



IRIDE: From Earth Observation to Operational Geospatial Services

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Hotine-Marussi Conference

10 September 2026

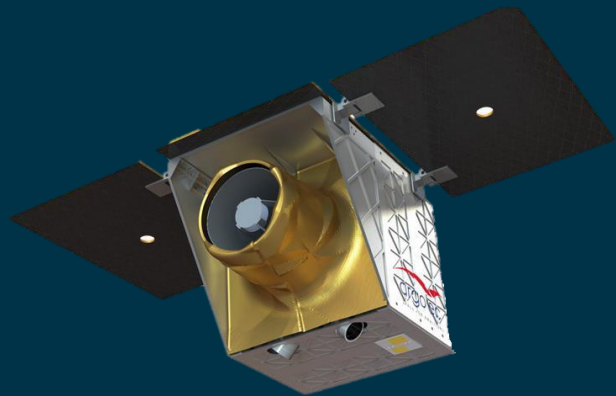
Agenda

- IRIDE Programme
- Upstream – Downstream
- IRIDE EO Data Products
- Services – Service Segment
- Cyber Italy



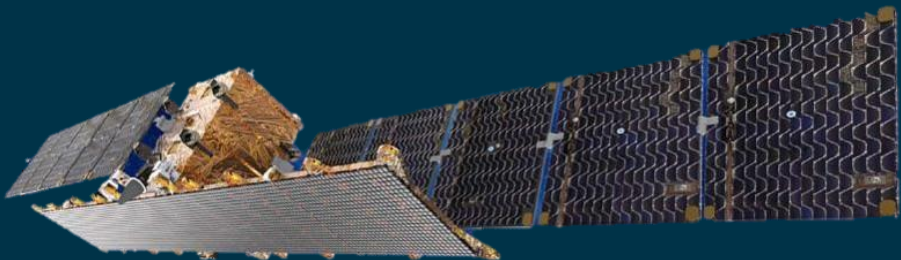
- IRIDE is an Italian Earth Observation Project Funded by Italy's National Recovery and Resilience Plan (PNRR)
- Implementation is managed by ESA with support of ASI
- Aimed at strengthening the capabilities to support environmental monitoring, disaster management, security and resources management over the Italian territory.
- Needs specified by Italian public Users (CNR, ASI, ISPRA, University etc...)
- Due to a challenging time schedule IRIDE relies mostly on existing capabilities within the Italian Space Industry, fostering its competences in commercial production.

IRIDE System - Upstream

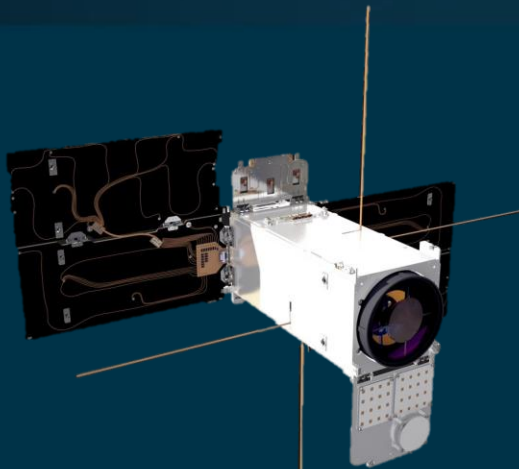


MS#2 HEO (Argotec, Officina Stellare)

MS High Resolution



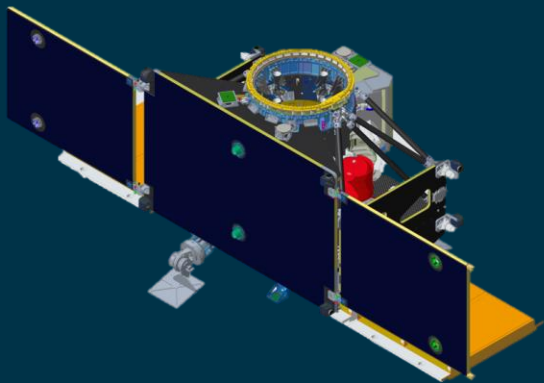
SAR#1 NIMBUS SAR (TAS-I)
X-band SAR



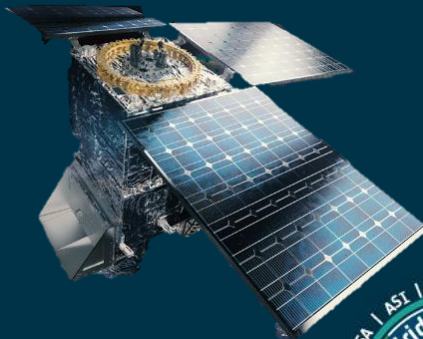
MS#1 Eaglet-2 (OHB-I, Optec)
MS High Resolution & AIS



NIMBUS VHR (TAS-I, MediaLario)
MS Very High Resolution



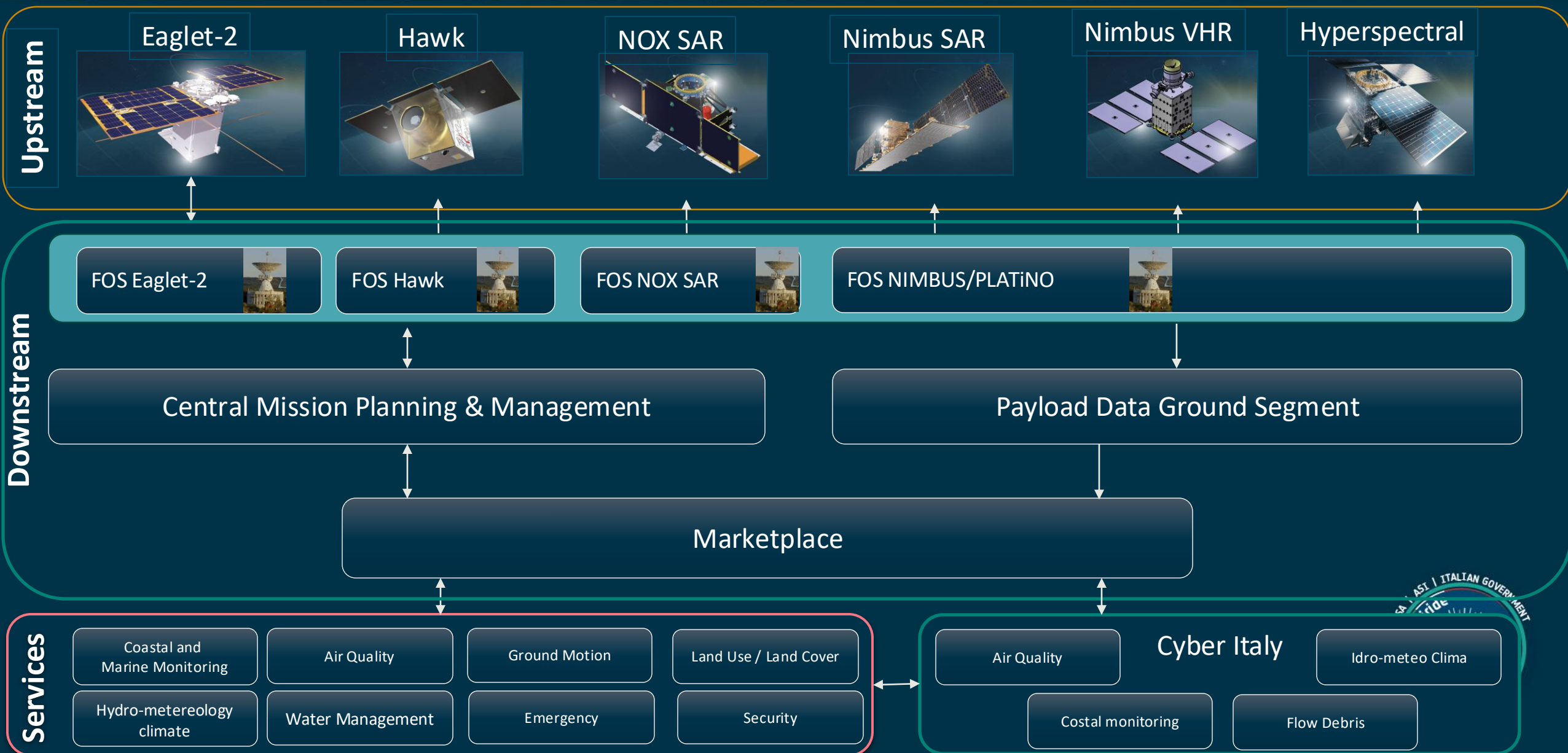
SAR#2 NOX SAR (D-Orbit, MetaSensing)
X-band SAR



PLATiNO HYP (Sitael, Leonardo)
Hyperspectral



IRIDE System Architecture



Flying Constellations – Current Status

First HEO satellite launched in January 2025, only 3 years after project start

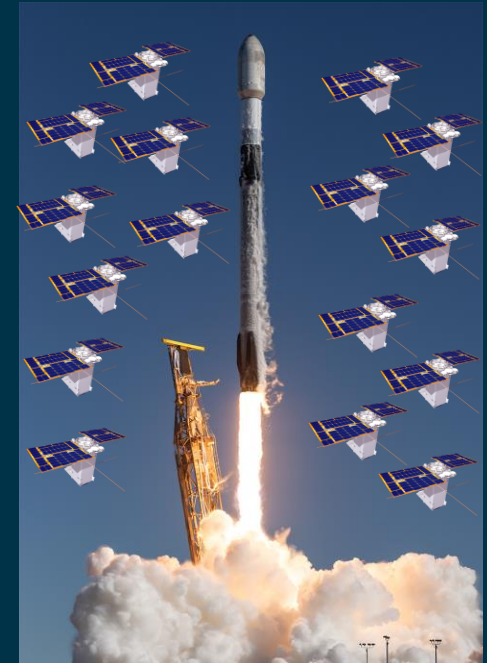


7 additional HEO satellites launched in June 2025 allowing deployment of the first constellation



7 additional HEO satellites launched in May 2026

8 satellites of the EAGLET-2 constellation launched in November 2025 allowing deployment of the second constellation; 8 additional EAGLET-2 satellites launched in March 2026. Total 16 satellites.



IRIDE Data Products Characteristics and Performance



IRIDE EO Data

Ground Resolution - Optical Payloads				
	HEO	Eaglet-2	NIMBUS-VHR	PLATINO- HYPER
PAN	2.7 [m]	n/a	0.9 [m]	< 5 [m]
MS	2.7 [m] (4 bands) * 5.4 [m] (3 red-edge bands)	2 [m] (RGB)	< 4 [m] *	< 21 [m] (Spotlight) < 31 [m] (Stripmap)
Swath	10.9 [Km]	18.3 [Km]	10.5 [Km]	21 [Km]

(*) Red, Green, Blue, NIR bands

Ground Resolution - SAR Payloads		
	NIMBUS-SAR	NOX-SAR
Spotlight	0.5 [m] – Swath: 2.5 [Km]	1.5 [m] – Swath: 10 [Km]
Stripmap	2.7 [m] – Swath: 27.5 [Km]	3 [m] – Swath: 30 [Km]
Scansar	11 to 17 [m] – Swath: 100 [Km]	6 to 10 [m] – Swath: 50-80 [Km]



Overall HEO Data Summary

- Level-1B (Radiance in sensor geometry)
- **Level-1C (Orthorectified TOA Reflectance)**
- Level-2A (Orthorectified BOA Reflectance + CC)
- GSD: 2.5 m
- Absolute Radiometric Uncertainty < 10%
- Absolute Geometric Accuracy < 6m (with GCPs)
- SNR > 90
- MTF > 10%
- Band co-registration < 0,3 pixels

