living planet symposium | BONN 23–27 May 2022

TAKING THE PULSE OF OUR PLANET FROM SPACE

EO Law – EO derived information in support of Law Enforcement

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May 27th 2022

GMV – International technology group

Multinational technology group

6th European Space Industrial Group

2,500+ employees

Roots tied to Space

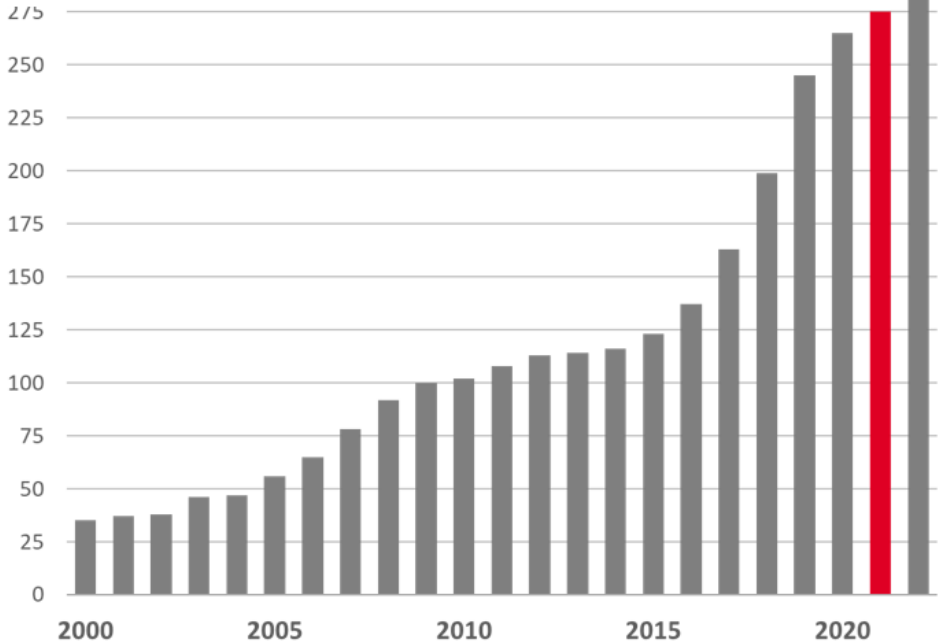
CMMI level 5

Private capital

Companies in 12 countries

Founded in 1984

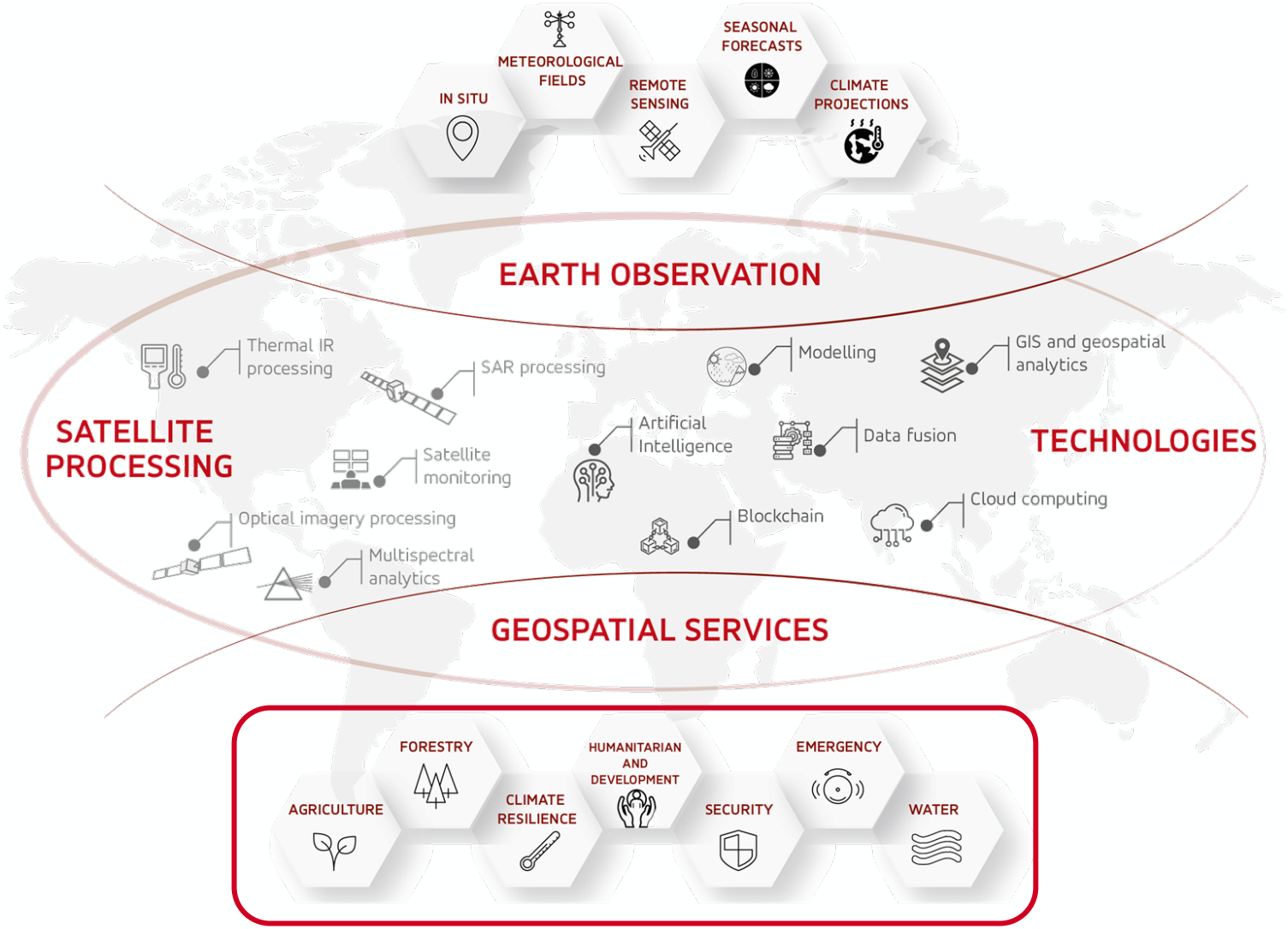
300 M€ worldwide revenue



Space, Aeronautics, Defense & Security, Intelligent Transportation, Banking & Finances, ICT Industries

