i monitoring powierzchni Ziemi

Michał Krupiński

Zakład Obserwacji Ziemi

Centrum Badań Kosmicznych PAN

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Budżet program na lata 2014-2020

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Źródło: http://earsc.org/news/airbus-selected-by-esa-for-copernicus-data-and-information-access-service-dias

COPERNICUS AND ITS SENTINELS

European Earth Observation Programme Copernicus: observing our planet for a safer world

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30 Public and Private missions are also contributing data

16 years of development and testing

Sentinel-Missions at the heart of the space component

Civil Security. Allowing early warning and crisis prevention in conflict and disaster areas

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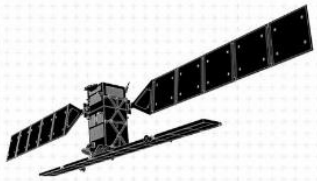

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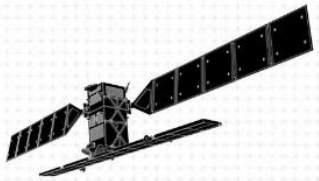

SENTINEL-2

- **Medium Res Multispectral optical satellite for observation of land, vegetation and water**
- 13 spectral bands with 10, 20 or 60 m resolution and 290 km swath width
- Global coverage of the Earth's land surface every 5 days
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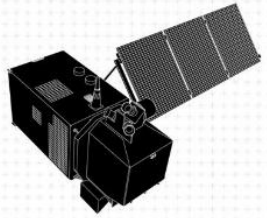

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Sentinel-2

Źródło: https://www.esa.int/ESA_Multimedia/Videos/2016/08/Sentinel-2_global_coverage

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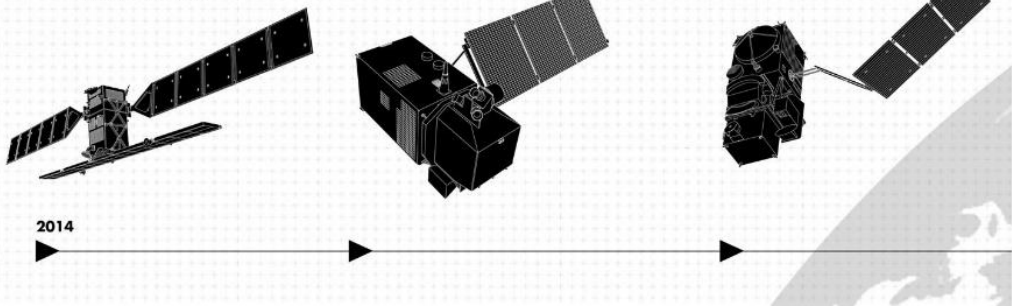

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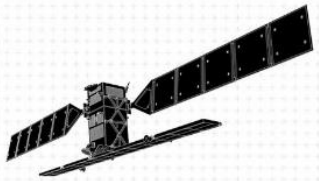

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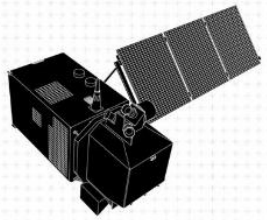

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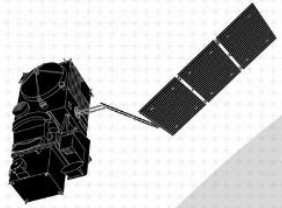

SENTINEL-5P

- **Global observation of key atmospheric constituents, including ozone, nitrogen dioxide, sulphur dioxide and other environmental pollutants**
- Improves climate models and weather forecasts
- Provides data continuously during five-year gap between the retirement of Envisat and the launch of Sentinel-5
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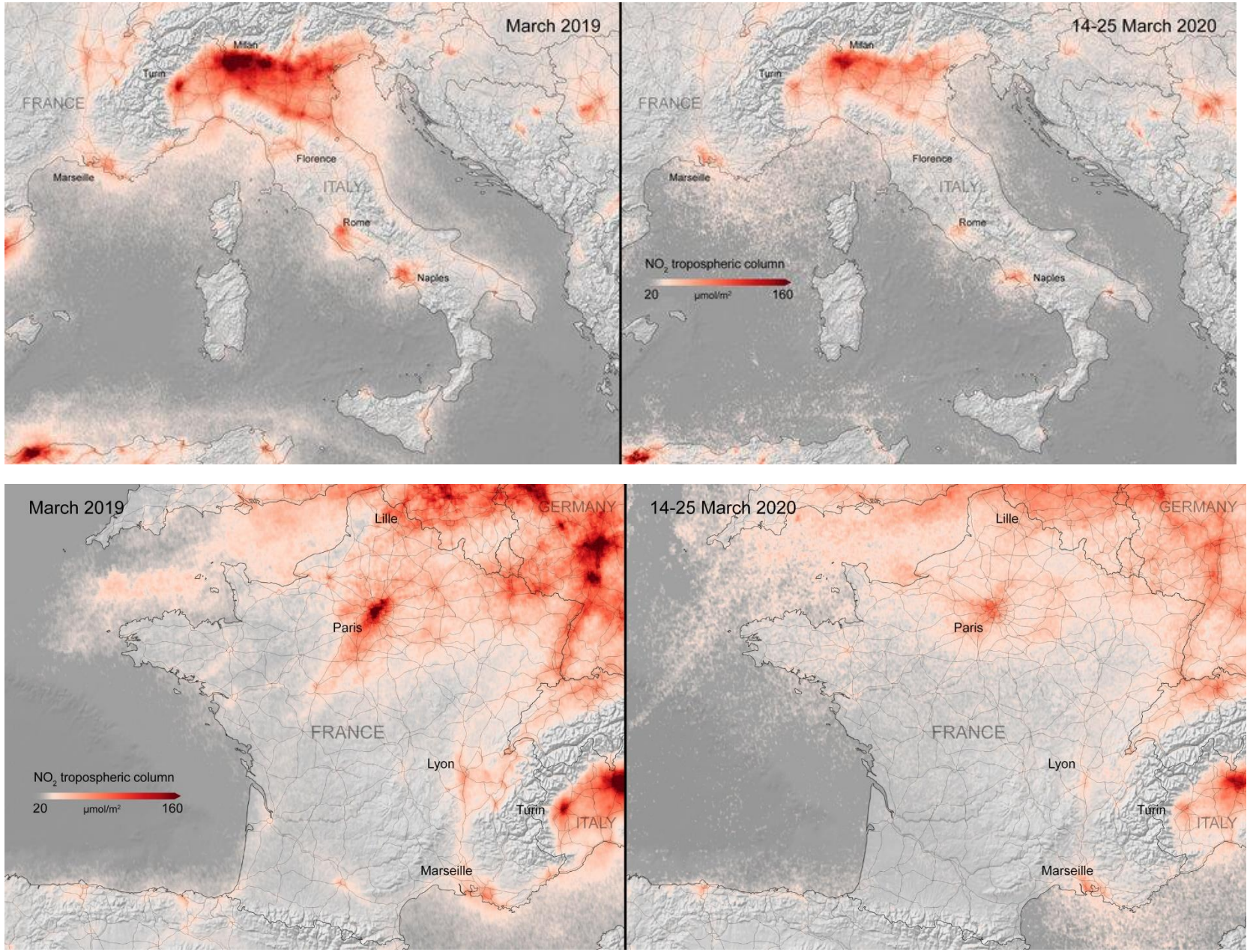

Źródło: https://www.esa.int/Applications/Observing_the_Earth/Copernicus/Sentinel-5P/Coronavirus_lockdown_leading_to_drop_in_pollution_across_Europe

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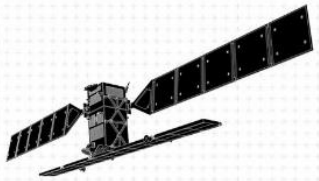

