COPERNICUS AND ME

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Ten concrete examples of how data and services based on the European Copernicus satellites improve life on Earth



Eurisy would like to thank the contributors to this publication for their readiness to share their experiences, and the time and effort they have put into helping Eurisy to produce this collection of success stories.



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INTRODUCTION

THIS PUBLICATION CONTAINS TEN HANDS-ON EXAMPLES OF WHAT CAN BE ACHIEVED BY USING DATA AND SERVICES FROM THE EUROPEAN COPERNICUS SATELLITES.

The stories feature public and private organisations using Copernicus data to improve their work in different sectors, including infrastructure management, urban planning, sailing, cultural heritage, risk management, and financial forecasts.

Keeping up with the Eurisy tradition, these examples are presented in a non-technical jargon, with a focus on the challenges faced and the benefits obtained by the organisations we interviewed. Six of these examples are also featured in short videos produced by Eurisy between July and December 2021. The videos and the single case studies can be accessed on the Eurisy website at www.eurisy.eu.

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COPERNICUS



COPERNICUS, EUROPE'S EYES ON EARTH

Copernicus is the Earth Observation Programme of the European Union, looking at our planet and its environment for the benefit of global citizens.

Five Copernicus missions are currently in orbit. The data they provide is coupled with groundbased, airborne, and seaborne measurements to make six information services focused on monitoring: Atmosphere, Marine environment, Land, Climate change, Security, and Emergency.

Such services are free and openly accessible and can be used by private, public and international organisations to improve life on Earth.

For more information about Copernicus, visit www.copernicus.eu

COPERNICUS & ME

Monitoring water turbidity during the port extension works at Port-la-Nouvelle



THE OCCITANIE REGION NEEDED TO MONITOR WATER TURBIDITY DURING MAJOR WORKS ON THE PORT.

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DATA FROM SENTINEL-2 AND SENTINEL-3 PROVIDED A "WATER TURBIDITY WEATHER" FORECAST NEARBY THE WORKS.

DAMAGE TO THE NEARBY NATURAL AREAS WAS AVOIDED WHILE EXTENDING THE PORT.

INFRASTRUCTURE WORKS NEARBY THE SEA CAN NEGATIVELY AFFECT WATER QUALITY

Port-la-Nouvelle is a French town in the Occitanie region, in the south of France, on the Mediterranean coast. With 11 kilometres of beaches, the town sees its population of 6,000 increase up to 30,000 people during the summer season.

The historic port of Port-la-Nouvelle extends over 2.5 kilometres and it represents a major economic asset in the area. Owned by the Region, it includes a commercial port, a fishing harbour, and a marina. The Chamber of Commerce of Aude is responsible for its daily management.

The annual traffic of the port represents two million tons and 350 ship visits, while the global port activity generates 1,600 direct and indirect jobs [1].

This commercial port has historically specialised in the import of oil derivates and the export of cereals.

IN 2018, THE OCCITANIE REGION DECIDED TO START IMPORTANT WORKS TO ADAPT THE COMMERCIAL PORT OF PORT-LA-NOUVELLE TO NEW TRAFFICS AND ALLOW FOR THE DEVELOPMENT OF NEW SECTORS.

Notably, the regional plan foresees the installation of floating wind-turbines and the creation of a green hydrogen production plant as from 2024.

These works are part of a regional policy that aims at combining the economic development of the region with the valorisation of its environment



Indeed, commercial ports are vital elements of the Occitan regional economy, and the Region spends a large part of its annual budget in the regional transport infrastructure.



In 2015, the national law on the new territorial organisation of the Republic (loi NOTRe) strengthened regional competencies in France and the region became the owner of certain marinas and of portuary areas.

In 2016, the Occitanie / Pyrénées-Méditerranée Region created a Directorate for the Sea within its administration and launched the Plan Littoral 21 (Coastal Plan 21), aimed at preserving while also modernising the littoral.

The Plan's objective is to promote investment in infrastructure and coastal preservation. It includes actions to support sustainable development projects, coastal resorts and marinas, fishery, and aquaculture activities.

Among these measures, the Plan includes continuing development projects in the ports of Sète, Port-La-Nouvelle and Grau-du-Roi [2]. The works to extend the commercial port of Port-la-Nouvelle are part of the plan for the development of the Coast and are managed by different entities. For the Region, the Directorate for the Sea is in charge of ensuring the environmental sustainability of the project.

The project includes the construction of two large dams of about 2.5 km long, of a new quay to assemble the future floating wind turbines, and of a new basin to allow large ships to enter and exit the port.

Carrying out such works implies dredging, which can bring back to the surface sediments on the seafloor, hence endangering the marine environment and the natural areas nearby.

TO AVOID DAMAGE TO THE ENVIRONMENT, THE REGION WANTED TO MONITOR WATER TURBIDITY DURING THE WORKS.



OCCITANIE / PYRÉNÉES-MÉDITERRANÉE REGION

Type of organisation: Public regional administration Country: France Annual budget in 2020: More than €1m Previous experience with Earth Observation data: Yes

Indeed, the Region was particularly concerned with the risk of a turbid plume entering the pond of Bages-Sigean, a lagoon pond located on the shores of the Mediterranean Sea, on an area of 5,500 hectares.

The Narbonnaise ponds are crossed by the Roben Canal, classed as UNESCO Natural heritage site. The pond of Bages-Sigean communicates with the sea by the inlet of Port-la-Nouvelle and the beach of the Vieille Nouvelle, today classed as a regional natural reserve [3]. TRUSTABLE AND EASY-TO-USE DATA ON THE WHOLE BASIN EXTENSION WAS NEEDED TO PREVENT, MONITOR AND RAPIDLY INTERVENE IN THE EVENT THAT A TURBID PLUME SPREAD TOWARDS VULNERABLE AREAS.



I-SEA, a company based in Aquitaine, supported the port authorities. I-Sea specialises in monitoring marine environments and the coastline by combining field measurements with observations by UAVs/USVs, airborne or spaceborne sensors.

I-Sea develops geo-information solutions for public administrations and private actors in the water and energy sectors, making use of data from the Copernicus Sentinel satellites to enhance environmental surveillance. The freely available Copernicus satellite imagery provided data on water turbidity in the past and in the near-future. The data were used to monitor water quality and to forecast water turbidity during the days of the works.

Before the works started, satellite imagery allowed I-SEA and the Region to better understand the hydrosedimentary processes of the site of Portla-Nouvelle.

DATA FROM SENTINEL-2 AND SENTINEL-3 COPERNICUS SATELLITES HELPED MONITORING WATER QUALITY NEARBY THE WORKS. During the works, the data contributed to in-situ monitoring, by providing a bigpicture of water turbidity levels and a forecast of turbidity levels expected within the next three days.

This is the very first time that this turbidity forecast model is used within the context of operational works in a port.



THANKS TO THE COPERNICUS DATA, IT WAS POSSIBLE TO AVOID DAMAGES TO THE NEARBY NATURAL AREAS AND TO PREVENT THE INFILTRATION OF A TURBID PLUME IN THE POND OF BAGES SIGEAN.

The satellite-based predictive method provided the personnel responsible for the implementation of the works in the Region with daily objective tools to monitor the impact of the works on water turbidity in the area.

In 2024, the commercial port of Port-la-Nouvelle will welcome the first floating wind turbines in the Mediterranean Sea. "We do our best efforts to ensure that economic development is based on the safeguard and valorisation of the region's natural resources". Benjamin Grente, Directorate for the Sea, Occitanie Region.

When we visit the site, in the summer of 2021, thousands of tetrapods are being moulded on the worksite. The shapes of these concrete structures are conceived for marine life to adapt to them throughout time, as if they were natural rocks.

They are being used to complete the rows extending the breakwaters at the entrance of the commercial port, to allow big cargo boats to enter and exit the port easily.



LINKS

Port-la-Nouvelle website: https://www.portla-nouvelle.com/presentation-generale/ Littoral et Croissance bleue (in French), Occitanie / Pyrénées-Méditerranée Region: https://www.laregion.fr/Littoral-et-Croissance-bleue

Plan Littoral 21- La Région et l'Etat lancent l'édition 2021 de l'appel à projet « Avenir Littoral », Occitanie / Pyrénées-Méditerranée Region, March 2021. Consulted on 20 October 2021: https://www.laregion.fr/Plan-Littoral-21-La-Region-et-l-Etat-lancent-ledition-2021-de-l-appel-a-projet I-SEA website: http://i-sea.fr/en I-SEA, ESA Business Applications, ESA BIC Sud France:

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narbonnaise.fr/decouvrir/sites-adecouvrir/le-littoral/lagunes-etmarais/etangs-du-narbonnais

CREDITS AND CONTACTS

Benjamin Grente, Environmental manager Directorate of the Sea, Occitanie / Pyrénées-Méditerranée Region Port-la-Nouvelle, France benjamin.grente@laregion.fr www.laregion.fr

Aurelie Dehouck, Founder i-SEA Bordeaux, France dehouckaurelie@gmail.com http://i-sea.fr/



COPERNICUS & ME

Supporting access to electricity in Sierra Leone



DECISION-MAKERS IN LOW- AND MIDDLE-INCOME COUNTRIES OFTEN LACK INFORMATION TO PLAN ELECTRIFICATION IN RURAL AREAS.



WITH SENTINEL-1 AND SENTINEL-2 IMAGERY IT IS POSSIBLE TO VISUALISE SUCH INFORMATION ON MAPS.

THANKS TO THE SATELLITE-BASED MAPS, GOVERNMENTS CAN TAKE INFORMED DECISIONS TO CARRY OUT THE ELECTRIFICATION PROCESS.

GLOBALLY, MORE THAN 1 BILLION PEOPLE DON'T HAVE ACCESS TO MODERN ENERGY.

Most of them live in South Asia and Africa, in rural areas.

Lack of knowledge on dispersed populations and insufficient infrastructure and energy coverage are among the main factors discouraging investments in rural areas [1].

Despite the ambitious objective established by the Sustainable Development Goal 7 of "ensuring access to affordable, reliable, sustainable and modern energy for all by 2030" [2], progress towards electrification is still insufficient to allow for social and economic growth in rural areas in low- and middle-income countries.

AN IMPORTANT OBSTACLE IN THE ACHIEVEMENT OF SDG 7 IS THE LACK OF ACCESS TO THE RIGHT INFORMATION FOR DECISION-MAKERS IN CHARGE OF PLANNING ELECTRIFICATION IN RURAL AREAS.

Indeed, planners and companies working in remote villages lack information for decisions, and the same applies to investors.

In particular, off-grid energy planners need to understand where to extend the energy grid and where to prioritise off-grid markets for mini-grids and solar-home systems.

Moreover, they need information that will enable them to prepare tender processes, monitor electrification progress and provide adjusted subsidies.



Typically, existing datasets are scattered in different formats and locations and are not ready for use.

