

La necessità di integrazione dei sistemi UAS, C-UAS e satellitari. I nuovi scenari di impiego

17 Ottobre 2022, Seminario CESMA, Casa dell'Aviatore, Roma

Integrazione tra droni e dati Earth Observation da satellite Use case e futuri sviluppi

serco

Marco Cerri
Account Manager
Serco Italy

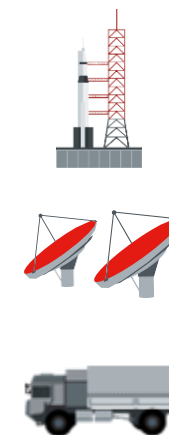
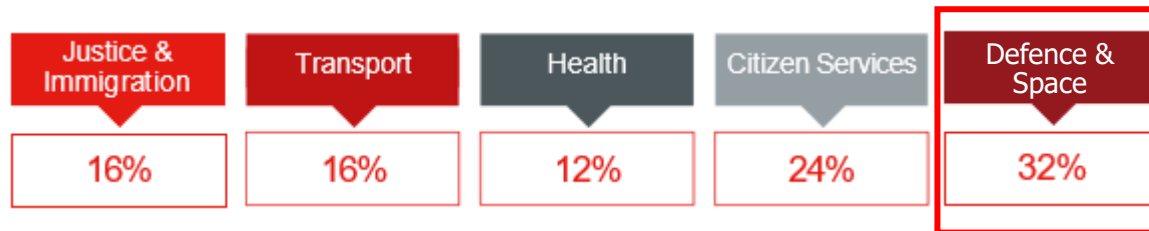
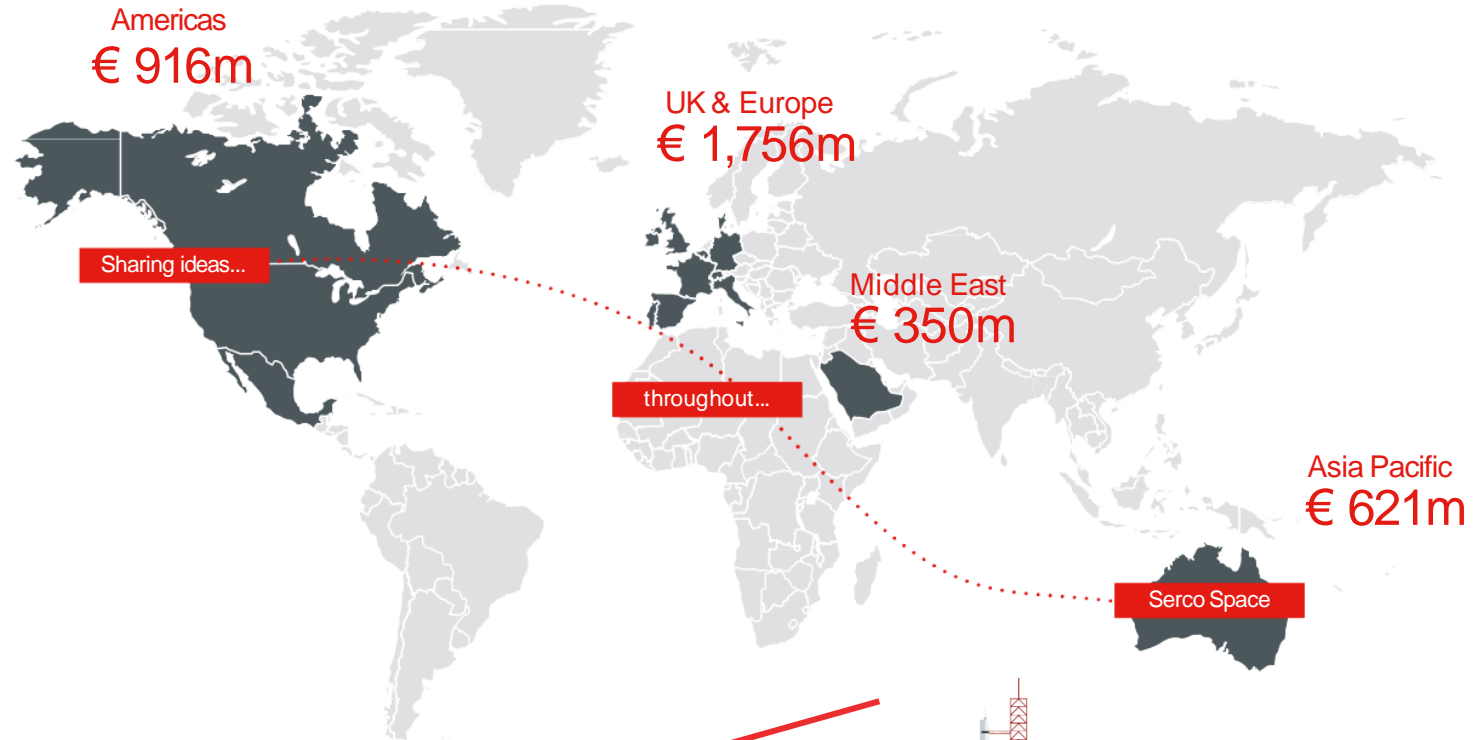


Serco Group Global Capability Overview

Proud to deliver technical and scientific services to governments and other public institutions who serve the public

Global operations across four geographic regions

- Over **55,000 employees** in 20 countries
- c. **€ 3.25bn revenue**
- c. **€ 14bn order book**
- 500 contracts worldwide
- Revenue in **Defence c. € 1.1bn**



Ground Operations

Engineering & Technical Services

Specialist Operations

Serco Europe Overview



Space



International Organisations



Defence



Others



Contracts

57



Staff

4000+



Revenues

€150m



History

40 Years



Acquired in May 2022

Serco Belgium & Serco Luxembourg



Deutsches Zentrum für Luft- und Raumfahrt
German Aerospace Center



European Space Agency
Agence spatiale européenne



Serco Czech Republic



Serco Netherlands & Serco Spain



EUMETSAT



CNES
CENTRE NATIONAL D'ÉTUDES SPATIALES

Serco Germany



Agenzia Spaziale Italiana

Serco Italy



Joint Research Centre
JRC

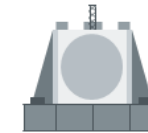
Serco France & Switzerland



European Environment Agency

● Serco Europe main sites

Serco Italy Focus on space mid- and downstream



Data Process

- Copernicus Data Access service
- User products generation

Develop Applications

- ONDA
- Applications development
- Training Services
- Copernicus Research and User Support
- International Disaster Charter Services/PRISM

←→
Ground Segment Services
(midstream)