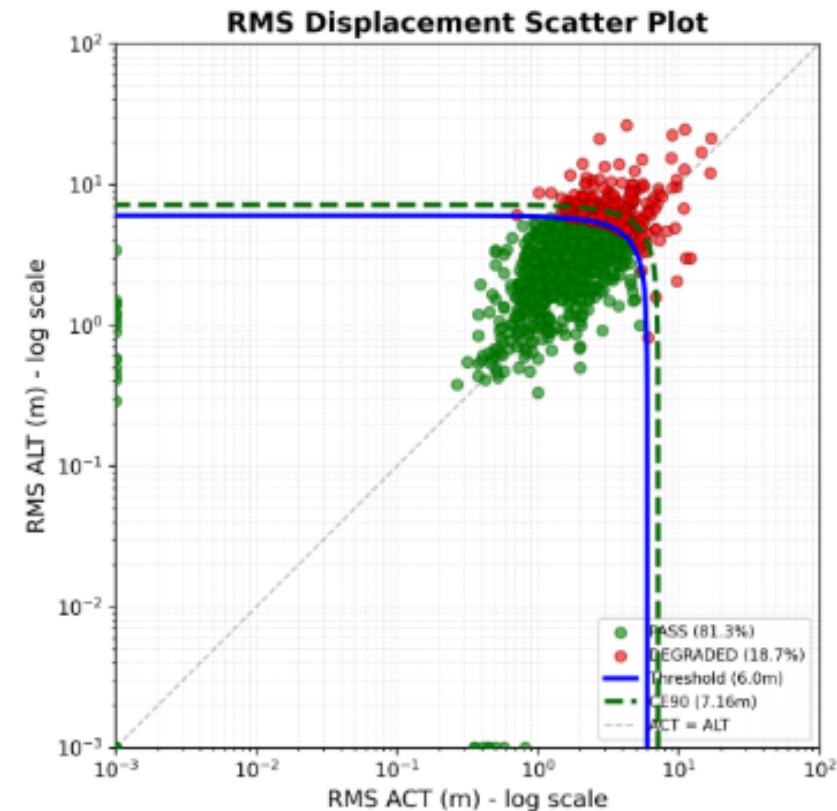
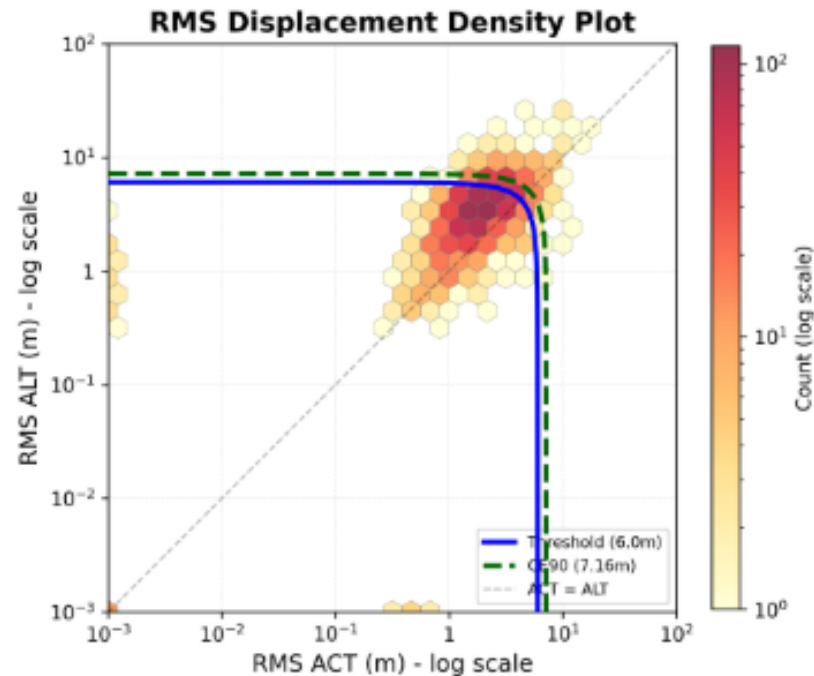
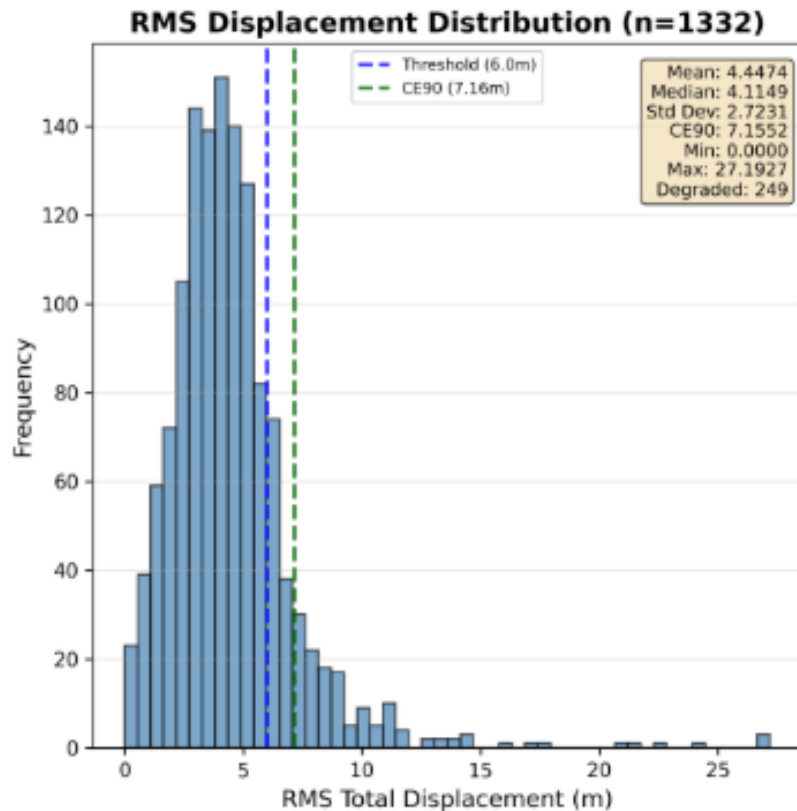


HEO Image over Google Earth - Alps



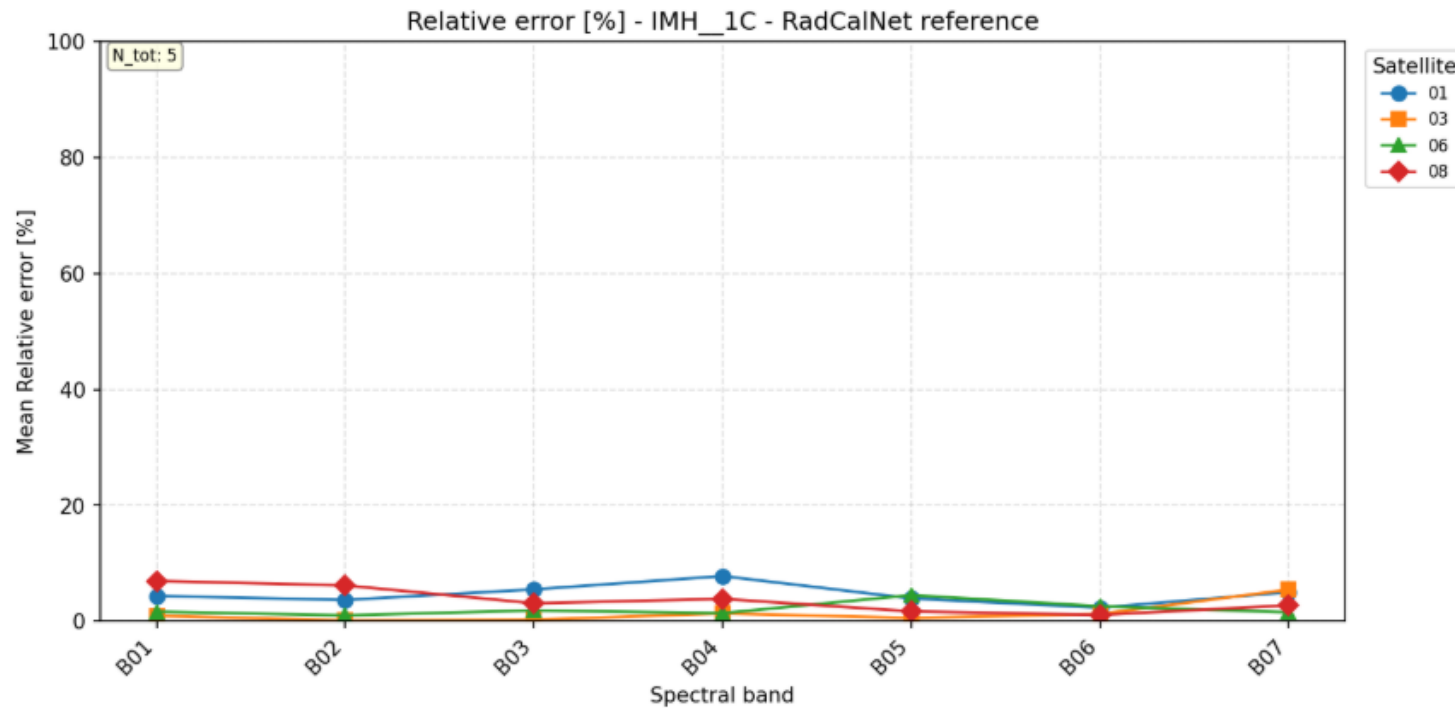
HEO Geometry – Absolute Geolocation

- Level-1C processing includes Copernicus DEM orthorectification and geometric refinement using GCPs

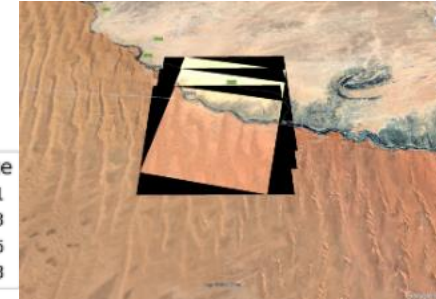


HEO Radiometry – Absolute Radiometric Uncertainty

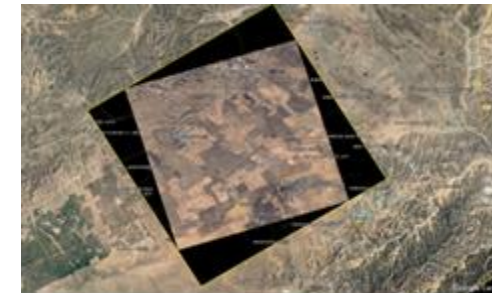
- Overall, the Radiometry Uncertainty is well below < 10%:



Gobabeb, Namibia - RadCalNet (GONA)



LaCrau, France - RadCalNet (LCFR)



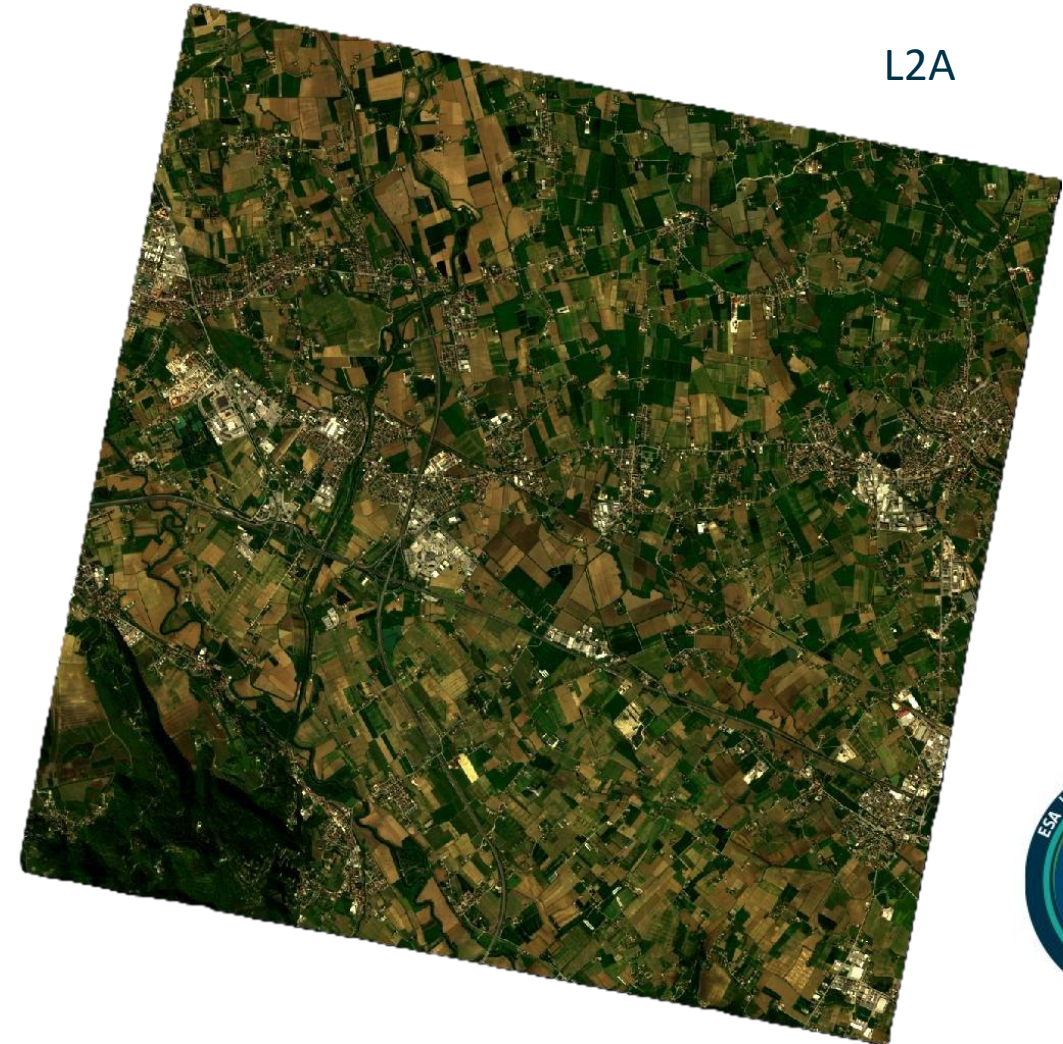
Baotou Sand, China - RadCalNet (BSCN)

product_name	B01	B02	B03	B04	B05	B06	B07
IMH01_1CST__OPT8_20260502T092955_20260502T092957_20260502T124118_07065	4,3448	3,6416	5,4680	7,7652	3,9101	2,3061	4,9945
IMH03_1CST__OPT8_20260219T115323_20260219T115325_20260508T140349_03595	0,9158	0,1032	0,2278	1,3173	0,5400	1,2241	5,4254
IMH06_1CST__OPT8_20260213T211625_20260213T211627_20260505T102055_03512	2,7118	1,3228	3,0873	2,5891	3,3866	0,5188	2,7651
IMH06_1CST__OPT8_20260213T211627_20260213T211629_20260505T102051_03512	0,5258	0,6400	0,5819	0,1340	5,5632	4,5872	0,2599
IMH08_1CST__OPT8_20260215T115514_20260215T115516_20260508T172418_03537	6,9301	6,1528	3,0651	3,8303	1,6751	1,0622	2,7174



