Satellite-based Services for Disaster Risk Management

17th May 2023 9:30 - 15:30 EEST HILTON NICOSIA Achaion 1, Egkomi Nicosia, Cyprus





In cooperation with the Department of Electronic Communications | Deputy Ministry of Research, Innovation and Digital Policy





Use cases of satellite-based services for Disaster Risk Management

ERATOSTHENES Centre of Excellence

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Overview of the Centre

 A new, autonomous Centre of Excellence, namely ERATOSTHENES Centre of Excellence (<u>www.eratosthenes.org.cy</u>), of the Cyprus University of Technology (CUT) has been established through the EXCELSIOR H2020 Widespread Teaming Phase 2 project (Grant Agreement No. 857510) (<u>www.excelsior2020.eu</u>), by upgrading the existing Remote Sensing and Geo-Environment Lab that has been operating at CUT since 2007.







DEC

TROPOS

The ERATOSTHENES COE consists of three Departments:

- **Environment and Climate**
 - Atmosphere \bullet
 - Agriculture \bullet
 - Water \bullet
 - Land •

Resilient Society

- Disaster Risk Reduction
- Cultural Heritage •
- Access to Energy \bullet
- Marine Safety and Security

Big Earth Data Analytics

- Information extraction
- Visual exploration & visualization

This project has received funding from the European

Union's "Horizon 2020 Research and Innovation

Programme" under Grant Agreement No 857510".

- Crowdsourcing & data fusion
- Geoinformatics \bullet

FFILIATED ENTITIES

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This project has received funding from the Government of the

European Programmes, Coordination and and Development".

Republic of Cyprus through the "Directorate General for



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This project is co-funded by the

Cyprus University of Technology,

University of

Investment

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



Data Acquisition Station (DAS)





Ground based station (GBS)





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



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 Technology Ь

ERATOSTHENES I I CENTRE OF EXCELLENCE

Research areas

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







Current projects



Duration: 36 months (Starting date: January 2023)



Current projects



Green-HIT: A Green - Holistic IoT platform for Forest Management and Monitoring

Call: CODEVELOP-ICT-HEALTH/0322

Duration: 24 months (Starting date: 1 February 2023)

Budget: €599,851.36 (ECoE: €65,280)





Applications and services

- Soil moisture detection from Space
- DEM development tool from Space
- Risk assessment tool for land displacements/fires/floods
- Systematic update of landslide inventory
- Geohazards/Fires/Floods impact assessment tool
- Decision Support Tools for evacuation and rehabilitation purposes
- Geohazards Observatory/EWS
- Fire Observatory/Early Warning System
- Floods Observatory/Early Warning System

End-users	Customer/User benefits				
Geological Survey	Landslide monitoring and landslide				
Department	risk assessment				
Department of	Protection of forests, Forest				
Forests	regeneration in areas impacted				
Water Development	Dam monitoring, Identification of				
Department	flood contributing factors				
Civil Defense	Timely landslide, fire, flood hazard				
Civil Defence	detection, Evacuation planning				
Emergency Response	Timely landslide, fire, flood hazard				
Units	detection, Evacuation planning				
Department of	Update of urban planning zones,				
Planning and Housing	Update of building permits				
Department of Public	Rehabilitation works for areas				
Works	impacted by landslides				
Civil Engineers/	Update of urban planning zones,				
Architects	Update of building permits				
	Update of home insurance fees in				
Insurance companies	areas with high landslide, fire, flood				
	susceptibility				
Real Estate agencies	Valuation of land and buildings				











Earthquake impact assessment through the application of DInSAR processing

<u>Results</u>

• 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



Rapid Landslide identification using Sentinel-2 satellite images through GEE



Rapid Landslide identification using Sentinel-2 satellite images through GEE

<u>Results</u>

dNDVI

Masked areas







Rapid Landslide identification using Sentinel-2 satellite images through GEE

<u>Results</u>



The validation of results derived from Sentinel-2 satellite imagery using high-resolution satellite data from the Google Earth platform is presented in (a) and (b) for landslide events in Akoursos and Agios Nikolaos Villages, respectively.

Additionally, (c) and (d) present time-series analysis based on the NDVI spectral index, which helps to identify the year in which the landslide events occurred for Akoursos and Agios Nikolaos Villages, respectively.

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Rapid Landslide identification using Sentinel-2 satellite images through GEE

<u>Results</u>



- Fusion of results from Sentinel-2 image processing and PSI results using Sewntinel-1 images.
- The processing concerns the classification (subsidence, stability or uplift) of PSI in both directions in comparison/integration of optical data in a wide coverage (in the range of the 30m from each point)



Sentinel-1 Change Detection with GRD Images



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Sentinel-1 Change Detection with GRD Images

<u>Results</u>

PEDOULAS

PYRGOS - PAREKLISSIA





SAR Coherent Change Detection with Sentinel-1 SLC images





SAR Coherent Change Detection with Sentinel-1 SLC images





SAR Coherent Change Detection with Sentinel-1 SLC images





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







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Multi-criteria decision analysis (MCDA)

Multi-Criteria Decision Analysis (MCDA) Reclass, score, standardize (0-100), Analytical hierarchy process (AHP)



MCDA

Information derived and acknowledged within MCDA:

- Geomorphometric and morphotectonic
- Seismicity
- Faults
- Sinkholes
- Quarries

Deformation/Motion hazard map consisting of various spatial distribution factors:

 (1) Amplitude of relief (Ar); (2) Stream lengthgradient (SL); (3) Topographic wetness index (TWI); (4) Slope gradient; (5) Lineament density;
(6) Seismicity; (7) Drainage density; (8) Stream frequency; (9) Sinkholes and; (10) Quarries











EUSPA CONSTRUCTION Agency for the Space Programme Bridge Space and Society

Burnt area estimation and mapping





Satellite-based applications for Disaster Risk Management National Workshop Cyprus 17 May 2023 Nicosia

Πυρκαγιά στην περιοχή Αρακα Wildfire in Arakapas village

Forest fires in National Forest park Dadias-Lefkimis-Soufliou in Greece

21 July 2022:

The ERATOSTHENES CoE used high-resolution PlanetScope satellite images, before and after the catastrophic wildfire in the National Forest Park of Dadia-Lefkimi-Soufli to identify and record the burnt areas with the ecological destruction in the biodiversity of the area being significant.







Fire severity mapping

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

Fire severity estimation using Differenced Normalized Burn Ratio (dNBR)





Estimation of the forest regeneration after fire events

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



















Dynamic flood modelling





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Flood Risk Assessment

Decision Support systems for flood risk/hazard monitoring



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















Digital Elevation Model







•DCH knowledge management











