



"PROtection of European Cultural HERitage from GeO-hazards. Satellite techniques for risk monitoring and for conservation policies"



Copernicus for Cultural Heritage Workshop



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Background and Rationale

BRUSSELS, 24 April 2017

Cultural Heritage domain

Natural and anthropogenic domain

Exposed elements:

Hazard:

Collection and implementation for all EU country of digital CH database.

Number, type and location (same format, glossary and metadata)

digital open source format (WMS, WFS,....)

Homogeneous and harmonized map at national level for all EU and for all possible hazard (landslide, earthquake, subsidence, floods, pollution.....) in order to produce correct static risk map for CH

Cultural Heritage

Natural & Anthropogenic Hazards

Satellite and space segment

Satellite and space domain
Monitoring:

We need dedicated and simple tool (e.g. web GIS platform) for downstream services dedicated to monitoring environmental and anthropogenic pressure on CH (e.g. SAR, multi spectral, hyper spectral sensor), both in low and high resolution

From static to dynamic integrated risk scenario

Management policies for EU Cultural Heritage :

A new paradigm for all the actors involved in the sustainable conservation and exploitation of EU CH

- Prioritization of intervention;
- Preventive conservation;
- Space market development;

Remarks and open issue

Copernicus services in support to Cultural Heritage

DG GROW

Prepared for EC DG GROW

2nd October 2018

Prepared by:
PwC France

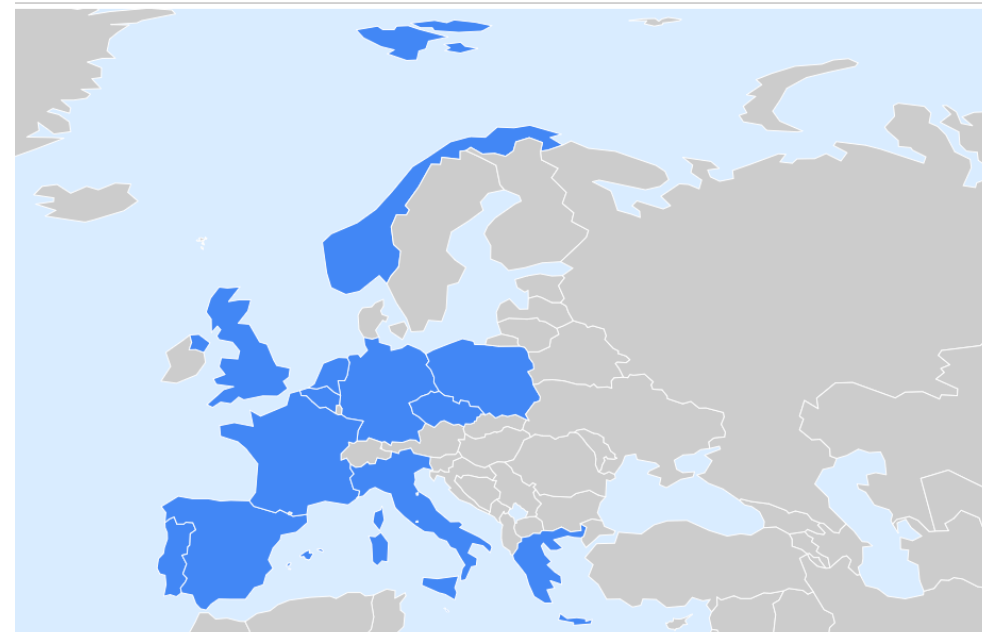
Final report

N° ENTR/341/PP/2013/FC - Framework Contract for Expert advisory support to the European Space Policy and Programmes

By the end of 2018 the Copernicus User Forum propose the institution of the “Copernicus Cultural Heritage Task Force”. Formalised by the Copernicus Committee.

The CCHTF was mainly composed by Member States (MS’s) national experts, belonging from both the Cultural Heritage and Earth observation domains, and is officially coordinated by Italy and chaired by the Italian Ministry of Cultural (MiC).

The activity of the Copernicus Cultural Heritage Task Force, based on the outcomes of the study “Copernicus services in support to Cultural Heritage” (PwC, 2018) was aimed at identifying the best option(s), to facilitate Cultural Heritage community access to Copernicus products.



Country
BE
CY
CZ
DE
ES
FR
GR
IT
MT
NL
NO
PL
PT
UK

Copernicus CH TF: Objectives and Roadmap

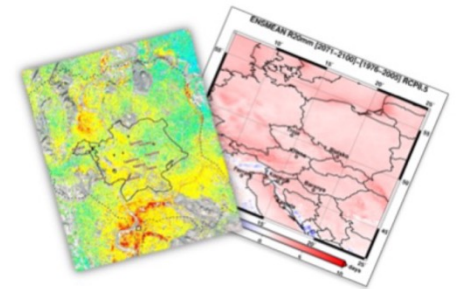
2018		2019										2020			
Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	
Task Force Establishment	Map the MSs users needs in the Earth observation domain, beyond those identified in the “Copernicus services in support to Cultural Heritage” study.			Complement, filter, aggregate and codify the user needs into specific requirements.		Analyse how existing Copernicus data, services and products could satisfy the identified requirements			Identify possible enhancement and customization of Copernicus products			Analyse possible synergies with National, European or International solutions to fill the gaps		Report consolidation and delivery to EC	
	<i>First Meeting in Rome</i> 18/1/2019		<i>Second Meeting in Bruxelles</i> 15/3/2019		<i>Third Meeting in Rome</i> 28/5/2019			<i>Fourth Meeting in Berlin</i> 24/10/2018							

