# The IRIDE Services segment

IRIDE Program

- Ambitious and innovative EO program mainly funded with the EU Recovery Fund and implemented by ESA together with ASI and other national institutions.

- Game changer in the EO national arena for the opportunities that it will open on the downstream market and the economic benefits that it will bring to the society.

- Operational EO system to fulfil services' needs specified by Italian public Users :
  - ✓ Complementing existing Italian and European systems (e.g. Cosmo-SkyMed/PRISMA and Sentinels), focusing on observations over Italy;
  - ✓ Consolidating and increasing national capabilities and promoting the competitiveness of Italian companies;
  - ✓ Fostering innovative applications.

IRIDE System Architecture
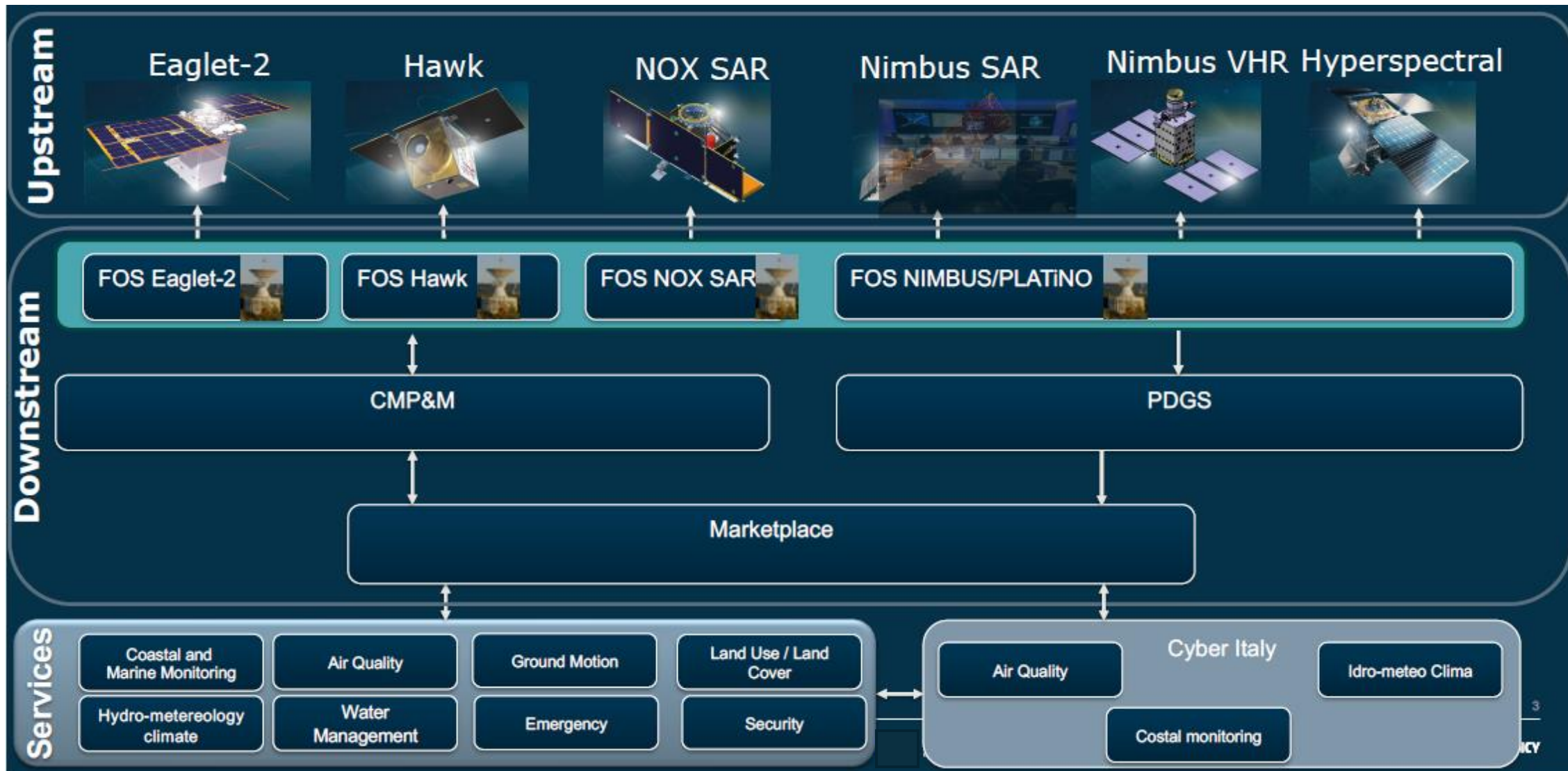
IRIDE Upstream and IRIDE Data

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]

Institutional User Needs

Fascia costiera e monitoraggio marino-costiero	Qualità dell'aria	Movimenti del terreno	Copertura del suolo
Idrometeoclima	Risorsa idrica	Emergenza	Sicurezza

IRIDE Service Portfolio

60+ Geospatial Services (Service Value Chains)

About 300 Geospatial Products (main specs)

IRIDE Service Value Chain

S1- Coastal and Marine Monitoring	S2- Air Quality	S3- Ground Motion	S4- Land Use\Land Cover ENVIRONMENT
Coastal Monitoring and Forecast - Wide and Specific Areas Coastal Area Mapping and Monitoring 3 SVCs: producing 28 EO Products, 4 Model Products, 2 EO based validation reports	Assessment of pollutant emissions Re-analysis of air quality at national scale 3 SVCs: producing 4 EO Products, 2 Model Products, 1 Web Application	Mapping of Ground Motion Thematic Analysis on volcanic areas, infrastructures, landslides, cultural heritage, etc. DSM\DTM at national scale 7 SVCs: producing up to 6 EO products (single geom., 2D deformation, active displacement areas, etc.), for Sentinel, CSK, SAOCOM, plus 29 thematic analysis	Land Cover\Land Use Mapping and Monitoring Soil Sealing Mapping and Monitoring Habitat Mapping Urban heat islands and green areas monitoring 6 SVCs: producing 21 EO products of mapping and monitoring

S4- Land Use\Land Cover FOREST	S4- Land Use\Land Cover AGRICULTURE	S5- Hydro-Meteo-Clima	S6- Water Management
National Forest Mapping and Monitoring Burnt Areas Mapping Forest health assessment Indexes Carbon stock Indexes 5 SVCs: producing 12 EO Products	Soil Organic Carbon Monitoring Water Needs and Used Mapping Common Agriculture Policy supporting mapping and monitoring 10 SVCs: producing 26 EO Products	Monitoring of GHGs and other essential climate variables Hydro-meteo mapping and monitoring atmospheric structure Lighting Monitoring 4 SVCs: producing 11 EO products, 8 model products, 4 EO based validation reports	Integrated water resource management support product including models and indexes derived by satellite data River hydro morphological mapping and channel dynamics 3 SVCs: producing 16 EO products and 7 model products