Space	Defense	IT	Transport
57%	10%	17%	16%

GeoSpatial services based in Earth Observation data



EO Law - EO derived information in support of Law Enforcement

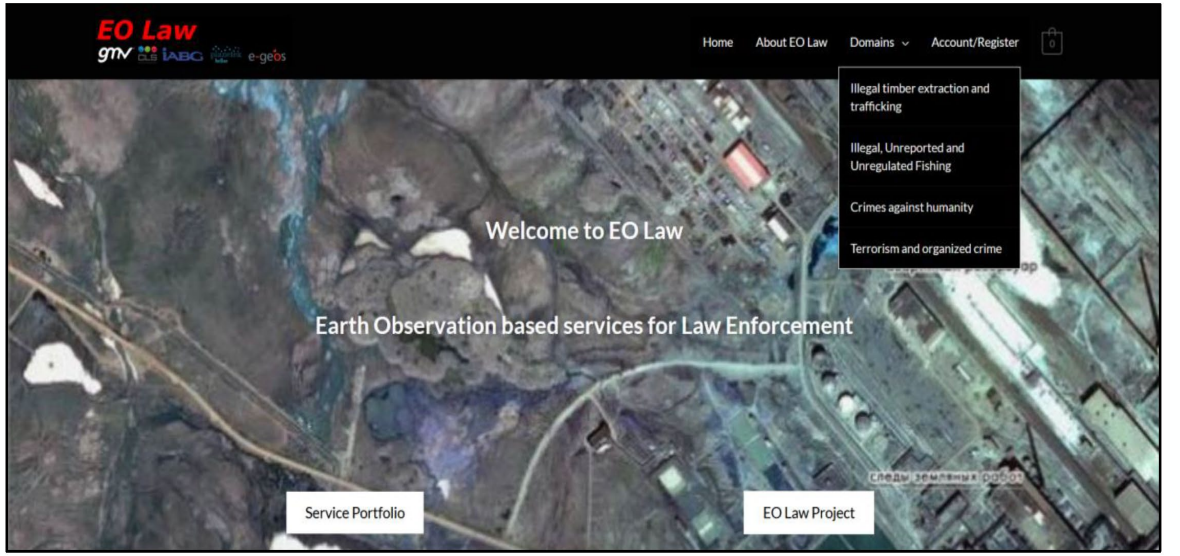
EO Law - Project Overview

EOLAW was based on virtual platform technology to develop novel services based on EO data combined with ICT data analytics and non-EO data for the Law Enforcement sector

Objectives

- Demonstrate impact and benefit from an integrated approach combining multiple datasets and analyses for stakeholders in the Law Enforcement domain
- Increase awareness, acceptance and understanding of the potential benefits in the Law Enforcement domain of using EO derived information
- Test prototype capabilities as a possible basis for future operational implementation
- Enable flexible access to EO derived information and analytic capabilities compliant with standards, formats and practices

Virtual Platform



Users : Interpol, Europol (observer), International Criminal Court, Indian Ocean Commission (Regional Maritime Information Fusion Centre), Forest Stewardship Council certification, ENCE, Xunta de Galicia, World Uyghurs Congress, Federal Criminal Police Office of Germany (Observer), Austrian Ministry of Interior (Observer)

EO Law - Project Overview

Four law enforcement domains were approached during the project:


Environmental crimes – Illegal timber extraction and trafficking


Environmental crimes – IUU fishing


Crimes against humanity

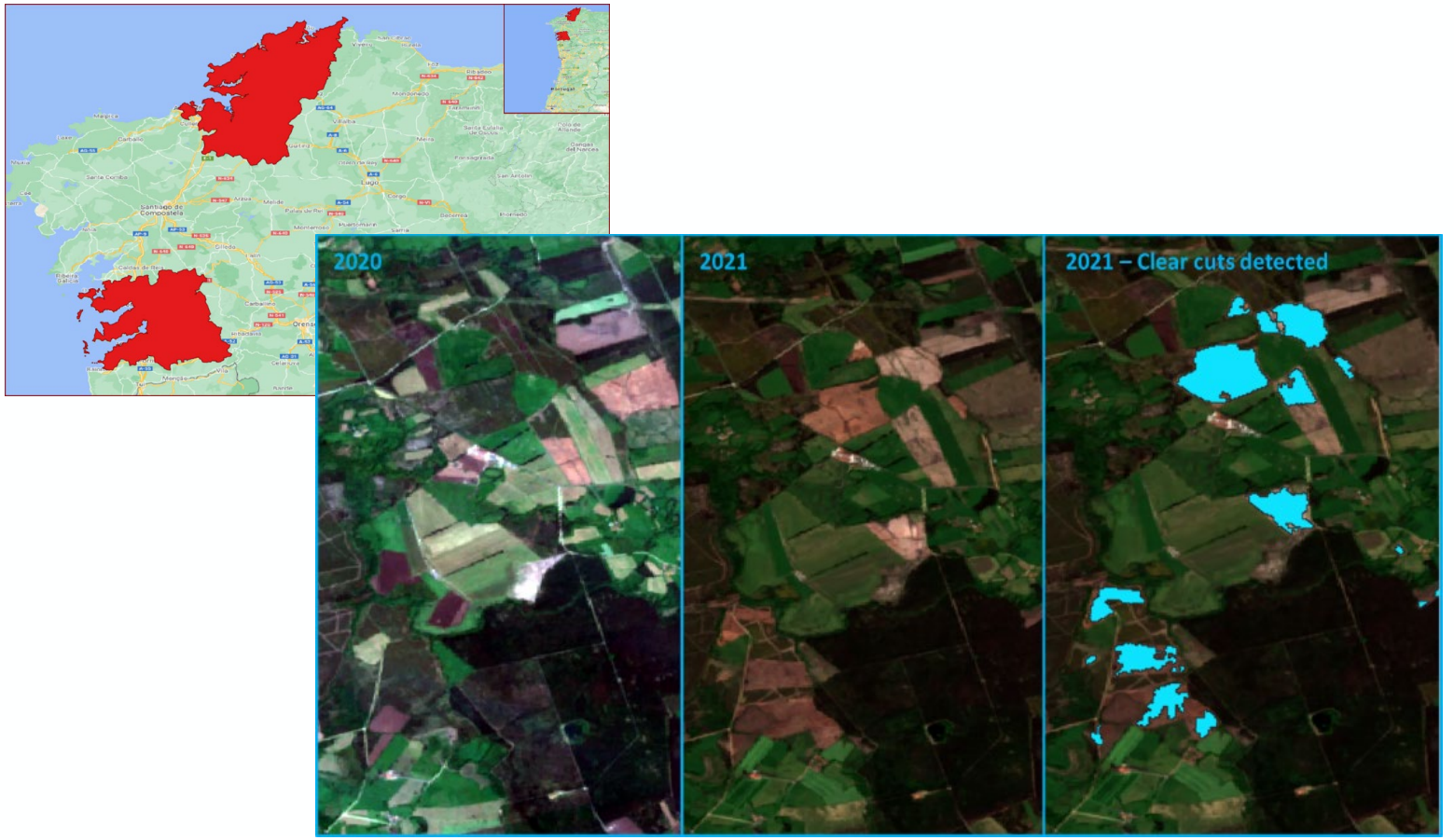

Terrorism and organized crime

e-geos → Benefits / impact assessment, and roadmap for the future

Environmental crimes - Illegal timber extraction and trafficking

Environmental crimes – Illegal timber extraction and trafficking

DETECTION AND MONITORING OF FOREST CHANGE



Objective

- Continuous monitoring of forest areas for the detection of clear cuts
- Assessment of the nature of the clear cuts (legal / illegal)

