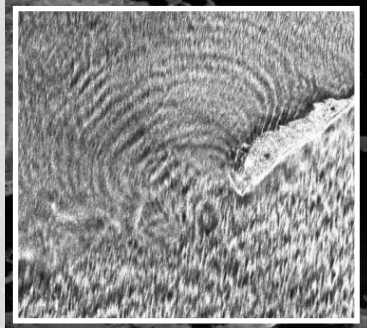
Land-Water line

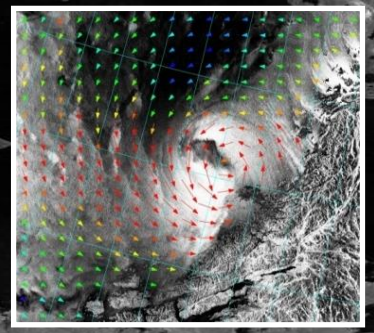

Wave groups


Wave breaking

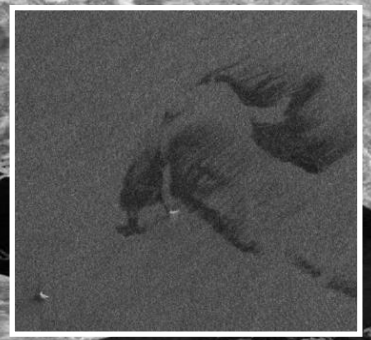

Surface Currents


Marine Spatial Planning

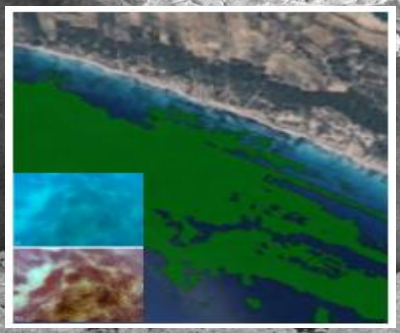

Sea state


Wind


Ship detection


Oil spills


Icebergs


Posidonia

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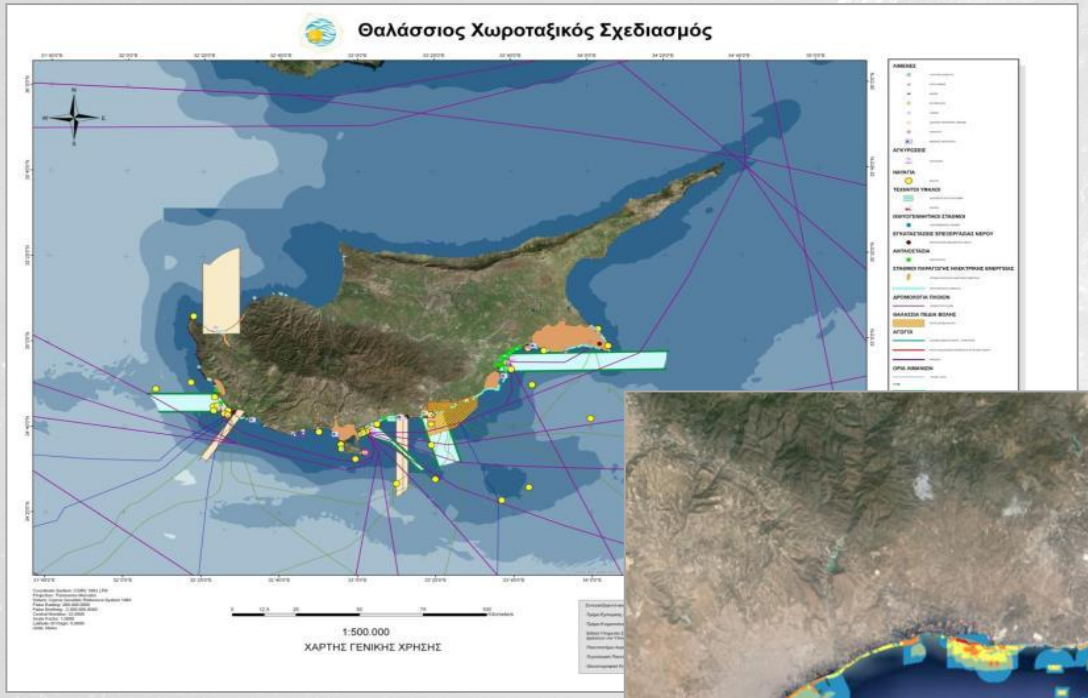
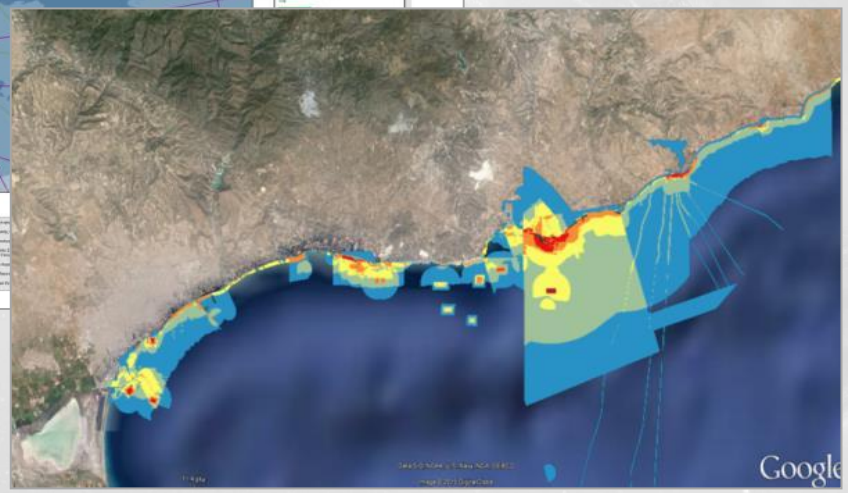
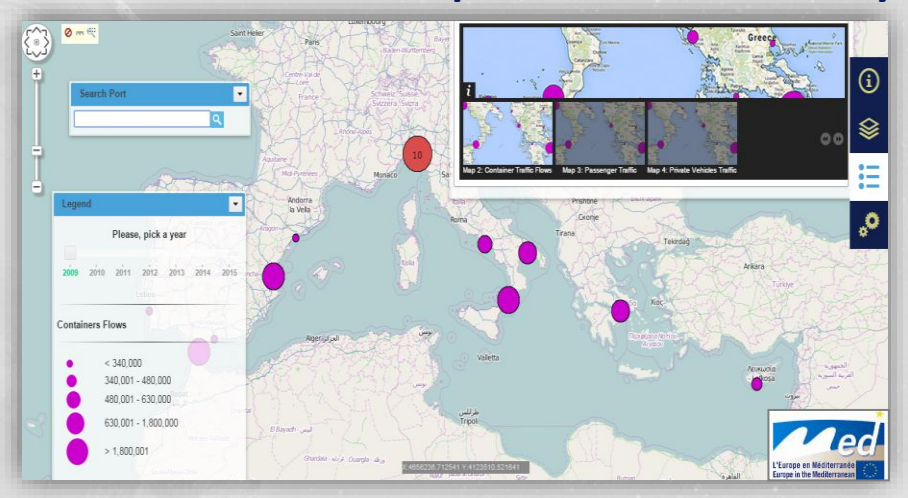
MARINE SAFETY AND SECURITY – Examples:



Marine Spatial Planning



Mediterranean Port Operations Observatory



Bathymetry using multispectral and SAR remote sensing data-SIMONA

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MARINE SAFETY AND SECURITY – Experience (Relevant projects):

- **THAL-CHOR II (Interreg V-A Greece - Cyprus 2014-2020):** Cross-Border Cooperation for the implementation of Marine Spatial Planning, https://www.mspcygr2.info/
- **THAL-CHOR (Interreg Greece - Cyprus 2007-2013):** Cross-border Cooperation for Maritime Spatial Planning Development, www.mspcygr.info
- **MEDNET (MED Programme):** Mediterranean Network for Custom Procedures and Simplification of Clearance in Ports, https://keep.eu/projects/15003/Mediterranean-Network-for-C-EN/

