ATHENA
Remote Sensing Science Center for Cultural Heritage in Cyprus

Diofantos G. Hadjimitsis[1], Athos Agapiou[1*], Vasiliki Lysandrou[1], Kyriacos Themistocleous[1], Branka Cuca[1],
Rosa Lasaponara[2] Nicola Masini[3],
Thomas Krauss[4], Daniele Cerra[4], Ursula Gessner[4] and Gunter Schreier[4]

[1] Remote Sensing and Geo-Environment Laboratory, Department of Civil Engineering and Geomatics Cyprus University of Technology Saripolou str. 2-8, 3036 Limassol, Cyprus, athos.agapiou@cut.ac.cy
[2] National Research Council, Institute of Institute of Methodologies for Environmental Analysis, C.da S. Loya, 85050 Tito Scalo, Italy
[3] National Research Council, Institute of Archaeological and Monumental Heritage, C.da S. Loya, 85050 Tito Scalo, Italy
[4] Earth Observation Center - EOC, German Aerospace Center – DLR,Wessling, D-8223 Oberpfaffenhofen, Germany

Abstract

Cultural Heritage (CH) sector, especially that of monuments and sites exposed directly to environmental conditions, has always been facing a number of challenges both of natural and anthropogenic character. Within this context, CH professionals are seeking to improve currently used methodologies, in order to better understand, preserve and valorise the common European past and common identity.

"ATHENA" H2020-TWINN-2015 project aims at improving and expanding the potentialities of the existing Remote Sensing and Geo-environment Research Lab of the Cyprus University of Technology, by involving experts dealing with remote sensing technologies for supporting CH sector. These are the National Research Center of Italy (CNR) and the German Aerospace Centre (DLR).

Fig. 1: Word cloud of ATHENA

ATHENA Center

The envisage ATHENA center will be devoted to the development, introduction and systematic use of advanced remote sensing science and technologies in the field of archaeology and built cultural heritage, the multi-temporal analysis and interpretation and the distant monitoring of their natural and anthropogenic environment in the area of Eastern Mediterranean.

ATHENA will take advantage of the current capabilities of Cyprus University of Technology (CUT), both in terms of technical and staff capacity and technological readiness of the existing Lab, performing advanced research to support CH sector. The Center aims to be in close collaboration with national and international research institutes and stakeholders, providing integrated remote sensing services and solutions in the area of Eastern Mediterranean, rendering that way ATHENA a center of knowledge and an established lab in the field of Remote Sensing Archaeology.
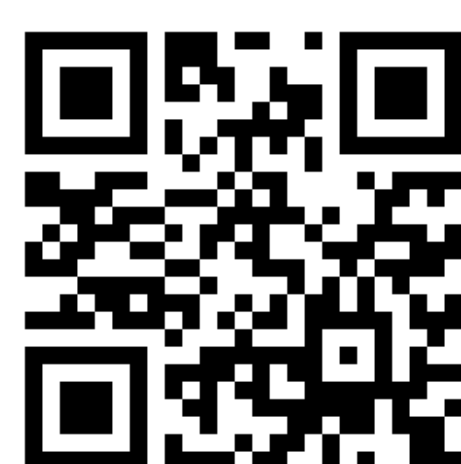
ATHENA's objectives

ATHENA's overall objective is to significantly strengthen the scientific excellence and innovation capacity of the Remote Sensing Science and Geo-Environment Research Laboratory established in Cyprus University of Technology (CUT) and specifically upgrade and improve its Archaeology and Cultural Heritage Section, turning it into a center of excellence ("ATHENA") specialised in the field of Remote Sensing for CH applications.

The improvement in the overall scientific and innovation capacity of the initiating Centre in the specific field for the eastern Mediterranean basin is vital for the area which is world-wide known for its important antiquities. The ATHENA project will significantly upgrade the CUT's Remote Sensing Science and Geo-Environment Research Laboratory in the field of Remote Sensing Archaeology by creating a unique link between two internationally-leading research institutions: National Research Council of Italy (CNR) and the German Aerospace Centre (DLR). Through ATHENA, CUT's staff research profile and expertise will be raised while at the same time it will enhance the science and technology capacity of the linked institutions.