Moreover, on-ground teams cannot access strategic data and cannot report their data to decision-makers in a structured manner.

Indeed, until recently, the only way to find out more about such remote areas (i.e., energy demand, location, distance from the grids), was to send survey teams there. That is a manual process, is expensive, slow, and often inaccurate.



Sierra Leone is one of the world's poorest countries [3], where less than a quarter of the population has today access to modern energy.

ONLY 23% OF SIERRA LEONEAN HAVE ACCESS TO ELECTRICITY, WHICH IS BELOW THE SUB-SAHARAN AVERAGE OF 30%.

This hinders modern education and healthcare, job creation, competitiveness, and poverty reduction.

Indeed, energy is necessary to improve the performance of all economic sectors in the country, primarily agriculture, irrigation, cooling and food processing, and their resilience to climate change. In January 2021, the World Bank approved a \$50 million grant from the International Development Association (IDA) to improve access to electricity in Sierra Leone and enhance institutional capacity and commercial management of the sector [4].

The "Enhancing Sierra Leone Energy Access" project aims at helping the country's economic recovery after the COVID-19 pandemic by providing access to low-cost electricity to households, businesses, health clinics and schools, for a total of approximately 276,000 people and about 700 health facilities [5].

ONE OF TOOLS CHOSEN TO SUPPORT THE ELECTRIFICATION PROCESS IS VILLAGE DATA ANALYTICS (VIDA). EURISY



Village Data Analytics

VILLAGE DATA ANALYTICS (VIDA)

Type of organisation: SME Country: Germany Annual budget in 2020: €500k - €1m Previous experience with Earth Observation data: No

VIDA, A SOFTWARE BASED ON COPERNICUS DATA, CAN SUPPORT ELECTRIFICATION IN REMOTE AREAS.

Village Data Analytics, or VIDA, has been created by Tobias Engelmeier and Sebastian Wagner.

Both based in Munich (Germany), Tobias and Sebastian decided to join forces to develop a tool facilitating electrification in rural areas.

On this journey, they were supported by the European Space Agency and the PARSEC accelerator.



VIDA IS A MACHINE LEARNING-BASED SOFTWARE THAT ANALYSES SATELLITE IMAGERY, PUBLICLY AVAILABLE GEOSPATIAL DATA, ON-GROUND SURVEY DATA, AND ENERGY MODELLING, TO IDENTIFY AND CHARACTERISE RURAL VILLAGES, AND TO ASSESS THEIR SUITABILITY FOR OFF-GRID ELECTRIFICATION, INCLUDING MINI-GRIDS AD OFF-GRID STANDALONE SYSTEMS.

VIDA USES SENTINEL-1 AND SENTINEL-2 IMAGERY, AS WELL AS LAYERS DERIVED FROM VERY HIGH-RESOLUTION IMAGERY [6].

The software aims at yielding information and management tools to governments, development organisations, investors, banks, companies, and NGOs on off-thegrid communities in remote areas.

The Copernicus satellites provide VIDA with radar, visible and near-infrared satellite imagery.

In addition, VIDA exploits products derived from nightlight and very highresolution imagery, publicly available GIS data such as Open Street Map (OSM) road data, Humanitarian Open Street Map's household data layers, and other available GIS/statistical data [7].



The four-step methodology of VIDA's data analysis workflow. Source: TFE Energy GmbH, Improved Mini-grid selection in West Africa using Village Data Analytics (VIDA).

Earth observation imagery is analysed by VIDA to obtain standardised data about villages at the individual household level, such as their position, their distance from the energy grid, the presence of roads and infrastructure, of cultivated fields, and the environmental features of the surrounding areas. The Earth Observation imagery is analysed through automated imagery recognition algorithms, and the data obtained are coupled with ground data on villages' demographic, topographic, agricultural, and socio-economic features that are obtained from customers, existing databases, and surveys.

THE RESULTING INTERACTIVE MAP ALLOWS USERS TO PICK RELEVANT INFORMATION FROM LARGE AMOUNTS OF DATA THAT CAN EFFECTIVELY SUPPORT DECISION-MAKING PROCESSES AT THE LOCAL LEVEL. VIDA's customers typically receive relevant information in the form of rankings of villages with socio-economic predictions to prioritise efforts, and can also integrate their own data. Indeed, the user interface can be adjusted to the needs and requirements of users and is also available on mobile devices.



In the case of Sierra Leone, the area of interest is the whole Country's territory. The software identifies and lists all the villages in the area.

Through the user interface, the Government can unlock village-level information and add its own data.

The villages can be filtered according to different parameters, such as their region and district, the number of buildings, the presence and number of healthcare facilities and schools, their distance from the energy grid, and their priority level for the electrification process.

The software also allows users to annotate, upload, download and share information, and to integrate the data with other software.

SATELLITE IMAGERY CAN BE USED FOR DATA-BASED DECISION-MAKING IN REMOTE AREAS.

As a platform, VIDA processes regularlyupdated EO and on-ground data.

Indeed, the rapidly expanding scale and update frequency of satellite imagery, as well as the fast pace of machine learning techniques, allow VIDA to characterise villages spread across the whole country and to monitor each village over time.



The VIDA interface over the town of Tihun, in the Southern Province of Sierra Leone.

In Sierra Leone, more than 500 villages were analysed with VIDA.

The software delivered a long list of villages suitable for mini-grid development that could be presented to stakeholders.

The settlements are sorted according to building connection count and settlement density, grid proximity, and infrastructure data, such as road access, proximity to a school or a hospital.

THE USE OF THE VIDA SOFTWARE AND ANALYSIS HELPED UNLOCK A \$200M CREDIT FOR ELECTRIFICATION AND WILL CONTRIBUTE TO THE ELECTRIFICATION OF OVER 500 NEW MINI GRIDS IN THE COUNTRY. "The Government of Sierra Leone can now accurately position the electricity grid and the villages, estimate their energy demand, and decide on how to best electrify them". Tobias Engelmeier, founder of VIDA.

This is crucial information for the government to create a transparent and data-based programme for electrification and to measure the effectiveness and impact of what they do.

Indeed, the government is now able to target electrification efforts on the basis of accurate, reliable information, to develop result-based subsidy programmes, and to monitor their impacts.





Data are provided fast, reliably and at-scale.

By integrating socio-economic data, VIDA makes the energy needs of remote villages visible to planners, companies and investors, thus acting as a catalyst for sustainable development.

The software is automated and globally available at village-level.

Until the Summer of 2021, VIDA was used to monitor more than 5.000 villages in 10 countries, helping to channel approximately 1.5 billion US dollars into remote electrification.

Through solutions like VIDA, governments can access the digital infrastructure needed to build the physical infrastructure.

Data, including satellite-based data, can be used to plan mini-grid systems and perform feasibility studies on these systems to predict their viability [8]. The site selection based on data analytics and satellite imagery creates a ranked shortlist of promising villages within an area of interest and reduces the number of on-ground surveys needed.

Overall, VIDA allows between 25-50% savings in the cost of man-hours needed to select the sites suitable for electrification, reducing the time to find a site by 67% and site-visit times by 80% through better scheduling [7].

WITHOUT ELECTRIFICATION, MORE THAN 1 BILLION PEOPLE IN SOME OF THE WORLD'S POOREST REGIONS WOULD FIND IT EXTREMELY DIFFICULT TO RESPOND TO THE CHALLENGE OF CLIMATE CHANGE, AND TO BUILD PROSPEROUS, MODERN LIVES.

LINKS

Village Data Analytics: www.villagedata.io AppliedAl website: www.appliedai.de Sustainable Development Goal number 7: sdgs.un.org/goals/goal7

European Space Agency: www.esa.int PARSEC accelerator: parsec-accelerator.eu World Bank, Access to electricity, rural (% of rural population) - Sierra Leone:

data.worldbank.org/indicator/EG.ELC.ACCS.RU.ZS? locations=SL

Village Data Analytics, Site selection for mini-grids in West Africa: www.villagedata.io/use-cases/site-selectionfor-mini-grids-in-west-africa

Video, VIDA - Interview with Tobias - Summer of Purpose 2021: www.youtube.com/watch?v=2kFl0O-HtkM

Video, Village Data Analytics (VIDA) by TFE Energy: www.youtube.com/watch?v=bNBqcLFMIOc&t=3s

Video, VIDA for Sierra Leone: www.youtube.com/watch? v=Esl2ZJALJEE

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[6] VIDA - Village Data Analytics Actionable data intelligence for frontier markets, ESA Space Solutions.

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Tobias Engelmeier, Co-Founder and CEO Village Data Analytics <u>tobias@villagedata.io</u> <u>www.villagedata.io</u>

COPERNICUS

Mitigating the effects of climate change at public transport stops in Prague

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Initian I

THE CITY OF PRAGUE WANTED TO VISUALISE HEAT VULNERABILITY NEARBY PUBLIC TRANSPORT STOPS.

DATA FROM SENTINEL-2A ALLOWED THE CITY TO REALISE THE URBAN HEAT VULNERABILITY MAP OF PRAGUE.

TRANSPORT STOPS MOST VULNERABLE TO HEAT WERE ADAPTED AND MADE MORE COMFORTABLE FOR CITIZENS AND TOURISTS.

PRAGUE IS RECORDING INCREASING TEMPERATURES, OF UP TO 34°C IN SUMMER, WHICH HEAVILY IMPACT THE CITY'S INHABITANTS AND VISITORS.

As a consequence of climate change, temperatures in cities are increasingly elevated, causing a phenomenon widely known as "urban heat islands", places where temperature are particularly high as compared to the city's outskirts.

Cities are vulnerable to high temperatures because of their population density, extended built areas and the concentration of social and economic activities. The effects of climate change vary significantly among cities and within city areas.

THE PAVED SPACES AND BUILT AREAS IN PRAGUE, TOGETHER WITH THE INDUSTRIAL INFRASTRUCTURE IN ITS OUTSKIRTS, MAKE THE CITY PARTICULARLY VULNERABLE TO EXTREME HEAT EVENTS.

Nevertheless, Prague can also count on a good amount of green spaces and vegetation, that can help cooling the city.

In 2018, the City released a Climate change adaptation strategy aimed at "enhancing a longterm resilience and reducing vulnerability of the Capital City of Prague to climate change effects by step-by-step implementation of adaptive measures, preferably applying nature-based solutions combined with grey, i.e. technological and soft measures, to provide inhabitants with high well-being" [1].

The Prague Climate Plan 2030 "Prague on the road towards carbon neutrality", includes



measures to improve health and environment in Prague, to increase the city's resilience to environmental risks and extreme events, and to reach carbon-neutrality [2].

EURISY



THE ENVIRONMENTAL PROTECTION DEPARTMENT OF THE CITY OF PRAGUE

Type of organisation: Public regional administration Country: Czech Republic Annual budget in 2020: More than € 100m Previous experience with Earth observation data: Yes

The Environmental Protection Department of the City of Prague approves and implements the Climate Change Adaptation Strategy and its Implementation Plans.