Stakeholders involved

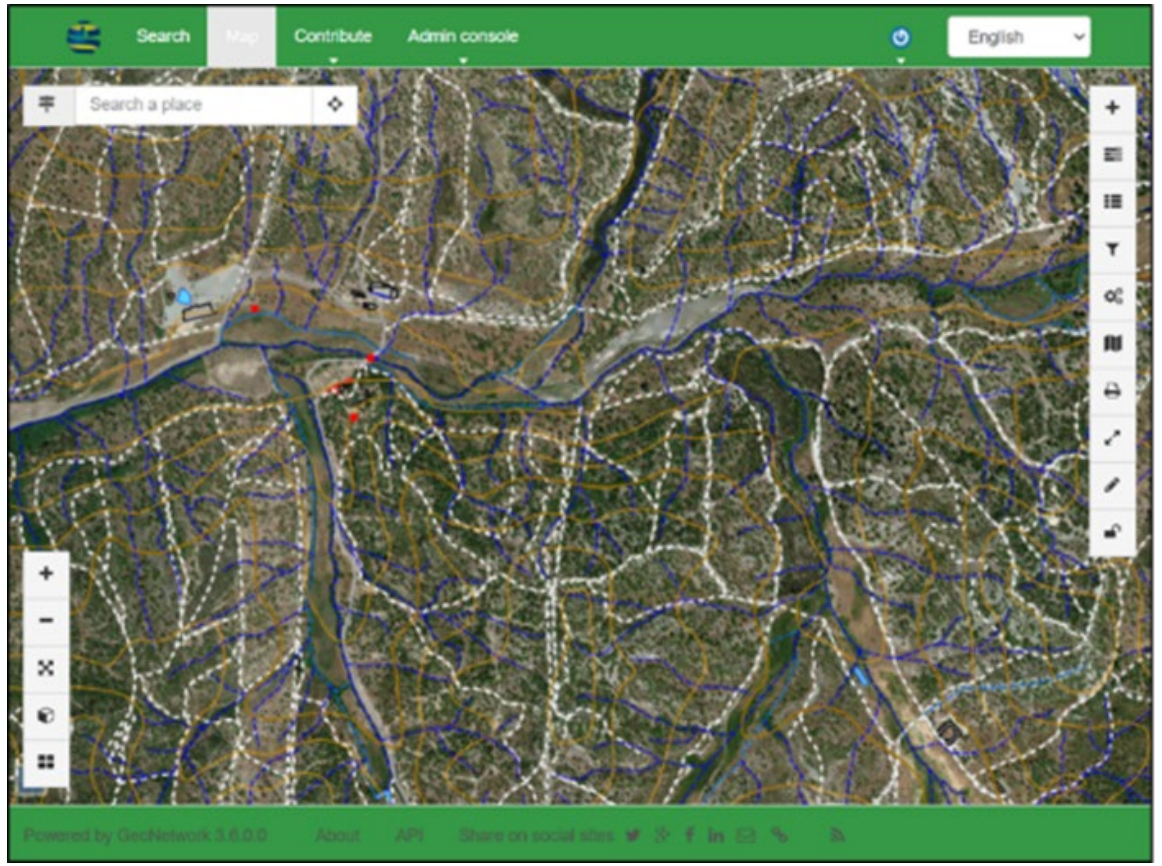
- ENCE and Xunta de Galicia

Added value for the stakeholders:

- Large areas being continuously analysed for the presence of clear cuts
- Various formats of outputs customized for different use cases
- Identify suspicious activities that could be further investigated (e.g., route characterization, logging machinery, etc.)

Environmental crimes – Illegal timber extraction and trafficking

DETECTION OF ROUTES FOR MOVEMENT OF TIMBER + DETECTION OF LOGGING SUPPORT INFRASTRUCTURES



Added value for the stakeholders:

- Large areas monitored
- Relevant features fully mapped (e.g., all kinds of roads, car tracks, dwellings, machinery, vehicles, etc.)
- MGCP standard used in features classification
- Various formats of outputs customized for different use case

Environmental crimes – IUU Fishing

Environmental crimes – IUU fishing

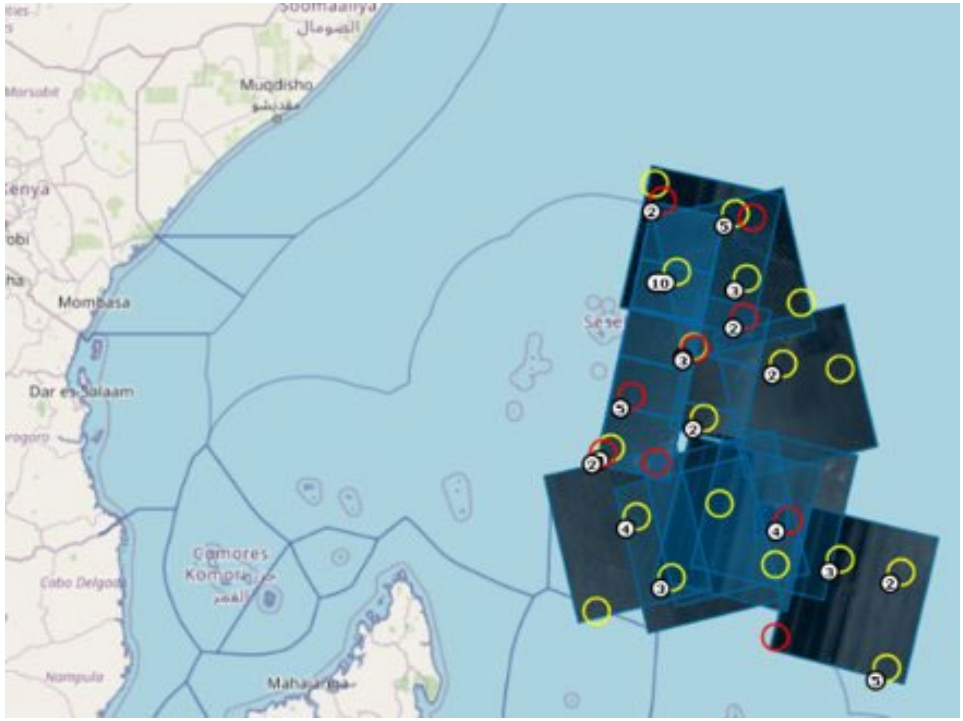
3 services developed for to the Regional Maritime Information Fusion Center (RMFIC) during the project

