

SPACE OPPORTUNITIES FOR CLIMATE CHALLENGES

2020 - 2021

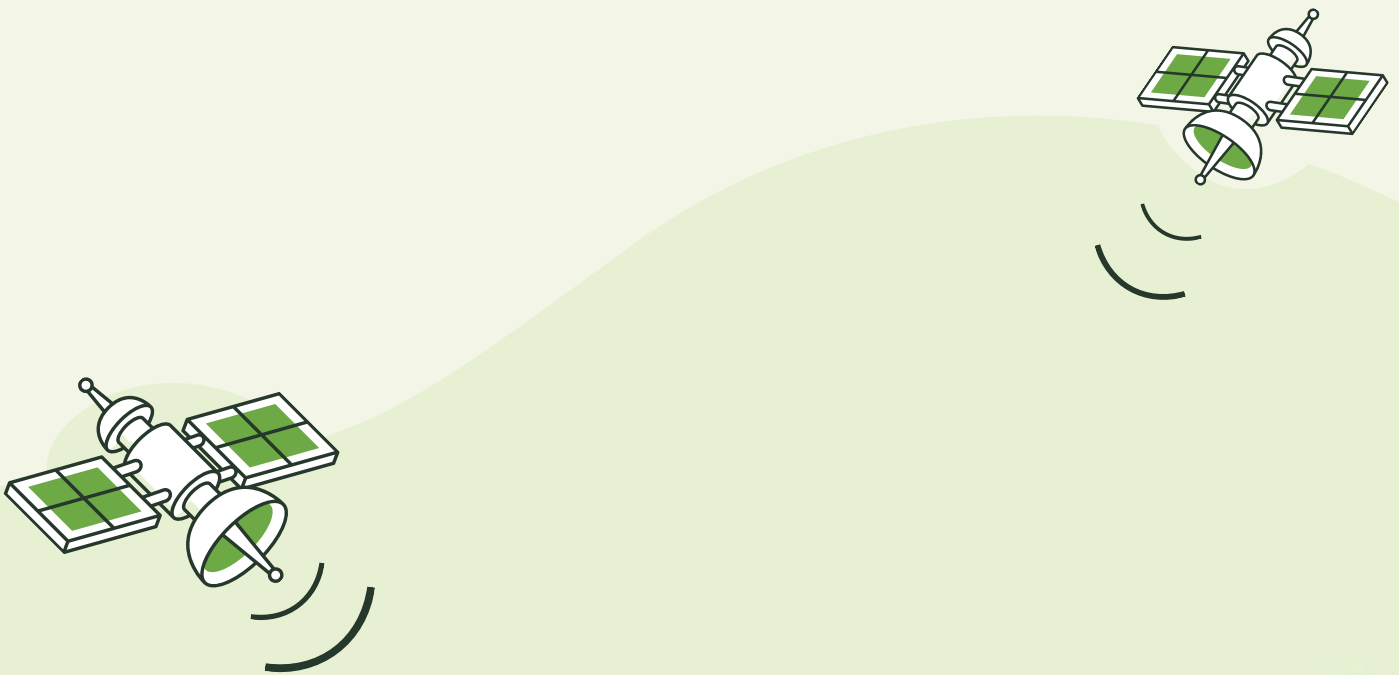













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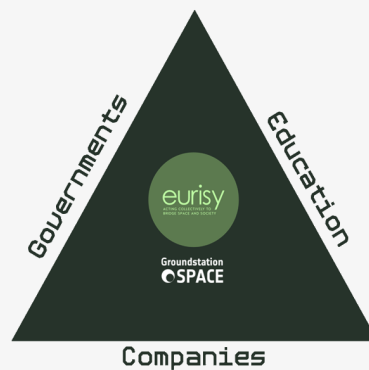
A GREEN AND DIGITAL EUROPE

Climate change and environmental degradation are an existential threat to Europe and the world. To overcome these challenges, the European Green Deal will transform the EU into a modern, resource-efficient and competitive economy.

