106th DGINS Conference on Earth Observation for Official Statistics

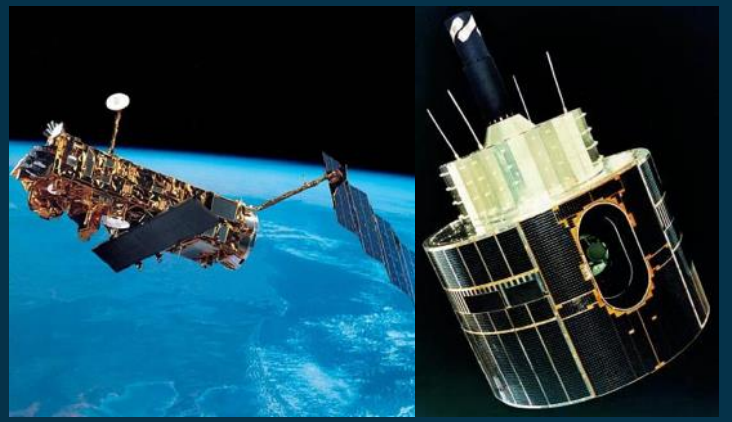
Earth Observation for Official Statistics – the context and the use

“The view of a space specialist”

Dr. Nicolaus Hanowski
European Space Agency EOP-G
Warsaw, Poland 27-28 October 2021

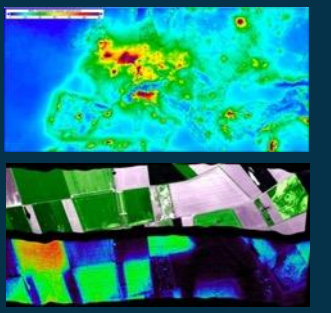
European Earth Observation Evolution and the Data Challenge

The Past (10 years ago)



Big individual satellites
for a few types of measurements
for specific communities
- ERS, ENVISAT
- Meteo-Satellites

Now



Families of big and small satellites
for a wide range of measurements and communities
- Copernicus Sentinels
- Earth Explorers
- Scout Missions
- Phi-Sats
- Meteo-Satellites

+ National Missions
+ Commercial Missions

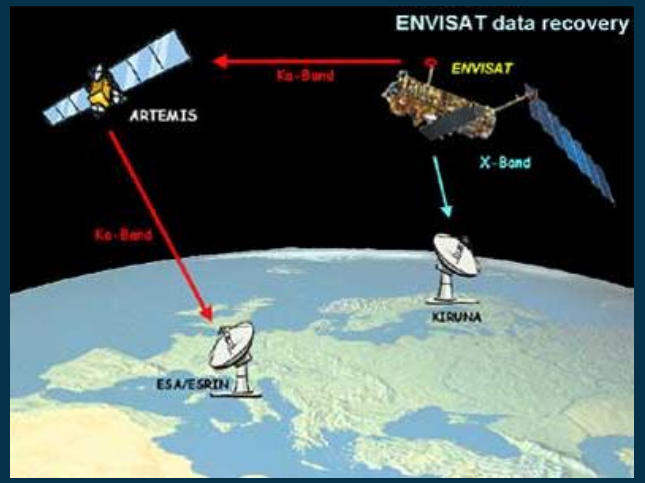
>40 satellites in preparation at ESA

→ Services, Science, Technology, Commercial Applications

→ Only domain in space in which Europe has gained a global leadership role !

