SATCULT Project: Good Practice Documentation Template

The application of satellite data in cultural heritage (CH) protection is still in its early stages, predominantly utilised by archaeologists. However, the SATCULT consortium has begun exploring its potential future uses in the wider CH area.

As part of an upcoming vocational training programme for CH practitioners , the SATCULT initiative gathers examples of Good Practices which show how satellite data can be used for the protection of CH including the benefits of accessing and utilising this data, and required skills for effective use. We are specifically interested in Good Practices from CH beyond archaeology.

The primary focus will be on desk research, collecting examples from European and international contexts with the assistance of Geoinformation and CH protection experts and practitioners. These examples will be analysed to determine the training needs of professionals and practitioners in CH protection and compiled into a compendium.

Please note filling this template requires knowledge to address properly the fields described throughout the survey. Although it is not long, it might take around 15 – 20 minutes to complete it thoroughly and properly.

A selected number of Good Practices, representing the working areas in cultural heritage, will be published in a European brochure and all Good Practices will be published on the SATCULT homepage and presented in the SATCULT LinkedIn group.

SATCULT:
Closing a knowledge gap by vocational training about satellite-based services in cultural heritage preservation

Erasmus+

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Name/Title of the Good Practice *

Monitoring Cultural Heritage Sites Affected by Geo-Hazards Using In-Situ and Synthetic Aperture Radar (SAR) Data: The Choirokoitia Case Study

Name of the organisation *

Cyprus University of Technology

Type of organisation in charge of the Good Practice *

- ○ Cultural Heritage organisation
- ○ Cultural Heritage site
- ○ Cultural Heritage -related public entity (Ministry, Prefecture, Municipality)
- ○ University
- ◉ Research Institute
- ○ Earth Observation -related organisation
- ○ Geo-Informatics (Geomatics) organisation/company
- ○ Private Company
- ○ Άλλο: .....

Domain of organisation's activities/expertise *

- ○ Cultural Heritage
- ○ Archaeology
- ◉ Earth Observation
- ○ Geo-Informatics
- ○ Άλλο: .....

Contact Information and Organisation's Logistics

Respondent's contact details

Full name of the contact person *

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Organisation's details

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Cyprus

City *

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82 Franklin Roosevelt, 3012, Lemesos, Cyprus

Information about the Good Practice

Please name below the *Country*, *City* and *District* where the Good Practice took place *

Cyprus, Larnaca District

Please provide below a *Google Maps link* or *GPS coordinates* to the Good Practice's location *

https://maps.app.goo.gl/W39YMyervaBt7EtBA

Is this considered a sensitive* area ? *
*(protected, fragile, has restricted access, or located within a conflict zone, etc.).

Please elaborate further.

No this is not a sensitive area

Who owns the cultural asset (ministry, other public body, private institution, none), on which the Good Practice was applied ? *

Department of Antiquities

Date(s) or period the Good Practice took place *

Please insert below the period when the good practice held. (eg. 2019-2020, March 2020 – June 2021, etc.)

2011–2017 (see page 303 of the below ref)

Description of the Good Practice *

Please describe how the satellite data were collected (please mention the repositories or services where you acquired them); how they were used in your project; which were the aims of your study; and why these data were useful towards your research goals. (character limit: 1500)

The Neolithic settlement of Choirokoitia, occupied from the 7th to the 4th millennium BC, is one of the most important prehistoric sites in the eastern Mediterranean (UNESCO World Heritage List 2016). Choirokoitia is one of the best preserved settlements of this period in Cyprus and the eastern Mediterranean. The site is located in the district of Larnaka, about 6 km from the southern coast of Cyprus, and lies on the slopes of a hill partly enclosed in a loop of the Maroni River. The satellite data used in this project were collected using Interferometric Synthetic Aperture Radar (InSAR) from the COSMO-SkyMed satellite constellation. Persistent Scatterer Interferometry (PSI) was applied to process the images and detect ground motion with millimeter precision. Additional geospatial data were gathered using UAV photogrammetry and ground-based geodetic measurements, including GNSS and total stations. The objectives of this study were:
- To detect and monitor geo-hazards at the Choirokoitia UNESCO World Heritage Site.
- To determine ground deformation trends (to plan long-term conservation efforts).
-To combine satellite data with on-site measurements (to enhance monitoring accuracy).
- To allow satellite data to monitor large scale deformations over time.
- To complement the high-resolution documentation achieved through UAV imagery and 3D modelling.