With their joint initiative, **Eurisy and DotSPACE** are advocating **for the potential of satellite data** to enhance the uptake of economically sustainable solutions **contributing to the green transformation** of many economic sectors. Together they seek European excellence to find breakthrough solutions that can turn green challenges into innovation opportunities.

FROM CLIMATE CHANGE TO CLIMATE ACTION

From November 2020 to July 2021, Eurisy and DotSPACE hosted a series **bringing together research, government and industry** experts to talk about their innovative solutions related to climate.



During eight webinar sessions, this multidisciplinary initiative provided an **open networking and knowledge sharing platform where space and non-space peers were able to exchange** ideas, discover opportunities and meet people to improve their activities.

THROUGHOUT THIS PUBLICATION YOU WILL FIND AN EASY OVERVIEW
OF THE APPLICATIONS PRESENTED DURING EACH SESSION.



ROOTING FOR PLANT HEALTH

The EU's biodiversity strategy for 2030 is a comprehensive, ambitious and long-term plan to protect nature and reverse the degradation of ecosystems. The strategy aims to put Europe's biodiversity on a path to recovery by 2030. The objective is to build our societies' resilience to future threats such as the impacts of climate change, forest fires, food insecurity, and disease outbreaks. The EU aims to restore degraded ecosystems by 2030 and manage them sustainably, addressing the key drivers of biodiversity loss.



HOW CAN SPACE CONTRIBUTE?

EARLY DETECTION OF PLANT STRESS



Challenges:

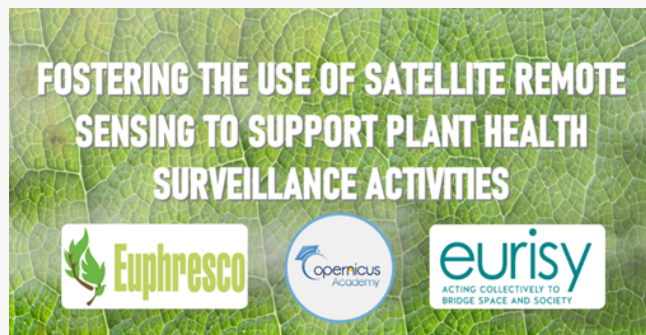
- Spread of plant pests through globalisation & trade
- Climate change effects such as droughts and floods
- Threat to human health and food security



Satellite remote sensing:

- Regular monitoring of large areas
- Identify and map plants and trees
- Detection of stress in plants before they are visible to the naked eye

Together with Euphresco, a network of organisations funding research projects and coordinating national research in the phytosanitary area, Eurisy published the policy brief "Fostering the use of satellite remote sensing to support plant health surveillance activities" to promote the operational use of satellite remote sensing to detect, monitor and fight plant pests.





MONITORING INVASIVE PLANT SPECIES

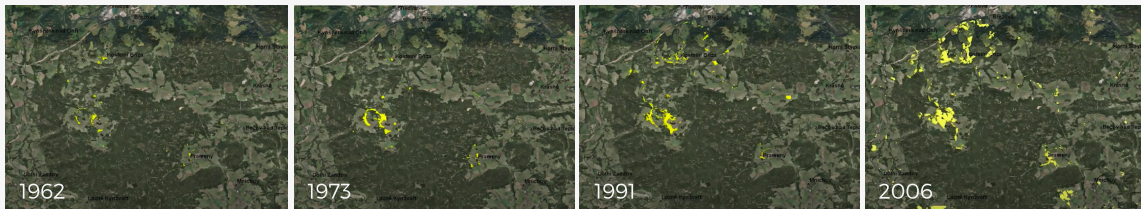


! Challenges:

- Growing impact of plant invasions
- Invasive species are hard to eliminate once established
- Threat to biodiversity, ecosystems, and traditional landscapes

✓ Satellite remote sensing:

- Improved early detection of invading plants
- Automated monitoring reducing costs of field campaigns
- Information on spatial structure of invasions



