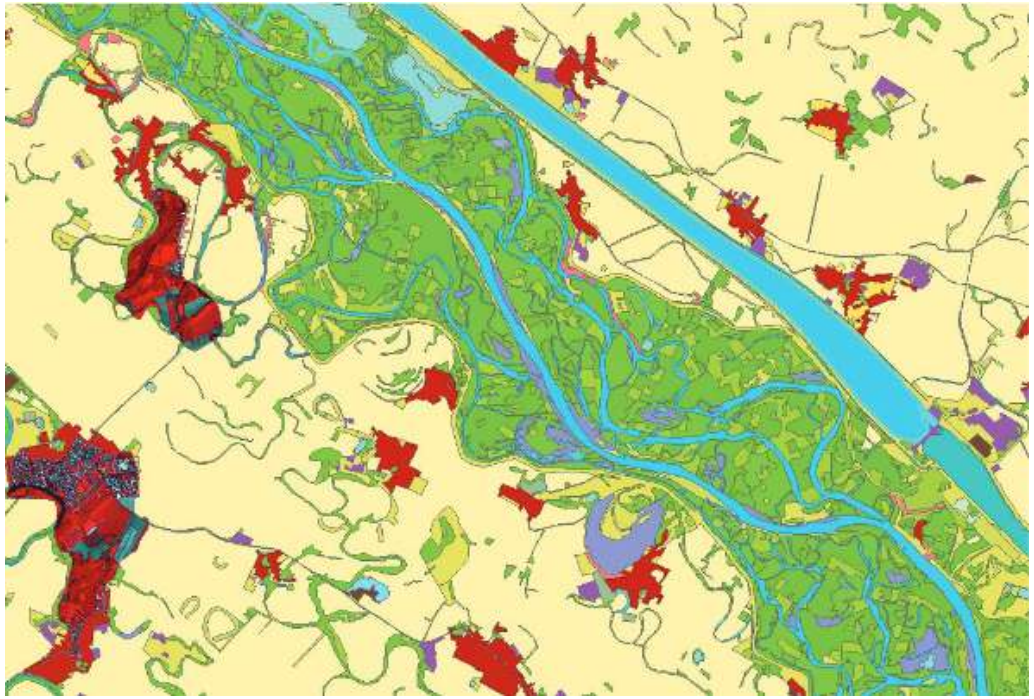
# Land Cover Dynamics Precursors of Land Cover Changes in SCERIN



## Copernicus services:

## Land Monitoring

Zolti Szantoi, Ph.D.
Scientific / Technical Project Officer
Joint Research Centre, European Commission
zoltan.szantoi@ec.europa.eu

# a land in transition

European Commission

"current land cover dynamics in the SCERIN region to identify the typical pre-cursors of land cover change, consider our ability via remote sensing to monitor their significance and influence on the environment and biogeochemical cycling"

2013

http://www.fao.org/gtos/gofc-gold/net-SEERIN_Thematic.html

2014

NASA LCLUC Spring Science Team Meeting 2014, 23-25 April

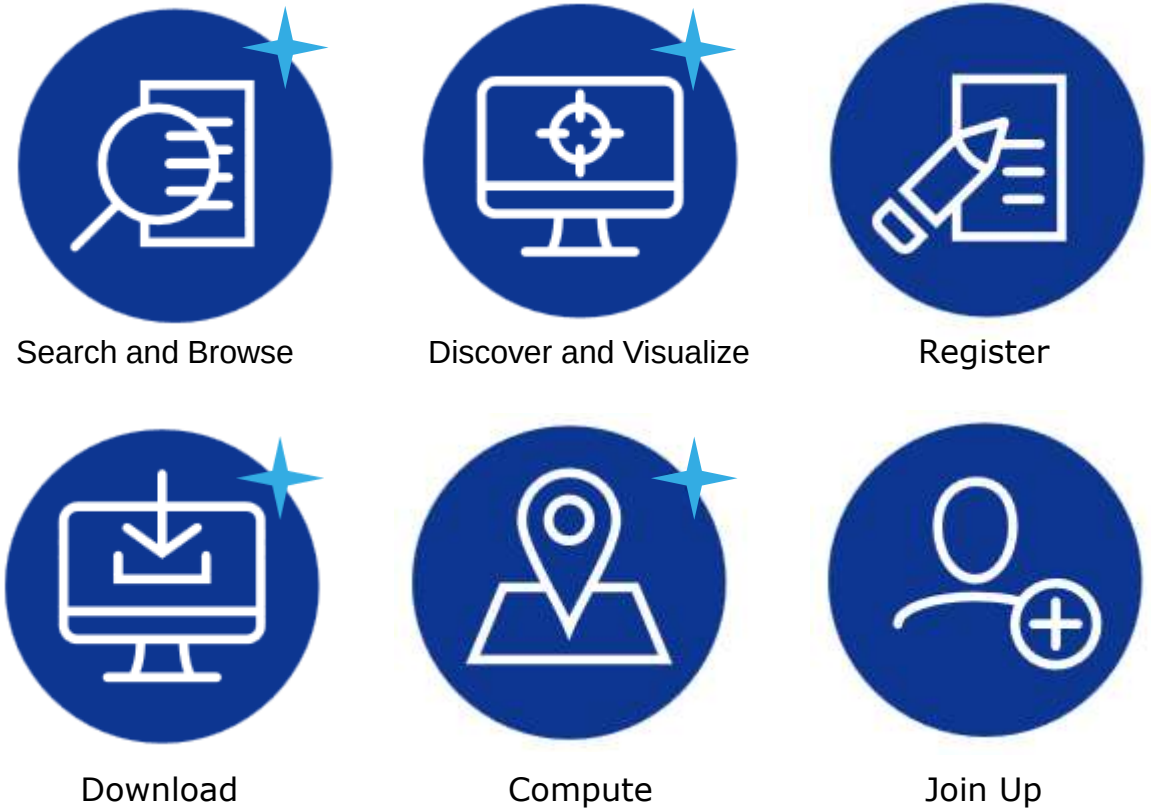
Joint Research Centre

| TAT-6 |
| --- |
| Latvia |
| Lithuania |
| Poland |
| Czechia |
| Slovakia |
| Ukraine |
| Hungary |
| Romania |
| Bulgaria |
| Serbia |
| Croatia |
| Russia |
| +? |

# Copernicus Land Monitoring Service

The Copernicus Land Monitoring Service (CLMS) provides geographical information on land cover and on variables related, for instance, to the vegetation state or the water cycle.

It supports applications in a variety of domains such as spatial planning, forest management, water management, agriculture and food security.



# Search and Browse

Three levels of geographical information

- Mid and low resolution **global** bio-geophysical products on vegetation, water cycle and energy budget in near-real time and long-term time series archives
- **Pan-European** high resolution land cover/use products on EEA-39 countries, 5 high-resolution layers (impervious surfaces, forest areas, grasslands, wetness, and water, small woody features), 2 pan-European reference datasets (EU-Hydro and EU-DEM)
- **Local component** is to provide detailed information on land cover/use on hotspots such as major cities, Natura 2000 protected sites, and riparian zones