CCH-TF TASK **Targets**

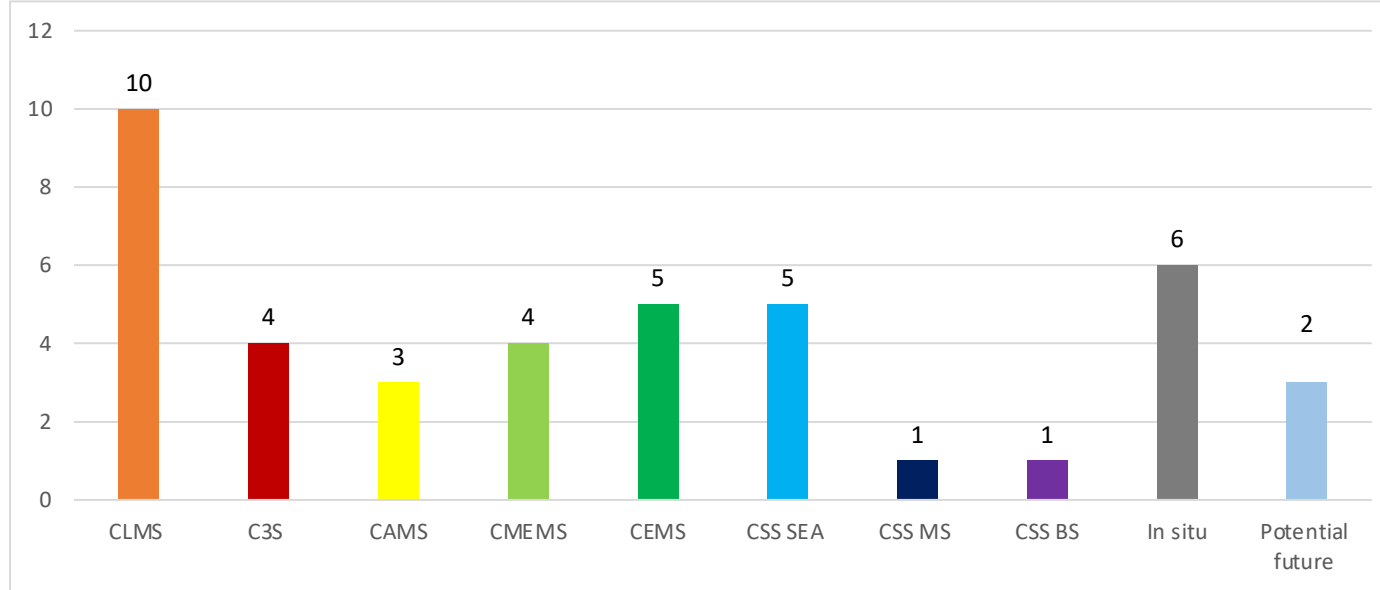
- Consolidate users needs and define dimensional (temporal and spatial resolution) requirements
- Validate the best one of the three hypotheses envisaged in the PwC study for accessing Copernicus data by CH users:

1. keep the current system for access to data by CH users (None action)
2. provide CH users with an interface that collects data from the different Core Services
3. create a new Core Service for CH users

Report on the user requirements in the Copernicus domain to support Cultural Heritage management, conservation and protection