Remote Sensing Archaeology in Europe

The use of satellite and other remote sensing technologies has progressively been established in the field of environmental monitoring. In the domain of CH and landscape, and in particular with regards to archaeological sites, these technologies have made a significant contribution to research and analysis over the past few decades. The potential use of Remote Sensing (RS) technologies for the understanding, documenting, monitoring and valorization of CH has long been recognised not only by RS experts and archaeologists, but also by the public authorities involved in heritage management, that suggested an increasing use of non-invasive technologies (Valletta Convention, 1992). These benefits are also of importance for forming policies, as well as for management of vast portions of territory, such as European Landscape Convention indicates (Florence, 2000). RS benefits are also emphasized in regions were conflicts or wars are taken place (i.e. Middle East and Northern Africa), since it can be used for detection of looting and destruction of World Heritage Sites (WHS).

Fig. 3: Example of the use of RS technologies for monitoring the status of CH sites in conflict regions. Palmyra archaeological site, comparison of imagery prior and post conflict.(from: AAAS Geospatial Technologies Project).
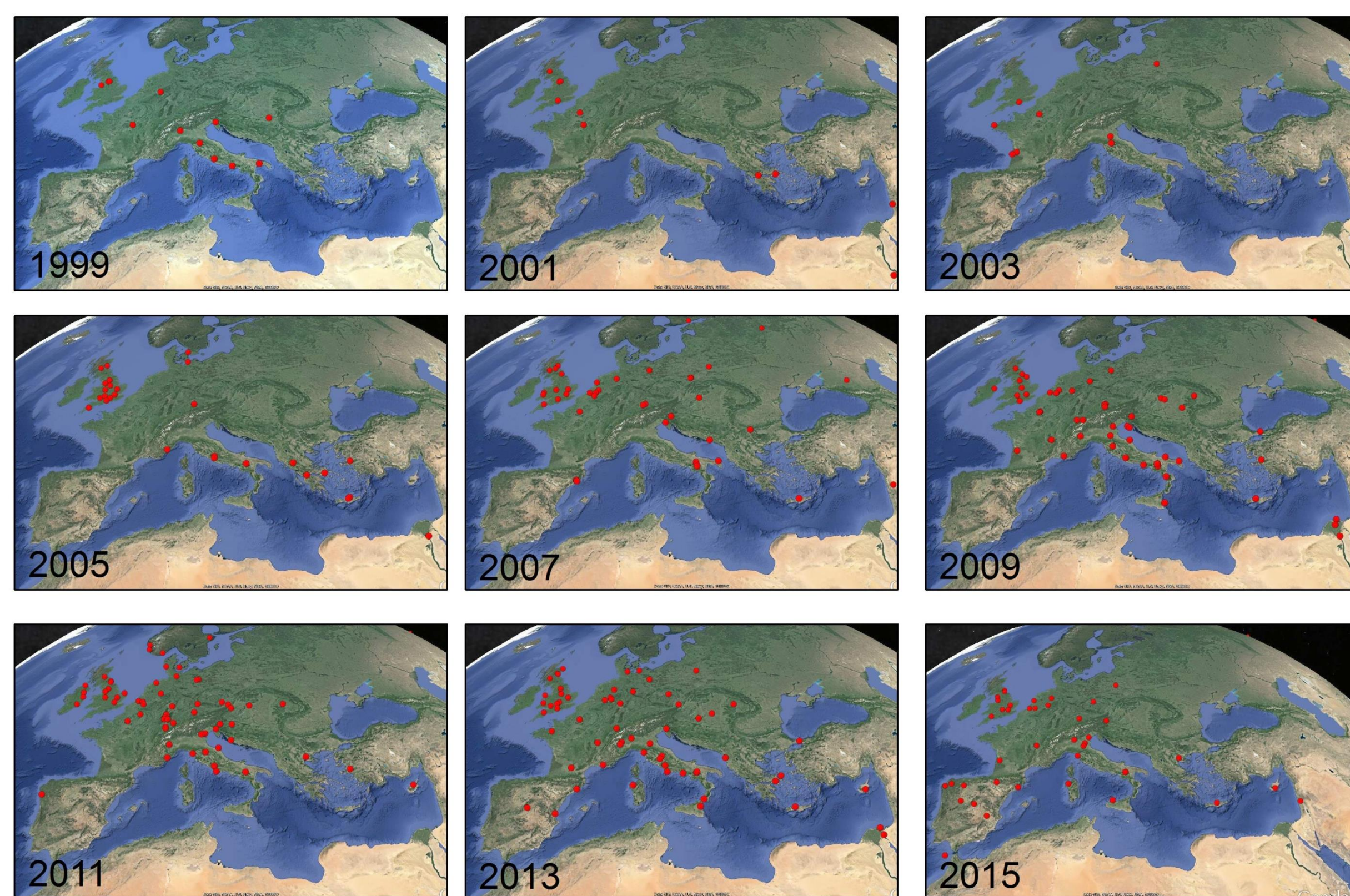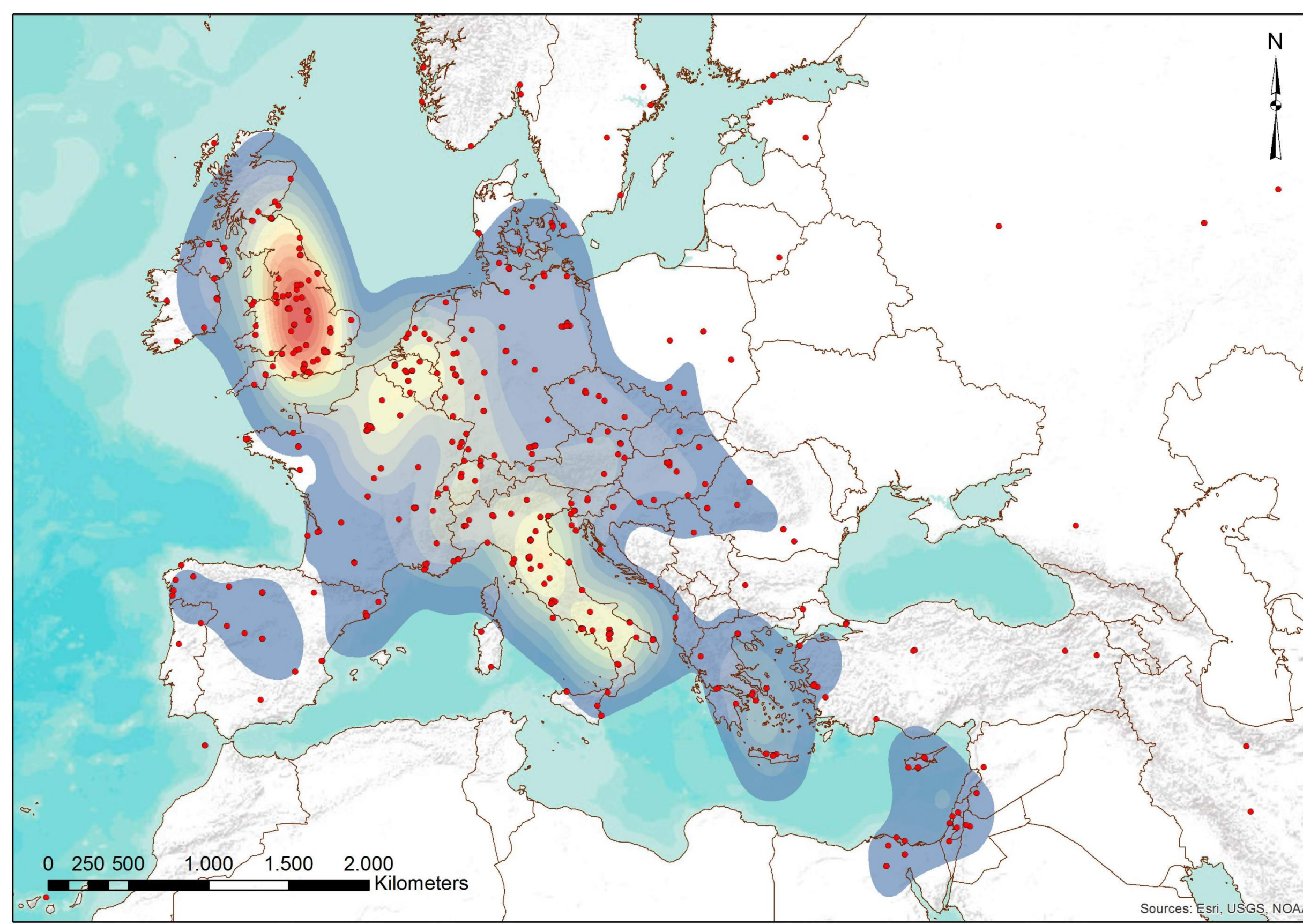
Fig. 2: Current status of "Remote Sensing Archaeology" application in Europe based on a citation based approach from SCOPUS and Web of Science scientific databases (from Agapiou A. and Lysandrou V. (2015), Remote Sensing Archaeology: Tracking and mapping evolution in scientific literature from 1999-2015, Journal of Archaeological Science Reports, 4, 192–200, 10.1016/j.jasrep.2015.09.010).

