



# EU GLOBAL ACTION ON SPACE

Africa

## EU space data in action: supporting sustainable economic growth & a greener future for Africa



Online



19 May 2022,

1:30 – 3:30 pm (CEST); 2:30 – 4:30 pm (UTC); 12:30 – 2:30 pm (UTC+1)



Funded by the European Union



Promoting the European Union Space Programme





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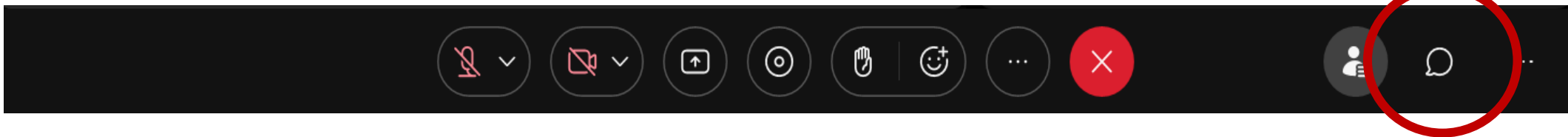
1:30 – 3:30 pm (CEST); 2:30 – 4:30 pm (UTC); 12:30 – 2:30 pm (UTC+1)





# Housekeeping rules

- The webinar will start soon
- Use the chat to ask questions





EU GLOBAL ACTION  
ON SPACE

# Opening remarks

Tomas Dimitrov

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EU GLOBAL ACTION  
ON SPACE

# The EU Space Programme and the EU Global Action on Space

Luis Cuervo Spottorno

Funded by the European Union



Promoting the European Union Space Programme





EU GLOBAL ACTION  
ON SPACE

# The EU Space Programme and its components

*Luis Cuervo Spottorno  
Principal Administrator – Global Action  
Directorate General for Defence Industry and Space  
European Commission - Brussels*

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8

Promoting the European Union Space Programme



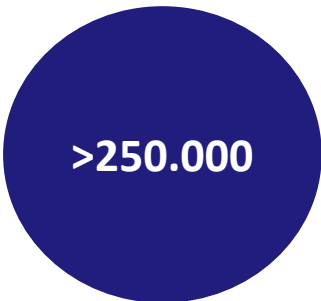




# The EU Space Programme

The EU Space Programme and the services and applications that it supports, help to advance the European Union's objectives and to achieve its key policy goals and priorities

Budget for EU  
Space investment  
between 2021-2027



Jobs supported by  
EU Space

## Flagship components



**10% of the EU GDP is enabled by satellite navigation**



**Operational in 360+ airports & helipads in 23 countries**



**No.1 global provider of space data and information**

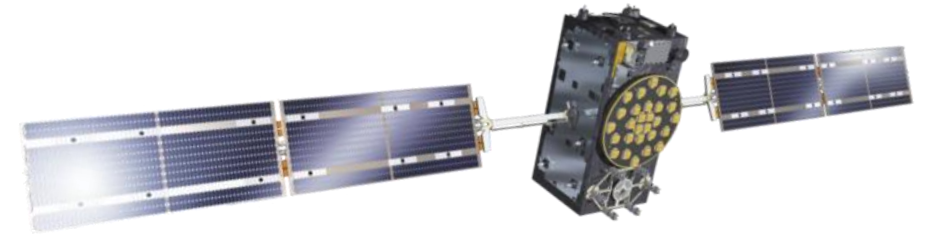




## Galileo and EGNOS

Galileo is the Global Navigation Satellite System (GNSS) of the European Union. It offers precise timing, positioning and emergency services to citizens, private companies and public authorities. Galileo also features a Search & Rescue service to assist individuals in distress. Galileo is able to provide up to 20cm high accuracy positioning.

The European Geostationary Navigation Overlay Service (EGNOS) is a satellite-based augmentation system operating in the European region. EGNOS currently enhances the positioning data of the US GPS. In the future, it will improve the performances of Galileo



<p>Number of satellites, control centres and sensor stations</p> <p><b>30</b></p>	<p>Value of the Global GNSS market</p> <p><b>€175 billion</b></p>	<p>Estimated revenue from services relying on GNSS technology by 2029</p> <p><b>€166 billion</b></p>
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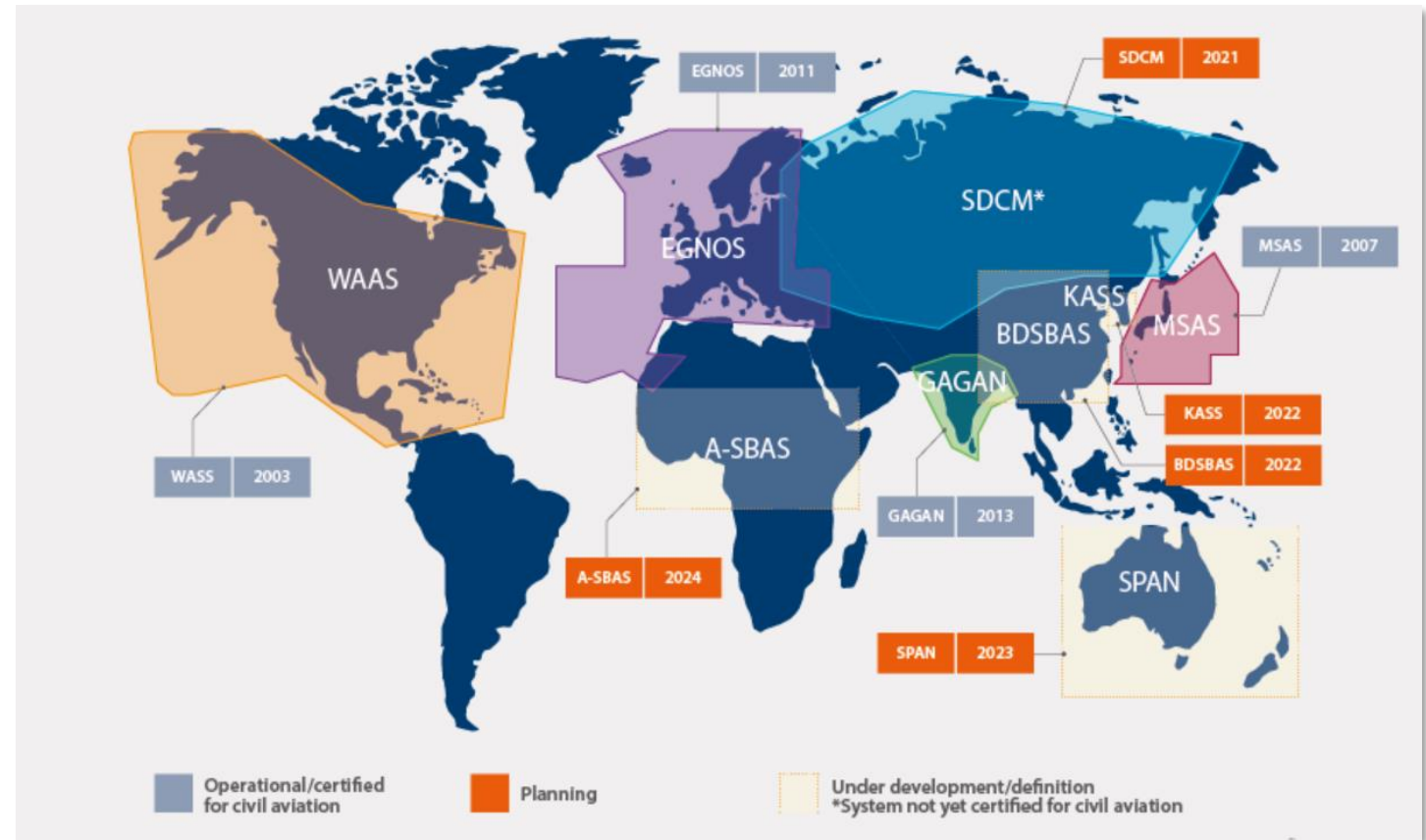
## Existing SBAS in the World

Interoperable: the SBAS equipment will work:

- in any of the regions where there is a SBAS service
- With other GNSS source

In the future (>2026):

- EGNOS will augment also Galileo
- EGNOS will broadcast dual-frequency corrections



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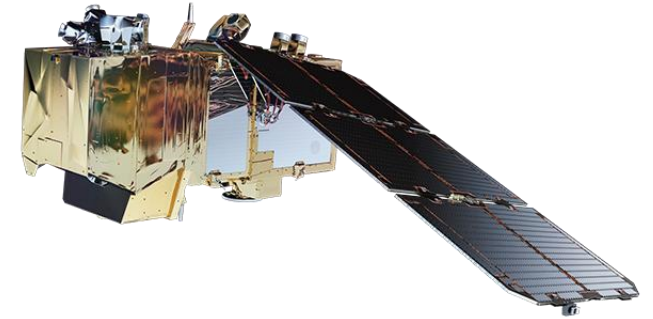
Promoting the European Union Space Programme





# Copernicus

Copernicus provides high quality and free Earth Observation data to a wide range of stakeholders. It builds upon a space component (observation satellites) and an in-situ component (ground, airborne and seaborne stations). The data and imagery collected are channelled into six thematic services: land, marine, atmosphere, climate change, emergency, and security



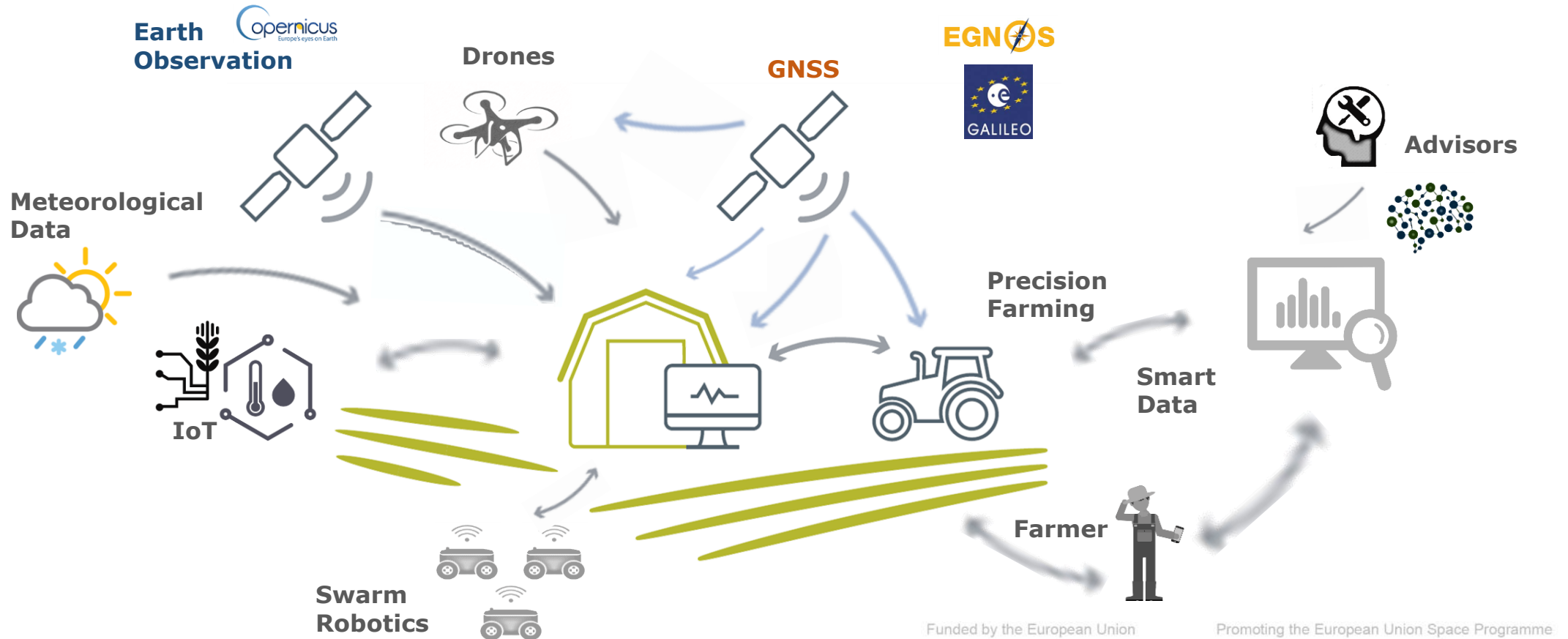
<p><b>Cumulative economic value generated</b></p> <p><b>€16.2 – 21.3 billion</b></p>	<p><b>Earth Observation Companies in Europe exploiting Copernicus Data</b></p> <p><b>72%</b></p>	<p><b>Volumes of downloads from Data Access Systems</b></p> <p><b>20 TB of data daily</b></p>
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# EU Space Programme Synergies

GNSS and Copernicus are core components in digital farming



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# The EU Global Action on Space supports the Union Space Programme globally

## Context

- The European Union is the **second Space economy in the world**
- **Copernicus, Galileo and EGNOS** have positioned the EU as a **global leader on Space**
- EU Space capabilities and services are **available worldwide**
- We seek to **provide opportunities globally for EU space around the world**, to maximize benefits to society whilst contributing to EU priorities

## Objectives

- 1. Promote the EU Space Programme worldwide and boost market uptake of its components i.e. Copernicus, Galileo and EGNOS*
- 2. Provide targeted space market information to facilitate the internationalisation of the EU Space sector*
- 3. Enable concrete business opportunities for the EU space sector in new markets*





## *Benefits for SMEs*



Tailored business and technical support



Access to the specific markets analyses



Participate in 50+ networking and education events



Conclude international commercial agreements



Access to pool of international experts

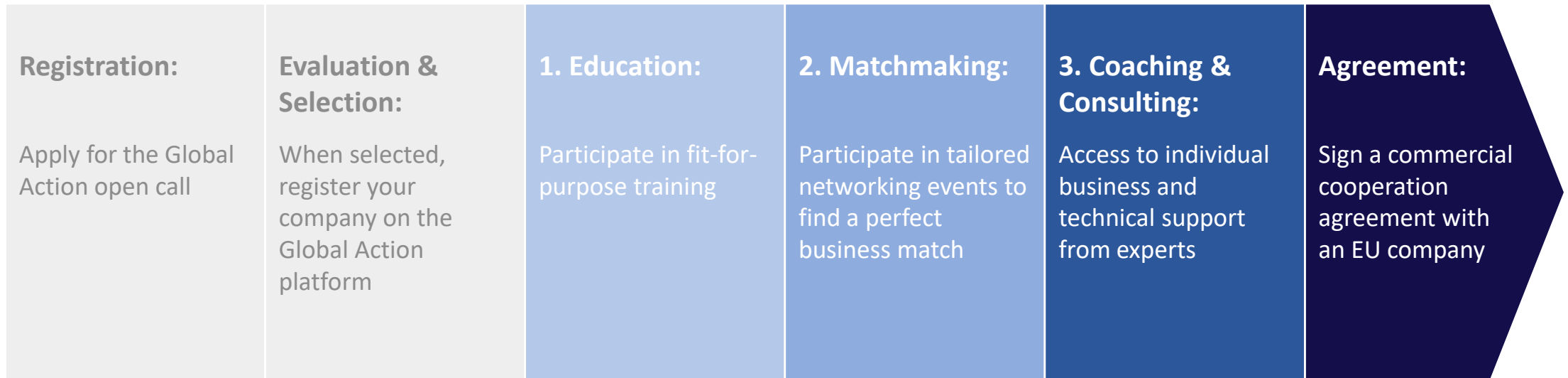


Discover the benefits of the EU Space Programme and its components





## *Business coaching services*



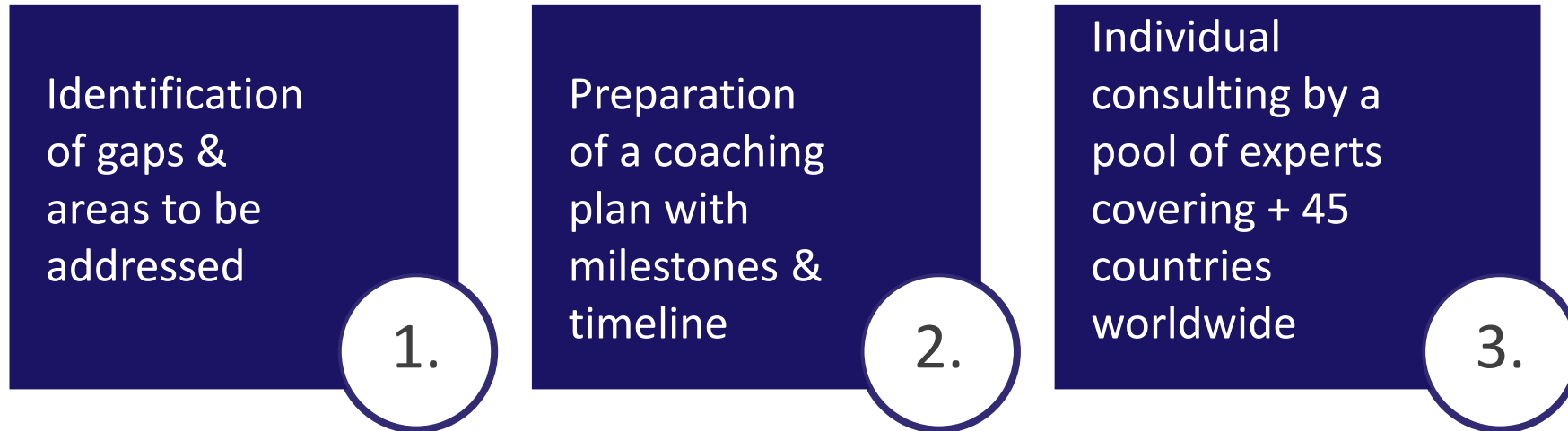
[www.eu-global-space.eu](http://www.eu-global-space.eu)







## *Individual coaching process*





## ***Business coaching - eligibility criteria***



### **Open Calls for EU and non-EU Entities**

December 2021 – November 2023

- Must be a **legally established** company or organisation
- **Private or public companies of all kinds and sizes**, including entities related to the space sector, space agencies, research organisations, universities, and technology centres not subject to restrictive measures by the EU
- Must demonstrate financial figures for 3 last years (turnover, net profit, total balance)

[www.eu-global-space.eu](http://www.eu-global-space.eu)