1st service : Area Surveillance service

- Analysis of historical maritime traffic data over large areas
- Based on radar satellite imagery (Sentinel 1)
- Provision of report in less than 48 hours after satellite image acquisition, based both on earth observation and maritime traffic data
- Awareness of maritime situation as well as potential seasonal behaviours

2nd service : Fast Imagery Analysis Delivery service

- Reactive ordering and analysis of earth observation products for on-going events of interest
- Provision of report in less than 24 hours after service request, based both on earth observation and maritime traffic data
- Multi-sensor and multi-platform satellite data ensures the availability and adaptability of the service for specific events of interest

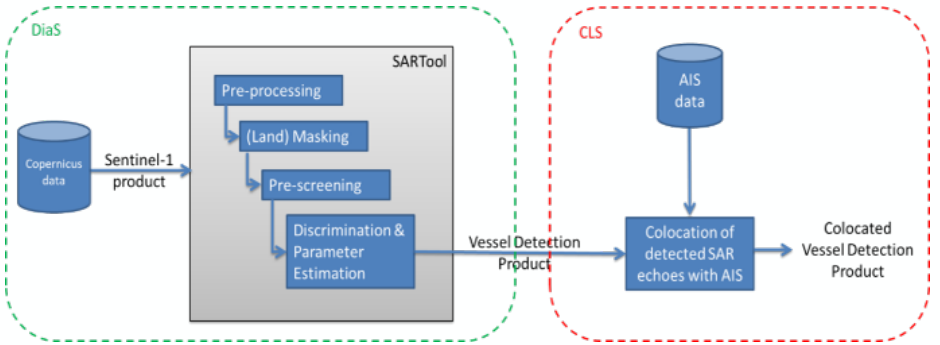


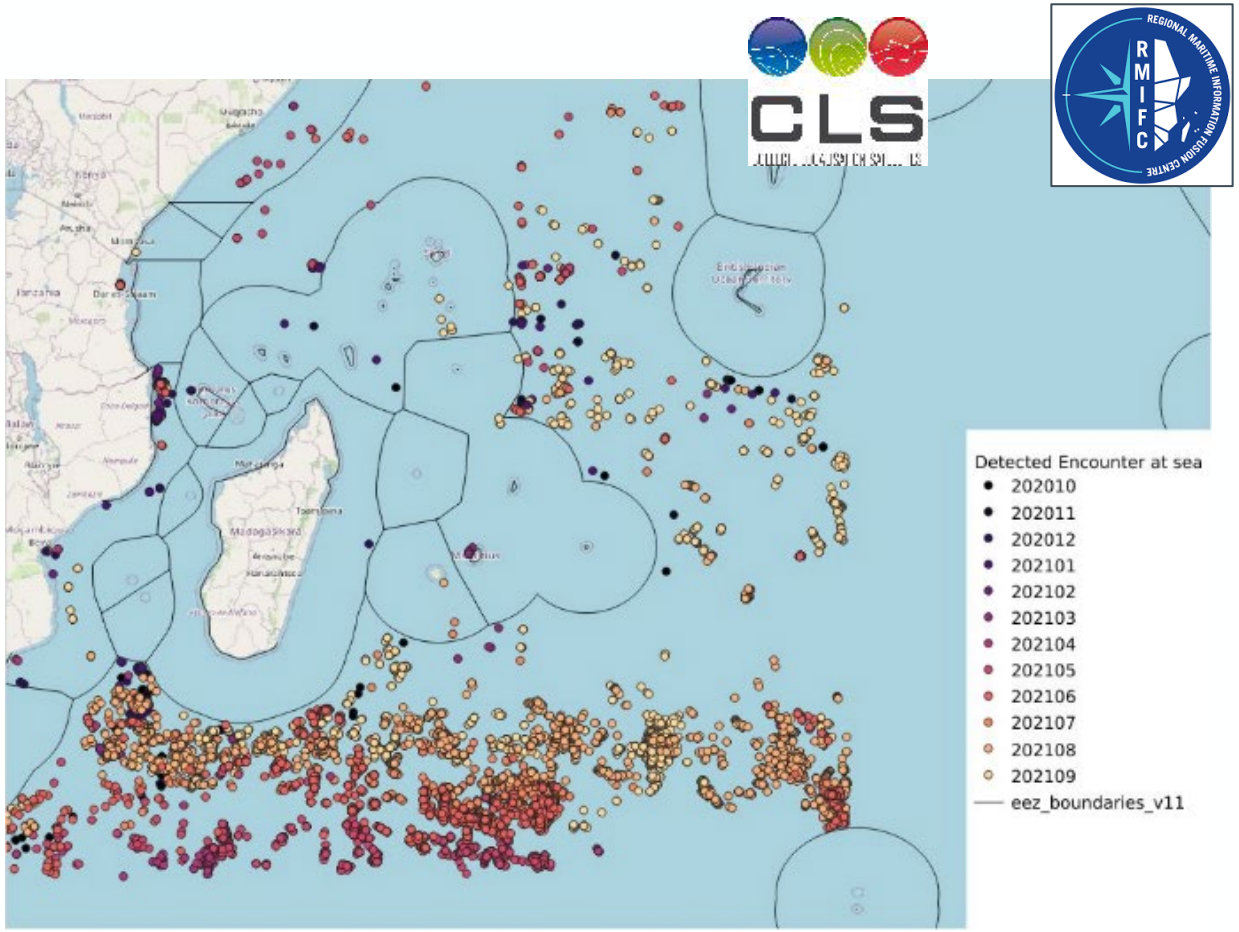
Area monitoring near the east of the Seychelles' EEZ over 3 weeks in June 2021