Motivation Europe has rich and diverse cultural heritage resources, including urban and rural landscapes, characterized and enhanced by the presence of both exposed and buried archaeological remains and isolated monuments. ATHENA project is focused on accessing, understanding, and strengthening European identity through its rich CH for both specialists and citizens at large. CH does not only reinforce the feeling of European identity, but also ensures social cohesion. Currently, Europe's cultural heritage and landscapes are at risk, endangered by environmental processes and anthropogenic pressures, in addition to under-funding vulnerability resulting from the general economic crisis. The consequences of these pressures combined with the steady decrease trend of the budgets allocated for the preservation of the archaeological remains are proving to be catastrophic for the European Cultural Landscape. Authorities responsible for the preservation of the cultural landscape to the future generations are well aware of the huge costs required by rehabilitation intervention as compared with preventive ones. Authorities have a strong requirement for systematic, effective, usable and affordable tools to monitor the degradation process and enable preventive maintenance.

Cultural heritage monuments and sites are endangered by anthropogenic and natural threats, with prevention sometimes being the only cure for any potential risk. Currently, CH sector seeks innovative and cost effective tools for systematic monitoring in order to protect CH sites, monuments and landscapes from possible hazards. In this framework, gathering data for vast areas can be time consuming and expensive, while sometimes data collection procedure might not be possible due to the lack of the appropriate equipment and tools. In contrary, remote sensing technologies for systematic monitoring of CH sites have shown a great potential as an important tool for the protection of monuments as well as the prevention of negative and destructive factors that threaten them. In the last two decades, the development of ground, aerial and space technologies have been successfully applied for several CH applications. The new technological achievements of space technology, such as higher spatial resolution and hyperspectral data, offer new opportunities for future archaeological discoveries. Satellite imagery offers a quick and economical alternative for monitoring natural and anthropogenic hazards over large and inaccessible areas. The availability of cloud free satellite images for operational projects is critical. Mediterranean countries are ideal for the use of optical remote sensing data as they are characterized by clear weather conditions with availability of cloud-free images.
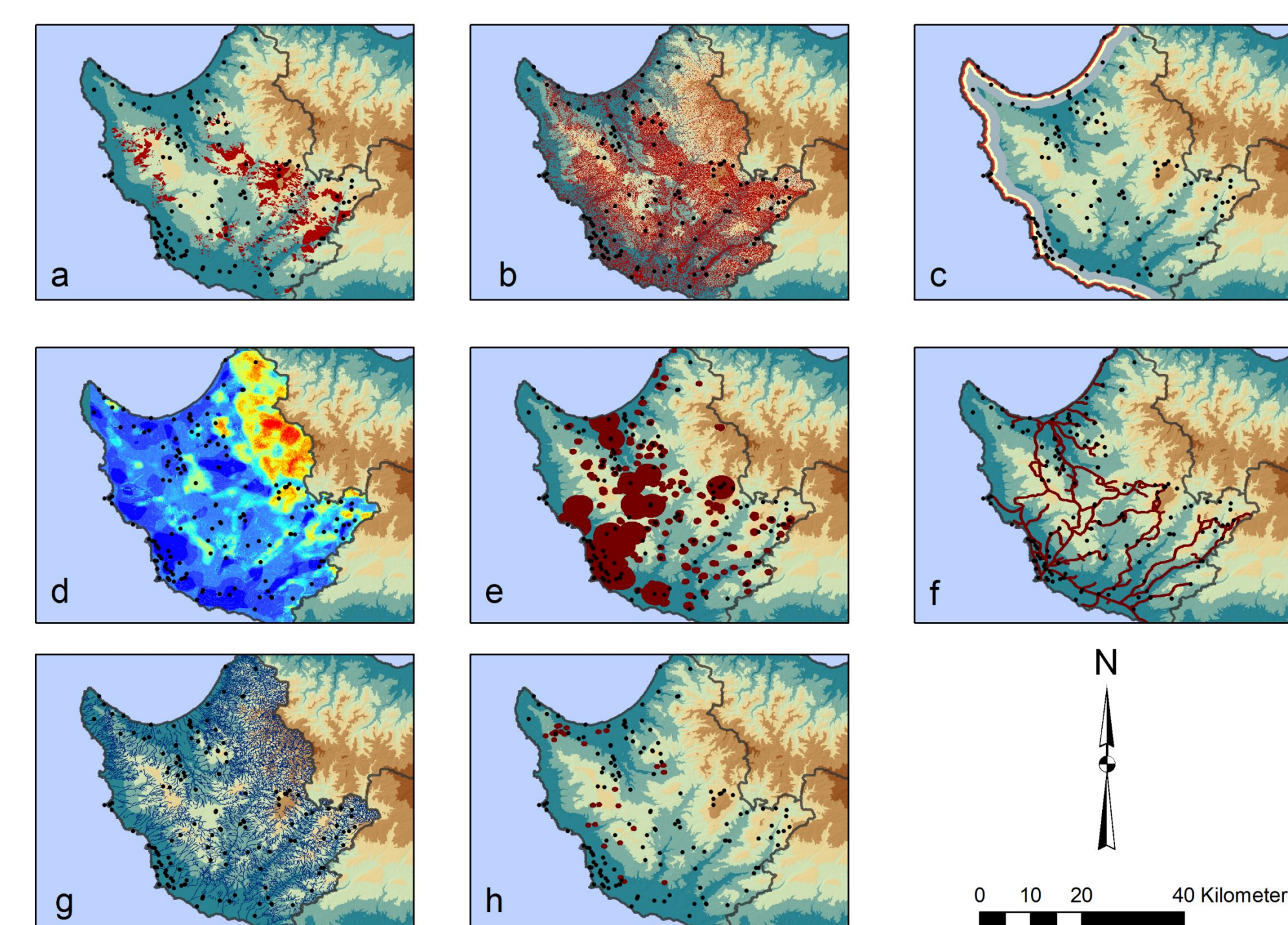