The Department designs, manages and finances adaptation projects and analyses of some selected data.

It can also count on the support of the Prague Institute for Planning and Development, which manages the Prague Geoportal, making available a number of maps of Prague, and which works with universities, scientific research institutions, and non-profit organisations, both nationally and internationally. BEING CONSCIOUS ABOUT THE THREATS POSED BY CLIMATE CHANGE ON THE CITY'S ENVIRONMENT AND ON PEOPLE'S HEALTH, THE ENVIRONMENTAL PROTECTION DEPARTMENT OF PRAGUE IS CONSTANTLY LOOKING FOR SOLUTIONS TO ADAPT SPATIAL PLANNING TO INCREASING TEMPERATURES.





The Department makes an extensive use of Geographic Information Systems (GIS) to understand how Prague is currently coping with climate change and to envisage scenarios to better adapt to rising temperatures in the future [3].

Indeed, GIS allow city planners to visualise and characterise the city and its assets both at the street level and as a totality from a bird's-eye perspective.

Different GIS layers allow to visualise on the same geographic map, information related to the physical space and human activities, such as infrastructure, buildings, materials, vegetation, demographics, and economics, and to see how these interact with raising temperatures. THE ENVIRONMENTAL PROTECTION DEPARTMENT WANTED TO VISUALISE HEAT VULNERABILITY IN THE CITY AND THE AREAS THAT ARE AFFECTED THE MOST, ESPECIALLY NEARBY PUBLIC TRANSPORT STOPS WHERE PEOPLE SPEND A CONSIDERABLE AMOUNT OF TIME.

Indeed, the City of Prague has one of the most efficient public transport systems in Europe and two-thirds of its 1.324.277 population use public transport to move around the city and its outskirts. To assess the effects of climate change on transport stops and identify the stops that are most vulnerable to extreme heat events, the Environmental Protection Department of the City of Prague asked for the support of ECOTEN Urban Comfort, a local start-up specialised in urban and environmental engineering.

As a first step, the company defined the indices to be taken into account for a heat assessment.

Thermal exposure, which indicates the distribution of heat over the city, was calculated by identifying the warmest areas of the city during the days in which temperatures exceeded 30 °C. These data were extracted from images acquired by the Landsat 8 satellite in the summers between 2015 and 2019.

Sensitivity, which represents the variable that drives the intensity of heat exposure (the longer you wait, the hotter you get), was measured through the average waiting time for passengers at each public transport stops, using information from Prague's OpenData.

Adaptive capacity, which is the ability of the urban ecosystem to be resilient to heat events, was assessed by mapping greeneries and water bodies around public transport stops.

The adaptive capacity was calculated by summing up the Advanced Vegetation Index and the Normalised Differential Water Index, both measured through data from the European Sentinel-2A satellite [4].

THE INDICES WERE COMBINED TO CREATE THE URBAN HEAT VULNERABILITY MAP OF THE CITY OF PRAGUE.

© Ecoten Urban Comfort

THE URBAN HEAT VULNERABILITY MAP SHOWS THE PUBLIC TRANSPORT STOPS THAT ARE MOST VULNERABLE TO EXTREME HEAT.

The map is meant to serve as a strategic tool for City administrators, urban planners and stakeholders, providing suggestions on measures to be taken to mitigate the effects of heat at the public transport stops in Prague. These include placing greeneries and systems to humidify the street pavement and the air, and using materials that retain less heat.

The Map classifies bus and tram stops in five categories, according to their degree of vulnerability to high temperatures.

- A category stops are highly vulnerable to heat and are typically located in the city centre within the pedestrian zone or in narrow streets with low traffic levels and no greeneries, but with the possibility of creating them in the nearby area;
- B category stops are located between the tram/bus and road lanes in wide streets, are not large enough to include greeneries, but could be widened to create space for plants (or plants could be placed in their proximity);
- C category stops are placed outside the city centre and along the tram/bus and road lanes in areas with few trees or greeneries;
- D category stops are located in the outskirts of the city, in developing or industrial neighbourhoods, along the tram/bus and road lanes in semi-open or open spaces, with few trees and greeneries;
- E category stops are in the outer city, typically on the side of wide roads with no tram lanes.



Top 5 vulnerable public transport stops in Prague.



- I. P. Pavlova
- Myslíkova
- Národní trída
- Masarykovo nádraží
- Námestí Republiky



Green solutions

Greenery provides shade to citizens and also cools down the urban environment through evapotranspiration.

Blue solutions

Misters and water fountains can help cool down the urban environment through humidification. Also, public drinking water stations can allow citizens to hydrate themselves during a heat wave event and hence better cope with extreme heat.





THE CITY AUTHORITIES USE THE MAP TO VISUALISE THE STOPS THAT NEED ATTENTION AND TAKE ACTION TO MAKE THEM MORE COMFORTABLE.

For example, the first green lawn on the roof of a tram stop was placed at the Hradčanská station, where the municipality planted grasses adapted to dry climates and rock gardens, which are to withstand drought and frost.

Solar panels were installed on some of the stops' roofs, supplying power for lighting and Wi-Fi signal.

Also, the Prague water supply company placed misting devices in the areas nearby some stops (Ládví, Palmovka, Karlínské náměstí, and Florenc). The droplets emitted from the misting devices absorb part of the heat in the immediate surroundings, thanks to the conversion of water into steam which cools the air. Moreover, fountains were placed nearby stops for residents and visitors to refresh themselves during warm days.

THANKS TO THE COPERNICUS SATELLITES, THE CITY HAS RELIABLE, OBJECTIVE AND SHAREABLE DATA TO ACT AGAINST CLIMATE CHANGE.

The use of a virtual map allows the Environmental Protection Department to understand how climate change currently affects the city as a whole and at the street level, and to make predictions on how these effects will evolve over time.

Using a GIS, the Department can study the relationships between different data and overlay statistics on top of the environmental information derived from satellites, sensors and other observations. THE URBAN HEAT VULNERABILITY MAP PROVIDES AN EVIDENCE BASE TO PLAN FUTURE MEASURES TO MAKE THE CITY'S INFRASTRUCTURE MORE RESILIENT TO CLIMATE CHANGE.

The combination of different data sources on GIS allows the city to monitor the effects of climate change on vulnerable people, such as the elderly and the children.

Earth observation data, coupled with statistics and other survey data, can be a precious tool for city authorities to take evidence-based decisions to improve life in cities.

DATA DERIVED FROM SATELLITE REMOTE SENSING CAN BE USED BY CITY AUTHORITIES TO DECIDE ON WHERE AND HOW PLACE NEW INFRASTRUCTURE, HOUSEHOLDS AND PARKS, TO CHOOSE BUILDING MATERIALS THAT RETAIN LESS HEAT, OR TO INSTALL AND MONITOR GREEN ENERGY SYSTEMS, SUCH AS SOLAR AND WIND POWER PLANTS ON ROOF TOPS.



LINKS

Environmental Protection Department of the City of Prague: https://adaptacepraha.cz/en

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IPR Prague's Geoportal: www.geoportalpraha.cz/en Public Transport Stops Heat Vulnerability Assessment of Prague, Czechia, Ecoten Urban Comfort, Portfolio: https://urban-comfort.eu/portfolio/city-of-prague SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable, United Nations Department of Economic and Social Affairs,

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Tereza Líbová, Climate change adaptation specialist Prague City Hall, Department of Environmental Protection Prague, Czech Republic tereza.libova@praha.eu www.praha.eu www.adaptacepraha.cz

Manon Corneille, Business Developer ECOTEN Urban Comfort s.r.o. Prague, Czech Republic corneille@urban-comfort.eu https://urban-comfort.eu/



COPERNICUS & ME

Diminishing the carbon footprint of ships



THE FRENCH SME D-ICE WAS LOOKING FOR WAYS TO DECREASE THE CARBON FOOTPRINT OF SHIPS.



COPERNICUS SATELLITES PROVIDE HISTORICAL DATA ON WEATHER, WIND, WAVES AND SEA CURRENTS ON SEA ROUTES TO SUPPORT WIND-PROPELLED SHIPS.

USING THESE HISTORICAL DATA, SHIPS CAN TAKE ROUTES WITH LOW POWER CONSUMPTION.

SHIPS, BOATS AND VESSELS HAVE A HEAVY IMPACT ON THE OCEAN AND THE ENVIRONMENT.

Indeed, they are responsible for a significant proportion of the global climate change problem.

More than 3% of global carbon dioxide emissions can be attributed to ocean-going vessels, which is equivalent to the annual greenhouse gas emissions from over 205 million cars.

Carbon dioxide emissions of ships are directly proportional to fuel consumption and speed.

Moreover, boats powered by fuel also cause noise pollution that negatively affects marine life.

TO ALIGN WITH THE OBJECTIVES OF THE INTERNATIONAL MARITIME ORGANISATION. THE SHIPPING INDUSTRY IS NOW CHANGING, AND MORE AND MORE SHIP OWNERS ARE TODAY TRYING TO REDUCE THEIR ENVIRONMENTAL FOOTPRINT.

The most studied solution is the hybridisation of ship propulsion, by combining wind-assisted propulsion with other means of green propulsion (hydrogen, solar panels, ammonia, etc.). This will lead to complex and innovative ships, with some uncertainties that need to be anticipated [1].





D-ICE ENGINEERING

Type of organisation: SME Country: France Annual budget in 2020: €500k - €1m Previous experience with Earth Observation data: Yes

D-ICE IS A FRENCH SME WORKING ON TECHNOLOGICAL SOLUTIONS TO DIMINISH THE IMPACT OF BOATS ON THE ENVIRONMENT. The company is based in Nantes, with a team of 26 people, and operates in the fields of routing, clean energy and safety at sea.

D-ICE assists ship owners and operators to find solutions to diminish their impact on the environment. In particular, they work on assessing the interest of adding wind-assisted ship propulsion systems onboard merchant ships.



THE SATORI SOFTWARE USES COPERNICUS DATA TO SUPPORT WIND-PROPELLED SHIPS.

The software is one of the latest created by D-ICE with the objective of analysing the performance of wind-assisted propulsion vessels on specific routes, according to historical weather data (wind, waves and currents). Available since November 2020, the SATORI online service allows for the estimation of fuel consumption of ships on specific routes. The associated algorithm picks the routes with less power consumption.

Initially funded by the Copernicus Marine Environment Monitoring Service (CMEMS), SATORI relies on data from Copernicus satellites to acquire information on weather, wind, waves and sea currents on sea routes.

Those historical data are made freely available by the Copernicus Marine Environment Monitoring Service through two products: the Global Waves Reanalysis Waverys and the Global Ocean Physics Reanalysis.