# Contacts



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**European Commission - Brussels**  
**DG for Defence Industry and Space**

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Global Action

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Spottorno@ec.europa.eu](mailto:Luis.Cuervo-Spottorno@ec.europa.eu)

Phone: +32 2 29 82084



*Andreas Becker*

Team Leader of the Global Action  
Email: [teamleader@eu-global-space.eu](mailto:teamleader@eu-global-space.eu)  
Phone: +32 476 446 317





EU GLOBAL ACTION  
ON SPACE

# An introduction to Copernicus

Astrid Christina Koch

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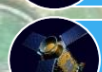


# The EU Earth Observation Programme Copernicus

Astrid – Christina Koch  
International Relations - Copernicus  
Directorate-General for Defence Industries and Space  
**Action – Africa Webinar – 19 May 2022**



# COPERNICUS architecture

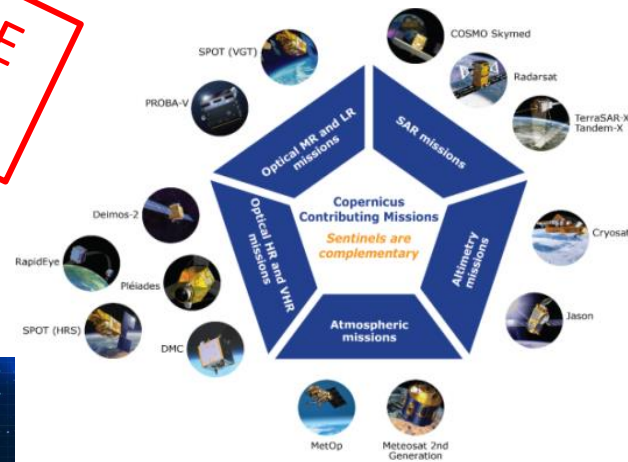
	<b>SENTINEL-1:</b> 4-40m resolution, 3 day revisit at equator	2 Sats in orbit
	<b>SENTINEL-2:</b> 10-60m resolution, 5 days revisit time	2 Sats in Orbit
	<b>SENTINEL-3:</b> 300-1200m resolution, <2 days revisit	2 Sats in Orbit
	<b>SENTINEL-4:</b> 8km resolution, 60 min revisit time	1st Launch in 2020
	<b>SENTINEL-5p:</b> 7-68km resolution, 1 day revisit	1 Sat in Orbit
	<b>SENTINEL-5:</b> 7.5-50km resolution, 1 day revisit	1st Launch in 2021
	<b>SENTINEL-6:</b> 10 day revisit time	1st Launch in 2020

## Sentinels



**FULL, FREE AND OPEN**

## 6 services use Earth Observation data to



## Contributing missions



In Situ




Copernicus

# COPERNICUS DATA ACCESS: KEY LINKS

## Access to Satellite data


**FULL, FREE AND OPEN \***



Scientific and Other Access

<https://scihub.copernicus.eu/>

**esa**



Copernicus Space Component Data Access Portal\*  
CSC-DA

<https://spacedata.copernicus.eu/>

**FULL, FREE AND OPEN \***

**EUMETSAT**

- Copernicus Online Data Access (CODA)
- EUMETCast:  
[www.eumetcast.com](http://www.eumetcast.com)  
*Needs to get a station and pay a yearly fee*

## Access to Copernicus Services Data

- Land-related data: <http://land.copernicus.eu>
- Atmosphere-related data: <http://atmosphere.copernicus.eu>
- Marine-related data: <http://marine.copernicus.eu>
- Emergency-related data: <http://emergency.copernicus.eu>
- Climate change-related data: <http://climate.copernicus.eu> (Beta version)

**FULL, FREE AND OPEN**

\* Not for Security Services  
And  
Data purchased from third parties

(\*) Includes instructions on how to access Contributing Missions data

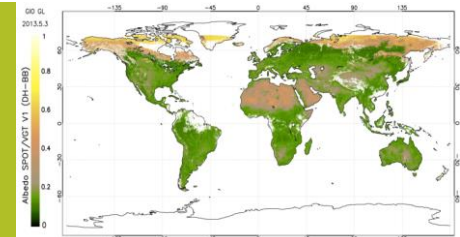


Land  
Monitoring

# LAND SERVICE OVERVIEW



Global Systematic Monitoring



Global Hot Spot



Pan-European land cover mapping



EU Local component





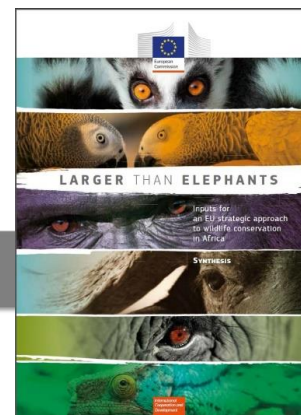
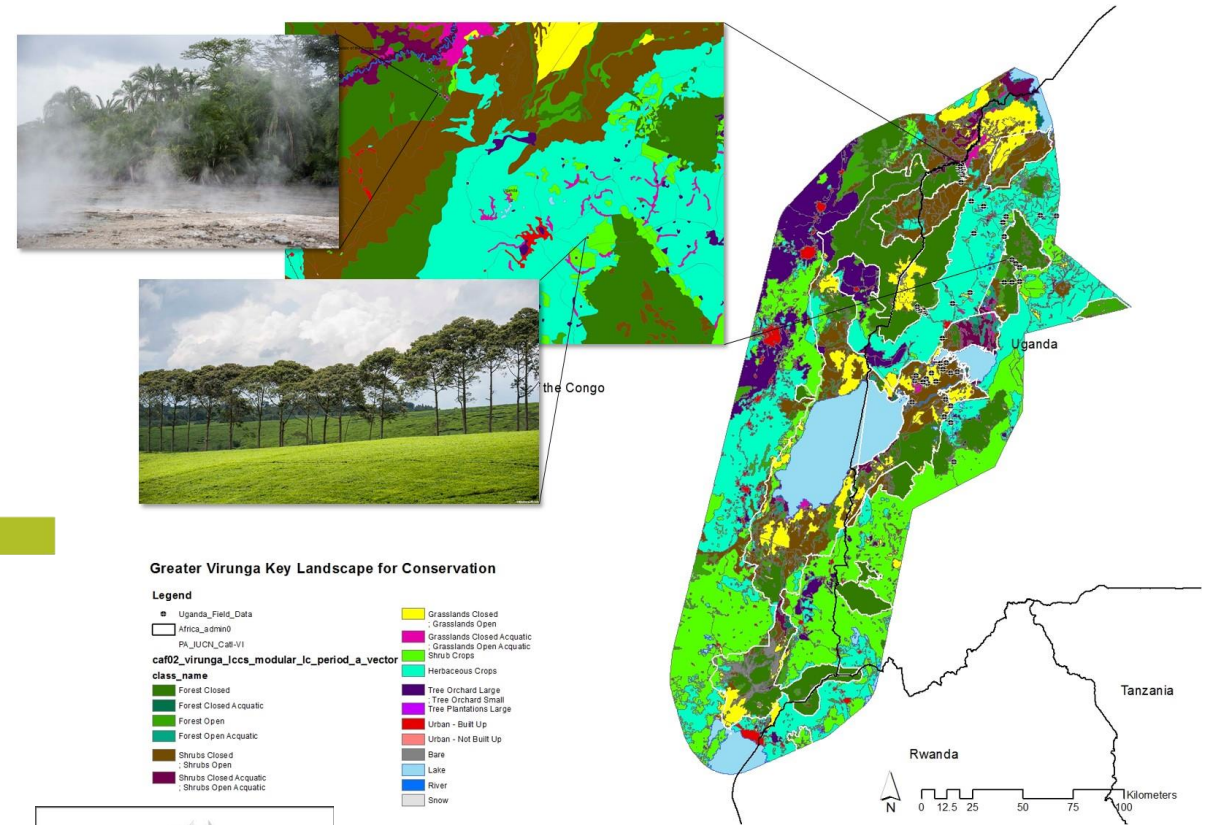
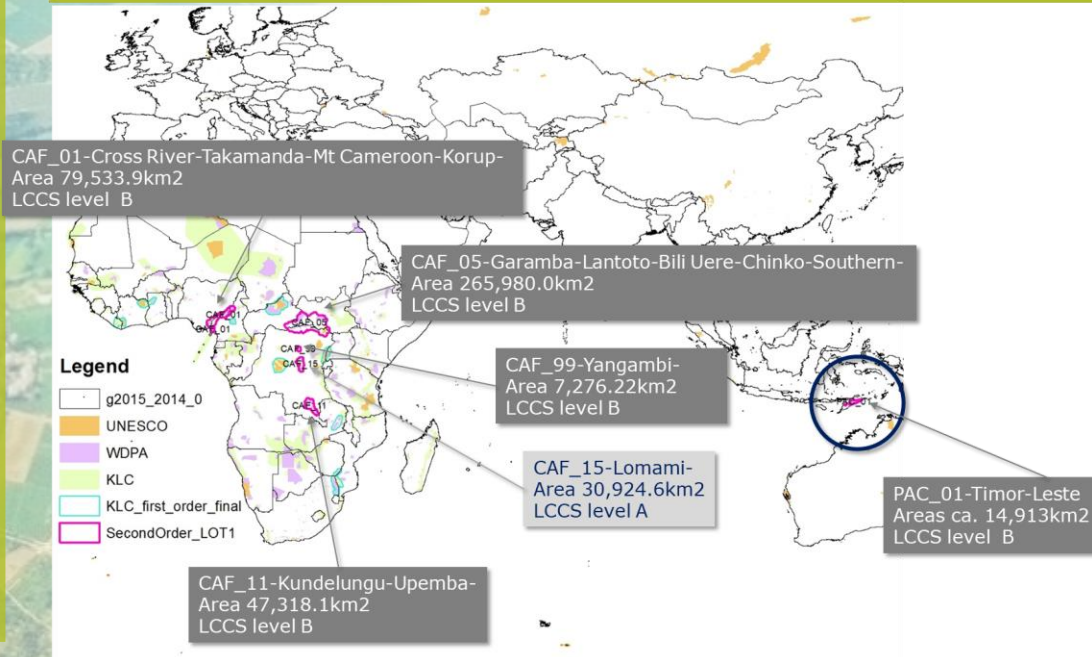


Land Monitoring

# GLOBAL LAND Hot Spot component

Provide detailed land cover information on specific areas of interest for EU outside the European Union, particularly in the domain of the sustainable management of natural resources.

## Second Specific Contract – AOI



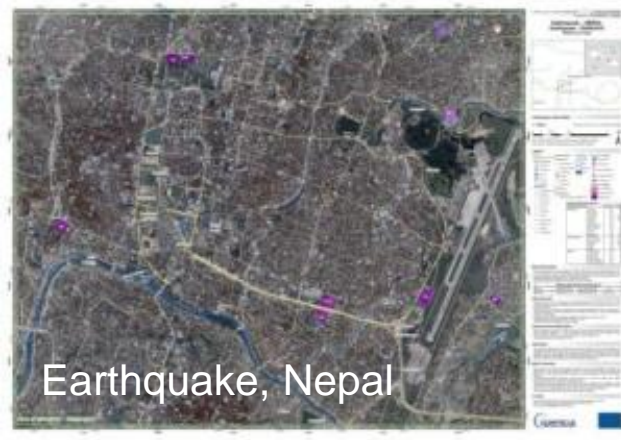
Africa : Areas of interest defined in collaboration with DG DEVCO to support EU Biodiversity Strategy in Africa.

Asia : EU funded project in collaboration with GIZ and Portuguese Coop. in Timor-Leste.



# EMERGENCY MANAGEMENT SERVICE IN BRIEF

On demand Risk mapping, Rapid mapping and Recovery mapping linked to disasters



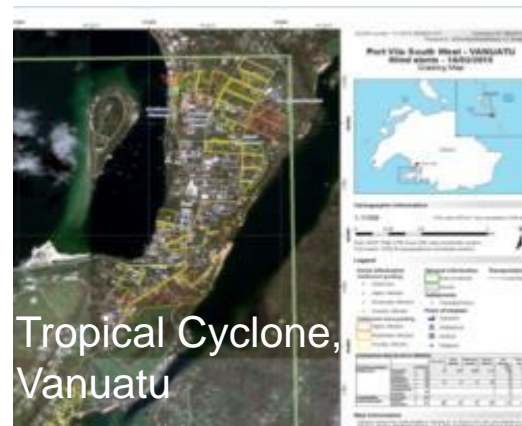
Earthquake, Nepal



Ebola, Guinea

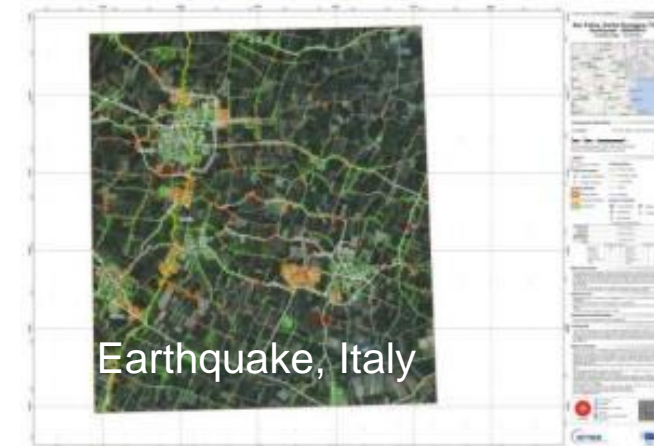


Floods, Norway



Tropical Cyclone, Vanuatu

ID	Activation name	Status
EMSN019	Germany - Detailed mapping of major chemical industry for selected sites	Completed
EMSN020	Portugal - Multiple natural hazard risk assessment - Planning and Recovery	Completed
EMSN021	Austria - Earthquake risk assessment for three areas	Completed
EMSN022	Bulgaria - Post-disaster analysis Flood	Completed
EMSN023	Poland - Risk maps World Youth Day (Krakow)	Completed
EMSN024	Germany - Nationwide assets mapping	Completed
EMSN025	Greece - Forest fire damage assessment	Completed
EMSN026	Spain - Post disaster assessment of toxic cloud dispersion	Completed
EMSN027	Somalia - Monitoring of drought mitigation measures	Completed
EMSN028	France - flood delineation and damage assessment	Completed
EMSN029	Spain - forest fire damage assessment using UAV imagery	Completed
EMSN030	Ukraine - ground deformation mapping and monitoring using DInSAR technique	Completed
EMSN031	Portugal - Forest fire damage assessment and landslide risk Madeira Island	Ongoing
EMSN032	Portugal - Forest fire damage assessment	Ongoing
EMSN033	Libya - Urban Profiling major cities	In preparation



Earthquake, Italy



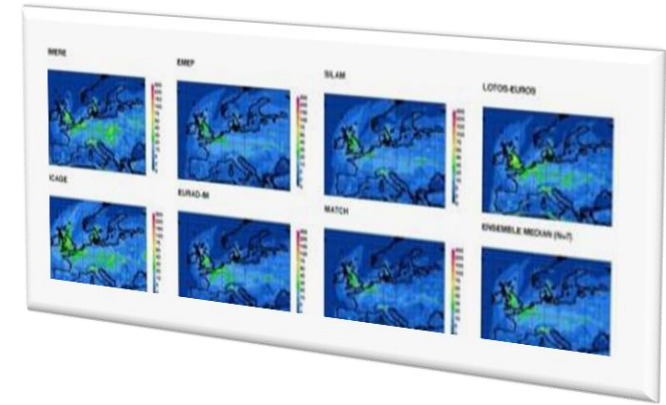
Atmosphere  
Monitoring

# Atmosphere Monitoring Service



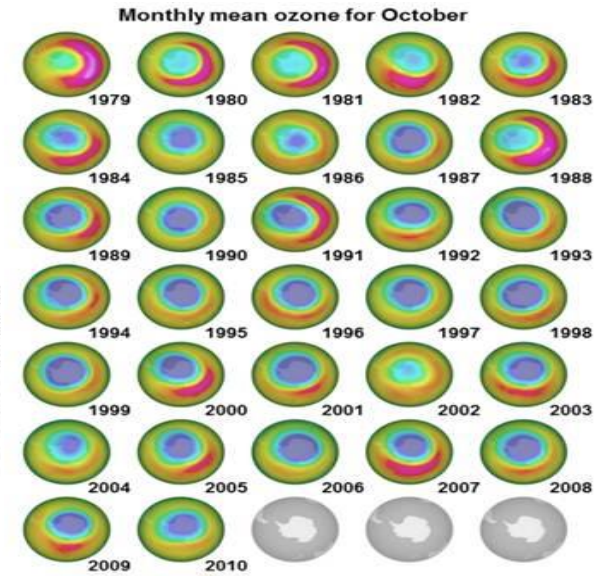
Air Quality  
forecast

and  
(Re-)Analysis



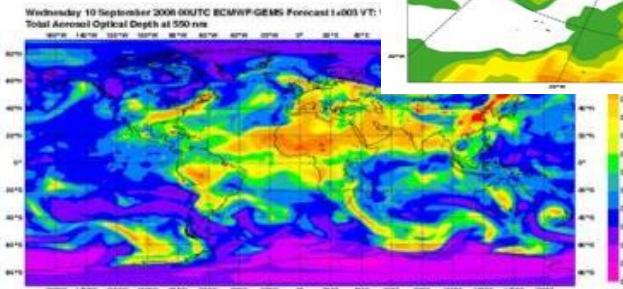
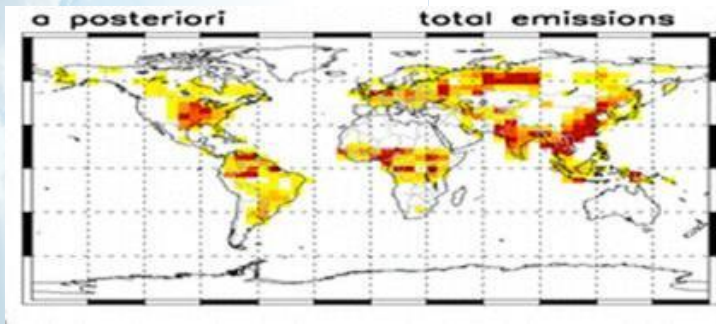
Stratospheric  
Ozone