Development of invasion at the landscape scale of Hogweed in the Czech Republic from 1962 to 2006. Satellite imagery: RapidEye

DETECTING ILLEGAL LAND CONVERSIONS

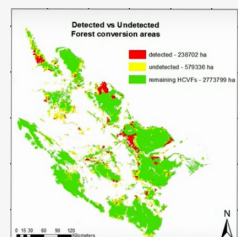


! Challenges:

- Illegal plantations (e.g. oil palm) threatening biodiversity
- Replacing high conservation value forests and vulnerable habitats

✓ Satellite remote sensing:

- Map land conversions
- Objective information for law enforcement



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SETTING COURSE FOR SUSTAINABLE MARITIME ACTIVITIES

The EU Blue Economy is indispensable to meet the EU's environmental and climate objectives. Earth is covered by oceans for 71% of its surface, containing 99% of the living space on the planet. The ocean is the main climate regulator we have. It offers clean energy and sustains us with oxygen, food, and many critical resources. There just can't be green without blue. However, 93% of Europe's marine area is under multiple pressures especially from human activities.



HOW CAN SPACE CONTRIBUTE?

MONITORING COASTAL CHANGES



Challenges:

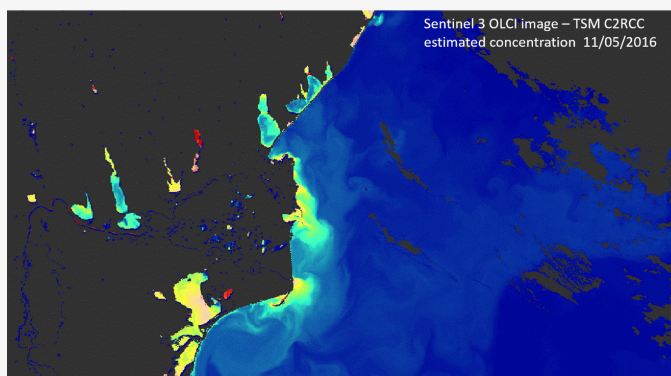
- Sedimentation
- Flooding & sea level rise
- Climate change impact on natural coastal processes and ecosystems



Satellite remote sensing:

- Time-series data for water constituents and other parameters
- Continuous monitoring
- Contribution to models for ocean surface

Satellite imagery (sentinel-3) of water and sediment fluxes transfer to the Black Sea, tracing the distribution of the Danube plume and its effects on the coastal zone. This enables scientists to improve climate change analysis in transitional areas.





MARITIME AWARENESS



! Challenges:

- Protection of biodiversity
- Sea state
- Impact on economic activities (fish farms, transport, trade, etc.)

✓ Satellite solution:

- Monitoring the marine environmental status (Wave height, water quality, icebergs, etc.)
- Large and hard to reach areas (high seas and the Arctic)
- Early warning systems and decision support

DETECTING DARK VESSELS & OIL SPILLS



! Challenges:

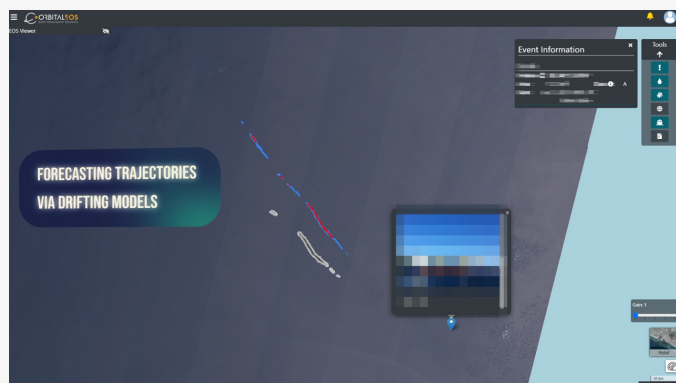
- Pollution and unlicensed fishing
- Risk for marine protected areas

✓ Satellite solution:

- Dark vessel detection
- Find oil spills and illegal dumping in international waters
- Decision support system for enforcement assets on the ground

Satellite imagery can provide key information on oil spill incidents such as the forecasting of movement trajectories in order to contain the damage and to clean up the affected areas.