S7- Emergency	S8 – Security LAND	S8 - Security MARITIME	IRIDE PRECURSOR SERVICE PORTFOLIO
Delineation and grading maps in case of flood, fires, earthquakes, volcanic eruptions, landslides, extreme meteo events 15 SVCs: producing 3 EO products for delineation, up to 3 EO products for grading, per activation type	VHR and HR Mapping Monitoring maps of human settlements (formal and informal) Risks analysis on critical areas Environmental Intelligence Services 5 SVCs: producing 36 EO products for activations on demand	Maps for Oil spill detection and sea pollution management Vessel detection, identification, tracking and S&R support 3 SVCs: producing 26 EO products for activations on demand	**64** **Service Value Chains** with SLA and standardised workflows **280** **GSP Products** with validated specifications

S1. Coastal and Marine Monitoring: IRIDE Service Portfolio

SVC ID	Service Value Chain Name
SE-S1-01	Coastal Monitoring and Forecast - Wide Areas
SE-S1-02	Coastal Monitoring and Forecast – Specific Areas*
SE-S1-03	Coastal Area Mapping and Monitoring

IRIDE Services contribute to this Domain, with:

48	EO Products
4	Model Driven Products*
3	Validation Reports

S1 IRIDE services provide a <u>satellite EO based homogeneous information base at the national level,</u> utilizing also in situ observation and forecasting systems.

Its objective is to assess the state of the marine environment, and the effectiveness of the measures implemented to achieve good environmental status.
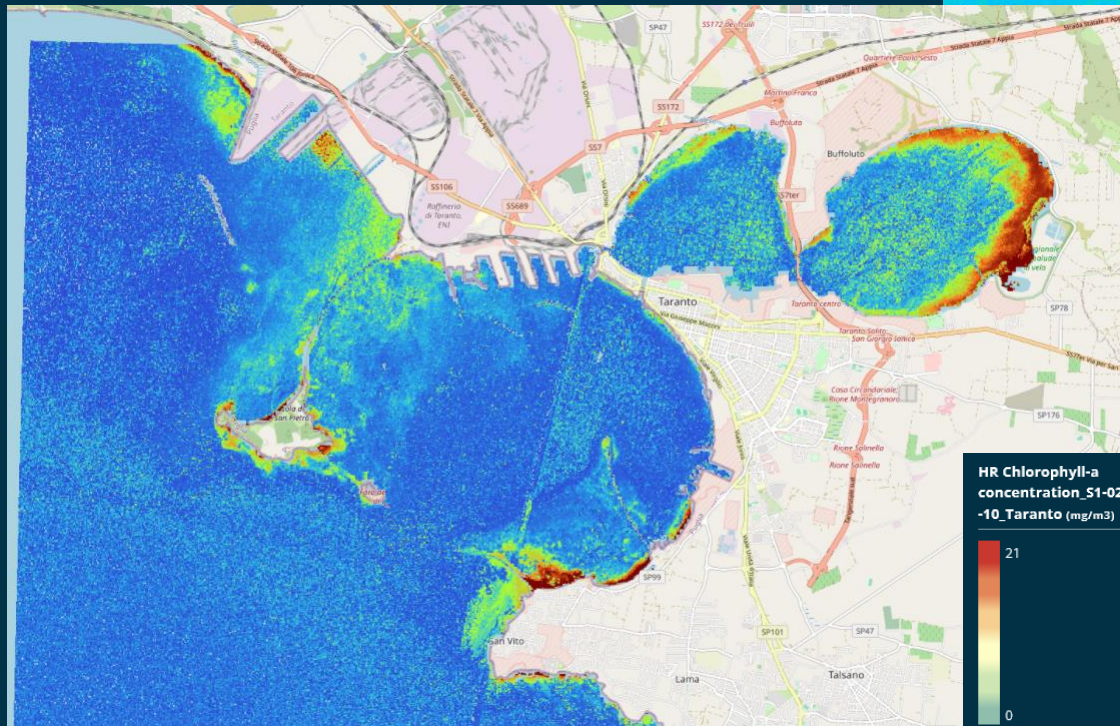
Additionally, it offers a <u>validation tool (using satellite EO and in situ data)</u> for institutional maritime models.
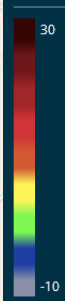
S1-02 — Chlorophill-a (HR)

HR Chlorophyll-a concentration_S1-02-10_Taranto (mg/m3)
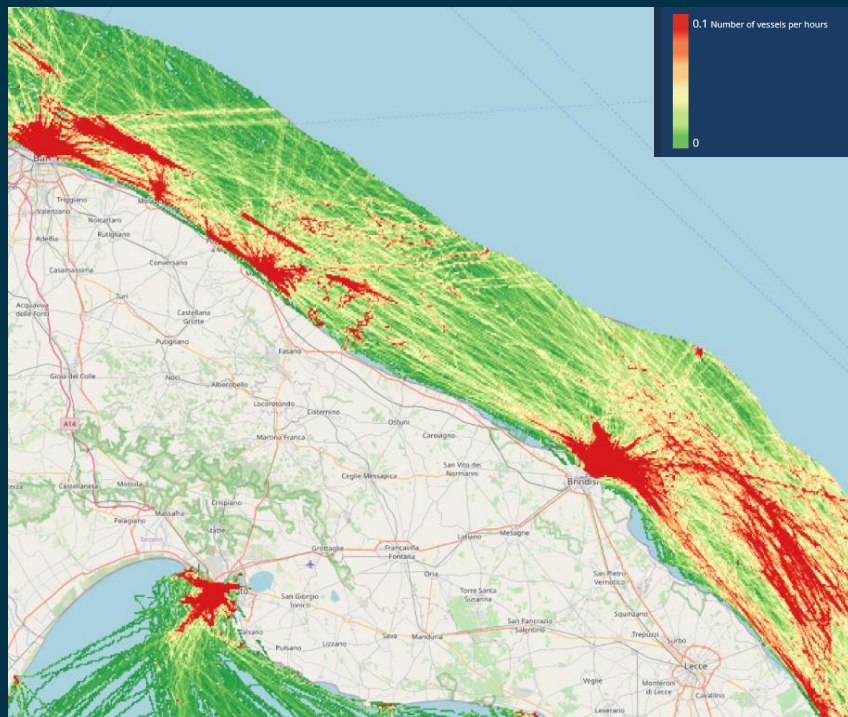21
0