UV Information



Emissions

Global  
Forecasts

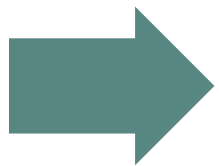




Marine Monitoring

# OCEAN DATA, A PUBLIC GOOD

**REANALYSES**  
~25 years



**REAL-TIME**  
Daily, hourly

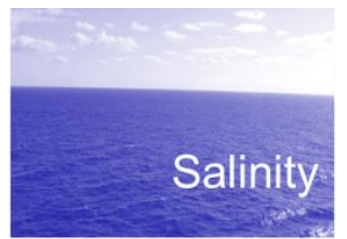
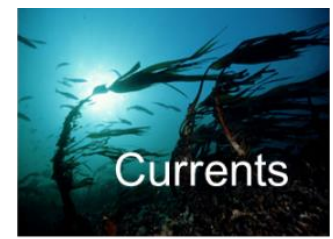


**FORECAST**  
5 to 10 days

## ESSENTIAL OCEAN VARIABLES



- 1 Global
- 2 Arctic
- 3 Baltic
- 4 NWS
- 5 IBI
- 6 Med Sea
- 7 Black Sea





Climate Change

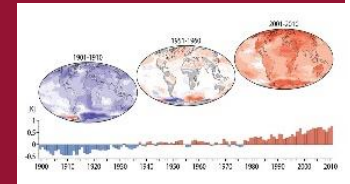
# CLIMATE CHANGE SERVICE OVERVIEW



**Consistent Estimates of the Essential Climate Variables (ECVs)**



**Global and Regional Reanalyses**



**Seasonal Forecasts And Climate Projections**



**Support to Mitigation and Adaptation Strategies**



# GMES and Africa

Long-standing EU-Africa Cooperation to support Africa's own capacity to exploit EO



2006:

*Maputo Declaration  
Call to extend the benefits of  
European GMES programme  
to ACP countries*



2007:

*Lisbon Declaration  
Launch of GMES & Africa initiative*

2018:

*Launch of first implementation  
phase with GMES & Africa program*

2021:

*Second implementation phase of GMES &  
Africa programme*

GMES/Copernicus programme is the main pillar of GMES & Africa

# GMES and Africa



EC-AUC Cooperation Arrangement signed on Access to Sentinel data and service products (June 2018)

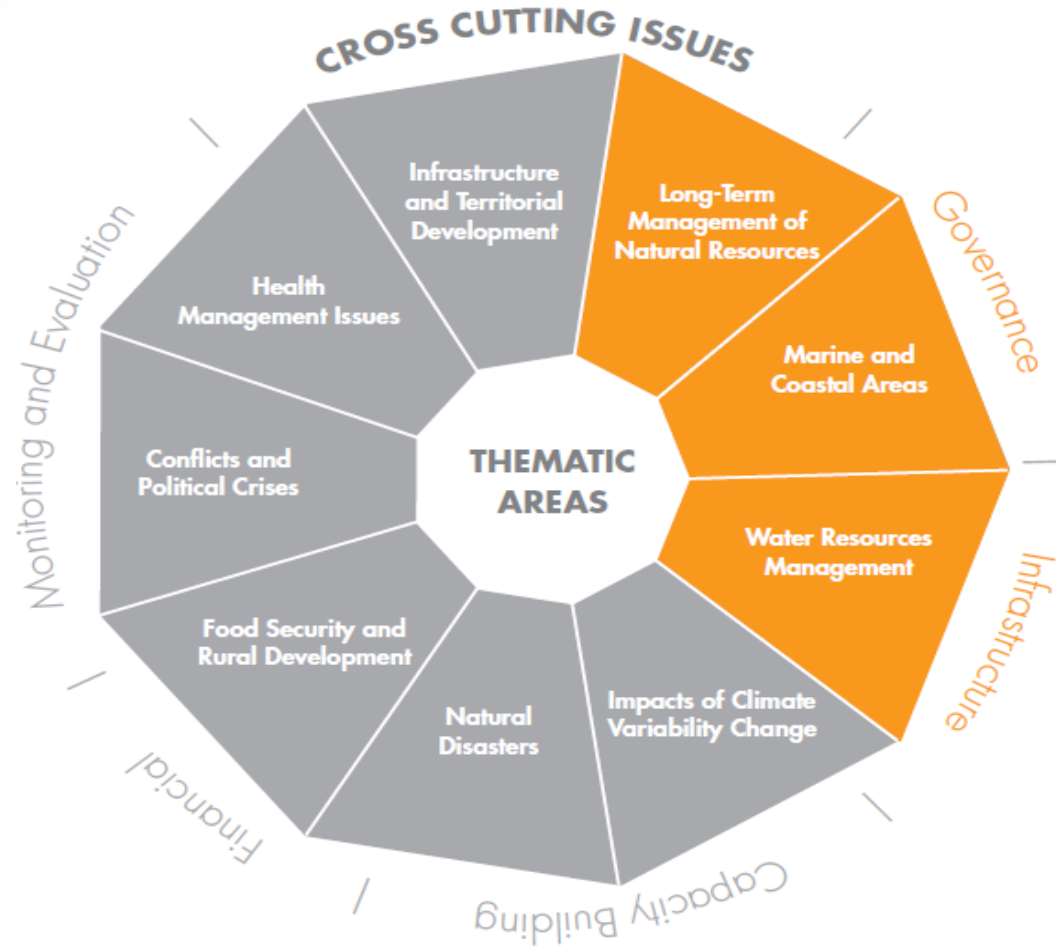
On-going implementation by  
ESA and EUMETSAT using  
technical capacities of  
Copernicus (Hub, DIAS ...) and  
agency capacities  
(EUMETCAST System)



# GMES and Africa Thematic areas



**GMES**  
AND AFRICA



**African Union**



Co-funded by  
the European Union







# GMES AND AFRICA

# Consortia & Institutions



Leaders of Consortia	Region
OSS-Tunisia NAKSS-Egypt	Northern Africa
CSE-Senegal MOSI-Ghana CSSTE-Ile de Ré-Nigeria	Western Africa
CICOS-Cote d'Ivoire AGBIOI-Gabon	Africa
ICPAC-Kenya MCS-Mauritius ICMID-Kenya	Eastern Africa & South western Indian Ocean
CSIR-South Africa SACC-Botswana SASSCAL-Namibia	Southern Africa

**REGIONAL CENTRE FOR MAPPING OF RESOURCES FOR DEVELOPMENT**

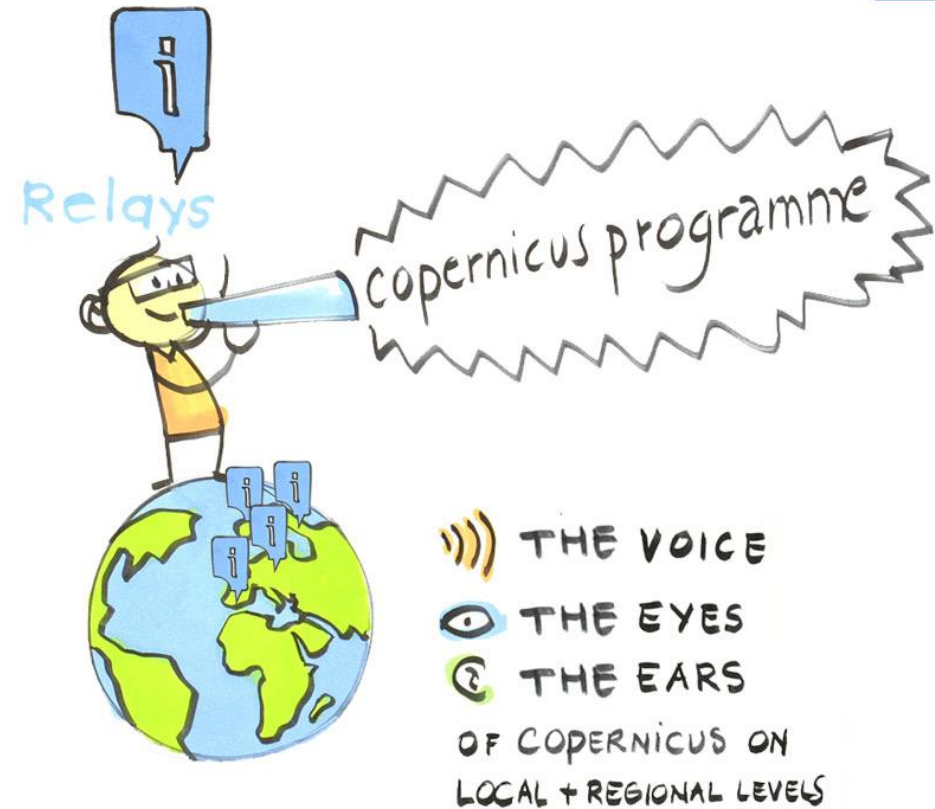
**CSIR**  
for Earth Through Satellites



# Copernicus Relays

- Reaching end-users in different countries and regions worldwide
- Content localization
- Local and global cooperation
- Support to local users
- Organizing promotional events and training

JOIN THE COPERNICUS RELAYS NETWORK !



THE MEMBERS OF THIS NETWORK ARE BRIDGES BETWEEN COPERNICUS AND THE END-USERS OF THE PROGRAMME INCLUDING BUSINESSES, START-UPS AND THE EU CITIZENS



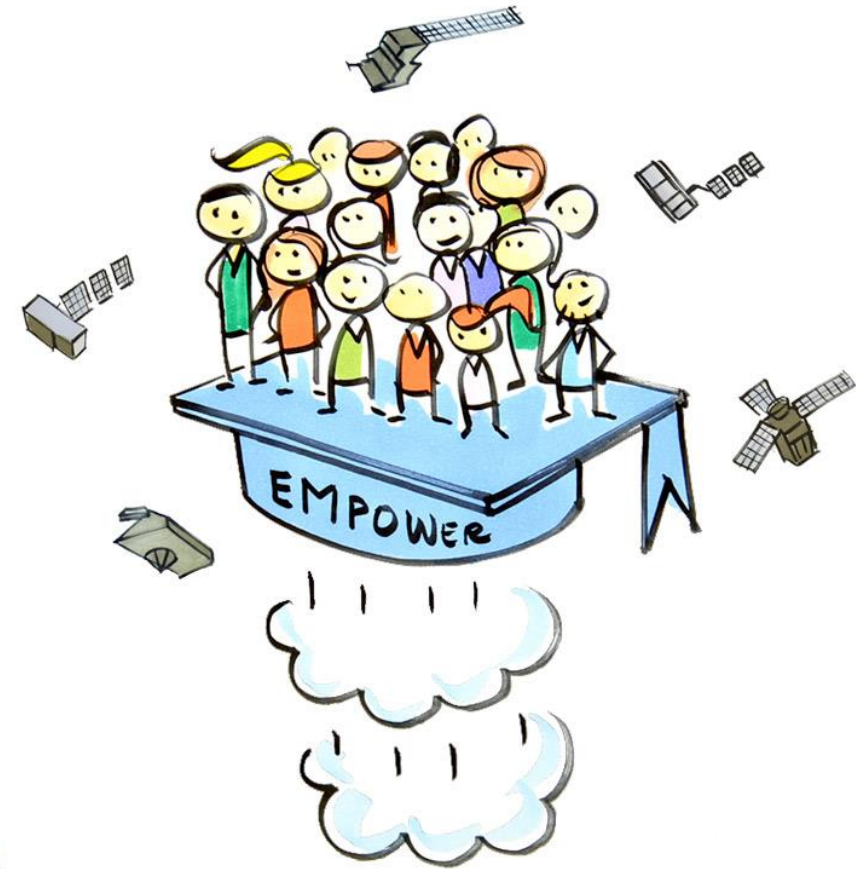
European  
Commission



# Copernicus Academy

- Reaching academic institutions worldwide
- Enabling global Earth Observation research network
- Promoting space in education
- Accelerate research to market link
- Building skills

JOIN THE COPERNICUS ACADEMY



THE MEMBERS OF THIS NETWORK ENSURE THAT SKILLS ARE DEVELOPED TO ENABLE COPERNICUS TO UNLEASH ITS FULL POTENTIAL

g u i d e s



EU GLOBAL ACTION  
ON SPACE

## Copernicus Academy & Relays networks: representing Copernicus around the world

Annekatrien Debien

Funded by the European Union



Promoting the European Union Space Programme





EU GLOBAL ACTION  
ON SPACE

# E-GNSS: Galileo and EGNOS

Pieter de Smet

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# Galileo and EGNOS: services and applications

Webinar 'EU space data in action: supporting sustainable economic growth & a greener future for Africa'

Bernardo Brum, EUSPA



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# Agenda

- Introduction to EUSPA
- Galileo
- EGNOS
- Applications



# A new EU Space Programme and new Agency

With the new regulation, **space data is at the heart of a technological revolution**



## EU space activities under one umbrella:

### Galileo

Global satellite navigation and positioning system (GNSS)

**10% of the EU GDP** enabled by satellite navigation



### EGNOS

Makes navigation signals more accurate and reliable

Operational in **360+ airports & helipads in 23 countries**



### Copernicus

Earth Observation (EO) and monitoring based on satellite and non-space data

**Nr.1 world provider** of space data and information (>20TB/day)



### GovSatCom

Secures satellite communications for EU governmental actors

Delivering rapid support over crisis areas

Funded by the European Union. **GOVSATCOM** is part of the European Union Space Programme



### SSA

Space Situational Awareness monitors and protects space assets.





# Global Navigation Satellite Systems

Global

Coverage

Navigation

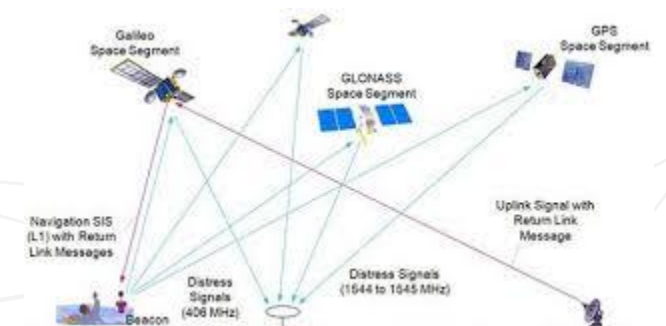
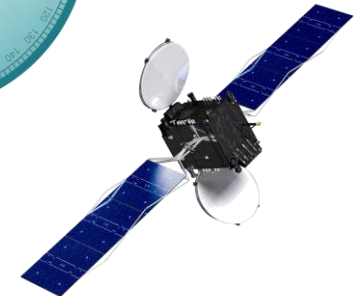
Allows positioning

Satellite

Satellite constellation

System

Formed by several elements



# Galileo differentiators for applications

Open Service  
Multi-frequency  
(E1/E5/E6)

Galileo High Accuracy  
Service (HAS)



Galileo Open Service  
Navigation Message  
Authentication (OS-NMA)

Galileo Signal  
Authentication Service  
(SAS)

# Galileo differentiators for applications

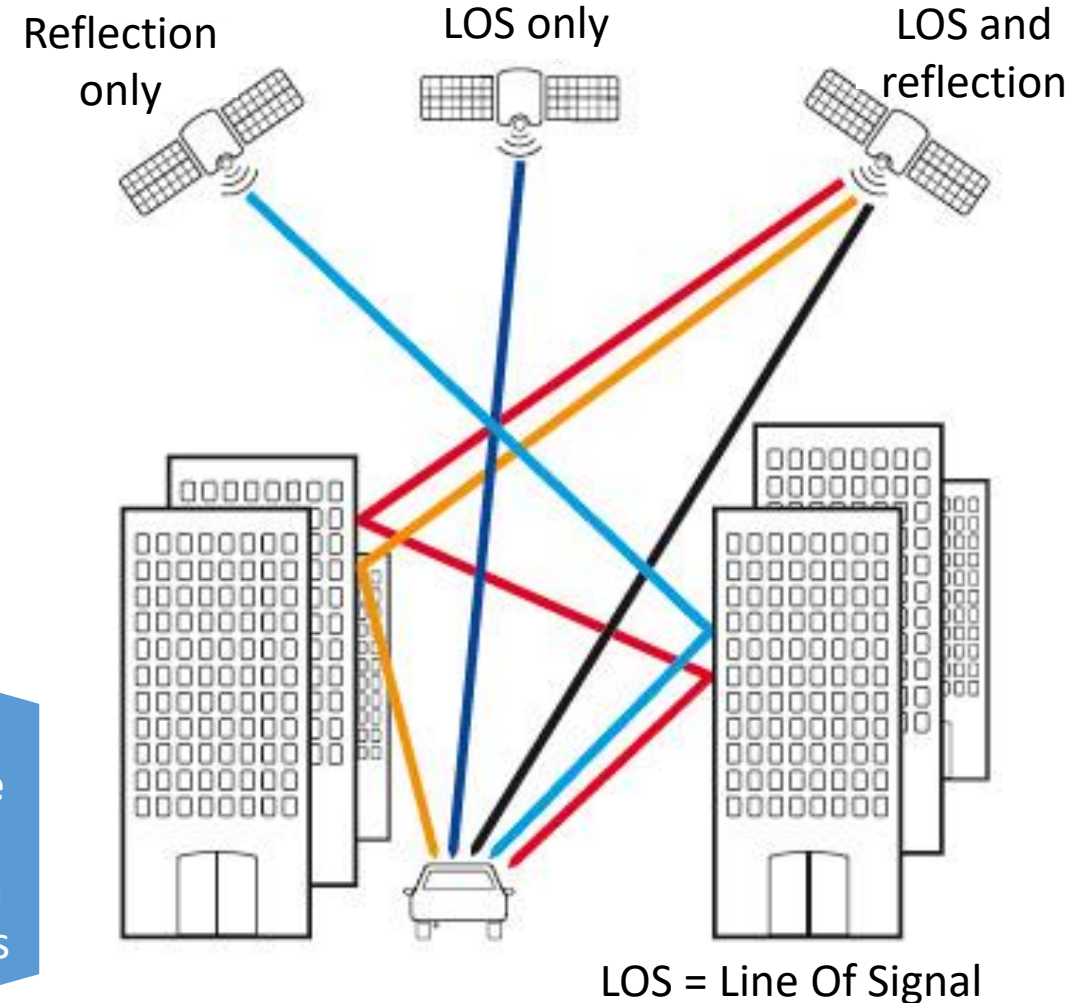
Open Service  
Multi-frequency  
(E1/E5/E6)

Useful in  
harsh  
environment  
(urban  
canyons, tree  
canopy, ...)