European Earth Obs

The Past (10 years ago)

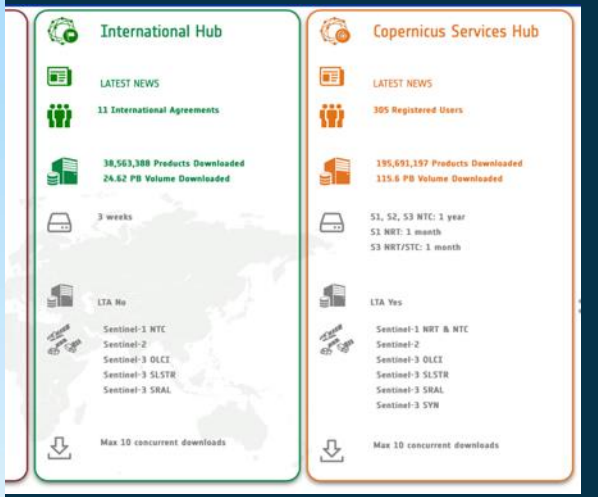


- Small Data (e.g 1Pbyte/10
- Few Users – 100s / 1000s
- Specialist Users
- No fusion with Data Industr
- ESA Data Infrastructure

→ Key challenge: transforma
into **reliable** and **relevant i**

1 day of ESA EO data dissimination on HD discs.

Data Challenge

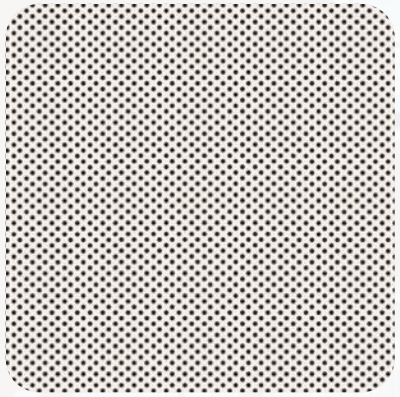


us 1Pbyte/day / 50 Mio products)
)0000s / >10000000s
specialist Users
ty of the Data Industry
tware as Services
nal & Commercial data

uropen assets and rules

Big Data Challenges

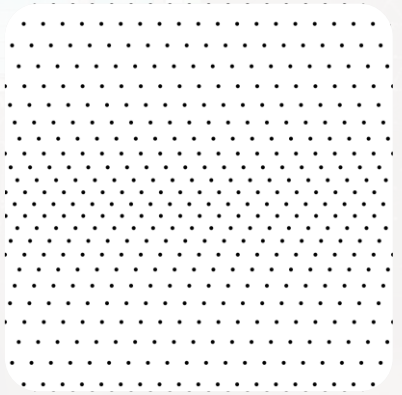
Volume



Data
at rest

Terabytes to exabytes of existing data to process & store

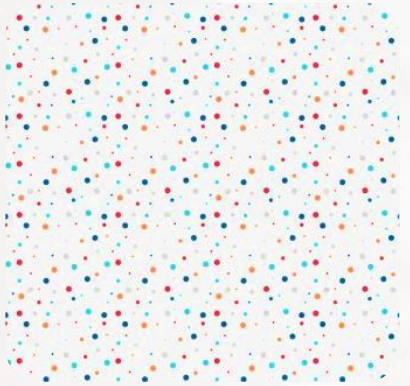
Velocity



Data
in motion

Streaming data across great distances in milliseconds

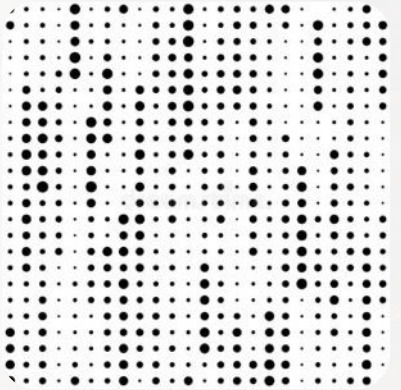
Variety



Data in
many forms

Structured, unstructured, text, multimedia, …

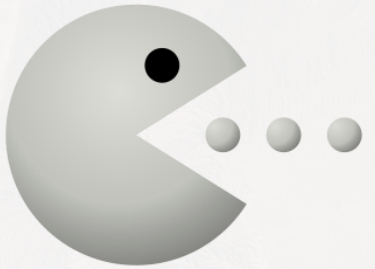
Veracity



Data
at doubt

Uncertainty due to inconsistency, incompleteness ambiguity, latency, deception

Value



Data into
benefits

Scientific insight, social benefits, commercial value

New and more Fexible Data Policies

- Free & open
- Smart licensing
- Anchor customer services
- More info than data focused

