



From Imagery to Digital Reality: ERS & Photogrammetry
17th International Scientific and Technical Conference
16-19 October 2017, Israel

EXCELSIOR

ERATOSTHENES: Excellence Research Centre
for Earth Surveillance and Space-Based Monitoring of the Environment

EXCELSIOR



Funded under Horizon 2020
Widespread-04-2017: Teaming Phase 1
Coordination and support action
Grant agreement no: 763643
Proposal acronym: EXCELSIOR

EXCELSIOR: a European Horizon 2020 Teaming project for the establishment of a Centre of Excellence in the Eastern Mediterranean for Earth surveillance and space-based monitoring of the Environment

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1. CYPRUS UNIVERSITY OF TECHNOLOGY 2. DLR 3. NOA 4. NASA 5. TROPOS 6. MINISTRY OF TRANSPORT, COMMUNICATIONS & WORKS (CY GOVERNMENT)



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COMMUNICATIONS

Overview

- Project Details
- The idea behind (upgrade the existing group)
- Excelsior's vision- Proposed activity in the Eastern Mediterranean and Middle East (EMME) and Middle East and North Africa (MENA).

EXCELSIOR's details

Funded under H2020

Pillar: **Spreading excellence and widening participation**

Work Programme Year: **H2020-2016-2017**

Work Programme Part: **Spreading Excellence and Widening Participation**

Call: **H2020-WIDESPREAD-2016-2017**

Topic: **H2020-WIDESPREAD-04-2017-TeamingPhase1**

Type of action: **CSA** (Coordination and support action)

Project GA number: **763643**

Proposal acronym: **EXCELSIOR**

Total Budget: **400,000 €**

Duration: **12 months**

End: **31 August 2018**



**December 2018 (results).....35 million euros for the next 7 to 15 years
[15 millions from the EC, 15 millions from Cyprus Government, 4-5 millions
from the University]**

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EXCELSIOR's consortium



Cyprus University of Technology—**CY** [coordinator]



DLR
Deutsches Zentrum
für Luft- und Raumfahrt
German Aerospace Center

German Aerospace Centre —**DE**



National Observatory of Athens —**GR**



Leibniz Institute for
Tropospheric Research

Leipzig Institute for Tropospheric Research —**DE**



Ministry of Transportation, Communications and Works,
Department of Electronic Communications—**CY**

The idea behind

to **upgrade** and further promote the existing 'Remote Sensing & Geo-Environment' Group /ERATOSTHENES Research Centre, established within the Cyprus University of Technology, into a **sustainable, viable and autonomous Centre of Excellence** for Earth Surveillance and Space-Based Monitoring of the Environment (**EXCELSIOR**), which will provide the highest quality of related services both on the **National, European and International** levels.

The **long term aim** of the centre is to **create new opportunities for innovative ground-breaking research and promote Cyprus to the European Research Area** in the field of systematic monitoring of environment using earth observation, space and ground based integrated technologies.

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EXCELSIOR's idea

EXCELSIOR

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



ERATOSTHENES Research Center
2017



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but what is ERATOSTHENES?

Remote Sensing & Geo-Environment Lab (2007-2017) activities



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The Group (ESA visit at the Lab)



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TROPIS
Leibniz Institute for
Tropospheric Research



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The Lab



- Field Spectroradiometers: 2 GER 1500, 1 SVC 1024, 1 GER1500i, 1 ASD
- Underwater enclosure
- Sun-photometers: 2 Microtops
- Software: ERDAS Imagine, ER Mapper, Apollo, ENVI, Mapinfo, ArcGIS etc.
- Calibration Device
- 1 Automatic CIMEL Sun Photometer (AERONET/NASA)
- 1GPR MALA
- GPS
- NDVI Camera
- PM10 / Met Stations
- Lidar



Resources



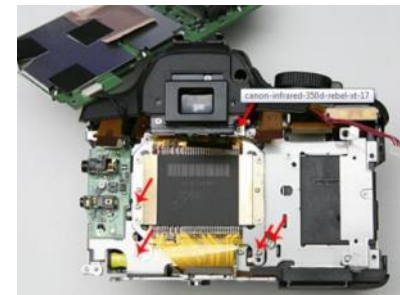
UAV systems



Laser Scanner



GPS



Digital cameras (Vis – NIR – Thermal)



Georadar



GIS – RS softwares

- **GNSS Receivers**

- 1 GNSS Reference Station (GPS1200)
- 8 Leica Viva GS15
- 10 Spectra Precision Mobile Mapper receivers
- 2 Leica CS15 Plus Mapping Tablets
- 3 High Sensitivity u-blox evaluation receivers



- **Inertial Navigation Systems**

- 1 SBG Ellipse-N
- 1 u-blox DR6



- **Laser Scanner**

- Leica C10



- **Geodetic Equipment**

- 10 Leica TCR 1203+ R400
- 10 Leica Sprinter 150
- 1 Leica Sprinter 250

The 'Remote Sensing & Geo-Environment' Group /ERATOSTHENES Research Centre, is COPERNICUS Academy member and member of the **European Association of Remote Sensing Laboratories (EARSeL)**.

EARSeL is a scientific network of European remote sensing institutes, coming from both academia and the commercial/industrial sector.



The Copernicus Academy will **connect European universities, research institutions, business schools, both private and non-profit organizations, in the Participating Countries of the Programme and beyond**. The Academy Network will also work to increase the exchange of ideas and best practices across borders and disciplines while contributing to the development of the use of Earth Observation data in general and Copernicus data and information in particular, in various public or private user organizations or industries.



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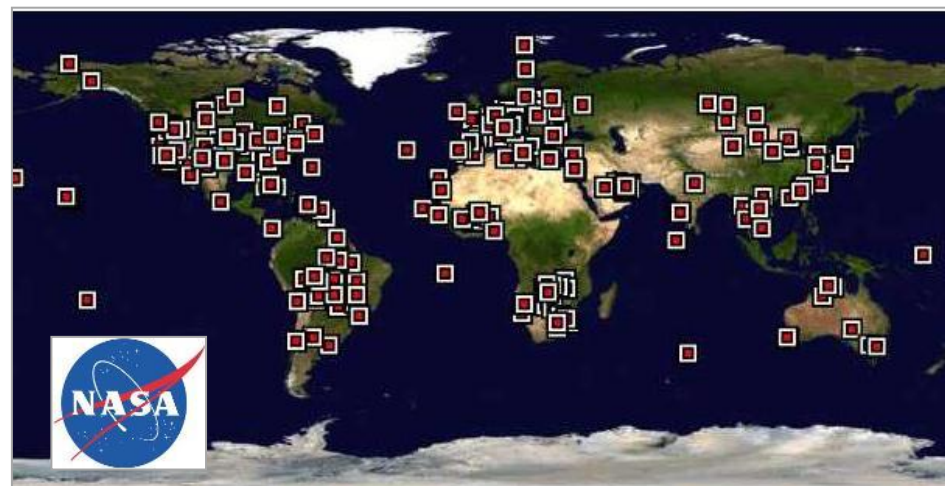
NETWORKS

- NASA
- ESA
- EARSEL
- SPIE
- EARLINET
- ACTRIS
- GEO
- DLR




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CUT-TEPAK AERONET


ACTRIS
Network



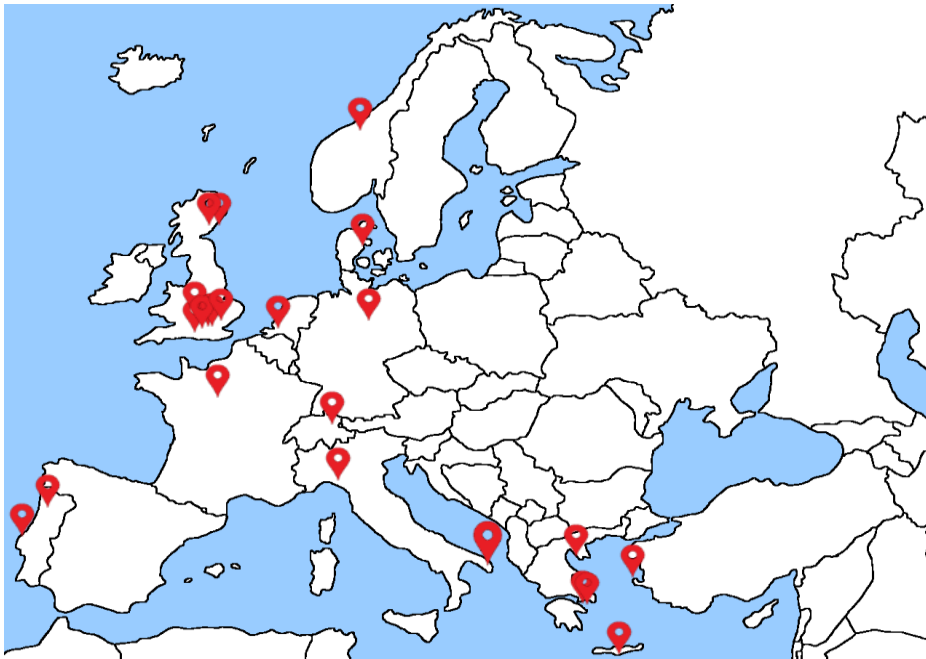
CUT-TEPAK EARLINET LIDAR

Cypriot collaborations



European collaborations

>300 Universities & Research Centers



- Imperial College London, (GB)
- University of Surrey, (GB)
- University College London, (GB)
- Southampton University, (GB)
- Aberdeen University, (GB)
- Cranfield University, (GB)
- University of Edinburgh, (GB)
- University of Sheffield, (GB)
- University of Pavia, (I)
- Delft University, (NE)
- Politecnico di Milano (IT)
- CNR (IT)
- Swiss Federal Institute of Technology (ETH), (CH)
- Norwegian University of Science and Technology, (NO)
- Instituto Superior Technico, (P)
- University of Porto, (P)
- Aalborg University, (DK)
- Aristotle University of Thessaloniki, (GR)
- National Technical University of Athens, (GR)
- National Observatory of Athens, (GR)
- Federal Institute of Material Research and Testing, (DE)
- Swiss Federal Laboratories for Materials Testing and Research for Industry, (CH)
- Ecole Nationale Supérieure des Télécommunications, (FR)
- TROPOS Institute (DE)

Beyond Europe collaborations



Funding

- ✓ Participation to more than 60 projects from since 2007
- ✓ Coordination of more than **20 funded research projects**

Research

- ✓ 30 active researchers coming from different backgrounds such as engineers; physics; earth scientist; chemists, surveying engineers, geologists, archaeologists etc working in 6 different thematic research areas of the Lab
- ✓ **Provide 120 job positions since 2007**
- ✓ More than 100 dissertations/ final year projects
- ✓ Phd Supervision (more than 15 since 2007)