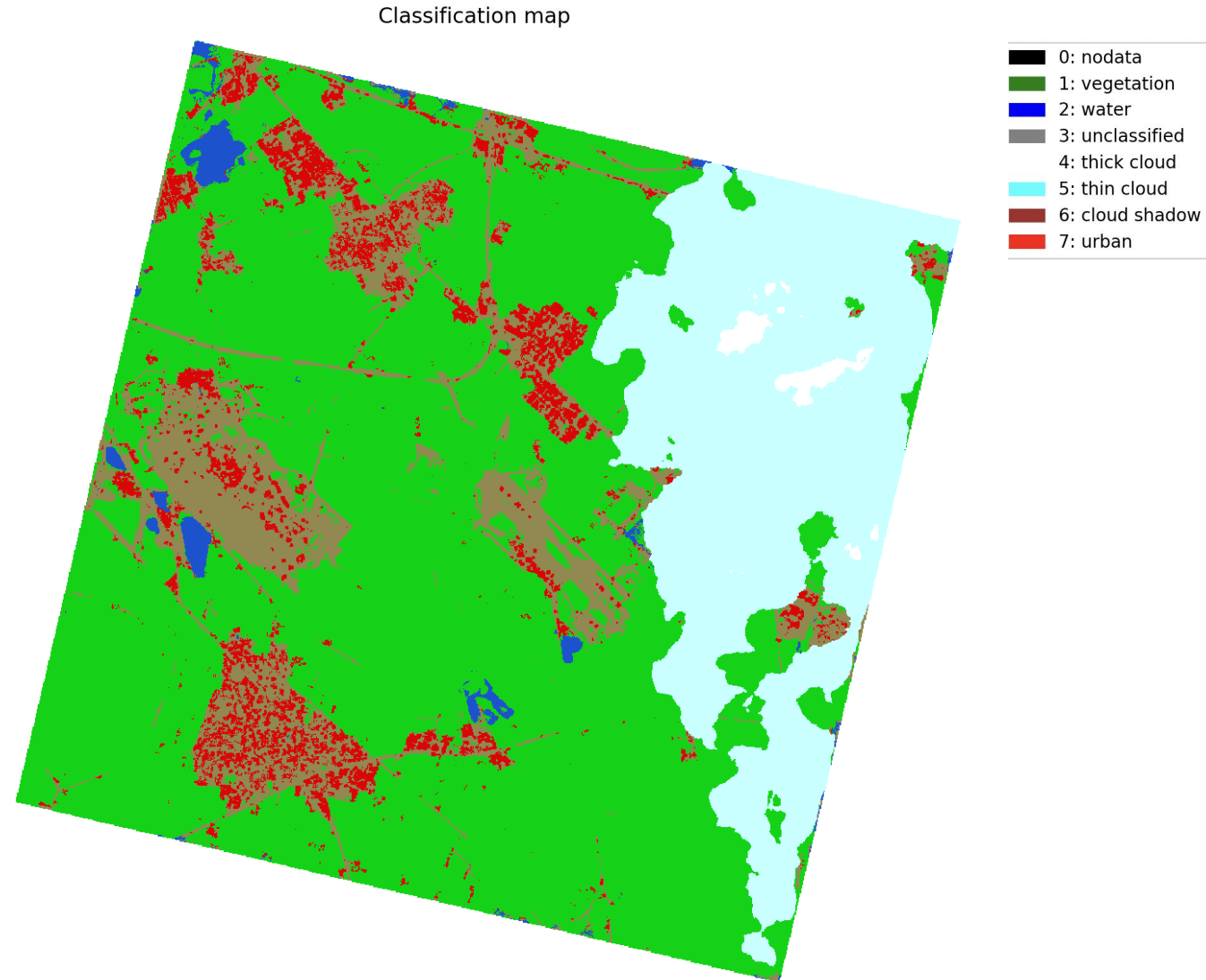
Level-2A – Atmospheric Correction

- To get Bottom of Atmosphere Reflectance (BOA)

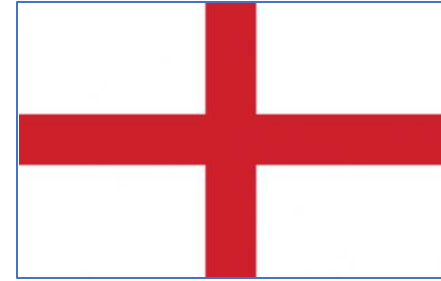


Level-2A – Scene Classification + Cloud Coverage

➤ ...and Scene Classification including Cloud Mask and Cloud Shadows



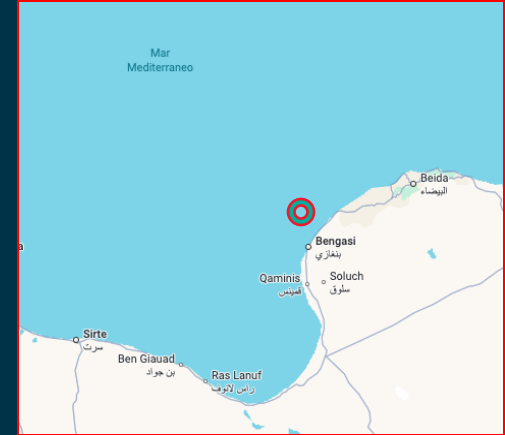
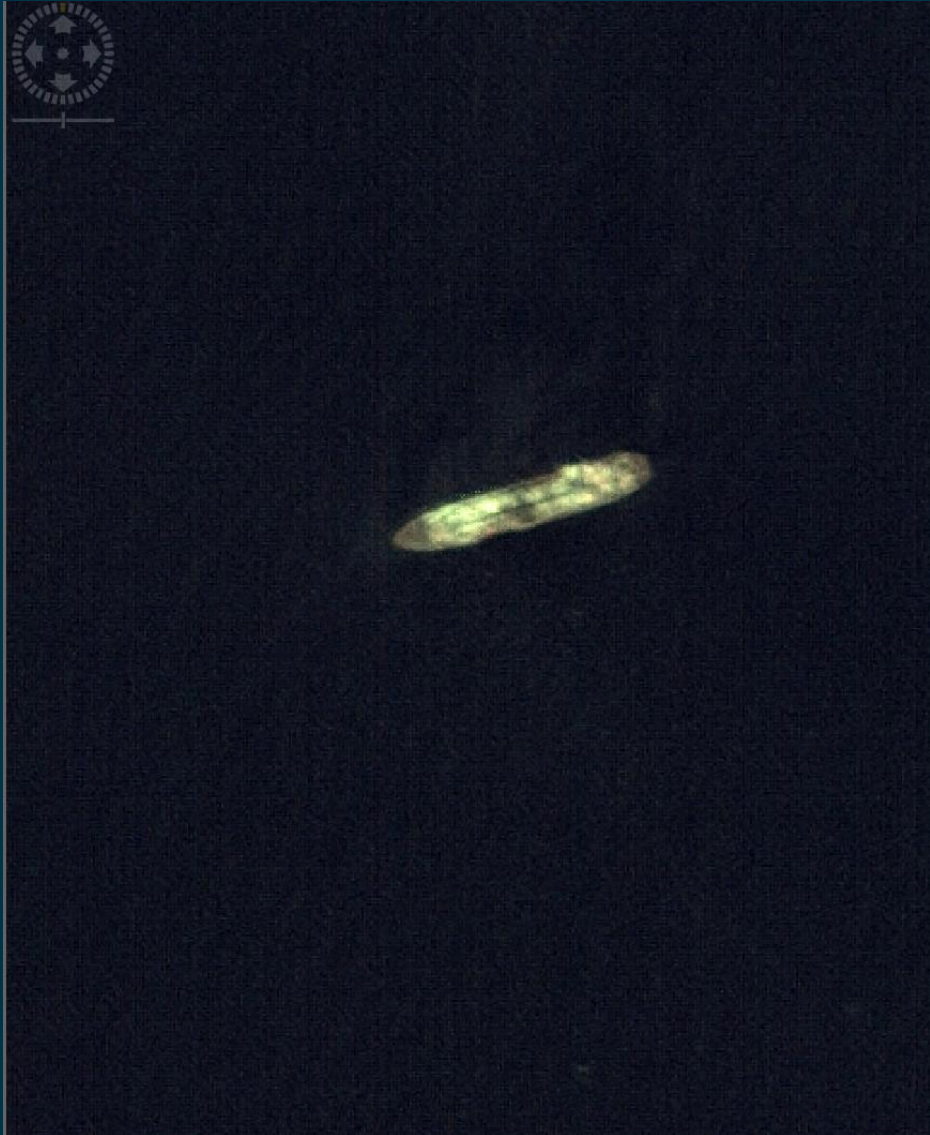
Genova from Space (HEO)



Thermal Anomalies with HEO (Forest Fire)



Arctic Metagaz (HEO & Eaglet-2)



Oil Slick - Strait of Hormuz



Niscemi Landslide (2024 - Pleiades)



Niscemi Landslide (2026 - HEO)



Eaglet 2 – Yokohama – Preliminary Analysis



Eaglet 2 - Haneda Airport – Preliminary Analysis



ITA Airbus A350-941



IRIDE Service Segment



IRIDE Services – designed on Institutions user requirements

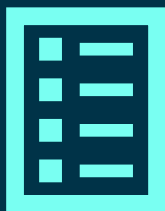
Piano Nazionale per lo sviluppo di capacità di Osservazione della Terra (PNOT)



Working with Users Representatives



IRIDE Service Portfolio



8 thematic areas:
60+ Service Value Chains
300+ geospatial products



IRIDE Services - Portfolio in a nutshell

S1- Coastal and Marine Monitoring

- Coastal Monitoring and Forecast - Wide and Specific Areas
- Coastal Area Mapping and Monitoring

S2- Air Quality

- Assessment of pollutant emissions
- Re-analysis of air quality at national scale

S3- Ground Motion

- Mapping of Ground Motion
- Thematic Analysis on volcanic areas, infrastructures, landslides, cultural heritage, etc.
- DSM\DTM at national scale

S4- Land Cover & Use - Environment

- Land Cover\Land Use Mapping and Monitoring
- Soil Sealing Mapping and Monitoring
- Habitat Mapping
- Urban heat islands and green areas monitoring

S4- Land Cover & Use - Forest

- National Forest Mapping and Monitoring
- Burnt Areas Mapping
- Forest health assessment Indexes
- Carbon stock Indexes

S4- Land Cover & Use - Agriculture

- Soil Organic Carbon Monitoring
- Erosion Risk Assessment
- Water Needs and Used Mapping
- Indexes for Crop Health assessment
- Common Agriculture Policy supporting mapping and monitoring

S5- Hydro Meteo Clima

- Monitoring of GHGs and other essential climate variables
- Hydro-meteo mapping and monitoring atmospheric structure
- Lighting Monitoring

S6- Water Management

- Integrated water resource management support product including models and indexes derived by satellite data
- River hydro morphological mapping and channel dynamics

S7- Emergency

- Delineation and grading maps in case of flood, fires, earthquakes, volcanic eruptions, landslides, extreme meteo events