New Domains for EO Data Integration

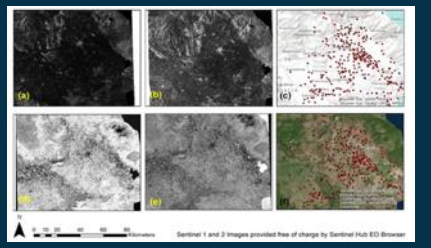
- Numerous Applications Tools
- Social and Public Media
- Industrial Service Products
- Operational Public Services

New Cloud- & Platform-based Data Access

- Quick acces to all data
- Efficient data management
- Less data download/traffic
- Tools for data processing

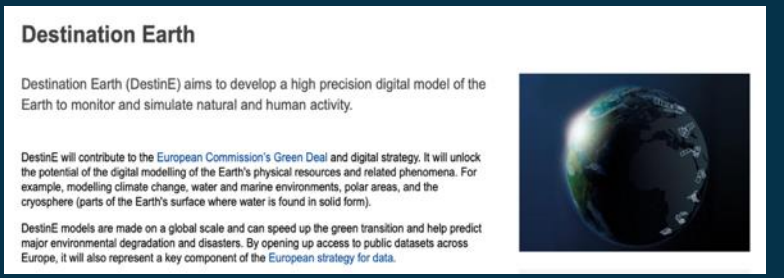
New and extensive EO Data Fusion

- Expanded data content
- Data quality synergies
- More complete data record
- Incentive for operator interaction



Progress toward "Predictive Earth Observation"

- Follow the weather & climate community
- Using EO data for simulations & modelling
- Mutual stimulation of digital and EO world
- European objectives are addressed at
- Continental, regional & local scale



Commonly stated obstacles to the scaling-up and operational use of EO in the Official Statistics

Restrictive data access policies (including cost)

Not enough "fit for purpose" products

Frequency of observations insufficient to track changes at appropriate scales

Needs for continuity of observations and long-term EO programs

Capacity building and training

Lack of analysis ready data

Lack of standardisation of EO data processing methodologies

Difficulties to discover and access EO data

Lack of clear and solid user-oriented methods and guidelines

Insufficient solid track records of successful case studies

2030 Agenda for Sustainable Development: 17 goals, 169 targets, 231 Indicators

New norms to integrate the principles of sustainable development into country policies and programs

The UN System of Environmental-Economic Accounting (SEEA)

System of Environmental Economic Accounting

European Natural Capital Accounting

esa

2012 — SEEA Central Framework (SEEA-CF) adopted by UN Statistical Commission

2013 — SEEA Experimental Ecosystem Accounting (SEEA-EEA)

2014

2015

2016

2017

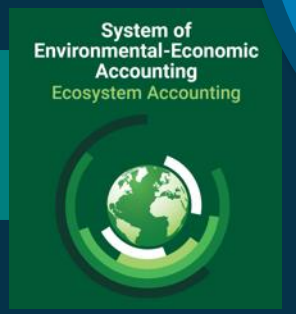
2018 — SEEA Experimental Ecosystem Accounting (SEEA-EEA) Global Revision