Image: [OrbitalEOS](#)



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POWERING RENEWABLE ENERGY SOURCES

Europe set the goal to become climate-neutral by 2050. To this end, we need to rapidly change our energy supply systems, which currently account for 75% of the EU's greenhouse gas emissions. The European Green Deal focuses on three key principles for the clean energy transition, which will help reduce greenhouse gas emissions. First, ensuring a secure and affordable EU energy supply. Second, developing a fully integrated, interconnected and digitalised EU energy market. Finally, prioritising energy efficiency, improving the energy performance of our buildings and developing a power sector based largely on renewable sources.



HOW CAN SPACE CONTRIBUTE?

SOLAR POWER



Challenges:

- Weather-dependent
- Difficult to determine energy production



Satellite solution:

- Site assessment
- Solar forecasting
- Solar yield monitoring for grid optimisation

ENERGY CORRIDORS



Challenges:

- Leakages
- Complex energy grid
- Conservative regulations



Satellite solution:

- Reliable, safe and sustainable monitoring service
- Frequent detection of activities in energy corridors



OFFSHORE WIND

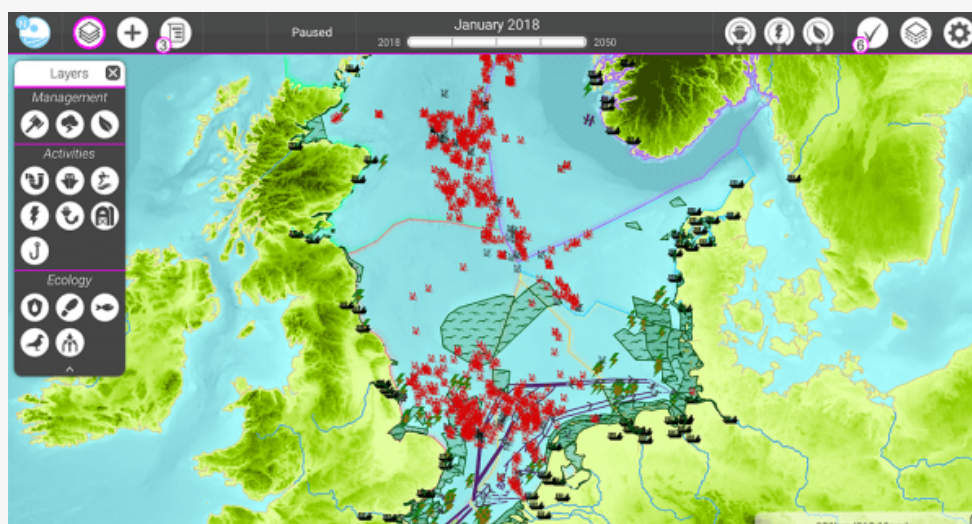


! Challenges:

- Weather-dependent
- Difficult to determine energy production

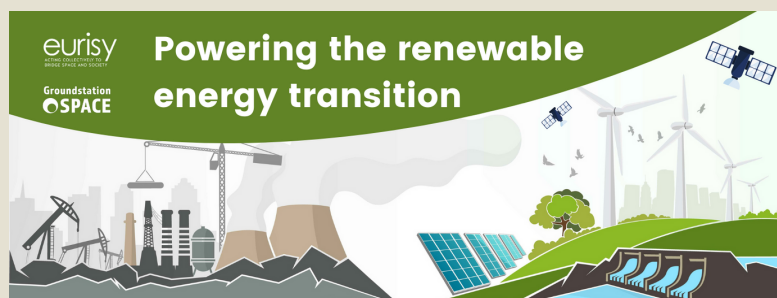
✓ Satellite solution:

- Mapping wind speed and direction
- Valuable data for planning, construction and monitoring of offshore wind farms
- Reduced uncertainty can reduce cost



The Maritime Spatial Planning (MSP) Challenge is a multi-user client server application based on the sea basin of the North Sea. The map offers multiple layers such as wind speed, wave height, and sediments with information derived from Earth observing satellites and other in-situ data. The MSP challenge app provides an engaging tool for students and young professionals to draw offshore planning for windfarms.