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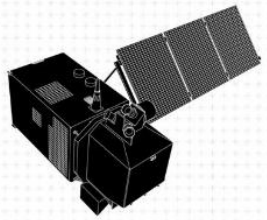

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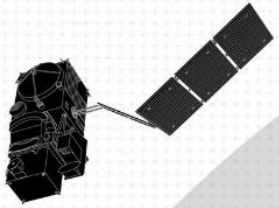

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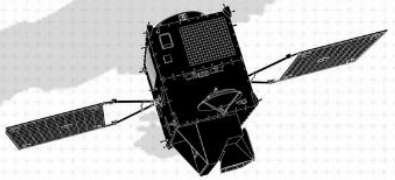
SENTINEL-4

- **Provides hourly updates on air quality with data on atmospheric aerosol and traces gas concentrations**
- Spatial sampling is 8 km and spectral resolution between 0.12 nm and 0.5 nm
- Airbus Defence and Space prime contractor for spectrometer
- Carried aboard EUMETSAT's Meteosat Third Generation (MTG) satellites



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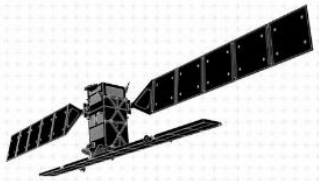

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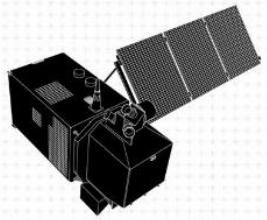

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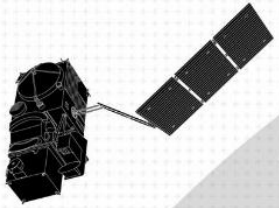

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SENTINEL-5

- **Measures air quality and solar radiation, monitors stratospheric ozone and the climate**
- Global coverage of Earth's atmosphere with an unprecedented spatial resolution
- Airbus Defence and Space prime contractor for instrument
- Carried aboard EUMETSAT's MetOp Second Generation satellites

2014

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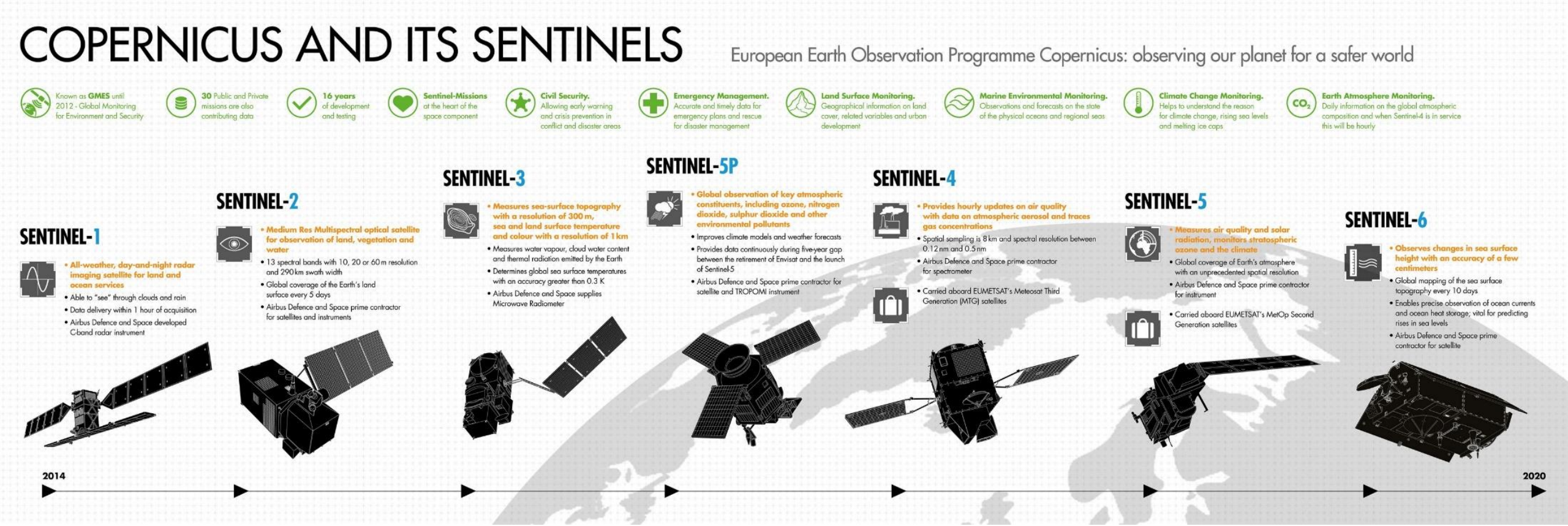

Więcej na: https://sentinel.esa.int/

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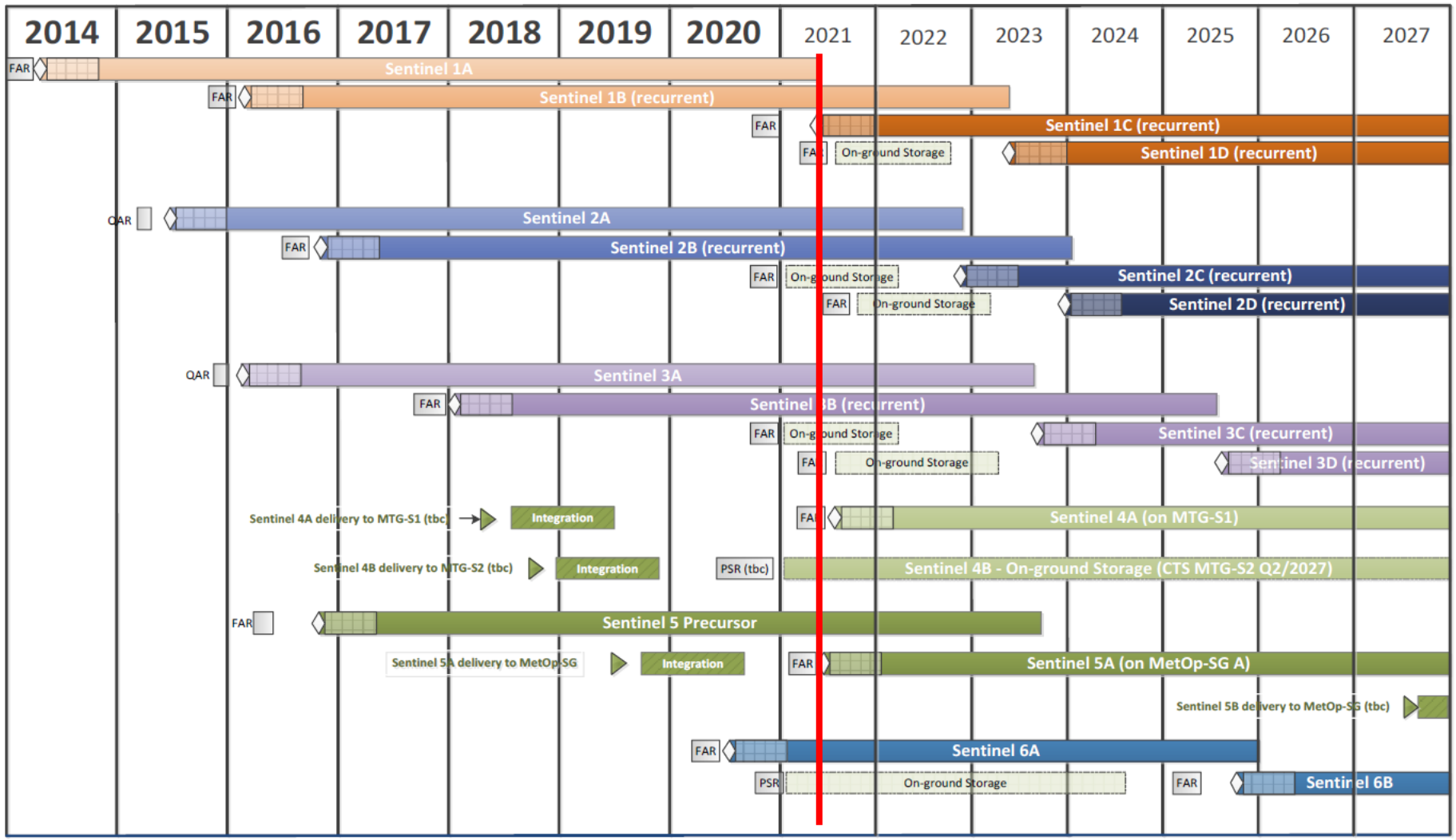
Copernicus Constellation Deployment Schedule