←→
Applications
(downstream)

2021 numbers

- Over **220 employees**
- €35m revenue**

Copernicus Data Access Services Some numbers



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

Statistics Data from 20 May 2022

Functioning

Worldwide most used Copernicus access portal



Sentinel-1



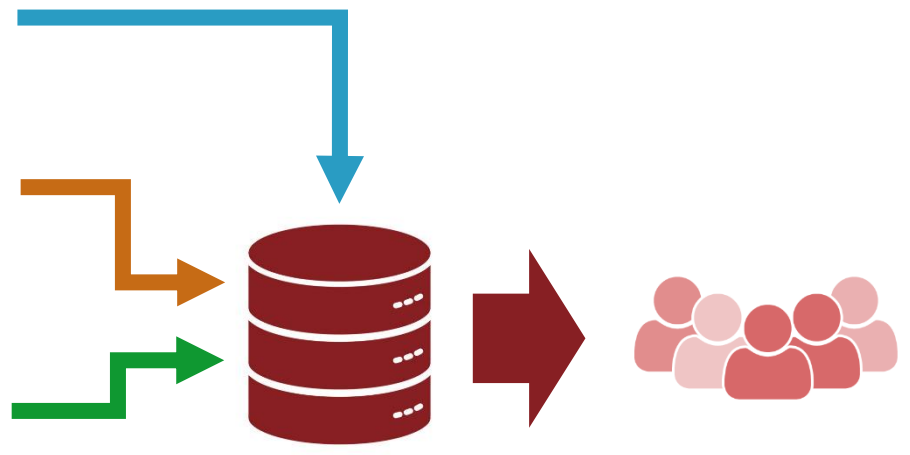
Sentinel-2



Sentinel-3



Sentinel-5p



Registered Users



561,071

Users Downloads Volume



445.82 PB

Published Products



50,607,836

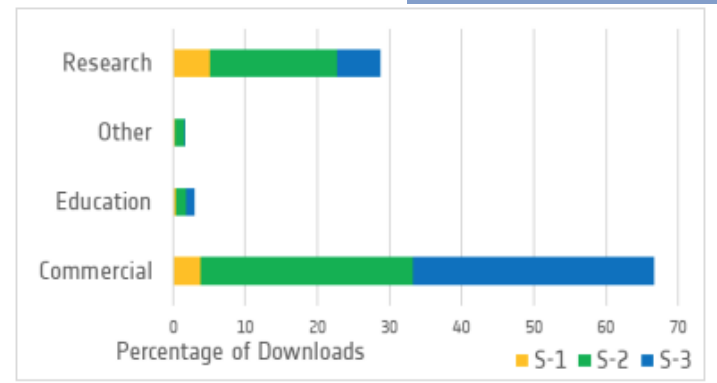
Daily Average Downloads

350,000 GB

Daily Average New Images

40,000 GB

Type of user



Satellite Earth Observation Availability and trend

- Optical and SAR
- Mid resolution to High resolution

March 23, 2021
Container ship Ever Given blocking the Suez Canal in Egypt



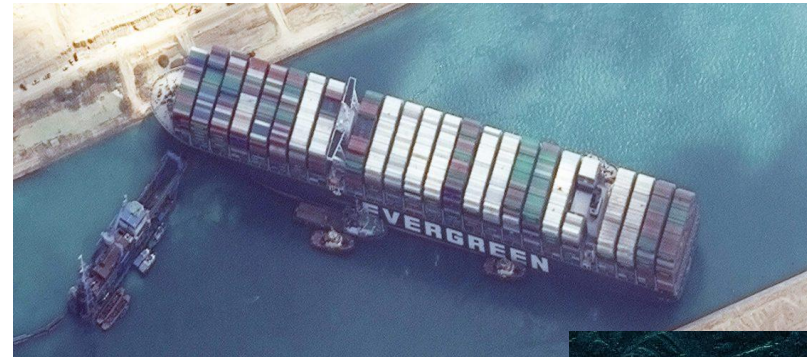
Ever Given: 400 m long, 59 m wide



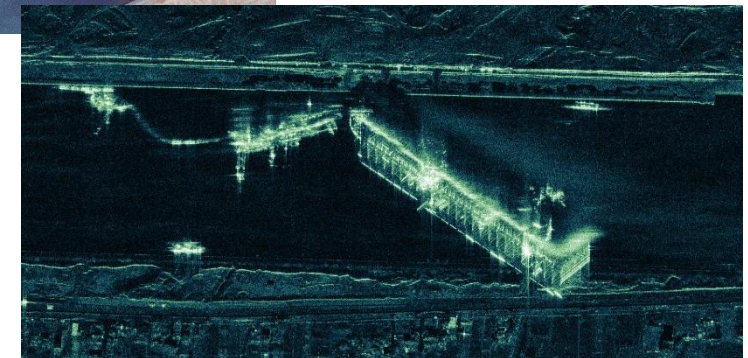
ESA Sentinel-2, 10 meter



Planet Labs, 3 meter



Maxar WV-3, 30 cm



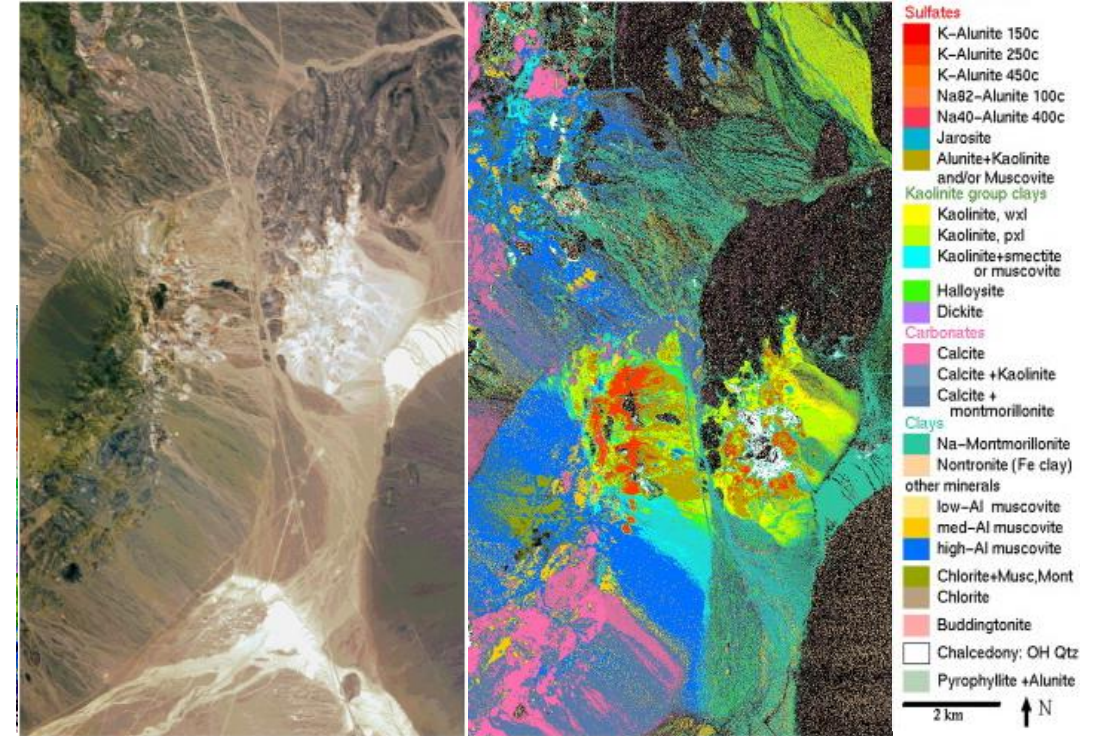
SAR - Iceye, 1 meter

Satellite Earth Observation Availability and trend

- RGB, Multispectral and Hyperspectral



SWIR bands - Maxar WV-3, 3.7 meter



Example of Hyperspectral acquisition

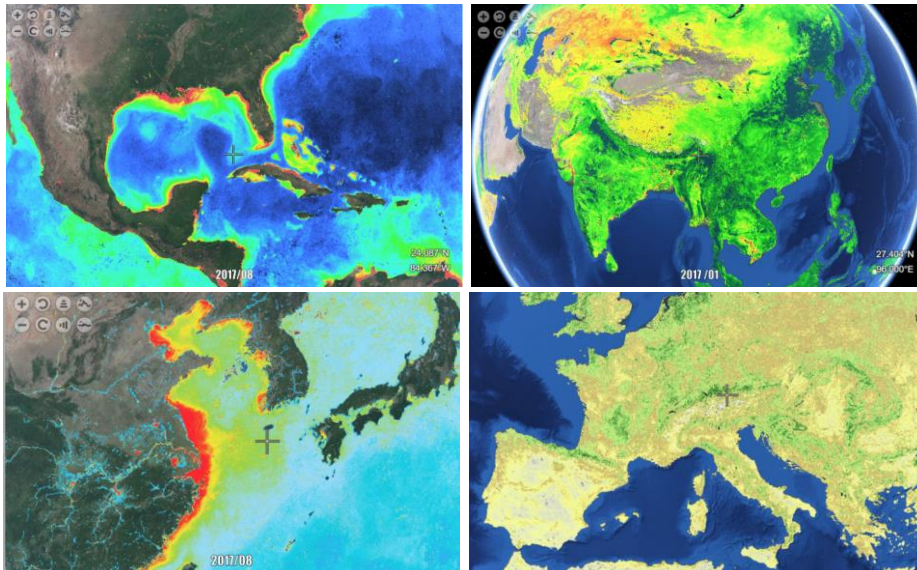
<https://doi.org/10.1016/j.geoderma.2010.12.018>