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MANAGING FORESTS AND CUTTING EMISSIONS

If managed sustainably, forests not only play an indispensable role in climate and biodiversity protection, but also in social and economic activities. In practice, this means using forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil relevant ecological, economic and social functions. Satellite data can help forest owners and managers to implement a more sustainable way of working.



HOW CAN SPACE CONTRIBUTE?

FOREST MONITORING

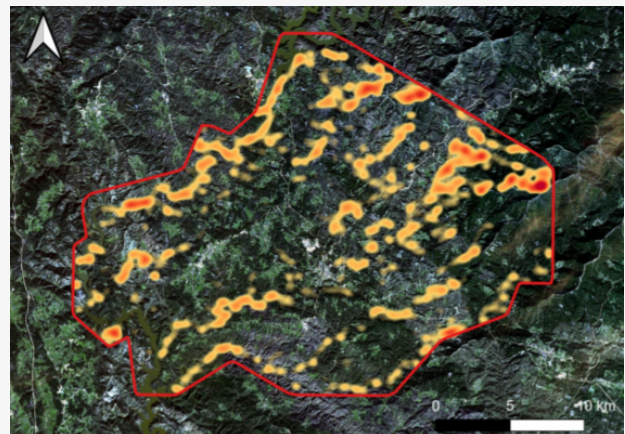
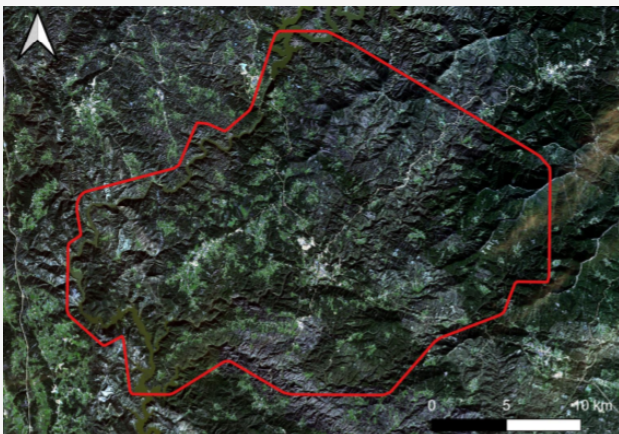


! Challenges:

- Dispersed tree plantations
- Illegal clear-cuts, disease outbreaks, forest fires, altered land use, etc.
- Regulations demand new tools and more information

✓ Satellite solution:

- Digital service to automatically monitor the state of a forest inventory
- Regular tracking and detection of changes



Detecting disease outbreaks using Sentinel-2 satellite imagery.



FOREST TRAFFICABILITY

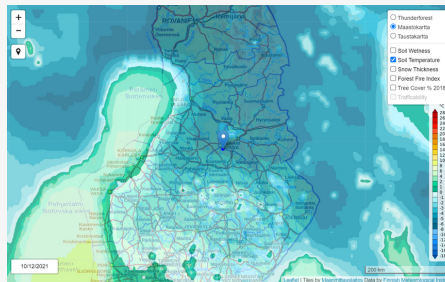


! Challenges:

- Impact of heavy forestry machines on soil
- Compact soil is bad for forest growth

✓ Satellite solution:

- Seasonal predictions (frozen soil depth, snow and soil moisture)
- High resolution trafficability maps
- Estimate carbon emission impacts of harvesting



Harvesterseasons.com

FOREST MANAGEMENT



! Challenges:

- Forest disturbance (e.g. fires, droughts, storms, biotic damages, harvesting, etc.)
- Balance economic, ecological and social values

✓ Satellite solution:

- Consistent high frequent information on disturbances
- Area statistics, landscape analysis, change detection
- Timely response

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DRIVING THE SMART AND GREEN TRANSITION

Today, transport accounts for a quarter of the European Union's greenhouse gas emissions. With its Sustainable and Smart Mobility Strategy, the European Commission laid the foundation for how the EU transport system can achieve a much needed green and digital transformation. As outlined in the European Green Deal, the result should be a 90% cut in greenhouse gas emissions in transport by 2050, delivered by a smart, competitive, safe, accessible and affordable transport system.