The Group has received funding for over 60 Competitive Research Programs since 2007

1. Cyprus Research Promotion Foundation
2. European Union
3. Industry



REPUBLIC OF CYPRUS



EUROPEAN UNION



Applications / Activities / Funded Projects

- Archaeology /Cultural Heritage
 - Marine Spatial Planning
 - Water Resources Management
 - Irrigation Demand / Agriculture
 - Water Quality monitoring
 - Forestry
 - Air Pollution
 - Climate Changes
 - Aerosol Typing
 - Aerosol/Cloud interaction
 - Transport
 - Crisis Management
 - Bathymetry
 - Positioning
 - Navigation
 - Animal Tracking
 - Real Estate
 - Utilities
 - Mapping
 - Infrastructure
 - Education
 - Navigation
 - Water leakages monitoring
 - Natural Hazards (Floods, earthquakes, fires etc)
 - Disaster Management
 - Defense & Security
 - Tourism
 - Landslides
 - Safety of Life
-selected projects



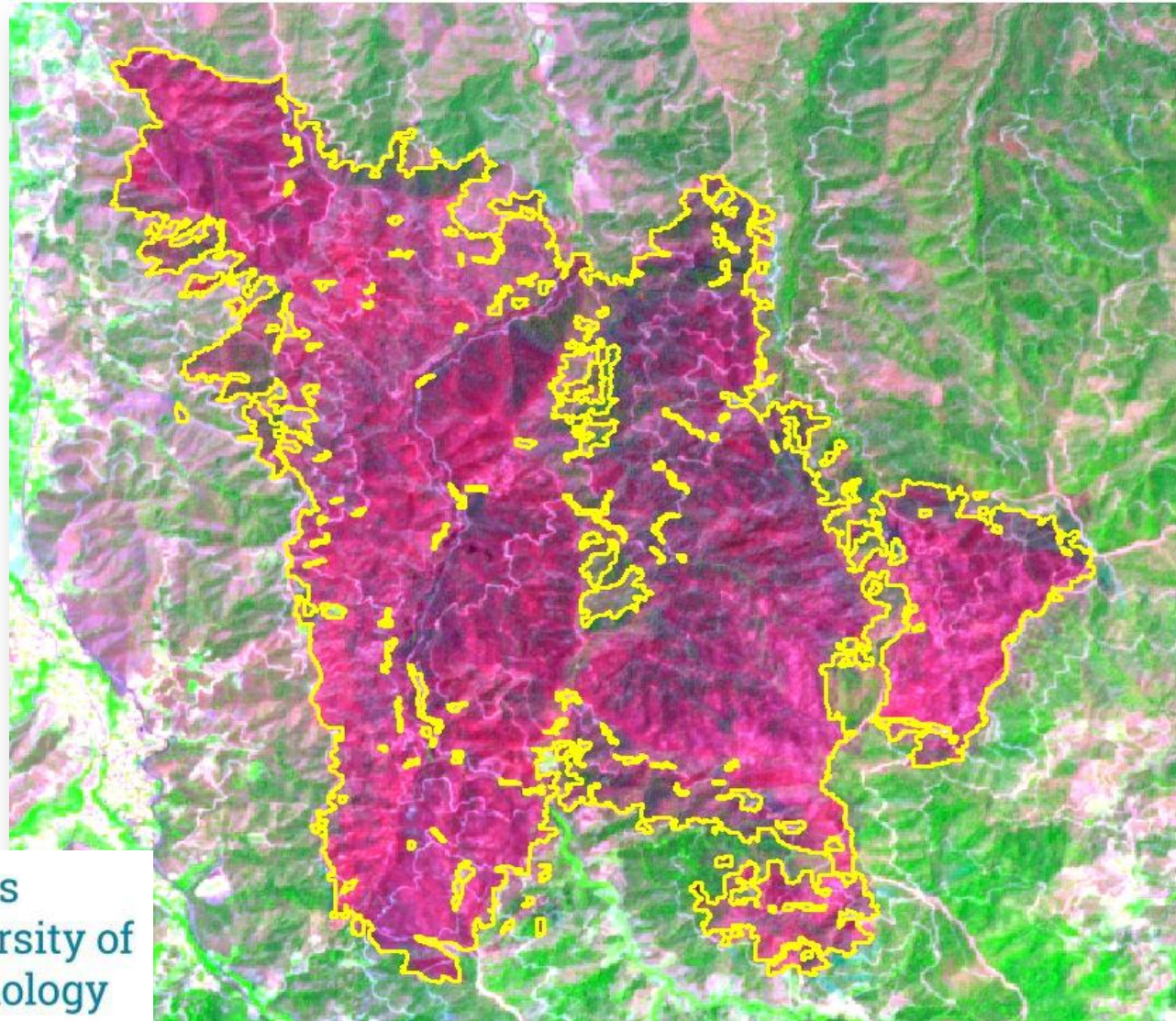
FORESTRY (Mapping, Signatures)

Landsat 8 , 24 Ιουλίου 2016 / SOLEAS CYPRUS

AOI
16,02 sq. km²



**Mapping of burned
areas in Solea using
Sentinel-2
28/6/2016
16.4 sq.km2
(7-5-3)**



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WATER: Water quality monitoring monitoring in inland waters (dams)



Synoptic coverage and continuous monitoring of coastal waters to detect at any time any pollution event achieving in the immediate and sustainable management of water resources

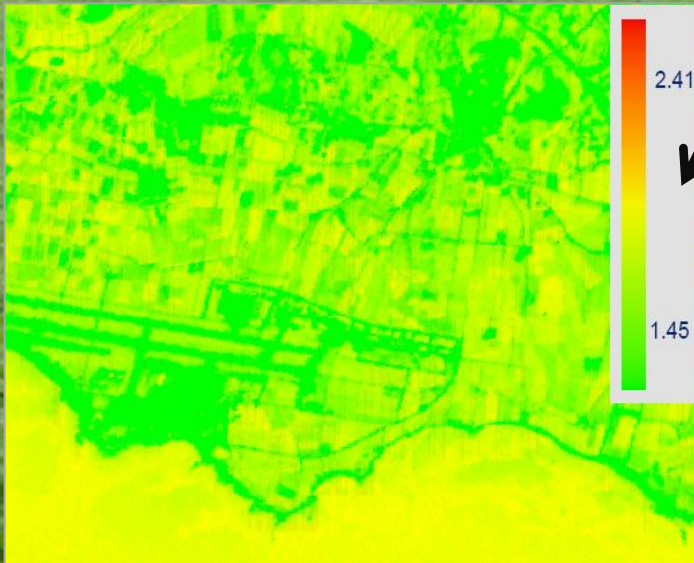


Data collected from the smart buoy was used for furthermore calibration of the retrieved algorithm due to high frequency of measurements collected.

LAND: Irrigation demand - Agriculture



- Integration of:
- Spectroscopy
 - Micro-sensor technology
 - Remote sensing



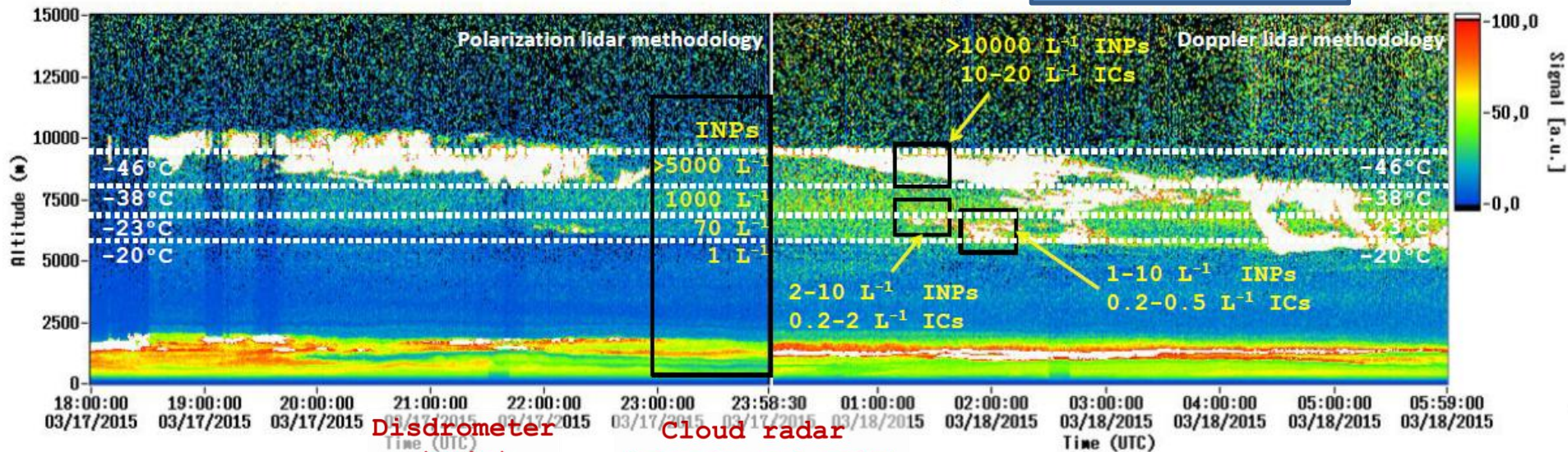
- Satellite imagery: retrieval of surface reflectance/temperature
- Spectroradiometric measurements: retrieval of ground reflectance
- Micro-sensors: soil moisture, temperature, RH etc.
- Irrigation models