Easier  
mitigation of  
multipath  
errors

Higher  
availability,  
continuity  
and  
reliability of  
signals

Improved  
convergence  
time when  
integrated in  
PPP solutions



# Galileo differentiators for applications

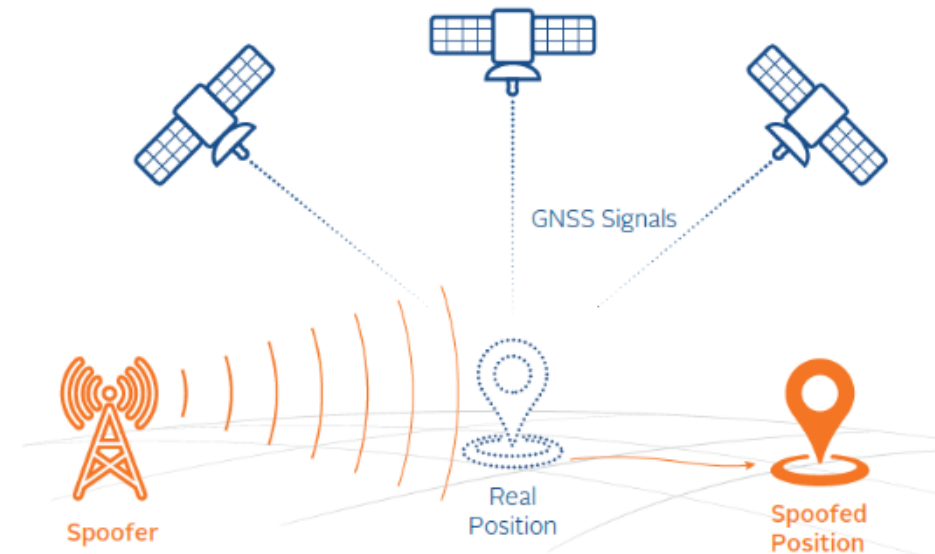
Disseminated on the first Galileo frequency (E1B)

Mitigate GNSS vulnerabilities

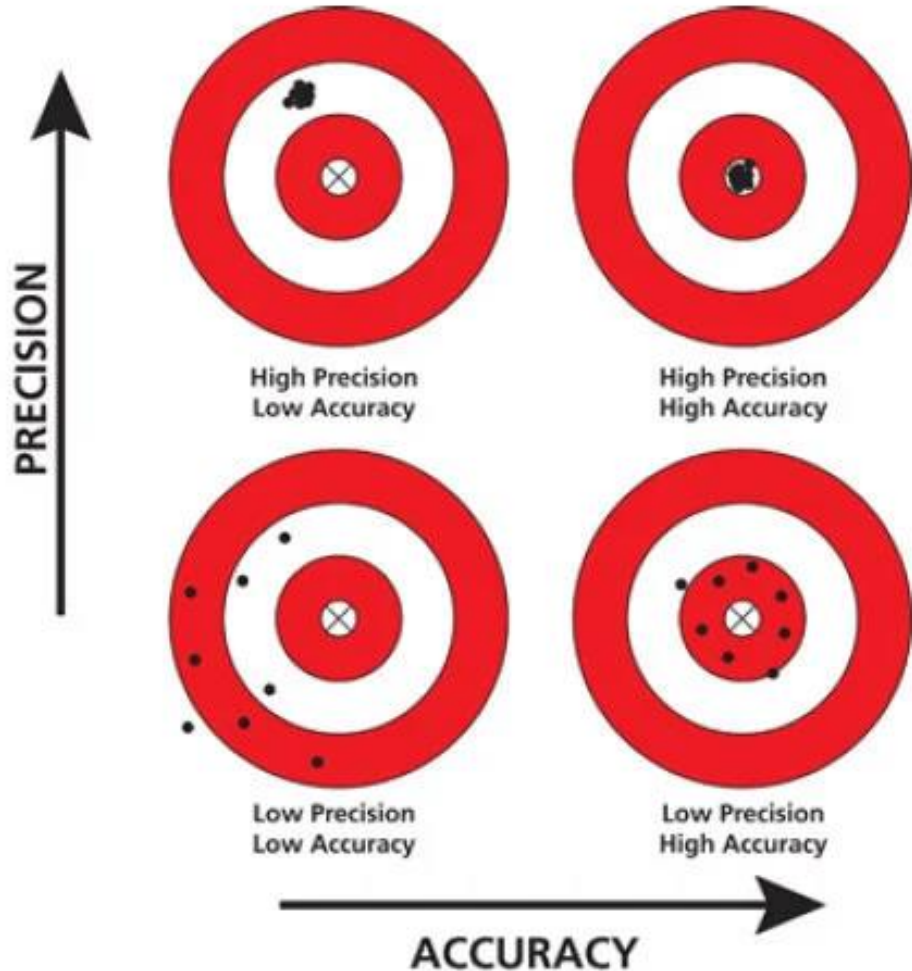
Public keys, no secrets

Follows crypto standards

Galileo Open Service Navigation Message Authentication (OS-NMA)



# Galileo differentiators for applications



Galileo High Accuracy Service (HAS)

Decimeter level accuracy (error  $\approx 20\text{cm}$ )

No need of additional communication channel

Global coverage

No link with reference stations

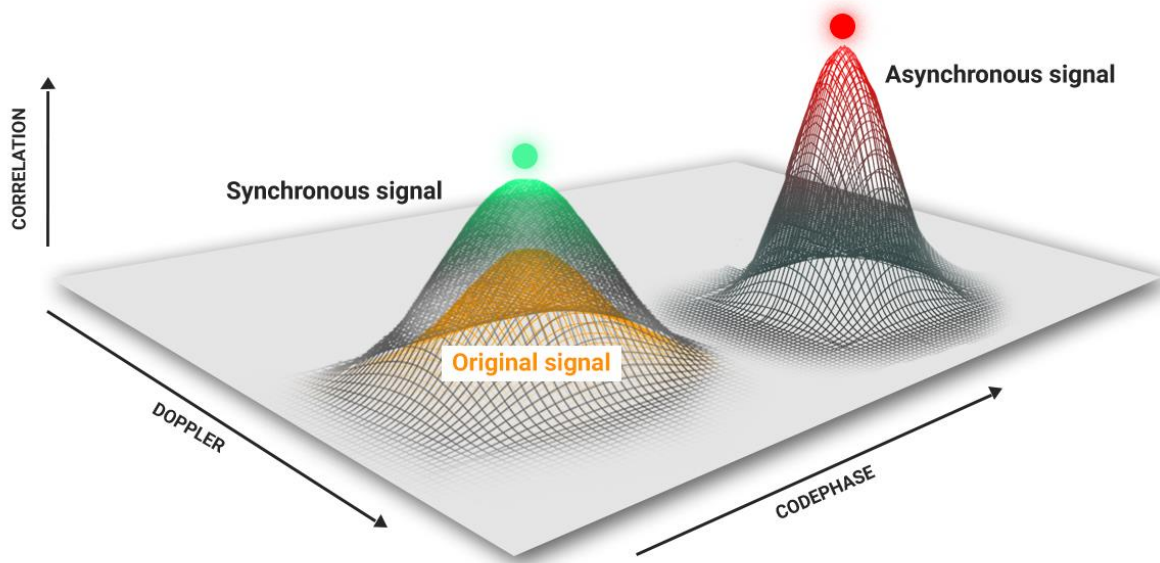
# Galileo differentiators for applications

Based on the Spreading Code Encryption

Using the Galileo E6C component

Based on OS-NMA (E1B)

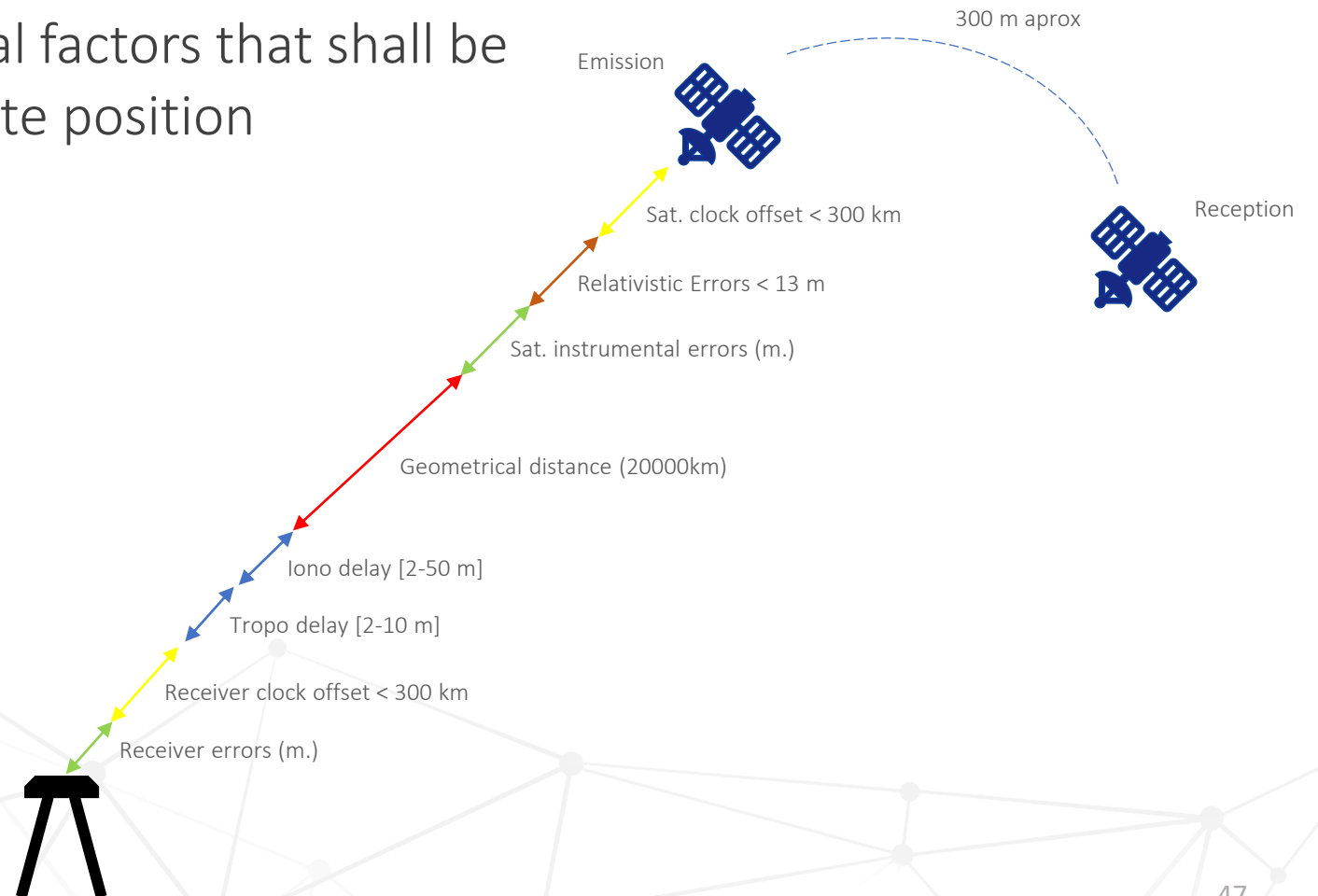
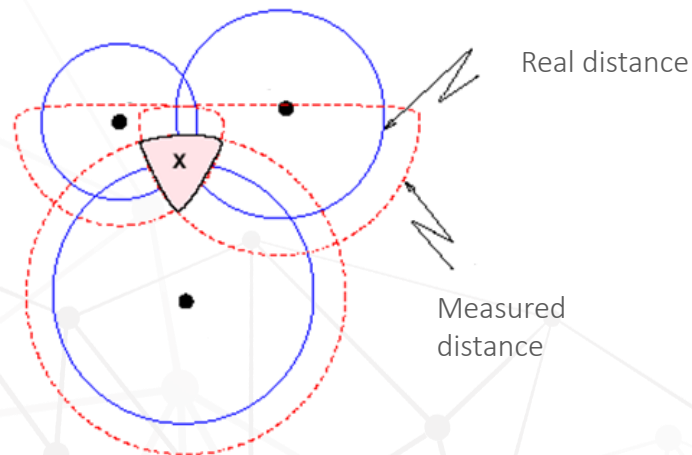
Utilizing also E6B data



Galileo Signal Authentication Service (SAS)

# Global Navigation Satellite Systems

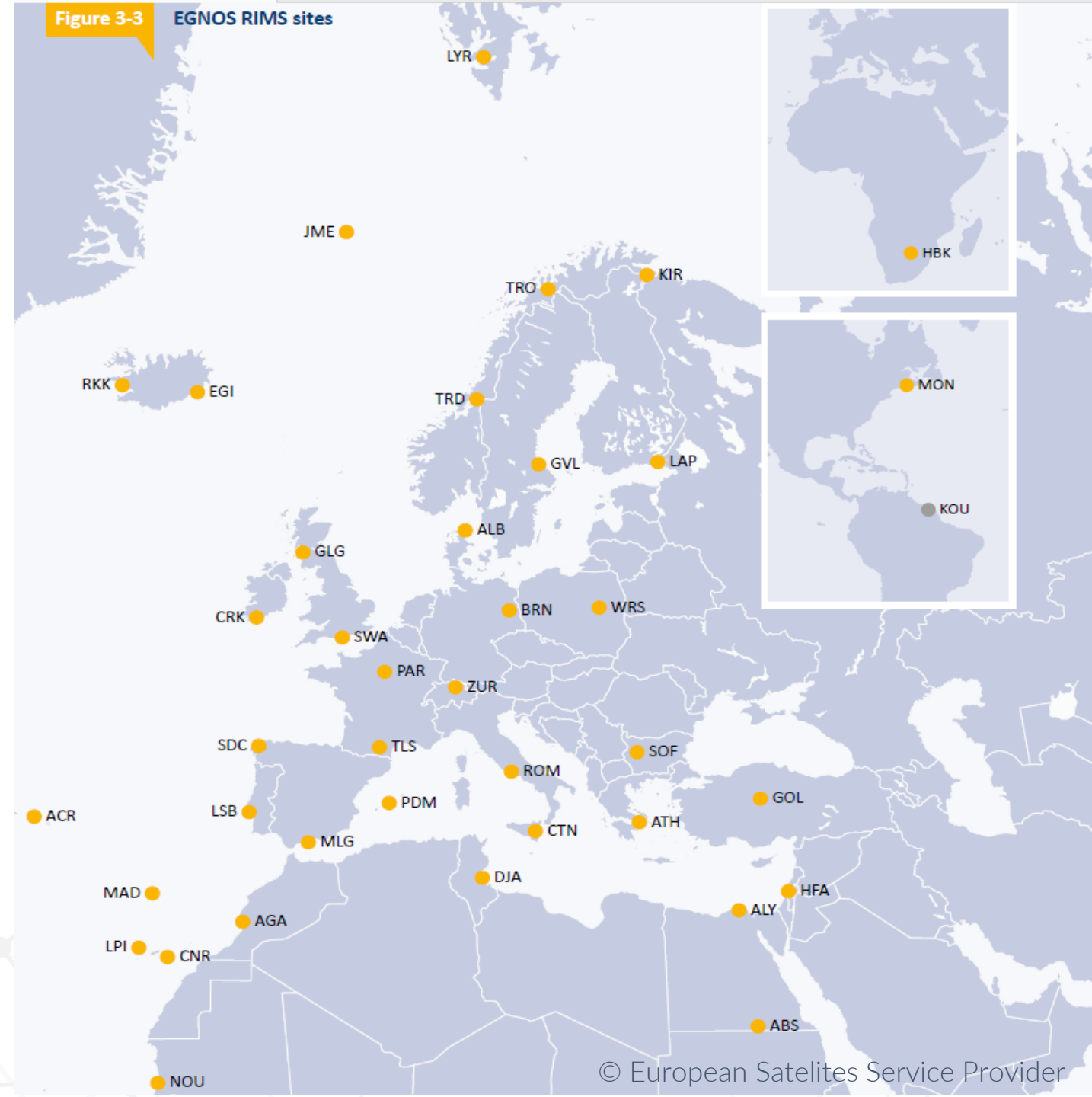
Satellite signal is affected by several factors that shall be corrected before getting an accurate position