Turbidty_S1-02-06_Taranto (NTU)
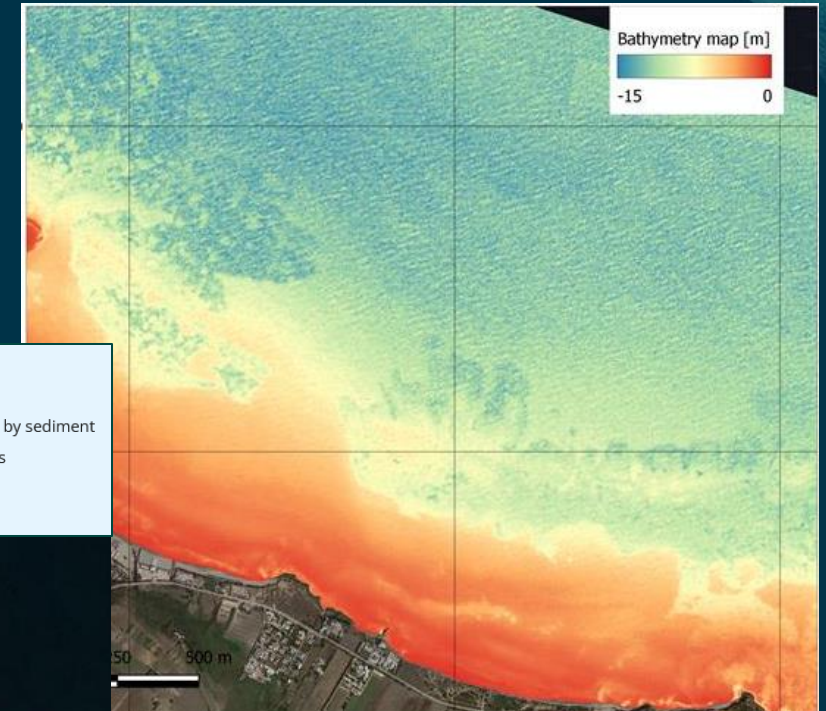30
-10

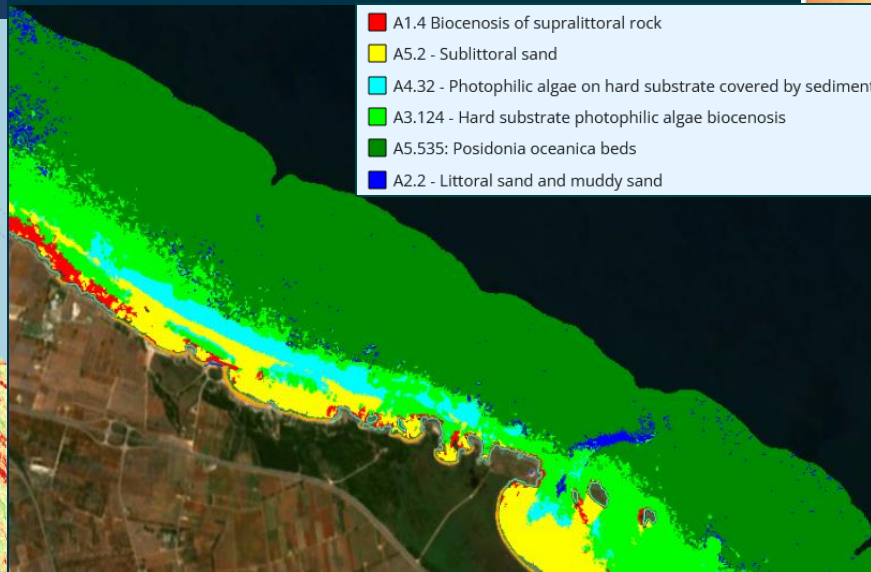Turbidity (HR)

S1 Coastal and Marine Monitoring

S1-03 Maritime traffic

S1-03 Underwater vegetation

S1-03 Coastal Batimetry

Bathymetry map [m]
-15   0

0.1 Number of vessels per hours
0

- A1.4 Biocenosis of supralittoral rock
- A5.2 - Sublittoral sand
- A4.32 - Photophilic algae on hard substrate covered by sediment
- A3.124 - Hard substrate photophilic algae biocenosis
- A5.535: Posidonia oceanica beds
- A2.2 - Littoral sand and muddy sand

S2. Air Quality: IRIDE Precursor Service Portfolio

SVC ID	Service Value Chain Name
SE-S2-01	Air Quality Monitoring and Forecast
SE-S2-02	Monitoring and assessment of pollutant emissions
SE-S2-03	Re-analysis of air quality at national scale*

IRIDE Services contribute to this Domain, with:

5   EO Products

3   Model Driven Products*

S2 IRIDE services provide a **Web service providing 3D model maps, and a 3D exploitation platform**, allowing access to full 3d-data useful for high-resolution model nesting by Italian environmental agencies.
Postprocessed satellite-based parameters such as NO2 concentrations, PM, dust, carbonaceous particles, etc., shall be also exploitable through the platform

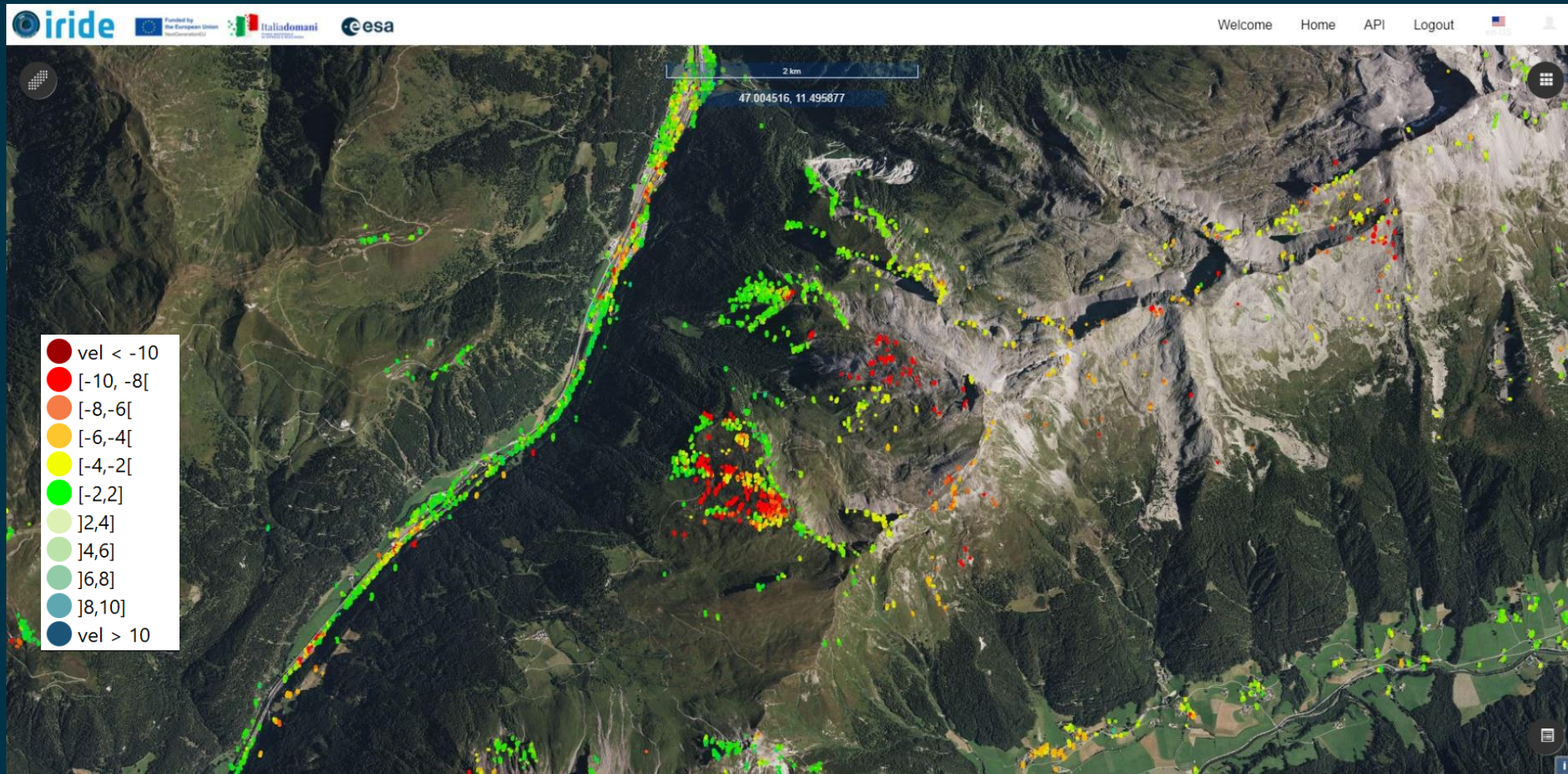| SVC ID	Service Value Chain Name
SE-S3-01	Mapping of Ground Motion - National Coverage
SE-S3-02	Landslide Monitoring
SE-S3-03	Cultural Heritage Areas Monitoring
SE-S3-04	Critical Infrastructure Monitoring
SE-S3-05	Monitoring of seismic wide areas during inter-seismic phase
SE-S3-06	Volcanic areas Monitoring
SE-S3-07	On-demand monitoring