HOW CAN SPACE CONTRIBUTE?

URBAN CYCLING



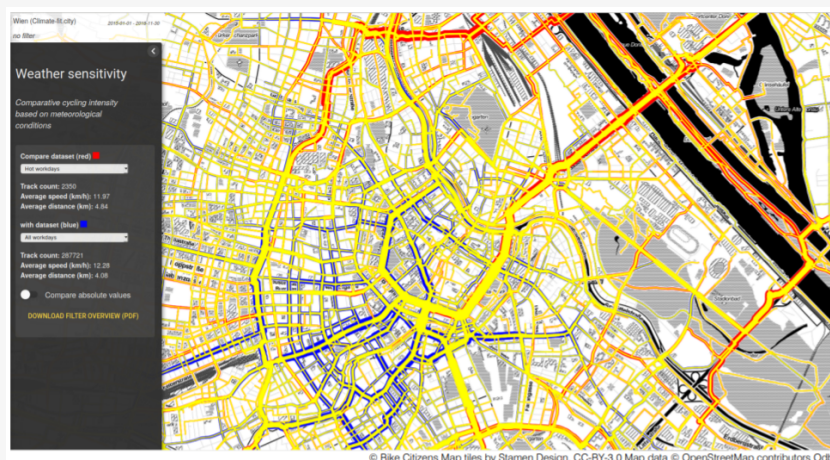
Challenges:

- Safety and motivation for cyclists
- Poor cycling infrastructure



Satellite solution:

- Smart route calculation
- Planning cycling schemes (quality of roads, popular routes, detect untapped potential)
- Promote cycling through gamification



Example of data insights by Bike Citizens: comparative cycling intensity based on meteorological conditions.



HOW CAN SPACE CONTRIBUTE?

KEEPING TRACK OF THE TRACK



! Challenges:

- GNSS accuracy along the railway environment (multipath and interference effects)
- Reduced line capacity during tests
- Cost of tests

✓ Satellite solution:

- Fail-safe train positioning system with zero on-site testing
- Increase in line capacity without the need to enlarge infrastructure
- Simulating railway scenarios in digital twin

AIR MOBILITY



! Challenges:

- Congested terrestrial channels
- Inefficient flight paths (airplanes)

✓ Satellite solution:

- Satellite-based air-ground communication system for aviation
- Unmanned autonomous vehicles positioning, navigation and tracking
- Reduced CO2 emissions

READ MORE:





SATELLITE DATA STREAMS FOR EUROPE'S FRESHWATER

Water is a precondition for human, animal and plant life as well as an indispensable resource for the economy. At the same time, the availability of freshwater throughout Europe is under pressure due to economic activities, population growth and urbanisation. Climate change results in increasingly frequent water scarcity and drought. Protection of water resources, of fresh and salt water ecosystems and of the water we drink and bath in, is therefore one of the cornerstones of Europe's environmental policy. The EU aims to address water pollution and enhance preparedness among its member states to water-related climate change impacts.

HOW CAN SPACE CONTRIBUTE?