Legend: Qualification Acceptance Review (QAR) Flight Acceptance Review (FAR) or PreStorage Review (PSR) · On-ground Storage · Tentative launch date · In-orbit Commissioning

Status: February 2016

European Space Agency

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Usług programu Copernicus

copernicus.eu

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Copernicus Europe's eyes on Earth — Land Monitoring Service

FAQ | Ask the service desk | Search

Global | Pan-European | Local | Product portfolio | News

Copernicus is a European system for monitoring the Earth. Data is collected by different sources, including Earth observation satellites and in-situ sensors. The data is processed and provides reliable and up-to-date information in six thematic areas: land, marine, atmosphere, climate change, emergency management and security. The land theme is divided into four main components:

Global

provides a series of bio-geophysical products on the status and evolution of the land surface at global scale at mid and low spatial resolution

Pan-European

provides information about the land cover and land use (LC/LU), land cover and land use changes and land cover characteristics

Local

focuses on different hotspots, i.e. areas that are prone to specific environmental challenges and problems

Imagery and reference data

Satellite imagery forms the input for the creation of Copernicus land products. In order to ensure an efficient and effective use of satellite data the Copernicus land monitoring service needs access to in-situ data

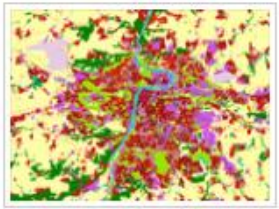
Pan-European

CORINE Land Cover

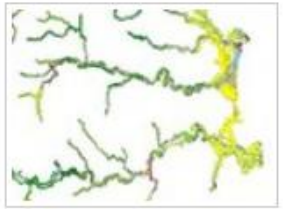
High Resolution Layers

Related Pan-European products

Local



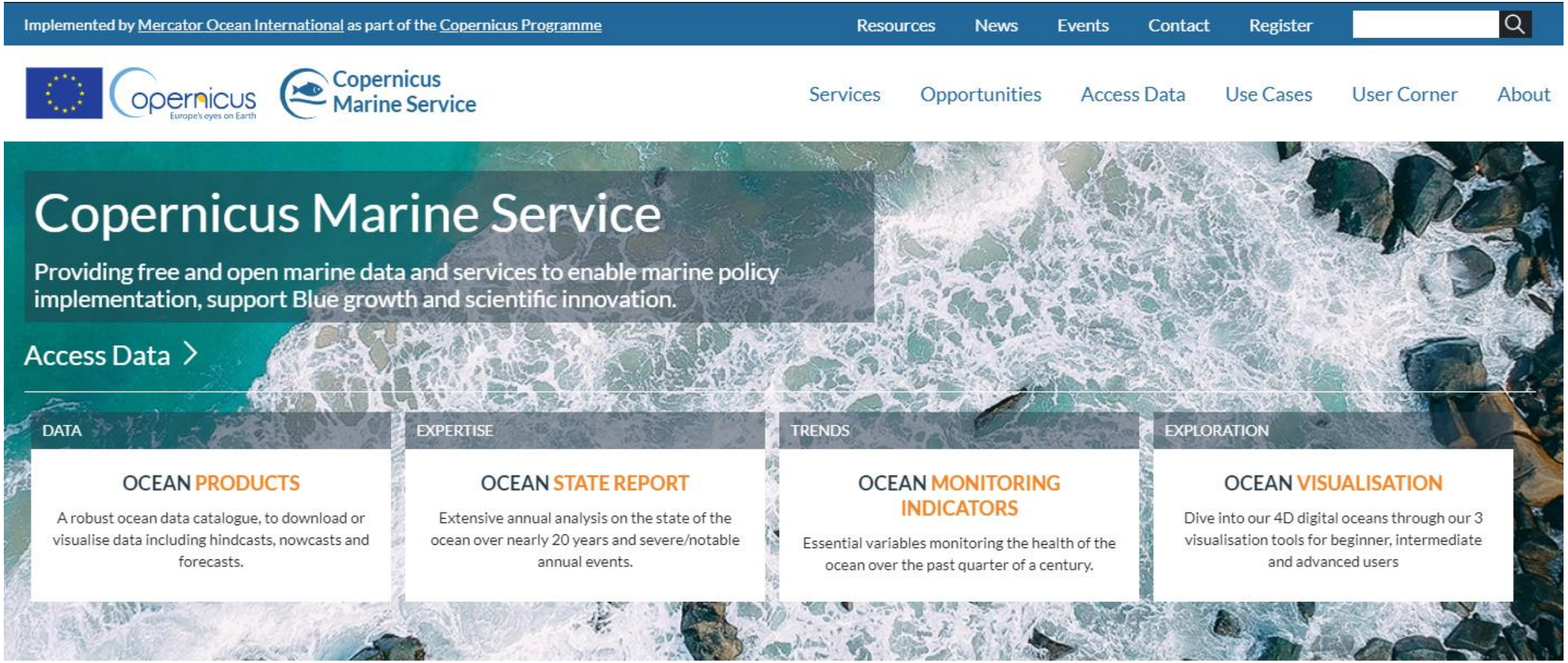
Urban Atlas



Riparian Zones

Natura 2000 (N2K)