The data are used to calculate ships' motions and interactions with the environment. Indeed, the evaluation of wind, waves and currents is necessary for the model to calculate the speed of ships and their engine power between two points at a specific time.

Waves

Provider: CMEMS | Model: MFWAM reanalysis Resolution: 0.5 degrees / 6 hours Product: GLOBAL_REANALYSIS_WAV_001_03 2

Our database is updated every 6 months



Current

Provider: CMEMS | Model: NEMO 3.1 Resolution: 0.2 degrees / 24 hours Product: GLOBAL_REANALYSIS_PHY_001_03 0

Our database is updated every 6 months



Source: D-ICE Engineering

Wind

Provider: ECMWF | Model: ERA 5 Resolution: 0.5 degrees / 6 hours Product: ERA5 **Our database is updated every 6** months



SATORI is built for shipowners, naval architects and providers of propulsion systems. Customers access SATORI through a web portal, where they can enter the ships' data and their potential speed according to different directions and winds.

Users can perform statistical weather routing studies on the online interface, choose a route and the time periods on which they wish to assess the ships' average consumption, and then create their own data visualisation to obtain the required forecasts (environmental conditions to be encountered, fuel saving associated with wind-assisted propulsion, ship motions).

The results can be filtered according to sea state, wind direction or speed, or engine power.

WITH THIS INFORMATION, USERS OF SATORI CAN ASSESS THE REDUCTION OF CONSUMPTION THAT WILL BE REACHED THANKS TO THE INSTALLED WIND-ASSISTED SHIP PROPULSION SYSTEM, EITHER ON A DIRECT ROUTE OR ON AN OPTIMISED ROUTE.




SATORI HAS BEEN ALREADY USED BY SOME NOTABLE SKIPPERS.

For example, Total and Z&B are today using the software on some of their ships, while AYRO and Chantiers de l'Atlantique rely on it to design wind-assisted ship propulsion systems.

The same algorithm which powers SATORI was used to perform a study for the design team of the new Banque Populaire trimaran after their boat capsized during the Route du Rhum yacht race in 2018.

In 2021, the boat Maître Coq won the greatest sailing race around the world, solo, non-stop and without assistance: the Vendée Globe.

D-ICE provided the skipper, Yannick Bestaven, with a software that contained a database of historical routes. This database was computed with the same algorithm as SATORI. This tool helped him to confirm his routes' choices and to eventually win the race.

"Thanks to this new technology, the shipping community can now validate business models around the new targets of the International Maritime Organization and take action to reduce greenhouse gases emissions globally". Sylvain Faguet, D-ICE Engineering.

FOR D-ICE, SATORI REPRESENTS AN OPPORTUNITY TO HELP SHIPOWNERS IN THEIR CARBON FOOTPRINT REDUCTION PROCESS, AND TO CREATE TRUSTFUL RELATIONSHIPS TO DEVELOP NEW PRODUCTS IN THE FUTURE.

Indeed, thanks to SATORI, shipowners can assess the convenience of installing windassisted propulsion systems to reduce the carbon footprint of their fleet.

Also, developers of wind-assisted ship propulsion (WASP) systems, can convince shipowners that their solutions will entail significant fuel consumption reductions, while ensuring a good return on investment. Finally, naval architects can validate the sizing and configuration of WASP systems onboard ships to obtain the best fuel reduction with the lowest impact on ships' structure and operations.

Among current developments, D-ICE is now working on the OCEANICS solution, a newgeneration navigation and control system aimed at optimising and securing operations, while significantly reducing fuel consumption.



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https://marine.copernicus.eu/services/ use-cases/satori-online-statisticalweather-routing



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Sylvain Faguet Chief Sales Officer, SATORI Nantes, France sylvain.faguet@dice-engineering.com https://dice-engineering.com/

COPERNICUS 2. ME

Monitoring and preventing floods in Wallonia



THE PUBLIC SERVICE OF WALLONIA NEEDS RELIABLE AND UP-TO-DATE INFORMATION ON FLOOD RISKS.

SENTINEL-1 AND SENTINEL-2 DATA ALLOWED FOR THE CREATION OF LAND COVER AND LAND USE MAPS OF THE REGIONAL TERRITORY.

WITH THE MAPS, THE PSW CAN COMPLY WITH THE EU FLOODS DIRECTIVE, AND DESIGN FLOOD RISK MANAGEMENT PLANS.

IN WALLONIA FLOODS REPRESENT A VERY CONCRETE RISK FOR THE ENTIRE TERRITORY.

Wallonia is one of the three regions of the federal state of Belgium, alongside Flanders and the Brussels-Capital Region. Located in the southern part of the Country, Wallonia covers 55% of Belgium and hosts one third of the Country's population.

The Wallonia region is crossed by many rivers, has a high population density and a significant interweaving of habitat and agriculture. These features make the region particularly vulnerable to floods.

Until June 2021, the average cost of flooding by runoff was of the order of $650,000 \in$ per year, and the cost could reach, for large floods by overflowing rivers, more than 100,000,000 euros.

IN JULY 2021, WALLONIA WAS HARD-HIT BY VIOLENT FLOODS. THE COST OF THE DAMAGE WAS ESTIMATED BETWEEN 4 AND 6 BILLION EUROS (40 TIMES MORE THAN PREVIOUS YEARS).

On July 14-15, 2021, the east of Wallonia experienced heavy rains, especially nearby the Vesdre and the Rochefort areas (Lesse).

The rain caused extreme floods. As a result, across the region 39 people died and 41,000 households were left without gas or electricity. More than 180,000 tons of garbage were collected.



A few days later, on 24-25 July, a flood amid heavy rain hit the Namur area, causing a mudslide. In the town of Dinant, the storm dumped 50 to 70 mm of rain in one hour, with automobiles being swept away by the waters [1].



Service public

de Wallonie

THE PUBLIC SERVICE OF WALLONIA

Type of organisation: Public regional administration Country: Belgium Annual budget in 2020: €2m - €5m Previous experience with Earth observation data: Yes

In recent years, most of the competences related to territorial management in Belgium have been delegated to the governments of the three regions. This means that a number of users of geospatial data are now situated at the regional, provincial and municipal levels.

The Public Service of Wallonia (PSW) is the primary interface between the regional institutions and the local administrations and citizens of Wallonia. The PSW employs around 10,000 people in its central department of Namur and the decentralised departments in Wallonia and Brussels.

THE PUBLIC SERVICE OF WALLONIA (PSW) IS IN CHARGE OF IMPLEMENTING THE POLICY OF THE WALLOON REGION.

For Wallonia, the Geomatics department of the PSW is in charge of harmonising territorial data collection and distribution, and of facilitating data acquisition and use by the region's public and private institutions.



To comply with the EU INSPIRE Directive, the Team needs to acquire precise, accurate and easily updatable information, including data on land cover (LC) and land use (LU).

Indeed, such data are of paramount importance for Walloon administrations, which use them for climate reporting, flood mapping, land take monitoring, forest management, agriculture planning, and land visualisation, among others.

Until 2017, the existing land cover and land use (LCLU) map of Wallonia was derived from cadastral and agricultural information, but did not allow users to distinguish information on LC from information on LU.

Moreover, the PSW is responsible for implementing the European Directive on the assessment and management of flood risks. The Directive invites European administrations to carry out a preliminary assessment of flood risks, then to analyse the risk in more detail by mapping it, in order to finally establish risk management plans.

TO COMPLY WITH THE EUROPEAN DIRECTIVE ON THE ASSESSMENT AND MANAGEMENT OF FLOOD RISKS, THE PSW HAS TO ANALYSE THE POTENTIAL DAMAGE TO THE POPULATION, THE ECONOMIC ACTIVITIES, THE HERITAGE, AND THE ENVIRONMENT.

Today, some of this information is provided thanks to the WALOUS project, which aims to map land use and land cover.



WALOUS IS A PROJECT OF THE PSW THAT USED COPERNICUS DATA TO MAP LAND COVER AND LAND USE IN WALLONIA. Funded by the Public Service of Wallonia, WALOUS was implemented by the Free University of Brussels, the Catholic University of Louvain and the Scientific Institute of Public Service.

In the framework of WALOUS, the Walloon government produced new land cover and land use maps for the whole territory.

The maps integrate the latest georeferenced data on the whole Walloon territory. Manmade assets, such as buildings and infrastructure, are precisely classified in the WALOUS land use map by using the sub-metric resolution of orthophotos, digital elevation models and other geodatabases, while vegetation and rural areas are better distinguished thanks to seasonal information from decametric satellite imagery (from the European Sentinel-1 and Sentinel-2 satellites). The algorithm producing the final maps integrates all the data collected to characterise the different classes.

THE MAPS WERE REALISED USING EXISTING GEOGRAPHIC DATABASES, AERIAL PHOTOS PRODUCED BY THE PSW SERVICES AND SATELLITE IMAGES THAT WERE OBTAINED FREE OF CHARGE THROUGH THE EUROPEAN COPERNICUS PROGRAMME.



View of the Semois river - On the left, the land use map. On the right, the land cover map. Source: WALOUS, Powered by Esri

THE LAND COVER (LC) MAP SHOWS THE PHYSICAL AND BIOLOGICAL COVER OF THE TERRITORY.

It highlights the physical and biological coverage of the land, allowing for the identification of natural features, such as trees, waters, shrubs, and grassland, as well as manmade assets, like buildings, rails, routes, and infrastructure.

The LC map provides information that can be used by public administrations and private actors to facilitate decisionmaking.



example, the Department As an of Natural Resources Agriculture, and Environment of the PSW uses the map to support farmers in making their declarations, while the Walloon Air and (AWAC) Climate Agency uses the information to estimate greenhouse gas emissions.



THE LAND USE MAP (LU), INSTEAD, DETAILS THE USES OF THE REGIONAL TERRITORY.

Indeed, a parcel occupied by trees can correspond to several purposes, for example a residential garden, a recreational area or a natural area.

The WALOUS map classifies land uses under different categories: primary, secondary, or tertiary production, transport networks, logistics and public utility networks, residential use, natural areas, and other uses.

Sub-categories are also available to get more insights into land uses.

The land use map is consulted by the Walloon administrations for several purposes, e.g., to manage and monitor the inventory of abandoned sites to be requalified, and to update the regional flood hazard map and assess the potential damage associated with flooding.

THE WALOUS LAND COVER AND LAND USE MAPS ALLOW THE PSW TO BUILD THE FLOOD RISK MAPS REQUIRED BY THE FLOODS DIRECTIVE, AND TO REALISE THE ANALYSES AND STATISTICS NEEDED TO DESIGN FLOOD RISK MANAGEMENT PLANS.

Indeed, the maps allow for the identification of sensitive issues in areas subject to flood risks. For example, the PSW can assess the area of economic activity potentially affected by a given flood scenario and propose measures to reduce the risk in these areas.

