



SUMMER SCHOOL WORKSHOP



ACTION 2020-2-21: COPERNICUS FOR CULTURAL HERITAGE

SPACE FOR CULTURAL HERITAGE

An ESA EO perspective on Trends, Challenges and Future Prospects in Cultural Heritage

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13-16.06.2023

PARCO REGIONALE DELL'APPIA ANTICA
Ex Cartiera Latina - Via Appia Antica, 42

Observing the Earth: Cultural Heritage from Space



UNDERSTAND

- Subsidence, ground motion detection
- Urban sprawl monitoring
- Climate Change indicators
- Sites monitoring and detection (buried sites)



SECURE

- Monitoring of the destruction or looting of sites
- Air pollution monitoring
- Coastline monitoring (erosion)



BENEFIT

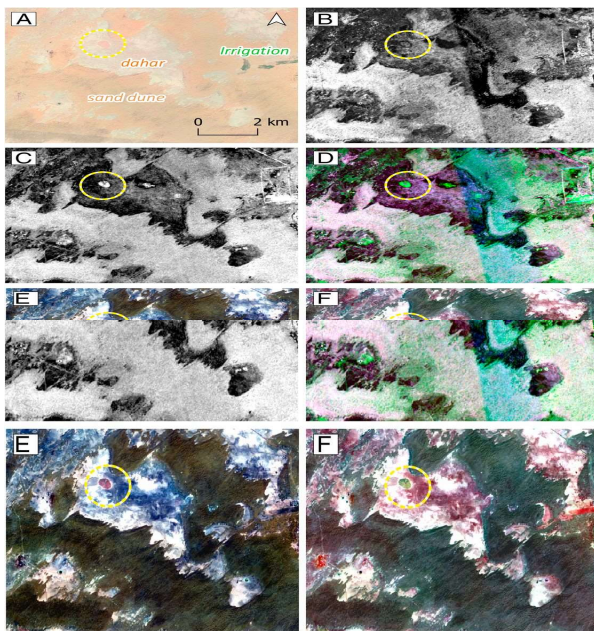
- Risk assessment/Land use change maps
- Preventive investigation for infrastructures realization
- Dissemination of culture awareness



EO use to date: which applications (1)

DISCOVERY AND MAPPING

Identification of new archaeological sites and further exploration of existing ones



ESA and the Vatican Apostolic Library: preservation, management and exploitation of archived information



DATA PRESERVATION

EO use to date: which applications (2)

ANTHROPOGENIC IMPACT

Intentional site destruction
(religious and fundamental reasons)

Indirect site destruction
(side-effect of a local human-made crisis)

Poaching of hidden archaeological artefacts / Looting

Urban sprawl and tourism impact

(High frequency of observations
VHR imagery
Near Real Time observation)



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Privilege preventive actions to reactive ones

NATURAL IMPACT



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ACTION 2020-2-2

New applications and techniques

APPLICATIONS

- *Mostly site-based, limited*
- Survey
- Looting
- Features detection
- Automation of process:
 - detection/counting/prospection etc.
- Cultural Heritage Fruition