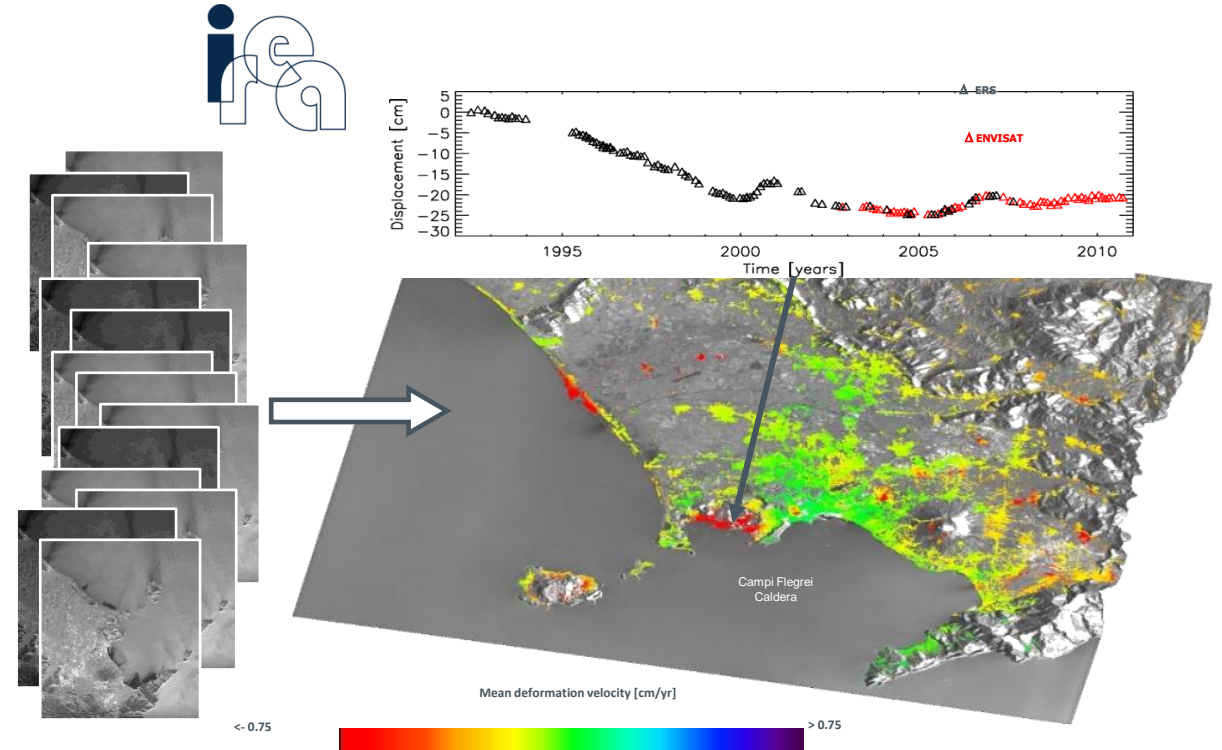
Hyperspectral satellite PRISMA

Satellite Earth Observation Availability and trend

- Surveillance, Monitoring, Analysis scopes



Various climate and weather observations

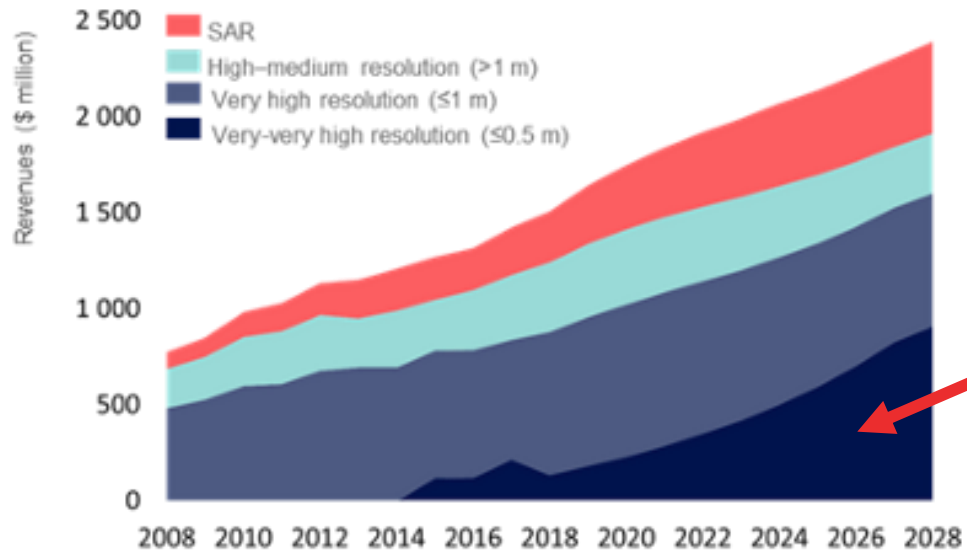


CNR-IREA, Interferometric analysis for land and infrastructure stability monitoring

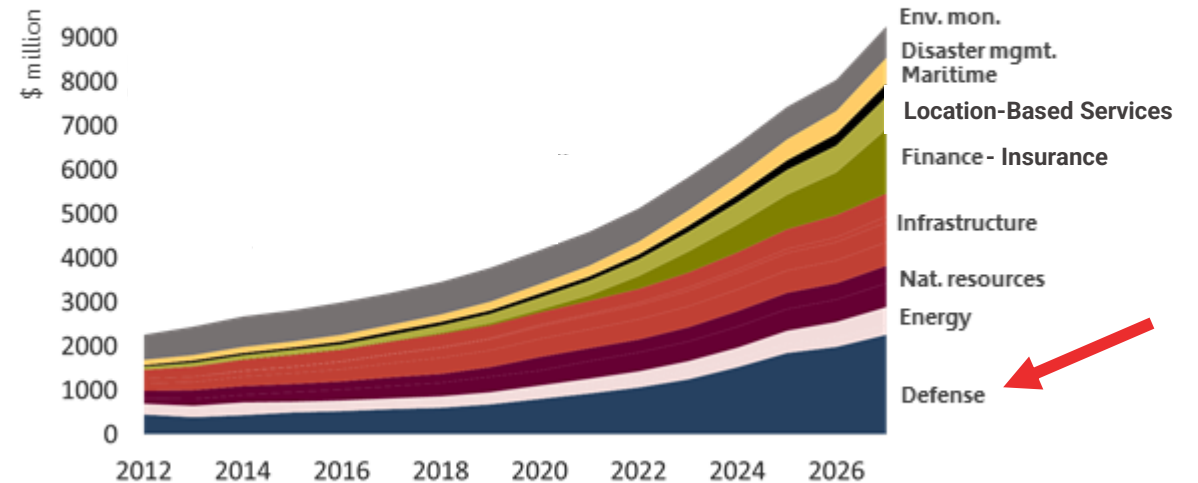
Satellite Earth Observation Availability and trend

- Diffusion and trends