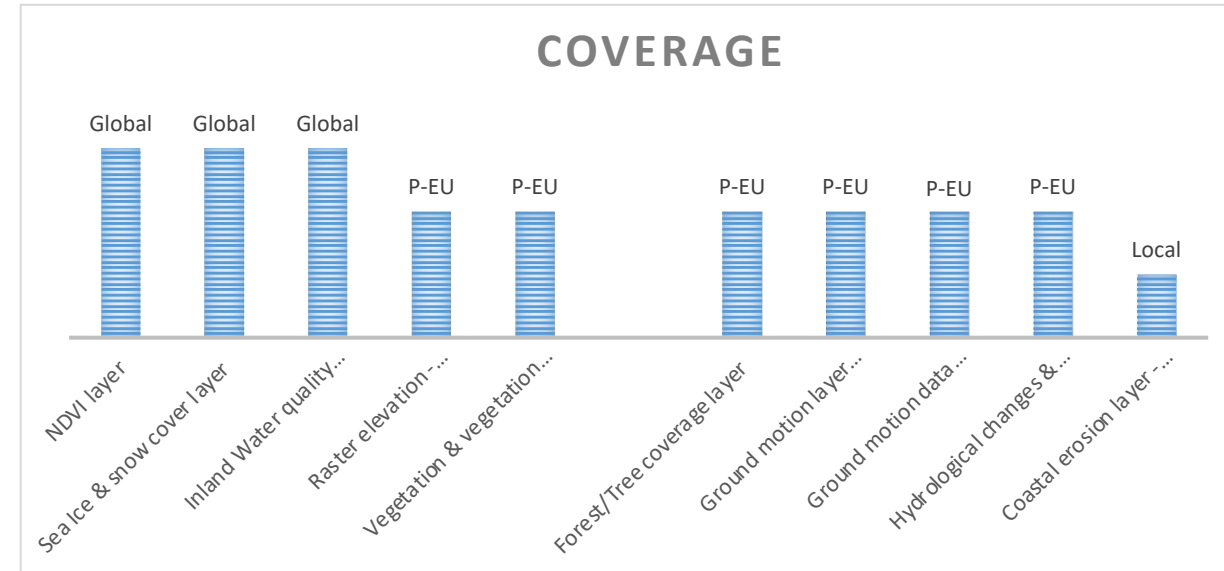


Gap analysis main outcome and results

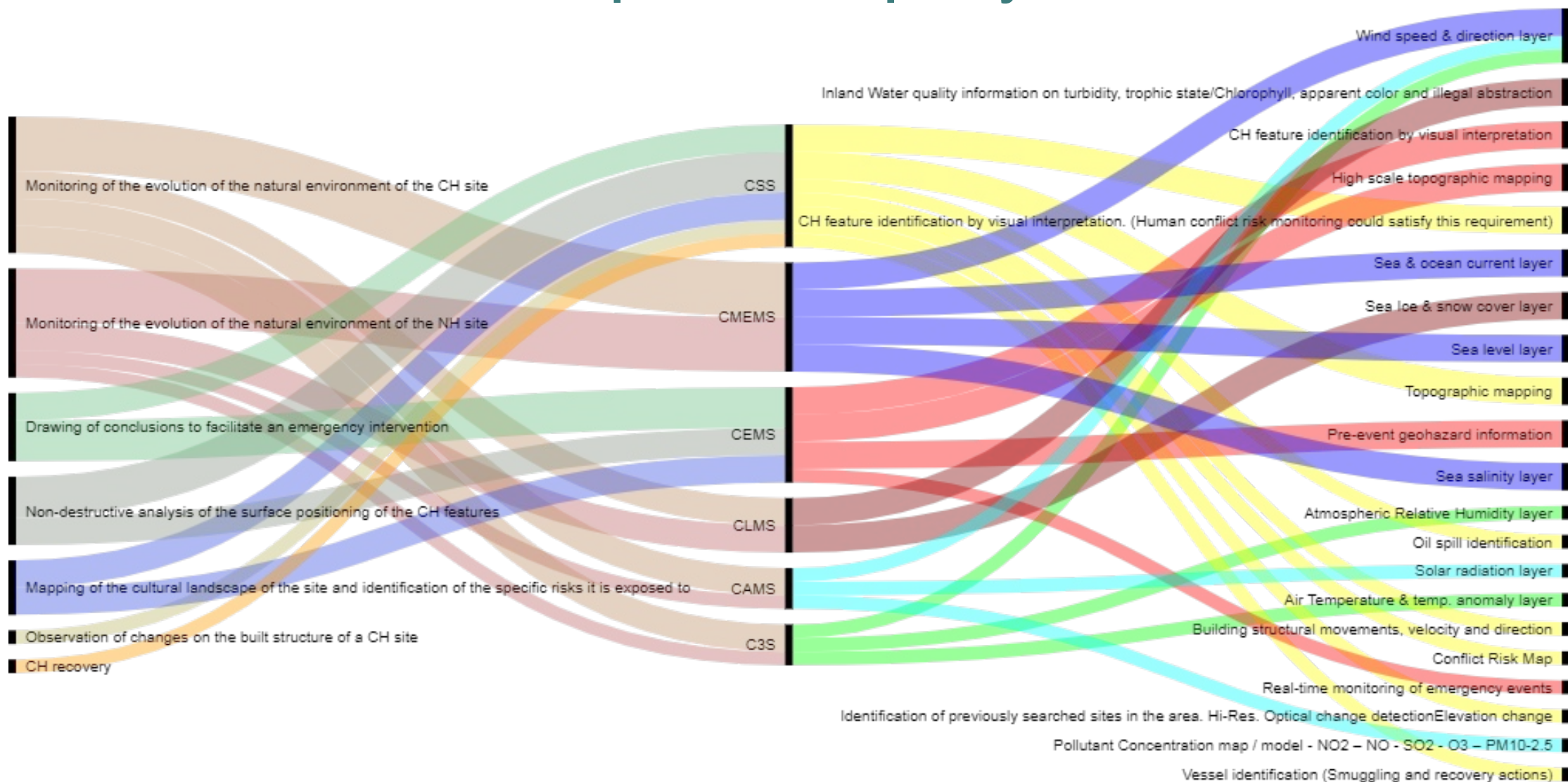


A considerable number of the identified requirements are already satisfied by the Copernicus Core Services Products.

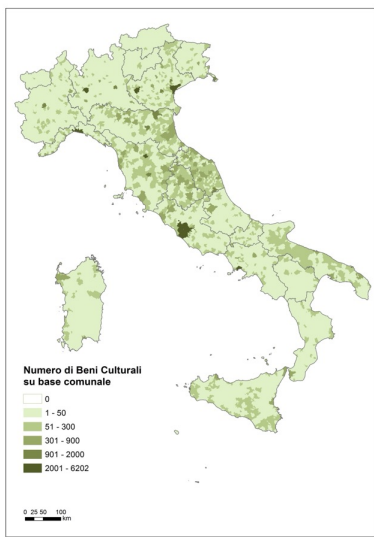
The CLMS collects most of the requirements and the CH user community is highly requiring. Since 2018, the spatial resolution for most of the requirements are fulfilled.