Combining aerial and satellite information and distinguishing land cover from land use in two different maps changed the use of LULC maps in Wallonia, while enabling the PSW to respond to the EU INSPIRE Directive requirements. Moreover, the frequent revisit of input data allows the PSW to plan for regular updates of the maps, which is required for statistical and decision-making purposes (climate. agriculture, land planning, forestry, risk management, etc.).

By updating the WALOUS maps, the PSW can amend the challenges and risks associated with floods according to the evolution of the territory. This process can be carried out for the three stages foreseen by the Floods Directive: the preliminary assessment of flood risks; the mapping of flood-prone areas and flood risks; and the development of Flood Risk Management Plans.



THE FLOODS OF JULY 2021 CONFIRMED THE IMPORTANCE OF CONTINUING DEVELOPING MAPPING PRODUCTS ON FLOOD RISKS. INDEED, IN SOME PLACES, THE AFFECTED AREAS WERE LARGER THAN THE FLOOD-PRONE SCENARIO CALCULATED FOR AN EXTREME RETURN PERIOD.

To enhance the use of cartographic products to better manage and prevent floods, all the information related to floods in Wallonia is now available on the brand-new site dedicated to flooding in Wallonia (inondations.wallonie.be). Resulting from a collaboration between many departments, the objective of this site is to centralise and provide all useful information on flooding to the citizens, administrations, as well as to building professionals.



LINKS

Public Service of Wallonia: https://spw.wallonie.be/ WALOUS web page: https://geoportail.wallonie.be/walous European Directive on the assessment and management of flood risks: https://ec.europa.eu/environment/water/floo d_risk/ European Inspire Directive: https://inspire.ec.europa.eu/inspiredirective/2 Géoportail de la Wallonie : https://geoportail.wallonie.be/home.html

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Nathalie Stephenne, Geomatics Expert Benjamin Englebert, Project Manager Namur, Belgium Public Service of Wallonia benjamin.englebert@spw.wallonie.be nathalie.stephenne@spw.wallonie.be https://spw.wallonie.be/



COPERNICUS & ME

Preventing and managing forest fires in Castilla-La Mancha



THE GOVERNMENT OF CASTILLA LA-MANCHA NEEDS RELIABLE AND UP-TO-DATE INFORMATION ON THE VARIABLES THAT CAN FAVOUR FIRES AND ON THE AFFECTED FOREST AREAS.



COPERNICUS SATELLITES PROVIDE DATA TO BOTH PREVENT AND MANAGE FOREST FIRES.

THE DATA PROVIDED BY COPERNICUS HAVE HIGHLY CONTRIBUTED TO DECREASING UNCERTAINTY AND INCREASING PREPAREDNESS AGAINST FOREST FIRES IN THE REGION.

SPAIN IS ONE OF THE MEDITERRANEAN COUNTRIES THAT ARE AFFECTED THE MOST BY SUMMER FIRES.

Forest fires develop in lands where combustible vegetation and sources of ignition are available due to human or natural activity.

The fire risk increases in summer periods, when conditions get more favourable for vegetation and soil to burn, triggered by increased drought caused by high temperatures and low humidity [1].

According to a report issued by Mediterranean Experts on Climate and Environmental Change (MedECC), in recent decades longer fire seasons alongside more frequent and severe fires occur in some Mediterranean countries, due to extreme climate events such as heatwaves [2].

Furthermore, climate change might cause even more severe forest fires in the future, as more extreme temperatures in summer are expected in the Mediterranean region [3].

In the summer of 2021, major forest fires led to both ecological and economic losses in Spain [4].

OF ALL SPAIN'S REGIONS, CASTILLA-LA MANCHA IS THE ONE WITH THE MOST MUNICIPALITIES IN HIGH FIRE-RISK AREAS, WITH A TOTAL OF 780 [5].





Castilla-La Mancha is a Spanish autonomous community located in the southern half of the Iberian Peninsula's Inner Plateau.

With a population of over two million people, the community occupies an area of 79,463 km2, including over 3.5 million hectares of forests, which represent 13% of the whole Spanish forests [6].

In Castilla-La Mancha, the fire season typically starts in June and ends in September. TO LIMIT THE DAMAGE OF FIRES ON FORESTS AND TAKE BETTER PREVENTIVE MEASURES TO AVOID THEM, THE GOVERNMENT NEEDS RELIABLE AND UP-TO-DATE INFORMATION ON THE VARIABLES THAT CAN FAVOUR FIRES AND ON THE AFFECTED FOREST AREAS.



INFOCAM - JUNTA DE COMUNIDADES DE CASTILLA-LA MANCHA

Type of organisation: Public regional organisation Country: Spain Annual budget in 2020: €50m - €100m Previous experience with Earth Observation data: Yes

INFOCAM, INTEGRATED IN THE REGIONAL DEPARTMENT OF SUSTAINABLE DEVELOPMENT, LEADS THE INTEGRAL MANAGEMENT OF FOREST FIRES IN CASTILLA-LA MANCHA.

INFOCAM performs its tasks in coordination with all the departments of the Government of Castilla-La Mancha, with local and provincial entities, and with the companies and private owners that are involved in sustainable rural development. INFOCAM takes action to preserve natural spaces and improve the quality of the environment, including activities related to the prevention and extinction of forest fires.

The Analysis and Planning Unit (UNAP) of INFOCAM issues periodical forest fire risk reports, that are used to enforce preparedness and response to forest fires.

UNAP is operated by a staff of twelve people who are mostly forest engineers, processing data from a wide range of sources, including remote sensing observations.



To prevent and monitor forest fire risks, INFOCAM needs to monitor the conditions of the vegetation.

Indeed, this is crucial information to perform a fire risk assessment: vegetation stress makes it prone to combustion, due to drought and high temperatures in summer or freeze in winter.

COPERNICUS PROVIDES DATA ON VEGETATION RELATED TO PHENOLOGY, PHOTOSYNTHESIS ACTIVITY, AND VEGETATION STRESS.

INFOCAM uses Copernicus data from Sentinel-2 and Sentinel-3 satellites to estimate the Normalised Difference Vegetation Index (NDVI) and the Fraction of Absorbed Photosynthetically Active Radiation (FAPAR) Index. The NDVI describes the difference between visible and near-infrared reflectance of vegetation cover and can be used to estimate the density of green on an area of land.

This information is important to know the amount of vegetation that could be available for potential fires.

The FAPAR is the fraction of the solar radiation absorbed by live leaves for the photosynthesis activity.

The index indicates the green and alive elements of the vegetation.

The UNAP obtains these data as already filtered information for the purposes of the INFOCAM.



Map indicating the status of combustible materials. Source: INFOCAM's web GIS platform

INFOCAM USES NDVI AND FAPAR INDICES PROVIDED BY COPERNICUS TO EVALUATE THE FIRE RISK.

These data are crucial to reduce uncertainty, especially with regard to emergency preparedness.

The maps and the data concerning the forest fire risks are provided to the stakeholders through a web-GIS (Geographic Information System) and daily reports that are distributed to the entities in charge of managing forests and fire risks.

Data from various indices can be also comparably used by INFOCAM to analyse variations between selected periods and estimate when and where the fire season is expected to start and what the risk areas are in Castilla-La Mancha. Thanks to Copernicus data and services, the Analysis and Planning Unit can issue regular reports indicating the forest fire risks in Castilla-La Mancha and produce maps of the risks that are made available to all the entities involved in the implementation of the INFOCAM Plan.



Part of the Forest Fire Risk Report issued by the UNAP in August 2021. Status of combustible materials. © INFOCAM



Part of the Forest Fire Risk Report issued by the UNAP for the period 29 November - 6 December 2021. Index of potential spread of forest fires. \circledcirc INFOCAM

THE MAPS HAVE HIGHLY CONTRIBUTED TO DECREASING UNCERTAINTY AND INCREASING PREPAREDNESS AGAINST FOREST FIRES IN THE REGION.

The INFOCAM'S Web-based GIS platform contributes to enforcing preventive measures and preparedness in order to better protect forests from fires.

The fire season does not start every year at a same time. Instead, its start varies according to the weather of previous seasons.

Knowing the level of vegetation stress allows fire managers to determine when vegetation is more prone to combustion.

Remote sensing data provided by Copernicus represent a crucial tool to support fire services before the fire season starts and enable them to activate resources and procedures. During emergencies, when fires are being managed, the vegetation condition indices provide fire managers with information about the spatial distribution of the fire risk that is useful to design operational plans for fire extinction.

Finally, the web-based GIS allows stakeholders to access information even from remote locations.

Based on the information on the fire risks contained in the maps, the region can increase or move resources (e.g., helicopters, fire engines and fire brigades) from prevention tasks to firefighting tasks in time.

Moreover, combined with wind and meteorological data, the maps allow for the forecasting of fire spreads into nearby areas.

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Juan José Fernández Ortiz UNAP Technician Analysis and Planning Unit Castilla-La Mancha Regional Operational Centre for fighting forest fires Toledo, Spain juanjofernandez@geacam.com www.geacam.es



COPERNICUS & ME

Safeguarding cultural heritage in Rhodes



THE EPHORATE OF ANTIQUITIES OF THE DODECANESE NEEDED TO MONITOR SOIL MOVEMENTS NEARBY ARCHAEOLOGICAL REMAINS.



DATA FROM SENTINEL-1 ALLOWED FOR THE CREATION OF SOIL DEFORMATION MAPS OF THE AREA.

THE EPHORATE CAN FORESEE THE EFFECTS OF SOIL MOVEMENTS AND TAKE MEASURES TO SECURE AND RESTORE MONUMENTS.

CLIMATE CHANGE AND GEOHAZARDS HAVE BEEN RECOGNISED AS VERY SERIOUS THREATS TO CULTURAL HERITAGE.

The increase in temperatures, with consequent phenomena such as floods and sea-level rise, erode our archaeological remains, endangering the physical materials with which they were built.

Also geological movements, in particular earthquakes and continuous soil subsidence, threaten the structural stability of the archaeological remains and historical buildings on which our societies and economies rely for social identity and cohesion and for sustainable growth.

Indeed, culture has a crucial role to play to achieve sustainable development and it is explicitly mentioned in the targets of the SDG N° 11 "Make cities inclusive, safe, resilient and sustainable". Target 11.4 calls for strengthening efforts to protect and safeguard the world's cultural and natural heritage. At the same time, the SDG N° 13 compels us to take urgent action to combat climate change and its impacts.

TO IMPLEMENT EFFECTIVE CONSERVATION MEASURES, GOVERNMENTS NEED RELIABLE, SHAREABLE, AND UP-TO-DATE INFORMATION ON THE STATUS OF OUR HERITAGE AND ON CLIMATE CHANGE PHENOMENA AND GEOLOGICAL MOVEMENTS AFFECTING IT.

Such information is vital to conceive and implement structural responses, preventive measures, and restoration, resilience and adaptation strategies.