EO market by Data type: 2008 - 2028



EO Added Value by Sector: 2012 - 2027



<https://www.euroconsult-ec.com/press-release/earth-observation-data-market-to-reach-2-4-billion-vas-market-potentially-at-9-billion-by-2027/>

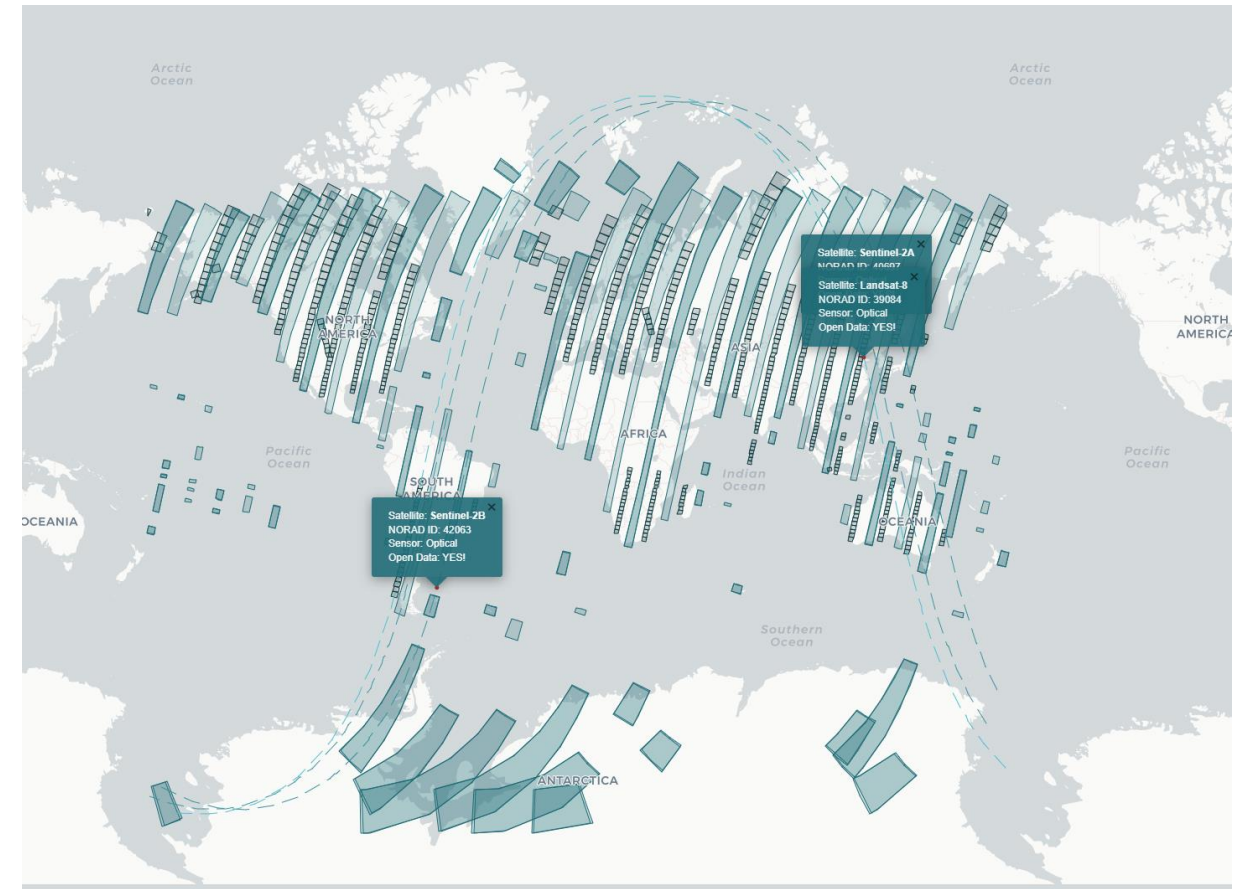
Satellite Earth Observation Advantages

- Regularity and frequency of revisit
- Access to remote areas
- No need of license or authorization to acquire
- Possibility to limit the distribution