Environmental crimes – IUU fishing

3rd developed service : Large Scale Systematic Analysis service

- Systematic processing of Sentinel-1 satellite images acquired over a very large Area of Interest during a year for detection of abnormal behaviours
- Overview of yearly maritime activities based on the fusion of maritime traffic data with earth observation products
- Generation of metrics and maps showcasing likely areas of IUU fishing activities
- Analysis report provided insights and recommendations regarding IUU fishing activities



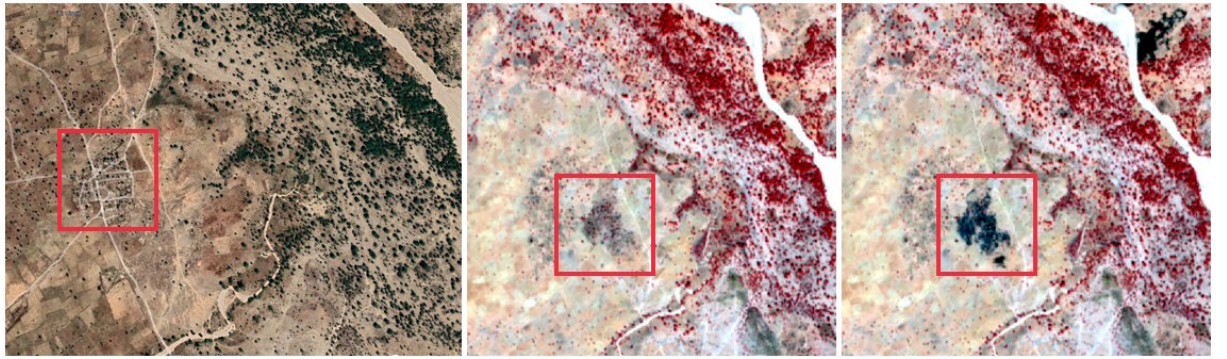


Map of detected rendez-vous at sea that occured between September 2020 and 2021 over the Western Indian Ocean region

Crimes against humanity

Crimes against humanity

Fire detection in settlements



Objective

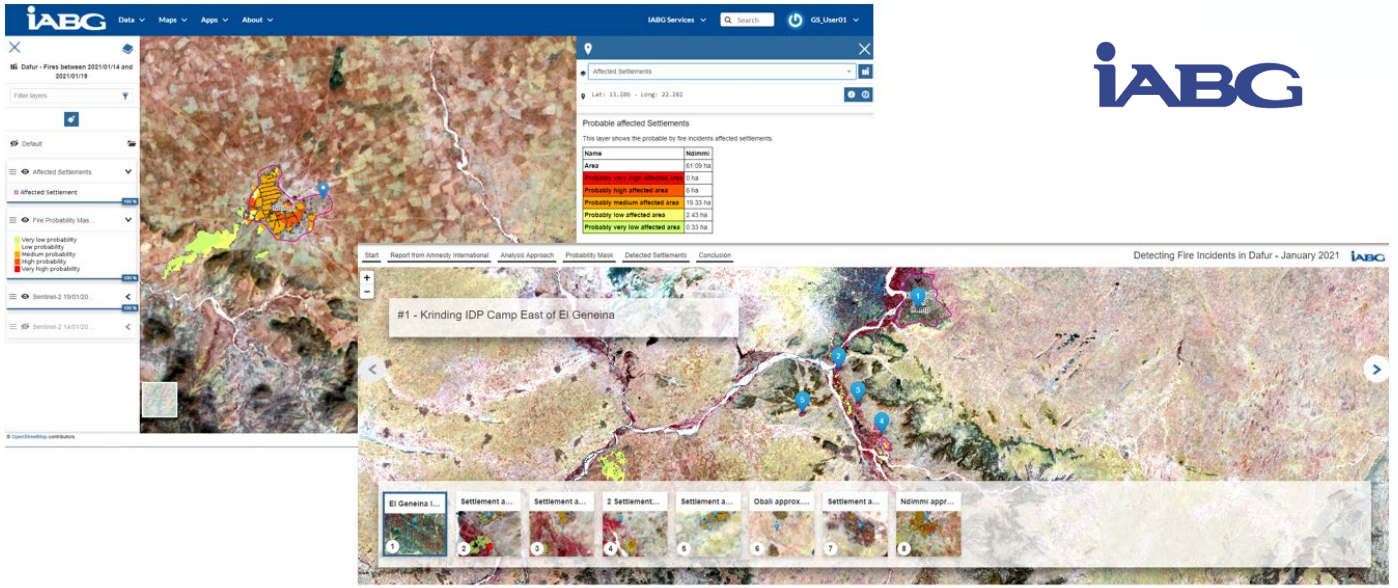
- Detection of burned down areas by combining various remote sensing technologies
- Probability estimation of areas of belonging to a settlement structure via GIS analysis including multiple geospatial data

Stakeholder

- International Criminal Court (ICC)

Added value

- Gathering of evidence for the destruction of settlements due to warlike or criminal activities in inaccessible areas
- Timely and on-demand validation and verification of potential cases of destruction of settlement structures by arson based on independent remote sensing methodologies
- Coverage of large areas that are fully automatically analysed



Crimes against humanity

Mass graves suitability modelling

Objective

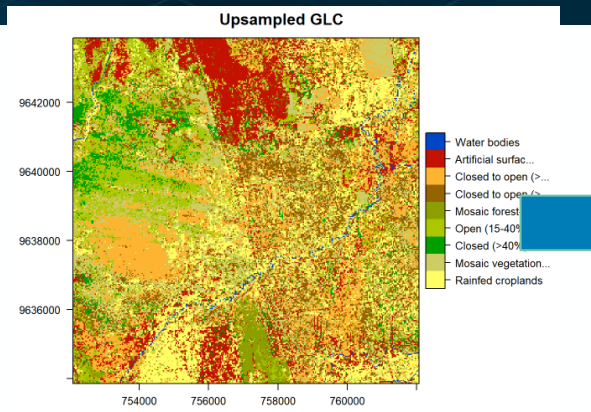
- Predictive multi-criteria mass grave site model
- Combining GIS/EO-based landscape analysis and expert knowledge
- Assumption: selection of burial sites is subject to environmental and contextual conditions

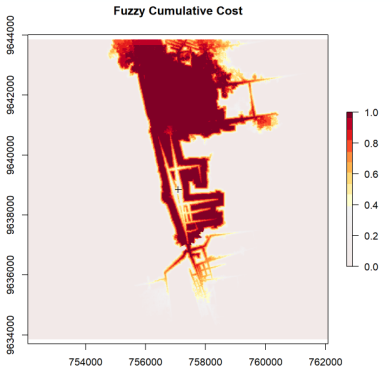
Stakeholder

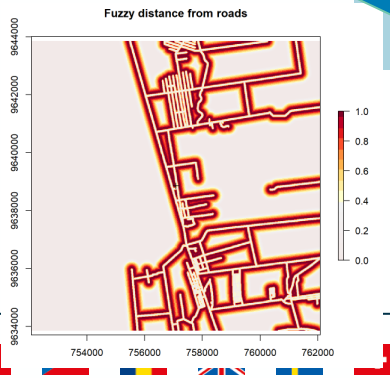
- International Criminal Court (ICC)