ARTIFICIAL INTELLIGENCE
DEEP LEARNING/CNN
COMPUTER VISION
AR/VR
CROWDSOURCING
CITIZEN SCIENCE

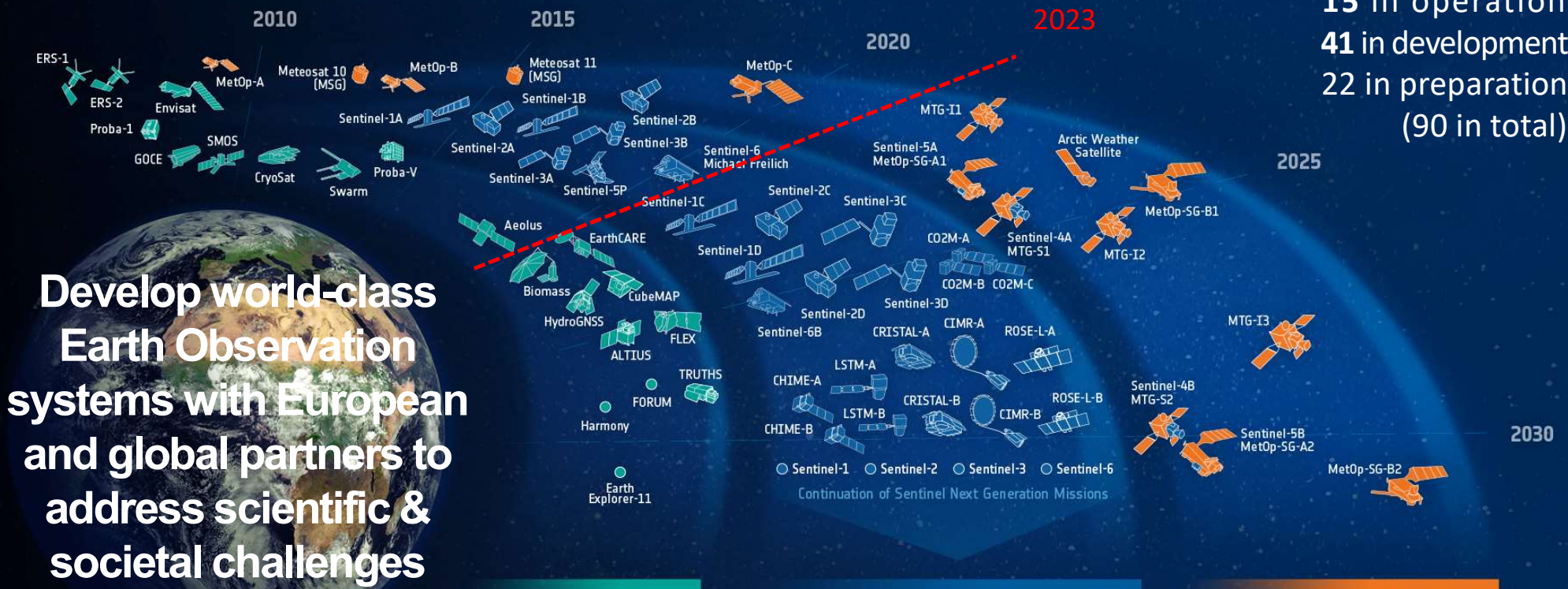
TECHNIQUES

- ⇒ Datasets typically tailored to the research interests of individual projects and dataset heterogeneity
- ⇒ Data aggregation/inter-project comparison challenging even when data are publicly available

ESA's Earth Observation Mission

Satellites

12 in heritage
 15 in operation
 41 in development
 22 in preparation
 (90 in total)



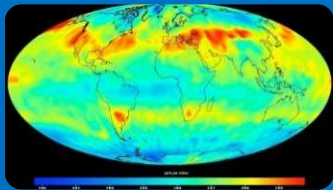
Develop world-class Earth Observation systems with European and global partners to address scientific & societal challenges