S8- Security LAND

- VHR and HR Mapping
- Monitoring maps of human settlements (formal and informal)
- Risks analysis on critical areas
- Environmental Intelligence Services

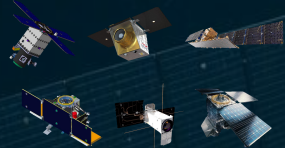
S8- Security MARITIME

- Maps for Oil spill detection and sea pollution management
- Vessel detection, identification, tracking and S&R support



IRIDE Services - multi-mission by design

01 • IRIDE



HEO • Eaglet-2 — optical HR
NIMBUS VHR — optical VHR
NIMBUS SAR • NOX SAR — SAR HR
PLATINO HYP • hyperspectral

03 • NASA



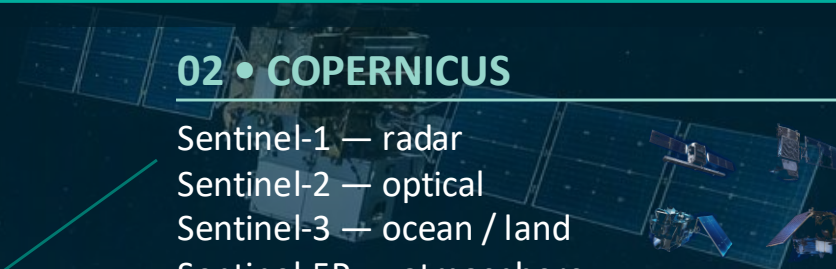
Landsat — land imaging
MODIS — global EO
VIIRS — daily visible / IR

05 • ITALIAN



COSMO-SkyMed — radar
PRISMA — hyperspectral
SAOCOM — L-band SAR

02 • COPERNICUS



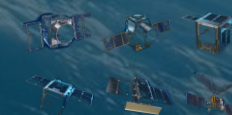
Sentinel-1 — radar
Sentinel-2 — optical
Sentinel-3 — ocean / land
Sentinel-5P — atmosphere

04 • METEOROLOGICAL



MSG — rapid weather
MTG — imaging • lightning
• sounding

06 • COMMERCIAL



WorldView • Pléiades
Planet • BlackSky
ICEYE • Capella Space
optical and SAR VHR

**ONE SERVICE SEGMENT
MANY MISSIONS**

COVERAGE • REVISIT
CONTINUITY • RESILIENCE

**MULTI-MISSION
TO MEET USER
NEEDS OF THE
8 DOMAINS**



Security



Coastal



Ground
motion



Climate



Air quality



Emergency



Land cover



Water

IRIDE Geospatial Services and User Access

DATA SOURCES → SERVICE VALUE CHAINS → GEOSPATIAL PRODUCTS → MARKETPLACE

01 INPUTS DATA SOURCES



IRIDE Satellite Data

Other Satellite Data

Model Outputs

In Situ Data

Other Data

Multi-source inputs



02 PROCESS



IRIDE
SERVICE
VALUE
CHAINS

Integrate • process •
transform



03 OUTPUT

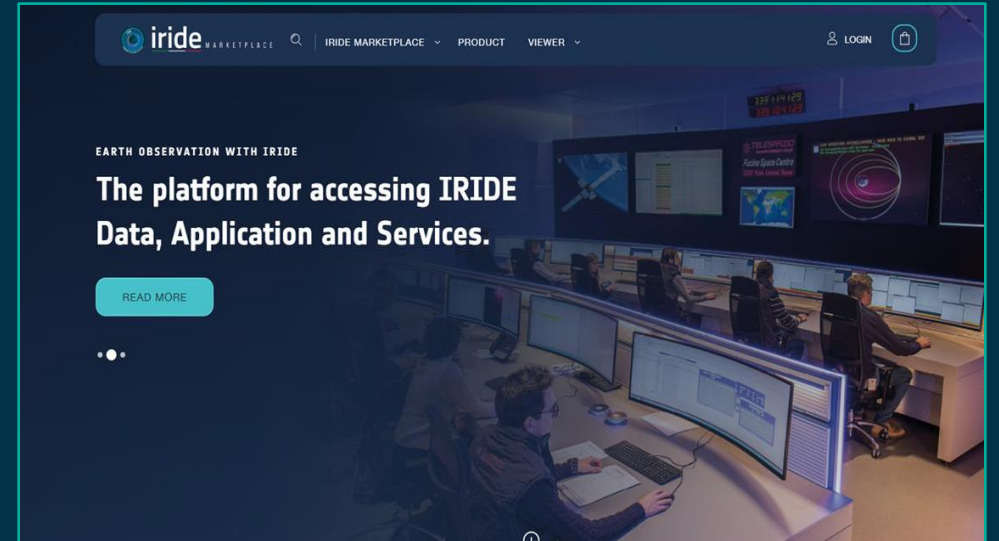


IRIDE
GEOSPATIAL
PRODUCTS

Ready-to-use
information



04 MARKETPLACE ACCESS



IRIDE MARKETPLACE

Unique point of access to Service Value Chain products and IRIDE SAT data.

PRODUCTS + IRIDE SAT DATA

Examples of IRIDE Services starting operations October 1st





IRIDE VIEWER

SU

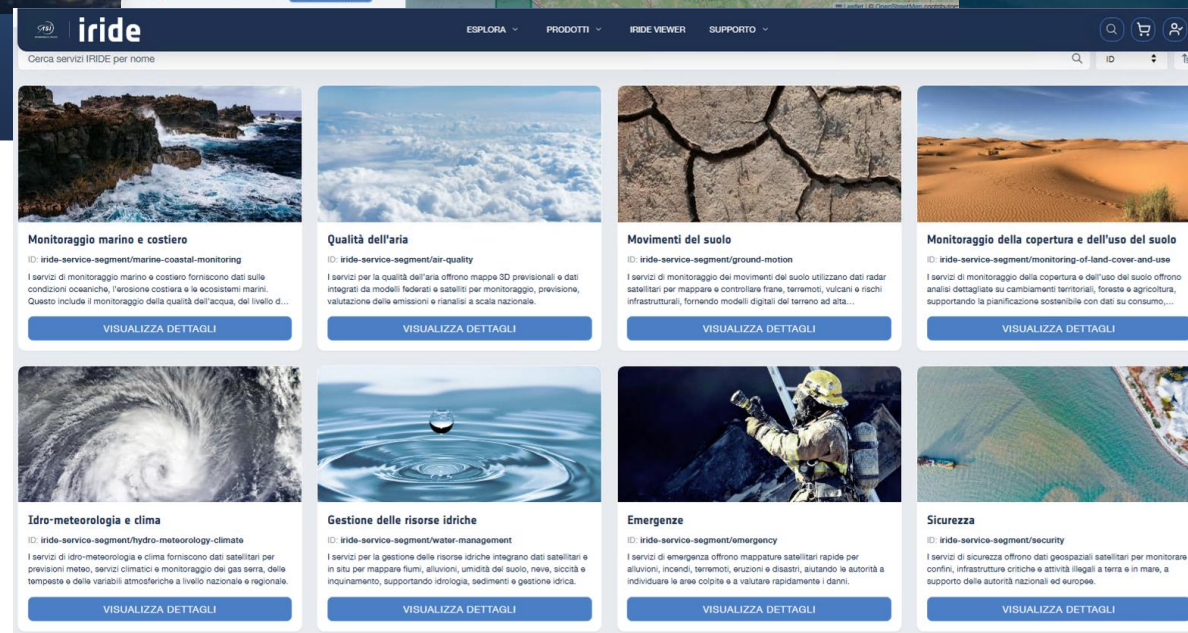
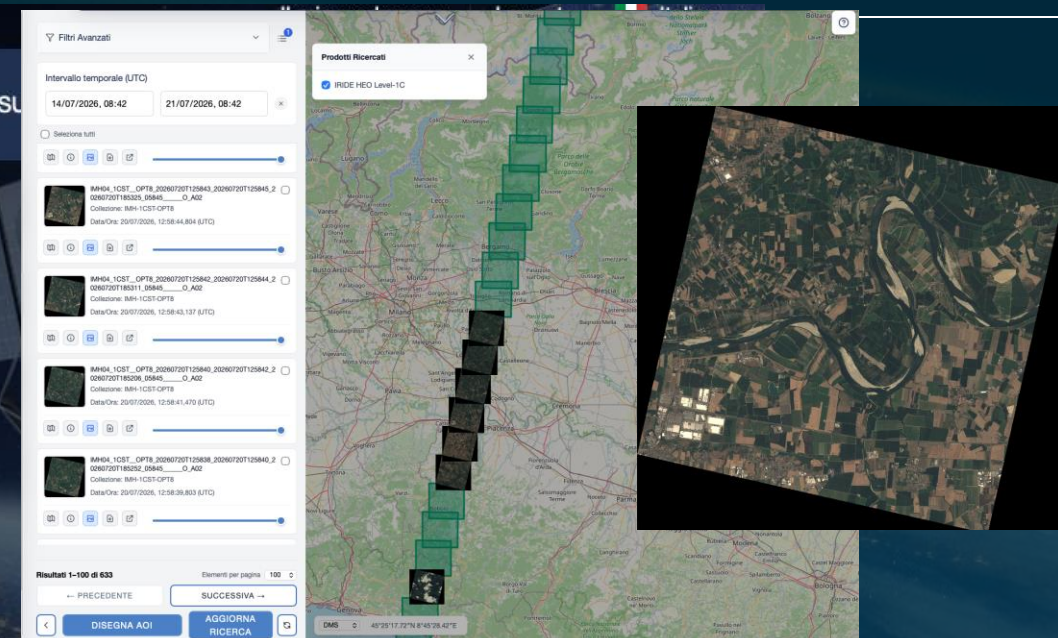
Scopri tutti i domini applicativi di IRIDE

IRIDE HEO Multi-Spectral

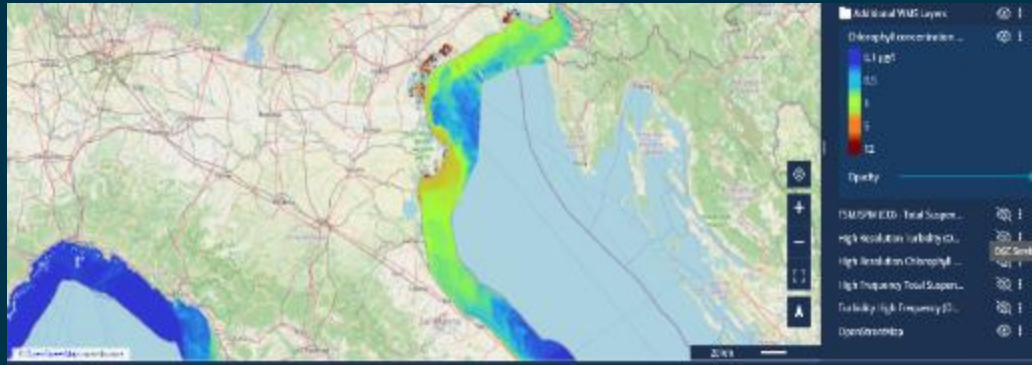
Ogni sensore multispettrale acquisisce 8 bande (inclusa una pancromatica e tre bande red-edge), con prodotti forniti ai livelli L1C e L2A a una risoluzione di circa 2,5 m (PAN/VIS/NIR) e 5 m (red-edge), su una strisciata di circa 11,5 km a un off-nadir nominale.



ESPLORA DATI SATELLITARI



Use Case: coastal water quality monitoring



Chlorophyll concentration EO S1-01-05 – Sentinel-3

24 May 2026



Total Suspended Matter OU-S1-01-07 – Sentinel-3

24 May 2026



Turbidity HF OU-S1-01-12 – Sentinel-3

24 May 2026

Chlorophyll concentration, suspended matter, and water turbidity are key indicators of coastal marine health.