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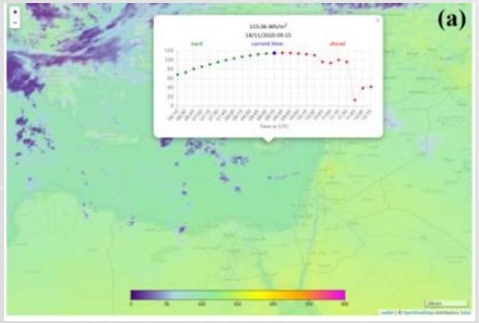
ENERGY – Activities

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

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

- Transfer from NOA – PMOD/WRC of the 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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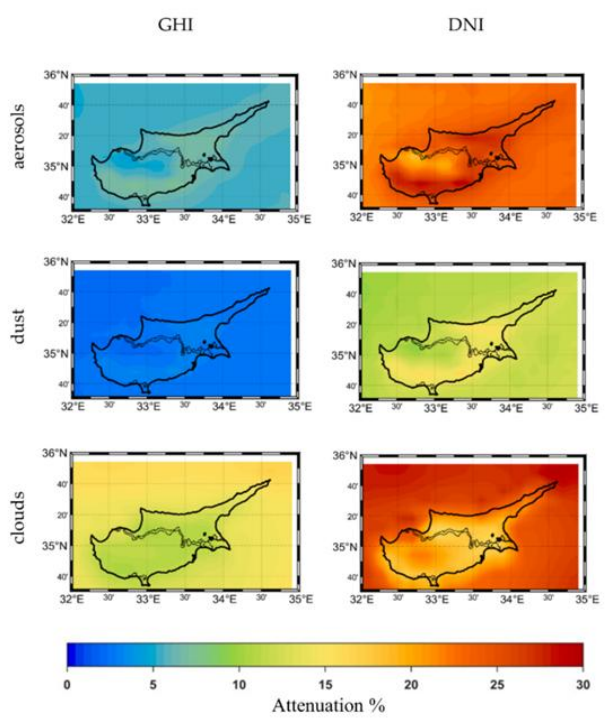
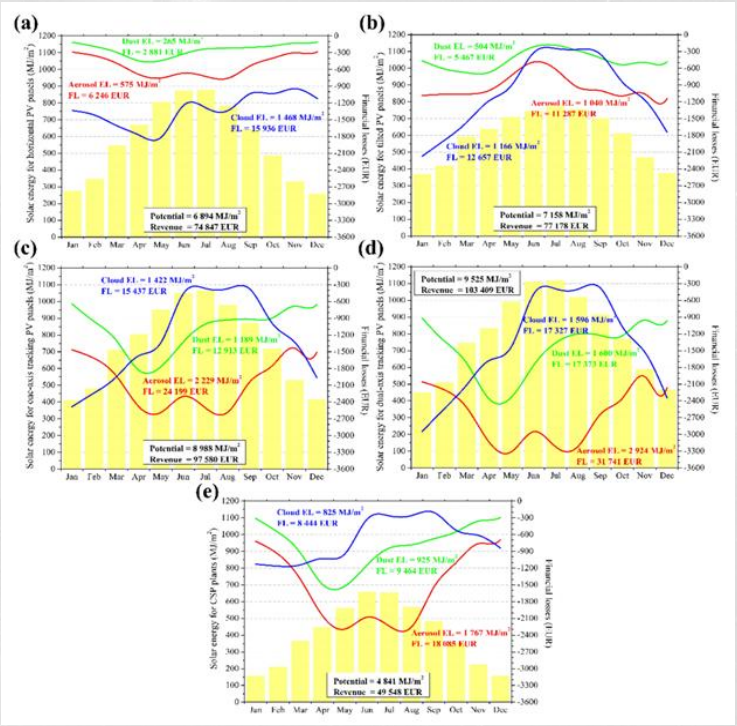
ENERGY – Examples

Effects of aerosols and clouds on the levels of Surface Solar Radiation and Solar Energy in Cyprus



Attenuation (in %) of the total annual GHI and DNI by aerosols, dust aerosols, and clouds

Financial analysis of the clouds, aerosol, and dust impacts on the produced solar energy from different PV installations



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Thank you

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