

The logo for the Polish Space Agency (POLSA) is located in the top right corner. It consists of the letters 'P', 'O', 'L', 'S', and 'A' in a white, sans-serif font. A white arc is positioned above the 'O' and 'L', and another white arc is positioned below the 'L' and 'S'.

P O L S A

# EARTH OBSERVATION ACTIVITIES IN POLAND

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Earth Observation Department  
Polish Space Agency

25.09.2023

12th ADVANCED TRAINING COURSE ON LAND REMOTE SENSING

# TODAY'S CHALLENGES



Climate change

Environmental pollution



Crisis events



SUSTAINABLE DEVELOPMENT GOALS

17 GOALS TO TRANSFORM OUR WORLD

<p>1 NO POVERTY</p>	<p>2 ZERO HUNGER</p>	<p>3 GOOD HEALTH AND WELL-BEING</p>	<p>4 QUALITY EDUCATION</p>	<p>5 GENDER EQUALITY</p>	<p>6 CLEAN WATER AND SANITATION</p>
<p>7 AFFORDABLE AND CLEAN ENERGY</p>	<p>8 DECENT WORK AND ECONOMIC GROWTH</p>	<p>9 INDUSTRY, INNOVATION AND INFRASTRUCTURE</p>	<p>10 REDUCED INEQUALITIES</p>	<p>11 SUSTAINABLE CITIES AND COMMUNITIES</p>	<p>12 RESPONSIBLE CONSUMPTION AND PRODUCTION</p>
<p>13 CLIMATE ACTION</p>	<p>14 LIFE BELOW WATER</p>	<p>15 LIFE ON LAND</p>	<p>16 PEACE, JUSTICE AND STRONG INSTITUTIONS</p>	<p>17 PARTNERSHIPS FOR THE GOALS</p>	



# FROM THE BEGINNING

Johannes  
Hevelius  
Kazimierz  
Siemienowicz

Space Research  
Centre of the Polish  
Academy of  
Sciences (CBK PAN)

Poland's accession to the EU

1977

2004

1543

1976

1978

1994

2008

Nicolaus Copernicus  
„On the Revolutions  
of the Heavenly  
Spheres”

OPOLIS  
IGIK

Mirostław  
Hermaszewski

Framework agreement  
with the European  
Space Agency

PECS/ESA

# POLAND IN SPACE – NEW CENTURY

POLSA established –  
executive agency of the Ministry  
of Economic Development & Technology

2014

National Space  
Program 2022-2027  
under preparation

2022-2027

2012

Poland in  
European Space  
Agency

2017

Polish Space Strategy

# SPACE SECTOR OF POLAND IN A NUTSHELL

## Heritage:

1973 – first instrument in orbit

1978 – first cosmonaut

2012 – first satellite

## 10 years in ESA:

~450 entities registered in ESA STAR

540+ projects worth €190 million

~100 new technologies developed

12.000 employees in space sector

## Strengths:

High innovativeness

High quality workforce

Proactive attitude

## Weaknesses:

Limited space heritage

Low level of investment so far

## Opportunities:

National Space Programme 2022-27

## Threats:

Competition from established players

# COMING SOON...



Increasing Poland's contribution to ESA on:

➤ Bilateral PL-ESA program of construction of EO satellites

➤ Bilateral program PL-ESA of technology development

➤ Optional and mandatory ESA programs

➤ Internships in ESA center for Poles

➤ Access to research on ISS  
(with sending the second Pole in history into space)



# POLISH DOWNSTREAM COMPANIES IN EO

## Areas of activity:

clouds solutions

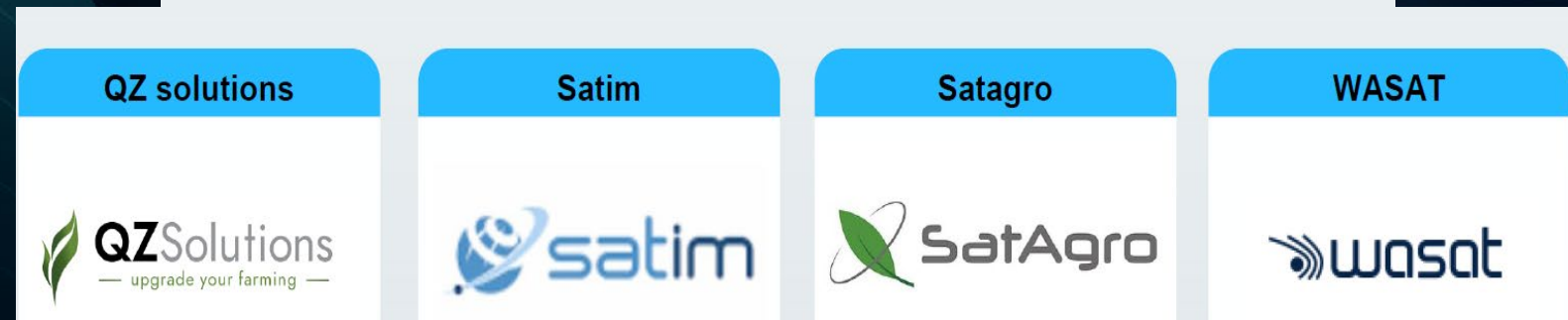
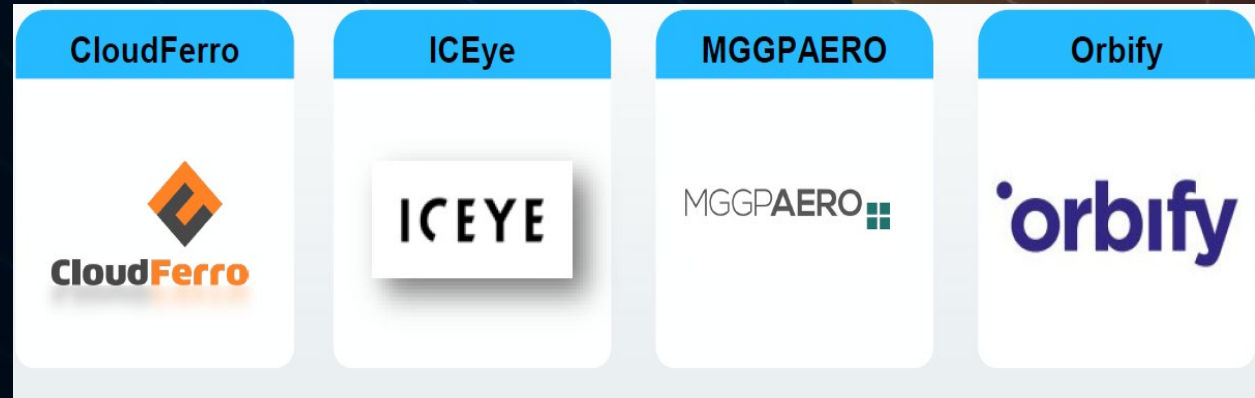
development of services

