ENVIRONMENTAL CRIMES WORKSHOP 2024

11-12 June 2024 | ESA-ESRIN, Frascati, Italy

EO4SECURITY
Environmental Crimes and Illegal Trafficking

S5 - Monitoring 2 - land

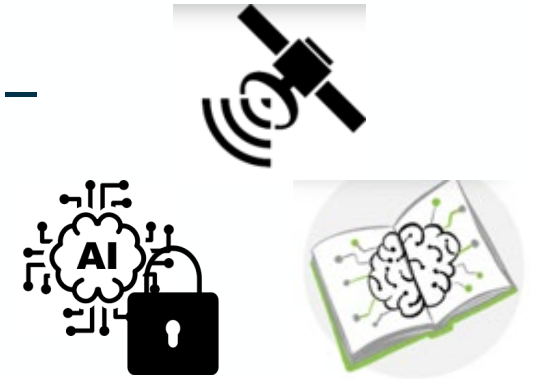
Agenda

1. Project introduction
2. Where we are
3. End Users requirements and Use Case Definition
4. Workplan
5. Indicators and products generation
6. Integrity data & secure transmission
7. Key Findings and Consideration
8. Q&A session

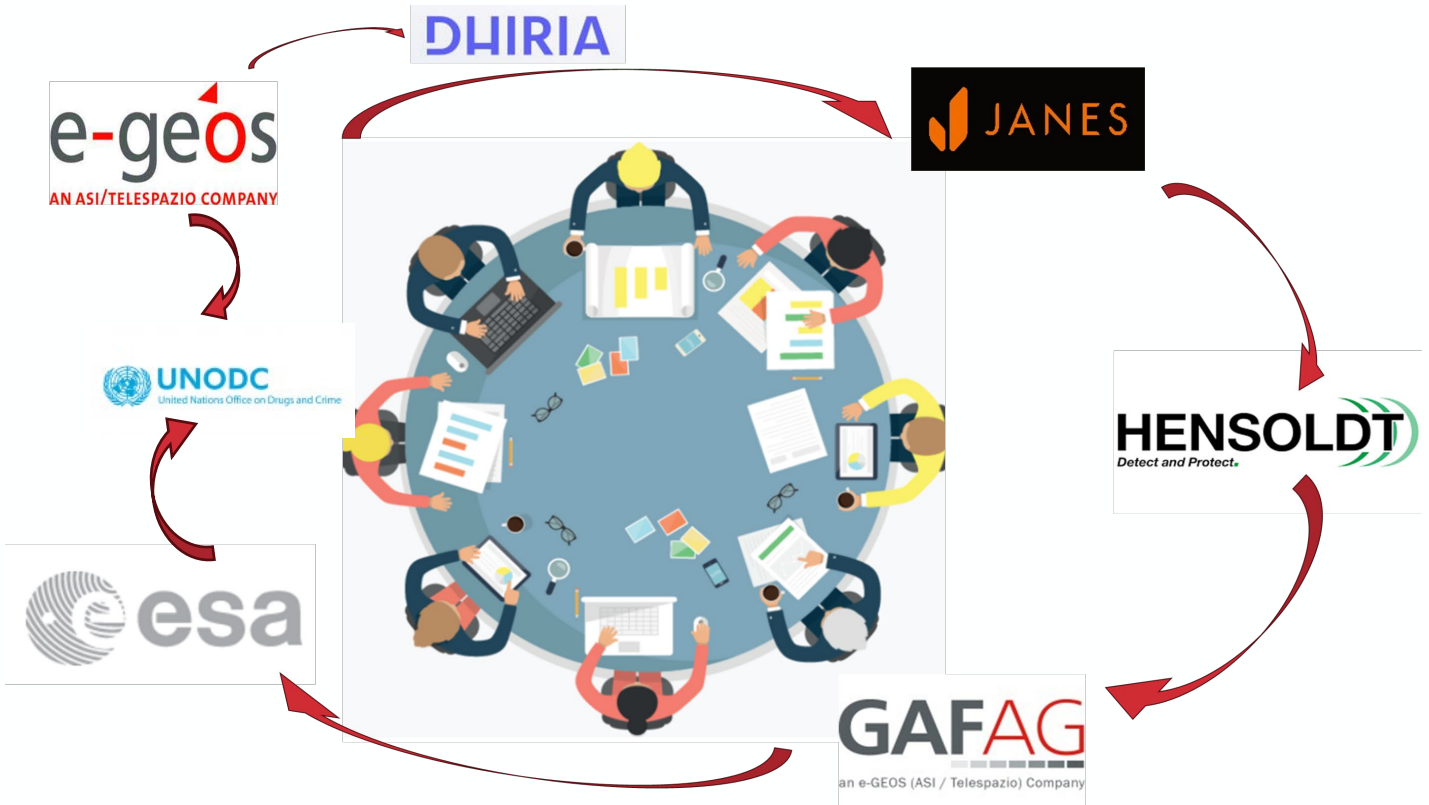
Project introduction

Scope
Improve analysis and support enforcement authorities to identify illicit activities in different phases (anticipation, detection, monitoring)

Inspiring principle:
Combined use of multiple data sources and tools – EO, OpenSource Intelligence, AI/automation

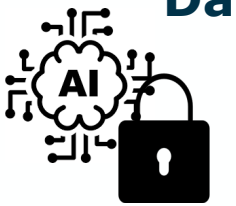


Our Team



EO data analysis
e-GEOS, GAF

Open Source Int
Hensoldt, Janes



Data integrity and secure transimssion
DHIRIA

Where we are

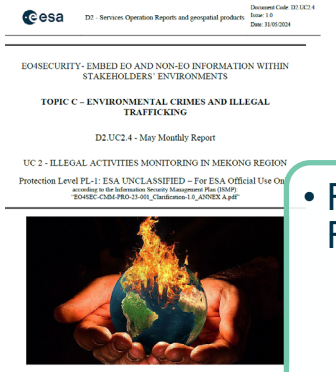
- Collection and consolidation of end-user requirements
- Definition of 2 Use Cases