Fig. 4: Map indicating the different anthropogenic and natural hazards over Paphos District in Cyprus. (a) Landsides; (b) Erosion; (c) Salinity; (d) Tectonic activity; (e) Urban expansion; (f) Road network; (g) Drainage network and (h) Fire (from Agapiou A., Lysandrou V., Alexakis D. D., Themistocleous K., Cuca B., Sarris A., Argyrou N., Hadjimitsis D. G. (2015), Cultural heritage management and monitoring using remote sensing data and GIS: the case study of Paphos area, Cyprus, CEUS Computers Environment and Urban Systems, 54, 230-239, http://dx.doi.org/10.1016/j.compenvurbsys.2015.09.003)

....more info

www.athena2020.eu

Consortium
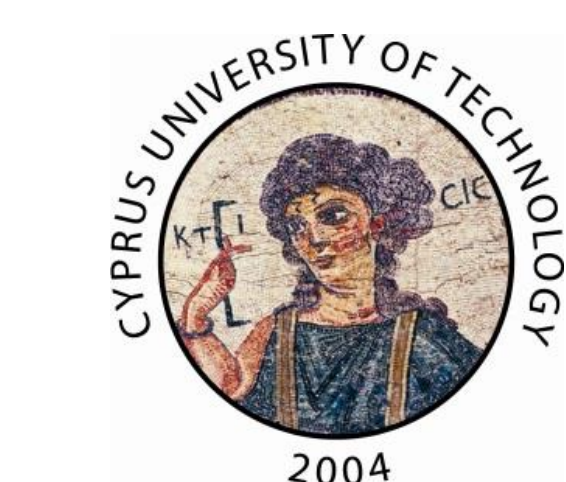
Cyprus University of Technology   National Research Council   German Aerospace Centre

Acknowledgments