# EGNOS

European  
Geostationary  
Navigation  
Overlay  
System

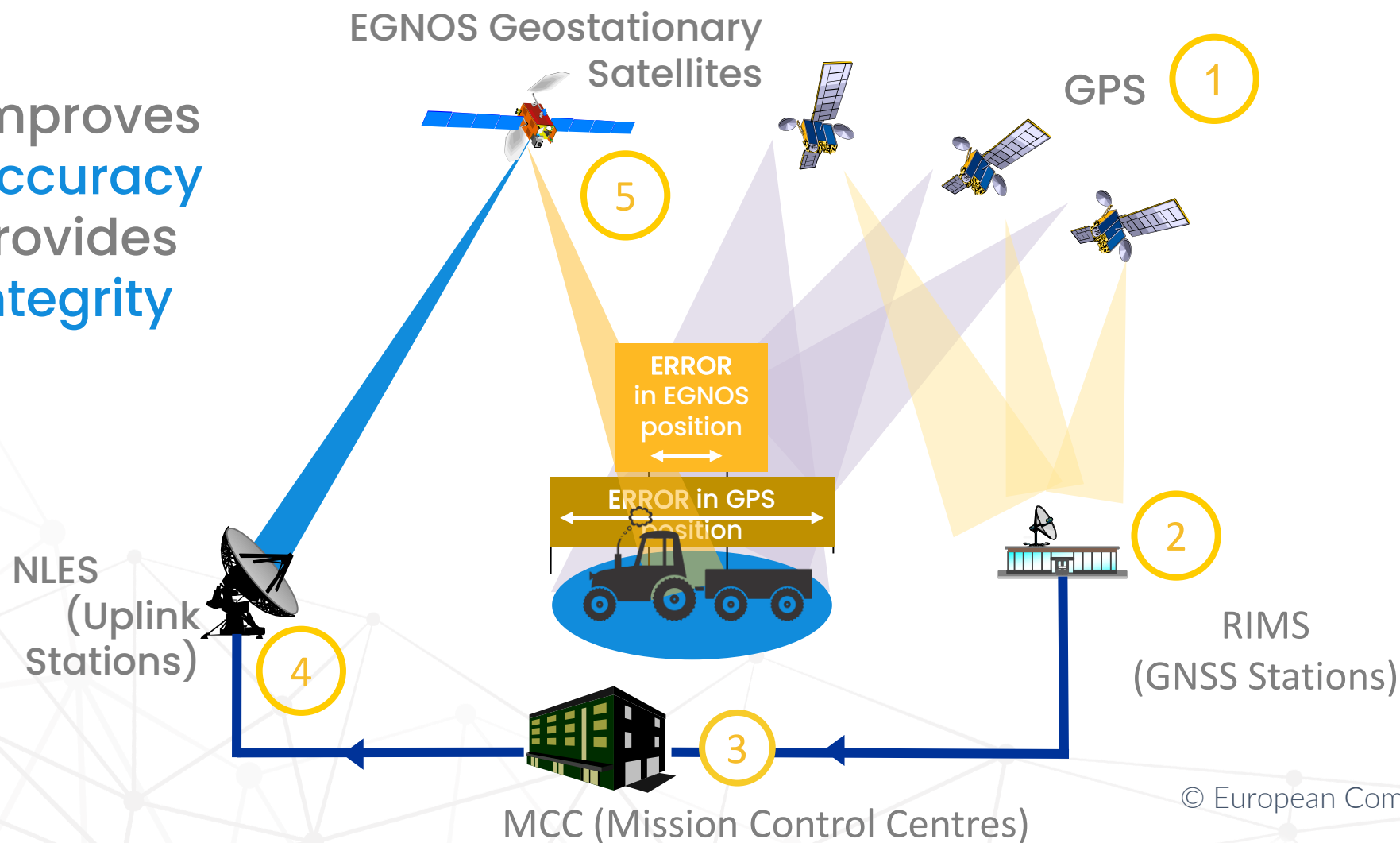
- **The European SBAS**  
(satellite-based augmentation system)
- **Europe's first step** towards independent satellite navigation
- **EGNOS improves GPS** (and Galileo in the future) over Europe
  - EGNOS will augment also Galileo
  - EGNOS will broadcast dual-frequency corrections
- **Interoperable:** the SBAS equipment will work:
  - in any of the regions where there is a SBAS service
  - With other GNSS source



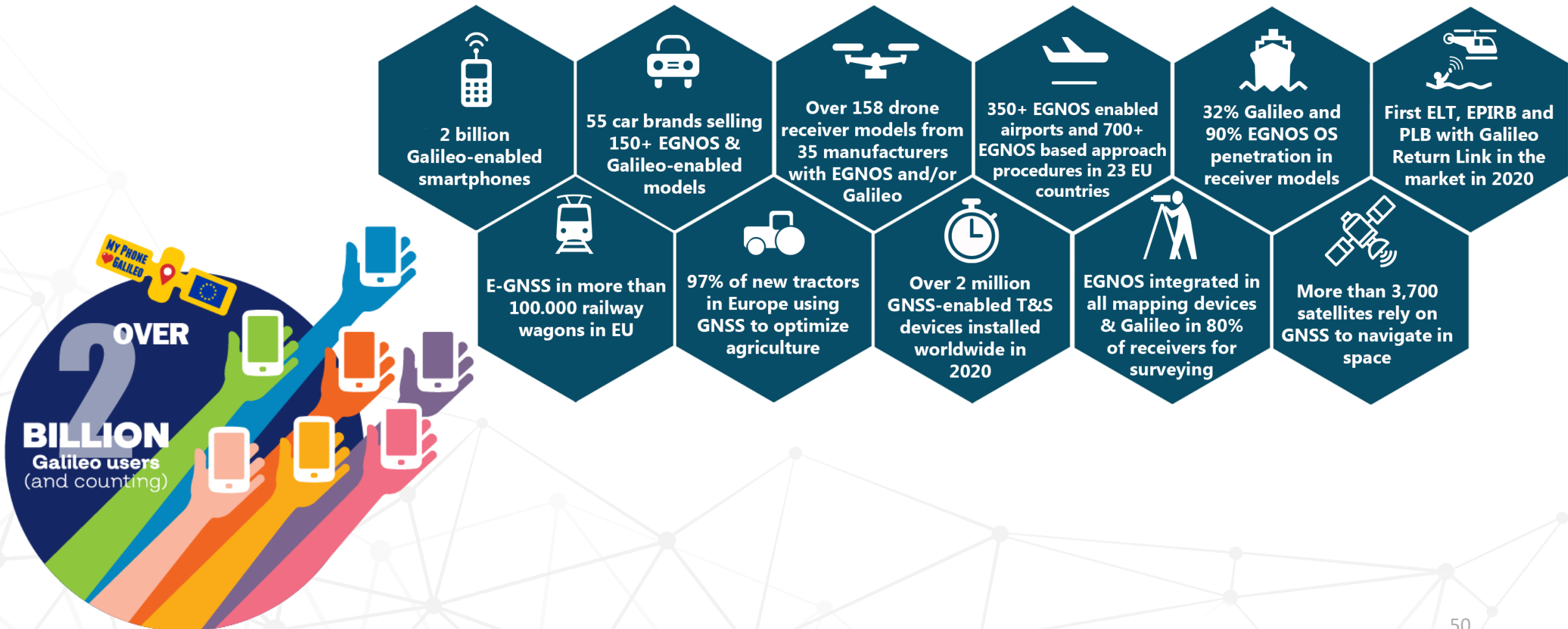


# How does EGNOS work?

- Improves **accuracy**
- Provides **integrity**



# Galileo and EGNOS: European success story enabling new business across different market segments



# Aviation and Drones



Services and products used by aviation and drone operators and industry. This includes airlines, pilots, helicopter operators, drone operators, airports and air navigation service providers.

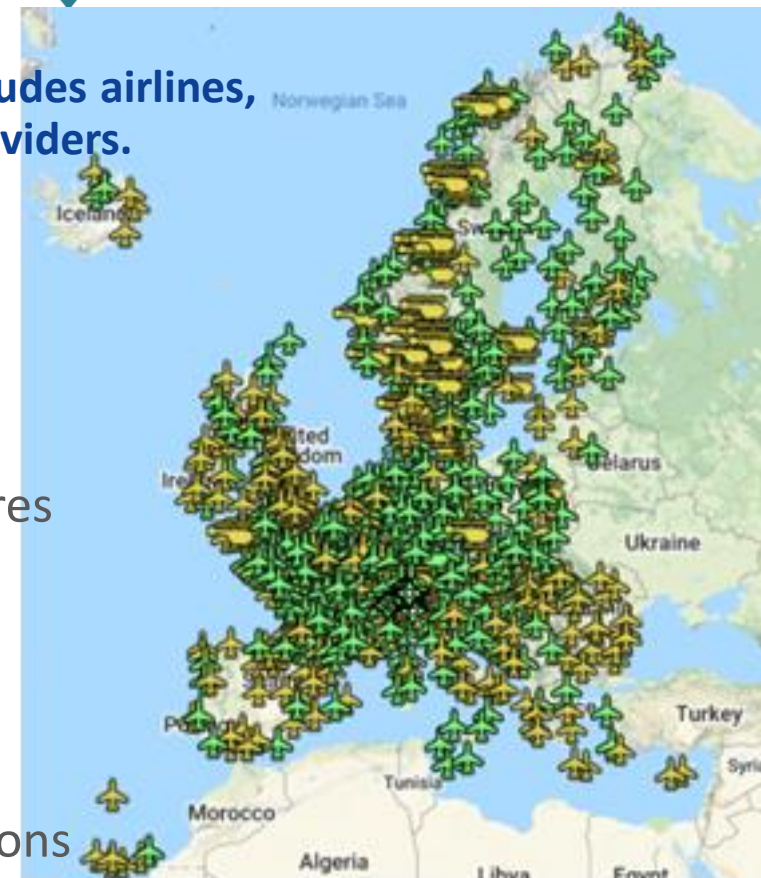
- ✓ Optimisation of flight routes, saving fuel, reducing emissions and noise impact
- ✓ Drones enabling new and greener air mobility and parcel delivery schemes

## AVIATION

- 426 European airports/heliports operate 804 EGNOS landing procedures
- Most commercial and small aircraft models are equipped with EGNOS
- First helicopter emergency operators equipped with EGNOS

## DRONES

- The biggest and fastest growing market for EU SMEs in GNSS applications
- The main commercial drone brands and receivers have Galileo on board
- EUSPA supported business creation via the myGalileoDrone competition
- EUSPA demonstrated EGNSS added value with 200+ flights in 2020/2021



**64% of all European instrument runway ends rely on EGNOS**

# Transport



## MARITIME & IWW

- 90% of receivers models are equipped with **EGNOS** (35% with **Galileo**)
  - 30+ key global manufacturers provides **Galileo-enabled receivers**
- 6 Member States operate EGNOS retransmission in shore infrastructure
  - robust position with Galileo and route predictions with Copernicus



## RAILWAY

- **GNSS** plays an **important role** in many **non-safety related applications**
- The introduction of **GNSS** in **future safety-related applications** is **expected to increase** railway network capacity whilst decreasing operational costs.



## ROAD

- 15 Mill. cars compatible with **Galileo** in Europe, thanks to **eCall**
  - 55+ car brands and 150+ models relying on Galileo
  - 3.5 Mill. trucks benefitting of EGNOS and Galileo in Europe
- 75% of EU roads using **electronic tolling** (85,000 km) make use of **EGNSS**
  - 6 car makers commercialising highly **autonomous cars** with **Galileo**



# Agriculture, LBS



## AGRICULTURE

- Almost 1,000,000 GNSS units shipped annually in 2020
- Precision farming, sustainable management of soils and the preservation of biodiversity require advanced solutions powered by GNSS and EO to cope with the food, agriculture and climate challenges
  - 97% of new tractors in Europe using GNSS are equipped with EGNOS
    - 69% of new agriculture machinery is equipped with Galileo



EGNOS and Galileo in the farmers' smartphones



Copernicus and Galileo are at the heart of the EU Farm to Fork Strategy

## CONSUMER SOLUTIONS



- The segment contributes to 92% of global annual GNSS receiver shipments (smartphones, sports & wearable)
- 991 different Galileo-enabled smartphone models in the market
- 48 global smartphone brands have chosen to integrate Galileo in their devices so far
- 243 dual frequency Galileo-enabled smartphone models available in the market



Linking space to user needs

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# Q&A

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# Using EU space data: African success stories

**Juan Suarez - Vivianne Meta -  
Clarisse Kagoyire - Stella Chelangat Mutai**

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# AfriCultuReS Enhancing Food Security in African Agricultural Systems with the support of Remote Sensing

## A long-term self-sustainable & user-centered initiative in Africa on food security

**Juan Suárez**

Manager EO & Innovation for Sustainable Development, GMV  
AfriCultuReS Project Coordinator

**EU space data in action: supporting sustainable  
economic growth & a greener future for Africa**

29/03/2022



**AfriCultuReS**



This project has received funding from the European Union's Horizon 2020  
Research and Innovation Framework Programme under grant agreement No 774652

# WHAT IS AfriCultuReS?

**H2020 - SFS-43-2017** "EO services for the monitoring of agricultural production in Africa"

**17 Partners** | Industry & Academia  
50% African + 50% European | Multidisciplinary

GMV (lead, ES)



Aristotle University of Thessaloniki (GR)



DRAXIS Environmental Technologies (GR)



HCP International (NL)



Sapienza University of Rome (IT)



Swedish Meteorological and Hydrological Institute (SE)



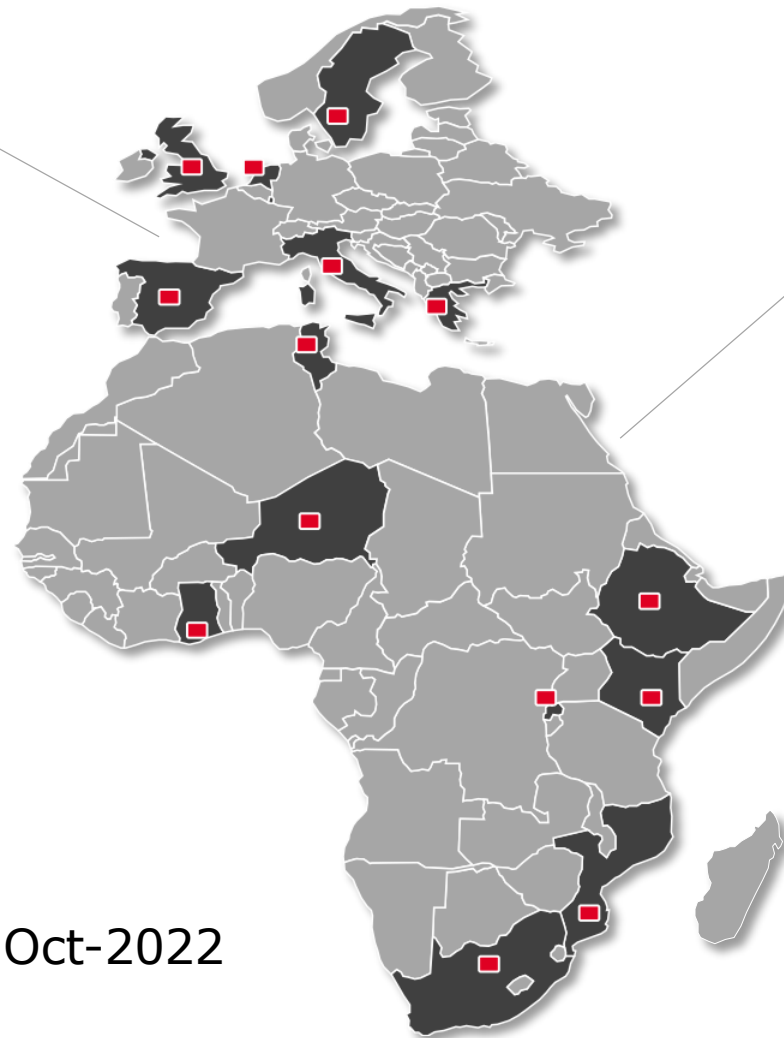
University of Cantabria (ES)



University of Leeds (UK)



University of Sheffield (UK)



Centre Régional AGRHYMET (NE)



CGIS – University of Rwanda (RW)



CERSGIS – University of Ghana (GH)



GeoSAS (ET)



LocateIT (KE)



Observatoire du Sahara et du Sahel (TN)



South African National Space agency (ZA)



Eduardo Mondlane University (MZ)

8.8M€ | 60 months | Nov-2017 to Oct-2022

AfriCultuReS – ENHANCING FOOD SECURITY IN AFRICA WITH THE SUPPORT OF REMOTE SENSING



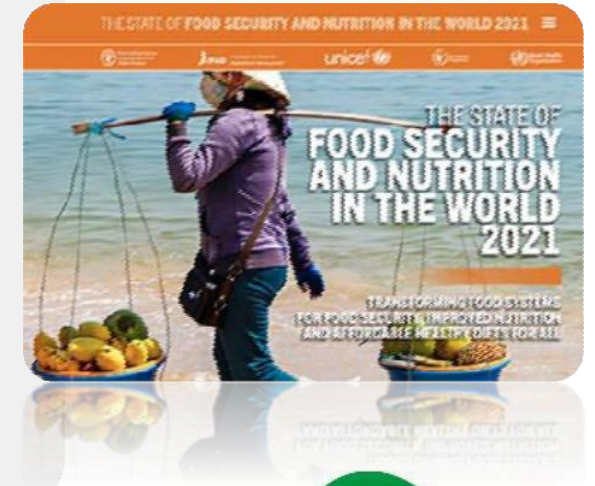
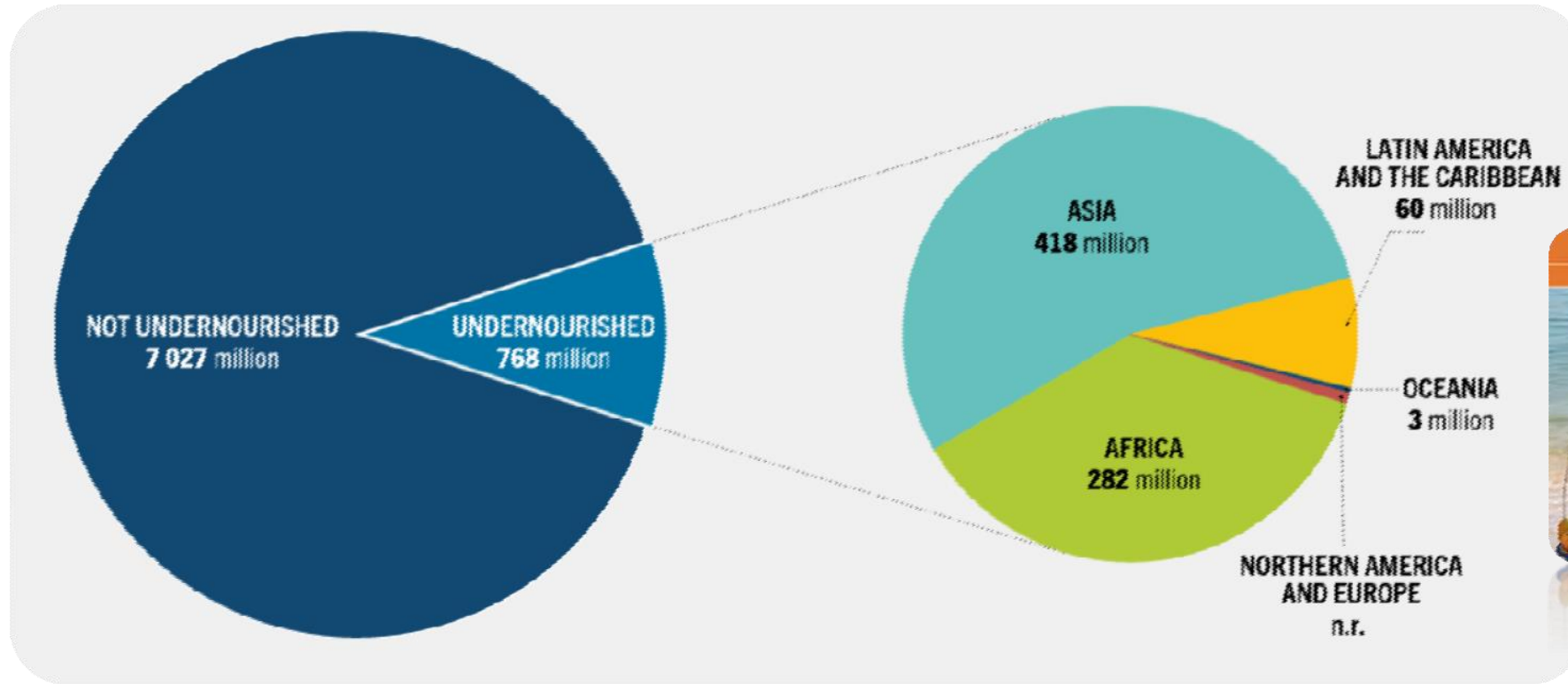
This project has received funding from the European Union's Horizon 2020 Research and Innovation Framework Programme under grant agreement No 774652