DTM/DSM	Italian Territory HR DSM and DTM

60 EO Products

IRIDE shall guarantee an operational engineered capability to create interferometric products over the Italian territory using SAR data from **4 different sensors** (Sentinel-1, SAOCOM, COSMO-SkyMED and NIMBUS SAR) operating in 3 different bands, with also the estimation of the North-South components of the displacement for the products based on NIMBUS-SAR.

S3 Lanslide Monitoring: Automatic identification of unstable slopes

Identification of measurements points located over potentially unstable slopes by means of statistical approaches

SVC ID	Service Value Chain Name
SE-S4-01	Land Cover/Land Use mapping & monitoring
SE-S4-02	Land consumption/soil sealing mapping & monitoring
SE-S4-04	Habitat Mapping
SE-S4-05	Urban Heat Island Monitoring
SE-S4-06	Green Urban Areas Characterization

IRIDE Services contribute to this Domain, with:

21   EO Products

S4\Environment IRIDE services provide <u>support to the knowledge of environmental evolution at national scale</u> through updated Land Cover/Land Use maps, and to monitor territorial weaknesses and criticalities due to climate change and human activities, through habitat maps, soil sealing, heat island monitoring etc..
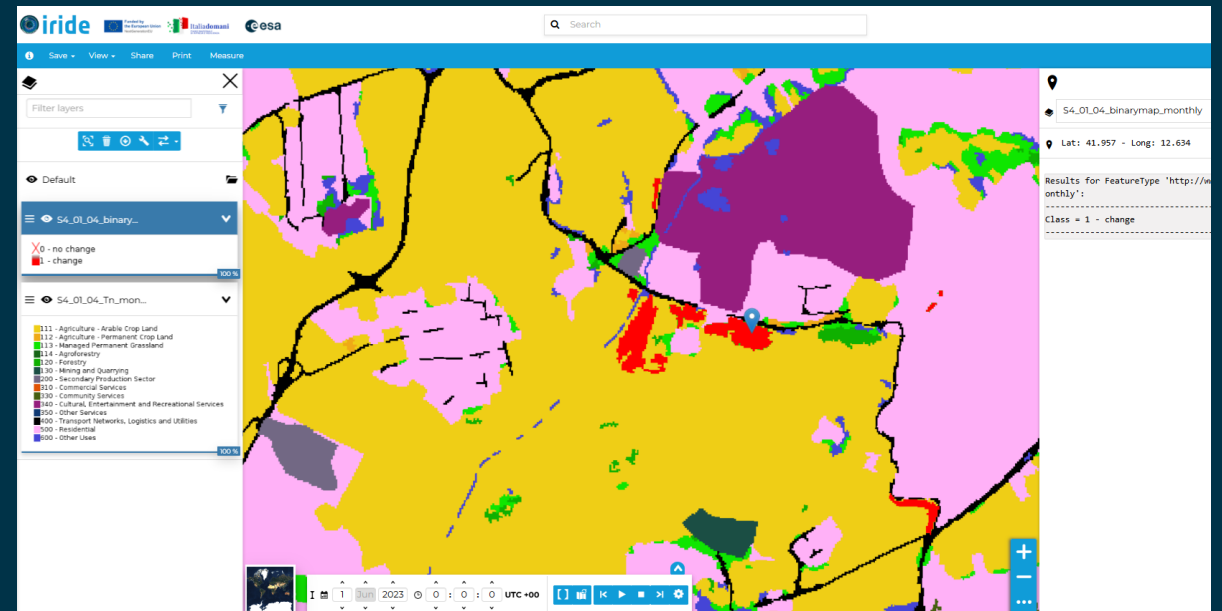
S4 Land Cover Land Use Mapping & Monitoring