# Discover and Visualize

# Global data

European Commission

From medium to high resolution

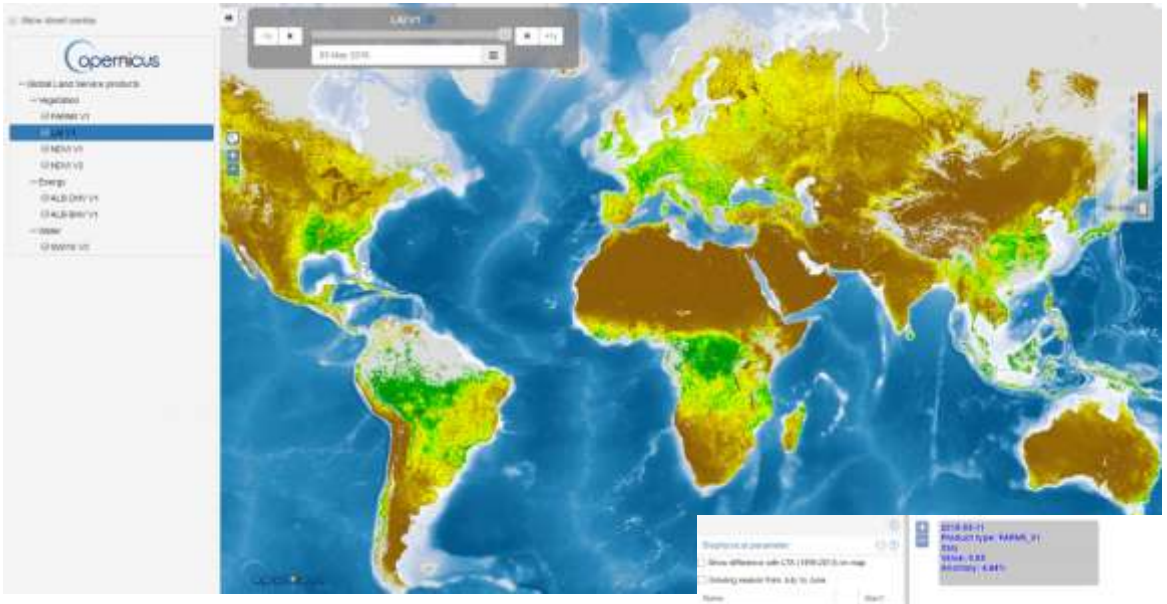
| Theme | Variable | Spatial Resolution Moderate 100m |
|---|---|---|
| Vegetation | Land Cover | In production |

From coarse to medium resolution

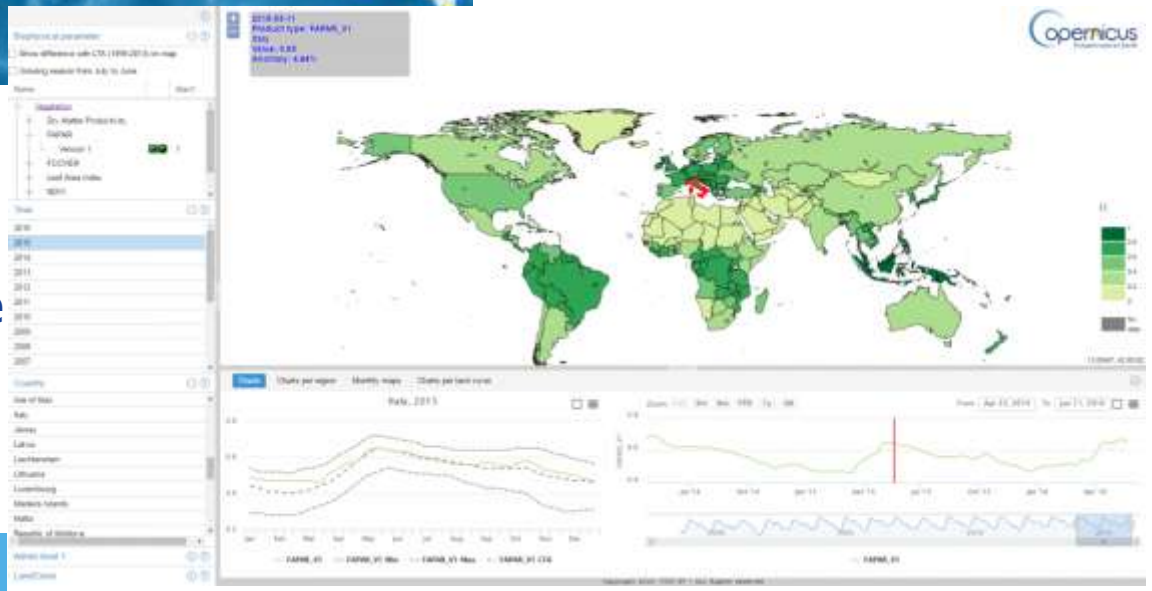
| Theme | Variable | Spatial Resolution Coarse >=1km | Spatial Resolution Medium 300m |
|---|---|---|---|
| Vegetation | Fraction of photosynthetically active radiation absorbed by the vegetation | In production | In production |
| | Fraction of green vegetation cover | In production | In production |
| | Leaf Area Index | In production | In production |
| | Normalized Difference Vegetation Index | In production | In production |
| | Vegetation Condition Index | In production | |
| | Vegetation Productivity Index | In production | |
| | Dry Matter Productivity | In production | In production |
| | Burnt Area | In production | In production |
| | Soil Water Index | In production | |
| | Surface Soil Moisture | In development | |
| Energy | Land Surface Temperature | In production | |
| | Top Of Canopy Reflectance | In production | |
| | Surface Albedo | In production | |
| | Downward Short- and Longwave Fluxes at the surface | In development | |
| Water | Water Bodies | In production | In production |
| | Lake Surface Water Temperature | In production | |
| | Lake Water Quality | In production | |
| Cryosphere | Lake Ice Extent | In production | |
| | Snow Cover Extent | In production | |
| | Snow Water Equivalent | In production | |

Non-gridded products

| Theme | Variable | Rivers and Lakes |
|---|---|---|
| Water | Water Level | In production |




Tiled map viewing service




Time series viewer service

https://land.copernicus.eu/global/

Joint Research Centre

# Discover and Visualize Pan-European

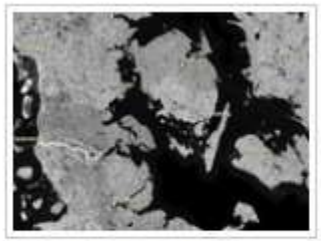
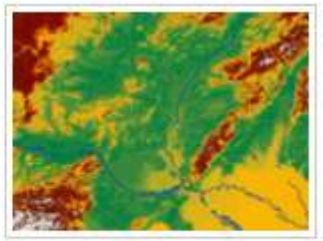


Image Mosaics

CORINE Land Cover

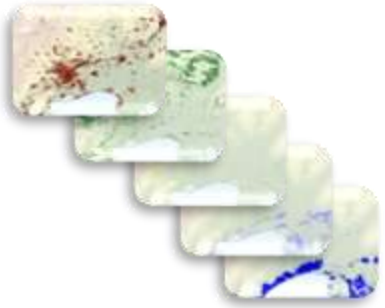
High Resolution Layers


Reference Data

Related Pan-European products

CLC & CLCC
1990-2000-06-12-18

HRLs
2006-09-12-15-18



EU-DEM

EU-Hydro

European Settlement Map

# High Resolution Layers

European Commission

**Imperviousness and imperviousness change products**

- Degree of Imperviousness and Imperviousness Change (0-100%)
- 2006-2009-2012-2015
- 20 m and 100 m

