Achievements and successes of past PECS activities

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GEOFEM

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Introduction to Geofem

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Who we are

- Established in 2007
- Services:

Geotechnical engineering

Satellite Remote Sensing

GIS

- We help maximise the resilience of infrastructure and the built environment to heavier use, climate change and geohazards through a combination of the above

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The Team:

Andrew Lees, CEng, PhD
Civil & Geotech engng.

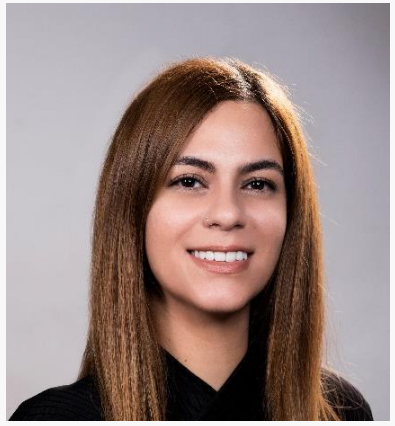
Skevi Perdikou, PhD
Satellites & Geotech

Jordan Aloupas, CEng, MEng
Civil engineering

Chris Ierides, MSc
Geotechnical

Egli Michaelidou, MSc
Satellites & coding

Dimitris Kouhartsiouk, MSc
Satellites, coding, AI



Styliana Stavrou, MSc
Geology & geoinformatics

Iphigenia Christoforidou, MSc
Business Development and Admin

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Who we are

- Geotechnical Engineering (2007)
  - Predicting ground stability
  - Reduction of risk in infrastructure and the built environment

- Satellite Remote Sensing (2016)
  - Monitoring infrastructure
  - Susceptibility to geohazards
  - Environmental applications, agricultural, land use classification, bathymetric studies

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Who we are

- Innovation
  - Research & Development: new tools, products and methodologies
  - Funded projects by European Space Agency, national & EU funded
  - Publications
- Commercial
  - Projects: Worldwide
  - Industries: Infrastructure, Mining, Energy, Insurance

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The Great Infrastructure Challenge

Ageing infrastructure

Skills shortage

Climate change

Declining budgets

Geohazards

Coastal erosion: $500 million/yr US alone

Landslides: $878 million/yr globally

Sinkholes: $300 million/yr US alone

Clay subsidence: $12 billion/yr globally

"Geohazards are difficult to manage and yet the numbers continue to increase with climate change"
World Bank, 2020

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Past and ongoing PECS projects

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PECS Calls

- 1st Call: 2017: **Failed**
- 2nd Call: 2018: **Resubmitted Successful** (2019 to 2021): **completed**
- 3rd Call: 2019: **Successful** (2020 to 2022): **submitted**
- 4th Call 2020: **Successful** (2021 to 2023): **ongoing**
- 5th Call 2021: **Successful** (2022 to 2024): **ongoing**

Title: Risk evaluation tool for assessing the risk of uplift and subsidence from swelling clays using radar and geotechnical data (RETUPS)

Prime Contractor: Geofem			**PECS Budget:**	**148 k€**
			Co-funded Budget:	**0 k€**
Contract No.: 4000126898 / Proposal ID: CY2_04		**Year of Contract: 2019**	**Proj. Mgr.: Stephen Airy**	
TRL	**Initial: 4**	**Achieved: 6**	**Target: 6**	**Date: 15/06/21**	**Email PoC:**

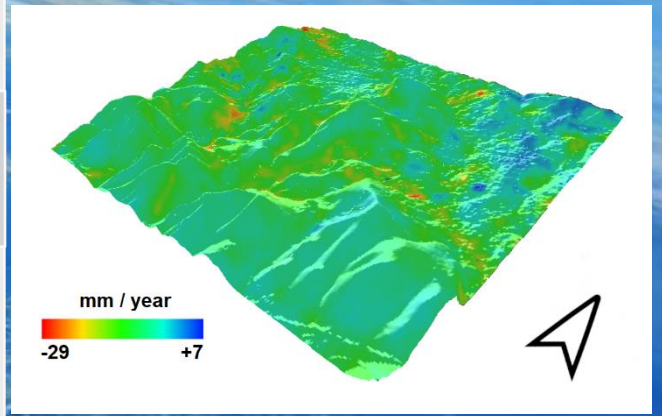
Background and justification: Swelling clays experience large volume variations as moisture levels change due to seasonal changes. These cause subsidence and heave and hence damage to buildings and infrastructure. This geohazard is referred to as swelling-shrinking clays. Even though the hazard of swelling clays has not received much attention compared to other natural hazards, the cost from the damages outweighs those caused by floods, landslides, earthquakes combined. It is therefore vital to derive a means for the detection, estimation and prediction of ground movements and damages caused by expansive clays.