Science Copernicus Meteorology

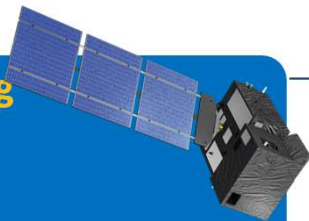
*Pending final mission selection

Sentinel Expansion Missions

CO2M - Anthropogenic CO₂ Monitoring



Causes of
Climate Change



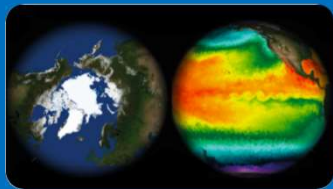
CRISTAL – Polar Ice & Snow Topography



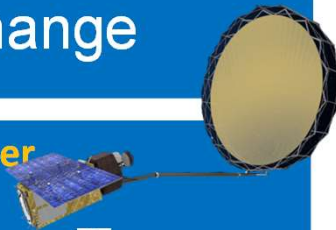
Effects of
Climate Change



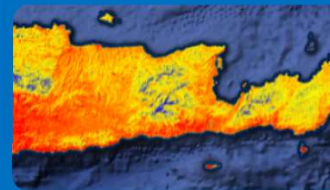
CIMR – Passive Microwave Radiometer



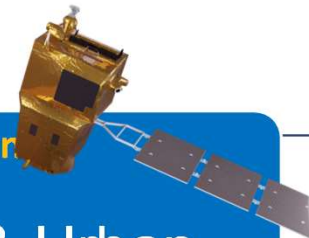
Sea: Surface Temp.
& Ice Concentration



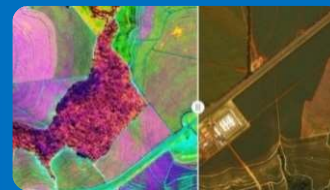
LST – Land Surface Temperature Mission



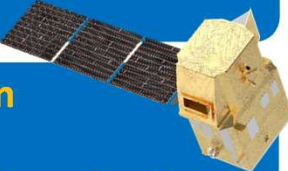
Agriculture & Urban
Management



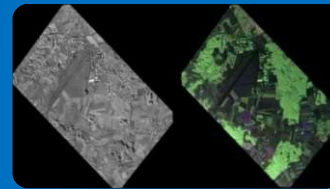
CHIME – Hyperspectral Imaging Mission



Food Security, Soil,
Minerals, Biodiversity



ROSE-L – L-band SAR Mission

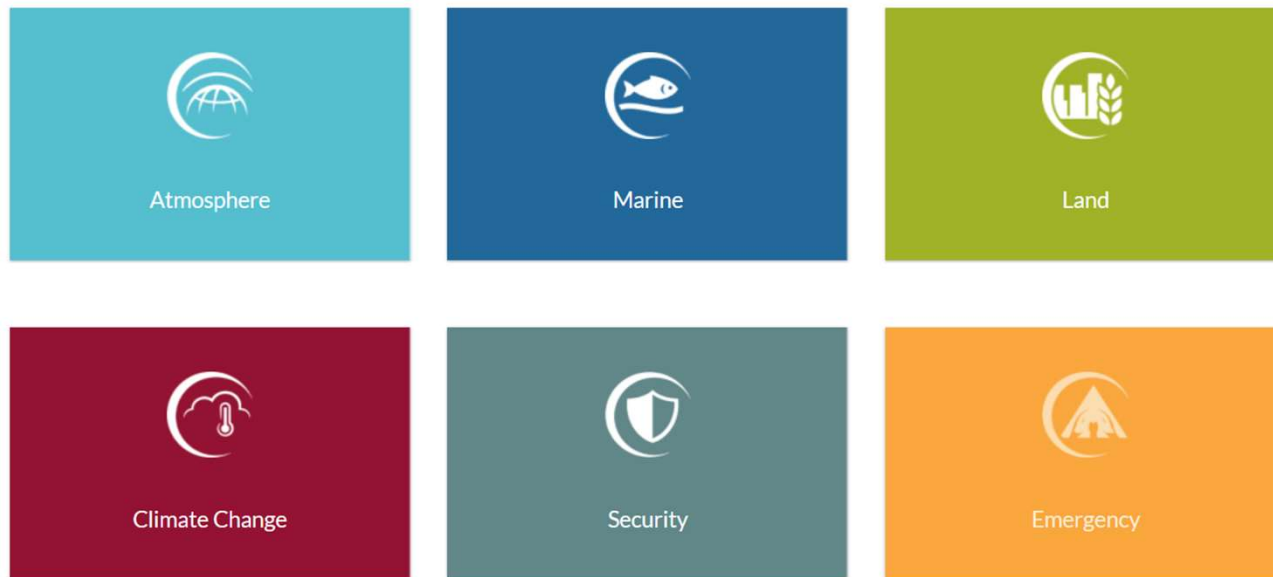


Vegetation & Ground
Motion & Moisture



The Copernicus contribution

Contribution of EO services and products such as those from Copernicus and Contributing Missions in last years for Cultural Heritage



The Copernicus contribution

Contribution of EO services and products such as those from Copernicus and Contributing Missions in last years for Cultural Heritage

- Management of cultural heritage during emergencies (especially in the case of geo-hazards)
- Mapping, monitoring, preservation and management of cultural heritage become a daily routine



AWARENESS

Ad-hoc activities must be based on the usage of available Copernicus products in collaboration with the CH community in order to improve the knowledge about the Copernicus offering and potential.

EO to raise awareness during the pandemic

CNN travel Destinations Food and Drink Stay News Videos Edition

Images of Venice from space show how coronavirus has changed the city's iconic canals

By Sara Spary, CNN

Updated 0911 GMT (1711 HKT) April 17, 2020

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ESA satellite images reveal the once bustling waterways of Venice are now empty during the coronavirus lockdown in Italy

INSIDER

INSIDER

DOW +0.09% S&P 500 +0.47% NASDAQ 100 +0.5%

HOME > NEWS

Satellite images show just how much Venice's canals have cleared up since the city went under coronavirus lockdown

Kelly McLaughlin Apr 17, 2020, 4:37 PM

CNBC MARKETS BUSINESS INVESTING TECH POLITICS CNBC TV WATCHLIST PRO

Coronavirus impact: Satellite images show world cities before and after outbreak

PUBLISHED MON, MAR 23 2020-1:18 PM EDT | UPDATED TUE, MAR 24 2020-8:04 AM EDT

View in Hindi: REPUBLIC WORLD.COM

Debate India News India Vs England Coronavirus Entertainment News Sports News

World News / Rest of the World News / Satellite images show how iconic canals of Venice have cleared up amidst COVID-19

Last Updated: 18th April, 2020 10:04 IST

Satellite Images Show How Iconic Canals Of Venice Have Cleared Up Amidst COVID-19 Lockdown

Italian government imposed a nationwide lockdown which drastically reduced the movement of Venice's boats including the vaporetti or water buses, wrote ESA.