https://land.copernicus.eu

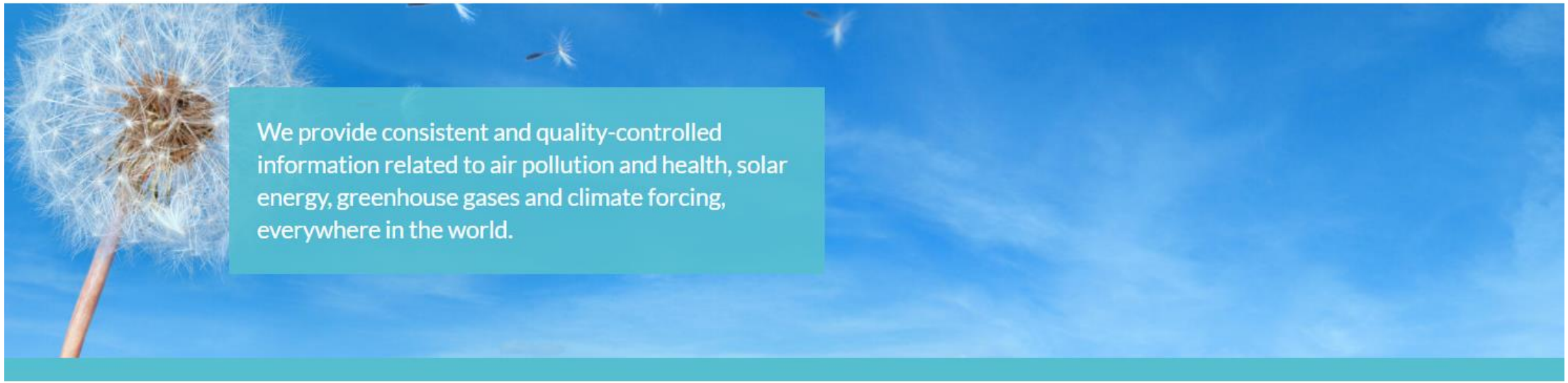


https://marine.copernicus.eu

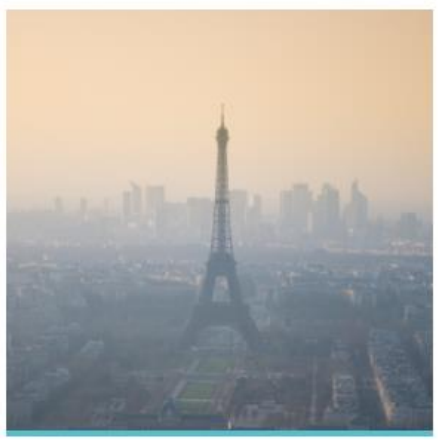
Copernicus
Europe's eyes on Earth

Atmosphere Monitoring Service

Data About us What we do



Today's air quality forecasts



Europe

Worldwide

Daily CAMS air quality forecast on Euronews

https://atmosphere.copernicus.eu

Implemented by ECMWF as part of The Copernicus Programme

News Events Press Tenders Help & Support Search

Copernicus Europe's eyes on Earth | Climate Change Service

About Us What we do Data

European Commission | Copernicus Europe's eyes on Earth | IMPLEMENTED BY ECMWF

Climate Change

We provide authoritative information about the past, present and future climate, as well as tools to enable climate change mitigation and adaptation strategies by policy makers and businesses.

Key products and services

Climate bulletins

Climate Data Store

Data in action

The *European State of the Climate 2020*, an essential snapshot of the region and a useful benchmark for future assessments of the environment.

In focus

https://climate.copernicus.eu

Implemented by the European Commission as part of the Copernicus Programme

Copernicus Europe's eyes on Earth

Emergency Management Service

Home | FAQ/Service Overview | Access to EMS data

On demand mapping

Copernicus EMS On Demand Mapping provides on-demand detailed information for selected emergency situations that arise from natural or man-made disasters anywhere in the world.

Rapid Mapping

Rapid Mapping provides geospatial information within hours or days of a service request in order to support emergency management activities in the immediate aftermath of a disaster.

Risk and Recovery Mapping

Risk & Recovery Mapping supplies geospatial information in support of Disaster Management activities including prevention, preparedness, risk reduction and recovery phases.

Early Warning & Monitoring

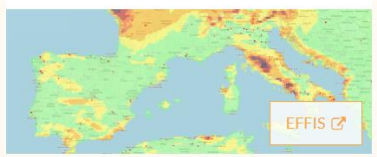
Copernicus EMS Early Warning and Monitoring offers critical geospatial information at European and global level through continuous observations and forecasts for floods, droughts and forest fires.

Floods

The **European Flood Awareness Systems (EFAS)** and **Global Flood Awareness Systems (GloFAS)** provide complementary flood forecast information to relevant stakeholders that support flood risk management at the national, regional and global level.

Fires

The **European Forest Fire Information System (EFFIS)** monitors forest fire activity in near-real time. EFFIS supports wildfire management at the national and regional level for EU member states and across the Middle East and North Africa.



Droughts

The **Drought Observatory (DO)** provides drought-relevant information and early-warnings for **Europe (EDO)** and **globally (GDO)**. The service publishes short analytical reports (Drought News) in anticipation of an imminent drought.

https://emergency.copernicus.eu

Latest Copernicus EMS - Mapping Activations

Act. Code	Title	Act. Date	Type	Country/Terr.	Feed
EMSN098	Nation-wide asset mapping for Sweden	2021-07-06	Other	Sweden	
EMSR516	Wildfire in Kephalonia, Greece	2021-07-05	Wildfire	Greece	
EMSR515	Fire in Cyprus	2021-07-03	Wildfire	Cyprus	
EMSN097	IDP camps monitoring in Northern Mozambique	2021-06-24	Humanitarian	Mozambique	
EMSR514	Flood in Guyana	2021-06-14	Flood	Guyana	
EMSN096	Damage assessment and reconstruction...	2021-06-03	Other	Syria	
EMSR513	Nyiragongo volcano's eruption, DR...	2021-05-23	Volcanic activ...	Congo (Kinshasa), Rwanda	
EMSR512	Forest fire in Arico Tenerife, Spain	2021-05-21	Wildfire	Spain	
EMSR511	Flood in Lapland, Finland	2021-05-21	Flood	Finland	
EMSR510	Fire in Peloponnese and Attika Regions,...	2021-05-20	Wildfire	Greece	

Activation codes: EMSR = Rapid Mapping, EMSN = Risk & Recovery Mapping

https://emergency.copernicus.eu

Products

A number of different types of products are available in order to satisfy a wide range of user needs. The selection of the appropriate product takes into account constraints such as timelyresponsiveness and accuracy. The user's request is evaluated with respect to the nature of the analysis required, the deadline and the temporal validity of the information to be provided. Products can be provided in printed or digital format, according to the operational needs of the user.

Reporting products

Quick Report (QR)

The Quick Report is the fastest reporting and analysis product available from the Copernicus SEA service (1 page). It is focused on providing specific answers to a user request within a tight deadline.

First Impression Report (FIR)

The FIR is a very fast reporting and analysis product (2-4 pages, maximum 10), providing timely analysis, monitoring of activity and change detection analysis of the specific Locations (or exceptionally Areas) of Interest.

Briefing Note (BN)

The BN is a fast reporting and analysis product (3-15 pages), produced using information from satellite imagery and collateral sources, and aggregated findings of previous analysis.

Cartographic products

Digital Geographic Information (DGI) – Image Map

The DGI – Image Map product provides cartographic and thematic information over a specific AOI. It may include a detailed "map series", depending on the area and the distribution of data.

Digital Geographic Information (DGI) – City Map

The DGI – City Map product provides complete cartographic information over a city at a detailed scale. It may include a detailed "map series", depending on the area and the distribution of data.

MapBook

The MapBook is a product combining cartographic information with analysis of activity, optionally complemented with thematic maps.

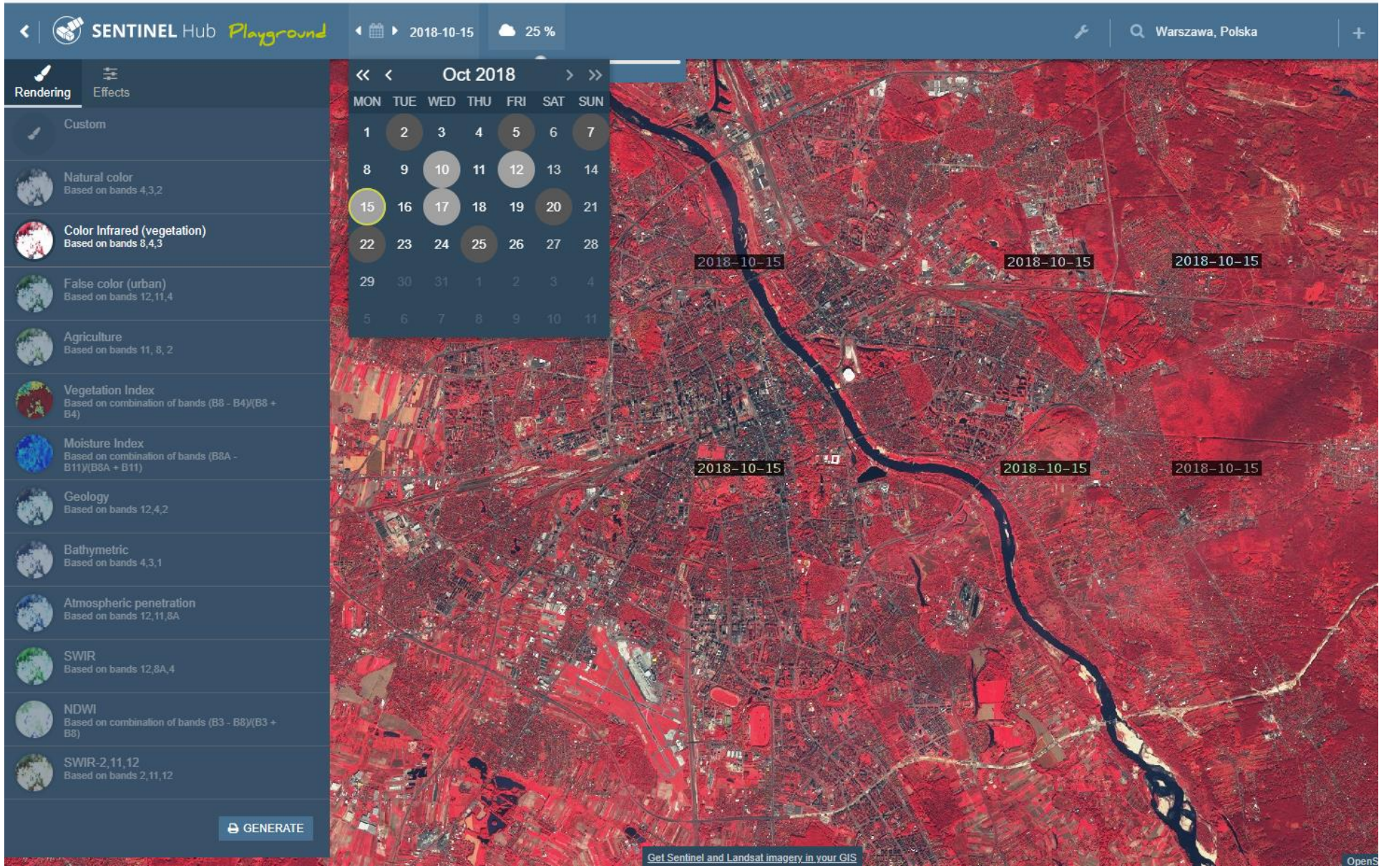
Country Map Coverage (CMC)