- 4 cycle of monitoring EO/OSINT combined Analysis: from February to May
- Integrity data and secure transmission

- Collection of feedback from the end-users on the work done and validation of the results
- Training and knowledge transfer activities
- Development of a 3°Use Case

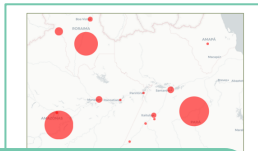
Work plan

01 - Onboarding:

- User need requirements
- Methodology and indicators definition



4 monitoring cycles



Location	Mentions
Pará	127
Amazonas	126
Roraima	112
Mato Grosso	63
TI Yanomami	40
Manaus	29
TI Kayapó	25
Tapajós	23
Itaituba	16
TI Munduruku	16

- February Reports
- March Reports
- April Reports
- May Reports

End-Users feedback collection and implementation

End-Users feedback collection and implementation

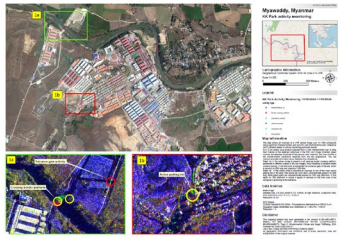
End-Users feedback collection and implementation

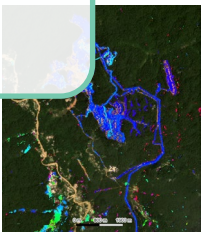
End-Users feedback collection and implementation

02 - Operations:

- Data collection (Satellite + OSINT)
- Data preparation
- Information extraction
- Data integration for advanced insights