**Forest**

- Tree Cover Density (0-100%)
- Dominant Leaf Type
- 2012-2015
- 20 m and 100 m

**Grassland**

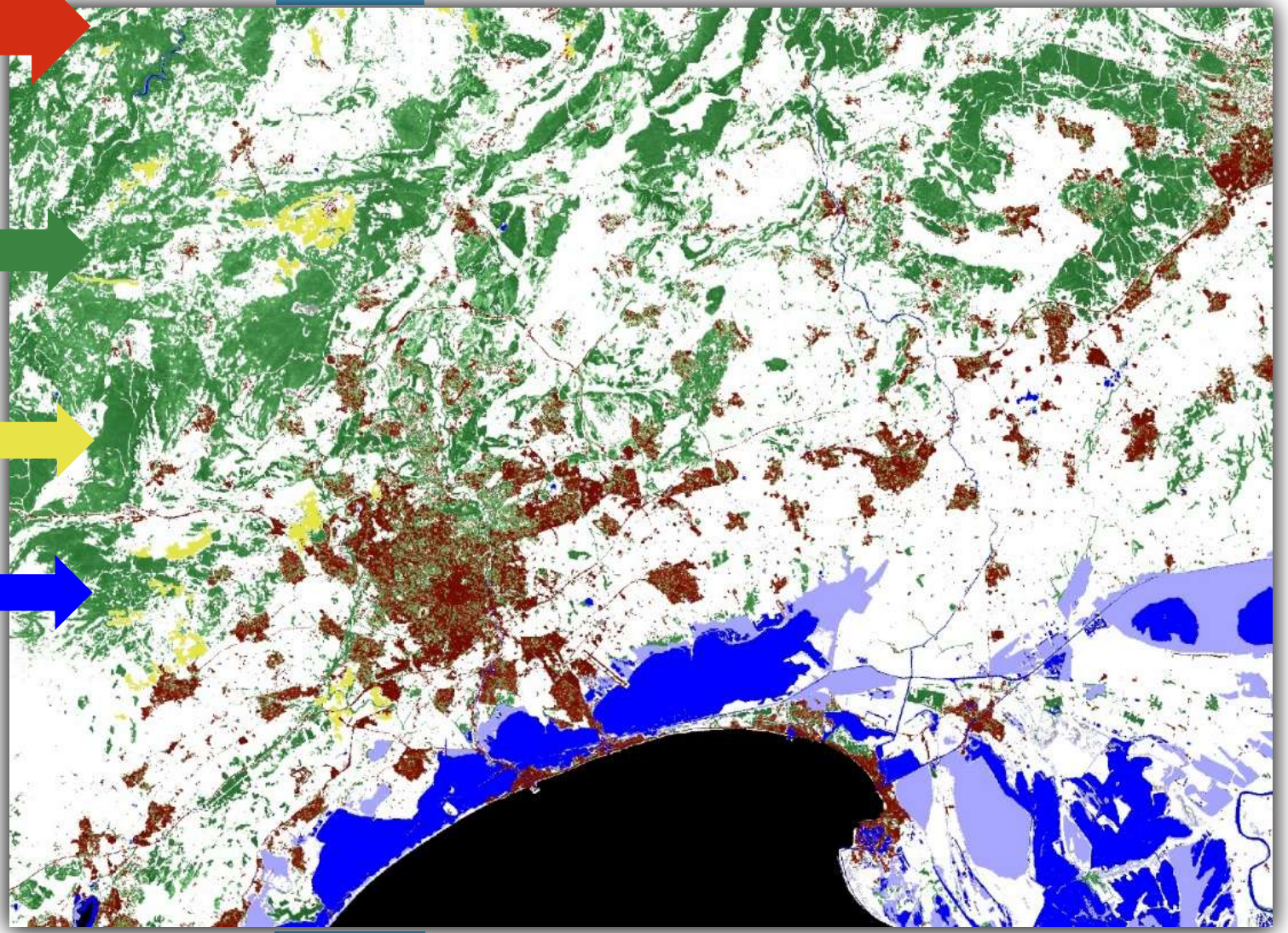
- Grassland (binary)
- 2012-2015
- 20 m and 100 m

**Water and Wetness**

- Permanent/Temporary Water
- Permanent/Temporary Wetness
- Based on 2009-2016 time series

**Small Woody Features**

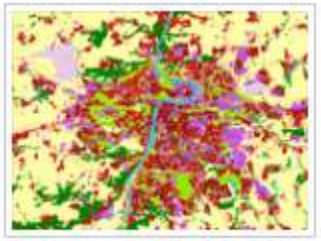
- Linear and patchy structures (binary)
- 2015