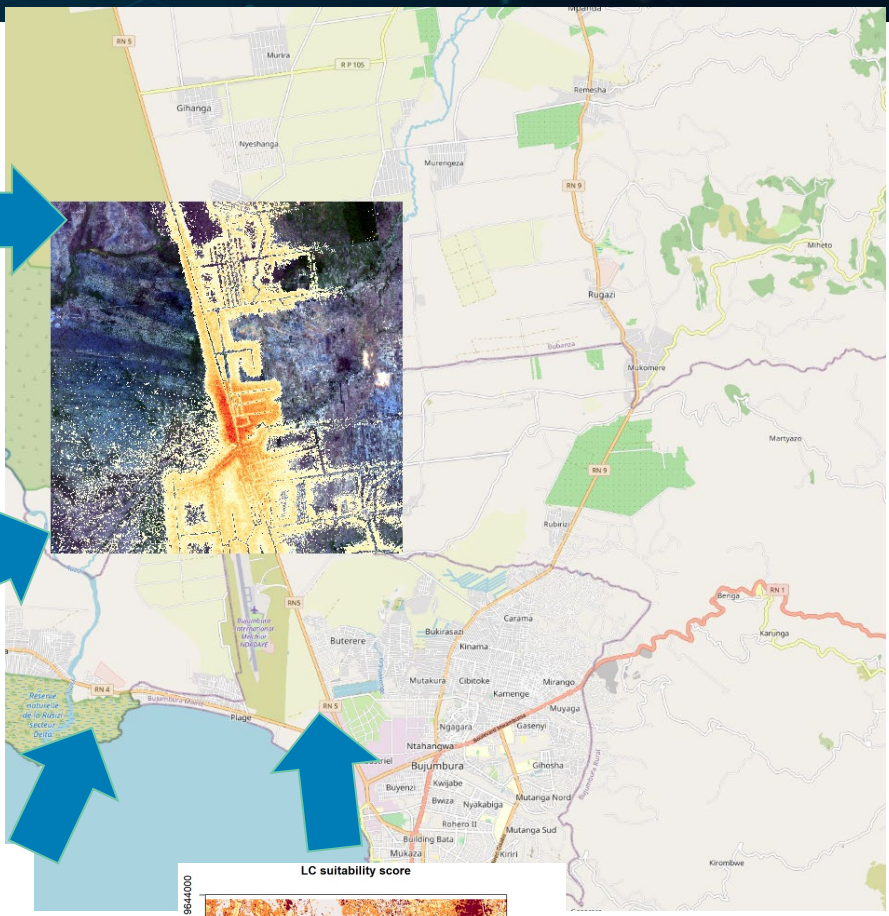
Added value

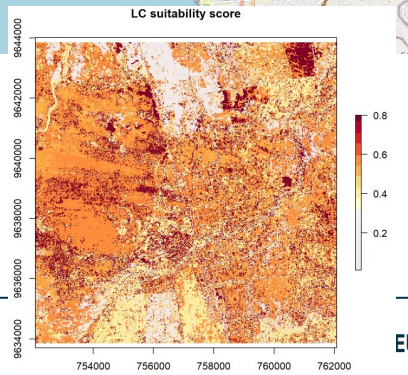
- Coverage of large areas that are analyses fully automatic
- Narrowing down possible locations of mass grave sites to aid search efforts by delineating areas with higher suitability
- Subsequent highlighting of possible sites applying change detection algorithms using satellite data











Crimes against humanity

Settlement development and change detection

Objective

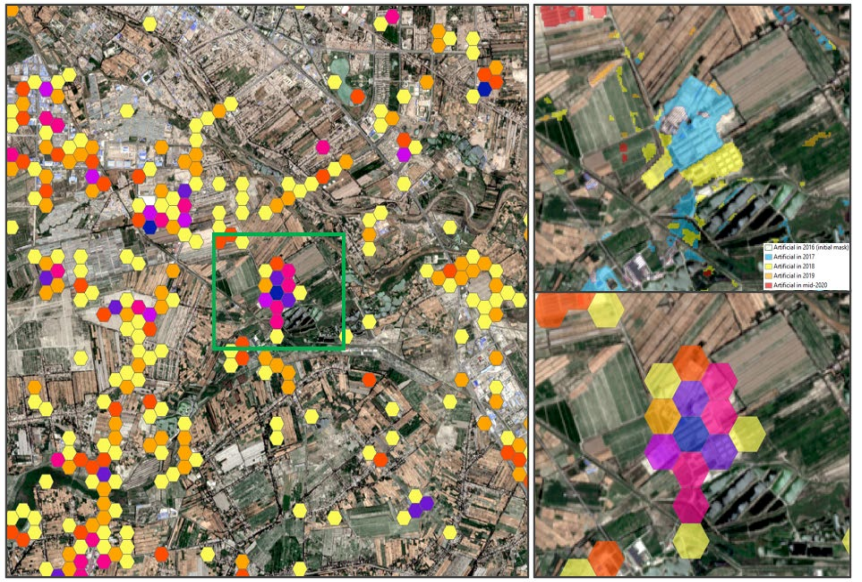
- AI-driven multi-temporal S2 analysis:
  - To generate an artificial surface mask/change mask over time
  - Changes inside and outside urban areas
- Hot Spot analysis: determine focus areas of changes