According to the UNESCO, "World Heritage properties are affected by the impacts of climate change at present and in the future. Their continued preservation requires understanding these impacts to their Outstanding Universal Value and responding to them effectively" [1].



Today, methodologies to understand and quantify the effects of climate change and geological phenomena on cultural heritage are still under development. Without such methodologies, it will be very challenging for our governments and cultural authorities to deploy effective and sustainable mitigation and reconstruction plans to safeguard cultural heritage [2].



Rhodes is the historical capital and the largest of the twelve islands of the Dodecanese, in Greece.

The island is also called the Island of the Knights, after the Knights of Saint John of Jerusalem, who occupied it from 1310 to 1522.

The city of Rhodes was founded in 408 B.C., and it has a rich and fascinating history.

Known worldwide for having hosted one of the Seven Wonders of the Ancient World, the legendary Colossus of Rhodes, its medieval town is today a World Heritage site, and the island has become one of main tourist destination in Europe.

The city is located at the northern tip of the island. In addition to the mediaeval town, it also includes numerous archaeological sites, among which the area of Rodini.

Rodini was part of the necropolis of the ancient city of Rhodes, much larger than what we can see today, including monumental graves and cave sanctuaries, within a valley crossed by a torrent. IN RODINI, ARCHAEOLOGICAL REMAINS ARE EMBEDDED IN THE NATURAL BEDROCK. WE CAN SEE HERE TRACES OF A MONUMENTAL GRAVE COMPLEX, WITH FALSE DOORS AND COLUMNS SCULPTED IN THE ROCK, AS FORMING A THEATRICAL SCENE, AND A VERY BIG GRAVE IN THE FORM OF A MAUSOLEUM.

Due to the beauty of the landscape, Rodini has been also used, since ancient times, as a park and a place for recreation.

Shortly before the torrent meets the sea, a bridge built in Roman times is still in use today. The Roman Bridge (1st century B.C.) is one of the few ancient bridges preserved in Greece and the only one still in use today. Indeed, the bridge is one of the main entry points to the modern city of Rhodes. In Rhodes, excavations started after the reunification with Greece, in 1948. The ancients performed successive works to allow the population to enjoy the area of Rodini, and during the Italian occupation of the Dodecanese (1912 – 1947), a modern park was arranged there.

Today, the construction of new buildings in the area is forbidden and the park is still stunning. Nevertheless, few tourists know about Rodini, which seems today neglected [3].

THROUGHOUT THE CENTURIES, SUMMER FIRES, STORMS AND FLOODS ERODED THE ARCHAEOLOGICAL REMAINS, WHICH ARE ALSO SEVERELY THREATENED BY LAND DISPLACEMENTS. Indeed, Rhodes is situated in a seismic area, and it has been struck by numerous earthquakes. Notorious earthquakes in the island include the 226 B.C. earthquake that destroyed the Colossus of Rhodes, the one of 1481, which devastated big parts of the city of Rhodes, the earthquake of 1926, and a 6.3 magnitude earthquake in 2008.

Due to the earthquakes, part of the Mausoleum complex in Rodini has collapsed. Another nearby grave complex presents a cracked rock façade, which could cause the crumbling of the grave monuments cut in it.

Also the roman bridge, even though statically stable, is presenting fissures on the inner sides of the arches, which makes its monitoring necessary.





THE EPHORATE OF ANTIQUITIES OF THE DODECANESE

Type of organisation: Public regional administration Country: Greece Annual budget in 2020: €1m - €1.5m Previous experience with Earth Observation data: No

The Ephorate of Antiquities of the Dodecanese is responsible for protecting, preserving and studying all antiquities in the islands of the Dodecanese.

Under the authority of the Greek Ministry of Culture, the Ephorate has a staff of around 100 people distributed around the islands. Most of them are based in Rhodes and in Kos.

The Ephorate performs excavations, and supervises conservation and restoration works of the antiquities in the islands, including sites, monuments and artifacts dating from prehistoric until Byzantine times. Moreover, it is in charge of authorising and controlling public and private works in the areas of heritage sites. In the last three decades, it carried out important conservation and restoration works, created new museums, organised exhibitions in the islands, and participated in periodical exhibitions of Rhodian artifacts in Greece and abroad.

The Ephorate is in charge of securing the excavations that started shortly after the reunification of the Dodecanese with Greece, and that have brought to light the ancient city of Rhodes, lying underneath the modern city.

A large number of monuments and entire parts of the ancient city were revealed. Studying them, the staff of the Ephorate realised that the island of Rhodes is subject to intense land deformation. In particular, Rodini is affected by intense ground deformation.



TO PREVENT FURTHER DAMAGE TO THE MONUMENTS IN RODINI, AND TO ADOPT EFFECTIVE CONSERVATION MEASURES, THE EPHORATE NEEDED ACCURATE AND UP-TO-DATE INFORMATION ON LAND DEFORMATION IN THE AREA. The Ephorate of Antiquities has a wellestablished collaboration with the National Technical University of Athens, which proposed their participation in the Hyperion project.

Launched in June 2019 with a duration of four years, the project is funded by the European Union's Horizon 2020 research and innovation programme, and it involves 18 partners from eight European countries.

The goal of the HYPERION project is to leverage existing tools and services and new technologies to deliver an integrated resilience assessment platform for multi-hazard risk understanding, better preparedness, faster, adapted and efficient response, and sustainable reconstruction of historical areas [2].

The project identified four test sites in Greece (Rhodes), Spain (Granada), Norway (Tønsberg) and Italy (Venice). Prior to the technical implementation of the project, a report was issued collecting needs and practices of the bodies responsible for managing cultural heritage in these sites.

In Rhodes, HYPERION aimed at recording the damage to the monuments in Rodini that is directly related to the natural environment and the microclimate of the area, at assessing their degree of risk and the rate of their deterioration over time, and to build tools to plan for conservation and restoration measures.

© HYPERION

THE SENTINEL-1 SATELLITES OF THE COPERNICUS PROGRAMME PROVIDED THE DATA NEEDED TO UNDERSTAND HOW LAND MOVES IN RODINI.

The Laboratory of Remote Sensing of the Technical University of Athens collected more than 100 Sentinel images from 2016 to 2019, which allowed them to assess the level of ground deformation in the area.

The images captured by Sentinel-1 satellites are particularly useful for this kind of assessment, since these satellites have a short revisit time, ranging from 6 to 12 days. This means that researchers are able to capture up-to-date information on land movements for each date in which satellite images are acquired.

Moreover, Sentinel-1 images also have a high spatiotemporal resolution, which enables for the identification of deformation patterns even on large size monuments.

The Sentinel-1 images allowed for the creation of a land deformation map of the area of Rodini.

The map shows a 10mm uplift around the area between 2016 and 2019, which clearly affects the structural integrity of the monuments there.

To ensure sustainability, after the end of HYPERION, the project partners committed to continue updating the ground deformation map once a year.



Hyperion



Rhodes-Greece Ground Deformation and Velocity Map



The Ephorate of Antiquities of the Dodecanese will have access to the information on land movements in Rodini through the holistic resilience assessment platform (HRAP) that will be developed within the framework of the HYPERION project.

Through the platform, they can consult ground deformation maps which classify the level of ground deformation with different colours, and can zoom on specific locations to know how the ground is moving there.

The movements are assessed with millimetre accuracy, providing the Ephorate with extremely precise information on the structural stress affecting the monuments.

This information can be consulted for a specific day or as an annual average.

The short revisit time of the Sentinel-1 satellites allows for the updating of this map every 2 or 3 months, hence ensuring the high reliability of the information provided to the Ephorate on soil movements.

THE MAP FACILITATES THE EARLY RECOGNITION OF POTENTIAL RISKS TO THE MONUMENTS AND SUPPORTS THE REGULAR MONITORING OF LAND DEFORMATION PERFORMED BY THE EPHORATE IN RODINI.

The map serves as a non-invasive tool to collect the information needed to preserve cultural heritage in Rhodes. The Ephorate can identify the structures that need more urgent action and propose measures to secure and restore the monuments.

For example, they will take action to stabilise the monuments that are more affected by land deformation in the ancient necropolis in Rodini and will ask the Municipality to stop or lighten the traffic on the Roman bridge.



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Goal 13 Take urgent action to combat climate change and its impacts: www.globalgoals.org/13-climateaction

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Vassiliki Patsiada, Archaeologist Sotiris Patatoukos, Head of Conservation Department Ephorate of Antiquities of the Dodecane Rhodes Island, Greece vpatsiada@yahoo.com spatatoukos@yahoo.com www.culture.gov.gr

Vassilia Karathanassi, Director Laboratory of Remote Sensing National Technical University of Athens Athens, Greece karathan@survey.ntua.gr www.survey.ntua.gr/en/departments/topo/topolabs/rslab

COPERNICUS

Copernicus data and services to SHELTER cultural heritage

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THERE IS AN INCREASING NEED FOR ACCURATE AND HARMONISED DATA ON LAND COVER IN MULTI-NATIONAL PROJECTS AIMED AT SAFEGUARDING CULTURAL HERITAGE.



EKODENGE, A TURKISH SME, USES DATA ON LAND COVER FROM SENTINEL-1 AND SENTINEL-2 TO MAP RISKS AROUND CULTURAL HERITAGE SITES.



THE SENTINEL DATA WILL BE USED TO PROPOSE MEASURES TO INCREASE THE RESILIENCE OF CULTURAL HERITAGE SITES AND MAKE RECOMMENDATIONS ON "BUILDING BACK BETTER" TECHNIQUES.

THERE IS AN INCREASING NEED FOR ACCURATE AND HARMONISED DATA ON LAND COVER IN MULTI-NATIONAL PROJECTS AIMED AT SAFEGUARDING CULTURAL HERITAGE.

Climate change is exposing historical and cultural sites to threats such as floods, wildfires and heatwaves, among others.

Data on land cover is critical to understand these hazards, as well as to monitor changes around cultural heritage sites [1].

Recent developments in space technology have made spatial information data on land cover more available at local, regional and global scales [2].

Even though spatial information becomes more and more abundant thanks to global Earth Observation (EO) systems, spatial data collected by different entities for different regions of the world still lack standardisation and harmonisation.

Cultural heritage is one of the areas that particularly suffer from the lack of harmonised and standardised data on land cover.

Indeed, in several projects aimed at safeguarding cultural heritage against natural and geological hazards, stakeholders from different countries need data that can be compared (i.e. harmonised and standardised data) to test methodologies and managing tools.





EKODENGE

Type of organisation: SME Country: Turkey Annual budget in 2020: € 2m - € 5m Previous experience with Earth Observation data: Yes

EKODENGE IS A TURKISH SME WITH A TEAM OF SUSTAINABILITY EXPERTS, PROVIDING CONSULTANCY, ENGINEERING, ARCHITECTURE, AND SOFTWARE SOLUTION SERVICES.