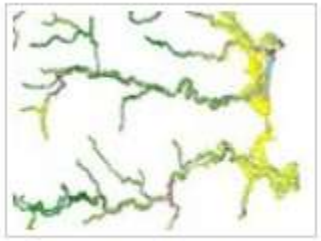


Joint Research Centre

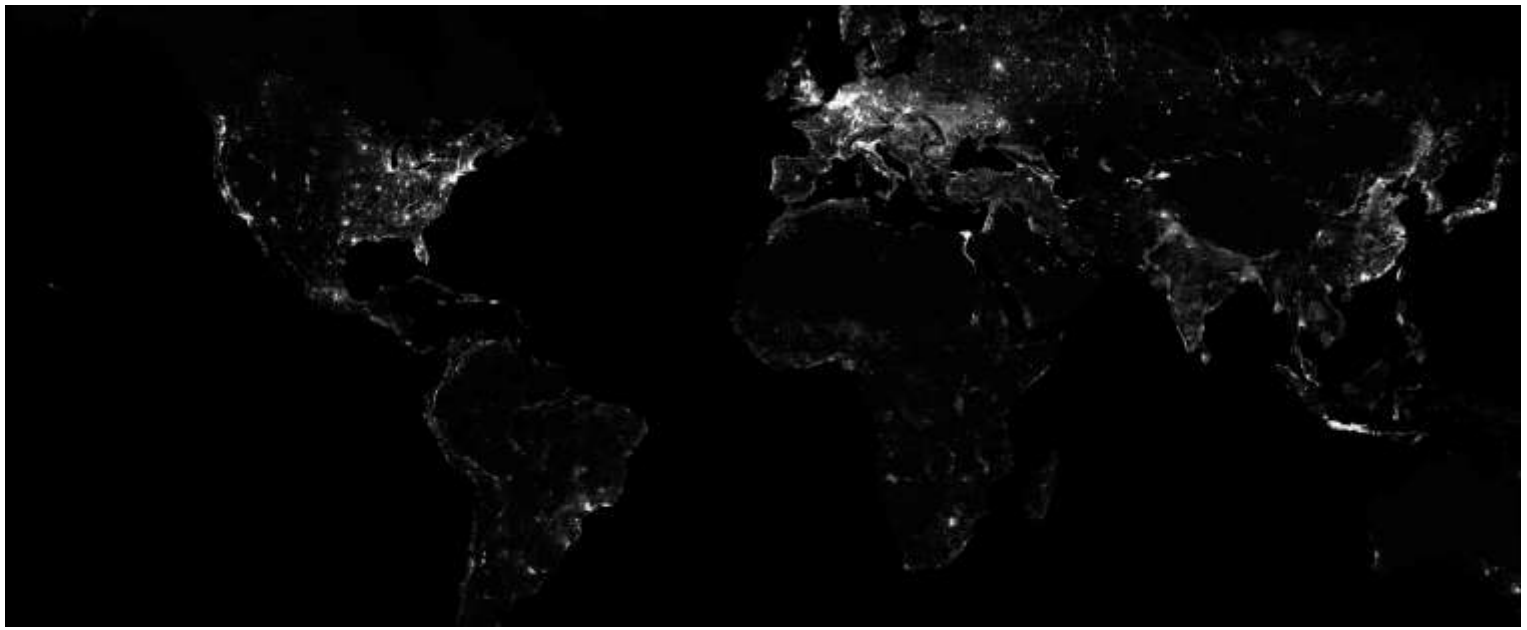
# Discover and Visualize Local

European Commission

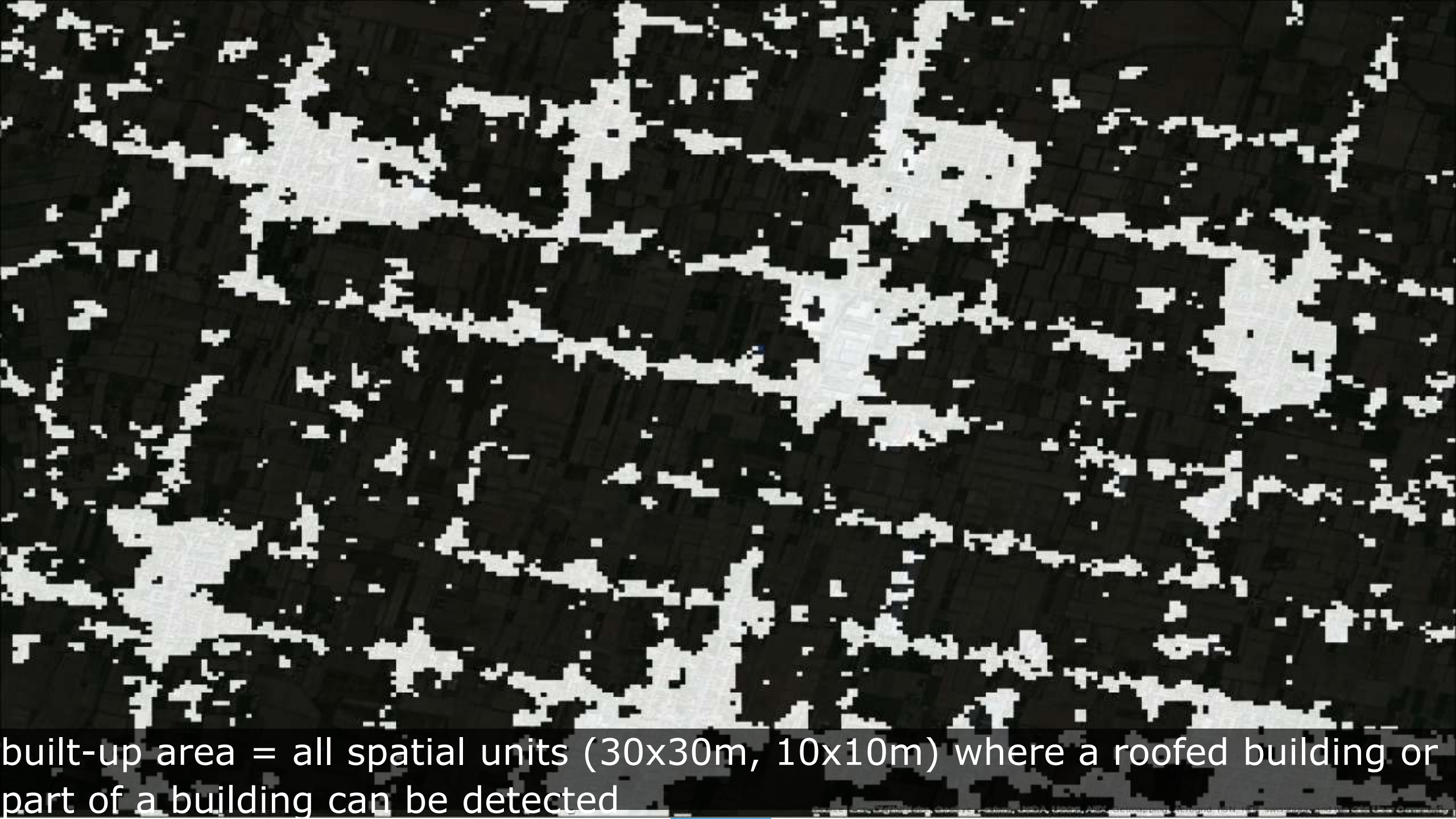

Urban Atlas


Riparian Zones

Natura 2000 (N2K)



http://ghsl.jrc.ec.europa.eu

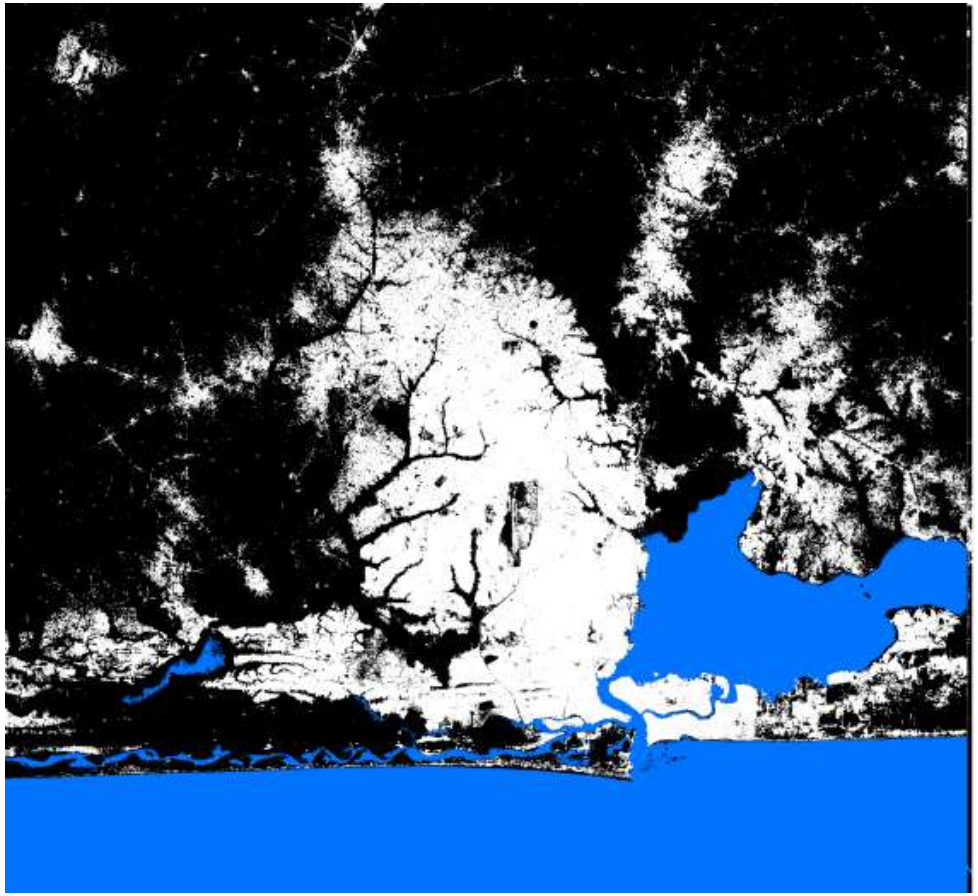


built-up area = all spatial units (30x30m, 10x10m) where a roofed building or part of a building can be detected