Owner	Input Data Source	Reporting period	Date(s)	AOI	Output Format(s)	Main purpose
GAF	Sentinel 1 (radar)	D2.UC1.1	From 1 Jan 18 to 1 Dec 23	Munduruku reserve	.tif	FCDM baseline
					.shp	Vector interpretation of above
GAF	Sentinel 1 (radar)	D2.UC1.1	1 Dec	Munduruku reserve	.tif	FCDM change detection
					.shp	Vector interpretation of above
GAF	Planet (5 m optical)	D2.UC1.1	Jan 24	Munduruku reserve	.shp	Airstrip map baseline
GAF	Sentinel 1 (radar)	D2.UC1.2	From 15 Feb 24 to 15 Mar 24	Munduruku reserve	.tif	FCDM change detection
					.shp	Vector interpretation of above
GAF	Planet (5 m optical)	D2.UC1.2	From 15 Feb 24 to 15 Mar 24	Munduruku reserve	.shp	Airstrip map change detection
GAF	Sentinel 1 (radar)	D2.UC1.3	From 15 Mar 24 to 15 Apr 24	Munduruku reserve	.tif	FCDM change detection
					.shp	Vector interpretation of above
GAF	Planet (5 m optical)	D2.UC1.3	From 15 Mar 24 to 15 Apr 24	Munduruku reserve	.shp	Airstrip map change detection
GAF	Sentinel 1 (radar)	D2.UC1.4	From 15 Apr 24 to 15 May 24	Munduruku reserve	.tif	FCDM change detection
					.shp	Vector interpretation of above
GAF	Planet (5 m optical)	D2.UC1.4	From 15 Apr 24 to 15 May 24	Munduruku reserve	.shp	Airstrip map change detection (no change detected)
GAF	Pleiades (30 cm optical)	D2.UC1.4	15 Dec 23	Namblikwara Sararé	.tif	Optical Validation of activity
					.shp	Interpretation of mining equipment for respective date
GAF	Pleiades (30 cm optical)	D2.UC1.4	06 May 24	Namblikwara Sararé	.tif	Optical Validation of activity
					.shp	Interpretation of mining equipment for respective date
GAF	Pleiades (50 cm optical	D2.UC1.4	29 Mar 23	Namblikwara Sararé	.tif	Optical Validation of activity
					.shp	Interpretation of mining equipment for respective date



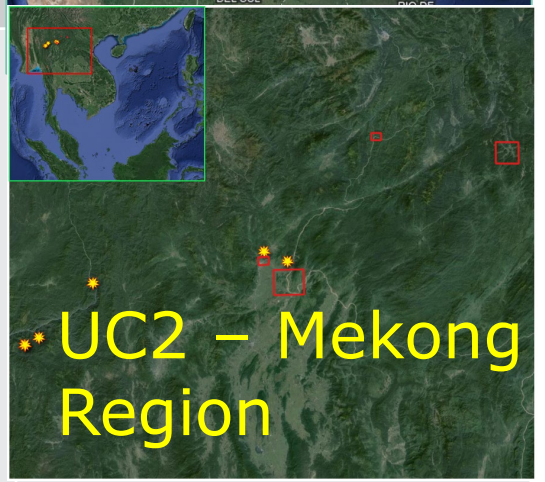


Onboarding: URs and UCs definitions

1. Users' requirements collection through online and offline interactions using a well-structured spreadsheet and a dedicated space on Confluence

2. Definition of use cases from the requirements obtained

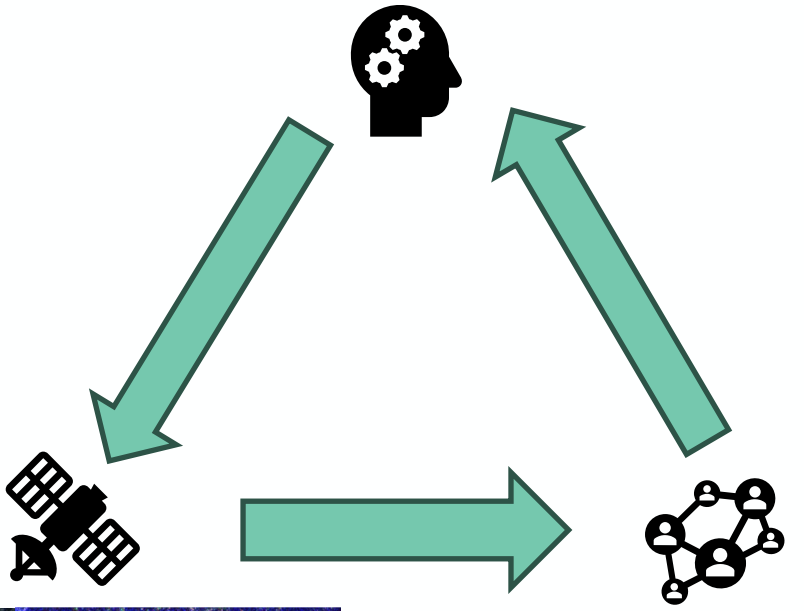
3. Feasibility Analysis of the selected use cases