Created in 1996, Ekodenge is headquartered in Ankara, at the Hacettepe Technopark research and business centre. The company can count on a multi-disciplinary team of 40 people, including architects, chemical, environmental and mechanical engineers. Ekodenge works on projects related to sustainability for a variety of private and public clients, including private sector organisations, organised industrial districts, chambers of industry and trade, development agencies, sectoral unions/ associations, and municipalities.

As an example of one of the products created by Ekodenge, EPESUS City is a GIS platform developed in house that calculates the urban carbon footprint for cities needing to develop sustainable climate and energy action plans.



EPESUS for Cities. Source: www.ekodenge.com

TODAY, EKODENGE AIMS TO EXPAND ITS WORK IN THE CULTURAL HERITAGE DOMAIN BY LEVERAGING ON ITS EXPERIENCES IN OTHER SECTORS.

Indeed, since 2019 Ekodenge is part of the Consortium implementing the SHELTER project (Sustainable Historic Environments holistic reconstruction through Technological Enhancement and community-based Resilience).

Funded by the Horizon 2020 programme of the European Commission under grant agreement No 821282 for a duration of four years, the project is coordinated by the Fundación Tecnalia Research & Innovation and involves 23 partners from 10 countries. THE SHELTER PROJECT AIMS AT DEVELOPING A DATA-DRIVEN AND COMMUNITY-BASED KNOWLEDGE FRAMEWORK THAT WILL BRING TOGETHER THE SCIENTIFIC COMMUNITY AND HERITAGE MANAGERS, WITH THE OBJECTIVE OF INCREASING RESILIENCE, REDUCING VULNERABILITY, AND PROMOTING BETTER AND SAFER RECONSTRUCTION IN HISTORICAL AREAS.



The countries of the 23 partners of the SHELTER project. Source: www.shelter-project.com/partners/

All the developments of the project will be validated in five open-labs, representing the main climatic and environmental challenges in Europe and different heritage's typologies [3]:

- The Santa Croce church and archaeological area in Ravenna, Italy. Characterised by the presence of floor mosaics, the church is exposed to outdoor climatic threats, while the archaeological site is subject to soil subsidence.
- The coastal district of Seferihisar, in the province of Izmir, Turkey. The district is located in a very seismic area.
 Successive earthquakes have deteriorated the walls of the old
 Fortress of Sigacik, while the whole area is also subject to extreme heatwaves and storms, which severely affect agriculture and fishery activities.

- The Island of Dordrecht in the Netherlands. The island is part of the historic city centre and includes almost 800 historical buildings, which are threatened by increasing water levels.
- The Serra Do Xurés Natural Park in Galicia, Spain. The area is particularly threatened by wildfires.
- The Sava River Basin flows through Slovenia, Croatia and along its border with Bosnia and Herzegovina, and finally through Serbia, feeding into the Danube in its capital, Belgrade. The area is particularly subject to floods, which endanger the several historical, religious, natural and prehistoric sites on the Danube's rivers.

THE SHELTER PROJECT AIMS AT MAPPING THE RISKS IN THESE SITES, WHILE CREATING EASILY ACCESSIBLE TOOLS TO VISUALISE THEM.



WITHIN THE PROJECT, EKODENGE IS RESPONSIBLE FOR CREATING A RISK ASSESSMENT TOOL VISUALISED ON A GIS.

THE GIS HAS TO CONTAIN INFORMATION ON LAND USE, USEFUL TO FORESEE RESILIENCE AND THREATS TO THE HERITAGE AND TO PLAN RECOVERY MEASURES. The project aims to develop a set of tools that utilise a common database, and this database needs to have standardised spatial data.

Hence, the GIS platform needs to rely on accurate and sharable information that can be compared over time and allow partners of the project to add their own data in a harmonised fashion.

To do this, Ekodenge needs accurate information on land cover in the sites targeted by the project.



The SHELTER's data-driven platform explained. Source: www.shelter-project.com

IN ORDER TO BUILD THE PLATFORM FOR DISASTER RISK MANAGEMENT IN THE AREAS INCLUDED IN THE PROJECT, THE SHELTER PARTNERS USE DATA ON LAND COVER AND CLIMATE AND HISTORICAL DATA FROM THE SENTINEL-1 AND SENTINEL-2 SATELLITES OF THE COPERNICUS PROGRAMME.

The Copernicus images provide data on vegetation cover, which are useful to foresee fires and to assess resilience metrics related to heatwaves, floods and built areas around the cultural heritage sites. Moreover, the historical data allow to retrace soil movements, changes in landcover, and weather events, such as heatwaves and floods, that damaged the cultural heritage sites in the past.

These data are integrated in the datadriven platform for disasters risk management produced within the project.

The Copernicus data is particularly useful for this kind of assessments, since the data are freely available across Europe and accessible in the same format.

This means that the data acquired through Copernicus allow Ekodenge to calibrate all different and site-specific data to be used into the same platform. Moreover, the information contained in the platform for each site can be easily compared and updated.


COPERNICUS DATA AND SERVICES PROVIDE ACCESSIBLE, HARMONISED, RELIABLE, AND ACCURATE DATA ON LAND COVER AROUND CULTURAL HERITAGE SITES.

Thanks to Copernicus data, Ekodenge can acquire data on land cover for the five different areas targeted in the open labs in a harmonised and standardised format.

The GIS platform developed by the partners of the SHELTER project will contribute to building a model to improve the resilience of cultural heritage sites through better decisionmaking processes and policies applicable at local and regional levels. All data will be used on an IT platform after the project ends in 2023. The platform is intended to be used by all the stakeholders operating in the sites targeted by the SHELTER project.

Indeed, it includes tools useful in all phases of risk management, from preparedness measures to increased sites' resilience and stability, to response and recovery measures. This means that the information contained in the platform can be useful for a number of public and private stakeholders, ranging from policymakers to fire brigades, and from construction companies to research institutes.



Dordrecht Open Lab, The Netherlands. Source: www.shelter-project.com

Based on the information regrouped in the platform, the project partners will propose measures to increase the resilience of cultural heritage sites and make recommendations on "building back better" techniques.

The platform not only includes information relevant for safeguarding cultural heritage, but also for protecting natural heritage and human settlements from natural disasters and climate change at the regional level.

After this experience, Ekodenge is eager to use Copernicus data to provide similar services to municipalities that often lack the specific spatial information needed to better manage risks. THE EKODENGE TEAM HAS LEARNED HOW TO USE COPERNICUS DATA TO ACQUIRE INFORMATION ON LAND COVER THAT CAN BE INTEGRATED INTO GIS AIMED AT DIFFERENT SCOPES.



Serra Do Xurés Natural Park Open Lab in Galicia, Spain. Source: www.shelter-project.com

LINKS

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Duygu Basoglu Ekodenge - Sustainability Experts Ankara, Turkey duygu.basoglu@ekodenge.com www.ekodenge.com/

COPERNICUS & ME

Supporting insurance companies to deal with climate-related damage to agriculture



INCREASING CLIMATE CHANGE MAKES IT DIFFICULT TO FORESEE AND ASSESS THE ECONOMIC LOSSES CAUSED BY WEATHER-RELATED DISASTERS.



DSE, A FRENCH SME, COMBINES ARTIFICIAL INTELLIGENCE AND SENTINEL-1 AND SENTINEL-2 DATA TO ESTIMATE AGRICULTURAL DAMAGE CAUSED BY WEATHER-RELATED EVENTS.

THIS SYSTEM ALLOWS INSURANCE COMPANIES TO SAVE MONEY AND TIME FOR DAMAGE ASSESSMENT AND TO AVOID FRAUDS. TODAY, THERE IS A GROWING NEED TO ENHANCE RESILIENCE TO NATURAL DISASTERS AND IMPROVE CLIMATE CHANGE ADAPTATION MECHANISMS.

Indeed, the economic impacts of weatherrelated disasters are expected to increase significantly, due to the combined effects of climate change and socio-economic developments, such as economic growth, increased urbanisation and population growth, especially in areas that are prone to disasters.

According to the World Meteorological Organization's Atlas of Mortality and Economic Losses from Weather, Climate and Water Extremes, the number of disasters related to a weather, climate or water hazard has increased by a factor of five between 1970 and 2019 globally.

In the 50-year period, weather, climate and water hazards accounted for 50% of all disasters and 74% of all reported economic losses. During the same period, 202 US million dollars in damage occurred on average every day.

Economic losses have increased sevenfold from the 1970s to the 2010s. Storms are the sole hazard for which the attributed portion is continually increasing, resulting in the largest economic losses around the globe [1].





AGRICULTURE IS AMONG THE SECTORS THAT ARE AFFECTED THE MOST BY CLIMATE-RELATED DISASTERS.

Indeed, if we consider the damage affecting agriculture, industry, commerce and tourism taken as a whole, on its own agriculture absorbs the disproportionate share of 63% of impact from disasters [2].

The Sendai framework for Disaster Risk Reduction for the period 2015-2030 encourages the use of instruments that finance recovery costs while offering incentives to reduce the potential impacts of weather-related disasters [3]. To establish mechanisms, and in particular insurance schemes, to support the recovery of agricultural activities affected by disasters, there is a growing need for data and information to foresee and assess such damages.

UNFORTUNATELY, INCREASING CLIMATE CHANGE MAKES IT MORE AND MORE DIFFICULT TO FORESEE AND ASSESS THE COSTS OF WEATHER-RELATED DISASTERS AND THE ECONOMIC LOSSES CAUSED BY THESE. EURISY



DSE - DATA SCIENCE EXPERTS

Type of organisation: SME Country: France Annual budget in 2020: Less than €500k Previous experience with Earth Observation data: Yes

DSE-DATA SCIENCE EXPERTS IS A COMPANY FOCUSED ON BUILDING PRODUCTS AND SOLUTIONS BASED ON ARTIFICIAL INTELLIGENCE.

Founded in 2020 in the French Alps by a team of engineers and researchers cumulating decades of experience in information processing and machine DSE combines artificial learning, intelligence, signal-processing, remotesensing, and computer-vision to build augmented intelligence for energy smart agriculture, management, insurance, and transportation.

Created by Vincent Couturier-Doux, Giorgio Licciardi and Jocelyn Chanussot, today the company employs 11 people.

The founders came up with the idea for DSE after working together with AXA Climate on using AI in damage estimates. The team's vision is to enhance insurance companies' efforts in providing support to the agriculture sector in times of natural disasters.

In 2020, the European Space Agency listed DSE among the 50 European startups that count in the industrial space landscape [4].

In the same year, the young SME received the Copernicus Masters France Award, and it is currently supported by BPI Banque publique d'investissement (a French public investment bank), as part of the i-Nov programme for the period 2021-2023.

Furthermore, DSE received in 2020 the ENEL Innovation Challenge prize for a competition focusing on the detection of archaeological remains by remote sensing.