Written By Zaini Majeed



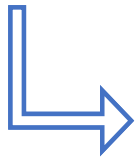
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Pandemic and Cultural Heritage

According to UNESCO's World Heritage Committee, as of early April 2020:

- 71% of the 1,121 World Heritage sites had been closed
- 18% were only partially open



increased vulnerability to looting
suspension of rehabilitation, conservation and archaeological exploration works

+ decline in cultural funding

Need to rethink business models for Cultural Heritage in the future

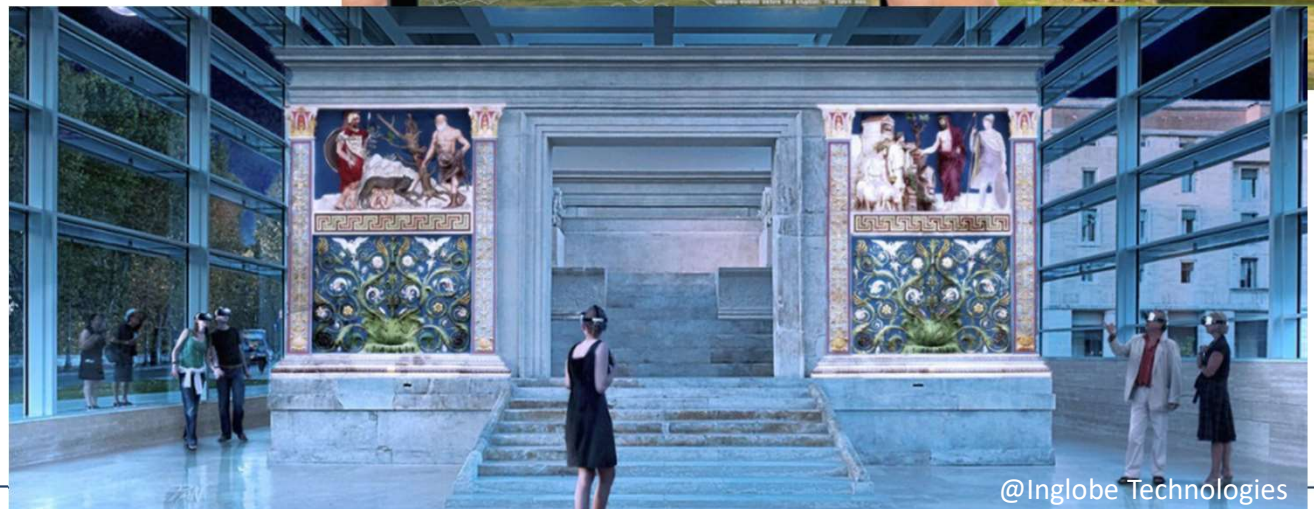
A larger stakeholders base

To date

Mostly research and institutional

New actors in the domain

- archaeological parks management
- companies providing virtual tours
- environmental organizations
- governmental authorities
- prosecutors
- media
- citizens community



DTE – Cultural Heritage as a new element

DIGITAL TWIN EARTH



Recommendation for a way forward

- ⇒ Strengthen the communication and the synergies between EO experts and Cultural Heritage management
- ⇒ Provide user-ready products (connection between the data providers and the end-users - site managers)
- ⇒ Supporting the generation of processes and practices for technology and Cultural Heritage

MULTI-SOURCE DATA



INNOVATION

- Predictive decision support capability for sustainable tourism policies and actions
- Engagement of multi- and inter-disciplinary communities to fill the gap between experts (remote sensing, CH managers, AI experts, social scientists, civil protection and actors from impact sectors)
- Involving the Public Administration in the planning of PROCEDURES AND BEHAVIOUR for prevention and REGIONAL PLANNING ACTIONS according to specific risks (mitigation, prevention, conservation)

Partnering with ESA

ESA supports projects that want to leverage EO data in the cloud, with sponsorship initiatives that facilitate the access to European EO Platforms and Data

Innovative projects combining the power of future technologies to preserve and enhance the fruition of Cultural Heritage



<https://eo4society.esa.int/>



Harbor of Trajan in the first Sentinel-1 acquisition over Rome. Patruno et al, 2016

THANK YOU!

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