Air: Aerosol-Cloud Interaction

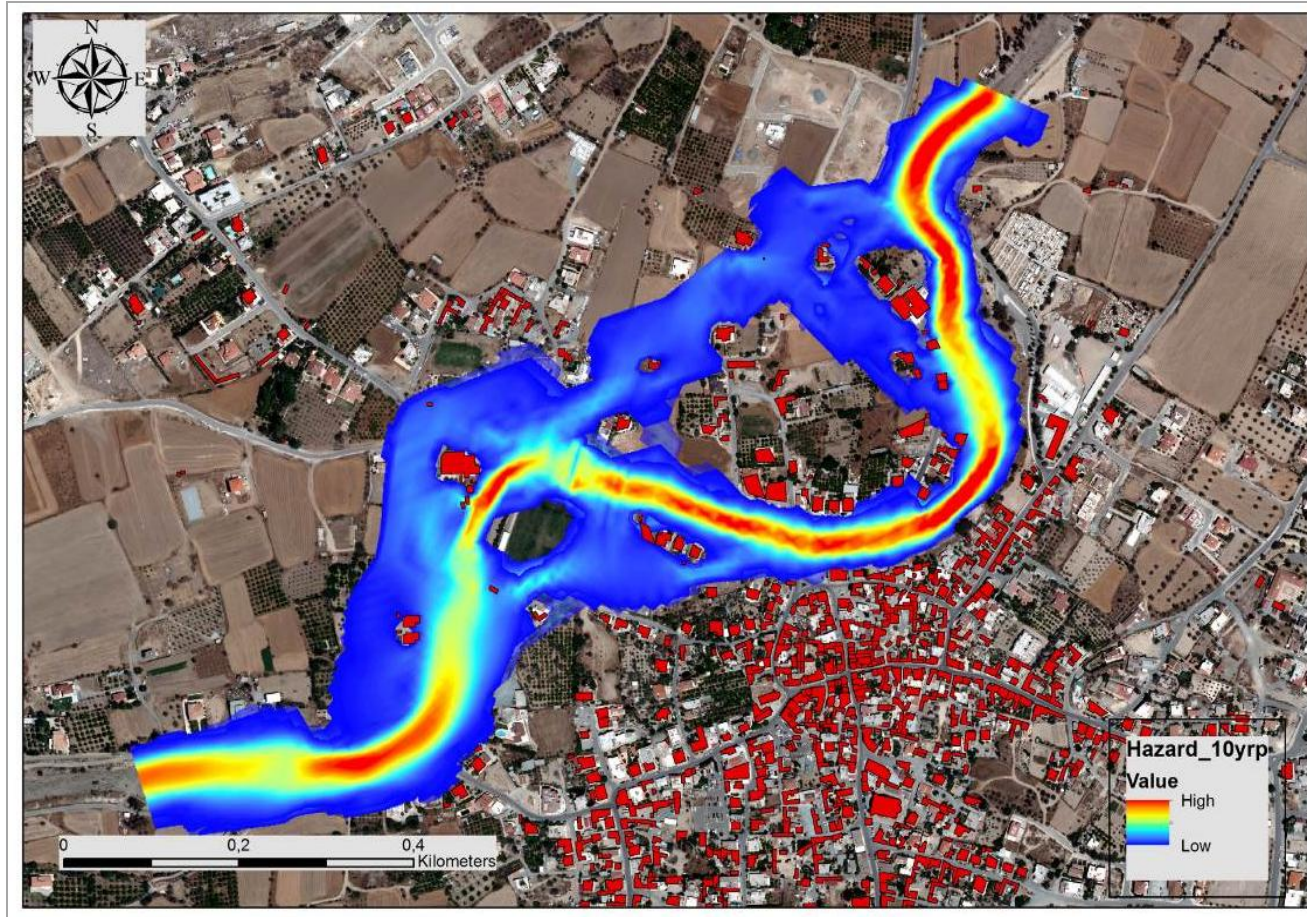
Cy-CARE campaign
BACCHUS project

Range-corrected signal@1064nm, PollyXT_NOA,



Risk analysis: Flood risk

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



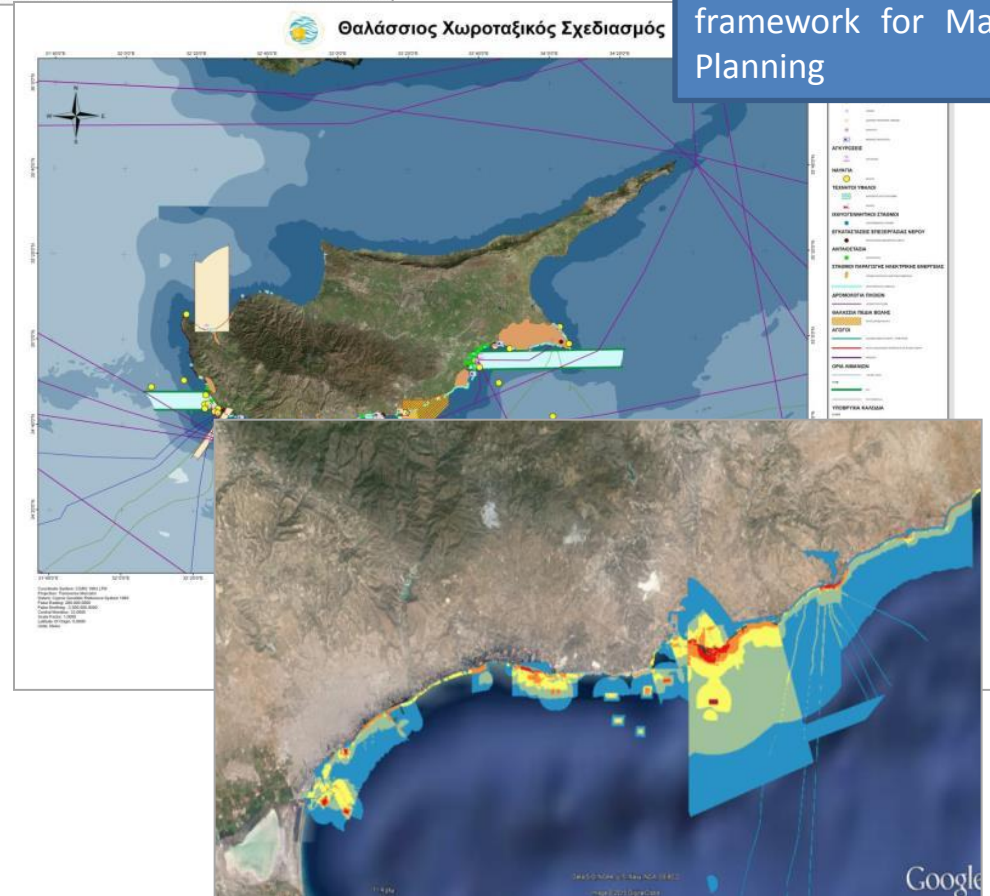
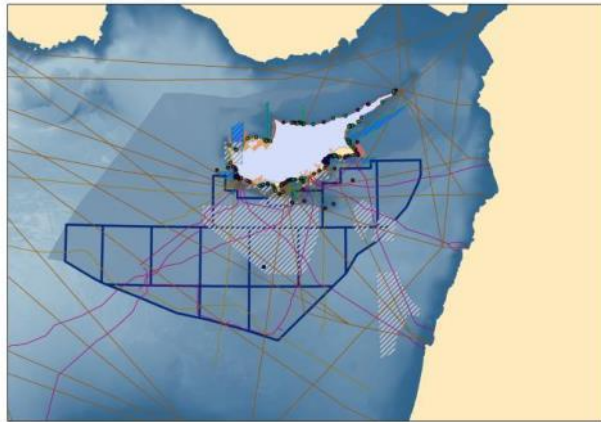
Funding (200, 000 euros), Cyprus Research Promotion Foundation, Structural Funds

Partners: Cyprus University of Technology (Coordinators), Technical University of Crete, National Observatory of Athens, Cyprus [Meteorological Service](#), [Water Development Department](#)

Marine Spatial Planning (MSP) (blue growth)



Main aim of the project is the joint development methodology, process and suitable implementation framework for Marine Spatial Planning



Consortium: DEPARTMENT OF MERCHANT SHIPPING, DEPARTMENT OF LANDS AND SURVEYS, UNIVERSITY OF THE AEGEAN, MINISTRY OF MARINE AND AEGEAN, CYPRUS UNIVERSITY TECHNOLOGY, OCEANOGRAPHY CENTRE