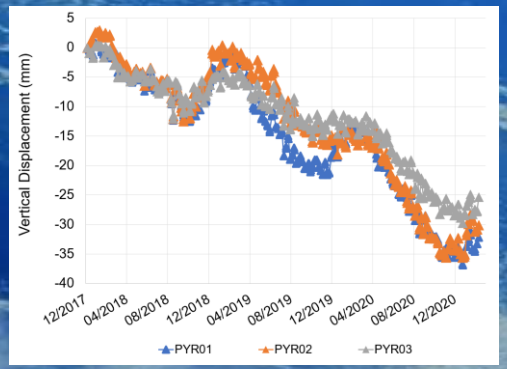
Objective(s): The project aims to develop a Risk Evaluation Tool in a GIS environment which will enable the categorization of areas covered by swelling clays into different susceptibility levels using a synergy of SAR technology with geotechnical, geological and soil moisture data. For this purpose, InSAR technologies (using Sentinel-1 SLC data), optical data (Sentinel-2) and SAR data (Sentinel-1 GRD) will be used together with in situ data for deriving soil moisture estimations, geotechnical and geological soil characteristics.

Achievements and status: The project is very close to completion. Final report is planned to be delivered in July 2021. The project achieved its goals. Specifically, main achievements include: a)Determination of ground behaviour in swelling clay areas and identification of pattern and magnitude of swelling behaviour, b) geotrechnical characterization of the swelling clays as a result of geotechnical laboratory testing and existing borehole data (areas of swelling clays have different behaviour based on geotechnical parameters), c) derivation of an algorithm for determining soil moisture via satellite data, considering other important parameters, d) development of a susceptibility map for the categorisation of areas into four susceptibility classes for the risk to building damage due to swelling clays. This can be updated every season (summer / winter), reflecting the seasonal changes.

Benefits:
The primary benefit is the development of the susceptibility tool which can be used as a decision-making tool, which will enable the stakeholders to make informed decisions with regards to the susceptibility of areas to building damage. This information could be used by government departments for determining zones suitable for developments, the insurance sector, developers, engineers and architects, utility owners, the road network authorities etc.

Next steps:
Completion of the Final Report.





Title: Direct Observation & Monitoring of Instability via Satellite Radar Interferometry (DOMISI)					
Prime Contractor: Geofem Limited				PECS Budget: 182 k€ Co-funded Budget: 0 k€	
Contract No.: 40001131059 / Proposal ID: CY03_10			Year of Contract: 2020	Proj. Mgr.: Stephen Airy Email PoC:	
TRL	Initial: 5	Achieved: 8	Target: 8	Date: 11/05/22	

Background and justification: The 'DOMISI' project is an important step towards establishing a nationwide platform/geoportal for the provision of information regarding ground displacements and geo-hazards in Cyprus using advanced DInSAR techniques. 'DOMISI' focuses on mapping and monitoring displacements such subsidence and uplift phenomena affecting all urban and residential areas as well as areas of critical infrastructure including sites of cultural importance using Copernicus SAR data and Third-Party Mission data.

Objective(s): The project's main objective is to provide a service to interested parties and potential clients for up-to-date surface and infrastructure displacement information. The project also aims to collect ancillary information for validation of the displacement data and to analyse the correlation between the measured displacements and contributory factors for each case study (site/building).

Achievements and status: The project is near completion (expected to be completed in June 2022). Main achievements include the interferometric analysis of the urban areas of Cyprus including the defined case studies by the stakeholders (Cyprus Department of Antiquities, Authorities and Municipalities) and in situ observations of selected buildings exhibiting displacements. Another achievement includes the identification of problematic archaeological sites ad the installation of 4 corner reflectors to monitor displacements at those sites. Also, a significant achievement is the development of the web-GIS platform that hosts the results, where interested parties/clients can access to obtain data for their area of interest.