# CHALLENGE

■ **282 million** people suffered from food insecurity in 2020 **Africa**

■ **One third** of the people in the **World** affected by hunger in 2020 were in **Africa**



# VULNERABLE POPULATION

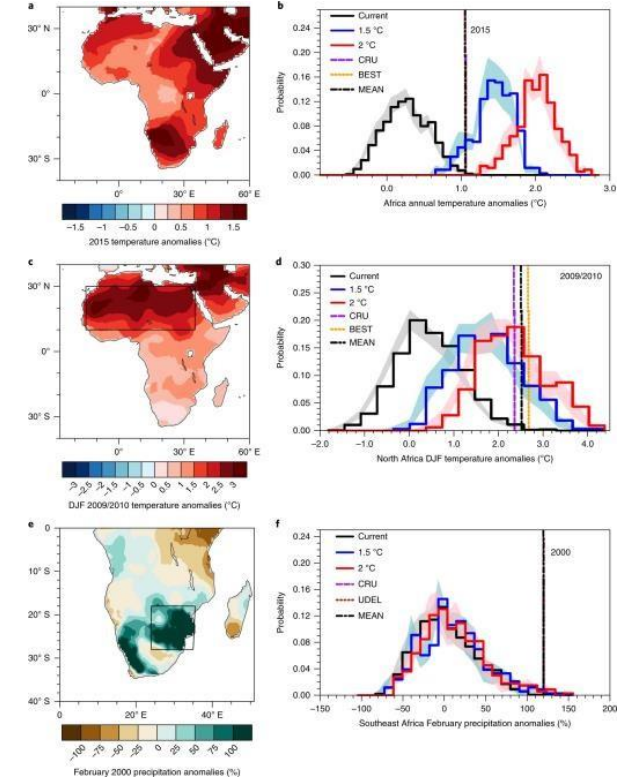
**Most Africans** make their living **from agriculture**

**70%** of Africans make a living from agriculture

but it accounts just **33%** of the Continent's GDP

**969.000.000** people

(Europe's population roughly **748.250.000** people)



Our aim is  
food security in  
Africa



# GOAL & OBJECTIVES



## **AfriCultuReS:** Enhancing Food Security in **African AgriCultural** Systems with the Support of **Remote Sensing**

Implement and maintain an integrated  
**agricultural monitoring and early warning system,**  
based on **Earth Observations,** to support **improved decision**  
**making** in the field of **food security in Africa**

# THE ROLE OF SPATIAL DATA

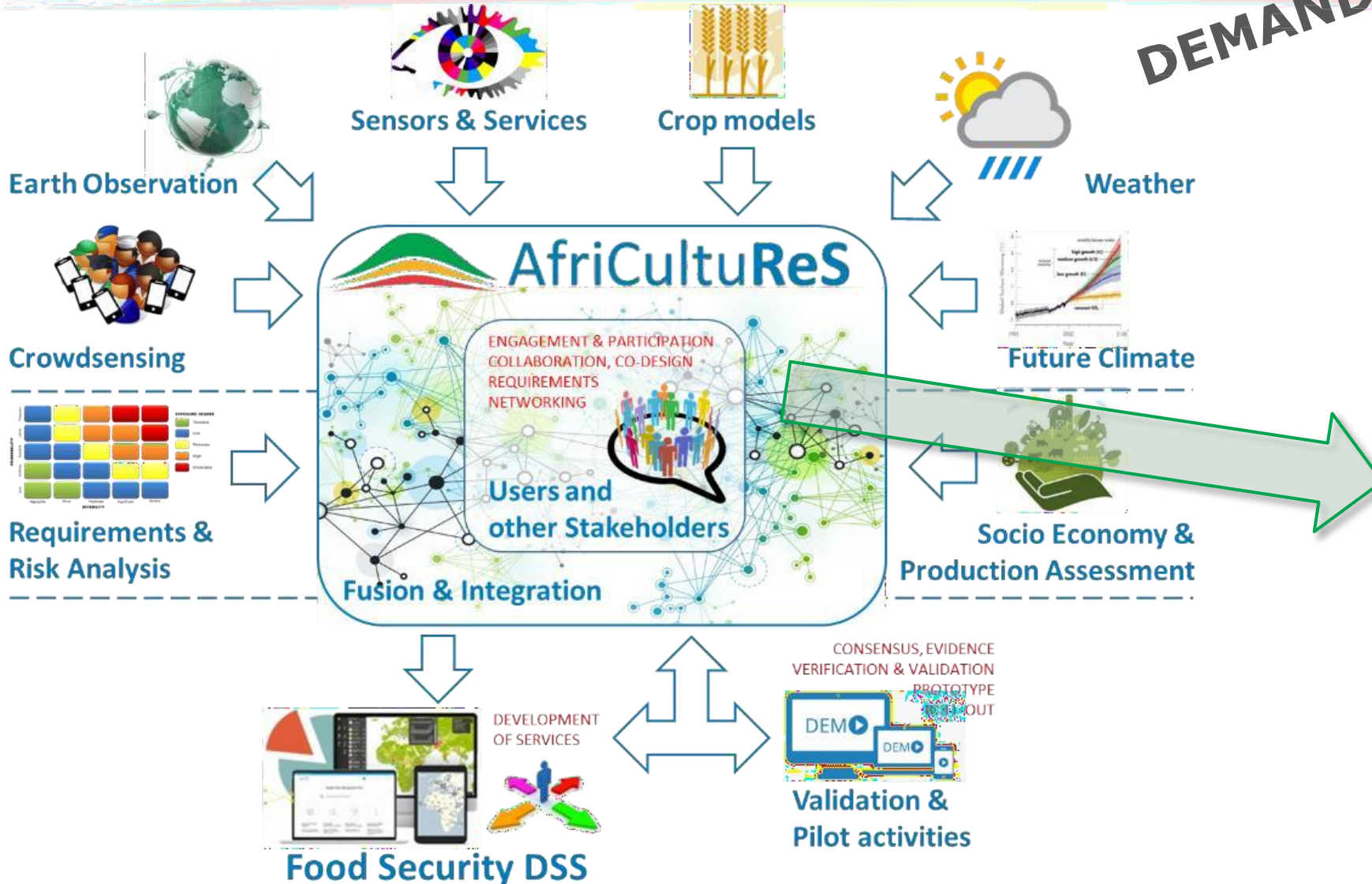
Food security is **achieved** when the **four components** are convergent in a **given area along time**



**Food production** has **unique characteristics** that differ from other forms of production  
Food production is affected by random phenomena characterized by  
a **high degree of spatial and temporal variability**

# CONCEPT

**DEMAND DRIVEN**



Setting up a **CO-DESIGNED & USERS CENTERED**

- ✓ interoperable,
- ✓ sharable,
- ✓ replicable,
- ✓ re-usable and
- ✓ discoverable
- ✓ open



# CONCEPT

CO-DESIGN | CO-DEVELOPMENT | CO-OWNERSHIP

**Stakeholders**

Public Sector, Farmers, Agribusiness, Financial, Academia...

**User Domain**

**Wisdom**

**Decision Making → KNOWLEDGE IN ACTION**

**Knowledge**

**Pieces of information connected to achieve a goal**  
Options, Scenarios, Assessments, Risks...

**Information**

**Clean, validated, documented data**  
Ready to use, analysis, fusion, semantic linkage...

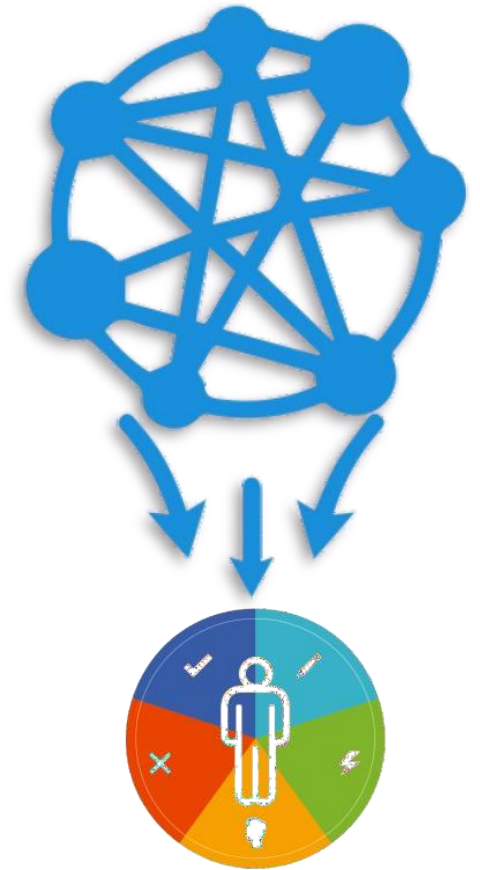
**Data**

**Raw collection of facts**  
Satellite, DB, networks, crowd-sensed...



# KEY-SECTORS, AGGREGATORS

- ✓ **Public sector:** stimulating economic growth; feeding the population; improved risk management; effective, efficient and sustainable use of public and natural resources.
- ✓ **Agribusiness sector** (including smallholder food producers): Increased production and productivity; increased income; improved risk management; good long-term perspective.
- ✓ **Financial sector** (with inclusive finance catering to smallholders): improved risk management; lower costs; well-designed products; increased outreach.
- ✓ **Academic sector:** high-quality research output; high-quality education; contributing to solving societal problems; affordable education for all



# AfriCultuReS SERVICES



**Climate:** to improve climate predictions, seasonal climate early warning and climate adaptation advice



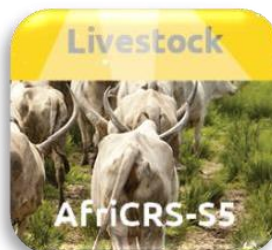
**Crop:** to improve crop condition monitoring and yield forecasts



**Drought:** to improve drought early warning and forecasts



**Land:** to provide advice on avoiding land degradation and to improve soil condition assessment



**Livestock:** to improve grazing and monitoring, browsing capacity assessment and identification of available water for livestock



**Water:** to improve monitoring of water availability and productivity, crop water requirements assessment and soil moisture monitoring



**Weather:** to improve (local) weather forecast and extreme weather events early warning

# SERVICES MAIN FOCUS IS ON...

**Maize**



**Wheat**



**Potatoes**



**Sorghum**



**Cassava**



**Millet**



**Rice**



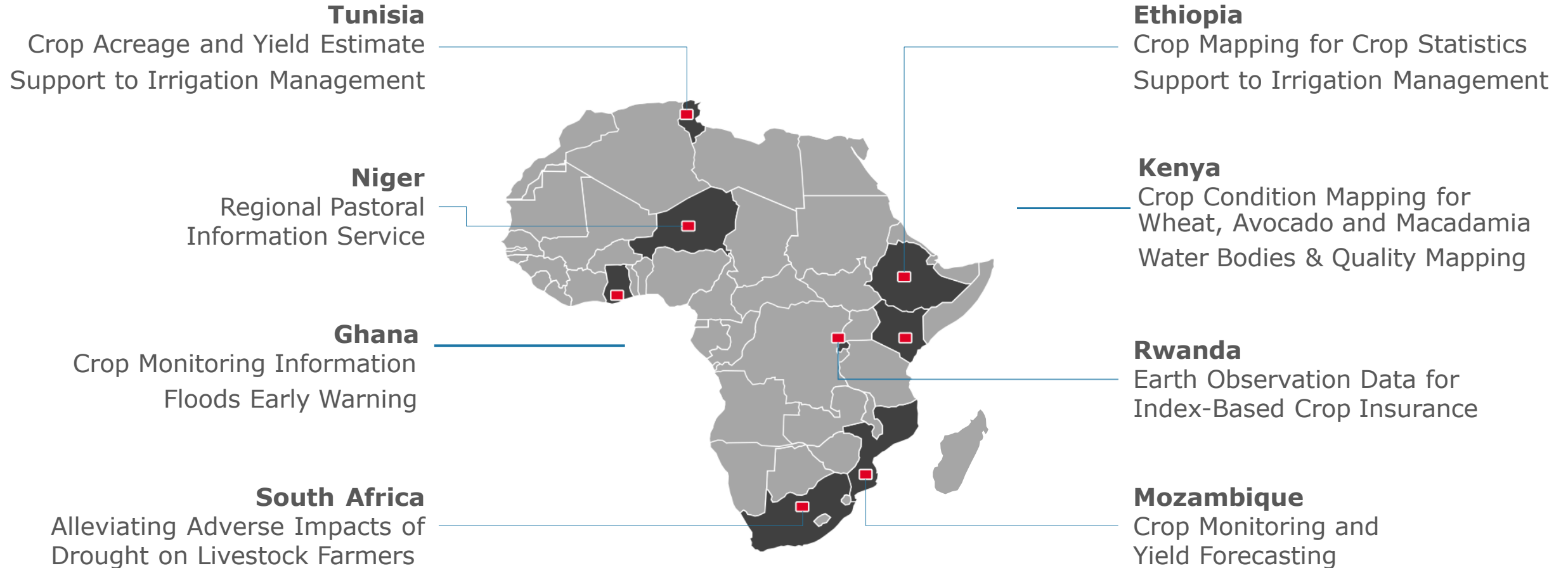
**Sugarcane**



**Grassland/pastureland/rangeland for livestock farming**

Room is made for **crops that are locally relevant.**

# USE CASES



# Enhancing Food Security in Africa

Services

AfriCultuReS webGIS

AfriCultuReS GeoBI

AfriCultuReS Use Cases



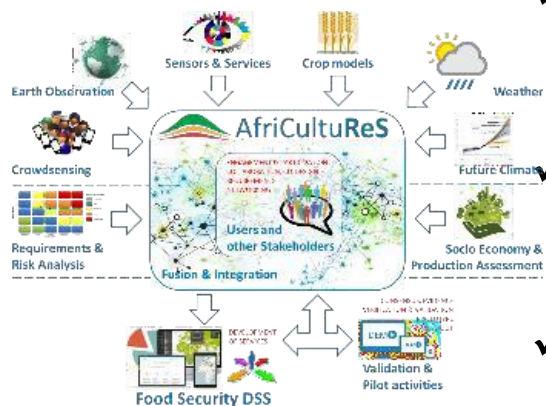
This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 774652



<https://africultures-platform.eu/en/>



# LONG TERM SUSTAINABILITY & IMPACT



✓ Use of free & long term **data availability, services** and **infrastructure**

Long-term **institutional interest and support**

✓ Long-term **user interest** for a **solution** that addresses **REAL LIFE NEEDS**

✓ Based on users experience and success stories - **TRUST**

✓ **Capacity Development**

✓ **Awareness Raising**

✓ **Exploitation plan & up-scale** strategy



**Juan Suárez**  
AfriCultuReS Coordinator

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[info@africultures.eu](mailto:info@africultures.eu)



**thank you**







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# Using EU space data: African success stories

Juan Suarez - **Vivianne Meta** -  
Clarisse Kagoyire - Stella Chelangat Mutai

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EU GLOBAL ACTION  
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## Earth Observation for Index-based Crop Insurance, Rwanda

Clarisse Kagoyire

CGIS, University of Rwanda



AfriCultuReS



# Background

Agriculture sector, in Rwanda:

- employs about 66% of population
- accounts for 31% of national exports and 26% of the national GDP
- about 90% of cropland are located on slopes
- Access to agricultural finance is 5.27%
- High competition between agricultural and non-agricultural land use
  - High population density (525 people per sq. km)
  - Land fragmentation



# Agriculture vulnerability

- Rwandan agriculture presents a strong dependence on rainfalls and vulnerability to climate shocks:
  - Excessive rainfall that lead to floods and landslides
  - Prolonged drought
  - Windstorms
  - Land degradation/soil erosion
- Pests and diseases
- Limited access to financial services
- Lack/limited of agricultural inputs
- Machines/agricultural equipment
- Limited agricultural techniques & low production