The CMC is a single topographic map (1 page) covering a region or a country. It includes very basic vector data such as administrative, transportation, population-related features, border-crossing points and toponyms.

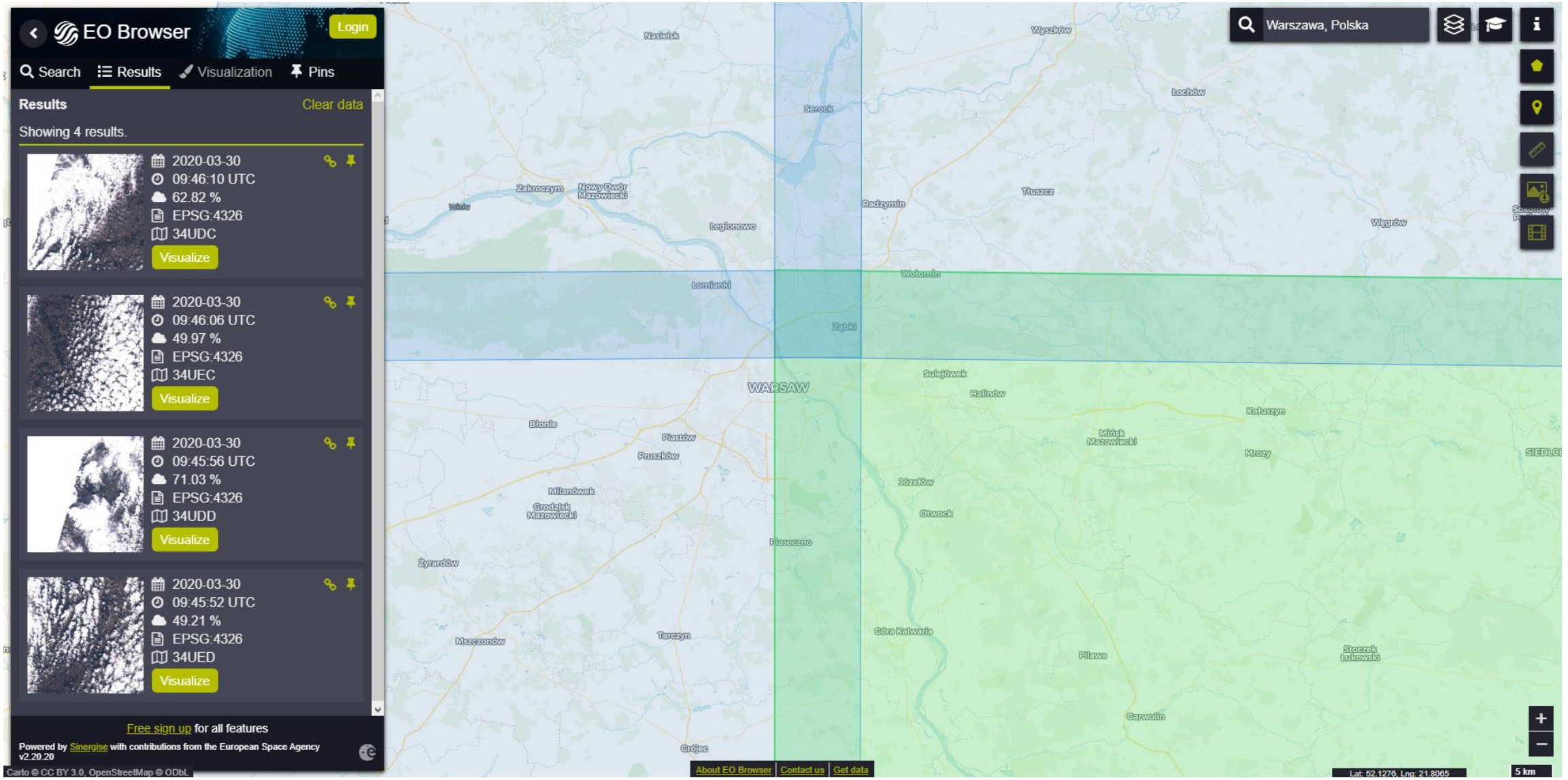
Dostęp do zdjęć satelitarnych

- Przeglądarki
- Data Hubs and National Mirrors
- Partial Mirrors
- Cloud Providers (np. Amazon, Google)
- DIAS (Data and Information Access Services)