object detection

object clasification

applications: forestry (biomass) and precision farming

satellite constellation management



# POLISH UPSTREAM/END-2-END COMPANIES IN EO

## Areas of activity:

construction of small satellites

platforms and on-board  
computing

optical payloads

hyperspectral instrument

control and measurement systems

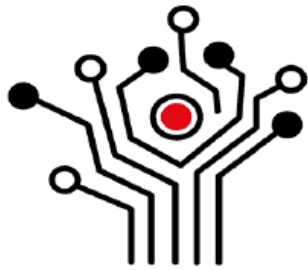
design, development and  
installation of space systems





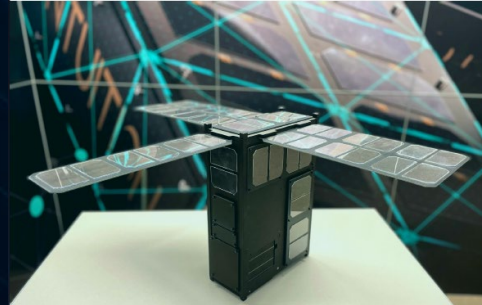
# POLISH SUCCESS STORIES IN EARTH OBSERVATION

## EO Innovation Platform Testbed Poland



**creo TECH**  
Instruments S.A.

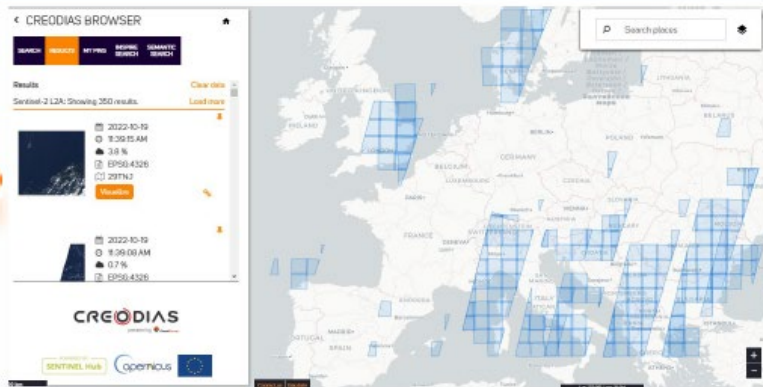
## Genesis / Intuition-1 mission



## S2GLC



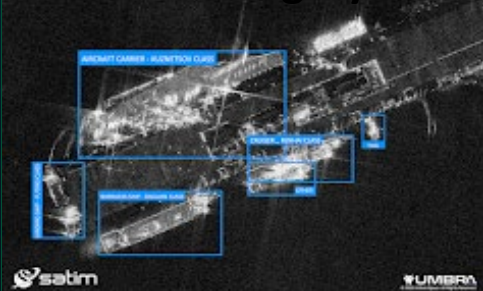
## CREODIAS



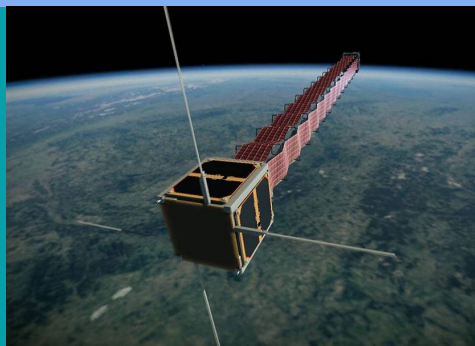
## Copernicus Data Space Ecosystem



## Object detection & classification using SAR imagery



# 16 SATELLITES FROM POLAND



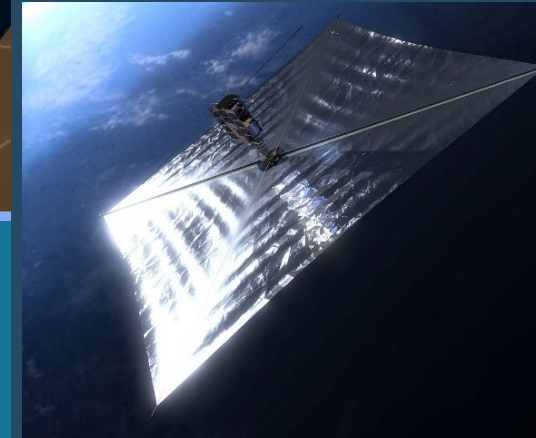
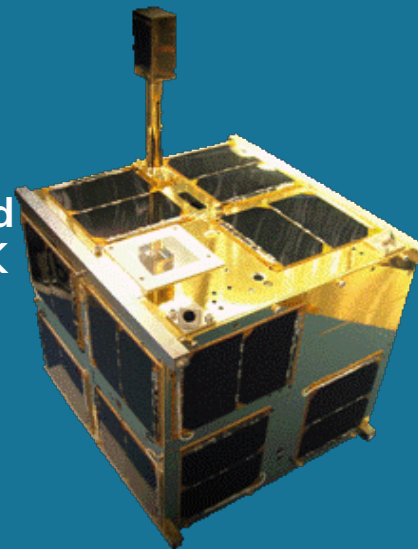
**PW Sat 1**  
The first polish satellite (2012), built by students of the Warsaw University of Technology



**IceEye**  
Finnish-Polish observation satellite (2018)

## BRITE satellites constellation

A constellation of 5 satellites, including 2 Polish: Lem (2013) and Heweliusz (2014) CBK PAN for the precise measurement of the brightness of the brightest stars in the Milky Way.



**PW Sat 2**  
The second artificial satellite (2018), built by students of the Warsaw University of Technology.

**KRAKsat**  
The world's first nanosatellite that uses a magnetic fluid to control orientation (AGH 2019)

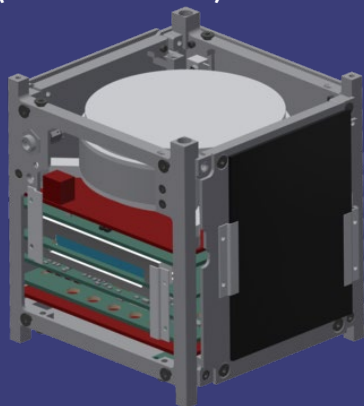


**Stork-4&5 (6.2021)**  
**Stork 6, Aman (5.2022)**  
EO satellites by SatRev



**Światowid (2018)** The first Polish commercial satellite. SatRevolution.

POLISH SATELLITES CURRENTLY IN ORBIT							
Name	Year of launch	Status	Orbit	Approximate height	Purpose	User / operator	Function
STORK 5	2021	In orbit	LEO	~ 500 km	Commercial	SatRevolution	Earth observation