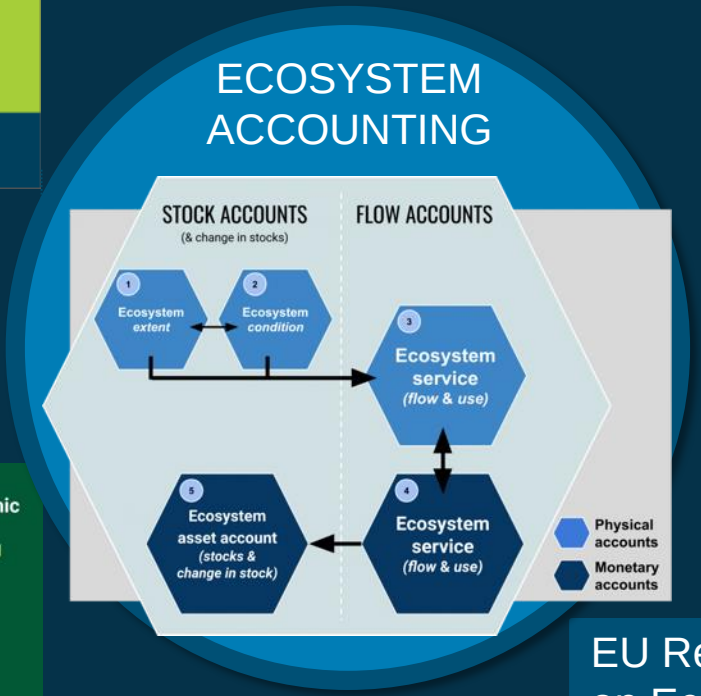
2019

2020

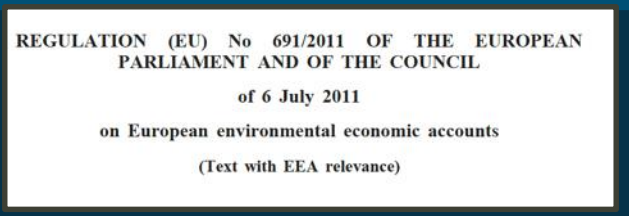
2021 — SEEA Ecosystem Accounting (SEEA-EA) Adopted by the UNSC

2022





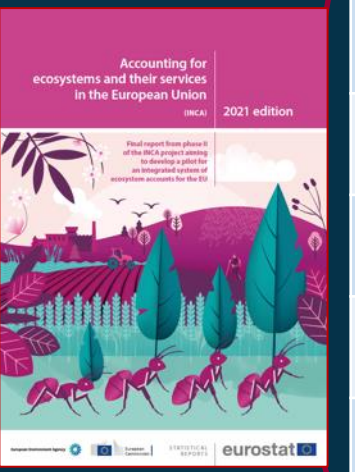
EU Regulation N 691/2011 on European environmental Economic Accounts


REGULATION (EU) No 691/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 6 July 2011

on European environmental economic accounts

(Text with EEA relevance)



EU Regulation N 691/2011 amendment on Ecosystem Accounting

2011

2012

2013

2014

2015

2016

2017

2018

2019

2020

2021

2022

International collaboration to scale up EO innovation for the full achievements of the 2030 Agenda on Sustainable Development and support NSOs

GEO GROUP ON EARTH OBSERVATIONS ⟷ CEOS The Committee on Earth Observation Satellites

UN Statistical Division

WG on Geo-spatial Information (WGGI)

IAEG-SDGs
Inter-agency Expert Group on SDG Indicators

UN Habitat | UNCCD | UNEP
UN ISDR | WHO | FAO
UN Specialized Agencies

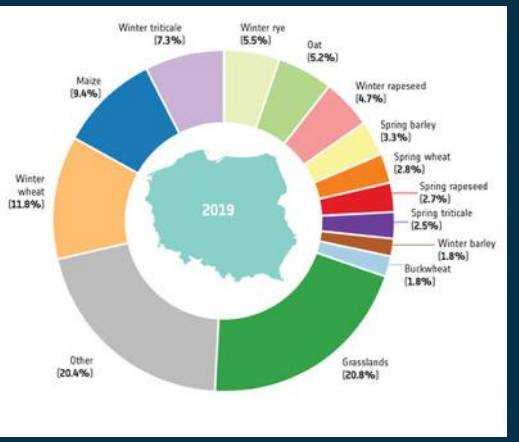
National Statistical Offices
Line Ministries