- https://github.com/Fernerkundung/awesome-sentinel



https://apps.sentinel-hub.com/sentinel-playground



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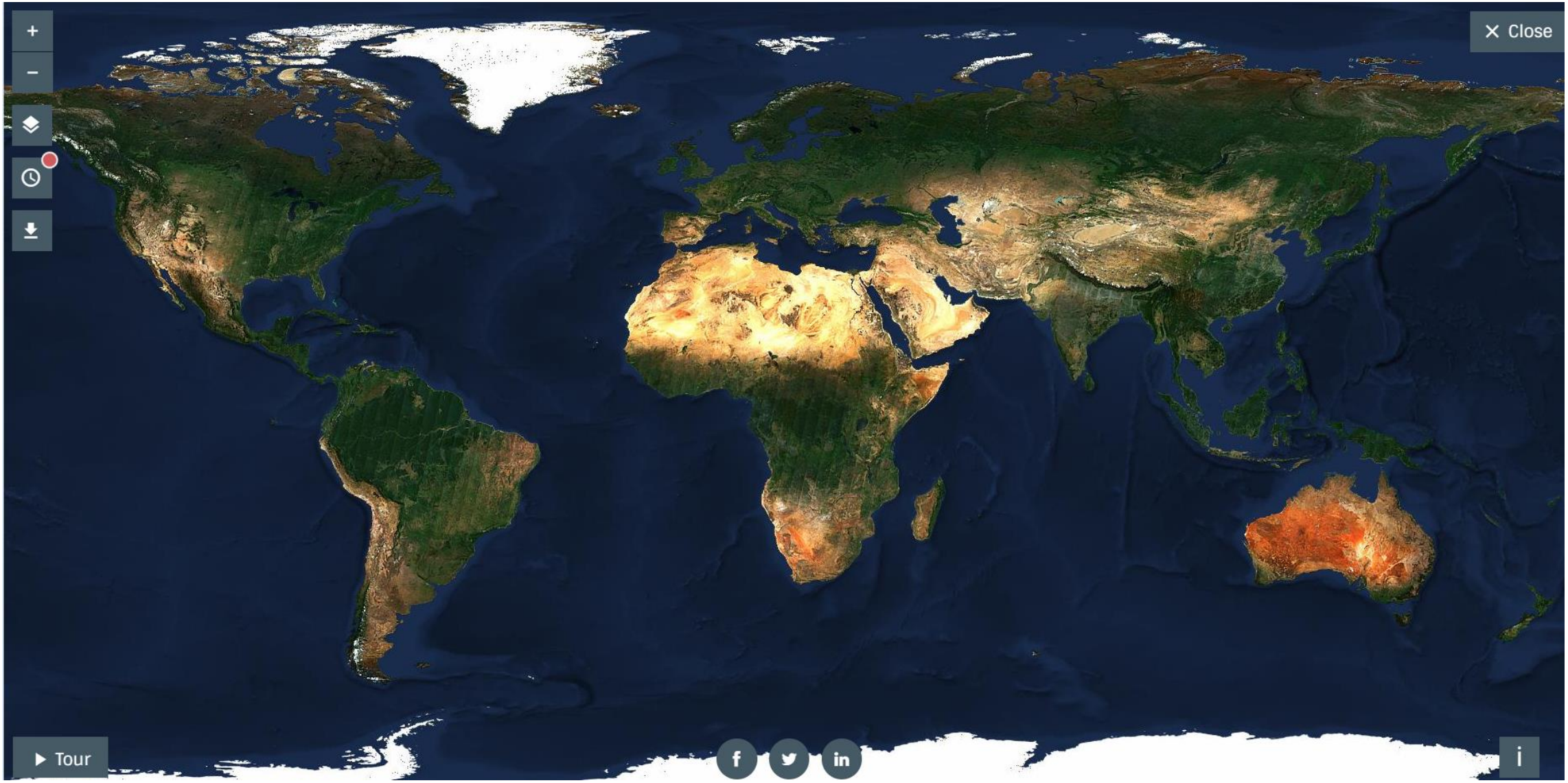
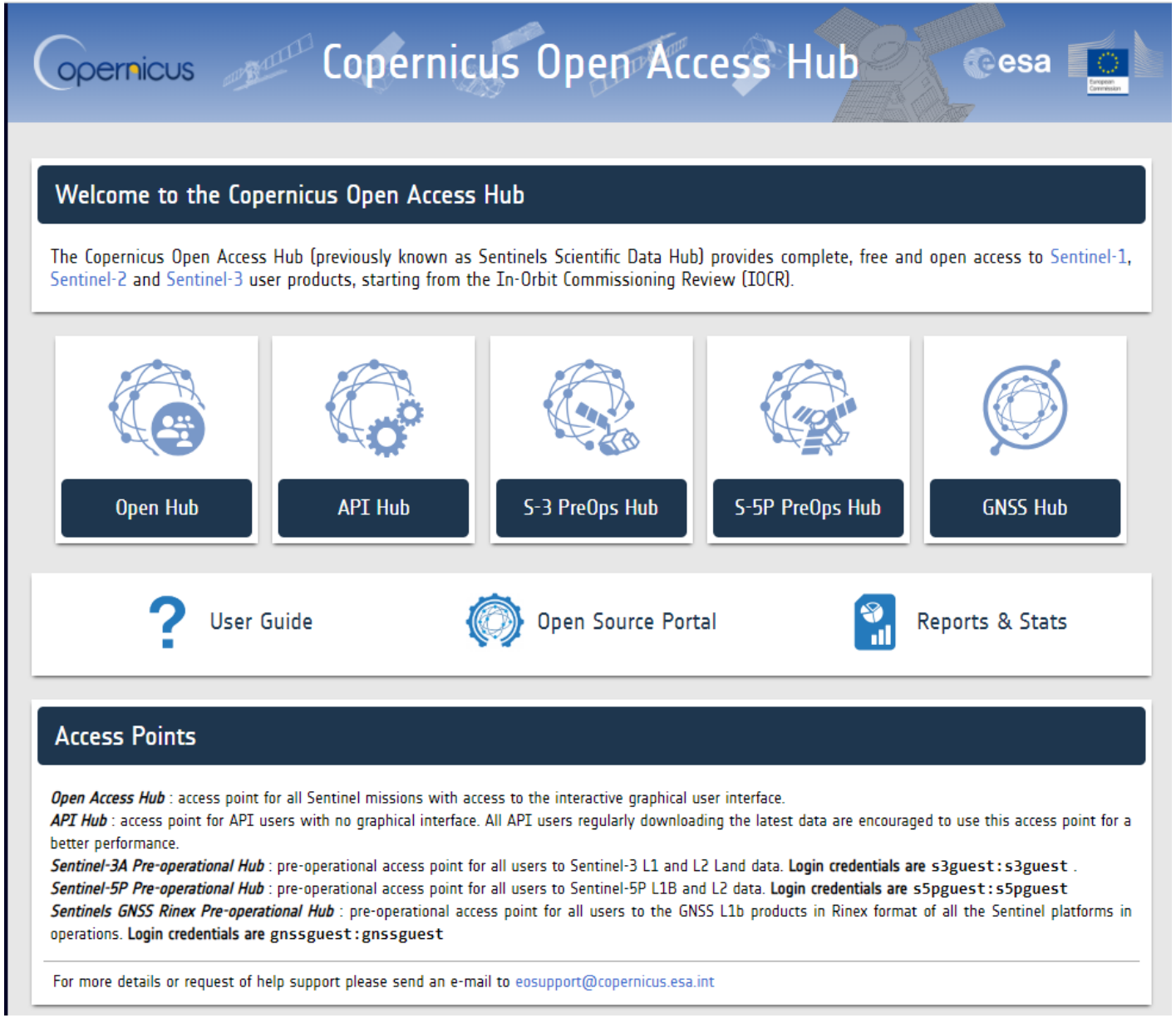
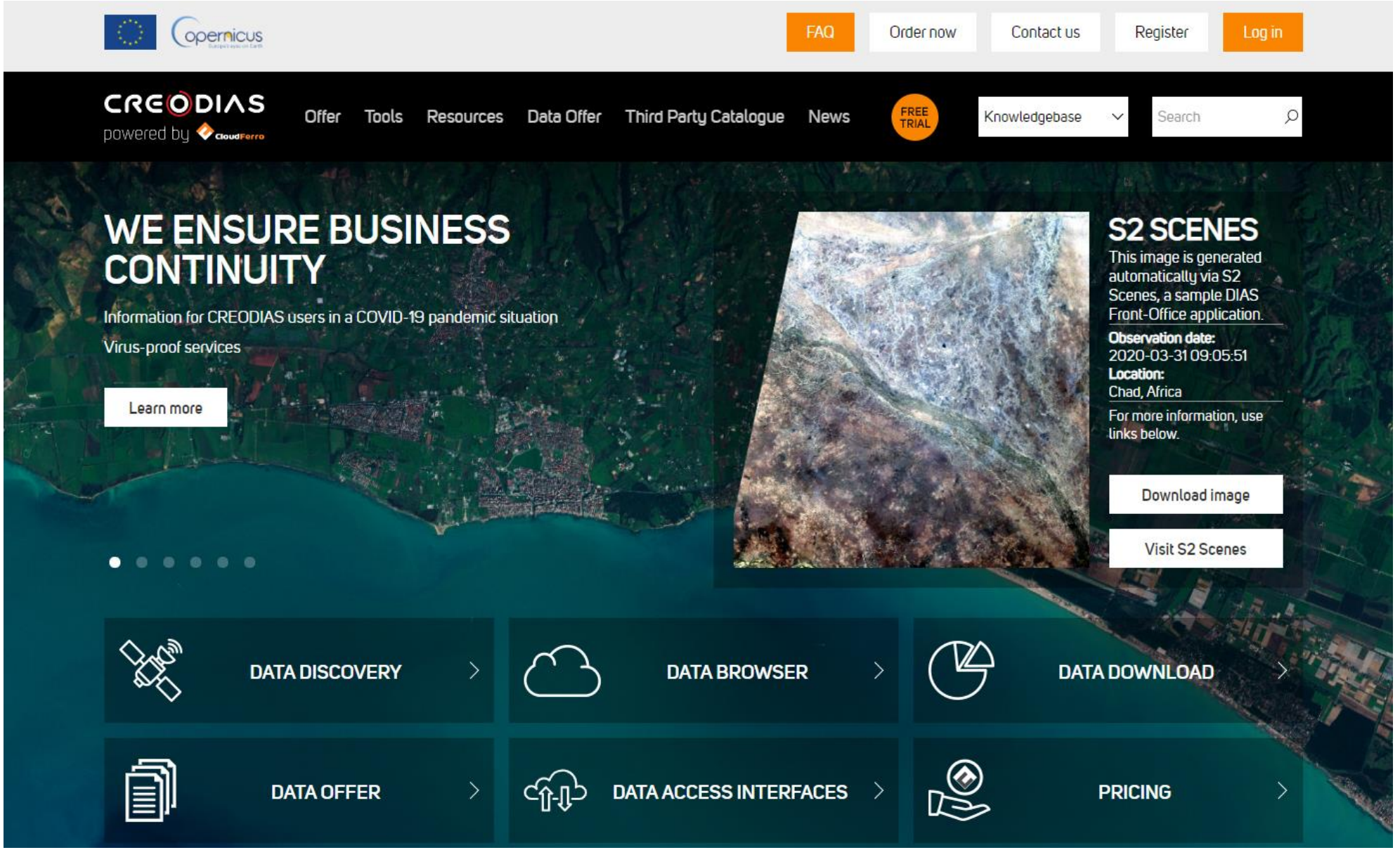