<https://www.google.com/maps/@48.8141413,2.2549908,846m/data=!3m1!1e3>

Blurred area - French military hospital in Clamart, Paris



spectator.earth | Leaflet. ©OpenStreetMap.

<https://spectator.earth/satellite-acquisition-plan-viewer/>

Live Sentinel-2 and Landsat acquisition plan with areas for successive 24h

Satellite Earth Observation Advantages

- Easy to perform constant monitoring and analysis
- Easy to interpretate data (optical)
- Data acquired and stored in a structured way
- Data easily accessible



Maxar - Apple Park construction works, Cupertino, USA

ONDA

Search

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Size: 1.58 GB Creation date: 05/Jul/2018 10:04:11.000
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Loaded Products 15 / 3772527

REMOVE LAYERS

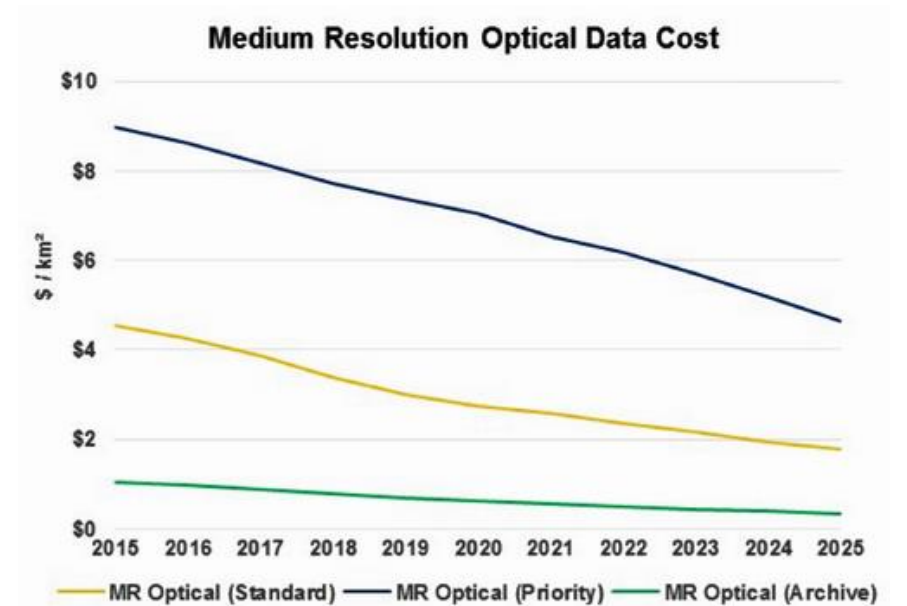
Earth Observation imagery catalogue from ONDA

Satellite Earth Observation Disadvantages

- Limited resolution for certain applications (for commercial providers)
- No possibility to acquire a continuous view (limited possibility to have live video acquisition)
- High cost (but decreasing over time)
- Weather limitation (for optical acquisitions)



Tweet from President Trump showing a spy satellite image at about 6 cm resolution



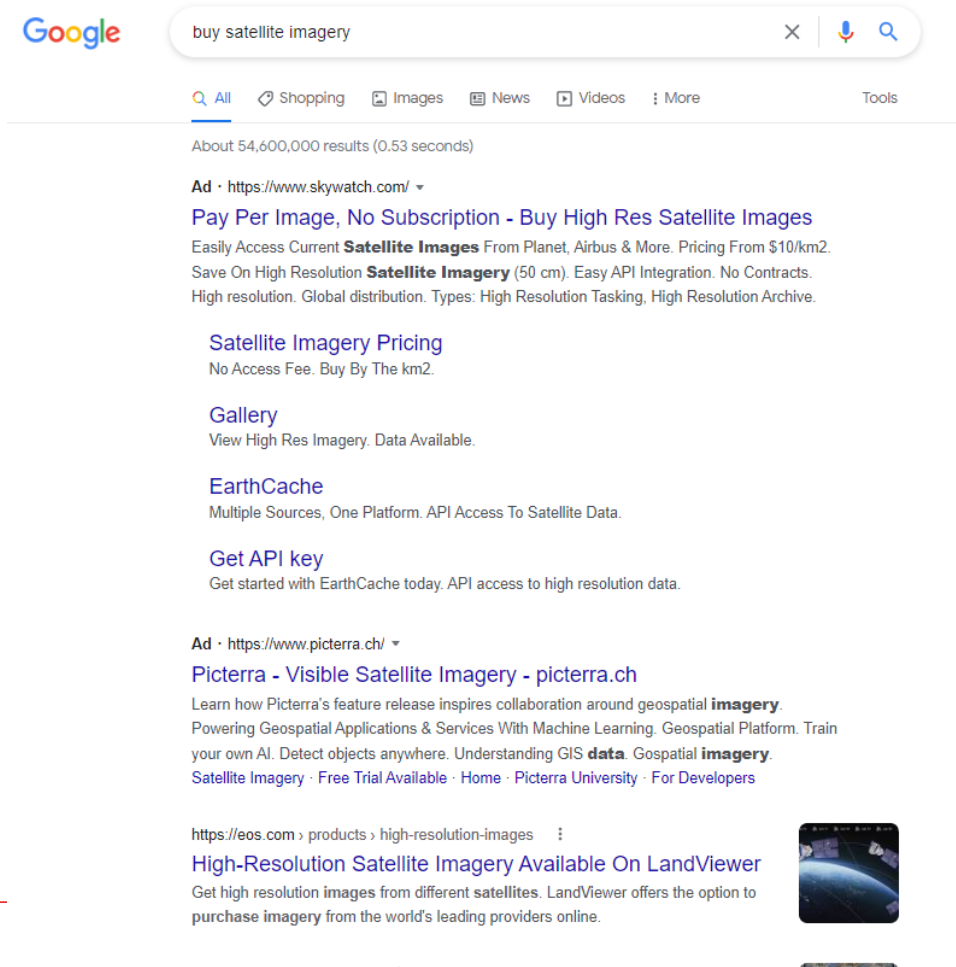
<http://www.satnews.com/story.php?number=102009455>

Cost per medium-resolution optical image

Satellite EO and Drones Differences

- Data archiving structure and access

EO **structured** databases universal **accessible** - UAV acquisitions **heterogeneous and operator-based**



Google search results for "buy satellite imagery".