Stakeholder

- Not disclosed

Added value

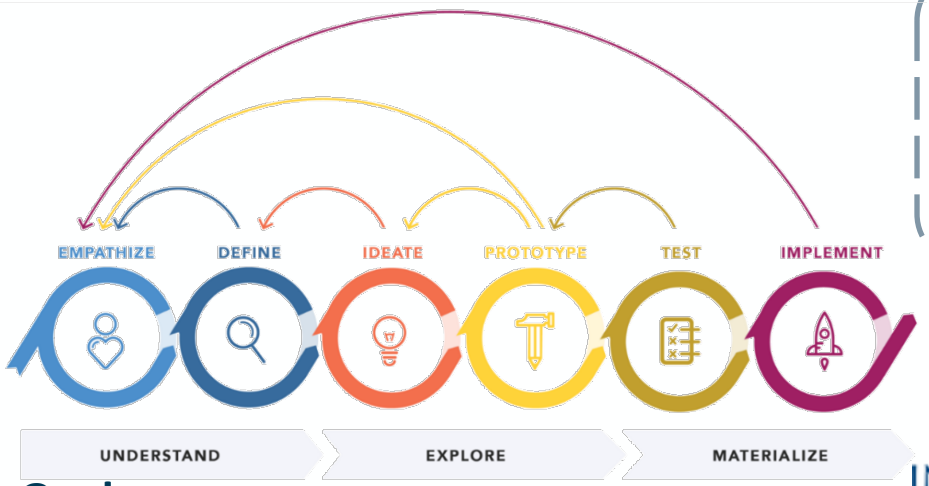
- Monitoring of large areas over several years
- Identification of areas with a high change in imperviousness to determine larger construction areas
- Change detection provided per image or aggregated (per month / year)
- Change detection provided as a single raster layer or aggregated via hot spot analysis



Terrorism and organized crime

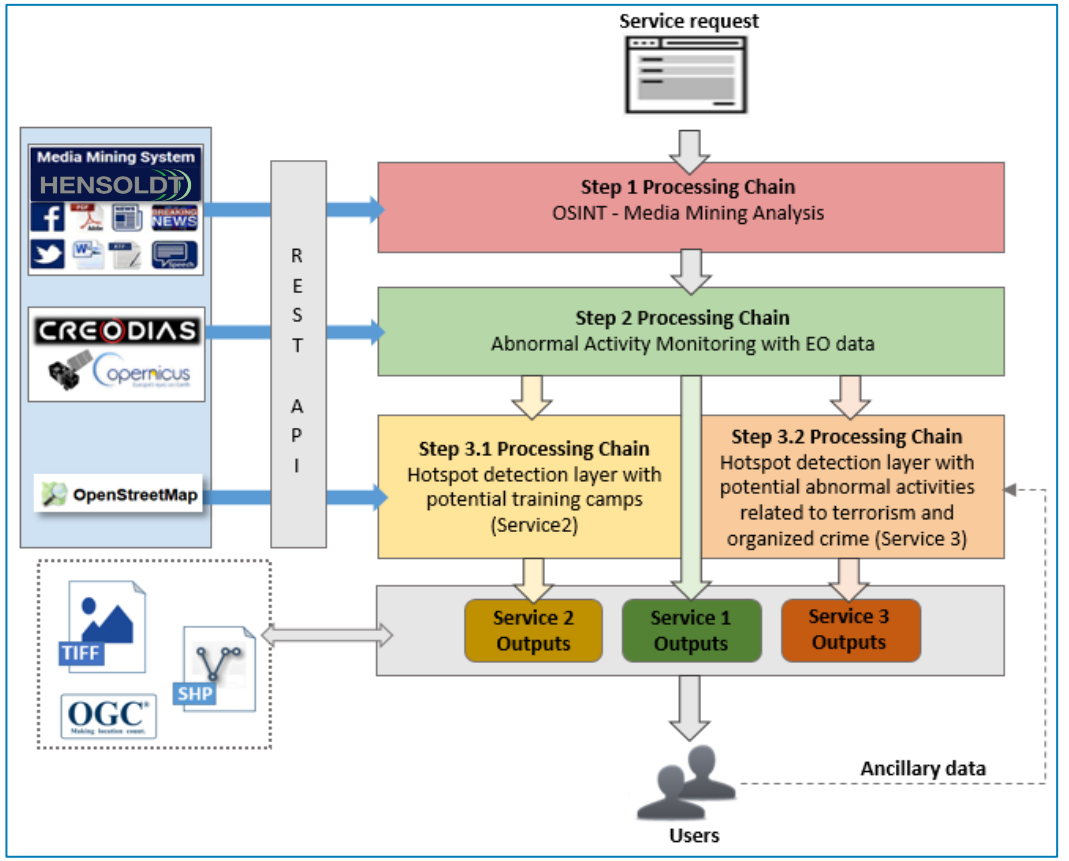
Terrorism and organized crime

Continuous User Engagement



From active and continuous user involvement & engagement to service request

INTERPOL

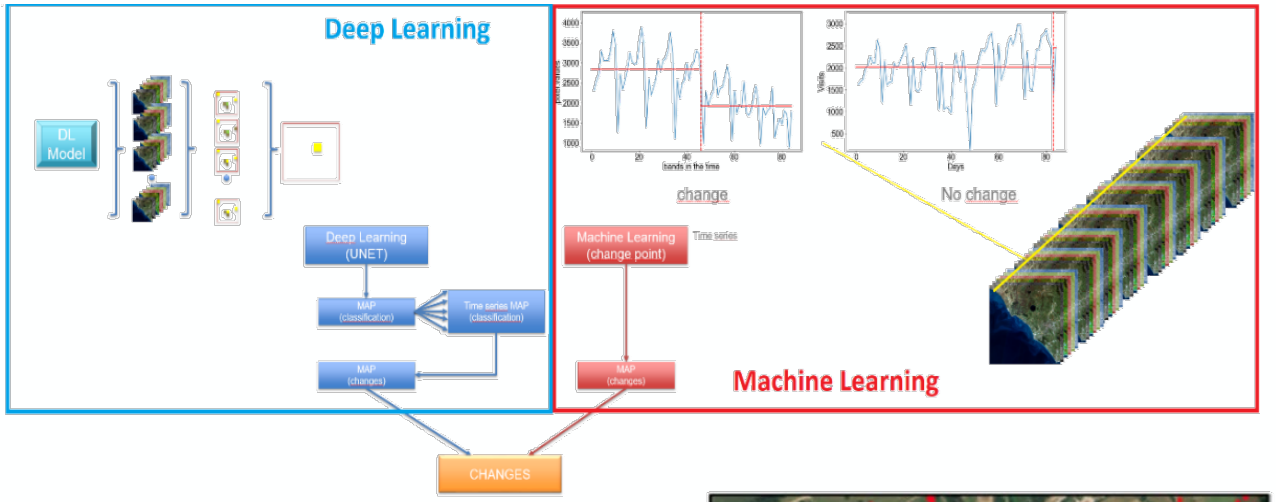


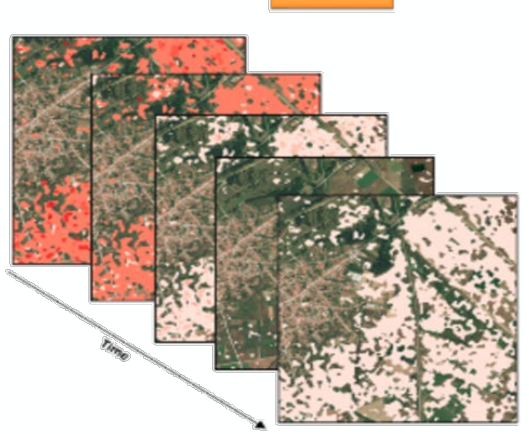
Goals:

- Spatial visualization of **abnormal activities** related to terrorism and organized crime.
- Identification of patterns and changes in **terrorism events** and locations.
- Fusion of **multi source data**, including GIS data, Earth Observation imagery, structured and unstructured data, databases as well as information from media and open sources.