DSE's portfolio of clients includes AXA, EDF, Boston Consulting Group, SpaceAble, CORYS, CSUG, ENEL, and HPE, among others.



AIPERION IS A SYSTEM, DEVELOPED BY DSE, THAT ESTIMATES THE DAMAGE AFFECTING AGRICULTURAL FIELDS, IDENTIFIES THE BOUNDARIES OF FLOODED AND BURNED AREAS, AND DETECTS THE EXTENT, IMPACT AND DURATION OF DROUGHTS BASED ON EXTREME WEATHER EVENTS OR NATURAL DISASTERS.

AlPerion aims at supporting the crop insurance sector to accurately estimate the damage produced by natural disasters and extreme weather events, such as hailstorms, floods, wildfires, droughts, tornados, sandstorms, and windstorms.

The system is based on AI applied to Earth observation images to identify and detect the boundaries of flooded and burned areas,

It integrates meteorological data from the MSG mission (Meteosat Second Generation satellites) to detect the intensity and duration of extreme weather events. AlPerion relies on data from the Copernicus Sentinel-1 and Sentinel-2 missions, to calculate vegetation indices and estimate agricultural damage.

The Alpeiron Fire Detection Dashboard



These analyses are combined to produce an assessment of the level of damage to the crops and of its causes. The results are provided to customers through a dashboard, in the form of maps and figures. Other satellite data, i.e., those provided by the Sentinel-5P mission, will be also included in the system to deliver new services, such as the monitoring of air quality parameters.



The AlPerion Drought Detection Dashboard

THE DSE SOLUTION HELPS CUSTOMERS, PARTICULARLY INSURANCE COMPANIES, TO PRECISELY ASSESS THE LEVEL OF DAMAGE DONE TO CROPS AND TO BETTER SUPPORT THE AGRICULTURAL SECTOR WITH EVIDENCE-BASED DECISIONS. The AIPeiron system based on Copernicus data allows insurance companies to save money and time for damage assessment and to avoid frauds. At the same time, it enables insurance companies to propose cheaper premiums and quick recovery plans to landowners affected by natural disasters.

By integrating Copernicus data into their software, DSE can provide precise information on the crops' health and determine if the damage to crop reported by farmers is actually a consequence of natural disasters and not of fraud attempts.

Moreover, based on the information provided by DSE, insurance companies can determine the premium to be paid in case of crop losses caused by natural disasters. Under the request of one insurance company, using this system DSE was able to map 80% of cultivated fields on the French territory to detect the growth status of vegetation.

That was made possible thanks to the high temporal resolution of the Copernicus data and could not have been done by using in-situ surveying techniques.





USING FREE AND OPEN COPERNICUS DATA, DSE CAN PROVIDE ITS SERVICES AT A MUCH LOWER COST THAN THE PRICE THAT THEY WOULD ASK IF THEY USED OTHER PAYING SATELLITE DATA. As a result, after only one year of existence, the company can count some of the world's biggest insurance companies among their customers.

In 2020, the AIPeiron system has been awarded the Copernicus Masters Prize for France. The Copernicus Masters are awarded to innovators fostering new solutions and concepts that showcase the benefits of the European Copernicus services for our everyday life.

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CREDITS AND CONTACTS

Vincent Couturier-Doux, CEO

DSE - Data Science Experts Grenoble, France vincent@dse-datascienceexperts.com giorgio@dse-datascienceexperts.com info@dse-datascienceexperts.com https://dse-datascienceexperts.com

COPERNICUS & ME

Improving financial estimates and forecasts



THE LACK OF REAL-TIME DATA MAKES IT HARD TO ASSESS AND ESTIMATE ECONOMIC GROWTH AND BUSINESS OPPORTUNITIES COMPARABLY IN DIFFERENT GEOGRAPHICAL ZONES.



QUANTCUBE, A FRENCH SME, USES SATELLITE-BASED DATA TO PROVIDE ECONOMIC INDICATORS IN REAL-TIME.

USING COPERNICUS DATA, QUANTCUBE CAN ENHANCE ITS MACROECONOMIC INDICATORS WITH GRANULAR, RELIABLE AND TRANSPARENT DATA. TO HELP COMPANIES DEVELOP BUSINESS STRATEGIES, FINANCIAL FORECASTING REQUIRES PRO-ACTIVELY COLLECTING FINANCIAL AND NON-FINANCIAL DATA THAT IS USEFUL TO IDENTIFY GROWTH OPPORTUNITIES AND MATERIAL RISKS.

Financial forecasting is the process by which companies think about and prepare for the future. Forecasting involves assessing historical and current data concerning macroeconomics, environmental, social and governance (ESG) factors.

While plenty of official economic data exists, these are often published with a lag of three or four months and for some areas of the world such data is difficult to access.

As an example, up-to-date information on urban growth or maritime traffic, which can be linked to economic growth, is not available for many geographic areas, and it needs to be retrieved from sources other than official reports.

The lack of real-time data makes it very challenging for industry practitioners to assess and estimate economic growth and business opportunities in a way that is comparable among different geographical zones and over time.

The uncertainties resulting from the COVID-19 pandemic make it even more challenging to perform financial forecasting to support businesses in their strategic decisions. This challenge highlights the need to procure and analyse macroeconomic data in an alternative fashion.



To boost financial forecasting, the industry is increasingly integrating cutting-edge technologies such as AI, blockchain and deep learning/data science with existing tools and models

FinTech companies are playing an important role in this area and serving their clients in almost every area of finance, from payments and loans to credit scoring and stock trading.

QUANTCUBE TECHNOLOGY



Type of organisation: SME Country: France Annual budget in 2020: Less than €500k Previous experience with Earth Observation data: Yes

QUANTCUBE TECHNOLOGY IS A FINTECH COMPANY THAT PROVIDES HIGH QUALITY FINANCIAL PERFORMANCE INDICATORS TO ITS CLIENTS.

QuantCube Technology was founded in 2013 by two entrepreneurs with strong expertise in Artificial Intelligence (AI) and Big Data.

The company develops macroeconomic and ESG nowcasting with real-time analyses of key Macro and ESG factors (i.e., insights into present, near future, and very recent past economic events).

QuantCube leverages a vast amount of alternative data to perform financial analytics that help their clients design and implement evidence-based business and investment strategies.



The QuantCube team. © QuantCube Technology

THE TEAM'S VISION IS TO PROVIDE VALUABLE INSIGHTS INTO TOMORROW'S ECONOMY WITH REAL-TIME MACRO INTELLIGENCE.

QuantCube's main product is a Macroeconomic Intelligence Platform (MIP) where users can find real-time macroeconomic indicators based on Al and Big Data technology.

These indicators provide users with timely insights for macroeconomic factors, such as GDP, inflation, job openings and others. The company processes a variety of alternative data including textual data (news and social media), geospatial data, telecommunications data, and Earth Observation (EO) data from optical, radar and atmospheric satellites.

QuantCube's portfolio of clients includes financial institutions, such as Moody's, the World Bank, Banque de France, Ardian, and Union Bancaire Privée (UBP).

	QUANTCUBE Data Portal Smart Search.	۹
•	Economic Growth Index	
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Я. Ф	SELECT COUNTRY Overview * Mid-term (90 days) *	SELECT FREQUENCY Daily *
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ø s	ECONOMIC GROWTH INDEX BY COUNTRY Country Index (change over last year)	CHART
*	United States -0.5% China +1.4%	
	Japan -2.9% Germany +0.6%	-5%
	United Kingdom -3.9% Spain -3.5%	Mar 20 May 20 Jul 20 Sep 20 Nov 20 Jan 21
	France -11.6%	United States - China - Japan - Germany United States - Spain - Lurozone - France
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Economic Growth Index. Source: QuantCube's Next Generation Macroeconomic Intelligence Platform

QUANTCUBE USES SATELLITE-BASED DATA FROM THE COPERNICUS CONSTELLATION AND SERVICES TO PROVIDE ITS CLIENTS WITH ECONOMIC INDICATORS IN REAL-TIME.

Copernicus data are used by QuantCube to collect real-time information on four wide sectors of activity that are crucial to economic growth:

Agriculture: Sentinel-2 images, as well as meteorological data, are used to calculate real-time estimates of the crop yield per region and country, allowing for better tracking of agricultural activities.

Pollution: Sentinel-5p satellite images allow QuantCube to estimate the level of pollution per region and per country, focusing on the industrialised areas. Assessing the level of pollution (and in particular of NO2 emissions), allows for the tracking of industrial production.

Urban growth: Sentinel-2 images are used to measure and monitor urbanised surfaces and their yearly evolution. This helps QuantCube to track how cities change over time.

Water stress: Sentinel-2 satellite images are used to monitor water sources. Monitoring the fluctuation of water surfaces enables QuantCube to foresee droughts, which have a noticeable impact on water-intensive economic sectors.

To obtain the best possible accuracy, QuantCube Technology couples information extracted from satellite imagery with other data sources, such as job offers, sentiment data from social media, or logistics flows data.

The results of the analyses are delivered in real-time via the QuantCube Macroeconomic Intelligence Platform (MIP), accessible via a license on the SaaS model. The platform offers users different levels of granularity, ranging from sector data to country-level macroeconomic indices.



By using Copernicus data, QuantCube can access information on regions where official statistics and indicators are difficult to obtain or are made available with some delay.

THE USE OF COPERNICUS-BASED DATA ADDS A SIGNIFICANT VALUE-ADDING LAYER TO QUANTCUBE'S GLOBAL MACRO SMART DATA OFFERING. By using satellite images, QuantCube is able to enhance its macroeconomic indicators with granular, reliable and transparent data.

The satellite images also allow QuantCube to monitor changes in a specific region or country over time to detect unusual trends.

In 2021, the Bank for International Settlements (BIS) Innovation Hub and the Bank of Italy placed QuantCube among the finalists for the G20 green and sustainable financial challenge, which was launched during the Italian G20 presidency

As climate change is increasingly affecting economic growth, environmental parameters are becoming more and more important for financial predictions. Hence, the use of satellite data will continue to play a crucial role in enabling companies to produce reliable financial and macroeconomic forecasts.



LINKS

QuantCube Technology website: www.quant-cube.com ESA Space Solutions website: www.esa.int/Applications/Telecommunic ations Integrated Applications/ESA Spa ce Solutions G20 TechSprint Website: www.techsprint2021.it/ Discover our satellites, Copernicus website: www.copernicus.eu/en/aboutcopernicus/infrastructure/discover-oursatellites BIS and Bank of Italy announce finalist list of G20 green and sustainable financial challenges, London News Today, 25th June 2021. Consulted on 29

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CREDITS AND CONTACTS

Alice Froidevaux, Lead Data Scientist QuantCube Technology Paris, France a.froidevaux@quant-cube.com quant-cube.com



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52 rue Jacques Hillairet 75012 Paris – France +33 1 47 34 00 79 eurisy@eurisy.eu

www.eurisy.eu

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