Search query: buy satellite imagery

Results: About 54,600,000 results (0.53 seconds)

Ad · <https://www.skywatch.com/>

Pay Per Image, No Subscription - Buy High Res Satellite Images

Easily Access Current **Satellite Images** From Planet, Airbus & More. Pricing From \$10/km2. Save On High Resolution **Satellite Imagery** (50 cm). Easy API Integration. No Contracts. High resolution. Global distribution. Types: High Resolution Tasking, High Resolution Archive.

[Satellite Imagery Pricing](#)
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Multiple Sources, One Platform. API Access To Satellite Data.

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Get started with EarthCache today. API access to high resolution data.

Ad · <https://www.picterra.ch/>


Picterra - Visible Satellite Imagery - picterra.ch

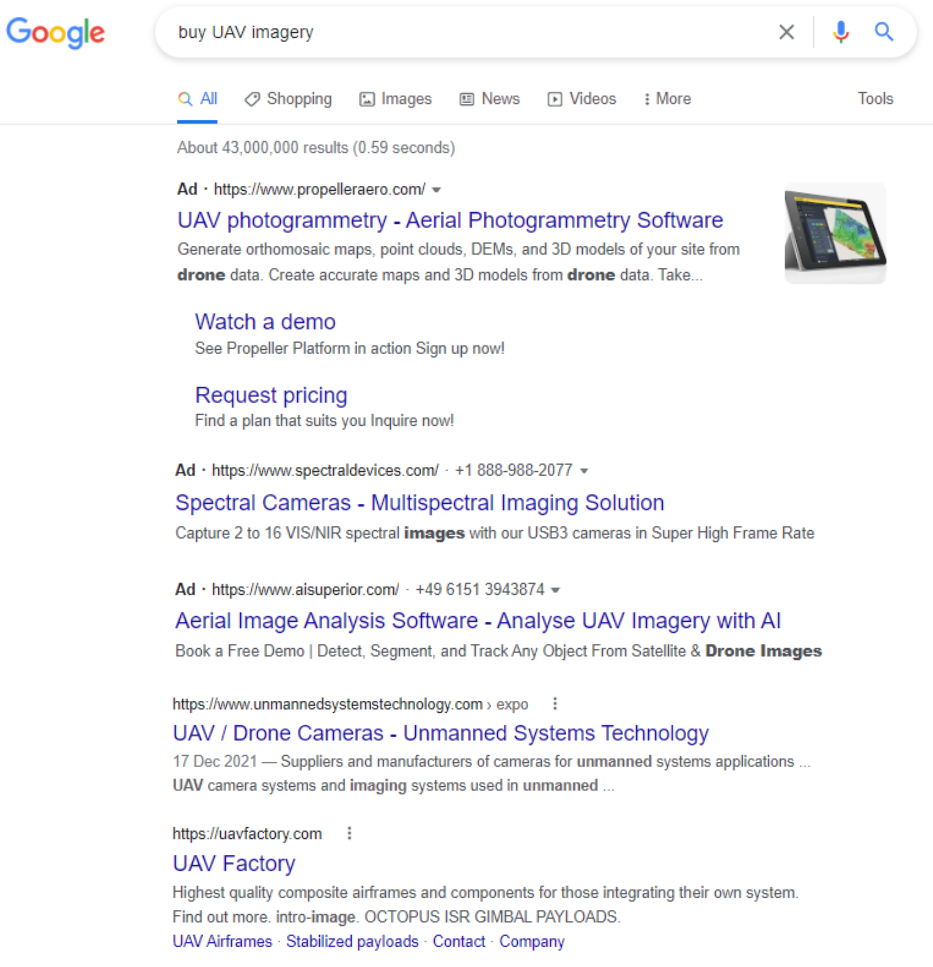
Learn how Picterra's feature release inspires collaboration around geospatial **imagery**. Powering Geospatial Applications & Services With Machine Learning. Geospatial Platform. Train your own AI. Detect objects anywhere. Understanding GIS **data**. Gospatial **imagery**. [Satellite Imagery](#) · [Free Trial Available](#) · [Home](#) · [Picterra University](#) · [For Developers](#)

<https://eos.com> > products > high-resolution-images

High-Resolution Satellite Imagery Available On LandViewer

Get high resolution **images** from different **satellites**. LandViewer offers the option to purchase **imagery** from the world's leading providers online.





Google search results for "buy UAV imagery".


Search query: buy UAV imagery

Results: About 43,000,000 results (0.59 seconds)

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<https://www.unmannedsystemstechnology.com> > expo

UAV / Drone Cameras - Unmanned Systems Technology

17 Dec 2021 — Suppliers and manufacturers of cameras for **unmanned systems applications** ... UAV camera systems and **imaging** systems used in **unmanned** ...

<https://uavfactory.com>

UAV Factory

Highest quality composite airframes and components for those integrating their own system. Find out more. [intro-image](#). [OCTOPUS ISR GIMBAL PAYLOADS](#). [UAV Airframes](#) · [Stabilized payloads](#) · [Contact](#) · [Company](#)

Satellite EO and Drones Differences

- Data archiving structure and access
EO **structured** databases universal **accessible** - UAV acquisitions **heterogeneous and operator-based**
- Acquisition method
EO covers **large areas** - UAV acquisitions **higher resolution**, focus on **specific areas**
- Acquisition control
EO follows **predetermined orbits** (last command up to 30 mins before – commercial) - UAV operator **flexible in the acquisition**, addressing **specific request**
- Data transfer time
EO **45 mins to the user's screen** – commercial (downlink to ground station – transfer to servers – ingestion in the system) - UAV **live view to the user's screen** (radio transmission)

Satellite EO and Drones Integration and Future developments

- Necessity to combine benefits from EO and UAV

Systematic acquisition from **EO** + **Dynamic** acquisition from **UAV**



- Data archiving structure and access

EO **structured** databases universal **accessible** - UAV acquisitions **heterogeneous and operator-based**

1. Need to create a **coherent and structured catalogue**

- **Location** coherency and accuracy
- Data **format** and readability
- Overlapping and comparison