Urban heat

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

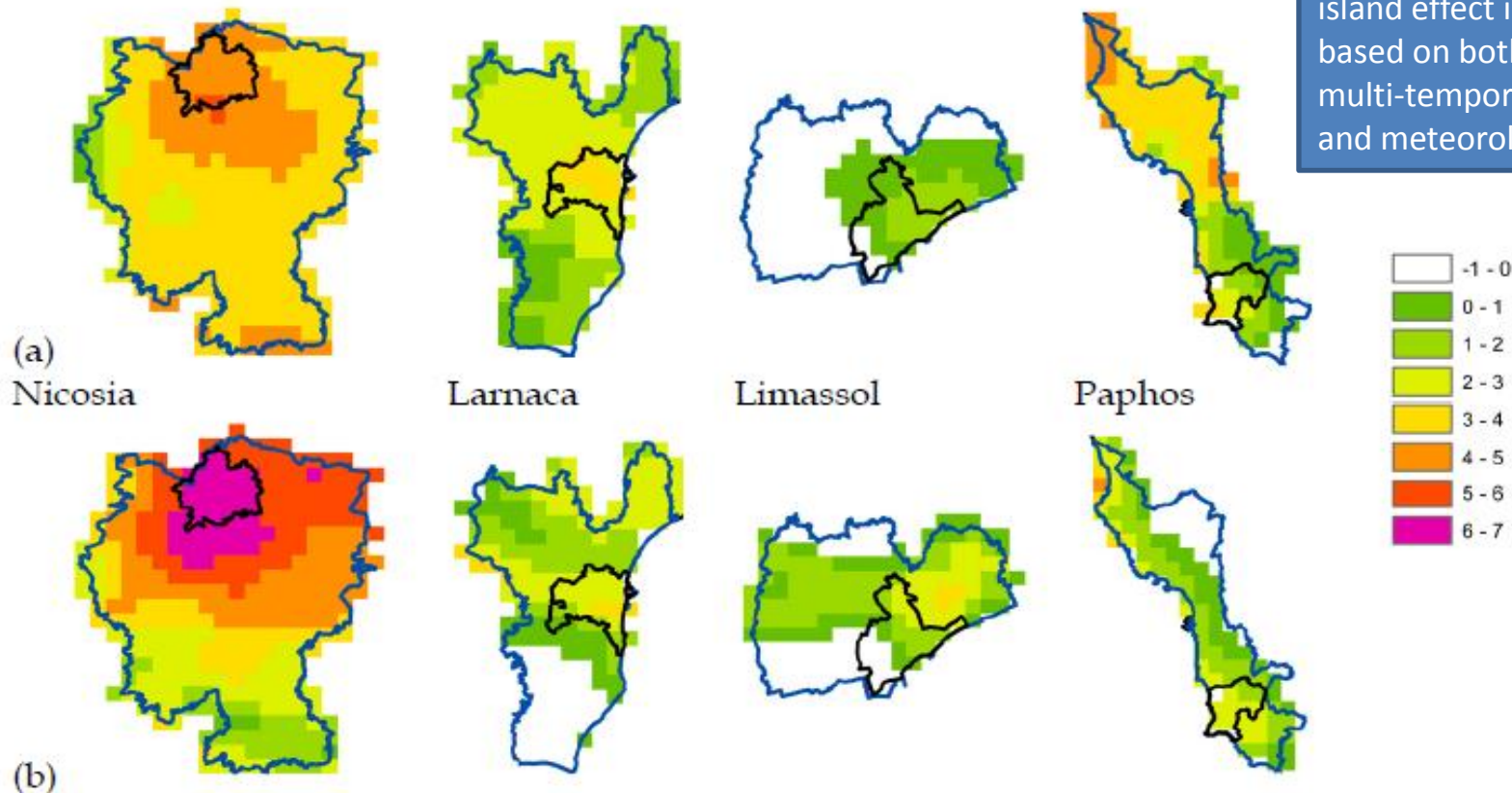
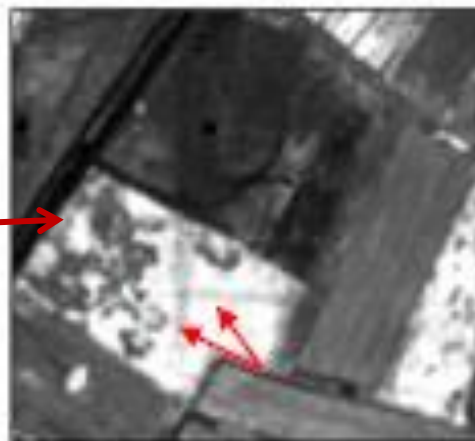
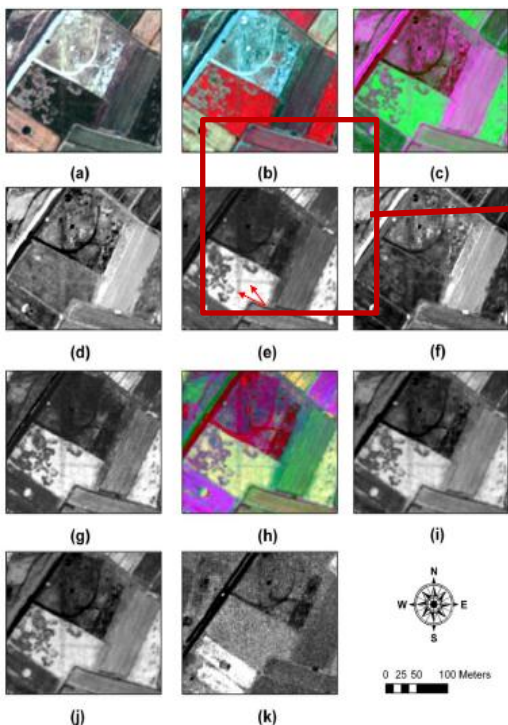
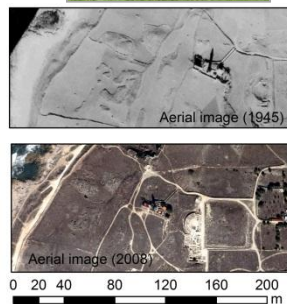
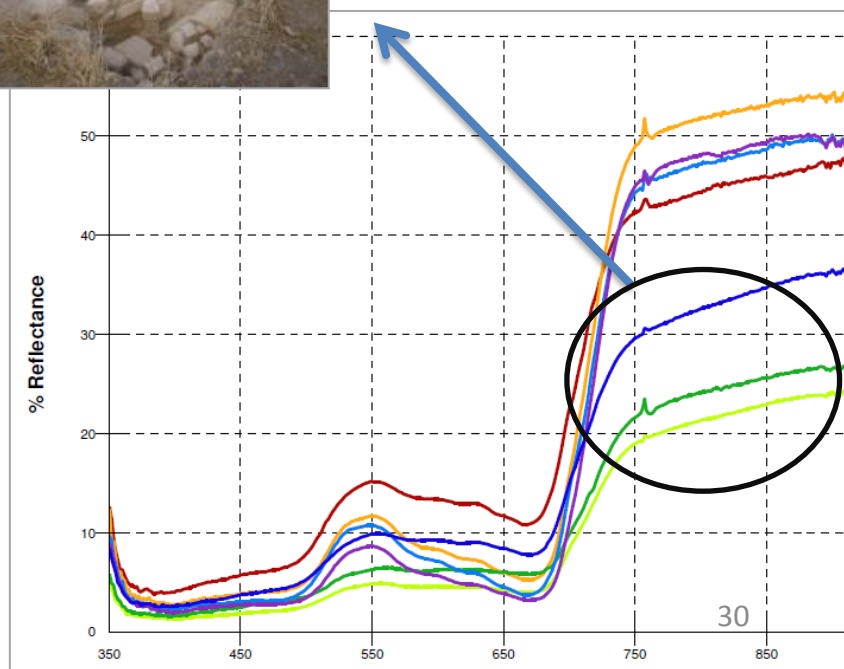


Figure 16. UHI estimated from MODIS Aqua nocturnal images for (a) 31 July and (b) 28 August 2010, for the four urban areas of Cyprus, separately

Earth observation for Cultural Heritage (detection, management, protection etc)



Our proposed equation from a GeoEye example
(Ilis archaeological site in Greece)
Detection of Unexcavated buried remains



Fusion of RS data

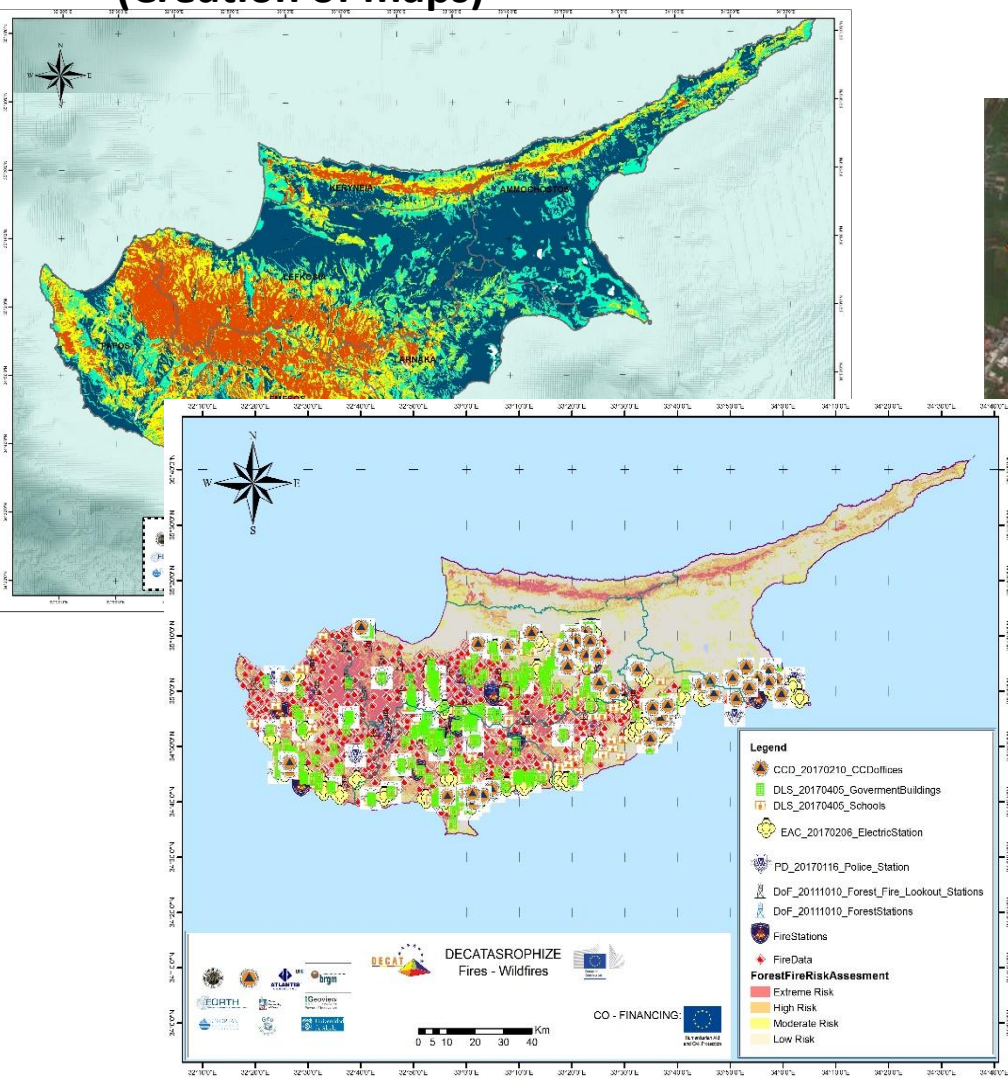
HAZARDS

USE OF A GEOSPATIAL EARLY-WARNING DECISION SUPPORT SYSTEM TO PREPARE FOR DISASTERS OR PLAN FOR MULTIPLE HAZARDS: DECATASTROPHIZE”

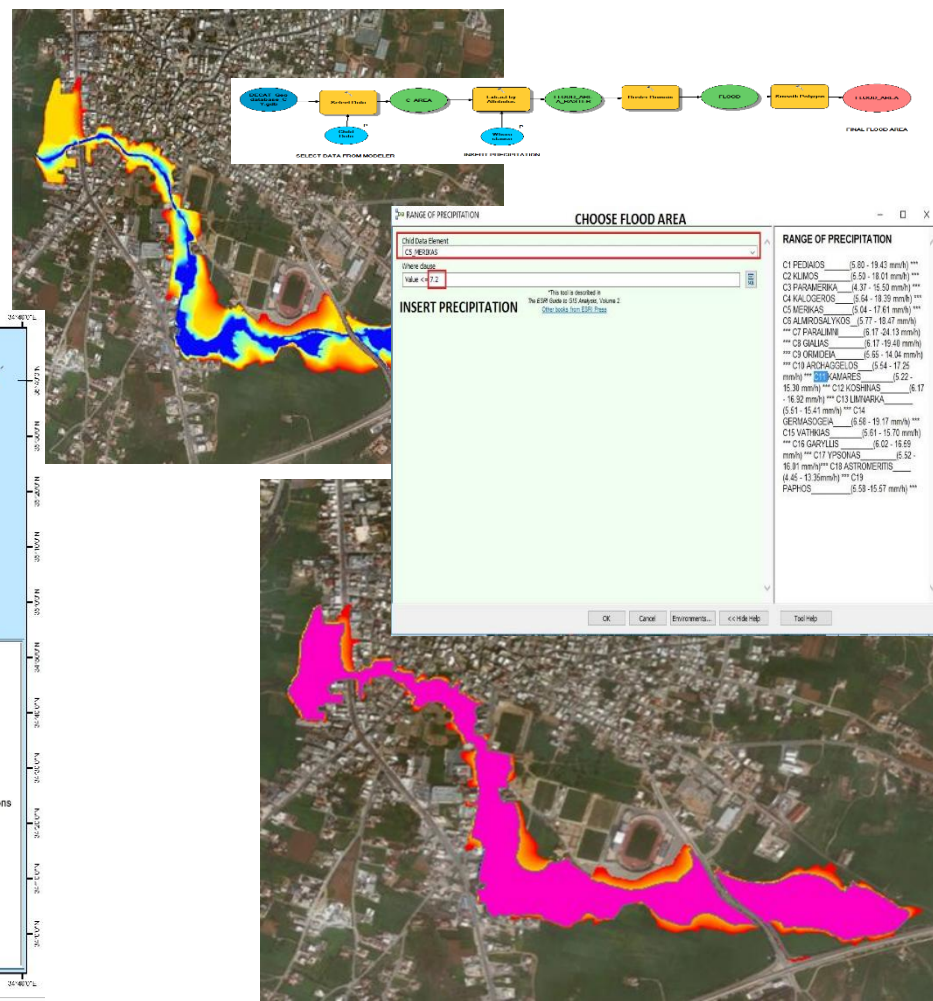
- The development of a geo-spatial early-warning decision support system that will be connected to Emergency Operation Centers (EOC) and Operational Resources (OR)