Copernicus CH TF: Matching the requirements with current Copernicus capacity



Link between high level user needs (monitoring domains), Copernicus Core services and user requirements satisfied



213.190 CH



58 WHL UNESCO site

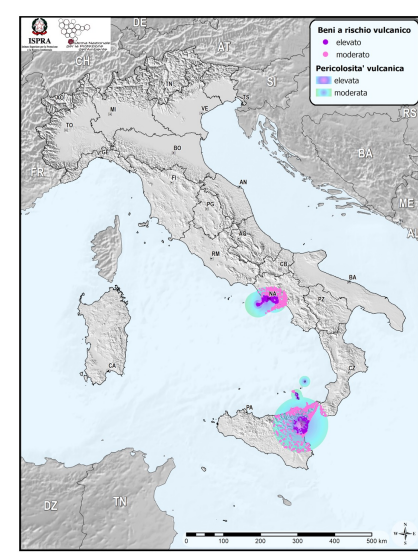
RISERVE DELLA BIOSFERA ITALIANE



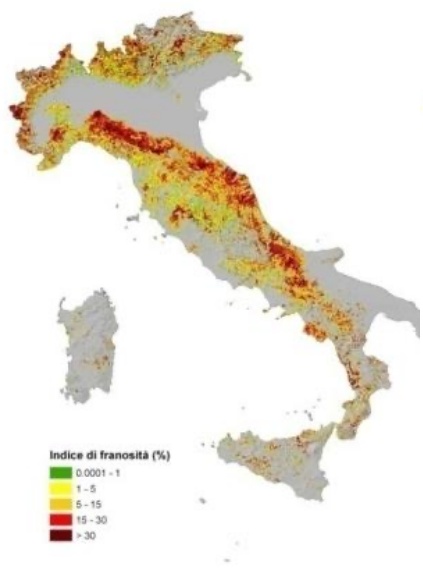
20 MAB



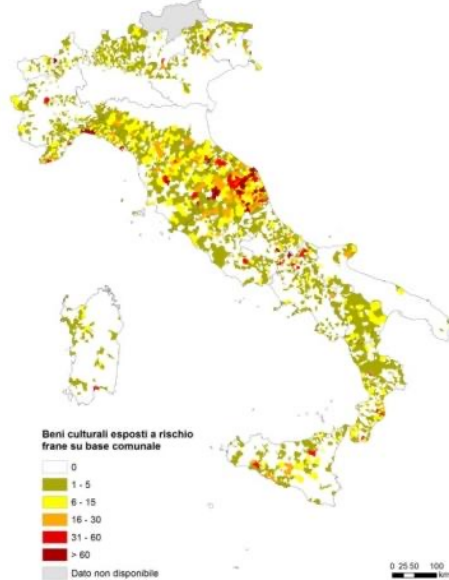
10 Geo-parcs (SIC, ZPS..)



(Spizzichino, 2017; Trigila & Iadanza 2018)



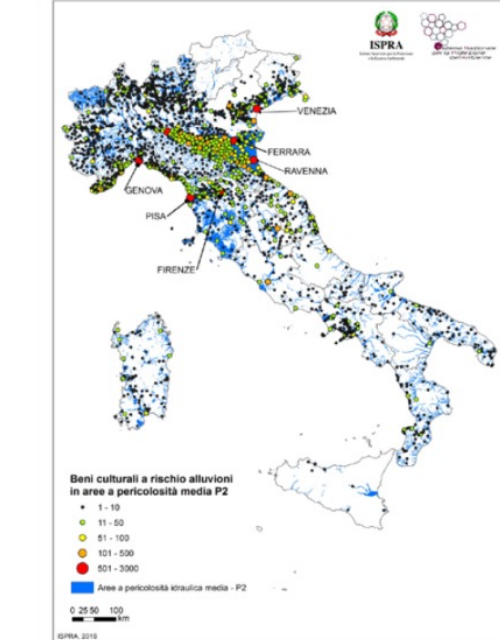
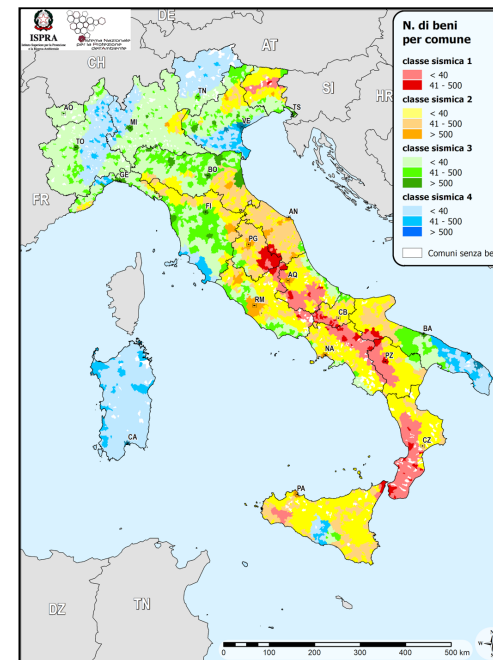
620k landslide, 23.700 km² = 7%