Benefits: The primary benefits that derive from the implementation of the project are societal (identifying and mapping sites exhibiting deformation) and economic with the development of innovative space products/services that in turn have the potential to increase industry competitiveness in Cyprus.

Next steps:
The next steps of the project towards its completion include the training of potential end users & stakeholders aiming at user adoption. Also, there will be a video recorded demonstrating the use of the developed geoportal. Finally, the next steps include the preparation of the Final Report and associated deliverables.

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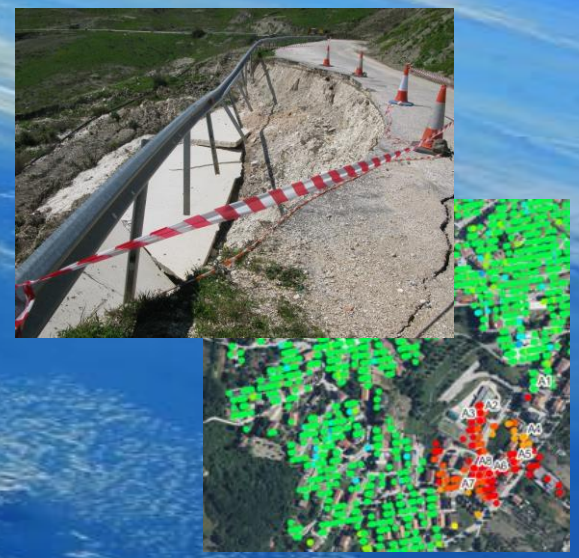
Title: A synergy of satellite radar interferometry and engineering assessment for forensic investigations of infrastructure assets

Prime Contractor: Geofem Limited				**PECS Budget: 180 k€** **Co-funded Budget: 0 k€**
Contract No.: 4000134977 / Proposal ID: CY4_26			**Year of Contract: 2021**	**Proj. Mgr.: Stephen Airy** **Email PoC:**
TRL	**Initial: 6**	**Achieved: TBD**	**Target: 8** **Date: 11/05/22**	

Background and justification:
Aging infrastructure, declining budgets, heavier use and climate change, all contribute to an increasing number of severe infrastructure asset damages and failures. Conducting a retrospective analysis is important as we gain an insight as to the causes of infrastructure asset damages and failures.

Objective(s):
The project aims to develop a service which will be well documented well supported and proven to demonstrate the benefits from the use of satellite image analysis and engineering assessment for forensic investigations. This will enable the identification of possible causal factors of severe damages and or collapses of infrastructure.

Achievements and status:
The main achievements to date include the preparation of the quality control plan, the risk evaluation and mitigation plan, the requirements baseline and user requirements documents via consultation with national and international stakeholders. Also, a list of 10 case studies have been identified and the desk study for each one has been completed. The desk study report has been submitted. The interferometric radar analysis and the engineering assessment are under way for each of the defined case studies.



Benefits:
The primary benefits are the identification of the causal factors of severe damages and or collapses which demonstrate the benefits of satellite image analysis for different disciplines. This is beneficial for the insurance and the infrastructure asset industries as well as for the society. Also, to learn from mistake and avoid future disasters by knowing the causes.

Next steps:
The following phase will include the completion of the engineering and satellite image analysis and the parametric and sensitivity analysis.

Experience from working with ESA

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Experience from working with ESA

- Geofem gained a lot from working with ESA:
  - More competitive
  - Gained greater understanding of space industry
  - Develop high quality commercial products and services
- Valuable suggestions/comments/ideas/reviews
- Consider commercialization aspects

Experience from working with ESA

- Extremely:
  - **professional,**
  - **helpful,**
  - **positive,**
  - **honest,**
  - **quick response,**
  - **constructive!**

Tips & lessons learned

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Tips & lessons learned

- Debriefings are always very useful for both successful and unsuccessful projects.

- ESA's comments/reviews as they will help you improve your products/services and become more competitive.

Tips & lessons learned

- Treat ESA as a client NOT as a funding agency.
  - You have to deliver on time
  - You have to consider the ‘client’s comments and reviews
  - You have to deliver what is in the contract

- Use the PECS programme as an opportunity to:
  - develop innovative products and services,
  - employ qualified highly skilled people,
  - commercialise internationally and
  - **NOT to make money!**

Importance of PECS for Geofem

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Importance of PECS for Geofem

- Growth of the company
- Commercialisation of products & services
- Form international collaborations

THANK YOU

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