LARGE-SCALE WATER SERVICES



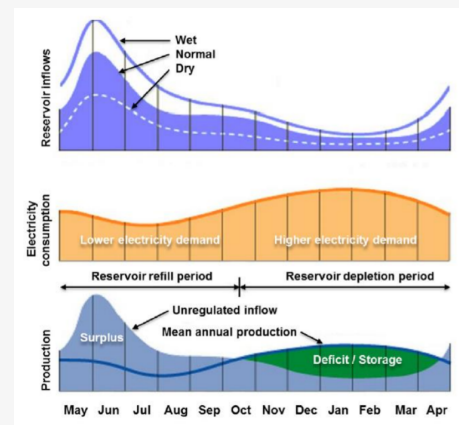
! Challenges:

- Lack of information for different variables (e.g. snow information or soil moisture)
- Seasonal forecasting

✓ Satellite solution:

- Reliable service line for the water industry
- Hydrological model evaluation
- Historical data availability for water quantity and quality

Seasonal forecasting service through assimilation of Earth observation data for the hydropower industry in Sweden. This allows hydropower users to better manage water reservoirs resulting in significant economic gains. More information [here](#).





SOIL WATER



! Challenges:

- Information about the behaviour of groundwater levels in the soil
- Numerical modelling is difficult at large scale

✓ Satellite solution:

- Remote sensing data as a “glue” between incidental data sources
- Updated soil map with improved drainage classes
- Useful for permitting, modelling and water management issues

WATER RELATED HAZARDS



! Challenges:

- Increasing frequency and intensity of water related hazards such as floods and droughts
- Water is the primary vehicle through which we feel the impacts of climate change

✓ Satellite solution:

- Monitor changes and evolution
- Reduce agricultural vulnerability
- Flood risk management

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Satellite data streams for Europe's freshwater

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SPACE DATA FOR URBAN GREEN SPACES

Reaching 100 climate-neutral cities by 2030, that is the objective identified by the EC Mission Board for climate-neutral and smart cities. Cities are the place where decarbonisation strategies for energy, transport, buildings, industry, and agriculture coexist and intersect. While cities cover about 3% of the land on Earth, they produce about 72% of all global greenhouse gas emissions. On top of that, cities are growing fast. In Europe, it is estimated that by 2050 almost 85% of Europeans will be living in cities.



HOW CAN SPACE CONTRIBUTE?

URBAN VEGETATION



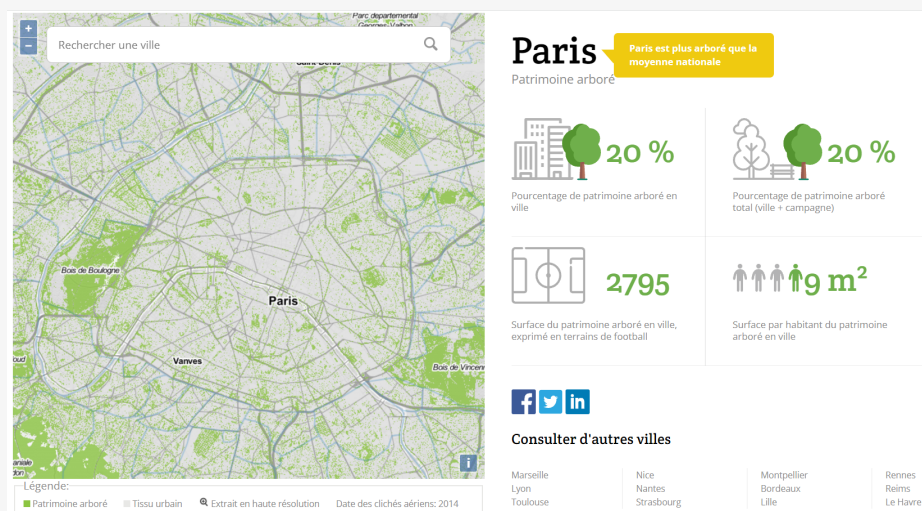
Challenges:

- Urbanisation
- Heat island effect



Satellite solution:

- High-resolution vegetation data
- Measure carbon storage capacity
- Local climate zones mapping



For any city in France, the platform nosvillesvertes.fr provides freely available information on green spaces.