N. CH exposed to landslide at municipal scale 11.700

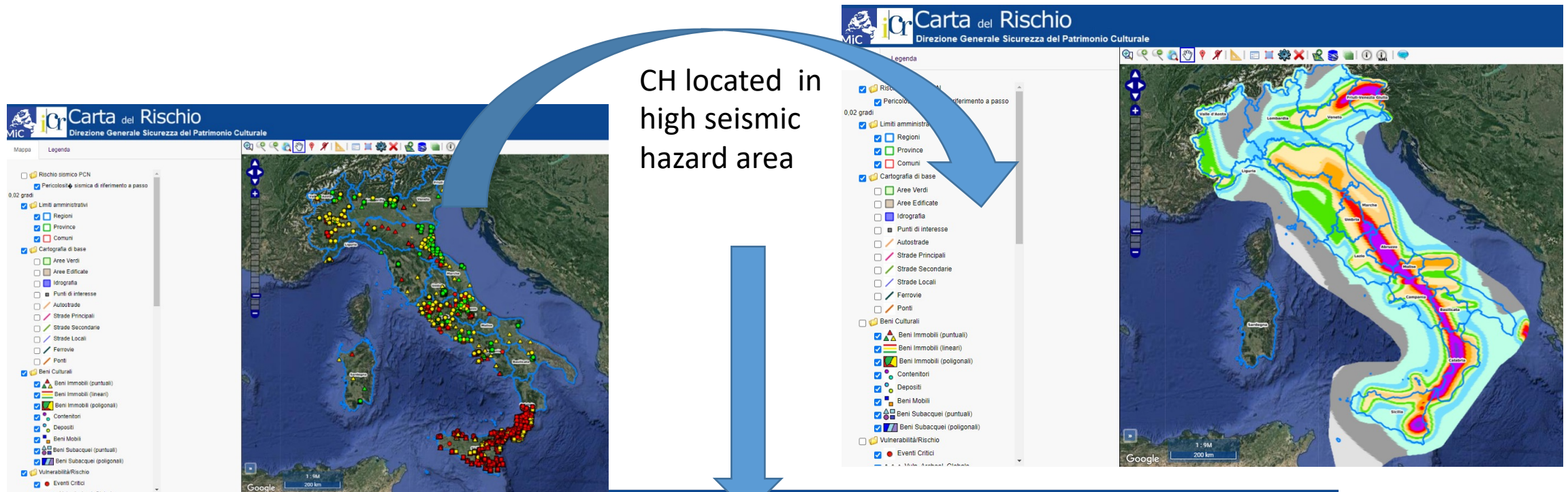


P2 (Tr 200 year) = 24.358 km²



30k Beni culturali a rischio in aree a pericolosità idraulica media P2 su base regionale e comunale e 40k P3 (tr=500 anni)

EXAMPLES OF ALREADY EXISTING ITALIAN INTEROPERABILITY CH vs SEISMIC HAZARD



Carta del Rischio
Direzione Generale Sicurezza del Patrimonio Culturale

Beni Culturali ▾ Vulnerabilità/Rischio ▾ Unità di Crisi ▾ Area Utenti ▾

Statistiche Parametri Sismici

Numero Beni aggregati per Pericolosità PGA - INGV (beni)

Pericolosità P.G.A.	Intervallo Valori P.G.A.	Numero Beni
basso	$0 \leq pga < 0.15$	104286
medio	$0.15 \leq pga < 0.25$	71523
alto	$pga > 0.25$	9215

2021 - NATIONAL EXTRAORDINARY PLAN OF ITALIAN CULTURAL HERITAGE MONITORING

GENERAL STRUCTURE OF THE DASHBOARD

- MERCALLI MARICA
<marica.mercalli@cultura.gov.it>
- IANNELLI PAOLO
<paolo.iannelli@cultura.gov.it>
- CACACE CARLO
<carlo.cacace@cultura.gov.it>

- Immovable heritage (“container”)
- Movable heritage (“content”)
- Containers (of movable heritage)
- Historic centre
- Urban aggregate
- UNESCO sites
- Submerged heritage

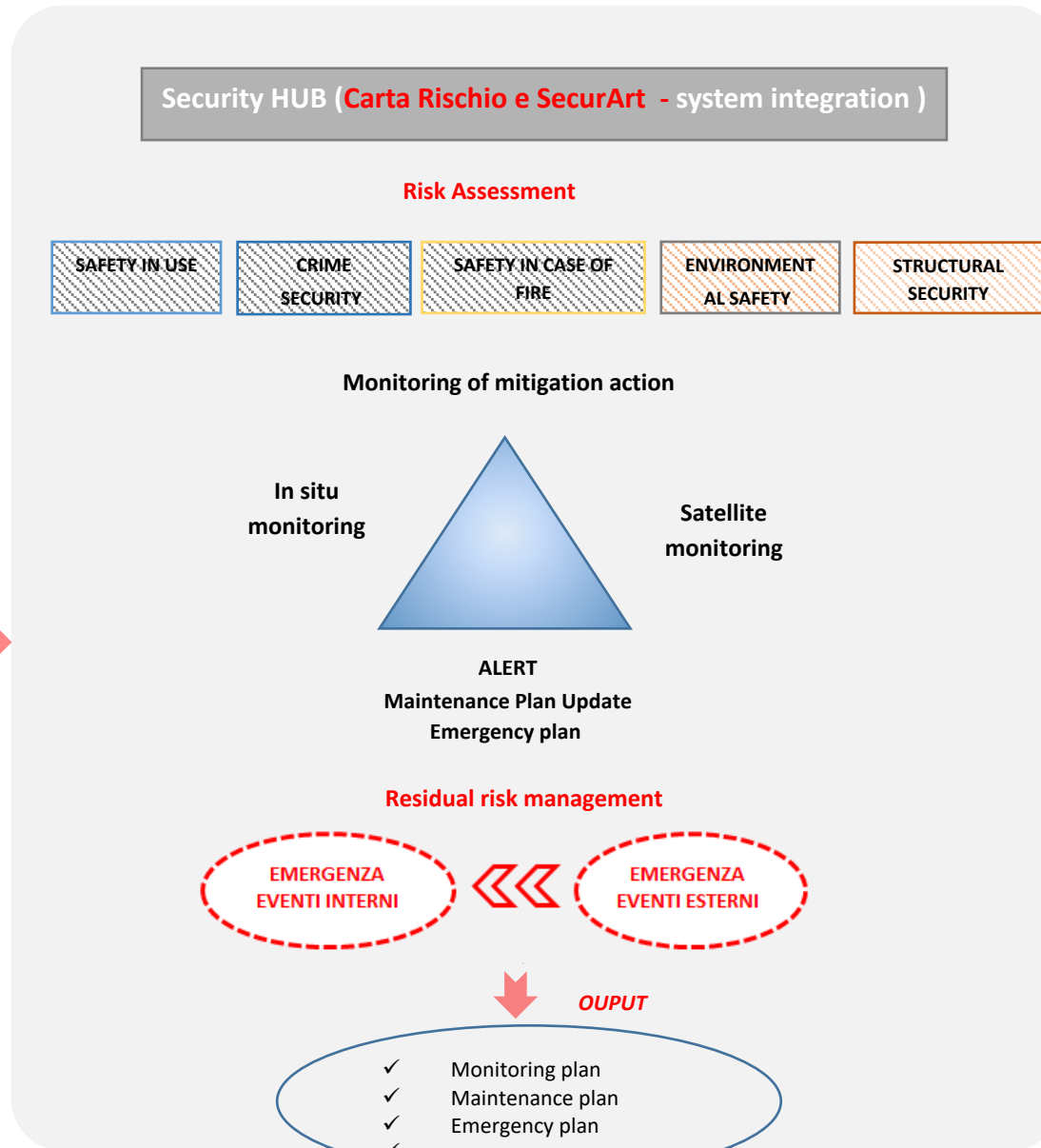
External Information system (DG – SPC)