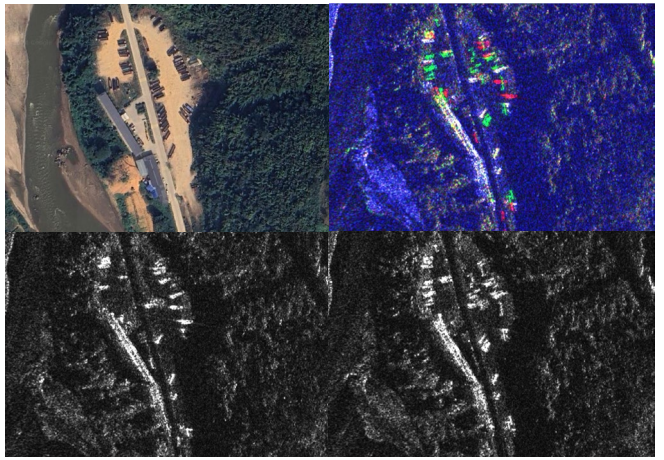
End-Users' needs	Use Case
Satellite patterns compatible with gold exploration + data from social networks about invasions of indigenous lands by miners.	
Evidence of criminal activity in special economic zones (SEZs) and Special Regions (SRs) in the Mekong combining EO and OSINT methodologies	

Onboarding: methodology and indicators definition

EO/OSINT Methodology

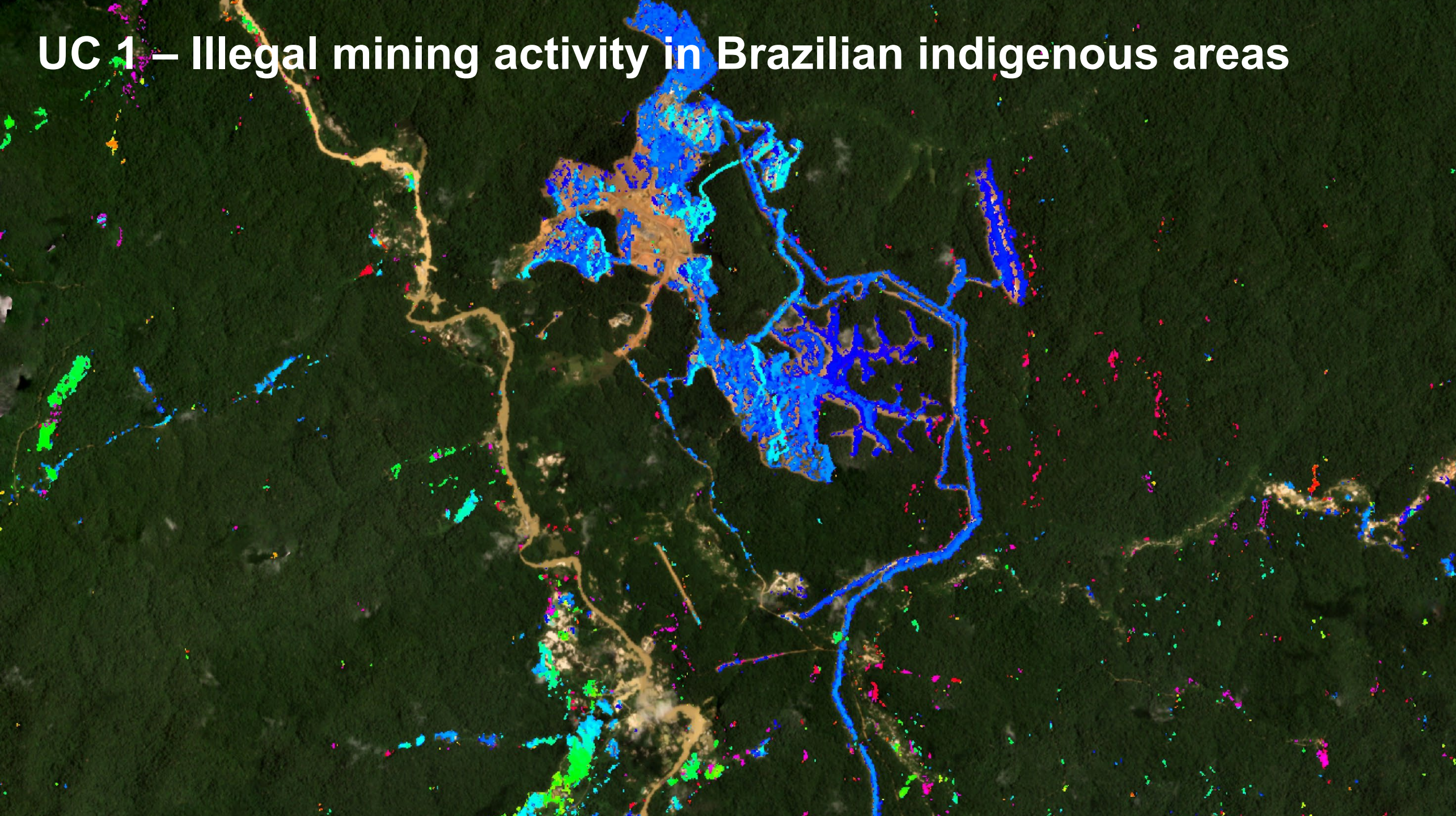
1. Ancillary Information from End User
2. EO investigation
3. OSINT investigation
4. Results validation
5. Cross-check of obtained results.
6. Interpretation and information extraction
7. Area refinement/ new word
8. Possible new starting point for analysis