Provides land cover and land use mapping and change monitoring services based on change detection and classification, to support the knowledge of environmental evolution due to the climate change and anthropogenic activities (urbanization, intensive agriculture, hydrological problems such as soil erosion and water pollution) allowing the production of updated statistics relating to land cover changes
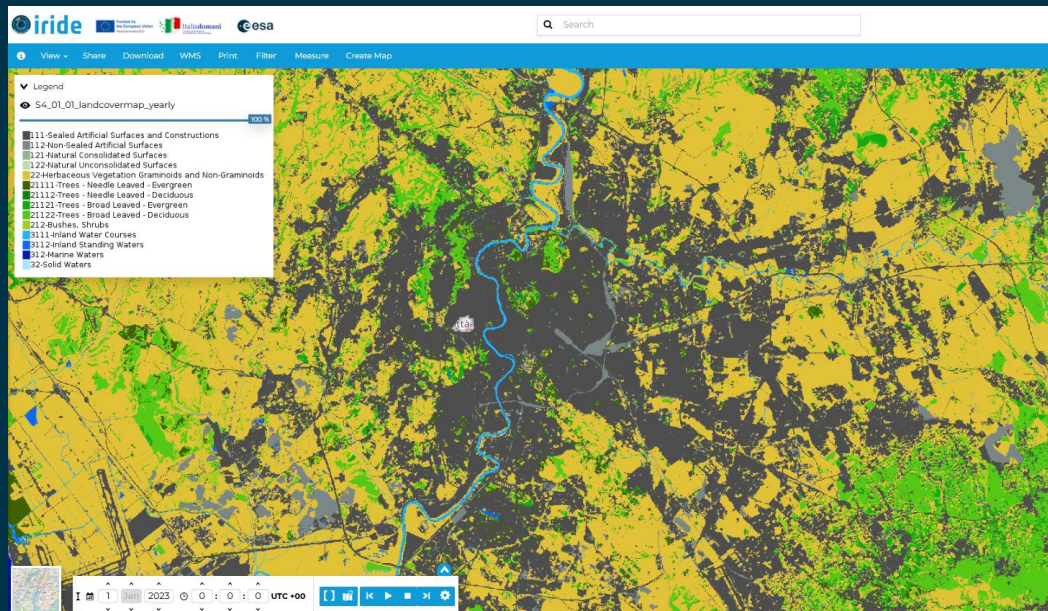
Land Cover Map of Rome, 2023 - From Living Lab

Land Use Change Map of Rome, 2023: change polygons are shown in red - From Living Lab

S4 Land Use\ Land Cover for Forest: IRIDE Service Portfolio

SVC ID	Service Value Chain Name
SE-S4-07	national Forest Mapping and Monitoring
SE-S4-08	Mapping of Burnt Areas
SE-S4-09	Fire Damage Assessment
SE-S4-10	Forest Health Assessment Indexes
SE-S4-11	Carbon Stock Indexes

IRIDE Services contribute to this Domain, with:
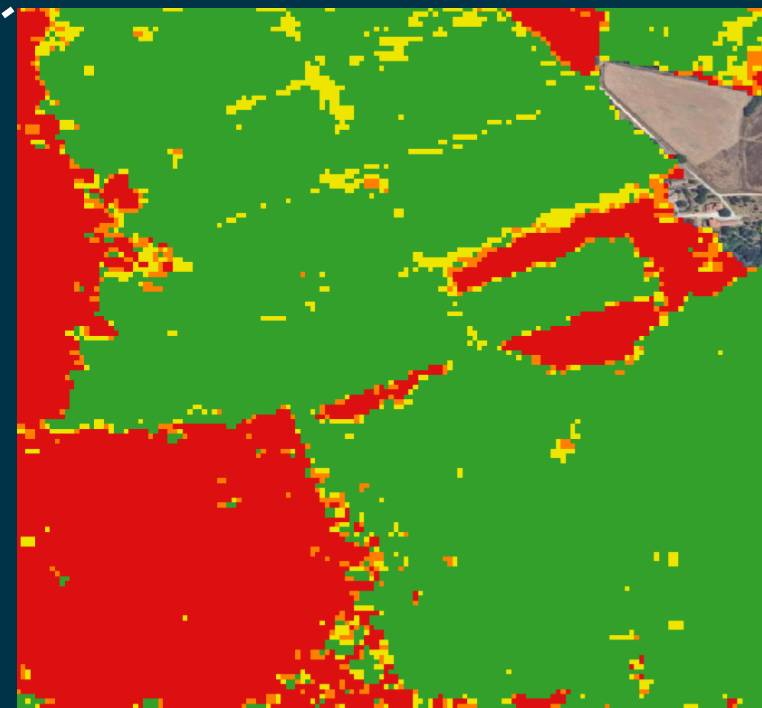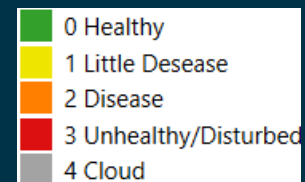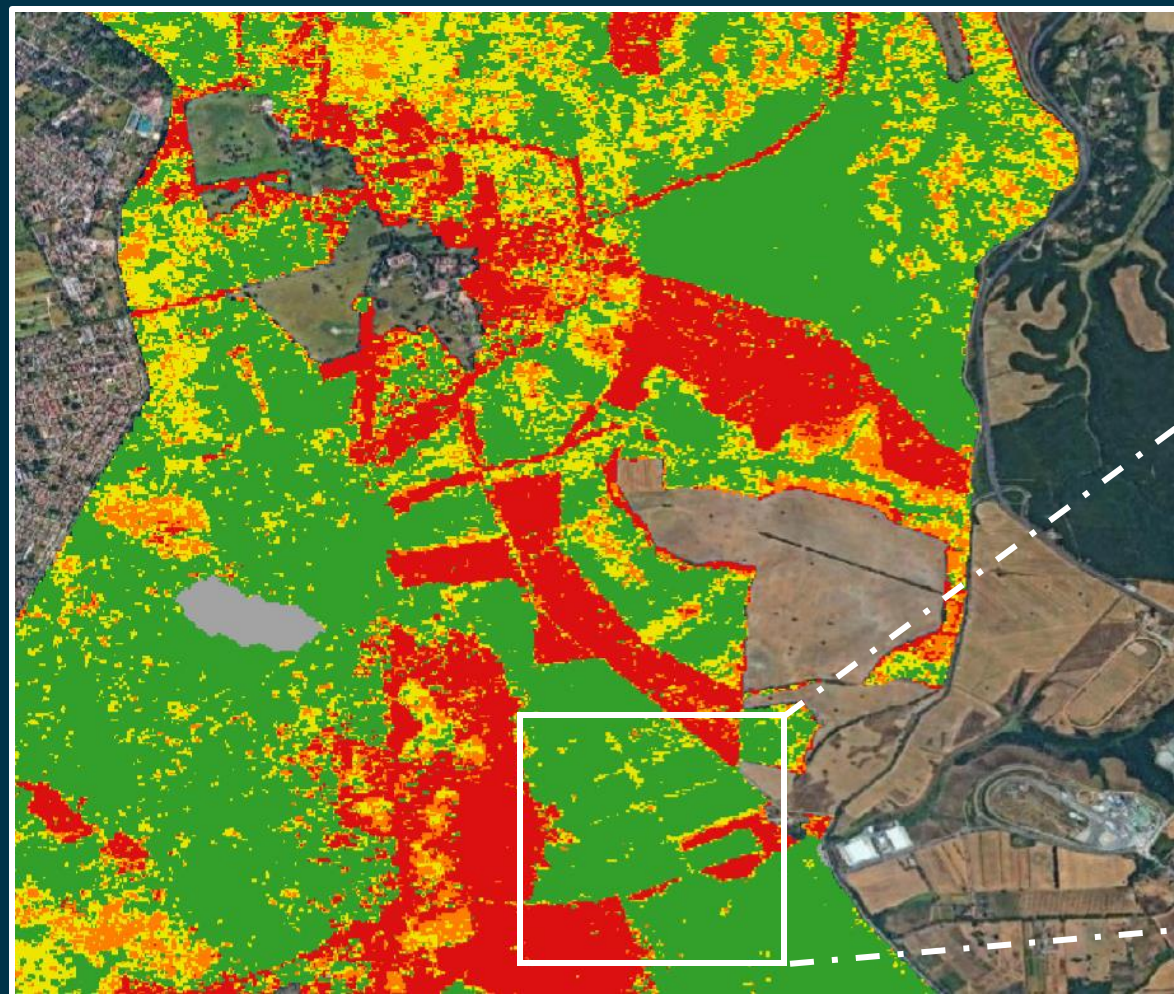
11   EO Products