Exchange of information with other administrations :

- Civil Protection
- ISPRA
- Fire fighters
- INGV
- District authority
- CEI
- Demanio agency
- ANCI
- Archives database
- Library database

Exchange of information with administrations within the MIC:

SIGECWeb
VIR { Beni Tutelati



Map consultation

- ✓ Hazard map
- ✓ Risk map
- ✓ Heritage location (exposure)
-

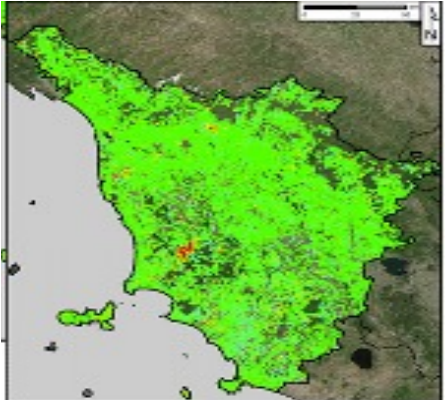
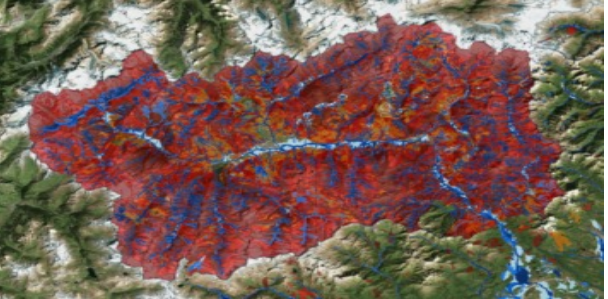
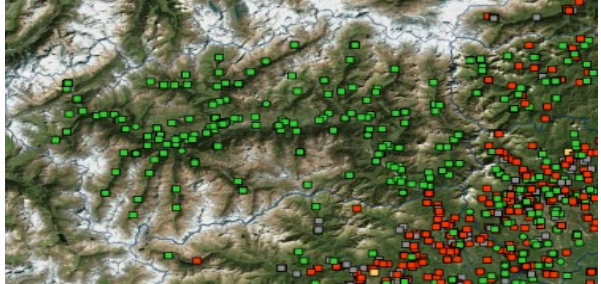
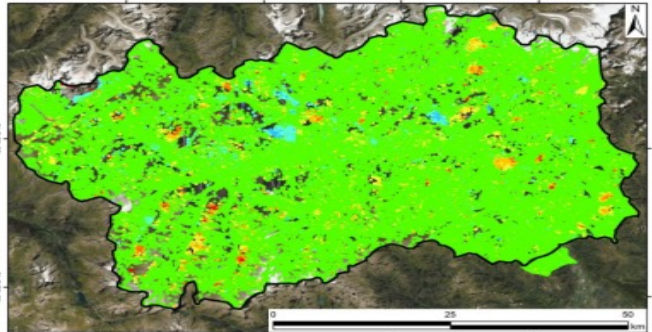
Alphanumeric consultation

- ✓ Risk ranking and index
- ✓ Vulnerability and damage data sheet consultation
- ✓ Emergency event report (e.g. damage statistics, architectural typology)
- ✓ Monitoring report
- ✓ Alert verify
- ✓ Inspection activity report consultation
- ✓ Consultation Plan and Monitoring Program...