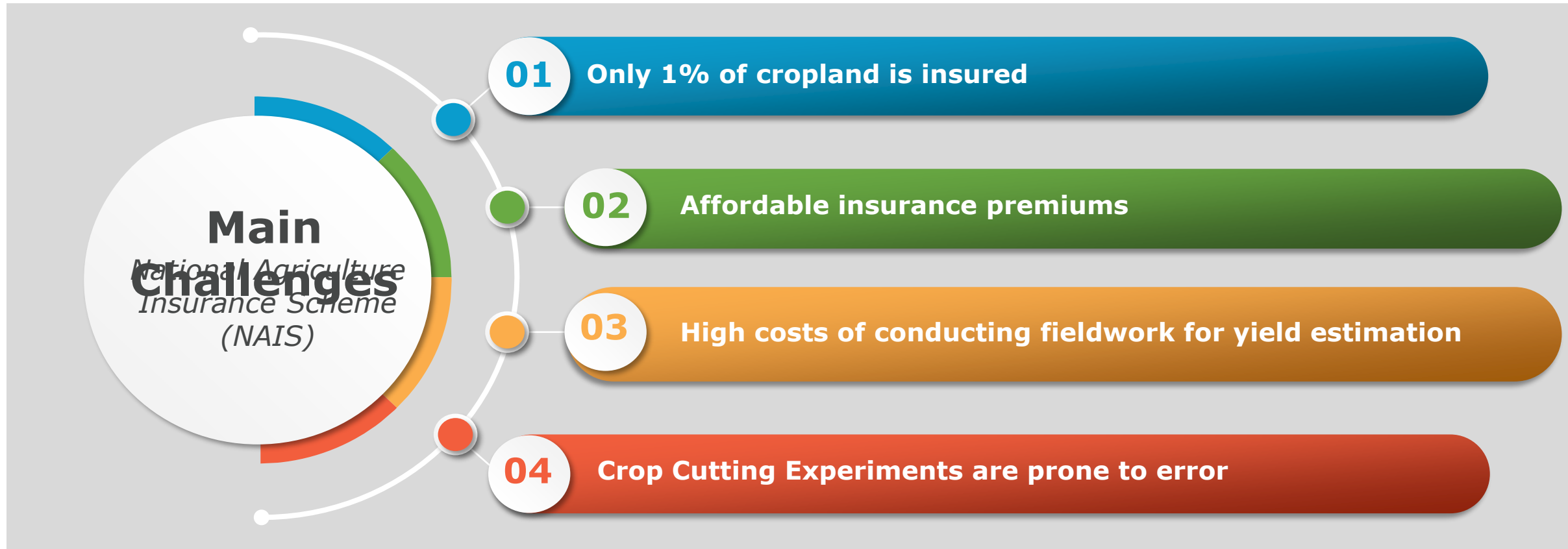
# National Agriculture Insurance Scheme

## Index-based crop insurance

- Area yield index insurance (AYII) product
  - ☛ Location of the farms/plots
  - ☛ Crop monitoring
  - ☛ Yield data (historical & current data)
- Weather index insurance (WII) product
  - ☛ Weather data (historical and current data)
  - ☛ Crop monitoring
  - ☛ Yield data



# Challenges with the NAIS



# EO for crop index insurance

## EO data Requirements

- ✓ Rainfall estimates and/or soil moisture
  - information on weather conditions that affect crop growth
- ✓ NDVI & FAPAR
  - crop growth & crop calendar.
- ✓ Other vegetation indices (NDVI, VI, LAI, VHI)
  - crop mapping.
- ✓ Evapotranspiration
  - crop water demand versus soil moisture)

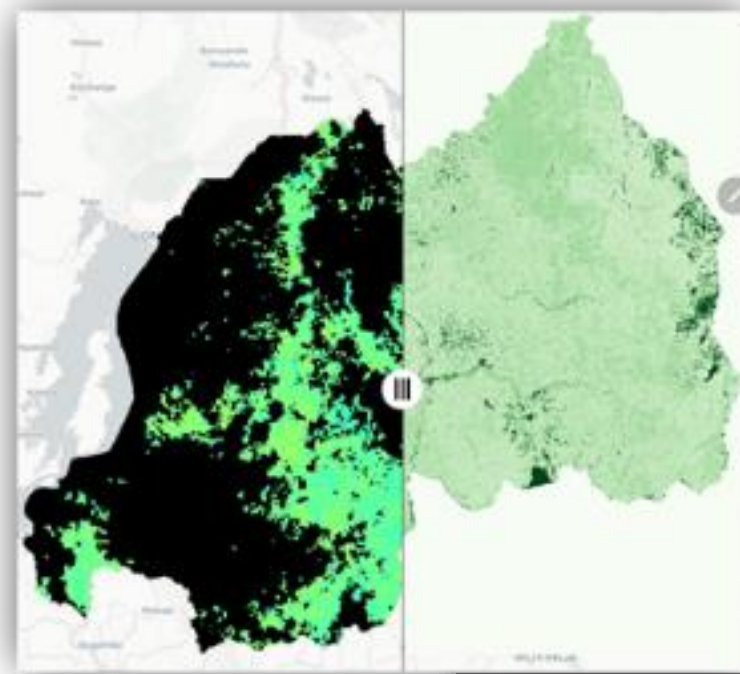




# EO for crop index insurance

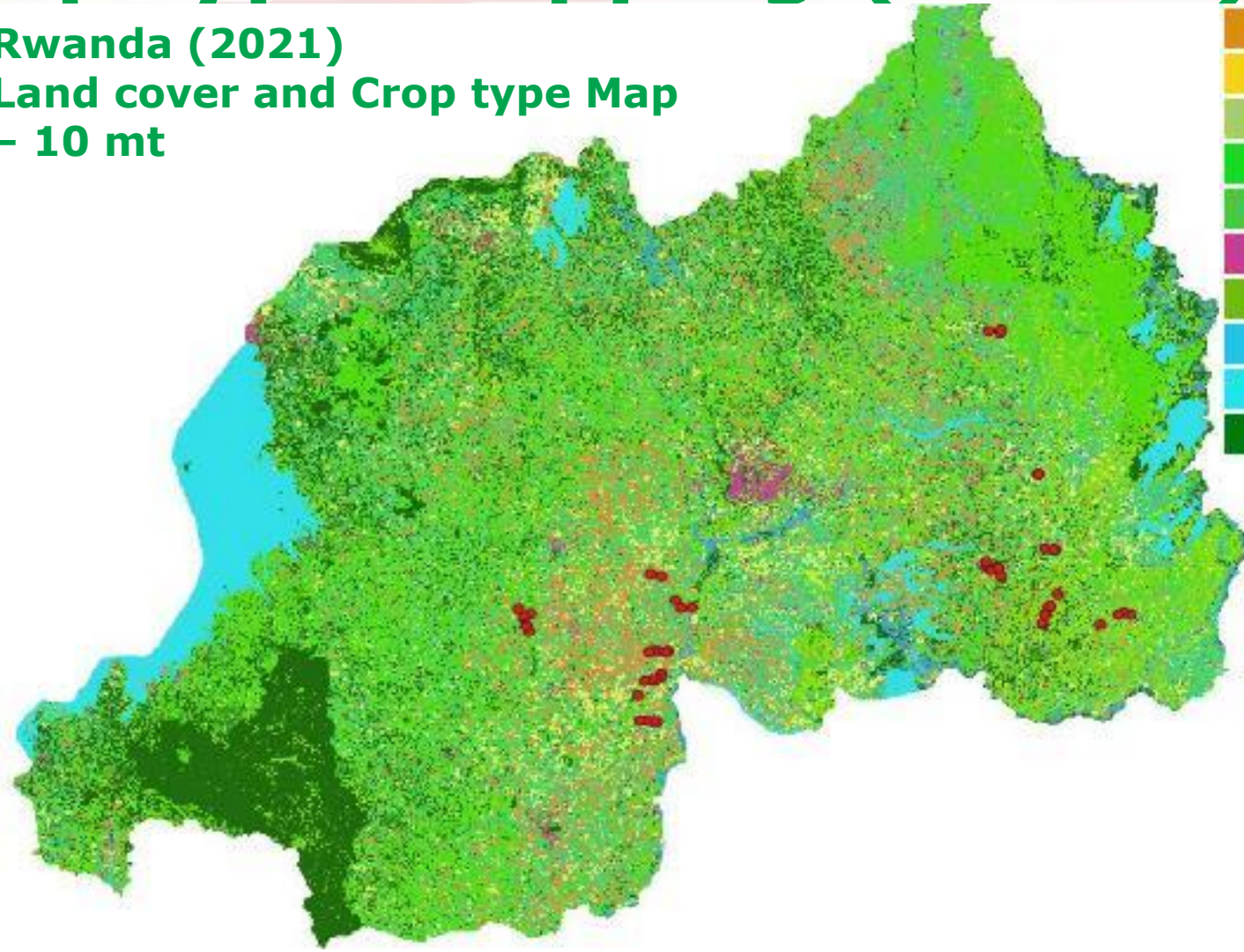
**AfriCultuReS  
Services**

- Crop Type Mapping
- Crop Condition Monitoring
- Crop Yield Forecast
- Crop phenology monitoring
- Crop Early warning
- Seasonal drought forecast
- Drought monitoring and early warning
- Soil Moisture Monitoring
- Weather Forecast



# Crop type mapping (S2P01)

Rwanda (2021)  
Land cover and Crop type Map  
– 10 mt



- Maize
- Rice
- Shrubland
- Grassland
- Cropland
- Urban Areas
- Bare vegetation
- Water Bodies (Perm.)
- Wetland
- Tree Cover

**Crop fields map computed by using Sentinel-2 time series images and NDVI cross-correlation.**

**Example of crop fields used for training data set (Red Points).**

**A field campaign is needed to get the validation.**

G.Laneve, M. Kganyago, T. Alexandridis, A. Challinor, S. H. García (2022). Introduction to AfriCultuReS Service Portfolio for Rwanda [Workshop presentation]. 3<sup>rd</sup> AfriCultuReS User Workshop. Kigali, Rwanda

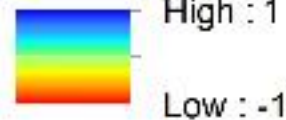
# Crop condition monitoring (S2P02)

## NDVI Anomaly:

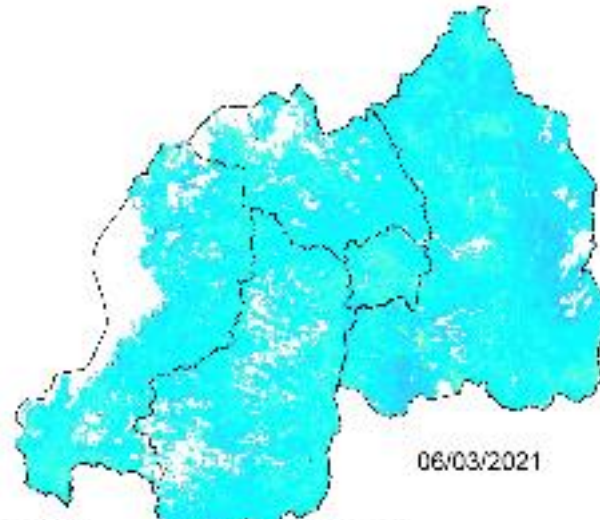
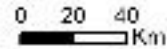
"variation of current NDVI compared to the long-term average" (250m, GIMMS 6v1)

### Legend

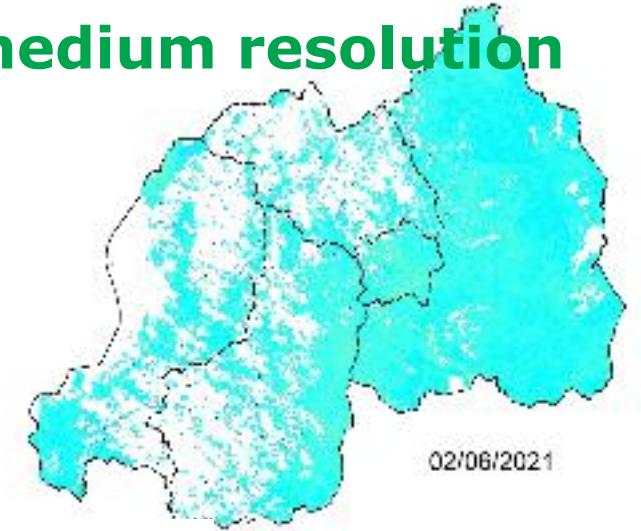
#### NDVI anomaly



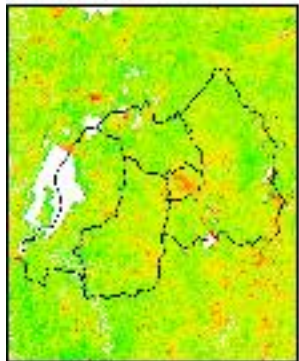
Adm. boundaries Level1



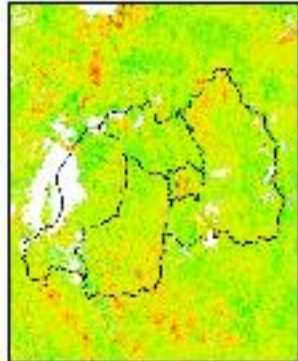
## medium resolution



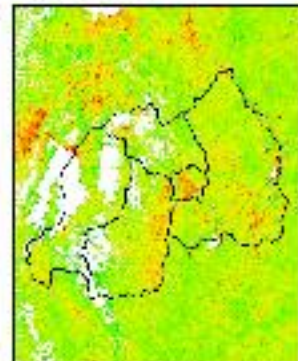
01/01/2021



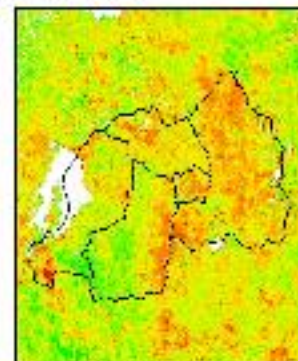
01/03/2021



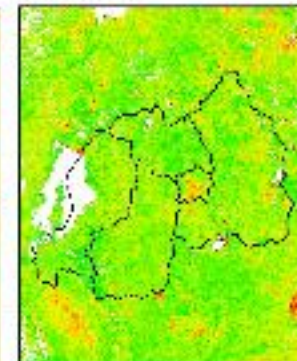
01/06/2021



01/09/2021

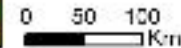
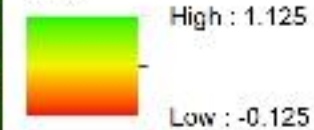


01/12/2021



### Legend

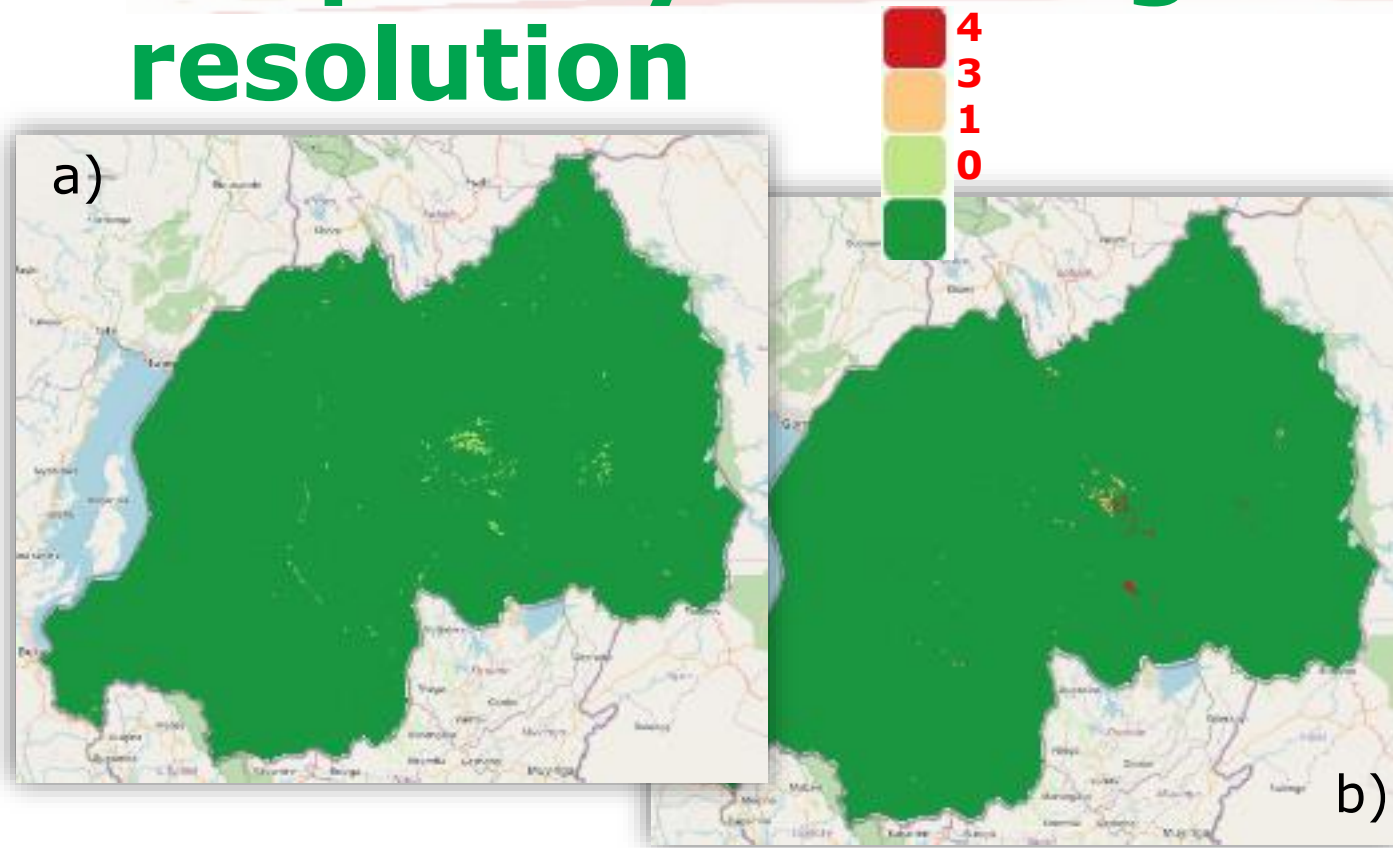
#### VCI



**Vegetation Condition Index (VCI):** "deviation of current NDVI from the min and max values over a time series at the same location" (1km, Copernicus Global Land Service v2)

- >0.7: normal vegetation condition
- 0.5-0.7: moderate vegetation condition
- 0.3-0.5: poor vegetation growth
- <0.3: extremely poor growth condition

# Crop early warning: medium resolution



The service provides maps in geotiff format. The files contain: an integer number comprised from 1 to 4 corresponding to the level of warning.

The maps are provided on an 8-days frequency with maximum two days delay with respect the last day of the synthesis period.