https://s2maps.eu



https://scihub.copernicus.eu

Główne Repozytorium Zdjęć



https://creodias.eu

Przykłady projektów

S2GLC

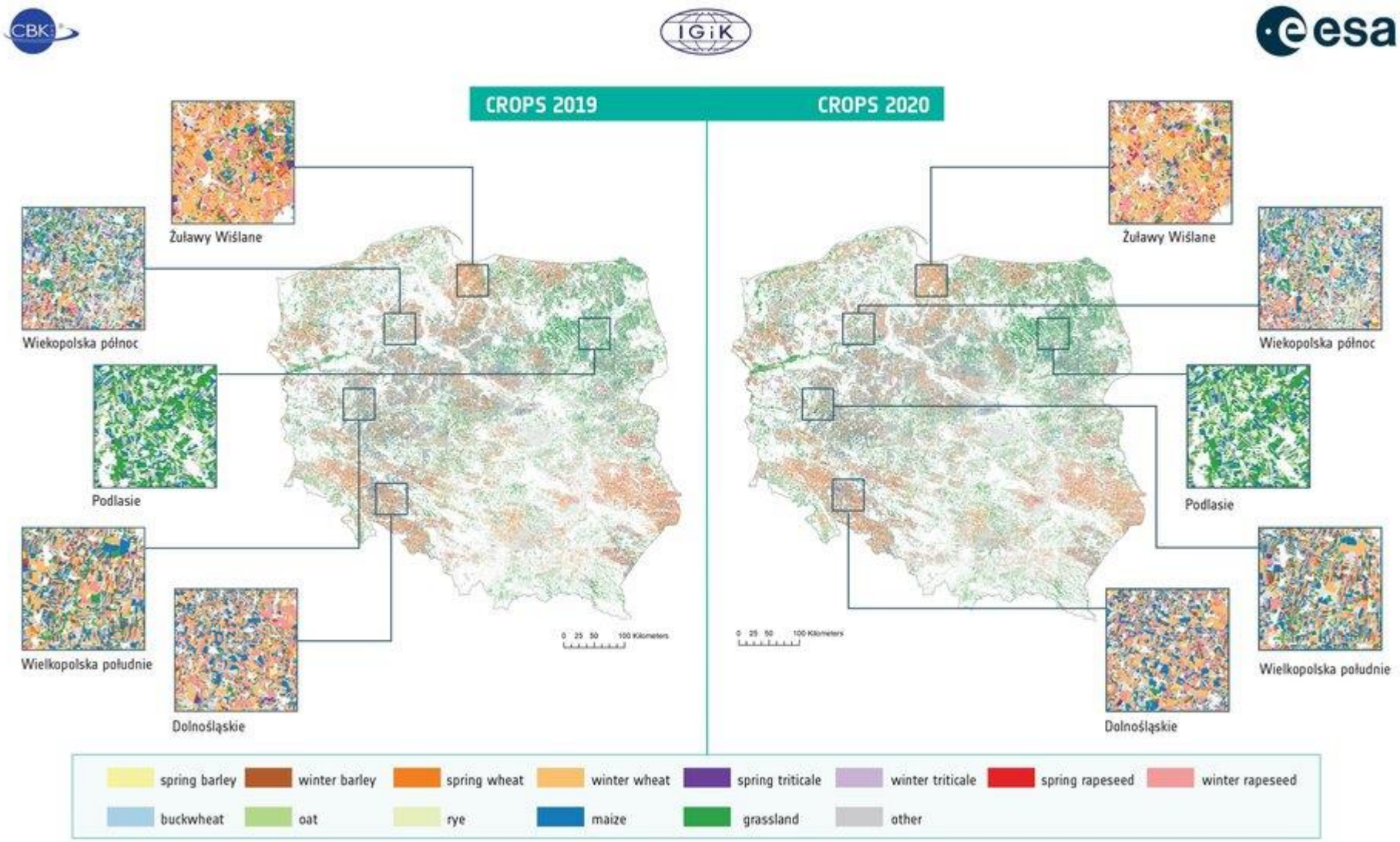
Project outcomes

- Classification legend defined based on existing databases – 13 LC classes
  - Individual rules for training samples selection for each LC class.
- Classification approach characteristic:
  - Pixel-based
  - Classification features – spectral bands (10 m, 20 m) and spectral indices
  - Random Forest classifier
  - Final result calculated by aggregation of single classifications of multi-temporal data based on classification prediction score.
- Full automation of all processing steps (training data generation, images selection, classification, aggregation, post-processing).
- Data for the whole Europe (815 S-2 tiles covered by over 15000 images) processed without manual visual interpretation work.
- All processing steps deployed as dedicated software developed by CBK PAN.
- Independent accuracy assessment for whole Europe.
- Overall accuracy: 86% (13 classes), 89% (10 classes).

Classification approach can be adjusted to other training data.