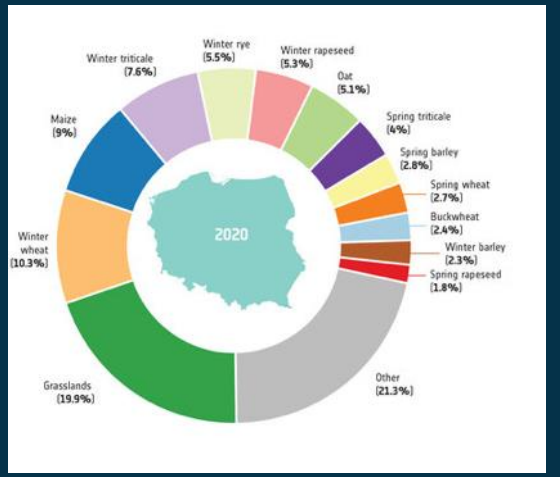
WBG | GPSDD
UN OOSA | GEE
SDG Stakeholders

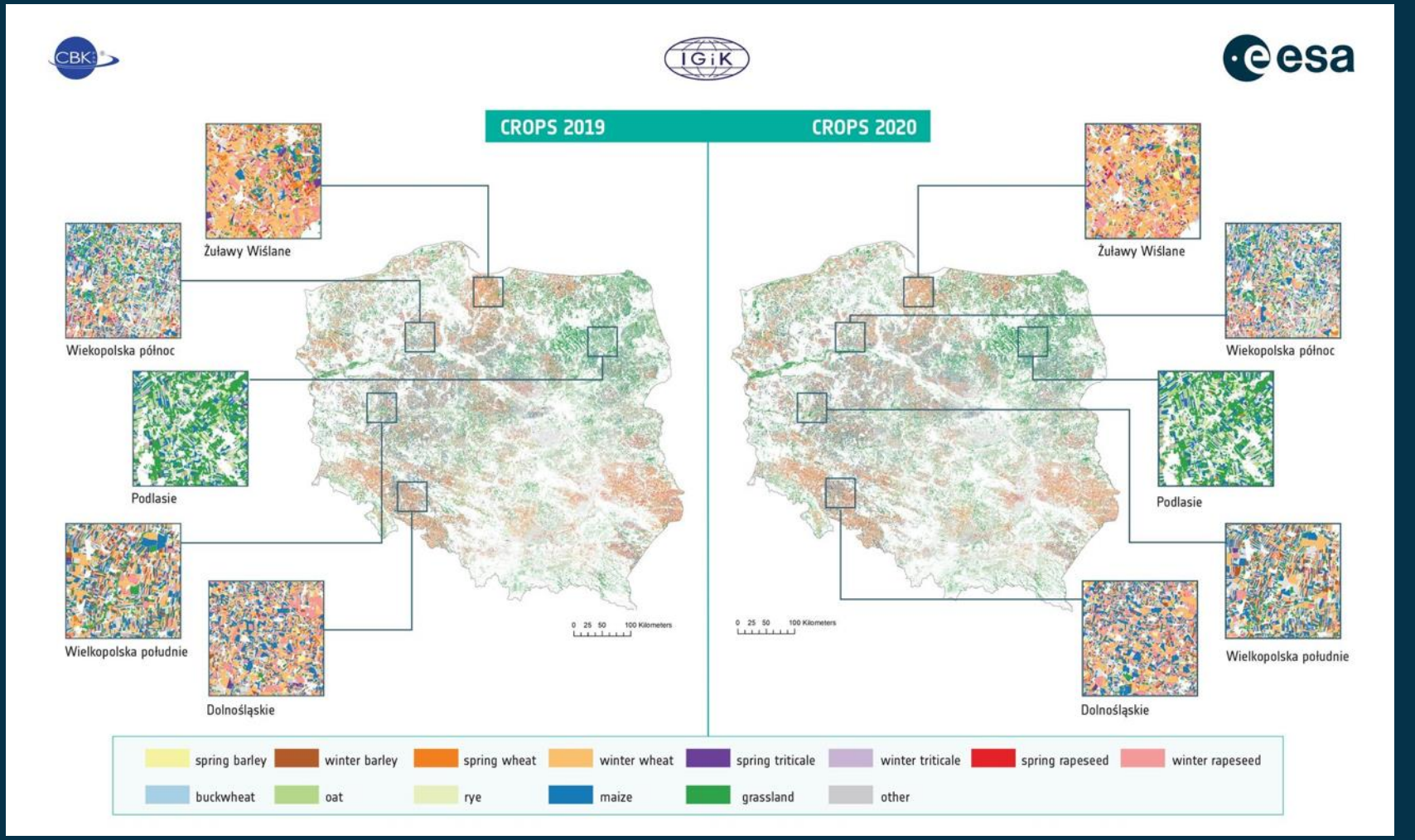
UN Agencies	Countries	EO Community
Global and Regional *fit for purpose* Datasets	Mainstreaming in National Systems & Processes	EO Enabling Infrastructures Tools & Platforms
Good Practices Guidance	Skills Transfer & Capacity Building	EO Knowledge Sharing