Static fire models (Creation of maps)



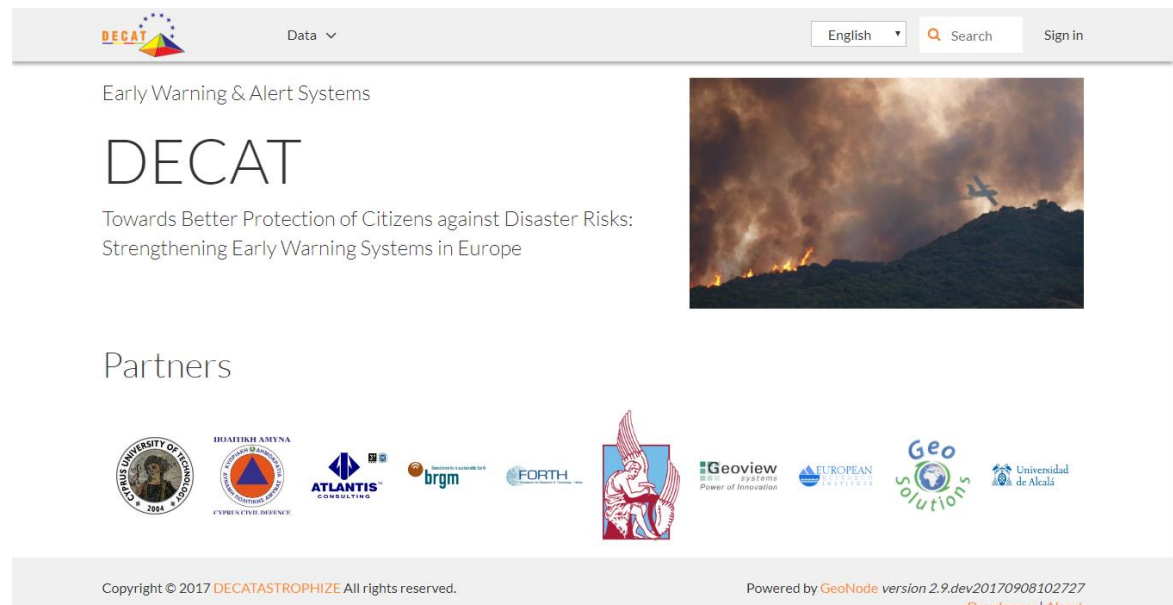
Dynamic flood model



➤ DECAT software: It is made up of three emergency management phase:

1. Early warning
2. Impact assessment
3. Emergency management – mitigation of impact

➤ End user of the software: **Cyprus Civil Defence**



The Group has strong expertise in Atmospheric correction methods: Development & assessment

$$\rho_{ts} = c + m \cdot \rho_{tg}$$

‘at-satellite reflectance’

‘atmospheric path radiance’

‘ground reflectance’



EU opportunities for widening EXCELLENCE...

Widening consists of three main actions, i.e. **Teaming**, **Twinning** and ERA Chairs.

ERA Chairs stands for excellence to institution.

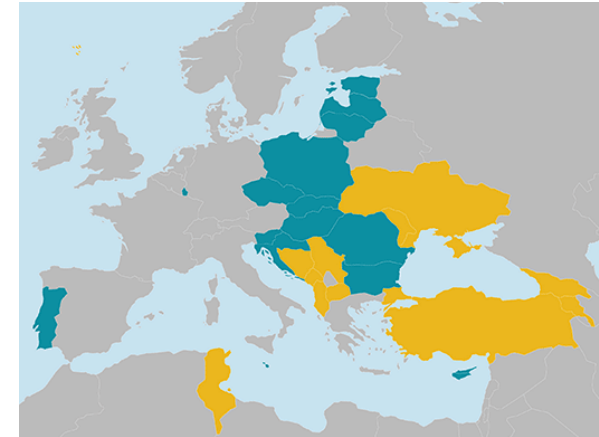
Outstanding academics, with proven research excellence and management skills, with potential for research excellence.

Twinning stands for institutional networking.

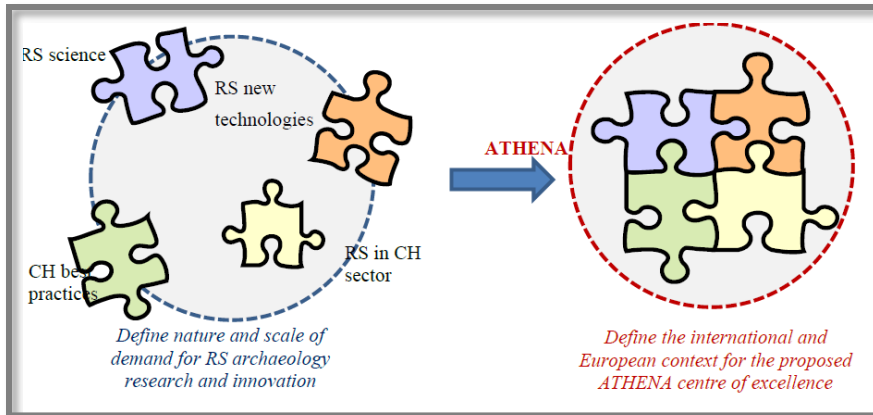
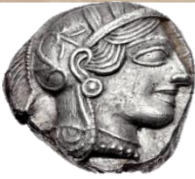
Transfer of Knowledge

Teaming means institution building.

Teaming projects create new or update existing centres of excellence in Widening countries through a coupling process with a leading scientific institution.



The Group is coordinating a Twinning project: Remote Sensing Archaeology Centre of Excellence - ATHENA



ATHENA: a funded project under the H2020-TWINN-2015 (www.athena2020.eu)

*The Centre aims to be in close collaboration with both national as well international research institutes and stakeholders, providing integrated remote sensing services and solutions in the area of the Eastern Mediterranean. The new perspectives on archaeological and cultural heritage in the region will position ATHENA as a centre of knowledge and a standard lab in the field of **Remote Sensing Archaeology**.*