Survey on the impact of illegal mining in the Amazon	19 Apr 2024	*MapBiomas Brasil* released findings from a survey on the impact of illegal mining in the Amazon.[3] While the findings are based on 2022 data, organisations and news sources are widely circulated the survey on social media, referencing the proliferation of illegal mining in indigenous regions including **TI Munduruku**.
ATL 2024 – national mobilisation bringing awareness to indigenous rights	22 - 26 Apr 2024	During this year's ATL gathering in Brasília, Indigenous leaders from **TIs Kayapó**, **Yanomami** and **Munduruku** met with the president of Funai and reported the violations of human rights caused by miners against their respective tribes.[4]
Operação Ararajuba – combating illegal mining in Pará	14 - 30 Apr 2024	The Federal Police, in combination with ICMBio, the National Force and the Military Police of Pará, launched Operação Ararajuba to target illegal gold mining in Itaituba.[5] The operation led to the destruction of R$11m worth of illegal mining equipment, including engines, excavators, and dredgers.
Operação Murici – combating illegal mining in Mato Grosso	30 Apr - 01 May 2024	The Federal Police and IBAMA conducted Operação Murici in Rondolândia, Mato Grosso, which focused on combating environmental crimes in **TI Zoró**.[6]

UC 1 – Illegal mining activity in Brazilian indigenous areas

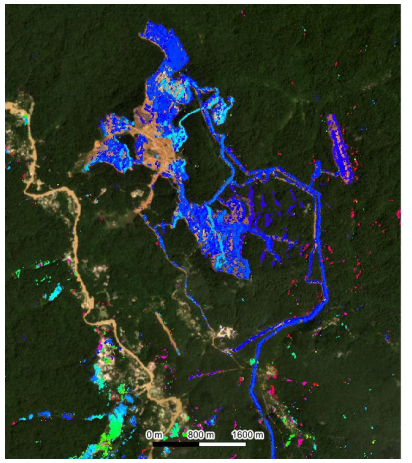


Onboarding: Indicators definition

- **EO:** Early warning alert for detection of alluvial gold mining in protected areas of indigenous tribes

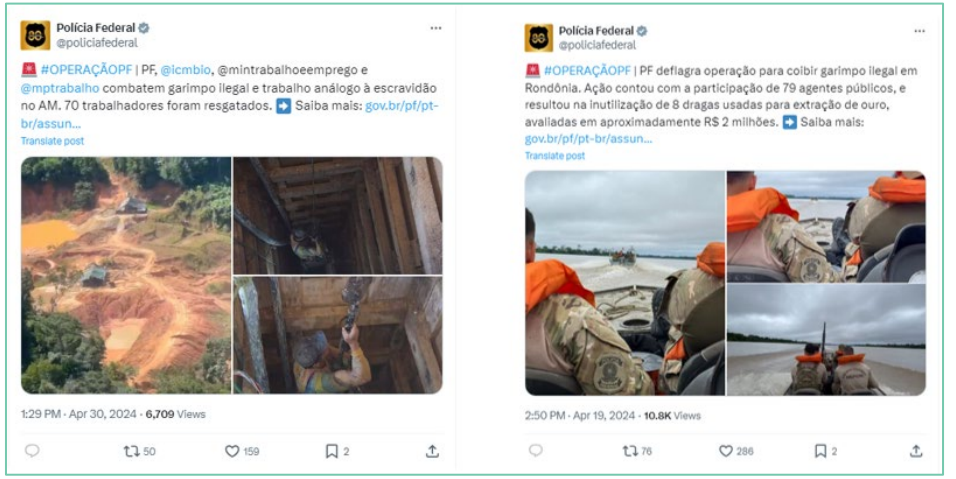
Continuous *monitoring* of protected areas through **Forest Canopy Disturbance Monitoring FCDM** tool updated every 2 weeks with Sentinel-1 images.