EOStat-Agriculture Poland

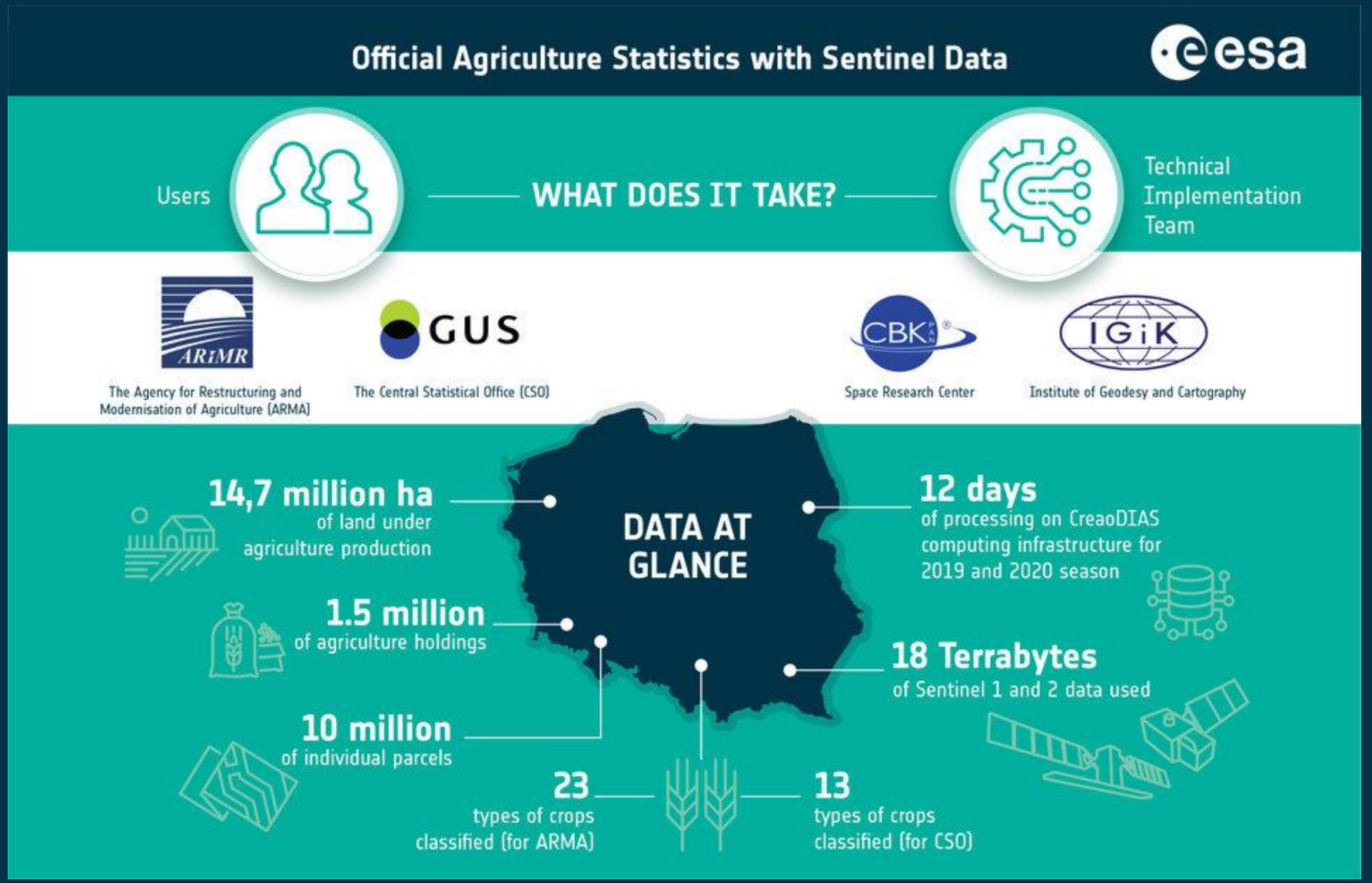
Sentinel data enables new system for agricultural monitoring in Poland