Summer schools



Training

workshops

Staff exchange

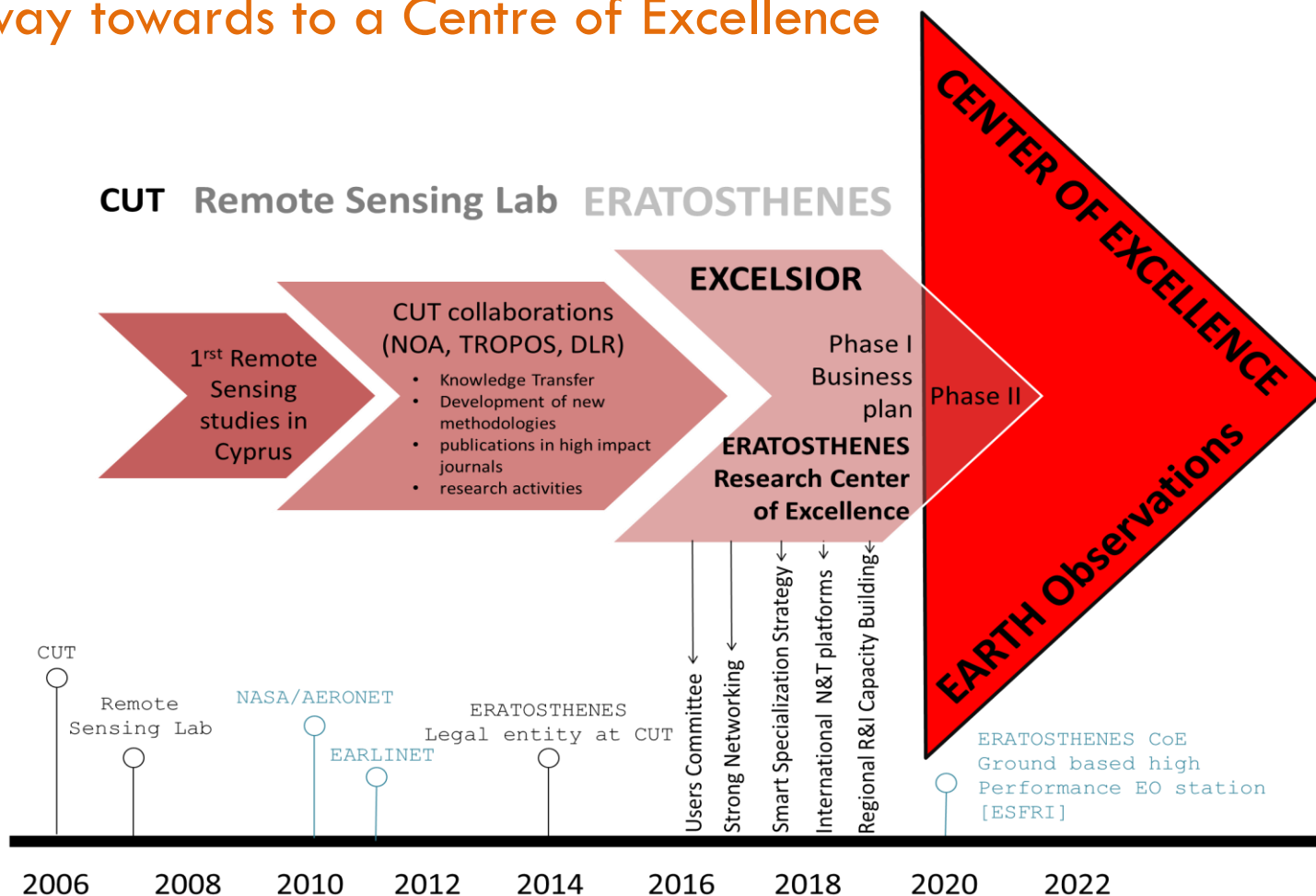
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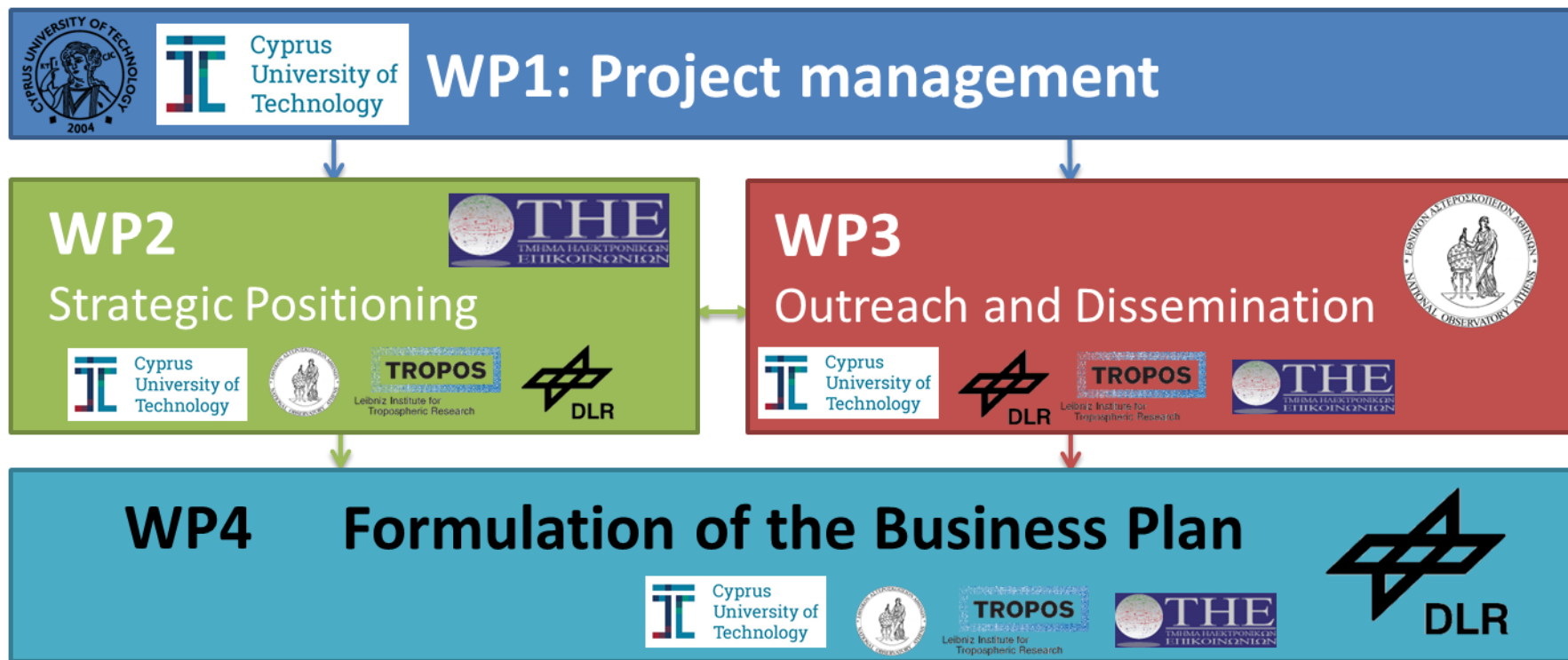


And now.....the teaming project

The pathway towards to a Centre of Excellence



EXCELSIOR's Structure: WPs



ERATOSTHENES

- The existing **Remote Sensing & Geo-Environment Group (Eratosthenes)**, being the **only established laboratory in Cyprus for space-based earth observation**, possesses significant experience on Earth Observation, Remote Sensing, as well as sophisticated instruments and models that are needed to systematically observe, understand, protect, monitor and predict environmental parameters in land, water and air.

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- DLR **will support the planning and establish a satellite receiving station** including attached processing and archiving functions with the possibility of a direct data flow into EO-based services and networks.
- NOA **will seek to establish sustainable links between ERATOSTHENES CoE**, and the **BEYOND Centre of Excellence**, that is established in the **European Research Area** as a regional Copernicus node for EO-based monitoring.
- TROPOS will be the key partner for the establishment of a **ground based Remote Sensing station** in ERATOSTHENES CoE, providing the close links between European networks and satellite validation activities.
- DEC-MTCW will **provide the links to the local and governmental community** and **promote** the space issues on the national level

Added value

- The integration of novel technologies** in the areas of Remote Sensing and space-based earth observation techniques, along with the use of Geographic Information Systems (GIS), **can assist in a more sustainable and systematic monitoring of areas of interest and the on-time detection of risks**, with the ultimate goal to protect the environment, providing critical information, through end user products, not only to policy makers and other local, national and regional authorities but also to citizens and tourists.

Why Space technologies?

Research, Products and Services generated by Space technologies has the capacity to mobilise R&I and development and **to boost the economies not only in Cyprus** but in the entire **Middle East region**.

The satellite data requires processing and, more importantly, “fine-tuning” towards the needs of the local users and their specific context in all branches of environmental monitoring, including climate change and emergency management.

The Centre of Excellence will provide added value both in Cyprus and in Europe by strategically positioning itself as a leader in space industry services in the region as a result of its focus on remote sensing, Earth observation and satellites technologies, its advancements in environmental science and through its alignment with the Smart Specialization Strategy of Cyprus (S3Cy).

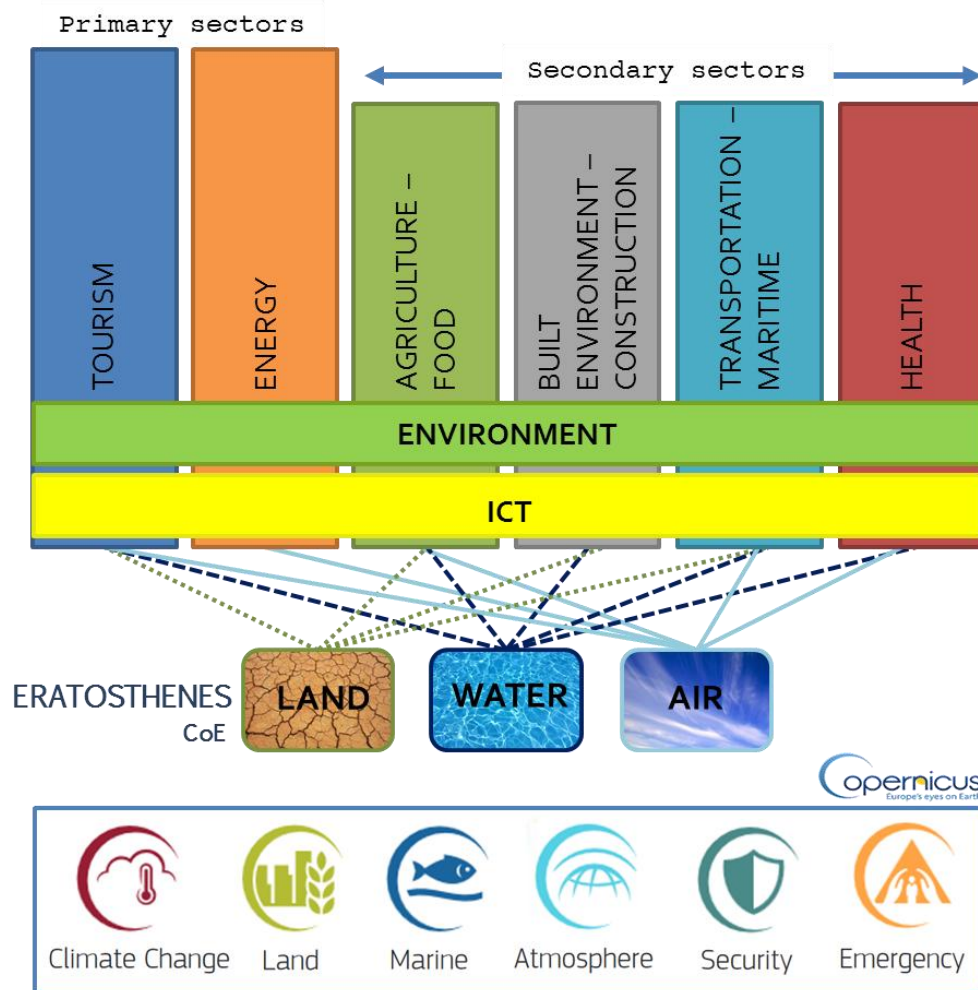
S3Cy

In relation to the **Copernicus trend**, which provides products and services on Land, Marine and Atmosphere monitoring as well as on Emergency management, Security and Climate Change, **ERATOSTHENES CoE** is organized in 3 main research thematic areas, i.e. Land, Water and Air.