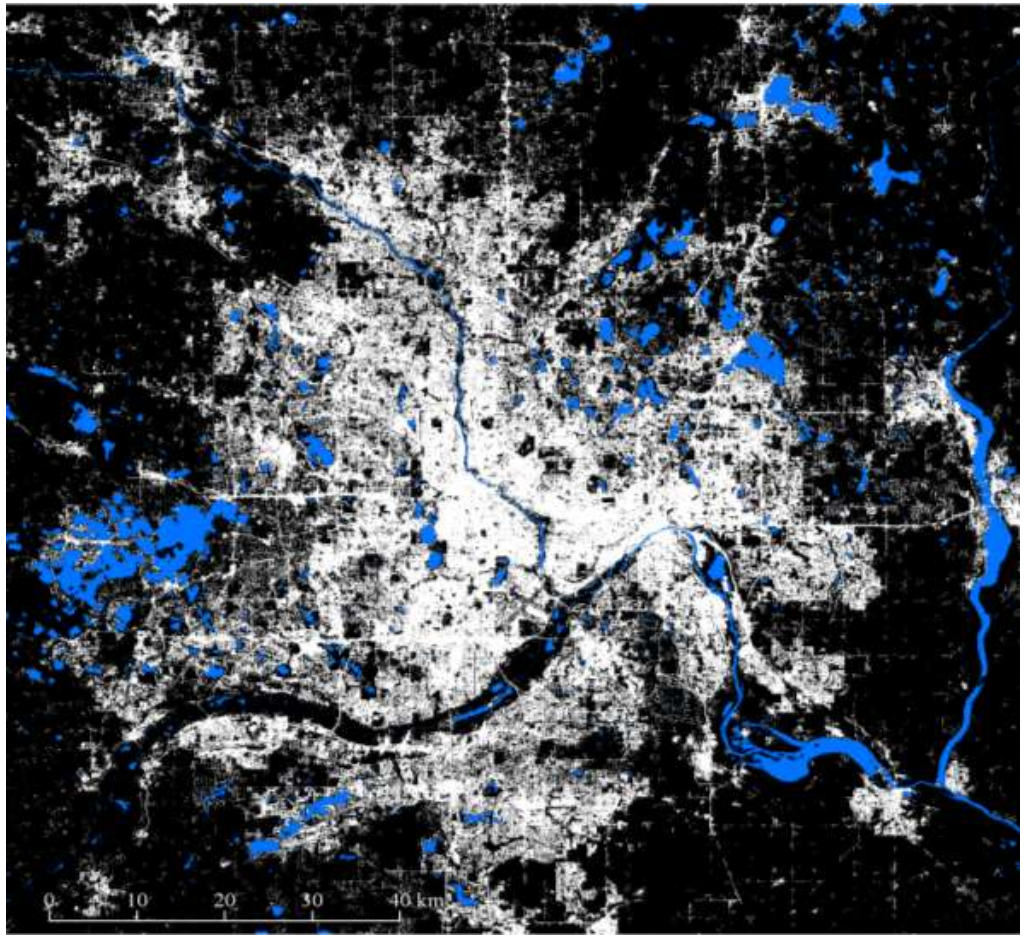
# Objective city-level comparison

European Commission

*Lagos, Nigeria:*
*~ 11 million inhabitants*



Minneapolis, US:
~ 1.5 million inhabitants



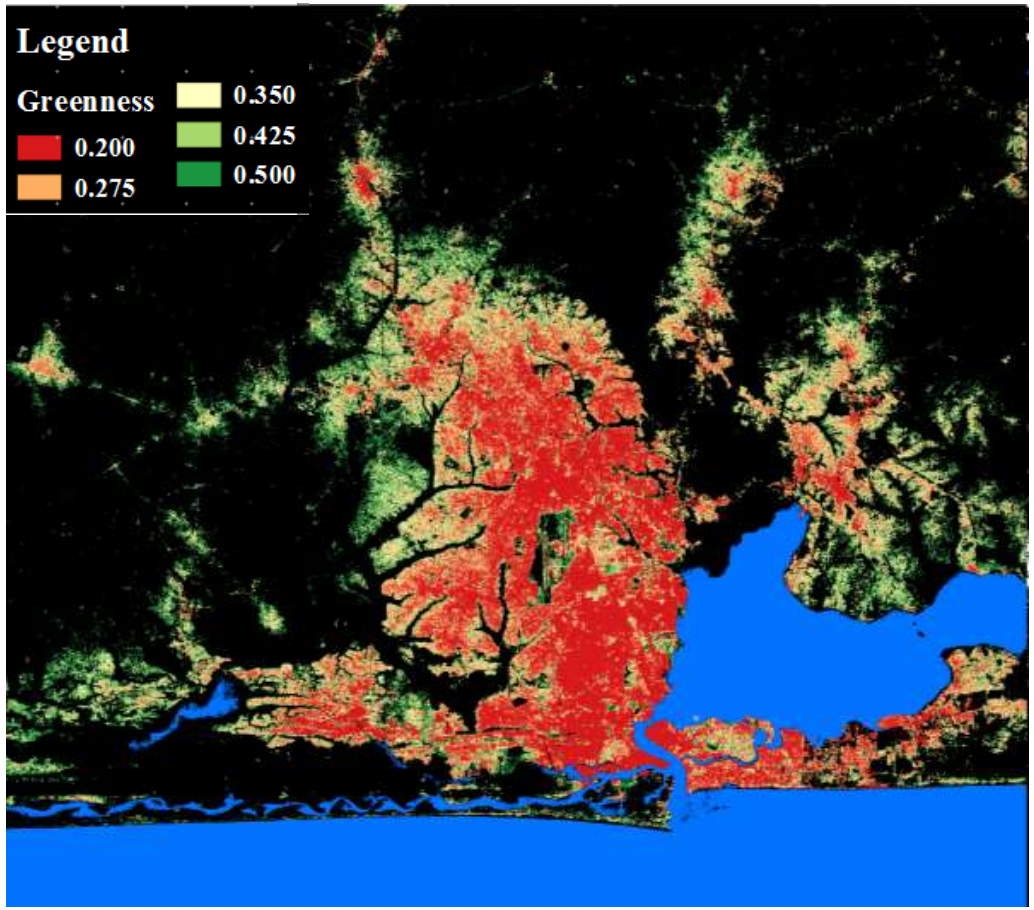

Built-up areas 2015

Joint Research Centre

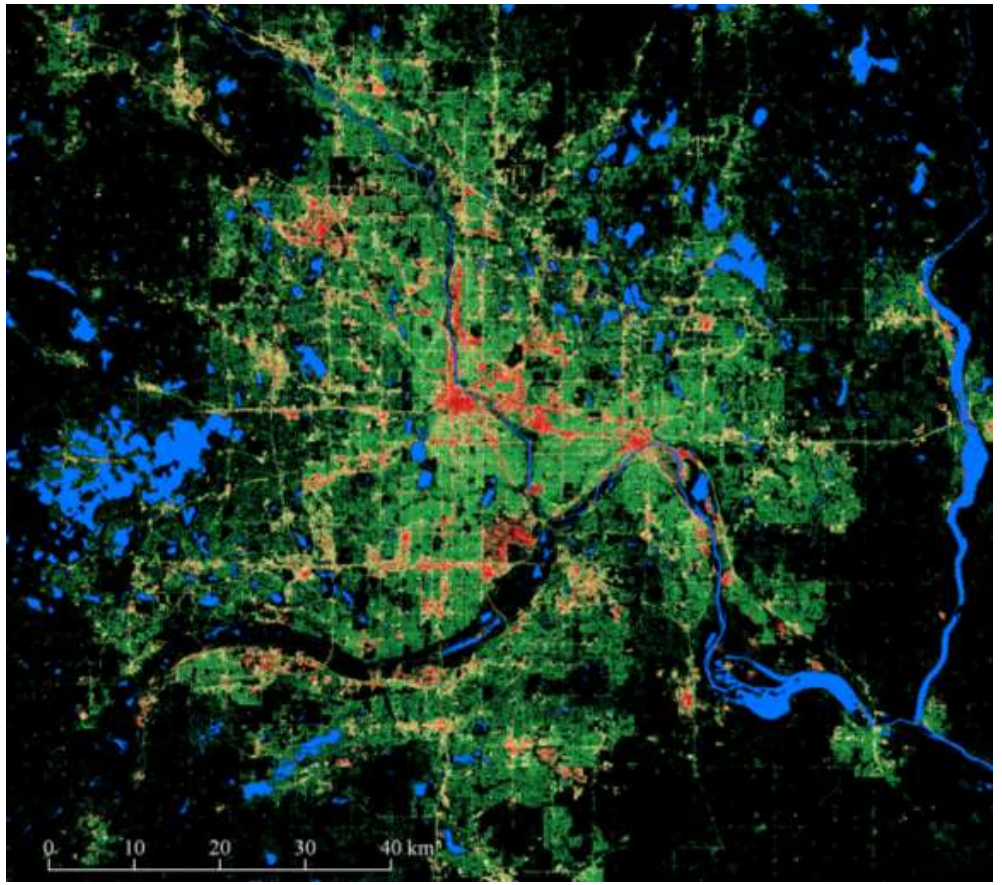
# Objective city-level comparison

European Commission

*Lagos, Nigeria:*
*~ 11 million inhabitants*




Minneapolis, US:
~ 1.5 million inhabitants




green areas 2015

Joint Research Centre

European Commission

## Copernicus Open Access Hub

LATEST NEWS

147,759 Self registered Users

46,479,634 Products Downloaded
34.07 PB Volume Downloaded

No Rolling Policy

Sentinel-1 NTC
Sentinel-2
Sentinel-3 (preops)