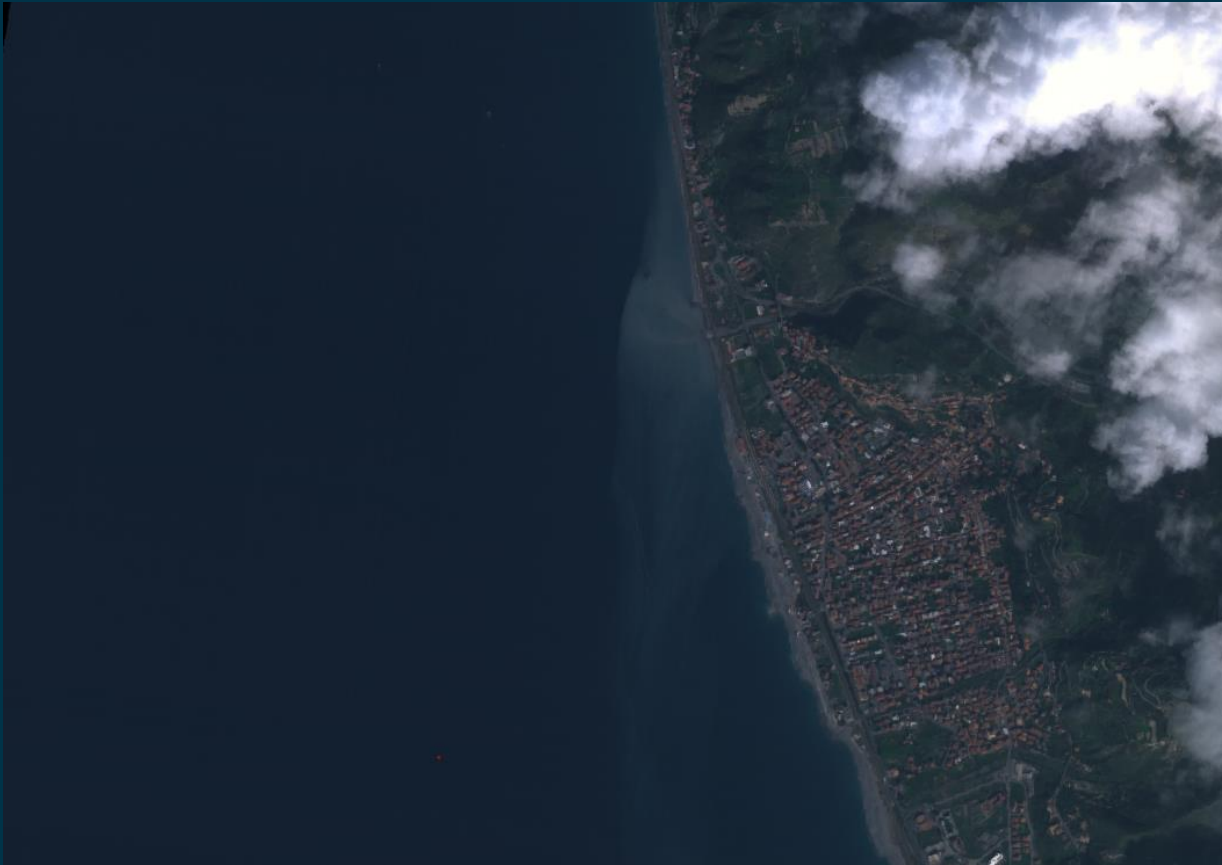
IRIDE measures these parameters at different spatial resolutions and revisit frequencies, supporting national and regional authorities in water quality monitoring and environmental management.

The indicators are derived from Copernicus data (**Sentinel-2** and **Sentinel-3**, specifically calibrated for Italian coastal waters) and from **IRIDE HEO** data.

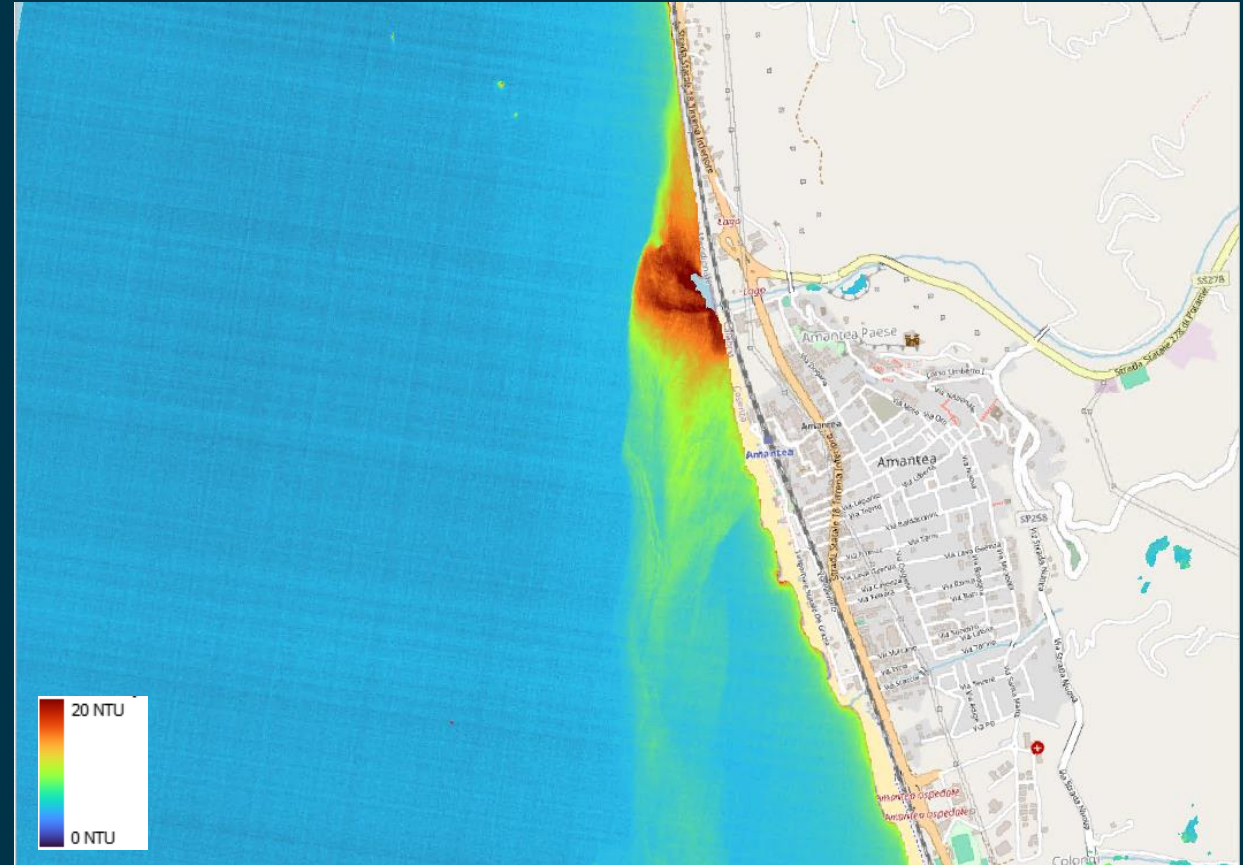
This provides users with either frequent updates (daily and every 5 days) at medium spatial resolution (300 m or 20 m) or very high spatial resolution (3 m) products with lower update frequency (monthly).



Use Case: coastal water quality monitoring



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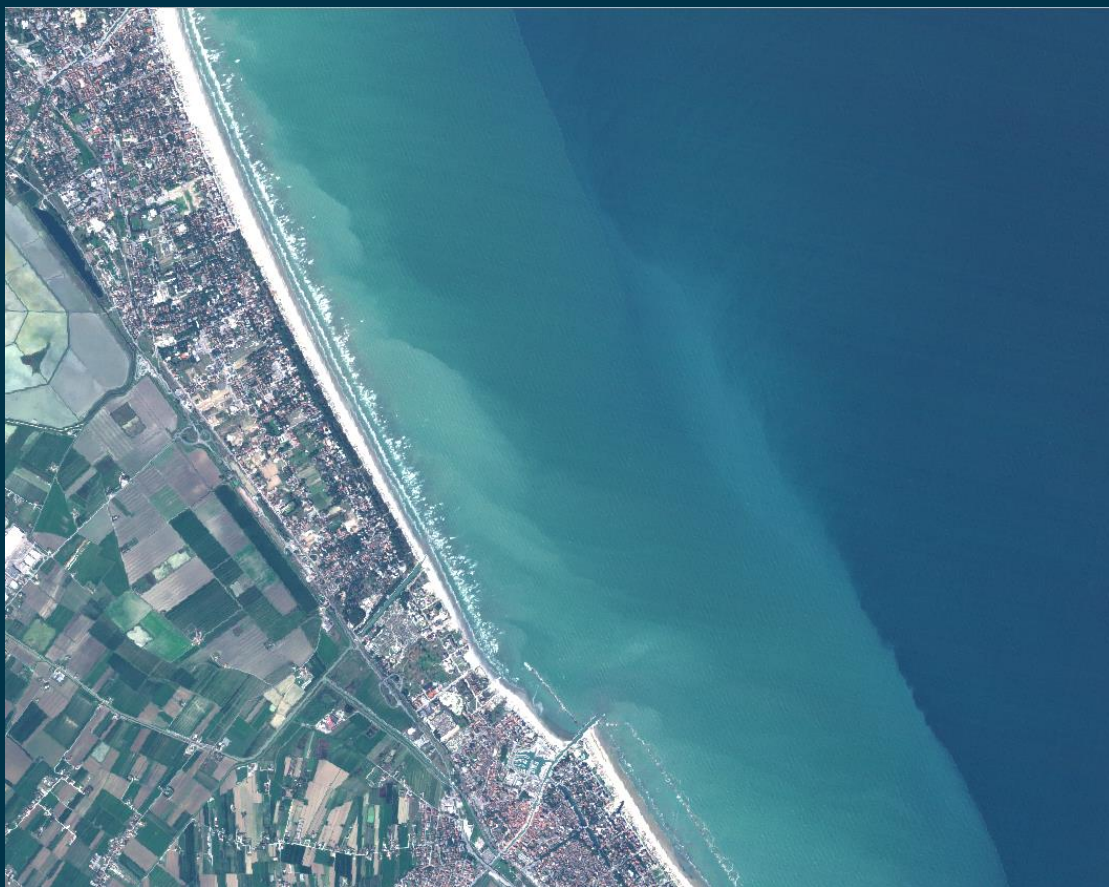


OU-S1-01-16 VHR Turbidity

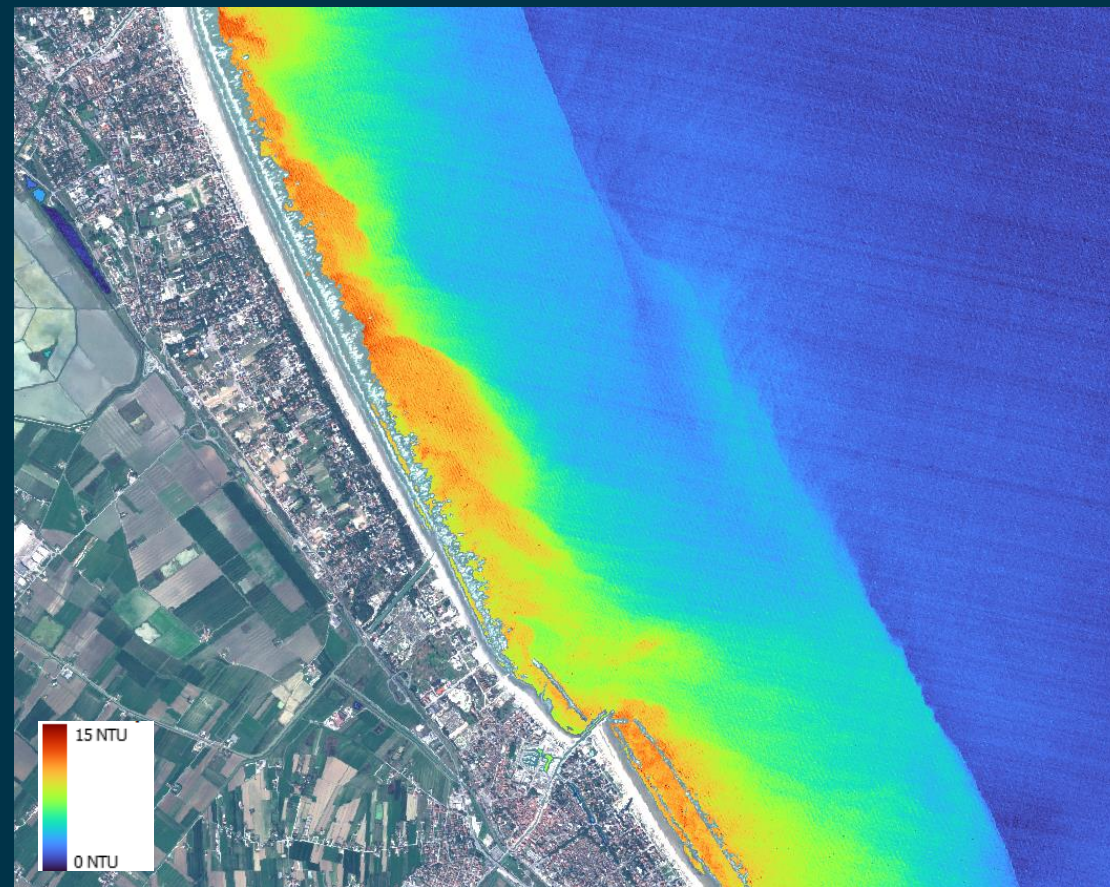


Acquisition date: 26/02/2026
Area: Calabria (Tyrrhenian sea)