S4\Forest IRIDE services provide support to the knowledge of our national forest inventory through up-to-date national forest maps, and to monitor both the health of forests and the damage due to pathogens, forest fires, providing maps of burn damage and fires, and supporting the national compliance with EU policies in terms of knowledge of the potential carbon stock of Italian forests.

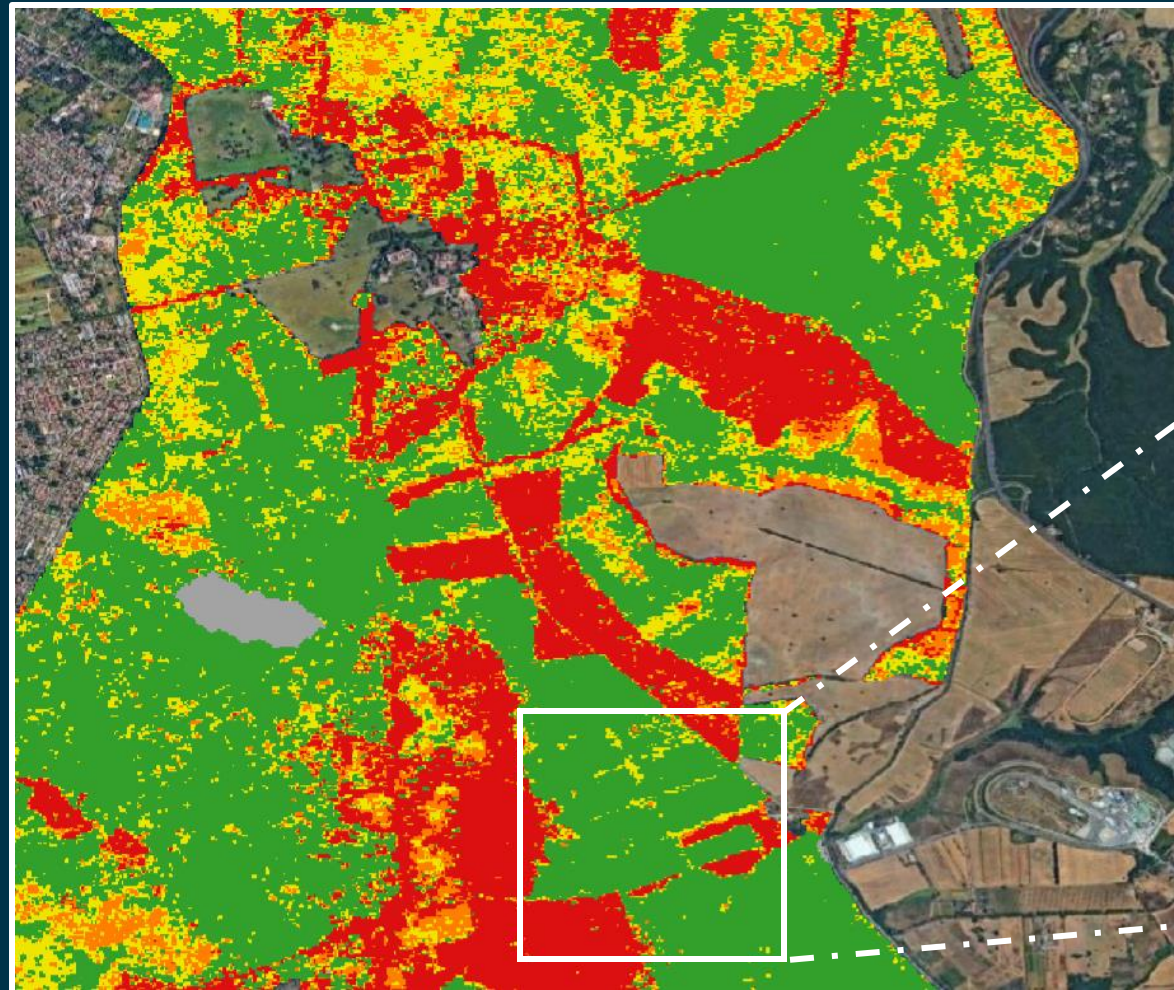# S4 National Forest Mapping & Monitoring

National Forest Map of Abruzzo, 2022 - From Living Lab

Legend:
- 0 Healthy
- 1 Little Desease
- 2 Disease
- 3 Unhealthy/Disturbed
- 4 Cloud

0 Healthy
1 Little Desease
2 Disease
3 Unhealthy/Disturbed
4 Cloud

SVC ID	Service Value Chain Name
SE-S4-12	Soil Organic Carbon (SOC) Monitoring
SE-S4-13	Erosion Risk Assessment
SE-S4-14	CPA – Crop Production Areas Mapping and Monitoring
SE-S4-15	Water Needs and Used Mapping
SE-S4-16	Identification of Indexes for Crop Health Assessment
SE-S4-17	a. CAP - Crop map to support CAP b. CAP - Continuous monitoring of annual LPIS changes (permanent crops and artifacts) c. CAP - Pasture tare and permanent grassland d. CAP - Identification of potential spills from stables e. CAP - Cross-compliance checks

IRIDE Services contribute to this Domain, with:

26 EO Products

A group of services focused on agriculture, to support the monitoring of the impact of agricultural practices on the environment and natural resources. This includes a contribution in assessing erosion risks, streamlining water needs, and mapping land use patterns for a more sustainable use of environmental resources.