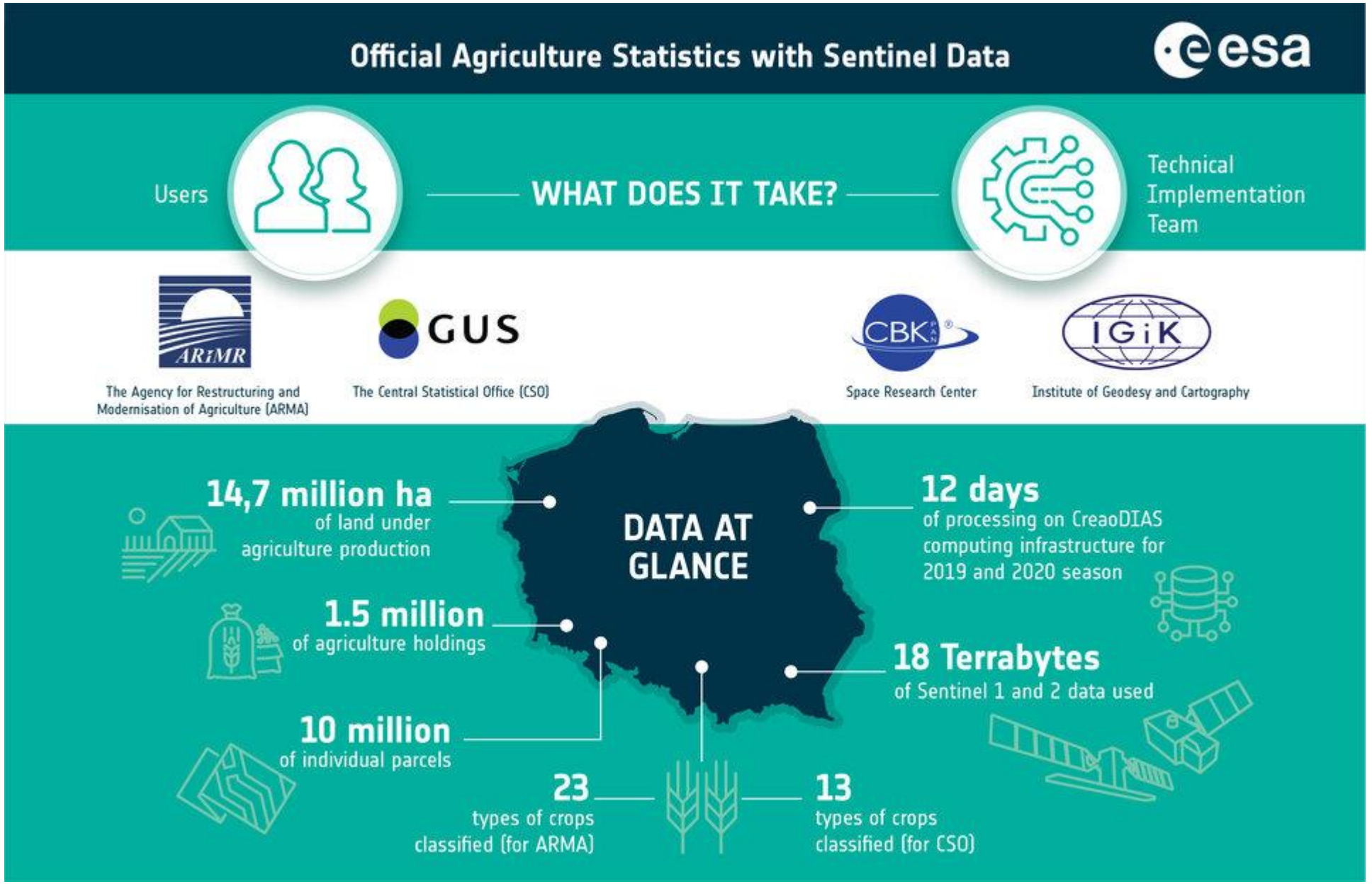
Żrodło: http://s2glc.cbk.waw.pl

EOStat



Żrodło: https://www.esa.int/Applications/Observing_the_Earth/Copernicus/Sentinel_data_enables_new_system_for_agricultural_monitoring_in_Poland

EOStat



Żrodło: https://www.esa.int/Applications/Observing_the_Earth/Copernicus/Sentinel_data_enables_new_system_for_agricultural_monitoring_in_Poland

Norway grants

Narodowe Centrum Badań i Rozwoju

Wrzesień 2020 – Sierpień 2023

ARICA

Wielokierunkowa analiza obszaru obozów dla uchodźców/osób wewnętrznie przesiedlonych w oparciu o dane satelitarne HR/VHR

POLNOR2019 polsko-norweski projekt badawczy finansowany w ramach Funduszy Norweskich (program „Badania Stosowane”)

CBK PAN

CMR

GRID WARSAW In partnership with UN Environment

NORCE

Marginal Lands as Potential Carbon Sink

MaiL - Identifying Marginal Lands in Europe and strengthening their contribution potentialities in a CO2 sequestration strategy

MAIL project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 823805; [H2020 MSCA RISE 2018]

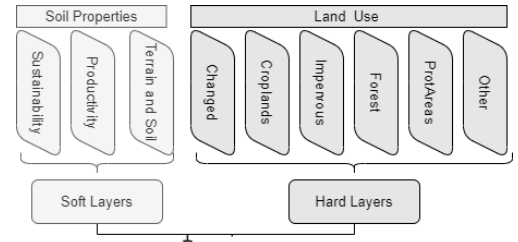
DEFINITION

Lands with significant, either environmental (biophysical variables) or socioeconomic, constraints and with potential to impact national accounting for C stock, excluding agricultural lands and other valuable areas (protected areas, uses with local importance etc.).

under-utilized
unused
degraded
set aside
waste
marginal
abandoned
fallow
unproductive
free
spare
additional

land

EUROPEAN LAYER



The MAIL project's [H2020 MSCA RISE 2018] main objective is to trigger utilization of Marginal Lands (MLs) as Carbon Sinks by activities related to forestry and foster the interaction and knowledge exchange between academic and non-academic institutions.

OUTCOMES

- **Methodology** for MLs identification
- **Identification** and of European MLs areas
- **Classification** of the MLs in carbon sequestration groups
- **Carbon Sequestration Capacity** for national test sites
- **Carbon estimation** in wood products
- **Sustainable Management** guidelines for MLs

OUTREACH

Info Days
Digital Newsletter
Massive Online Open Course
Best practices and **success stories**
Geoportal / Web based application

Edyta Woźnik, Michał Krupiński,
Sebastian Aleksandrowicz, Ewa Gromny

Od czego zacząć?

- Jakie serwisy i produkty są dostępne
- Kierunki studiów?
- Praktyki
- Konkursy / hackatony

ESA Digital Twin Earth (DTE) Challenge

ESA seeks to stimulate applications which combine AI and Big Data from Copernicus Sentinels and EO data to provide forecasting on the impact of climate change and responding to societal challenges.

DLR Environment, Energy & Health Challenge

DLR is looking for innovative solutions that use Earth observation (EO) data to support sustainable management of our limited natural resources and foster human well-being.

Planet "See Change, Change the World" Challenge

Planet is looking for new ways to help solve climate and environmental challenges through the use of daily satellite imagery, tools and analytics.

BayWa Smart Farming Challenge

BayWa is looking for innovative solutions that use new technologies, ideas and products to support sustainable agriculture and horticulture.

Airbus sobloo Multi-Data Challenge

Airbus Defence and Space together with sobloo are looking for solutions that use both Copernicus and Airbus EO data to deliver new services and/or applications that provide insight and have impact on areas like Natural Resources Consumption, Agriculture, Forestry, Maritime, Defence & Security and Smart Cities.

BMVI Digital Transport Challenge

BMVI is looking for solutions that use Copernicus data to solve major challenges faced by transport systems today.

EC EU Space data for new Business Applications Challenge

The EC EU Space data for new Business Applications Challenge is looking for solutions that have the potential to stimulate new commercial incentives in "established" markets and open up business opportunities to startups.

EC EU Space data for „Blue Economy" Challenge

The EC EU Space data for "Blue Economy" Challenge is looking for solutions that have the potential to stimulate new markets and to contribute to environmental protection related to the so-called "Blue Economy".

University Challenge

The University Challenge is looking for students and research associates to compete for the chance to transform their bright ideas into successful commercial ventures.

Save the Date
Submission starts 19 April 2021!

https://www.copernicus-masters.com

Copernicus incubation

Home | Programme | How to apply? | Evaluation & Selection | Experts, investors & incubators | Webinars | Media | Partners | Contact

€ 50.000 to boost your start-up

Make Copernicus data and services work for you

The programme will award **50.000 euro to 20 European start-ups** every year, to finance their incubation in an incubation/acceleration supporting organisation of their choice .

http://copernicus-incubation.eu/