AIR QUALITY



! Challenges:

- Air pollution is detrimental to human health and can cause damage to the climate or to materials

✓ Satellite solution:

- Mapping air quality
- Adapting cities' policies and reducing the exposure to pollution

SMART INFRASTRUCTURE



! Challenges:

- Urban planning
- 3D motion monitoring of buildings, landslides, pipelines, bridges, etc.

✓ Satellite solution:

- Analysing rooftops and calculating the potential for solar power
- Thermal imaging to identify heat losses and to assess electrical consumption

READ MORE:



Space data for urban green spaces

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SUSTAINABLE TOURISM: DESTINATION EARTH

Every year, Europe attracts millions of tourists. Tourism currently accounts directly for the 4% of the EU GDP expanding to 10% including all the indirect links with other sectors, supporting a consistent share of job creation, social development, and economic growth for the region. According to the World Tourism Organization CO2 emissions will tend to increase worldwide by 25% by 2030. Innovative solutions will have to be deployed in order to make the tourism industry more sustainable.

HOW CAN SPACE CONTRIBUTE?

PUBLIC PARTICIPATION GEOGRAPHIC INFORMATION SYSTEMS



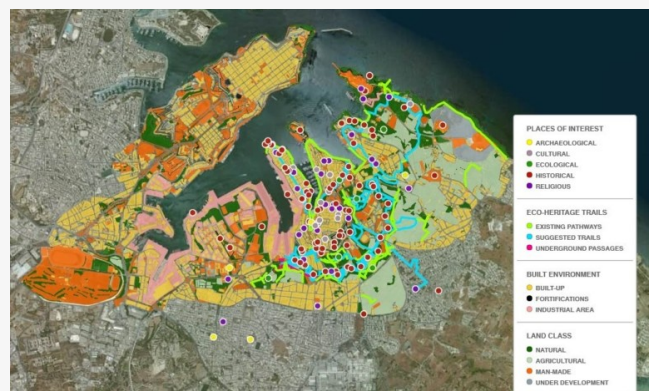
⚠ **Challenges:**

- Spatial planning
- Involving local communities

✓ **Satellite solution:**

- Field mapping
- Highlight and safeguard heritage sites
- Fuse satellite imagery and open crowdsourced data

Eco-heritage trail drafted by local communities in Malta. The residents of Valletta's Grand Harbour were invited to contribute with their knowledge on the archaeological, cultural, historical, green and religious sites of the area and were asked to connect sites of interest through heritage trails on digital satellite-based maps.





- ✓ **Satellite solution:**

- Mapping environmental impact on destinations around the globe
- Dashboard for decision makers and tourists professionals



DIGITALISATION



- ✓ **Satellite solution:**

- Monitor tourist flows and facilitate mobility
- Increased connectivity
- Virtual experience for remote destinations

READ MORE:



Space data to make the tourism industry sustainable

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CONCLUSIONS

Throughout the Space Opportunities for Climate Challenges series, various examples have been showcased proving that **satellite solutions can contribute to the green transition**.

However, despite the many examples, there is **still a lot of untapped potential** when it comes to the deployment of satellite-based services. The Space Opportunities for Climate Challenges series has been a joint effort to overcome this issue. In order to foster entrepreneurship and to support sustainable development, the series brought funding and innovation calls related to climate closer to the European space community,

At the same time, by focusing on the user benefits, we hope to have inspired an **audience beyond the space sector to integrate satellite services into their daily operations**. The presented set of operational solutions bear a variety of cases from the local city level to a global scale. This publication calls on potential users and decision-makers to look at these satellite services in order to implement their climate adaptation policies more easily.

Eurisy will continue to stimulate the uptake of satellite-based solutions, providing a framework to structure the dialogue between the space community and wider society. The goal is to reach a critical mass of users across borders and sectors by raising awareness of the strategic importance of space for sustainable economic, environmental, and social development.

If you are already using satellite applications in your daily job, or if you know someone who does, reach out to us [here](#) so that we can share hands-on experience to inspire more stakeholders to follow suit.



CONTACT

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Acknowledgment

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