STORK 4	2021	In orbit	LEO	~ 500 km	Commercial	SatRevolution	Earth observation
KRAKsat	2019	In orbit	LEO	~ 400 km	Scientific	AGH	Testing a flywheel based on ferrofluid
BRITE PL-2	2014	In orbit	LEO	632 km	Scientific	CBK PAN	Measurement of changes in the brightness of stars
BRITE PL-1	2013	In orbit	LEO	604 – 925 km	Scientific	CBK PAN	Measurement of changes in the brightness of stars



# EARTH OBSERVATION SYSTEMS

Country Awareness Mission In Land Analysis – at least four (4) EO small OPTO satellites and SAR in cooperation with ESA; civilian use

EO Satellite System **MikroGlob** – MoD plans for national constellation (OPTO microsatellite – PAN, RGB, NIR) – dual use

MoD purchased 2 high-res **Pléiades**; ~0,5 m resolution – military use and crises management

# POLISH SPACE ECOSYSTEM



User  
awareness



Infrastructure,  
tools



Data,  
Products,  
Services



Legal support



# RAISING AWARENESS



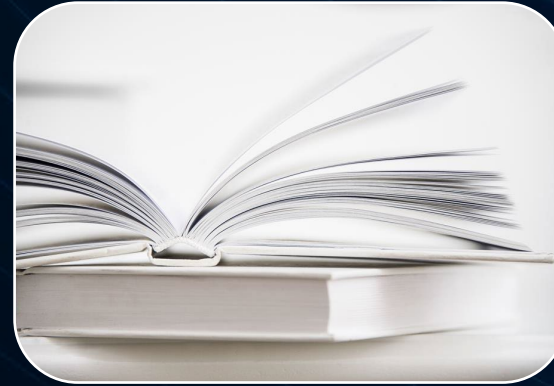
## WORKSHOPS

550 users trained



## E-LEARNING

513 unique accounts



## TEXTBOOK IN GEOSCIENCE

published in 2020,  
4122 downloads



## EARTH OBSERVATION FORUM

in 2021, 2022, 2023,  
over 200 participants  
yearly

# COPERNICUS RELAYS/ACADEMY

- CloudFerro
- UNEP/GRID - Warsaw
- Absiskey Polska (leader) and Institute of Geodesy and Cartography
- Creotech Instruments S.A., Centrum Badań Kosmicznych PAN, Blue Dot Solutions sp. z o.o



IGIK, UNEP/GRID

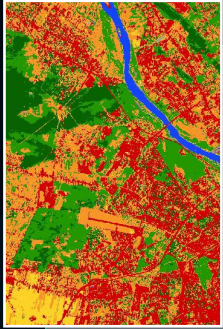
# COPERNICUS NATIONAL USER FORUM

## National thematic expert's group:

- CAMS: Institute of Environmental Protection – National Research Institute
- C3S: Institute of Environmental Protection – National Research Institute
- CEMS: Institute of Meteorology and Water Management - National Research Institute, Institute of Oceanography - Polish Academy of Science, University of Gdansk
- CLMS: Institute of Geodesy and Cartography
- CEMS: Crisis Information Centre (CIK) - Space Research Centre of Polish Academy of Sciences
- CSS: Crisis Information Centre (CIK) - Space Research Centre of Polish Academy of Sciences