S5. Hydro-Meteorological-Climate: IRIDE Service Portfolio
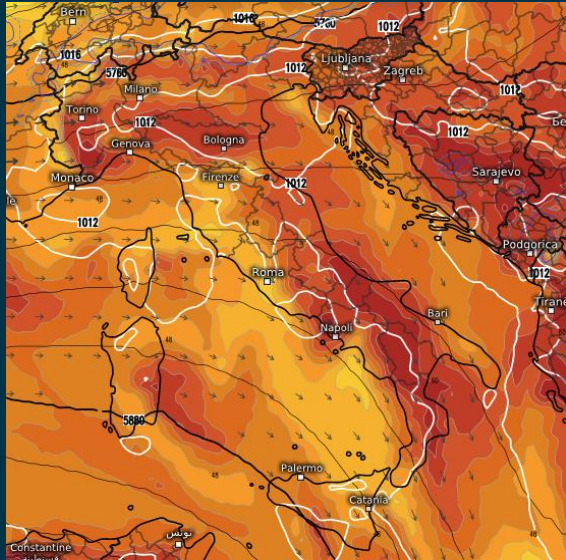
SVC ID	Service Value Chain Name
SE-S5-01	Hydro-meteorological mapping and monitoring atmospheric structure*
SE-S5-02	Monitoring of greenhouse gases and other Essential Climate Variables (ECVs)
SE-S5-04	Lightening Monitoring

IRIDE Services contribute to this Domain, with:

10   EO Products

8   Model Driven Products*

4   Validation Products

The Hydro-meteorological-climate Service Thematic Domain (S5) offers support to monitoring and forecasting services for hydro-meteorological variables, greenhouse gas levels, and other essential climatic variables. IRIDE services integrate satellite and in-situ data to support national and regional weather forecasting and climate services.

S6. Water Management: IRIDE Service Portfolio

SVC ID	Service Value Chain Name
SE-S6-01	Hydrological and Hydraulic modelling, flood forecasting and sediment management
SE-S6-02	River hydro-morphological mapping and channel dynamics
SE-S6-03	Integrated water resource management

IRIDE Services contribute to this Domain, with:

40 EO Products

The Water Management Service Thematic Domain provides geoinformation on water resources, sediment, flood risks, and river hydro-morphology. It integrates satellite and in-situ data to map various river-related parameters like macro-geomorphic units, sediment granulometry, soil moisture, and pollution sources. These services support the implementation of the Water Framework Directive and the Floods Directive, enhancing understanding of river processes and promoting sustainable water management under changing climate conditions.

S7. Emergency: IRIDE Service Portfolio

SVC ID	Service Value Chain Name
SE-S7-01\08	Rapid Damage Delineation\Grading - Earthquake
SE-S7-02\09	Rapid Damage Delineation\Grading – Flood*
SE-S7-03\10	Rapid Damage Delineation\Grading – Volcanic Eruption
SE-S7-04\11	Rapid Damage Delineation\Grading - Wildfires
SE-S7-05\12	Rapid Damage Delineation\Grading – Extreme Meteo Event
SE-S7-06\13	Rapid Damage Delineation\Grading – Landslide/Avalanche/Mudflow
SE-S7-07\14	Rapid Damage Delineation\Grading - Tsunami*
SE-S7-15	Rapid Damage Delineation / Grading – Other natural/Man made disaster

IRIDE Services contribute to this Domain, with:

40   EO Products

2   Model Driven Products*

S7 IRIDE service provides rapid mapping upon User request during emergency situations such as floods, fires, earthquakes, volcanic eruptions, etc., complementing and tailoring the contribution provided by Copernicus EMS.

S7 RAPID DAMAGE MAPPING / DELINEATION – FLOOD (RIVERINE AND COASTAL)