EOStat-Agriculture Poland



Earth Observation for Smart Statistics project

Objective

EO for Smart Statistics is a new ESA project (2021-2023) intended to develop and demonstrate applications that advance the use of Earth Observation data sources in European Statistical System

Where is the novelty?

- To advance the concept of “Smart Statistics” which involves real-time, automated, interactive technologies as new statistical data sources
- Demonstrate fusion of EO with third party data as data sources of official statistics (in situ data, smart sensor data)
- Develop new indicators
- Address data life-cycle considerations = trusted data

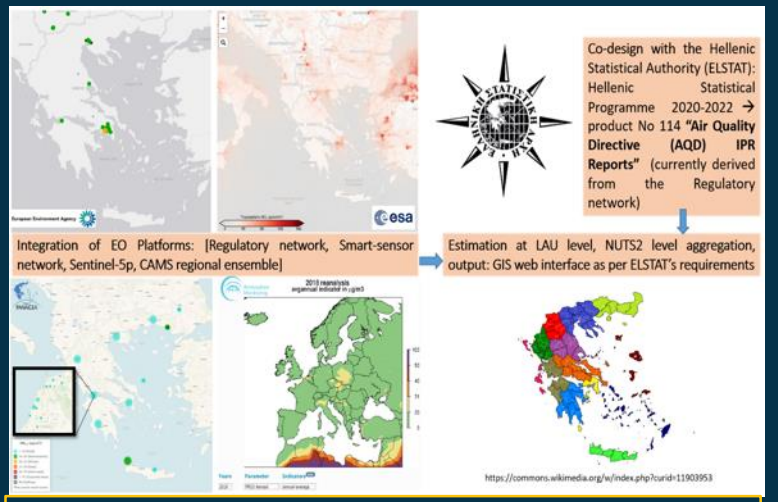
The recently endorsed by the United Nations Statistical Commission (March 2020) the Degree of Urbanisation methodology utilizes EO (Global Human Settlement Layer)

- User consultation process with champion European statistical offices (PL, FI, GR) as well as Eurostat

ESSnet Big Data II, EO for Official Statistics at Research and Methodology level (WPH)