Association of Geographic Information Laboratories in Europe (AGILE) – IGIK, WGIK, SpaceOS

# NATIONAL SATELLITE INFORMATION SYSTEM (NSIS)



launching, improving and expanding as well as providing access to monitoring services (6 thematic areas)



integration of existing technical solutions and development of infrastructure, Copernicus archive, product repository, POLSA operational center;

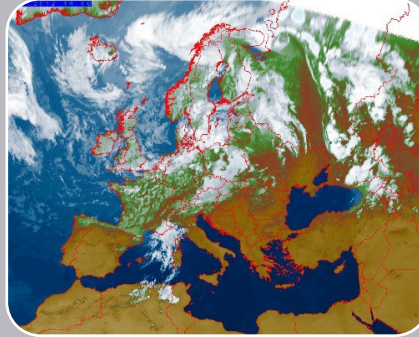
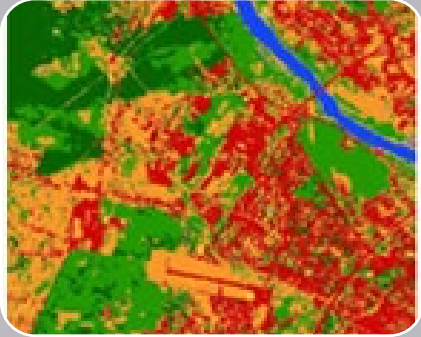


information, communication, education and training activities and ongoing cooperation with users and suppliers;

**interoperable system for receiving, storing, processing and sharing satellite data to provide monitoring services, information products, analytical tools along with the necessary infrastructure**



# NSIS PLATFORM - ASSETS



POLSA's  
satellite  
products

National  
repository of  
geodetic data

National  
meteorological,  
environmental,  
hydrological  
geospatial data

Atmosphere  
Monitoring Service  
(CAMS), Marine  
Environment  
Monitoring Service  
(CMEMS), Land  
Monitoring Service  
(CLMS), Emergency  
Management Service  
(CEMS), Climate  
Change Service  
(C3S)

Commercial  
solutions



# HTTPS://NSISPLATFORMA.POLSA.GOV.PL/EN

Knowledge base

POLSA

ABOUT POLSA

ABOUT NSIS

NEWS

NEWS PORTAL

MARKETPLACE

KNOWLEDGE BASE



PL

EN



Geoportal

Marketplace

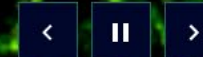
## NATIONAL SATELLITE INFORMATION SYSTEM

### AGRICULTURAL DROUGHT SATELLITE MONITORING

2023-09-05

In 2022 agricultural drought monitoring system has been prepared in consultation with the National Support Centre for Agriculture, which is building a satellite monitoring system for agricultural crops. Based on the indices, maps of crop growth conditions were prepared for 2022, as well as yield reduction assessment maps of selected crop groups(...)