The IRIDE service contributes by providing End Users with updated information on the extent of flooded areas using EO-based data.
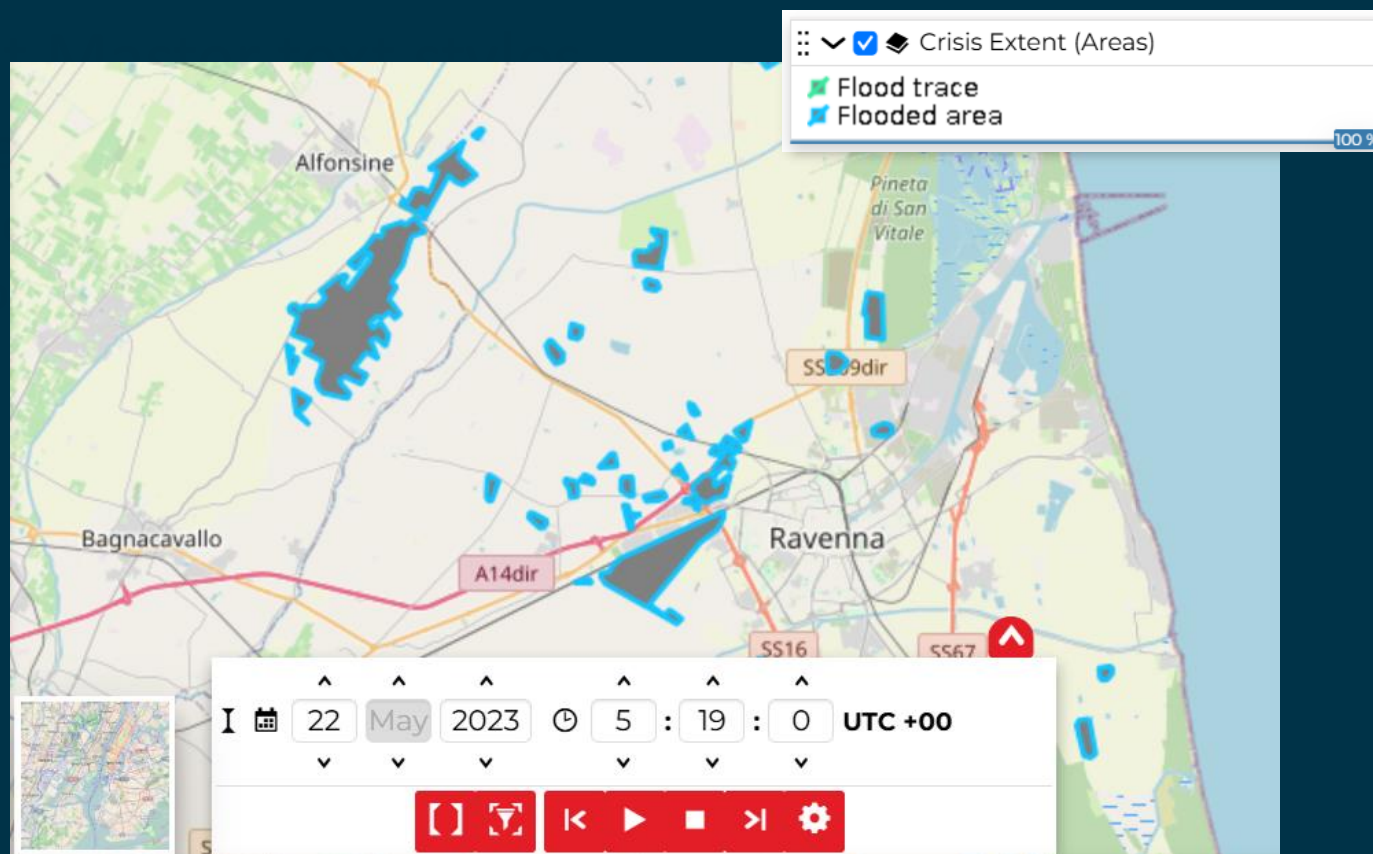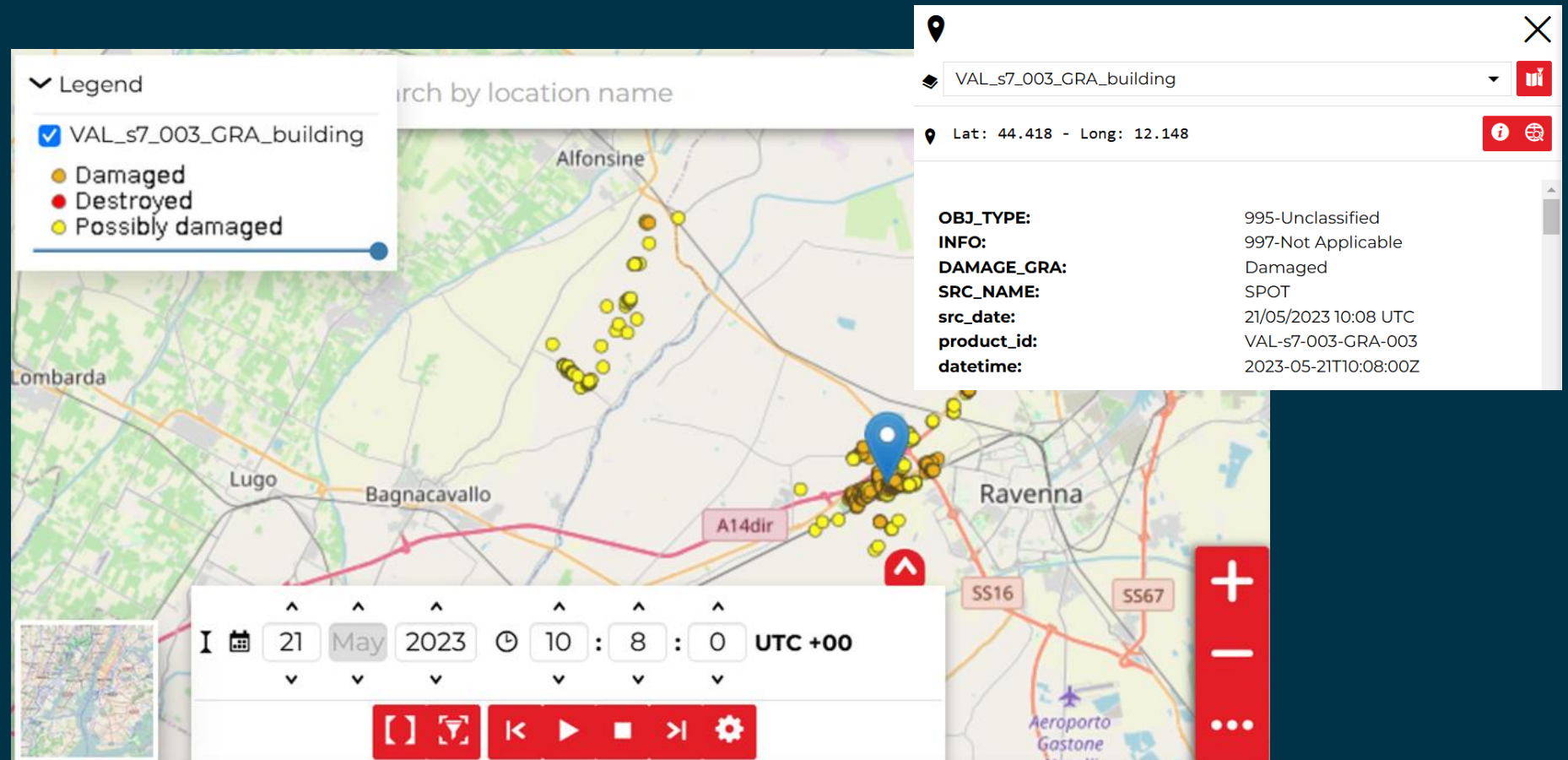

Delineation Product Area Extent (SAR), related to the extreme event happened in Ravenna (2023) from Living Lab

S7 RAPID DAMAGE MAPPING / GRADING – FLOOD (RIVERINE AND COASTAL)

The IRIDE service aims to provide End Users with flood depth data and damage grade assessments for assets such as buildings, roads, and critical infrastructures. These assessments is based on the analysis of flood depth.

OBJ_TYPE:	995-Unclassified
INFO:	997-Not Applicable
DAMAGE_GRA:	Damaged
SRC_NAME:	SPOT
src_date:	21/05/2023 10:08 UTC
product_id:	VAL-s7-003-GRA-003
datetime:	2023-05-21T10:08:00Z

Legend
- VAL_s7_003_GRA_building
  - Damaged
  - Destroyed
  - Possibly damaged

VAL_s7_003_GRA_building
Lat: 44.418 - Long: 12.148

S7-09-01 Grading Product - Damage Grade Assessment to
Ravenna event (2023) from Living Lab

SVC ID	Service Value Chain Name
SE-S8-03	Maritime Surveillance: Maps for Oil Spill detection and Sea Pollution management*
SE-S8-04	On-demand Maritime Surveillance: vessels detection, identification, tracking and S&R Support Services
SE-S8-05	Systematic Maritime Surveillance: vessels detection, identification, tracking and S&R Support Services

IRIDE Services contribute to this Domain, with:

25	EO Products
1	Model Driven Products*

IRIDE's services in support of security activities include geospatial products for monitoring the Italy territorial waters and maritime target areas on a global scale. Geospatial information based on satellite data provide ship and anomalies detection (e.g., unexpected anchorages or activity along the path of submarine cables, navigation in the dark or in groups of vessels) or combat illegal activities at sea (such as oil spills).

SVC ID	Service Value Chain Name
SE-S8-01	HR and VHR Monitoring Maps
SE-S8-02	Monitoring maps of human settlements (formal and informal)
SE-S8-06	Risk Analysis on Critical Areas
SE-S8-07	Environmental Intelligence Services
SE-S8-08	Cross Border and Pre-Frontier Surveillance Service (Migrants' Flow, Road Network Status Assessment

IRIDE Services contribute to this Domain, with:

36   EO Products

IRIDE's services in support of security activities include geospatial products for monitoring the national territory and target area on global scale. Geospatial information based on satellite data provide the detection, classification and monitoring of targets and activities (such as Human temporary settlement detection and evolution on borders, detection of deforestation areas for the construction of airstrip, aircraft detection and classification, …) or to combat illegal activities (such as illicit discharge).