Use Case: coastal water quality monitoring



IMH05_1CST__OPT8_20260317T124743_20260317T124745_20260317T145500_03984_____O_A02

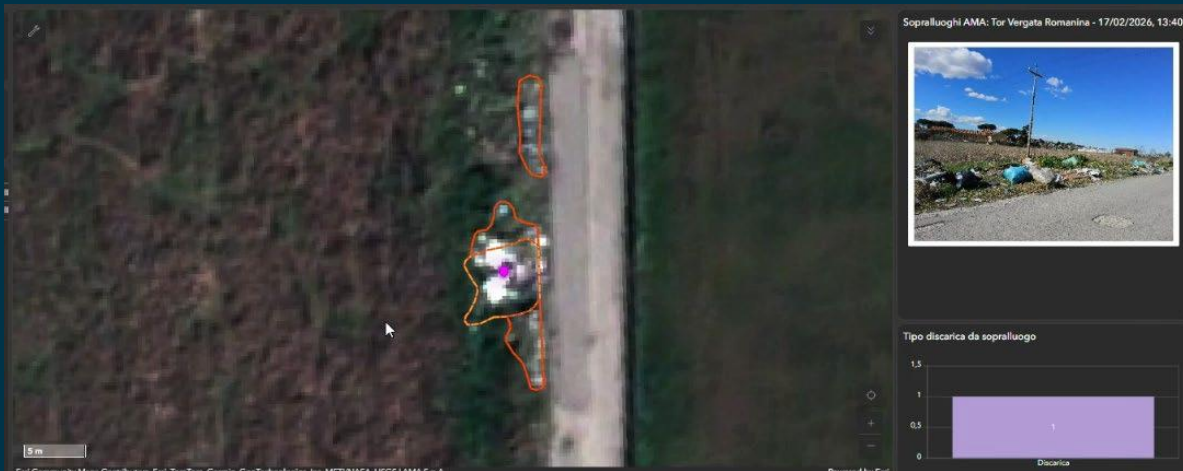


OU-S1-01-16 VHR Turbidity

Acquisition date: 17/03/2026
Area: City of Cesenatico



Use Case: identification of areas affected by illegal dumping of waste



Google Street View of roadside waste, Rome



Pleiades Neo 30cm image overlapped with detected illegal sites, Rome

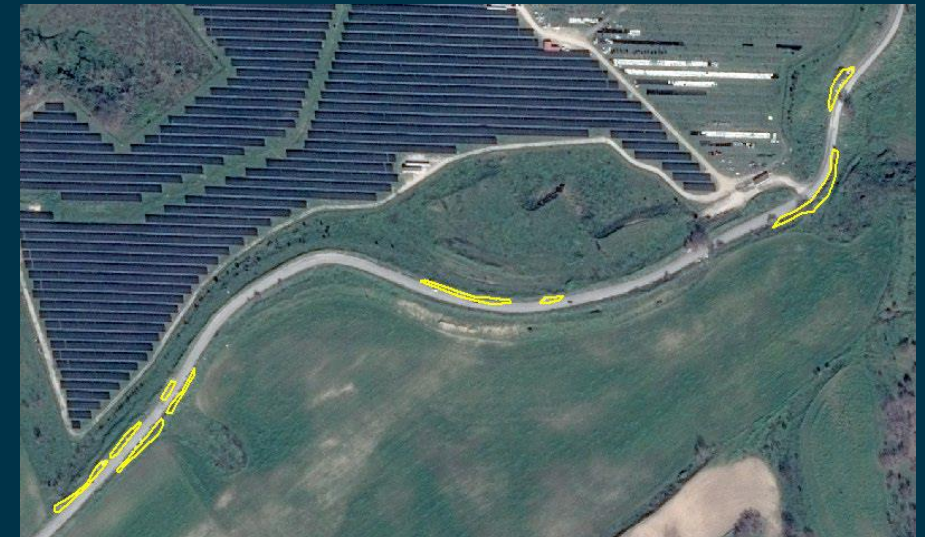
10 March 2026

This service leverages satellite imagery to identify and monitor illegal waste accumulation areas, both in hard-to-access locations and along roadsides, enabling authorities to efficiently plan and prioritise waste collection operations. The service was successfully validated in collaboration with the Waste Utility of Rome, which supported the in situ verification of satellite detections and the assessment of the service's operational effectiveness.

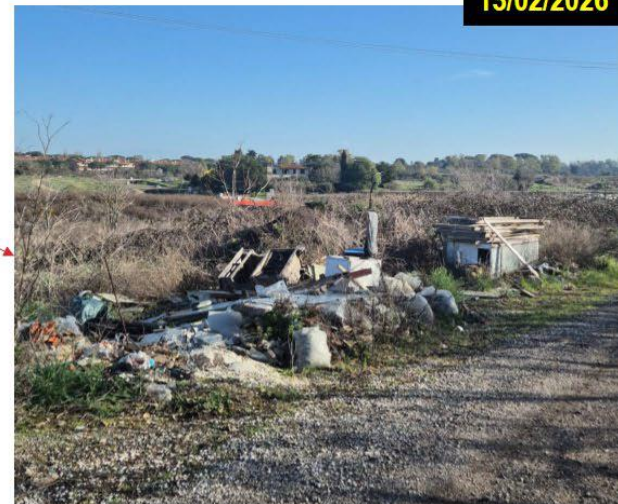
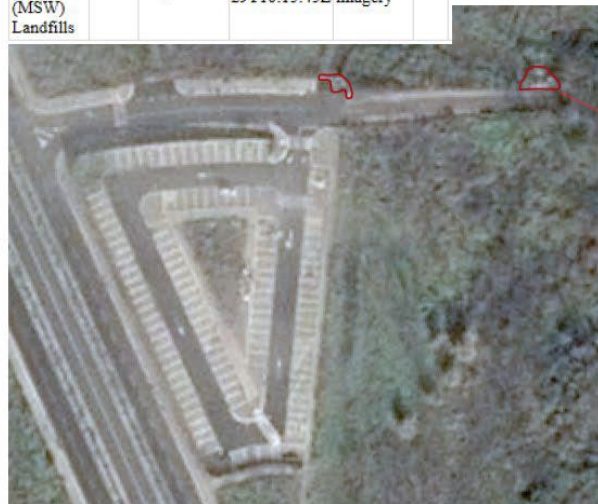
The service is provided on an on-demand basis and exploits VHR optical satellite imagery (e.g. Pleiades Neo, Worldview,...) to accurately detect and map waste accumulation sites.



Use Case: identification of areas affected by illegal dumping of waste



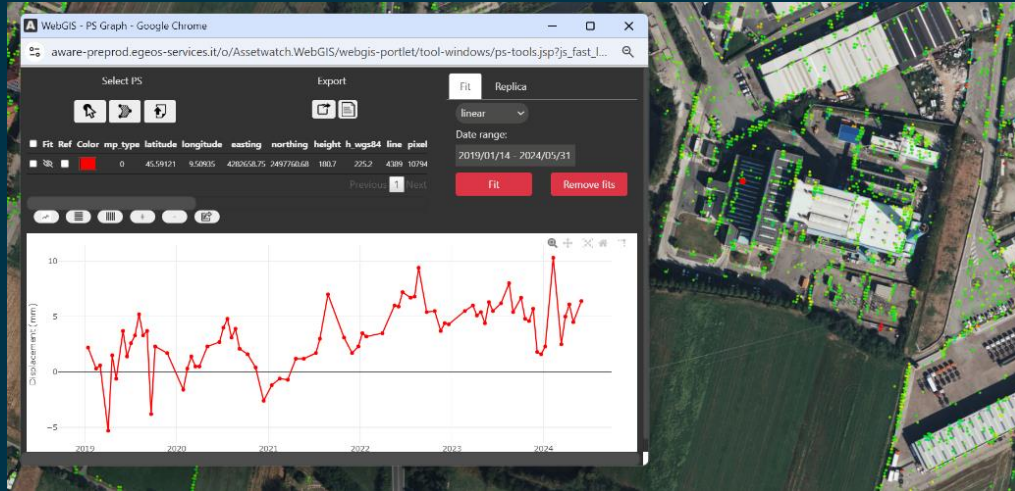
L2_Label	Notes	AOI_name	src_date	src_name	ID
Municipal Solid Waste (MSW) Landfills		Trigoria	2026-01- 29T10:15:45Z	Pleiades imagery	39.0



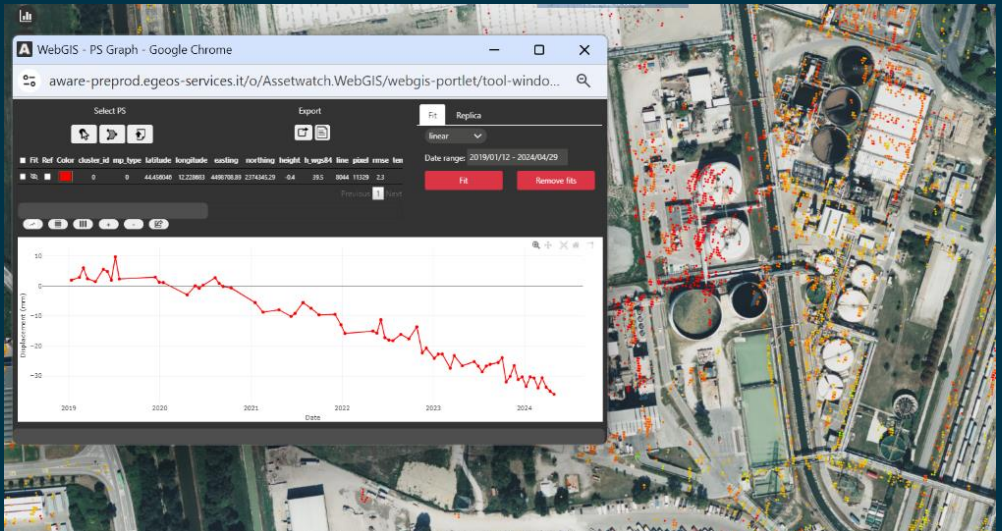
Example of in-situ validation
Rome, Trigoria Area, 13/02/2026



Use Case: Ground Motion - Critical Infrastructure Monitoring



Ground Motion Product – waste-to-energy plant - Trezzo sull'Adda (AOI Treviglio)



Ground Motion Product – Centro ecologico Baiona – Ravenna

This service provides products for mapping and monitoring ground deformation phenomena over the Italian territory, focusing the analysis over critical infrastructures and their surroundings.

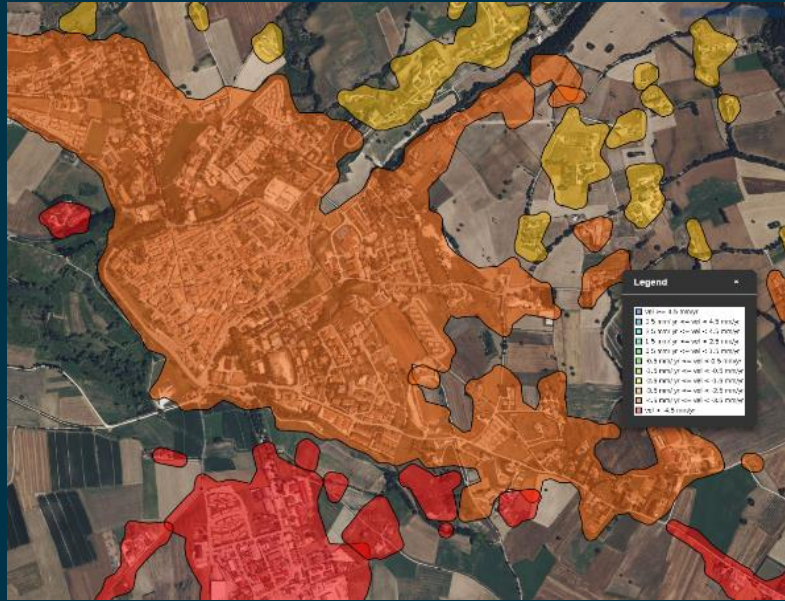
It aims to improve understanding of ground displacement processes (e.g., landslides, subsidence, etc.) affecting the stability of national infrastructures of strategic relevance.