READ MORE



# POLSA SATELLITE PRODUCTS

**Land Cover  
Maps**

**Change  
Detection  
Maps**

**Orthophoto  
Maps**

**CIR  
Orthophoto  
Map**

**SWIR  
Orthophoto  
Map**

**Urban Heat  
Islands**

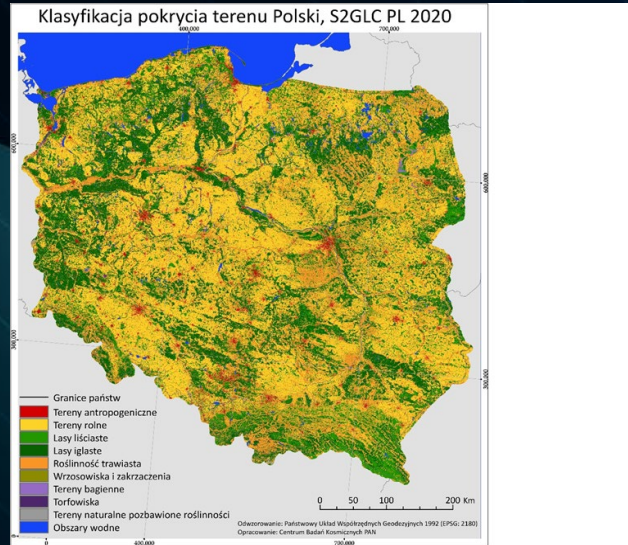
**Agricultural  
Drought**

**Soil Moisture**

# LAND MONITORING

## Land Cover Maps 2019, 2020, 2021, 2022

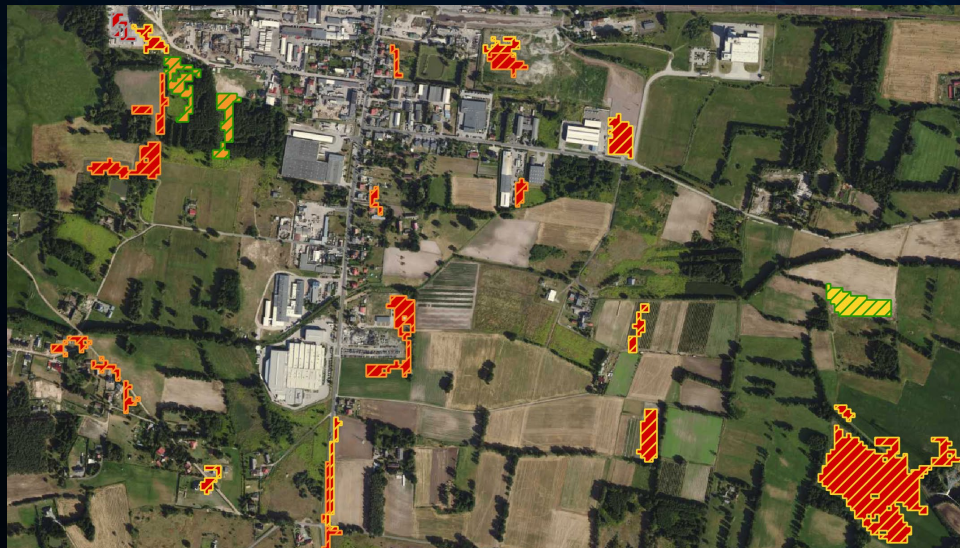
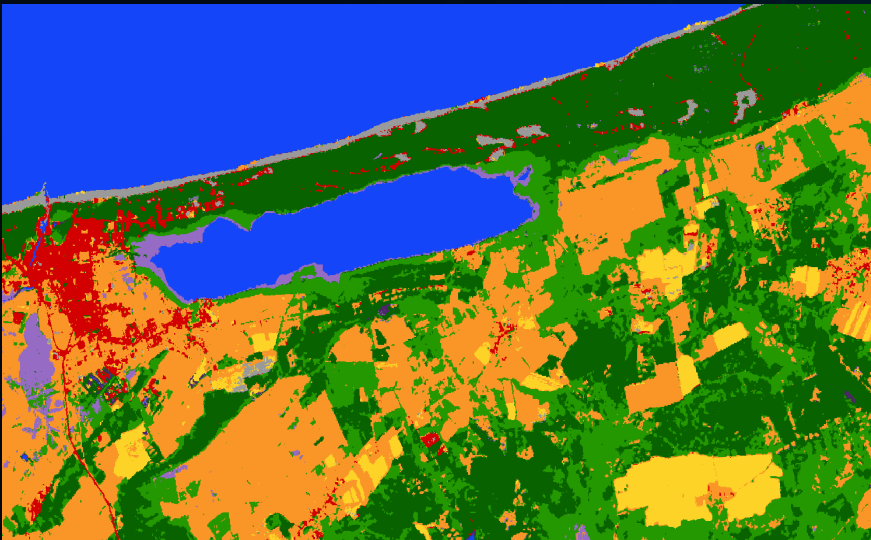
- automatic classification S2GLC
- Pixel 10 m
- 13 classes
- validation BDOT



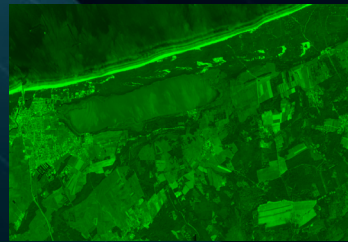
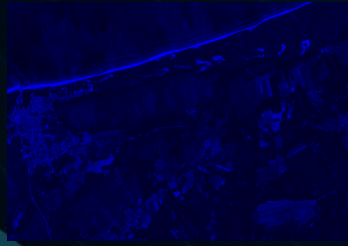
## Land Cover Changes 2019-2020 and 2020-2021

- Automatic change detection
- raster maps, vector maps, tabular statements by administrative division

Brak danych - Tereny bagienne
Obszary zachmurzone - Lasy liściaste
Obszary zachmurzone - Tereny rolne
Obszary zachmurzone - Tereny antropogeniczne
Brak danych - Wrzosowiska i zakrzaczenia
Brak danych - Roslinność trawiasta
Brak danych - Lasy iglaste
Brak danych - Lasy liściaste
Brak danych - Tereny rolne
Brak danych - Tereny antropogeniczne
Tereny antropogeniczne - Tereny rolne
Tereny rolne - Lasy liściaste
Tereny antropogeniczne - Lasy liściaste
Lasy liściaste - Lasy iglaste
Lasy iglaste - Roslinność trawiasta
Tereny rolne - Lasy iglaste
Tereny antropogeniczne - Lasy iglaste
Roslinność trawiasta - Wrzosowiska i zakrzaczenia
Lasy liściaste - Roslinność trawiasta
Wrzosowiska i zakrzaczenia - Tereny bagienne
Tereny rolne - Roslinność trawiasta
Tereny antropogeniczne - Roslinność trawiasta
Lasy iglaste - Wrzosowiska i zakrzaczenia
Tereny bagienne - Torfowiska
Tereny naturalne pozbawione roślinności - Obszary wodne
Obszary wodne - Obszary zachmurzone
Lasy liściaste - Wrzosowiska i zakrzaczenia
Roslinność trawiasta - Tereny bagienne
Tereny rolne - Wrzosowiska i zakrzaczenia
Tereny antropogeniczne - Wrzosowiska i zakrzaczenia
Torfowiska - Tereny naturalne pozbawione roślinności
Lasy iglaste - Tereny bagienne
Wrzosowiska i zakrzaczenia - Torfowiska
Obszary zachmurzone - Brak danych
Lasy liściaste - Tereny bagienne
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Tereny rolne - Obszary zachmurzone
Tereny antropogeniczne - Obszary zachmurzone



# LAND MONITORING



## Satellite orthofotomap 2022

- mosaic (automatic) S2
- spatial resolution 10m
- RGB, CIR,
- **increased spatial resolution - artificial intelligence algorithms (4x)**