Max 2 concurrent Downloads

## Collaborative Hub

LATEST NEWS

18 Collaborative GS
7 Data Hub Relays

21,726,906 Products Downloaded
18.46 PB Volume Downloaded

Node1: 30 days
Node2: 2 weeks
Node3: 3 weeks

Sentinel-1 NRT & NTC
Sentinel-2
Sentinel-3 SRAL

Max 10 concurrent downloads per Node

## International Hub

LATEST NEWS

4 International Agreements

7,459,632 Products Downloaded
5.96 PB Volume Downloaded

3 weeks

Sentinel-1 NTC
Sentinel-2 L1C
Sentinel-3 SRAL

Max 10 concurrent downloads

## Copernicus Services Hub

LATEST NEWS

207 Registered Users

9,572,124 Products Downloaded
6.26 PB Volume Downloaded

No Rolling Policy

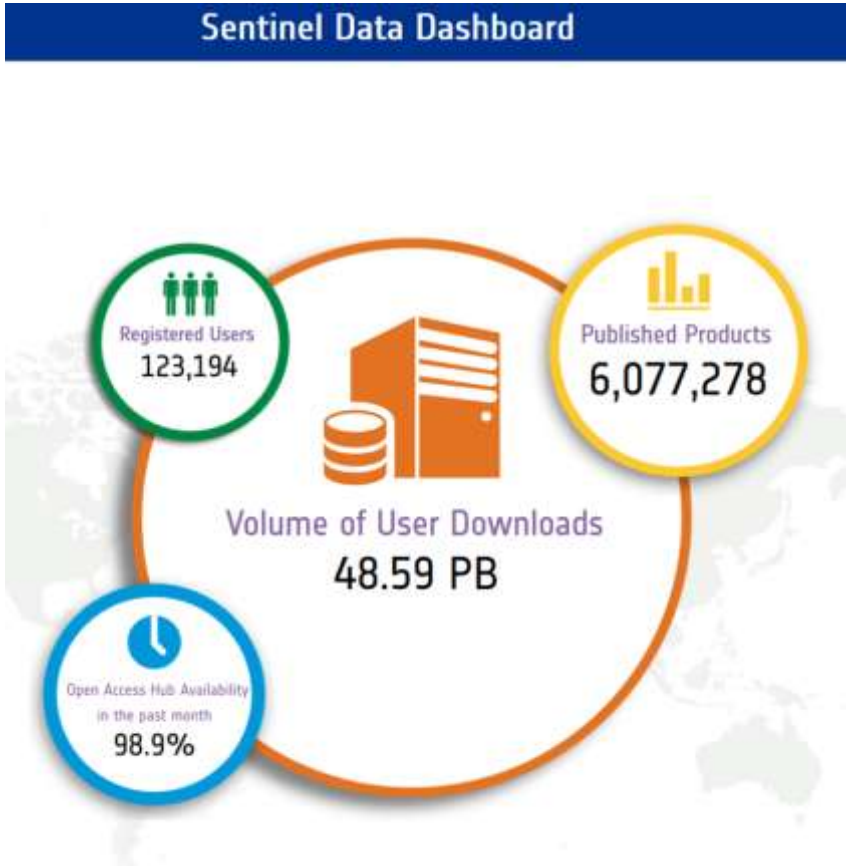
Sentinel-1 NRT & NTC
Sentinel-2
Sentinel-3 SRAL