Satellite EO and Drones Integration and Future developments

2. Need to adopt **Data Fusion** algorithms for integrating EO data, UAV data

- Based on AI algorithms for data ingestion from different sources
- Possibility to integrate ground-based surveillance cameras, IoT
- Allow for data analysis, feature identification

EO data + UAV data

3. Need to cope with **enormous computational demand**

- Development of **cloud platforms** for computing infrastructure
 - Scalability of intense **Computing Power and Storage**
 - **Cyber security**

Scalability



Cloud Resources and Data Offer



Dedicated Virtual Machines on the cloud

Huge amount of data on the cloud

Cloud Resources



Tailored **Virtual Machines**
Pre-installed **Software Tools**

Copernicus Sentinel family



Commercial Satellites

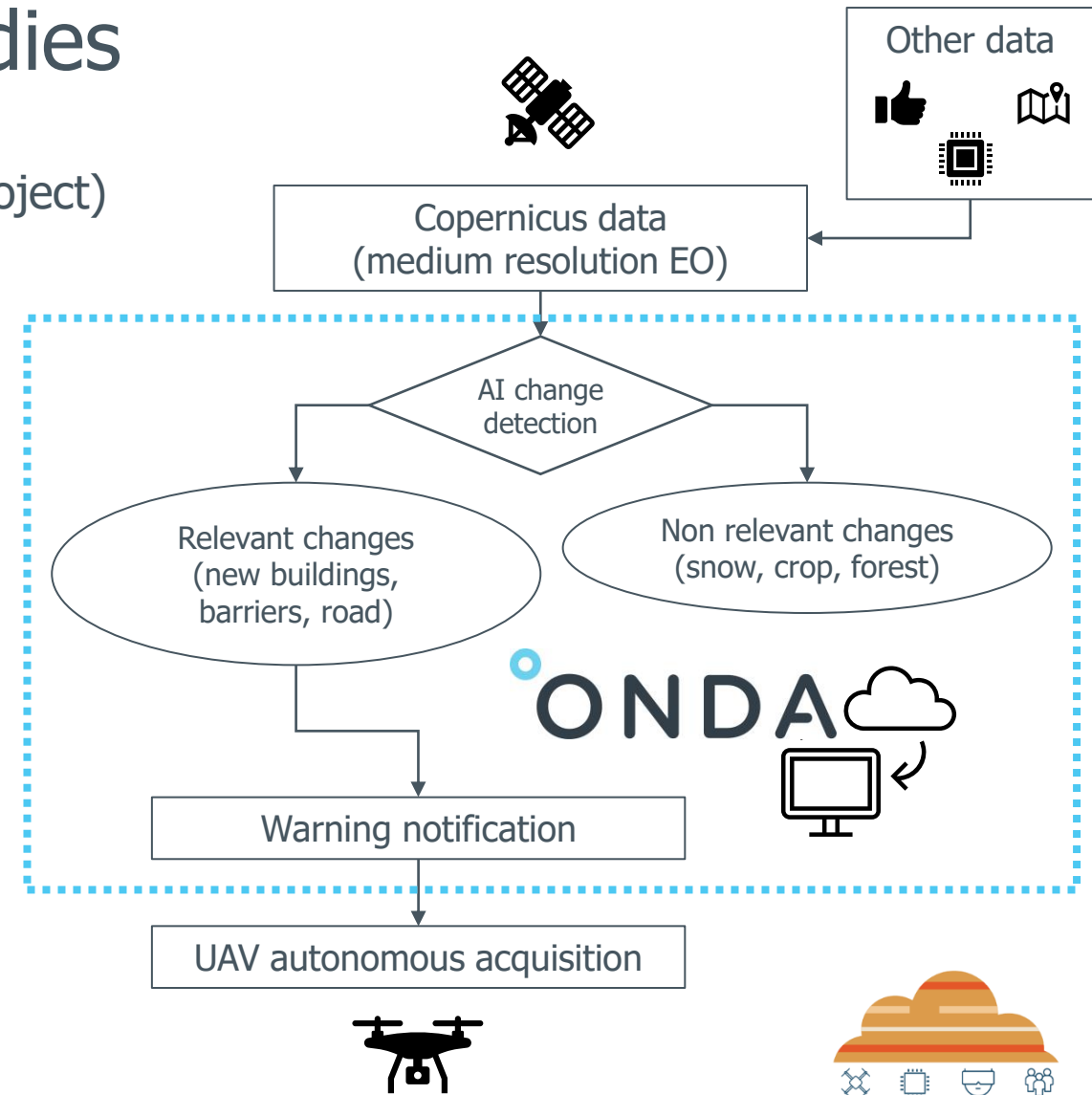
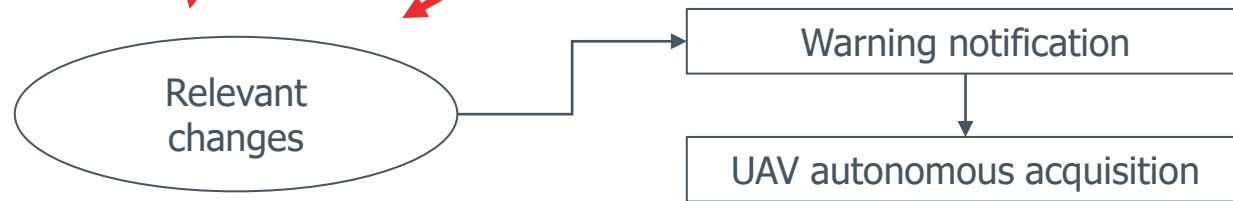
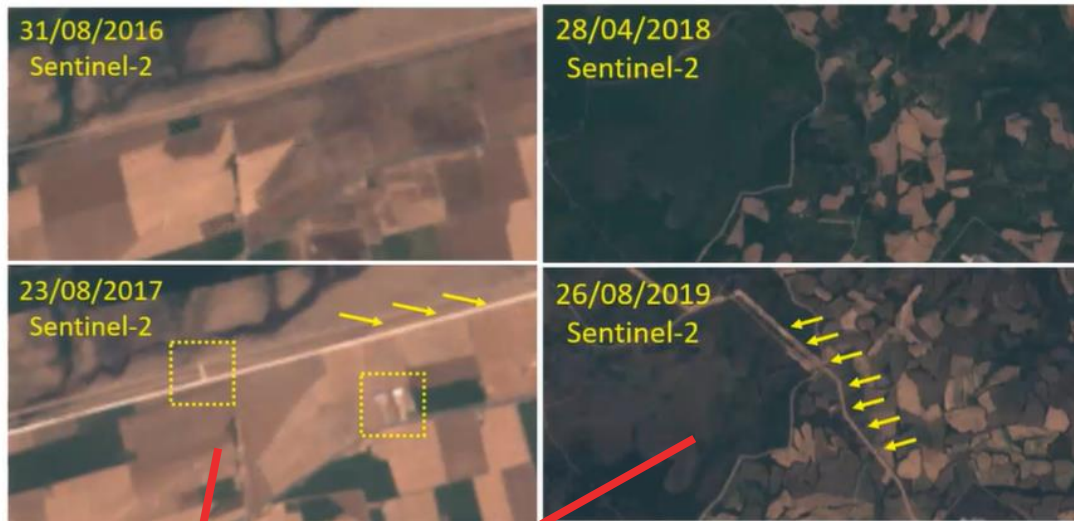