## Satellite orthofotomap 2021

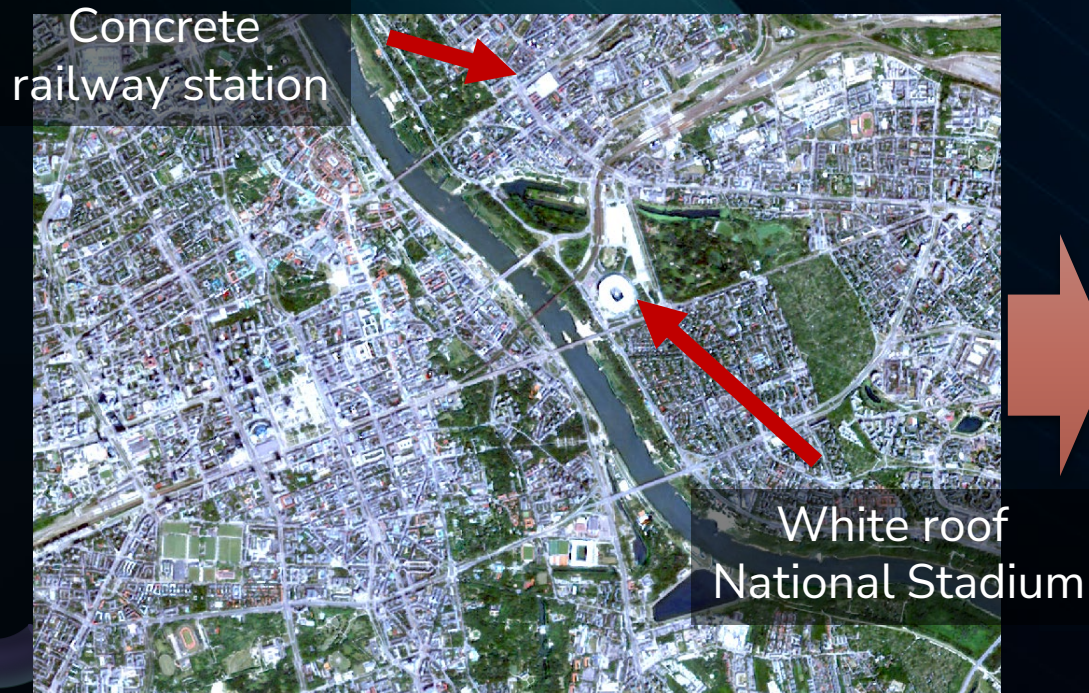
- mosaic (automatic) S2
- spatial resolution 10m
- RGB, CIR, SWIR



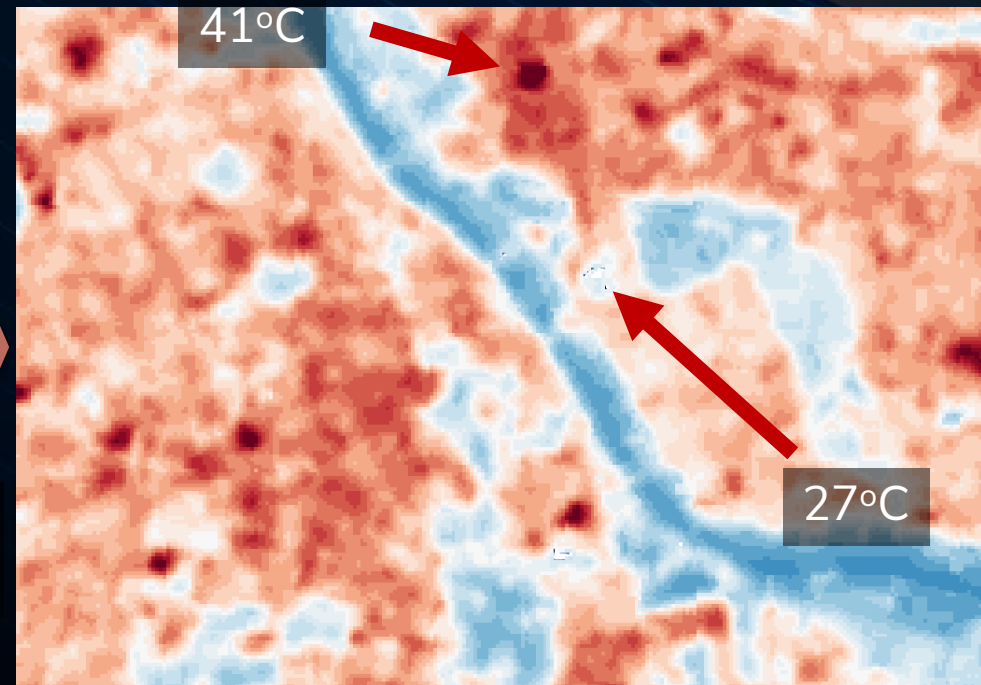
# URBAN HEAT ISLAND

5 Polish cities in 2022

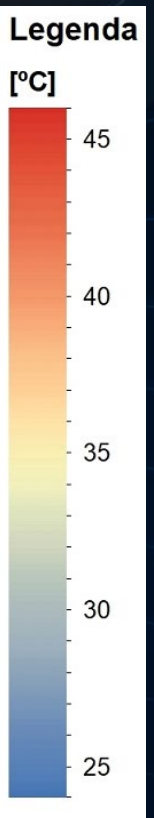
Landsat-8 and Landsat-9 Thermal data (30 m after resampling)