EO for Smart Statistics Use Cases

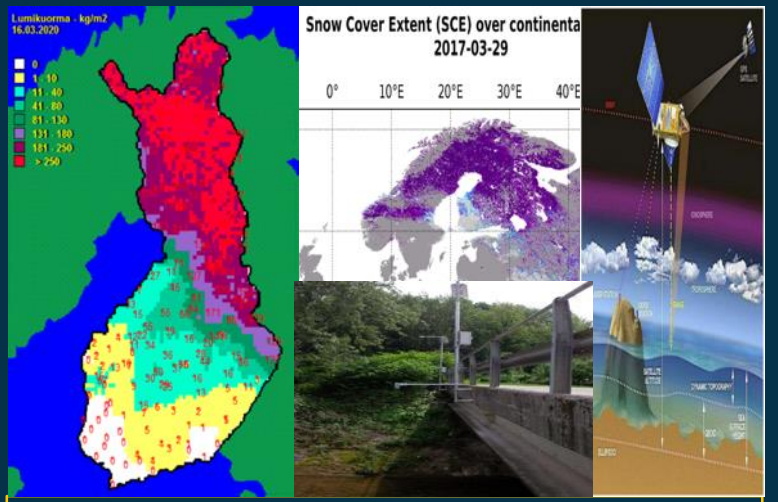
Greece, Air Quality Statistics using multiple EO platforms
NOA and ELSTAT (Greek Stat. Office)



Sentinel-5p, In-situ low cost smart sensors, Regulatory AQ network, Copernicus Atmospheric Monitoring Service ensemble reanalysis AQ product

Obtain air quality statistics (for $PM_{2.5}$, PM_{10}, NO_2, and O_3) at local administrative unit (LAU) and NUTS2 level instead of the current bulk levels. Capture underrepresented areas, identify AQ hot spots

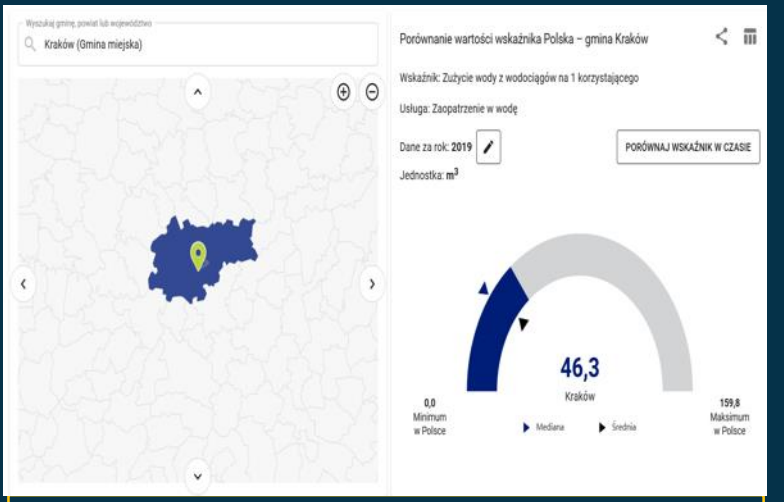
Finland, Enhanced smart Statistics for Snow, Hydrological Drought Statistics
FMI and SYKE / Statistics Finland



Copernicus Global Land Service products on SWE and Snow Cover Extent, In situ snow measurements, Webcam data, Reanalysis models powered by EO, EO based climate indices, Satellite Altimetry (Jason/Sentinel-3), In-situ water sensors

Improvement of snow-related statistics and of generating new snow-water equivalent statistics. Water statistics improved capability of quantifying rivers/lakes status and volume and managing surface water resources.

Poland, Green Indicators for Wellbeing
IGiK and Statistics Poland



Sentinel-2, Sentinel-3 (OLCI/SLSTR), MODIS, ERA-5 reanalysis, GIOS ground network of air quality

AQ products generated by NOA and hydrological drought index generated by FMI

More accurate, more timely and less expensive national statistics on vegetation-related well-being indicators

Key Considerations

BUCHAREST MEMORANDUM
As adopted by the European Statistical System Committee (ESSC) meeting on the 12th October 2018

EUROPEAN STATISTICAL SYSTEM

"…That new data sources represent a unique opportunity to produce new and improve existing statistics within a collective collaborative framework…"

Key Considerations for the relationship of EO Systems wrt Statistical Systems:

- Accessibility of EO Data
- Integratibility of EO Data into Statistical Systems
- Integratibility of Statistical Data into EO Systems
- Relevance of EO Data (timeliness, completeness, precision, accurracy, etc.)
- Authenticity & Integrity of EO Data
- Continuity of EO Data
- Potential of future EO data