Analysis of satellite monitoring data through case studies at different scales:

Regional (e.g. area of competence of the superintendence and regions, repeated analysis on a quarterly / half-yearly basis with Sentinel-1 / CSK data from the regional PS Journal)

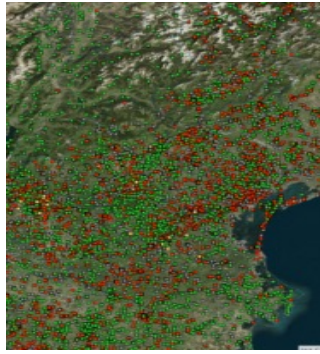
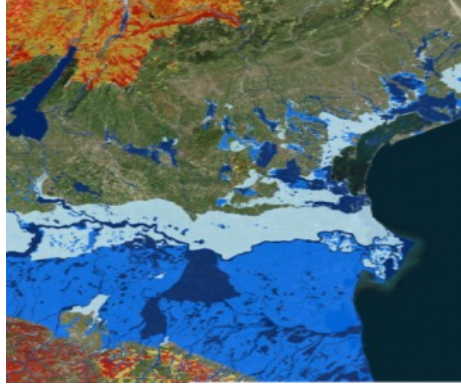
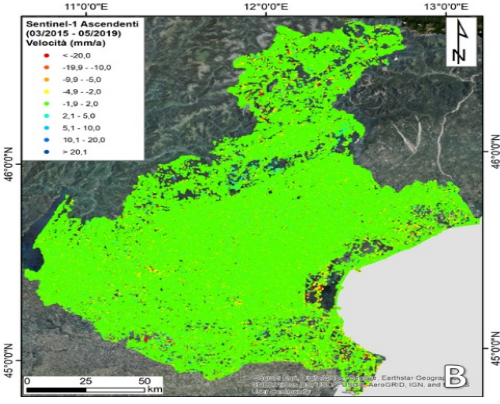
Valle d'Aosta



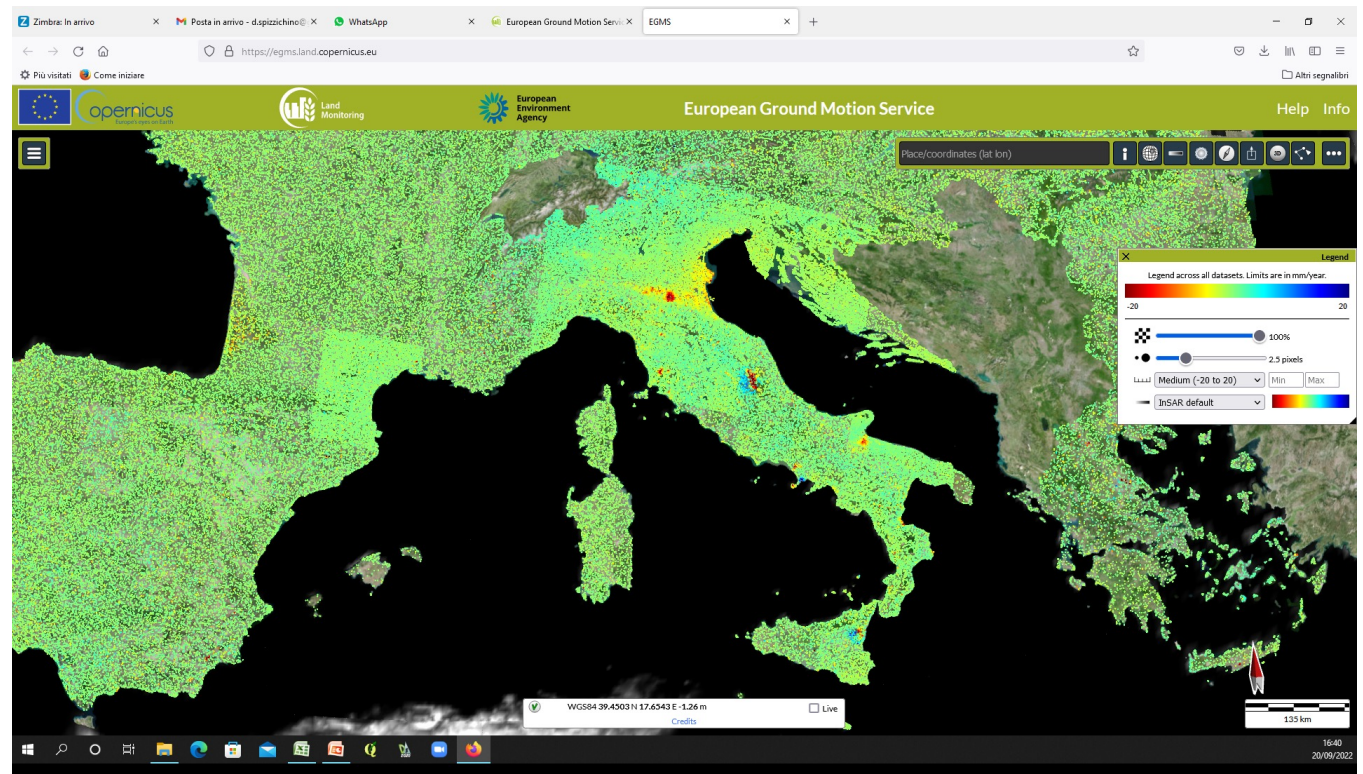
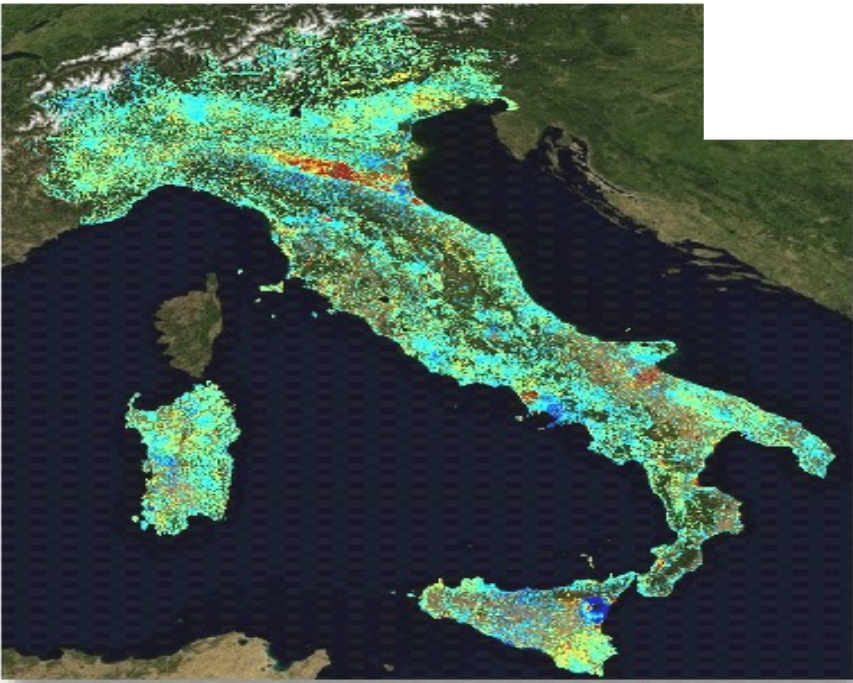
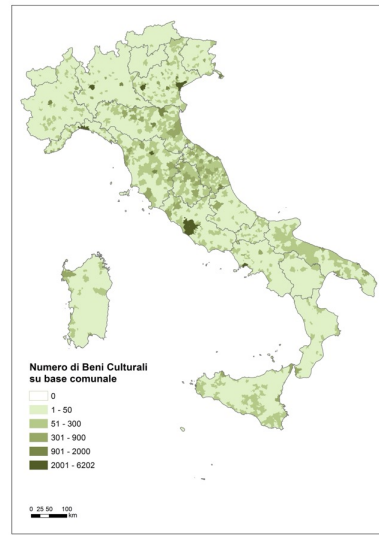
Toscana