Warsaw orthoimage 2.5 m

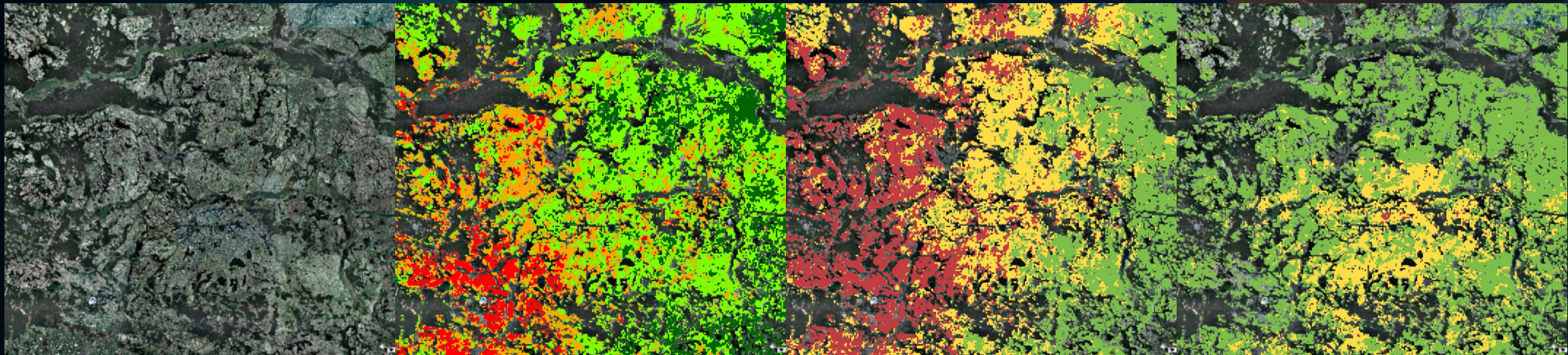


Warsaw Urban Heat Island 30 m



# AGRICULTURAL DROUGHT

Drought Identification Satellite System based on Terra MODIS images with 1 km spatial resolution



Orthoimage Sentinel-2



Corn crop reduction map

Rape crop reduction map

Crops condition map  
Drought Identification Satellite System  
12-19.07.2022

# SOIL MOISTURE

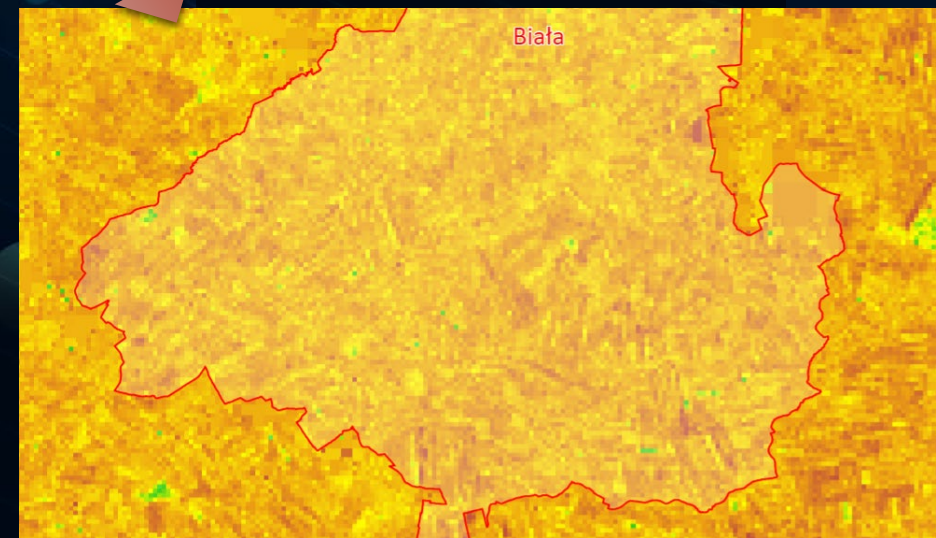
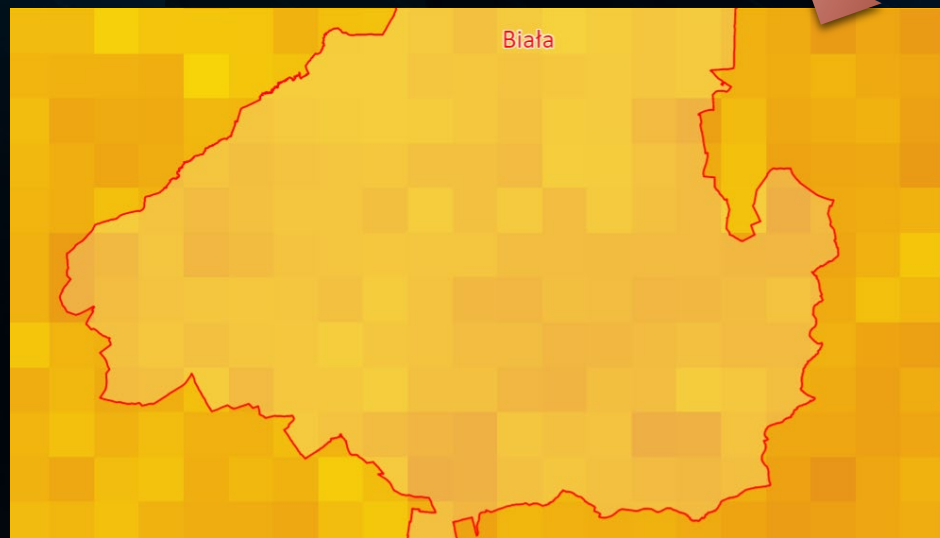
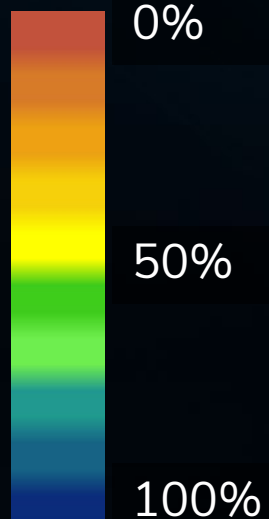
- Soil moisture monitoring based on Sentinel-1 images
- Monitoring every 12 days
- 2021-2022