(Natural Hazards, Agriculture, Forestry, Water Resources, Energy etc)

NATURAL & BUILT ENVIRONMENT

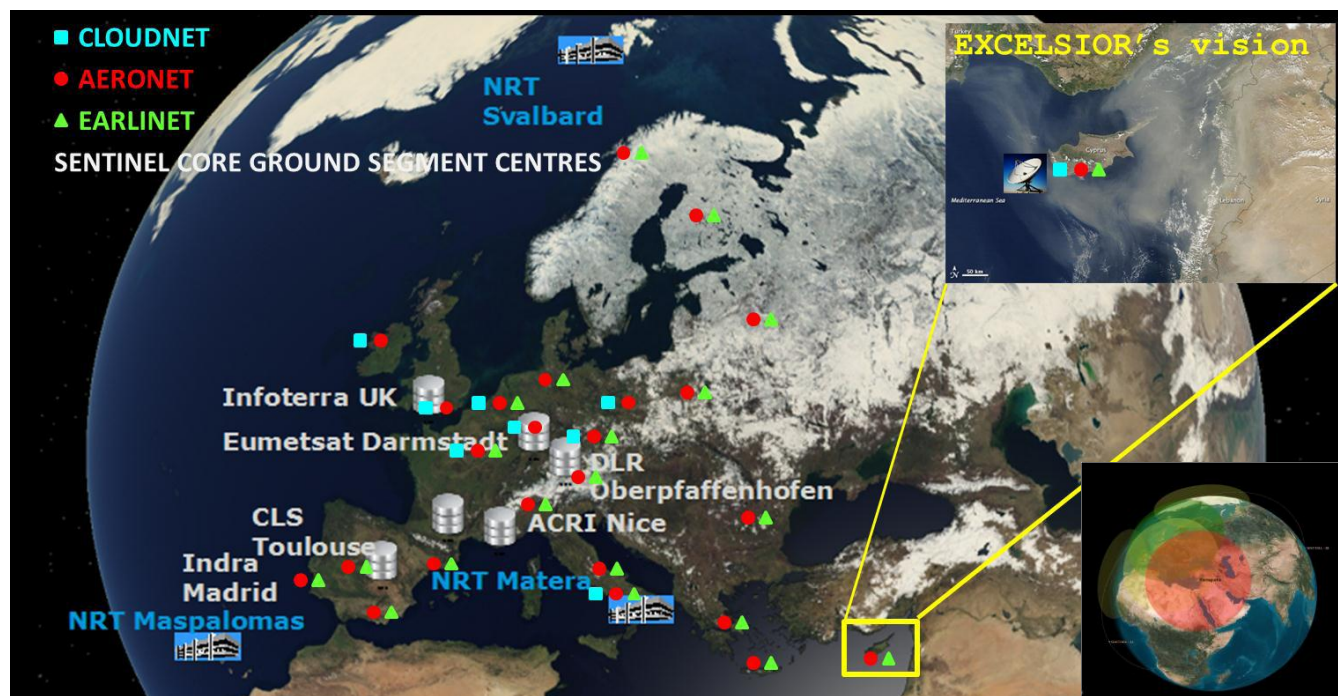
These three thematic Research Areas of the CoE **embrace all six Copernicus services and interact with the priorities of S3Cy**



why Cyprus?

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

The **ERATOSTHENES CoE** – with its expertise and infrastructure (e.g., prospectively its own satellite receiving stations and a state of the art ground based remote sensing station) - **could further complete the existing network of international ground stations.**



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

The priorities of the Centre of Excellence

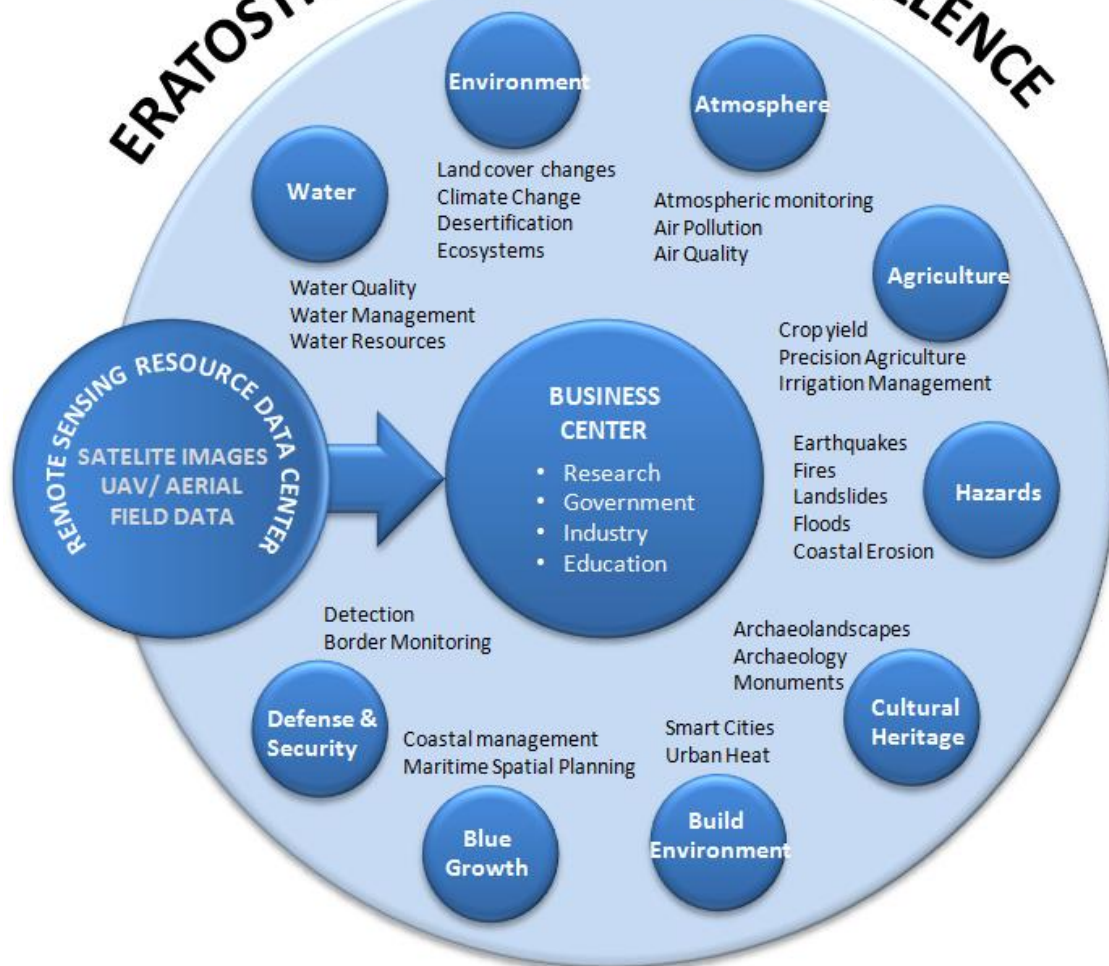
The Horizontal Priorities of the ERATOSTHENES CoE are:

- ☐ to promote Sustainable Development, based on exploitation of natural resources in respect and safeguard of the environment;
- ☐ to extend innovation in the field of Satellite Remote Sensing techniques and their integration with other geo-spatial data;
- ☐ to promote and enhance use of ICT-based tools and services oriented towards monitoring and protection of the environment (including air, land and water domain).

The Vertical Priorities of the ERATOSTHENES CoE are:

- ☐ to promote knowledge on general benefits deriving from space-based products and services for non-space sectors;
- ☐ to experiment and promote basic and applied research in domain of remote sensing technologies for the benefits of environment monitoring;
- ☐ to optimize the citizens experience in terms of everyday space-based ICT systematic services and applications.

ERATOSTHENES CENTER OF EXCELLENCE



Pillars



Innovation

Research



Services

Products



Education

Culture



Expected impact on National economy and society

- Provide **new job opportunities** for highly educated researchers in Cyprus
- Establish new Departments of the Centre that will improve and expand current research capabilities
- **Foster mobility among researchers** (towards and from the Centre) with other universities, research centre and private sector
- **Strengthen the relationship with industrial sector** through specific agreements with local SMEs in EO domain regarding research exchange, collaboration on patents and creation of spin-offs
- **Develop and disseminate integration tools** to fully exploit the use of multiple remote sensing techniques at ground-based stations, in particular for the calibration/validation/integration of satellite sensors
- **Maintain and enhance capacity of training** in the field of EO particularly directed to new users including those from non-EU developing countries

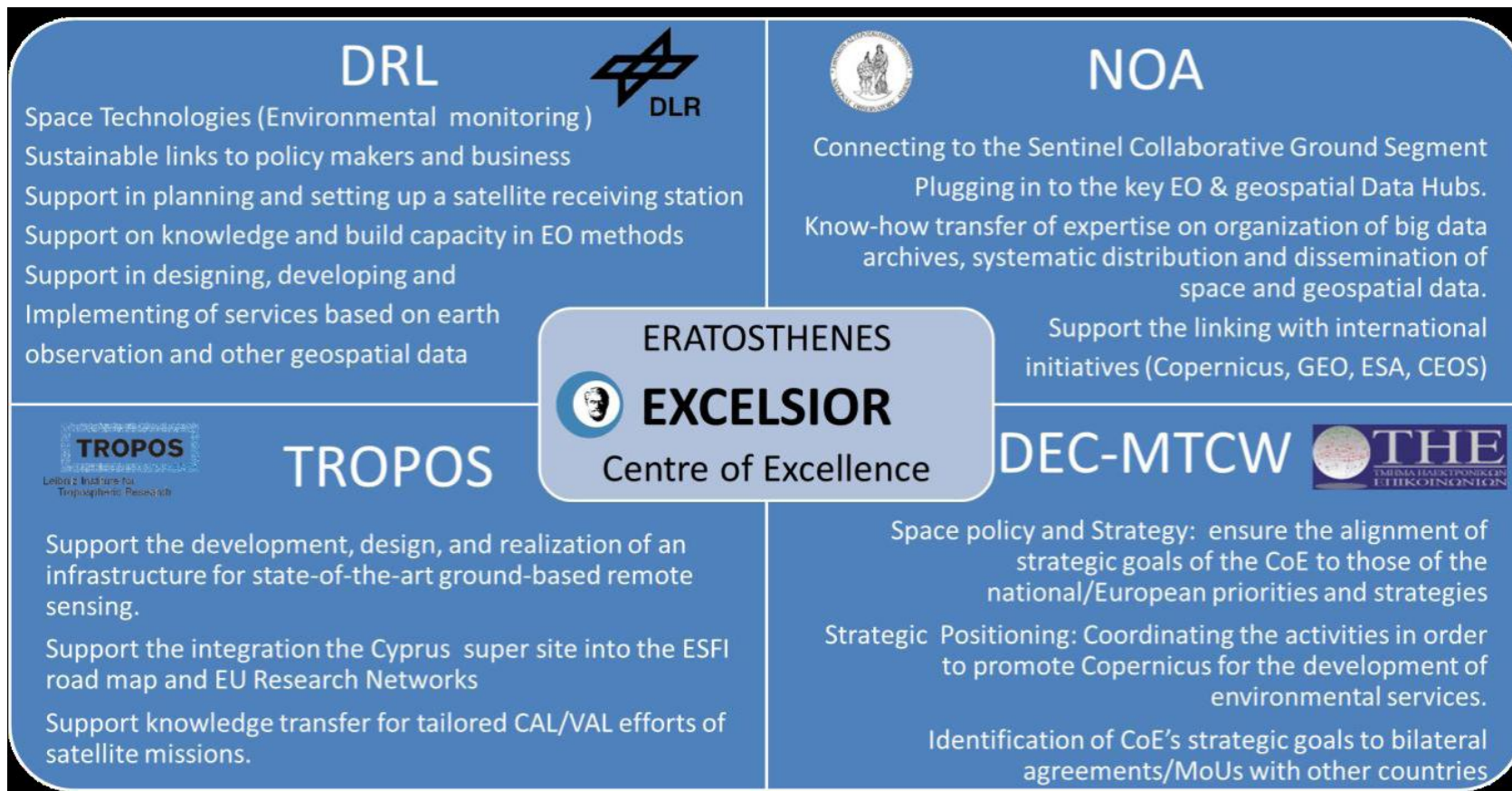
The way

The **upgrading of the existing ERC into a CoE will be accomplished** through a close interaction with a selection of the **key partners** (DLR, NOA, TROPOS) by **taking advantage of their excellence** in the topics addressed by the project. **There is a strong collaboration between the partners for the last 5 to 10 years.**

EXCELSIOR **will take full advantage of such partnerships with EU-leaders** already well founded on their proven efficient collaboration through existing long standing partnerships in other EU funded and ESFRI projects.