Possibility to upload and store any file



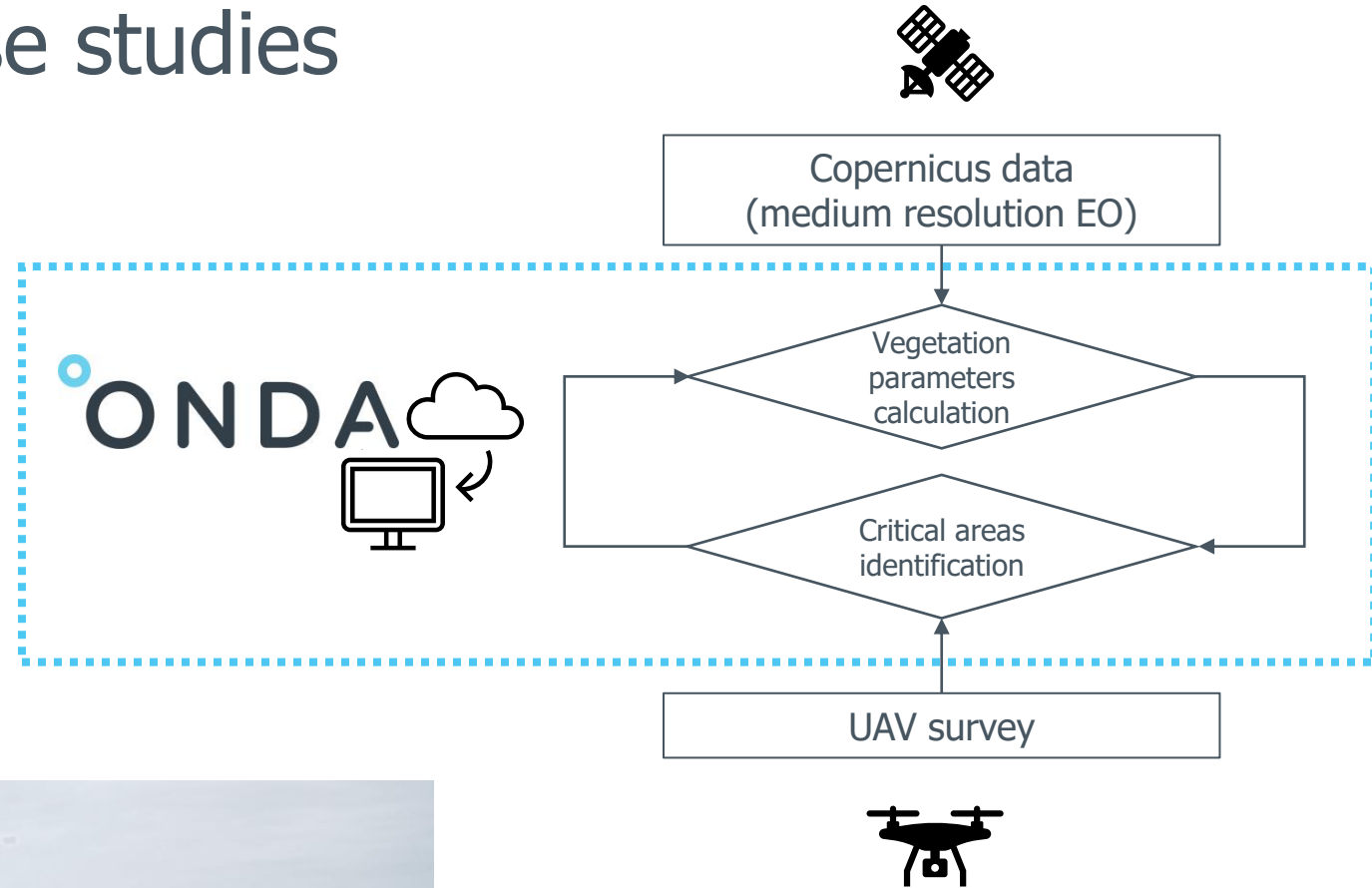
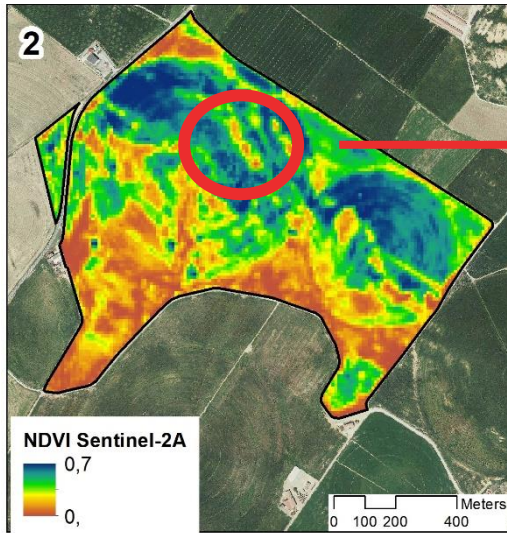
Satellite EO and Drones Case studies

- Callisto Project (European Commission funded R&D project)
 - **Border control** – Land surface change detection



Satellite EO and Drones Case studies

- Agriculture monitoring service
 - EO overall monitoring of parameters
 - UAV detailed mapping



NDVI - Normalized difference vegetation index
For assessing vegetation health status

Take home message

1. Earth Observation and UAV data NEED to be integrated because they complete each other
EO general overview and regular monitoring + **UAV focus** and higher details on specific areas



2. Cloud platforms are NECESSARY to implement AI algorithms for data fusion and big data analysis
 - **Scalable, powerful capacity, storage**



3. Some solutions can NOT be integrated and interchanged between EO and UAV
 - Satellites have **regular** orbit, time acquisition, light conditions, view angle
 - UAV have higher **flexibility**, higher resolution, based on expert pilot's judgment
 - Some technologies (Interferometric Analysis) **cannot be transferred**

Contact me:

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Serco.com/Space

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