Why is this considered a Good Practice for making satellite data beneficial for Cultural Heritage ? (character limit: 1500) *

This approach integrates advanced satellite remote sensing methods with traditional geodetic techniques. It proposes an alternative, cost-effective means of monitoring and protecting cultural heritage sites damaged by geohazards, reducing the need for traditional hands-on approaches and thereby increasing the utility of the data for conservation purposes.

From the derived results is apparent the appropriateness : This combination of satellite data and other field techniques allowed for the detection of small changes in the environmental stability of the site, but also assessed the risks in order to minimise any further invasive action on the site.

Required skills section

Skills required to conduct the Good Practice *

Please reflect here which skills – e.g. technical, technological, social, heritage-related – are/were needed for the successful implementation of this Good Practice.

Expertise in InSAR data processing, UAV operation, photogrammetry, GIS, and geodetic measurements such as GNSS and total station surveys.

Are/were there any technical skills required for this Good Practice that were not initially available within your organisation and had to be acquired or outsourced? *

- (●) Yes
- ( ) No

Please list the specific skills acquired or outsourced and describe their purpose (e.g. “I learned Python to automate the downloading and preprocessing of collected satellite data.”) *

I guess people would need to get advanced training in radar data analysis, multi-temporal image processing (because of the InSAR), and the integration of aerial and ground-based surveying data for comprehensive monitoring.

Evidence of success *

Please describe the benefits they provide to the cultural heritage asset (e.g. a site can be protected from a hailstorm, looters can be deterred from illegal excavation, damage can be recorded online through international cooperation, etc.). (character limit: 1500)

The project successfully identified deformation trends at Choirokoitia, highlighting areas at risk from natural hazards. High-resolution 3D models and Digital Elevation Models (DEMs) were created. These were very useful for effective documentation and comparison over time. The methodology demonstrated to be scalable for application at other UNESCO sites.

Available references for the Good Practice *

Please mention below if there are any derived publications, media reports or any other content that refers to the described Good Practice. Please include also a web link if available.

(character limit: 1500)

Themistocleous, K. and Danezis, C., 2020. Monitoring cultural heritage sites affected by geo-hazards using in situ and SAR data: the Choirokoitia case study. Remote Sensing for Archaeology and Cultural Landscapes: Best Practices and Perspectives Across Europe and the Middle East, pp.285-308. https://doi.org/10.1007/978-3-030-10979-0_16

Please upload 2-3 images that concern the Good Practice. *
(each image cannot exceed the size limit of the 100 MB)

choirokitia_psian...

Προσθήκη αρχείου

Do you own the copyrights for these images ? *

- ○ Yes
- ◉ No

Should any form of media or outreach material will be created in the future, can we use them to advertise your organization and the CH asset with proper acknowledgement? *

- ○ Yes
- ○ No

Please provide below the credits for the picture(s): *

Themistocleous, K. and Danezis, C., 2020

Did you encounter any technical and/or technological challenges or issues associated with the implementation of this Good Practice? E.g. missing knowledge, doubts of colleagues, financial issues. *

Challenges included processing large datasets from multi-sensor sources, maintaining data alignment, and mitigating vegetation interference in aerial imagery.

Is there any potential for transferring this Good Practice to other cultural heritage organisations ? If so, please share more details. *

This practice is transferable due to its adaptable and scalable (e.g. regional and international) capacity. It uses satellite remote sensing (e.g. InSAR), UAV photogrammetry and geodetic techniques which can be applied to cultural heritage sites facing similar geo-hazard risks (e.g. sites affected by subsidence, landslides or tectonic activity). It allows documentation and study of remote or inaccessible areas and is not limited to specific geo-hazards; it's applicable to many challenges such as:

- Coastal erosion at heritage sites near bodies of water.

- Monuments in earthquake zones.

- Human induced hazards (urban encroachment)

The practice is cost-effective, widely accessible, and supports global conservation efforts by providing standardised monitoring and risk mitigation protocols. The success of transferring this Good Practice also depends on capacity building. Workshops, training, and sharing of case studies like Choirokoitia can help cultural heritage organisations adopt this methodology. Partnerships with research institutions, universities, and space agencies can further facilitate technology transfer.

Additional Information. Please include below any other information or experience you wish to share.

This case study is part of the broader PROTHEGO project, which monitored over 400 UNESCO World Heritage sites across Europe. It showcases the effectiveness of combining space-based and ground-based monitoring techniques.

The information provided will be used exclusively for the activities of the SATCULT project and within the rules and obligations defined by the GDPR rules. The EU General Data Protection Regulation (GDPR) regulates how personal data of individuals in the EU may be processed and transferred. *

- (●) I have taken note of this information and agree to the use of my responses within the SATCULT project.