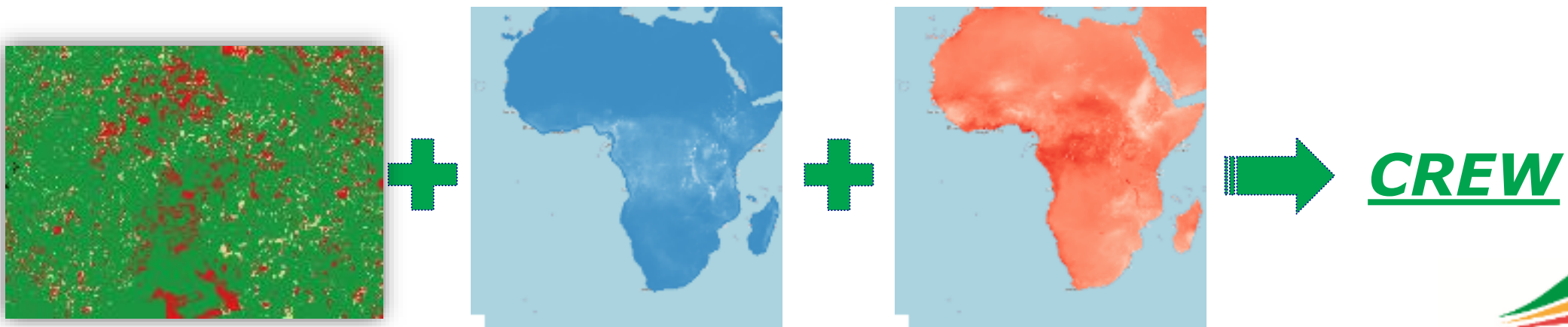
The output files have the following characteristics:

- Geotiff format.
- Spatial resolution: 250 m.
- Reference system: WGS 84.
- 1 band.
- Frequency: 8 days
- Band meaning: level of warning. 4 levels of warning are considered: 1 = low warning, occurs when only NDVI anomaly is detected in the period, 2 = medium warning, occurs when NDVI anomaly, accompanied by temperature anomaly, is detected in the period, 3 = high warning occurs when NDVI anomaly, accompanied by precipitation anomaly, is detected in the period, 4 = very-high warning occurs when temperature, precipitation and NDVI anomalies are detected in the period.
- Band 1 range values: 0 – 4, bad value = -1, Out of the ROI = -1111

**Figure 1.** Crop early warning based on NDVI Anomaly, Temperature Anomaly and Precipitation Anomaly. The figures refer to a low, moderate and high warning due to NDVIA, Temperature and Rainfall (level of warning = 1, 3 and 4 respectively). The images are referred to the dates of 10/02/2022 (a), 17/01/2022 (b).

# Crop early warning (S2-P06): high resolution

Indicator name	Explanation
<b>VCI</b>	VCI time series based on last 6 years of Sentinel-2 images (actually in production phase)
<b>TAI</b>	Temperature anomalies time series computed from the time of the crop growth starting season
<b>Rain</b>	Precipitation shortage cumulative value starting from one month in advance with respect the crop growth starting season

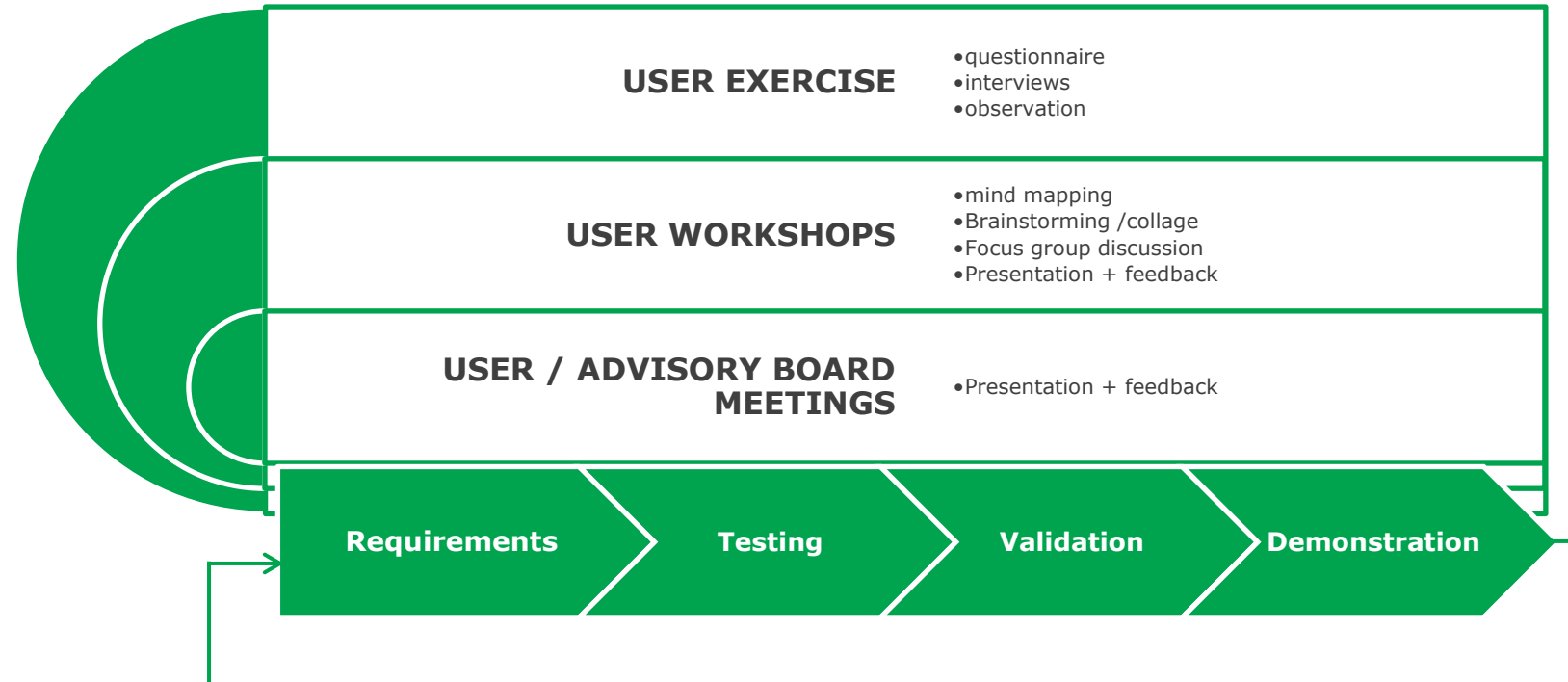


G.Laneve, M. Kganyago, T. Alexandridis, A. Challinor, S. H. García (2022). Introduction to AfriCultuReS Service Portfolio for Rwanda [Workshop presentation]. 3<sup>rd</sup> AfriCultuReS User Workshop. Kigali, Rwanda

# Co-Design & co-development

## Key Sectors

- ✓ Public sector
- ✓ Agribusiness sector (including smallholder farmers)
- ✓ Financial sector
- ✓ Academic sector
- ✓ NGO



**Clarisse Kagoyire**  
**CGIS, University of Rwanda**  
**[c.kagoyire@ur.ac.rw](mailto:c.kagoyire@ur.ac.rw) | [kclarisse@gmail.com](mailto:kclarisse@gmail.com)**



**thank you**





EU GLOBAL ACTION  
ON SPACE

South America

# Earth observation for monitoring food security in Kenya

Stella Mutai  
World food programme  
[stellachela1@gmail.com](mailto:stellachela1@gmail.com)

Earth Observation for monitoring coffee farming in Kenya







## Earth Observation is key to monitoring food security in Kenya

- This research assesses the feasibility of monitoring coffee diseases by using vegetation indices and textural variation through the use of a technological innovation namely the Digital Earth Africa (DE Africa).
- DE Africa offers an opportunity to assess differences in agriculture fields over time, location and allow the assessment of vegetation phenology such as planting and harvesting.
- DE Africa has helped conduct time series analyses of coffee growth variability in diverse seasons and permit the use of diverse datasets.
- We measured the vegetation indices representing the crop leaf area and the annual variations that occurred in these indices expressing the gain or loss of leaves during the coffee crop development within the agricultural year.





## Earth Observation is key to monitoring food security in Kenya

- DE Africa offers an opportunity to assess differences in agriculture fields over time, location and allow the assessment of vegetation phenology such as planting and harvesting.
- The value added, to end users, is the improvement of crop-type mapping with multi-sensors-temporal data in agriculture scenarios by use of effective data on crop planting adjustment and yield precision in coffee agricultural regions, where higher NDVI/EVI indicates coffee plantations are suffering from plant disease



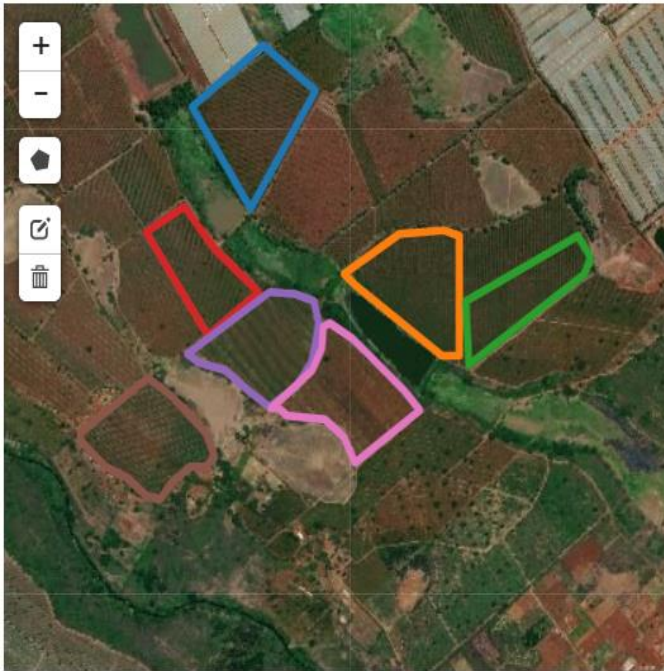
Study area: Central Kenya



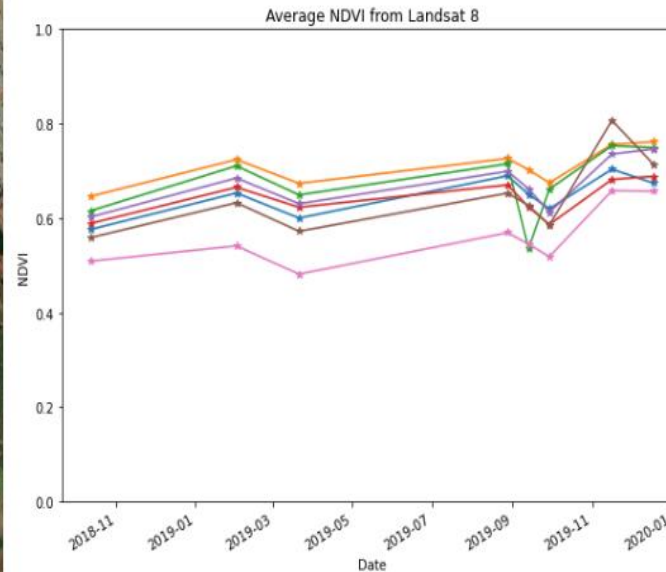


## Earth Observation is key to monitoring food security in Kenya

- Assessment of farming in Central Kenya using DE Africa. We can see the difference in greenness values (NDVI) for different farms.



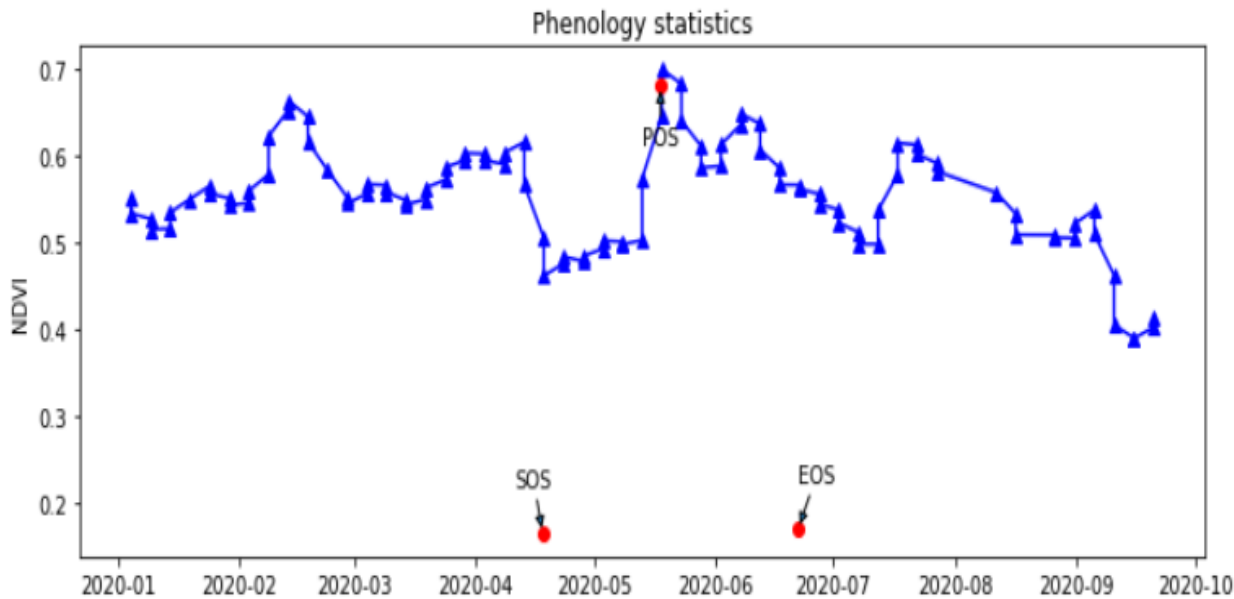
Leaflet | Tiles © Esri — Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, UPR-EGP, and the GIS User Community



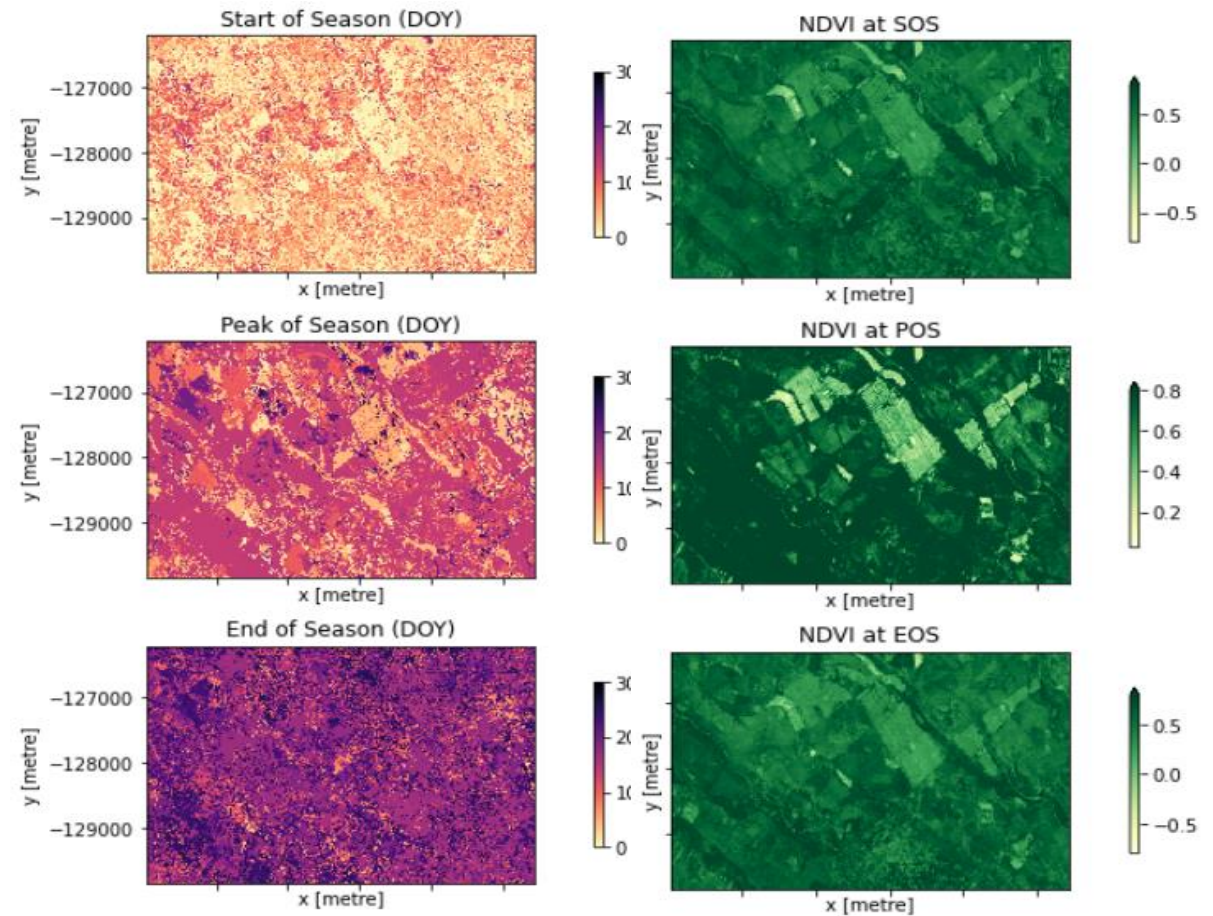


# Earth Observation is key to monitoring food security in Kenya

- Assessment of crop health in the year 2020



SOS: start of season  
 POS: peak of season  
 EOS: end of season



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## Earth Observation is key to monitoring food security in Kenya

- The information from DE Africa can be used for decision making regarding optimised planting, location, optimised fertilization, and yield forecasting based on historic and current climate conditions.
- The use of DE Africa is fairly new and open source, thus saving costs in implementation in support of agriculture and food security in Africa.
- The use of DE Africa strengthens connections between data, applications, and users facilitating management, access and use of Analysis Ready Data allowing different types of users to harness big Earth data at minimum cost and effort.
- DE Africa is working on developing a crop mask, which will help in validation of some the products from this research link: <https://www.digitalearthafrika.org/co-designing-product-development-address-food-security-africa>





## Thank you

- Digital Earth AFRICA:  
<https://www.digitalearthafrica.org/>
- GitHub Wiki:  
[github.com/digitalearthafrica/deafrica-sandbox-notebooks](https://github.com/digitalearthafrica/deafrica-sandbox-notebooks)
- Slack: [opendatacube.slack.com/](https://opendatacube.slack.com/)

### Special Africa Prize: GeoM&E – Kenya/Italy





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# Roundtable

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# Closing remarks

Tomas Dimitrov





Thanks for your participation !



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