Veneto



Analysis of satellite monitoring data through case studies at different scales: National



Sentinel-1 P-SBAS National Scale Analysis

Time span: March 2015 – September 2018

Descending Orbit

Ascending Orbit

38 P-SBAS processing
~300.000 km²



<-3 Mean Deformation Velocity LOS [cm/a] >3






Highlights and Remarks

1. A European Cultural Heritage **advisory board**, composed of expert representatives from all EU member states, should be established to advise the Copernicus User Forum about Cultural Heritage user' needs.
2. **Ready-to-use integrated information** related to land cover/use, geo-hazards, climate as well as atmospheric parameters, **will allow a better understanding of the specific phenomena affecting the sites.**
3. There is high potential for Copernicus to stimulate substantial growth of the Cultural Heritage downstream market: The creation of a **CH Thematic hub**, where different players (users and providers) can interact for the definition and development of user requirements-based services would support the market development process.
4. The **access to Very High-Resolution imagery to test innovative applications** aimed at improving monitoring capacity and novel applications is required by the Cultural Heritage research community, having high and specific thematic and geomatic skills.
5. The Copernicus Academy network could support new generation with specific academic courses on CH monitoring through academic courses, including both Earth observation and Copernicus Services capacity elements including for examples **the FPCUP actions up and running.**

Article

Copernicus in Support of Monitoring, Protection, and Management of Cultural and Natural Heritage

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Abstract The current Copernicus evolution aims to meet horizontal users' needs in order to widen uptake of the Copernicus monitoring products by non-traditional users. In 2019, the European Commission initiated a coordinated action to evaluate the current and potential uptakes of Copernicus products, and for the monitoring and protection of European Cultural and Natural Heritage in a future climate change scenario. An interaction matrix was developed, circulated to and fulfilled by users in order to collect their needs and identify the main gaps in terms of monitoring data and information. The results show what users require from Copernicus to face the daily challenges of preserving and protecting CH features. Moreover, the interaction with users identified a data and information access model that best maximizes uptake by the users. The present work illustrates the user requirement coordination mechanism adopted by the European Copernicus Cultural Heritage Task Force; synthesises the results achieved in terms of gap analysis; and assesses the current and potential uptake of Copernicus data, services, and products in support of the monitoring and protection of European cultural heritage. It also provides recommendation about the implementation of infrastructural solutions to improve Copernicus services data and information access by cultural heritage users.

Keywords: earth observation; spatial and temporal resolution; safeguarding heritage; climate change; conservation

1. Introduction

During recent decades, awareness of the need for efficient, science-based tools to monitor and protect cultural and natural heritage has rapidly grown. Indeed, heritage assets are increasingly at risk because of the impact of natural and anthropogenic hazards, the frequency and intensity of which continue to be amplified by climate change [1–4]. The protection of archaeological sites and monumental complexes in the age of mass tourism and climate change represents a growing challenge, which can only be addressed by integrating management models and practices. In this context, the innovative application of remote sensing technologies [5] and Copernicus data and information could certainly constitute a turning point, as demonstrated in other transversal areas [6]. Sites and monuments are affected by various environmental agents, acting in synergy, which leads to varying frequency and intensity. The majority of these agents, such as wind erosion [7–9], ground water level changes [10], air pollution, and climate change [7,9], can be extremely harmful when they affect a site over a long period of time [11]. Therefore, long-term monitoring



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Thank you for the attention

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