Service main characteristics

Input data	Ground Motion Products (computed from COSMO- SkyMed, Saocom, NIMBUS SAR X-band), DEM, Risk hazard maps, Database di Sintesi Nazionale IGM
Spatial resolution	Up to 3 m
Area Of Interest	Selected AOIs over Italy
Update Frequency	Monthly

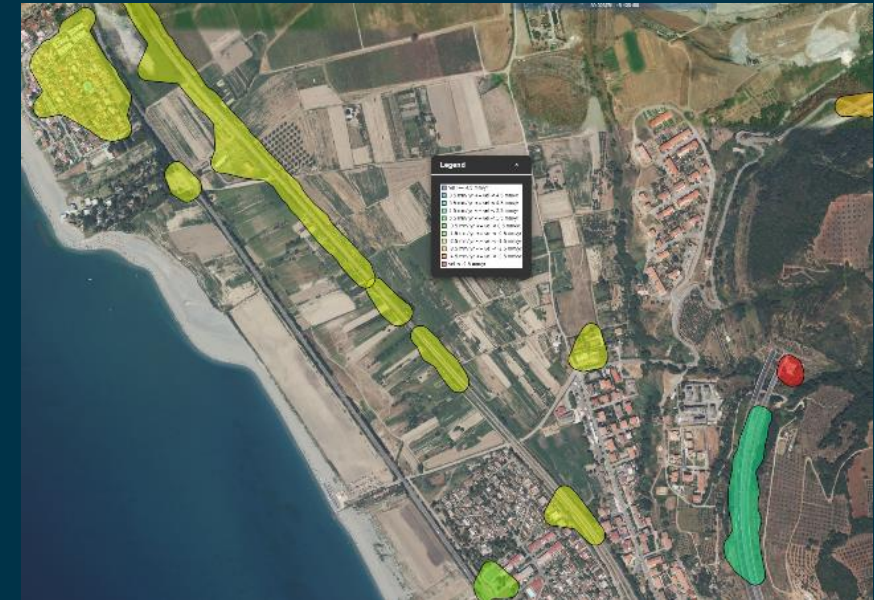
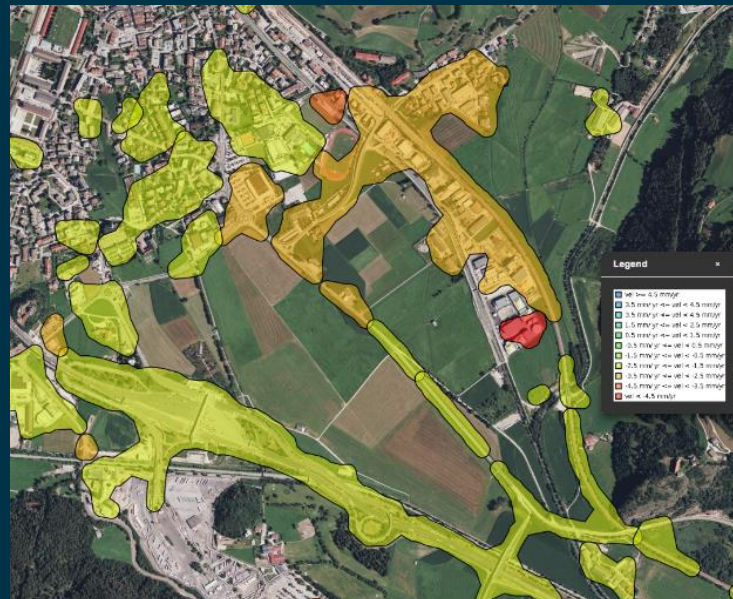


Use Case: Ground Motion - Critical Infrastructure Monitoring



Norcia – Active Deformation Areas

Vipiteno (AOI Brennero) – Active Deformation Areas

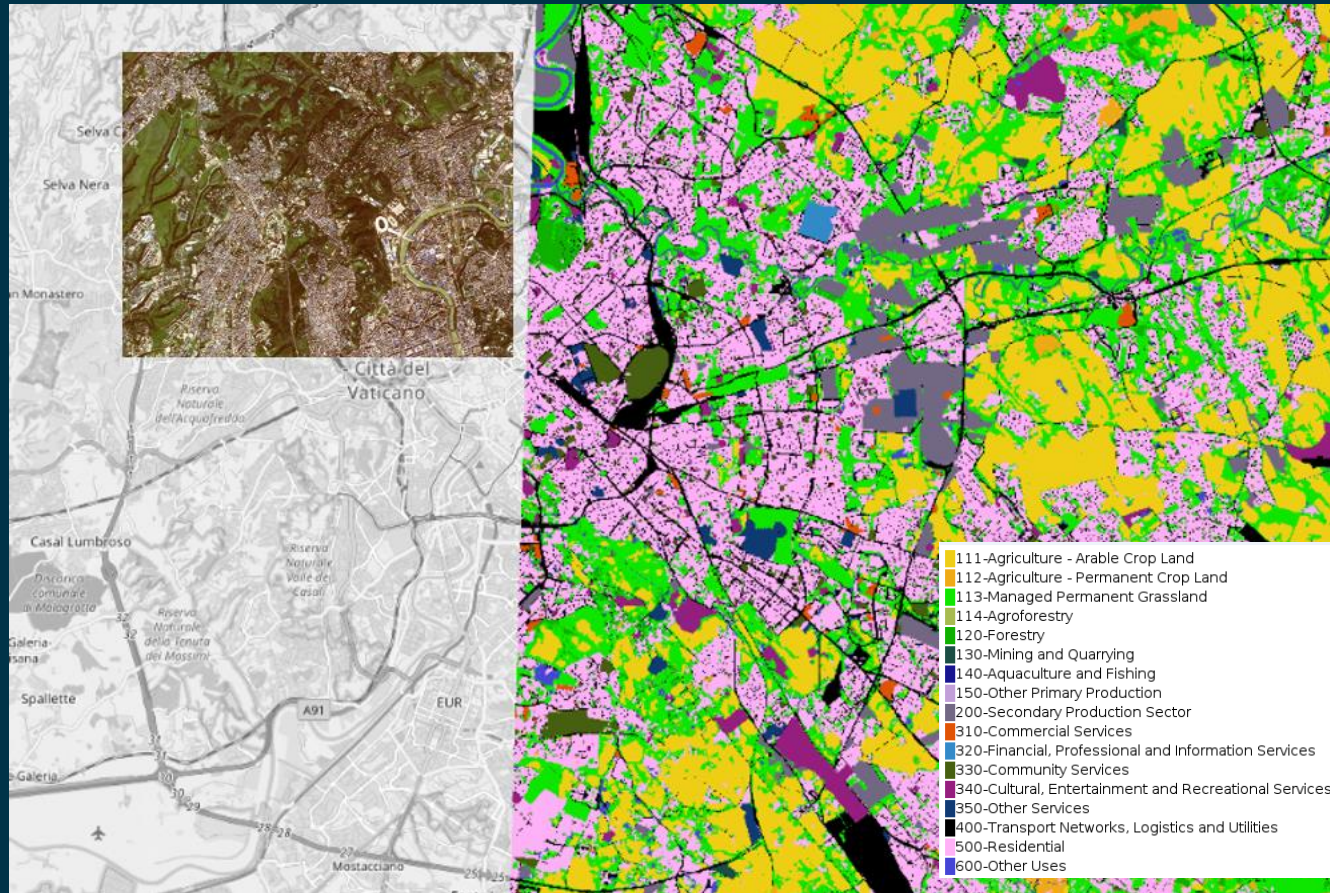


Nocera Terinese – Active Deformation Areas

Examples of IRIDE Services under development



Use Case: Urban land use / land cover mapping and monitoring



HEO – Image Pathfinder, Rome 05/03/2025

Land Use Mapping - Map of Rome

The Land Cover and Land Use Mapping and Monitoring Service provides yearly status maps and change detection products that can support national and local administrations for the continuous analysis of the land dynamics across various thematic temporal scales.

Service main characteristics

Input data	IRIDE HEO, COSMO-SkyMed, IRIDE NIMBUS SAR (optional)
Spatial resolution	2.5 m
Number of thematic classes	17
Area Of Interest	Italian National Territory
Update Frequency	Yearly



Use Case: Land consumption / soil sealing mapping and monitoring

The service aims to provide up-to-date geospatial information on land consumption and soil sealing across the Italian territory through annual mapping and monitoring activities.

The service is designed to support national, regional, and local authorities in assessing the evolution of soil sealing phenomena and evaluating its environmental impacts.

Service main characteristics	
Input data	IRIDE HEO, OpenStreetMap, VIDA - building footprints, Google Earth and Bing satellite images, Catasto – fabbricati, European Reference Grid – Italy, DBSN - DataBase di Sintesi Nazionale
Spatial resolution	2.5 m
Number of thematic classes	14
Area Of Interest	Italian National Territory
Update Frequency	Yearly



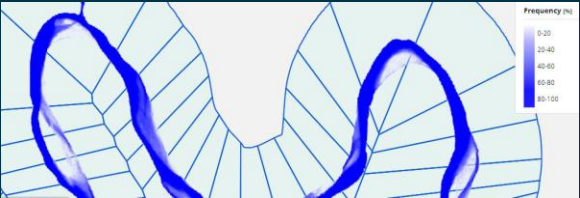
Soil sealing map, Puglia region



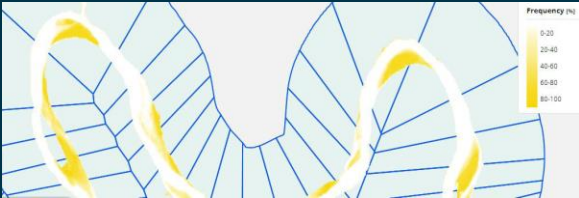
Use Case: River hydro-morphological mapping and channel dynamics

The service encompassing a series of products which represent the national-scale observatory of river macro-geomorphic units for medium-large rivers. National authorities will be able to access classified river macro-geomorphic units for all Italian medium-large rivers with water width >15-30m, in a format that is comparable through space and time, enabling a more effective and objective monitoring of river geomorphic trajectories and river management.

Service main characteristics	
Input data	IRIDE HEO, Sentinel-2
Spatial resolution	10 m for rivers with Active Channel width > 30 m 3 m for rivers with Active Channel width > 15 m
Area Of Interest	Major Italian Rivers (width > 15 m)
Update Frequency	Monthly



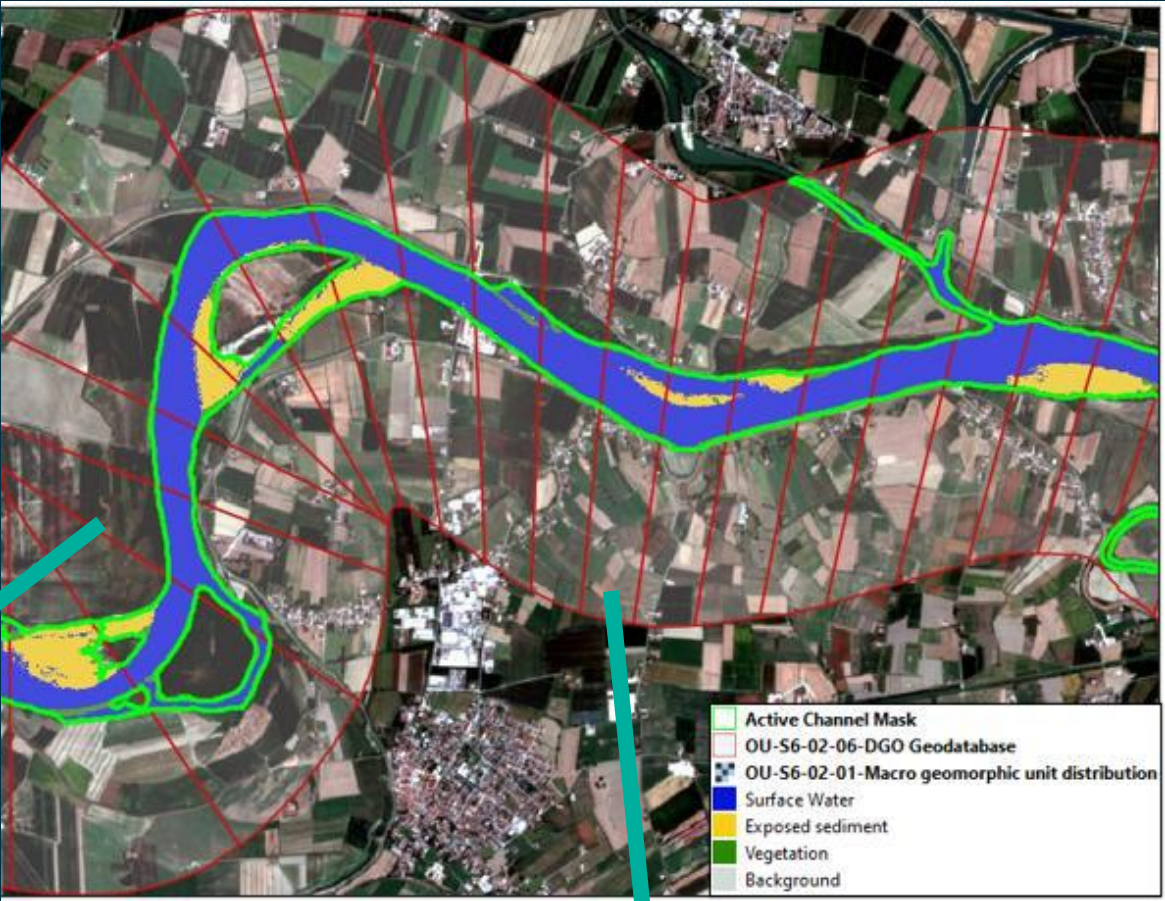
S6-02-03 - Water frequency maps



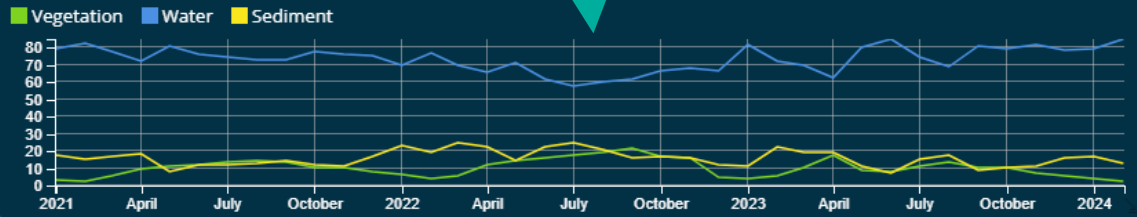
S6-02-04 - Exposed Sediment frequency maps