Max 10 concurrent downloads

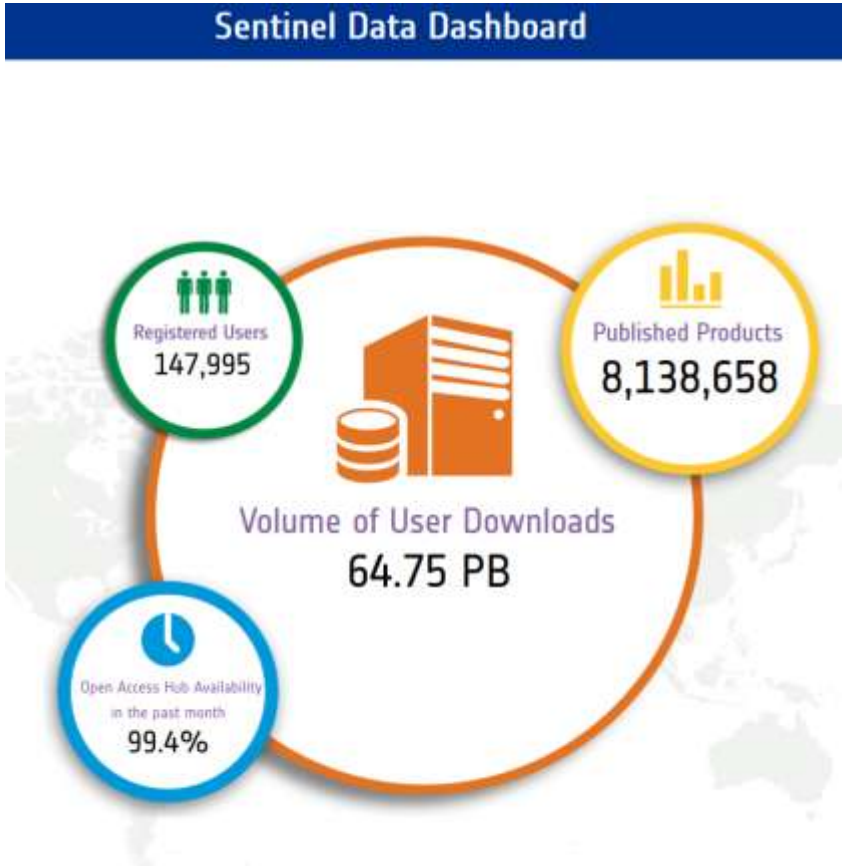
# Copernicus user uptake

European Commission

## February 21, 2018




## June 5, 2018



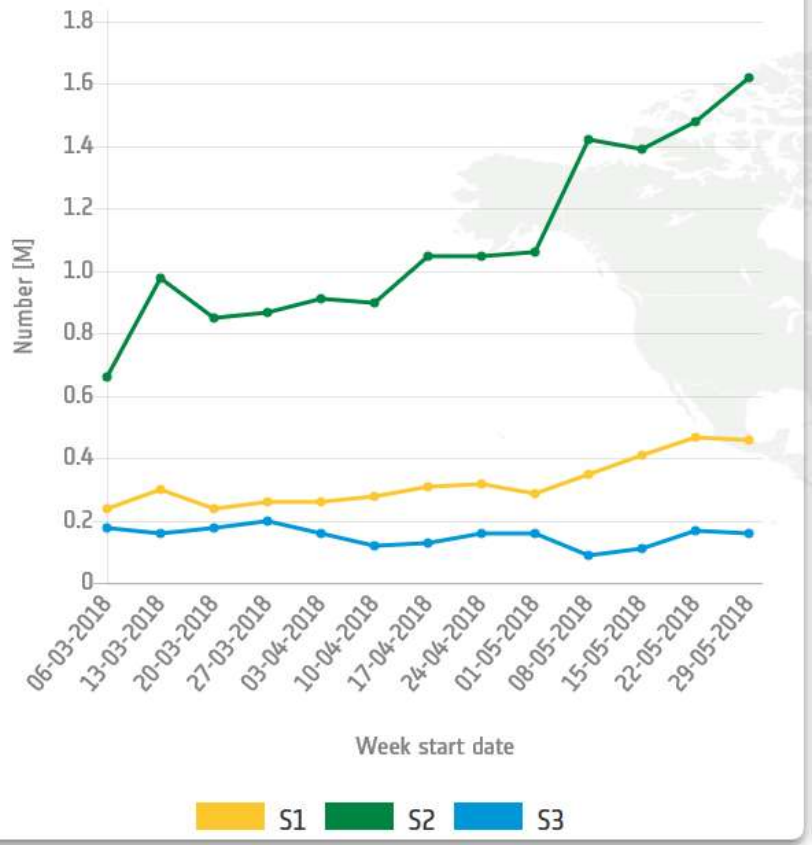

Joint Research Centre

European Commission

Total number of downloads

21,409,871

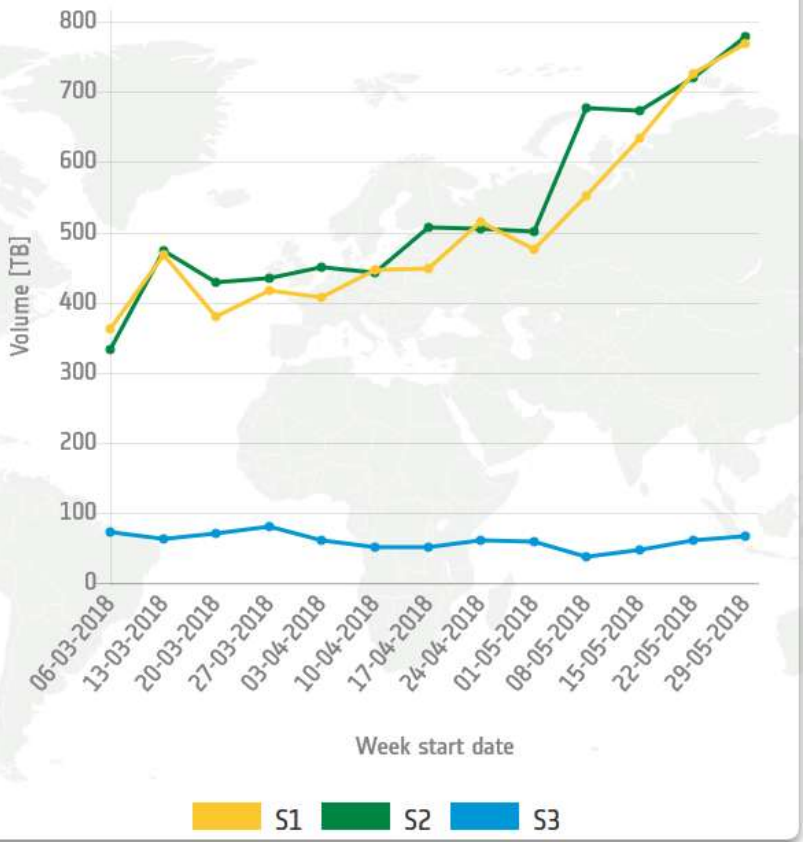
Number of products downloaded per Sentinel

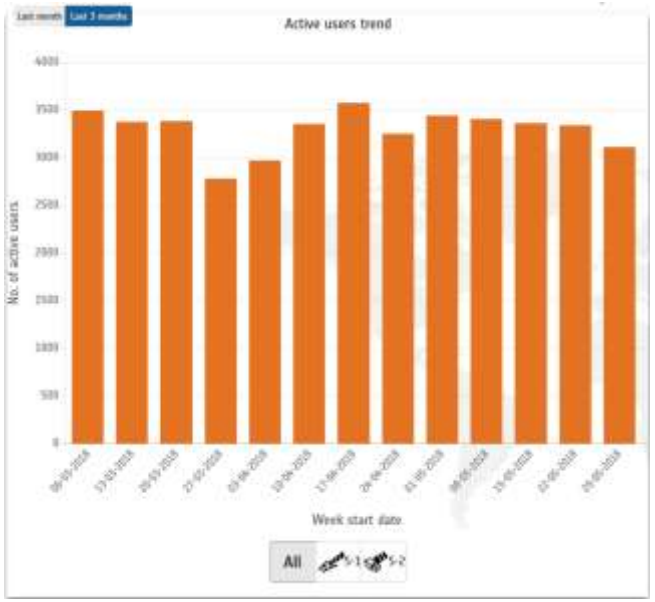


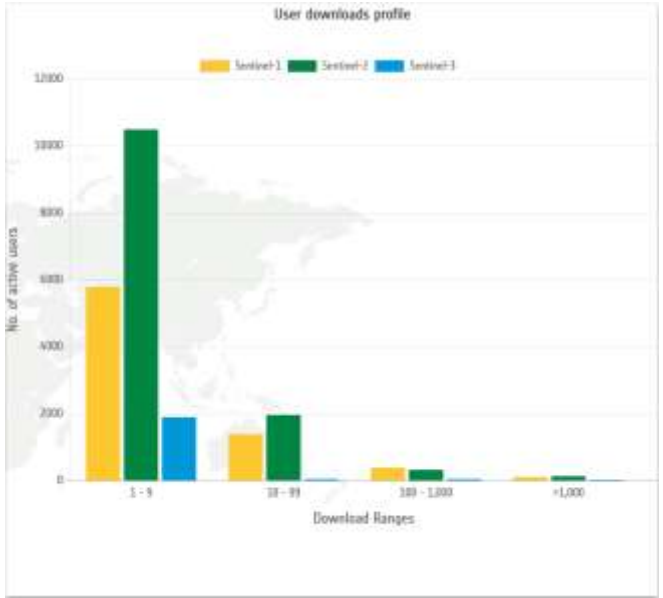

Total volume of downloads (PB)