Orthoimage Sentinel-2



Soil moisture 1000x1000 m  
26.10.2022

Soil moisture 100x100 m  
26.10.2022



# NATIONAL DATA

## ➤ State Geodetic and Cartographic Resources:

- ❑ addresses and streets, PRNG, PRG, BDOO, BDOT, KIEG, orthophotomap

## ➤ Central Register of Nature Protection Forms:

- ❑ Protected Landscape Areas, LP, NP, Natural Monuments, Reserves

## ➤ National Integration of Local Development Plans

# COPERNICUS PRODUCTS

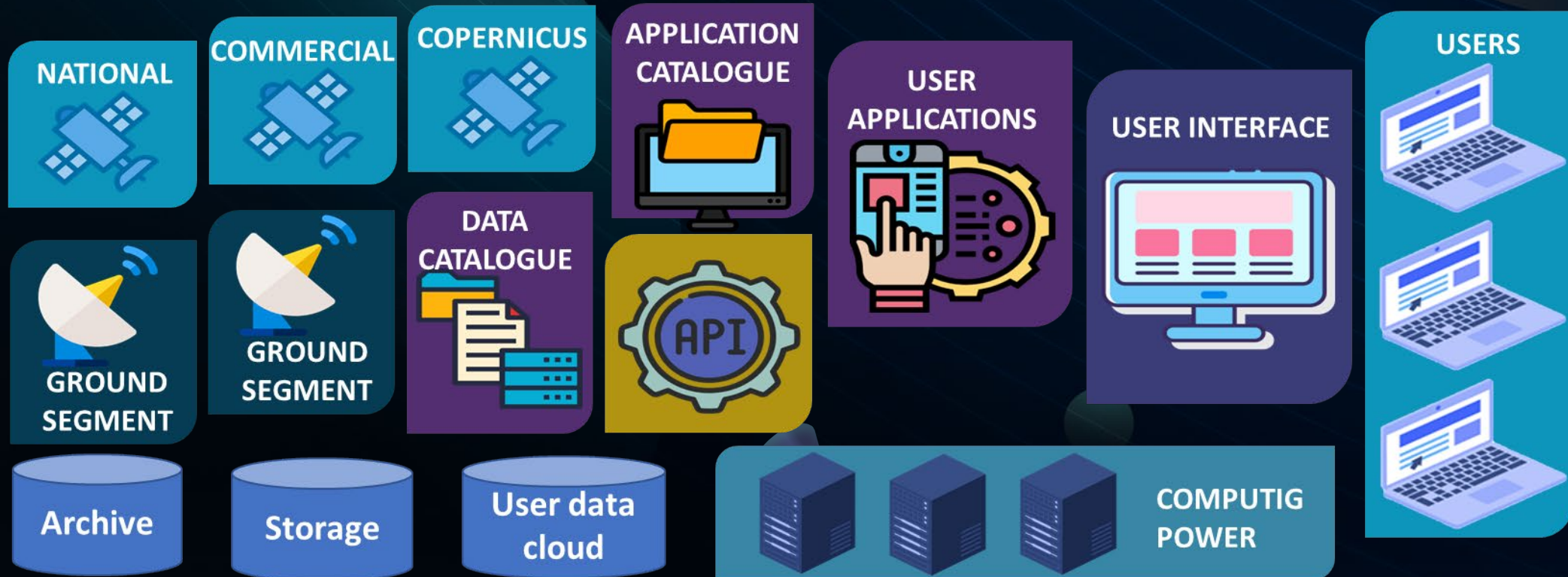
## ➤ Copernicus Land Monitoring Service (CLMS):

- ❑ Impervious areas 2018
- ❑ Grassland 2018
- ❑ Water bodies and wetlands 2018
- ❑ Urban atlas 2018
- ❑ Corine Land Cover 1990, 2000, 2006, 2012, 2018
- ❑ Flood zone boundaries 2018



# NEXT STEPS

- Development monitoring services: forestry, crisis management/emergency, environment, water management
- Adding new products and assets
- Expand the Marketplace (implementation and promotion of commercial products, services and applications)

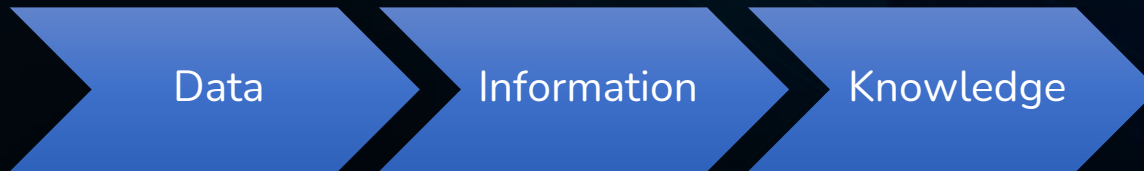


# NEXT STEPS

- Integrating more EO data for better understanding of processes on Earth and support for decision-making
- Providing an easy access to data and products and enabling necessary analysis
- Applying new algorithms, AI and cloud computing
- Ensuring constant monitoring and modelling processes on Earth, prediction and simulations towards DTE



## DIGITAL TWIN EARTH





**P O L S A**