S6-02-05 - Vegetation frequency maps



S6-02-02-Temporal and spatial evolution of river corridors and active channels



S6-02-02 - Temporal and spatial evolution of river corridors and active channels (Monthly)

IRIDE Cyber Italy



CYBER ITALY (Digital Twins)

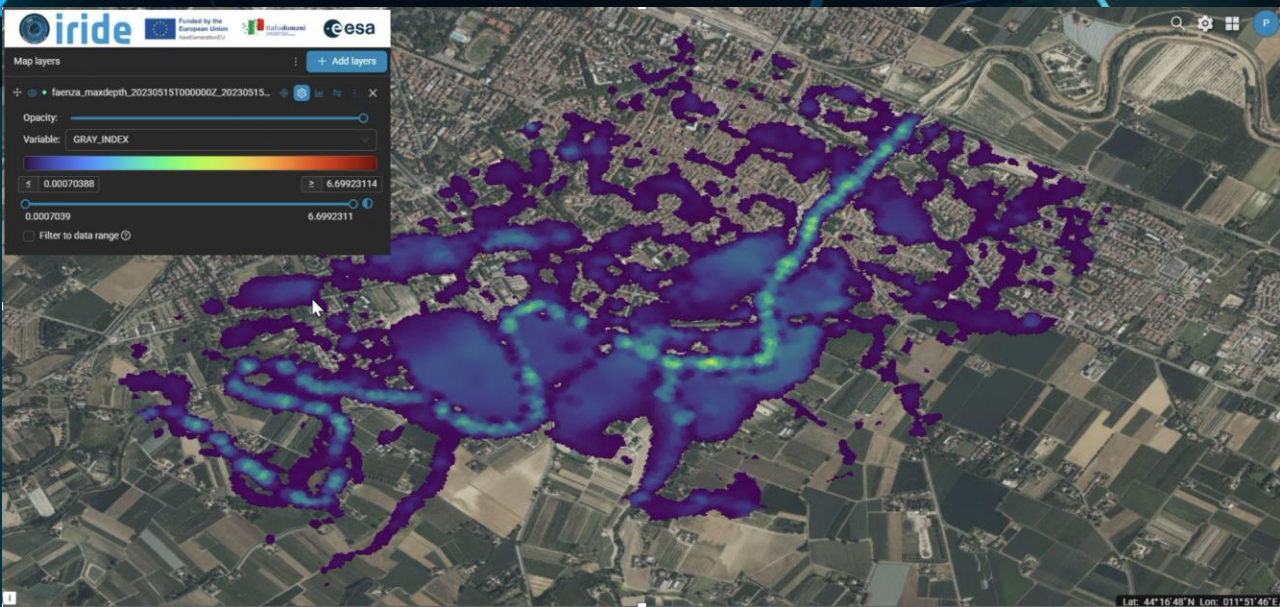


- An integrated system for simulating "what-if" scenarios using real-time data, AI, and advanced computing to create high-fidelity digital replicas of Earth's processes
- It is composed of a dedicated scalable framework hosting the Digital Twins
- 4 DTs integrated up and running
- ISPRA and in-situ weather data integrated
- Development activities concluded
- Pre-operations started in July 2026
- Pre-operations will end by Q4 2026

Thematics: Hydro-Meteo-Climate, Air Quality, Coastal monitoring, Landslides, Urban Planning, etc.

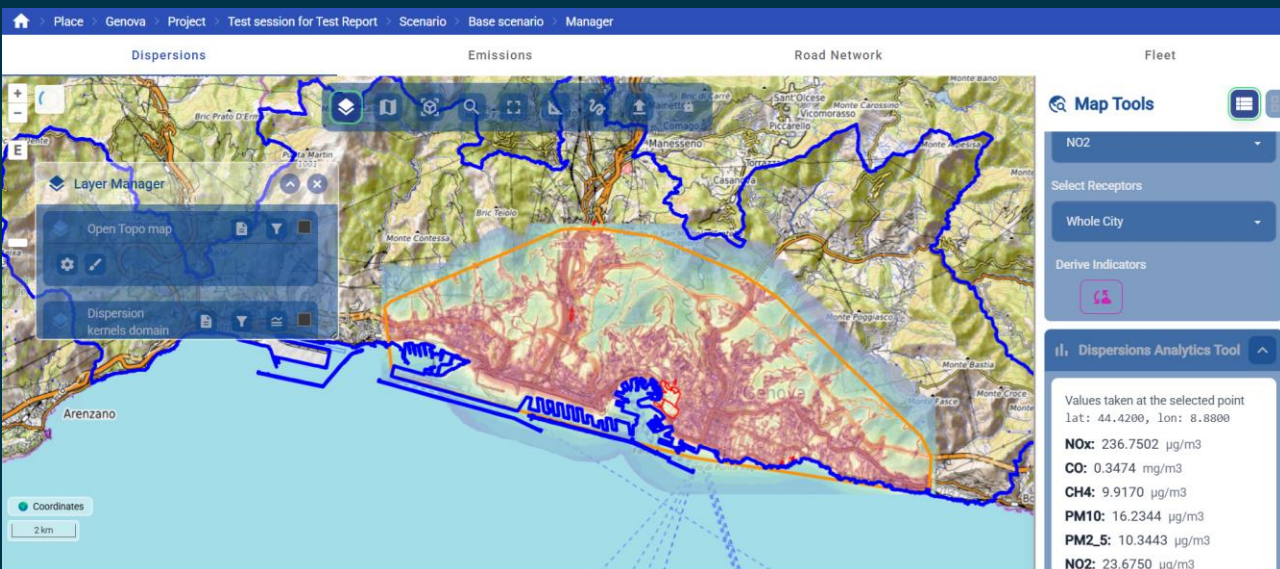


Hydro-meteo climate



It can characterize the **damage** taking into account the exposure and value of each individual element in relation to the water depth expected;
Identification of areas and buildings potentially affected by flooding event.

Air quality

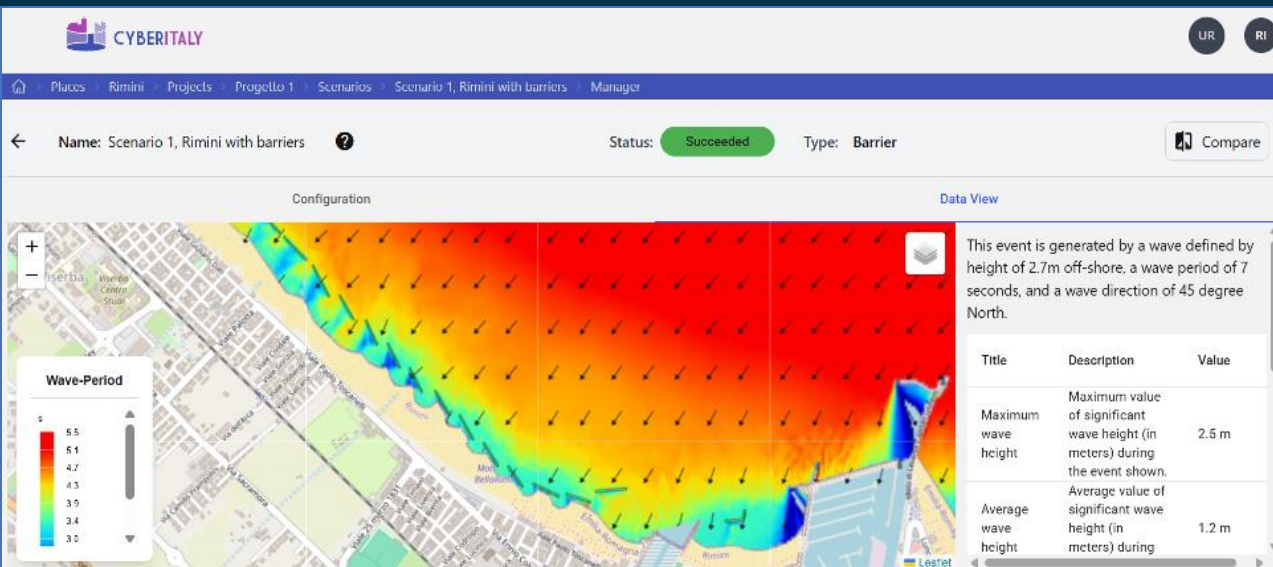


Can simulate the effect of traffic restriction to some vehicle categories or access prevention to some roads.

What-if-analysis based on simulated **traffic & weather conditions.**

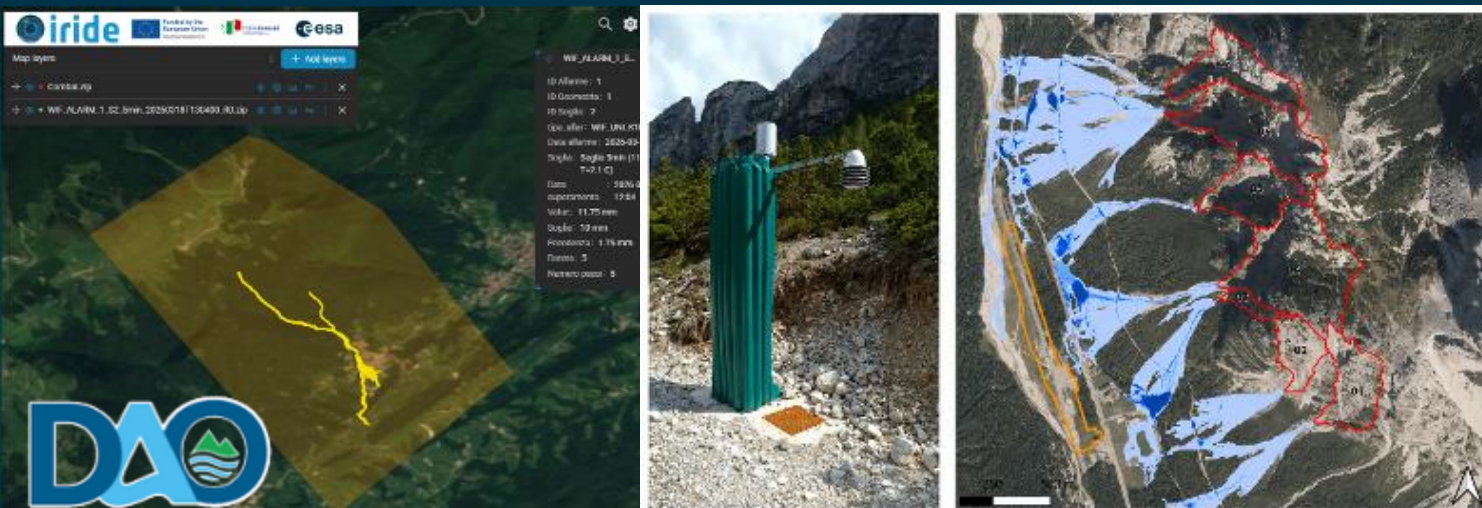


Costal Monitoring



Simulating costal dynamics and Planning of intervention based on simulation of e.g. costal erosion and/or meteorological events.

Landslides



To predict debris flows in the Fiammes area (Cortina d'Ampezzo, BL) starting from in-situ and weather forecast data.





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