Networking, combined with **experience in proposal preparation/coordination**, and **strong links** as well as **deep engagement of different stakeholders**, is the key for **continuous funding attraction** and maintenance and enhancement of capacities.

Partners contribution





‘...Together with the strategic location, the national infrastructure and expertise, we can develop innovative space technology services and attract investments. The Earth observation sector in Cyprus is one of our priorities.....’

Minsister of Transport, Communications and Works at the kick off meeting 8 Sept 2017



Proposed HUB: for data, products, services

- Part of the business plan.
- Ground receiving station in Cyprus.
- Infrastructure for hub (design, plan, implement).
- **Provide R &D, services in the Eastern Mediterranean and Middle East (EMME) and Middle East and North Africa (MENA).**

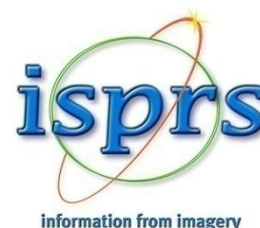
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An External Advisory Committee have been set up to **guarantee and monitor the scientific quality of EXCELSIOR project**. The Committee is composed of leading scientists in the field of Space-Based and Earth Observation technologies. Bearing in mind the scope of the **EXCELSIOR** project, every effort has been made to have in this EAC representatives from the areas of academia, business and science.

Name	Position	Organisation
Dr. Vincent Ambrosia (M)	Associate Program Manager NASA Applied Sciences Program	California State University
Dr. Marcello Maranesi (M)	International business experience in Geo-Spatial Information and Earth Observation	independent consultant
Prof. Lena Halounová (F)	Head of the Remote Sensing Laboratory/ IPSRS Secretary General	Czech Technical University
Dr. Peter Zeil (M)	Senior expert in the field of EO services and applications	Spatial Services Gmbh
Dr. Simonetta Cheli (F)	Head of Coordination Office	ESA Headquarters



VISION

- The new Centre to be **the top-leading one** in the Eastern-Med region in the earth observation
- **Strong collaboration with partners/ organizations/agencies in the Eastern Mediterranean and Middle East (EMME) and Middle East and North Africa (MENA).**
- To **host top scientists** in earth observation.
- To be a **sustainable centre** through European and national funds
- To provide **product and services / Hub**
- 'Cyprus' to be on the '**European Map of Earth Observation**'
- Establishment of respective research infrastructure in Cyprus could further complete the existing network of international ground stations

Next Step

...develop a business plan for promoting further the existing Group to a 'EXcellence Research Centre for Earth SurveiLLance and Space-Based MonItoring Of the EnviRonment'. The business plan will be submitted for evaluation to the EU Horizon 2020 framework for Research and Innovation during Phase 2 of the Teaming Programme, seeking funding of 15 million euros for a period of 5-7 years, with the possibility of an additional equal amount of national co-funding for a period of 15 years plus 4 millions from CUT= 35 MILLION EUROS

consortium



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COMMUNICATIONS

Join us at this phase (through memorandum of understanding) Letters of commitment)

- Think for collaboration in earth observation in natural and built environment

hazards, water resources, agriculture, coastal, cultural heritage, land applications, atmosphere, climate changes etc

- Think for future collaboration in the **EASTERN MED REGION** such as **ENERGY (solar radiation, oil & gas etc)!** This is one of the future activities of the upgraded centre

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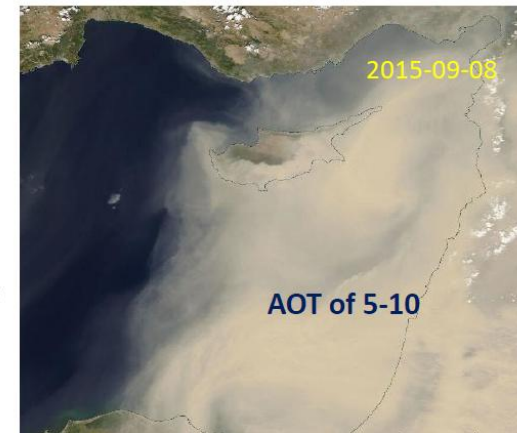
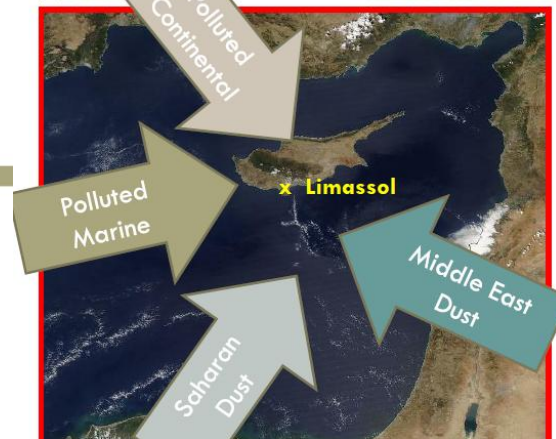
ERATOSTHENES: Excellence Research Centre for Earth Surveillance and Space-Based Monitoring of the Environment
Eastern Mediterranean-Cyprus



Aerosol sources



Cyprus: A Remote European Outpost



ATMOSPHERE:
Why EAST MED? Why
Cyprus

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Instrumentation



LACROS, Limassol, Cyprus, CyCARE 2016-2018



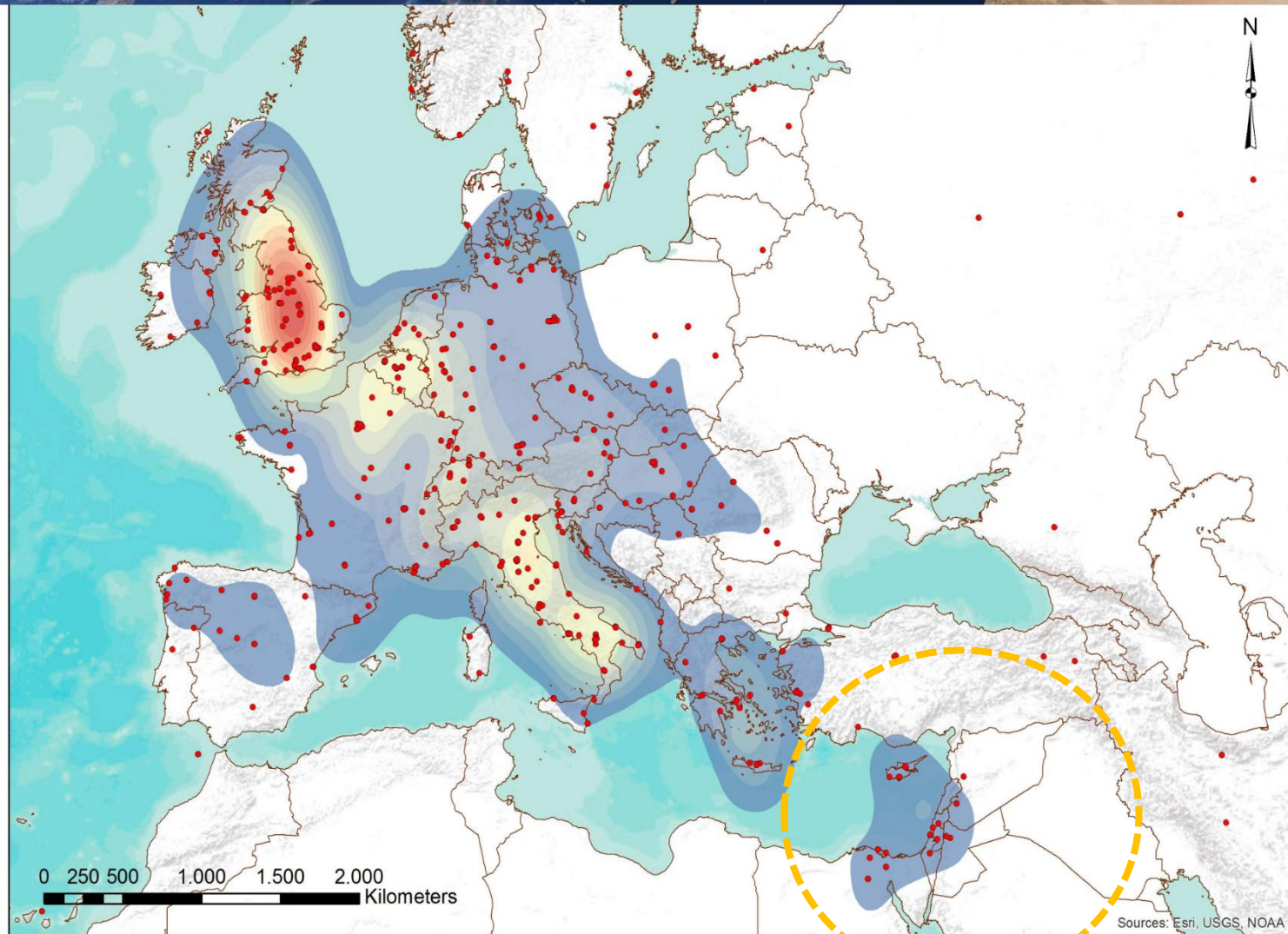
CROS: Leipzig Aerosol Cloud Remote Observation System

SPIE Remote Sensing | 11-14 September 2017 | Warsaw | Poland



WATER RESOURCES MANAGEMENT
Agriculture: Irrigation water management
(image based techniques for evapotranspiration +field spectroscopy): GREAT OPPORTUNITIES IN THE EAST MED!





“Remote Sensing Archaeology”, Citation based research from 1999-2015: ~~STILL A LOT TO BE DONE!~~

Fifth International Conference on Remote Sensing and Geoinformation of Environment' 20-23 March, 2017 - Cyprus



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RSCy2018

SPIE

PAFOS

CYPRUS (26-29 March 2018)



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Thank you for your attention

For more information you can visit: www.excelsior2020.eu



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Widespread-04-2017: Teaming Phase 1
Coordination and support action
Grant agreement no: 763643
Proposal acronym: EXCELSIOR

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