Terrorism and organized crime

Summary of Use Cases





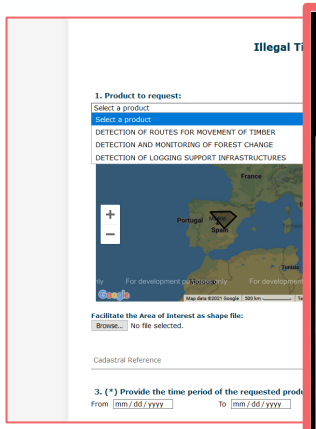
- Realization & Verification of 6 use cases
- Complex scenarios
- Additional products were generated

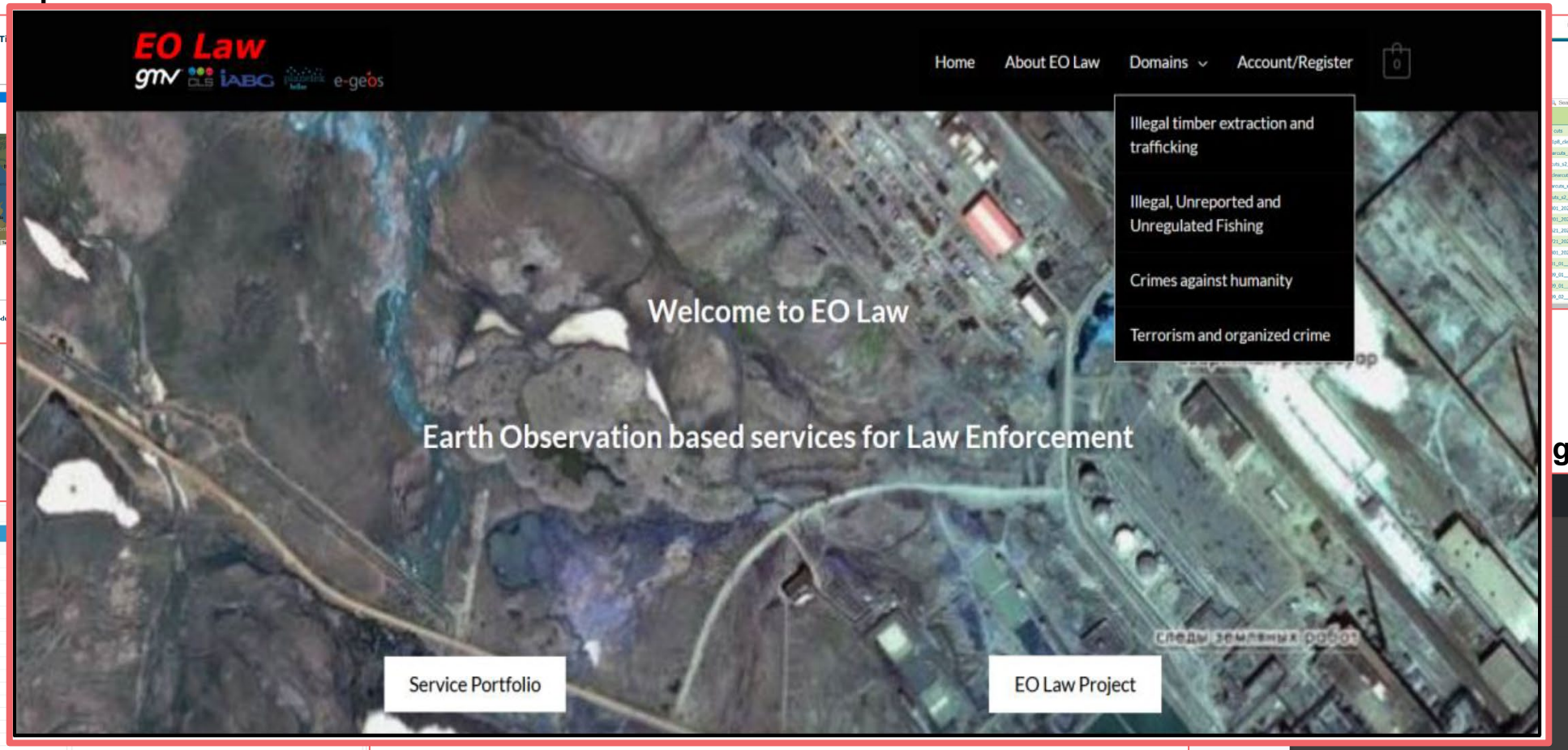
EO Law Virtual Platform

EO Law Virtual Platform

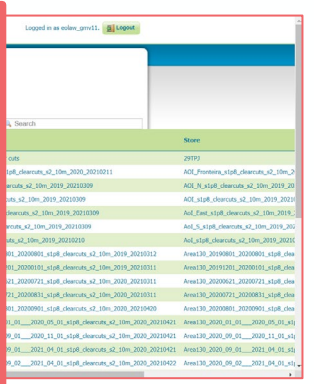
GMV - EO Merlin

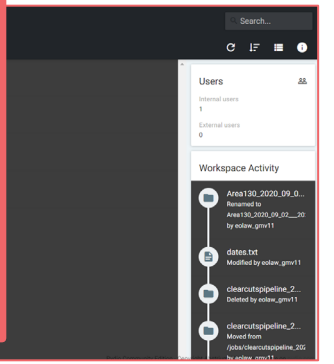
Service request form





Geoserver





Project outcomes

Project outcomes

New types of users

- International, National and Local law enforcement agencies
- NGOs
- Official authorities
- Industry

Services provision

- Services requested and provided in dedicated platform
- EO / Non – EO data fusion
- Data analytics
- Several outputs provision mechanisms

Industry strategy

- Services and project in line with industry development plans
- Further developments for the future
- Follow-up activities in the EO Law domains

Cooperation with ESA

- Active cooperation with ESA in stakeholders engagement and networking
- Active ESA support in management and technical aspects
- Open and permanent communication ESA/Consortium

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