13.98

Volume of products downloaded per Sentinel

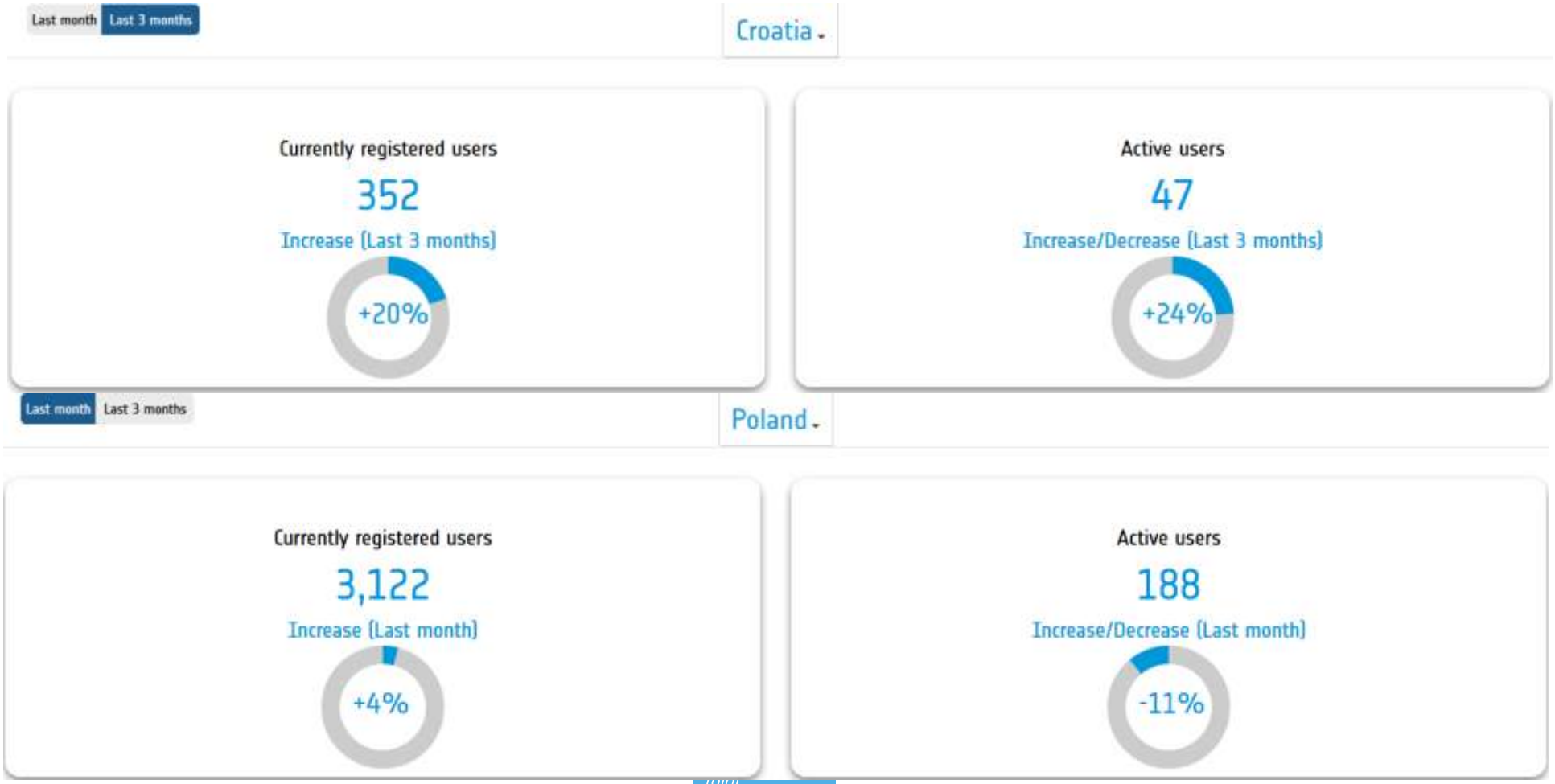



Joint Research Centre

# Active Users on Copernicus Open Access Hub: EU-ESA Member State focus

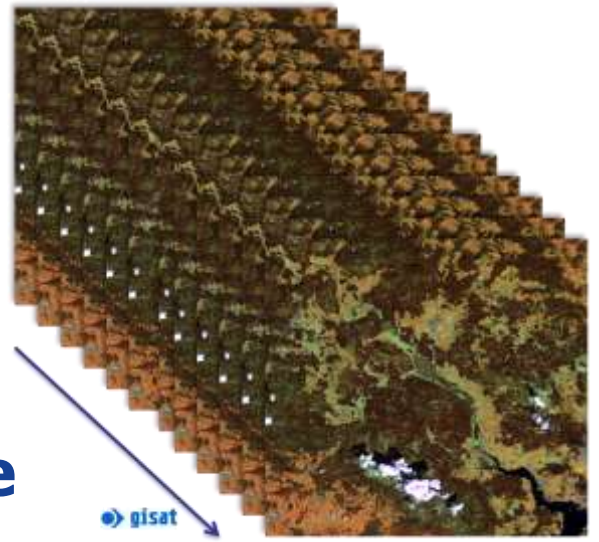



Joint Research Centre

# Copernicus Land Monitoring – service evolution

<u>New demands:</u>
LULUCF monitoring, reporting and verification - Climate and Energy 2020-2030 framework
Monitoring agri-environment-climate measures - CAP reform
Sustainable Development Goals – Agenda 2030

<u>Major challenges:</u>
Annual update frequency of selected products
Merging 20 m Global/European product portfolio
Automation and machine/deep learning
Copernicus **Data and Information Access Service**



# Copernicus - challenge

- Massive amounts of data
- Full, open and free-of-charge
- Ease of access and use

**Over 10 Petabyte/year of new data**
with just Sentinels-1, -2 and -3 fully operational (data are downloaded **many times over)**

- Different types of **dissemination** infrastructures
- Member States Collaborative GS
- **New technology** developments
- ICT and EO **cross-fertilisation**
- **Interoperability** with non-EO datasets
- Public programs as enablers
- Growth and jobs in **downstream** sector

**Copernicus Data and Information Access Services**

# DIAS Objectives

- Easy and user--friendly
- Maximize uptake and exploitation of Copernicus/ EO data in an efficient environment
- Stimulate the emergence of an ecosystem that facilitates activities by 3rd parties
- Bring together R&O, supply & demand, different data sources and know-how

# Core principles

- Access must be open and non-discriminatory
- Operation must be fair and obey competition rules including for institutional demand
- Transparency of governance and reporting
- Must promote Copernicus brand
- Intellectual property must be protected

# DIAS - Functional Context

## Public functions

Data holdings
- Sentinel data (-1, -2, -3, -5p)
- Copernicus Services Information
- Selection of Third party data

Services
- Discovery and View services, Basic downloads
- Basic Programming / application environment
- Free/open source tools
- Basic user support services

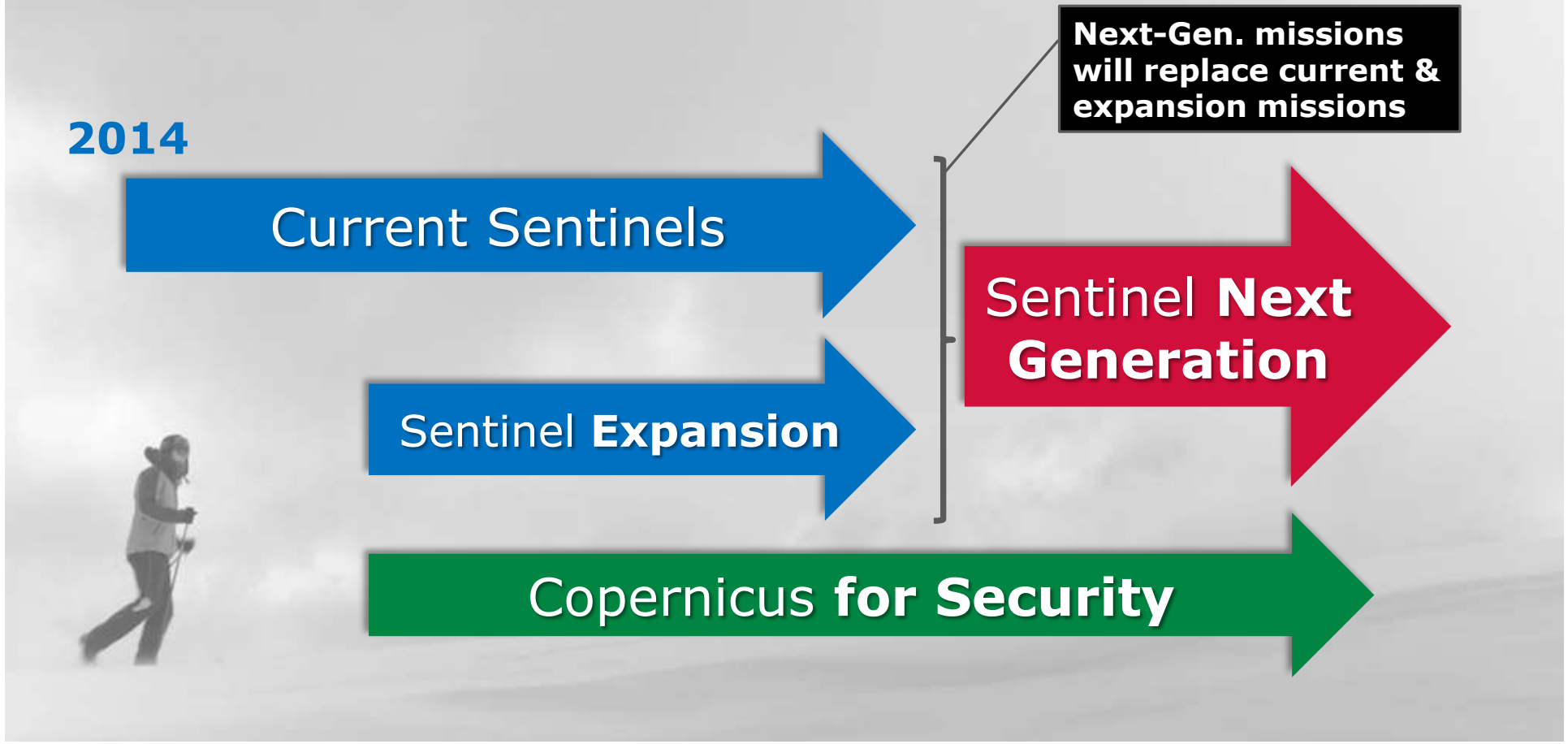
## Commercial functions

Data
- Hosting of Third Party data (e.g. Commercial, Institutional data)

Services
- Advanced development and application environment
- ICT resources (Storage & processing power)
- Advanced/commercial tools
- Third Party business hosting

Market place for Third Party value- adding services

# Copernicus Space Component Evolution



# Policy Needs and stated priorities: Space Strategy for Europe

Top priority:

**Stability of the program and long term commitment**
**(proposal of €16 billion from 2021)**

Baveno Manifesto!