Image © 2024 Planet



FCDM classification results

- **OSINT:** Alerts of miners' intrusion in indigenous lands, mercury seizures, security incidents, killings, armed groups from OSINT (traditional and social media, news, government websites) analysis. Geolocated imagery used as validation tool and trigger of new analysis. English/Portuguese (“*garimpeiros”, “terras indigenas*”) language analysis.



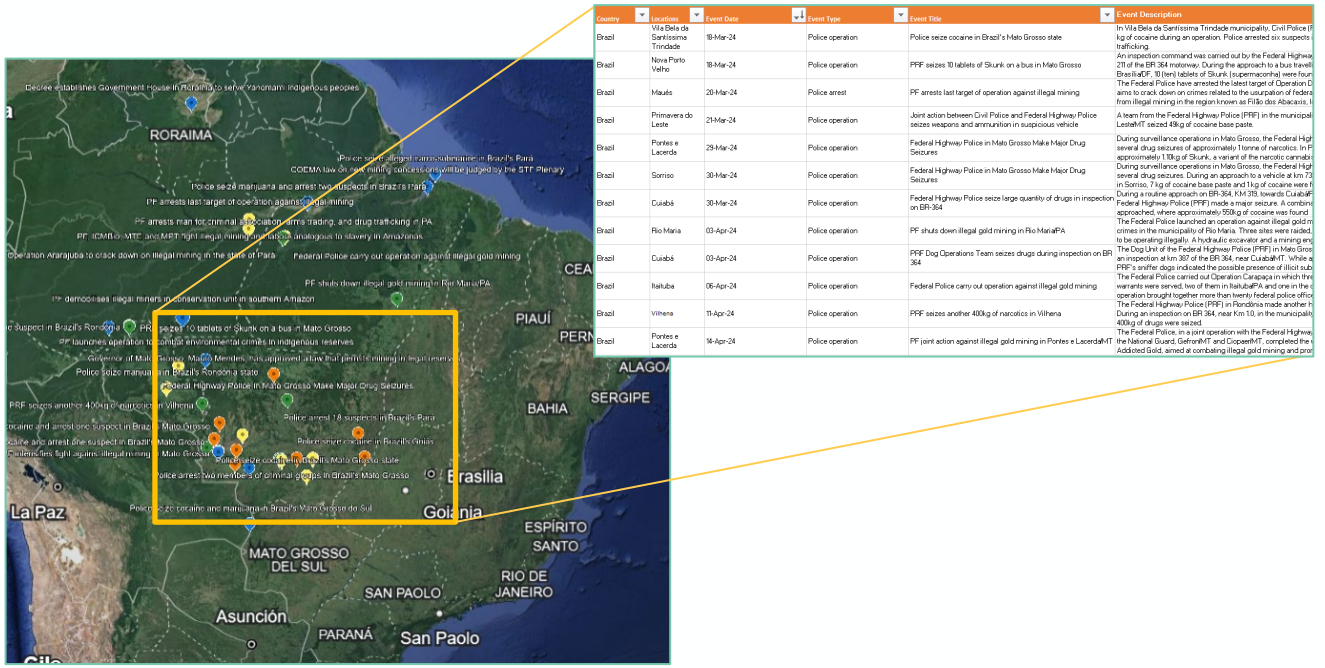
Operations: OSINT Products generation

Social Media Reports - HENSOLDT Analytics

9/04/2024: The Federal Highway Police reported an increase in gold seizures from illegal mining in Mato Grosso.
14/04/2024: The Federal Police completed the work of Operation Addicted Gold, aimed at combating illegal gold mining and promoting the eviction of the *Sararé* Indians.

Security Analysis Results - JANES

Comprehensive and granular dataset showing relevant information including geo-location, typology, description, and further characteristics of the events.



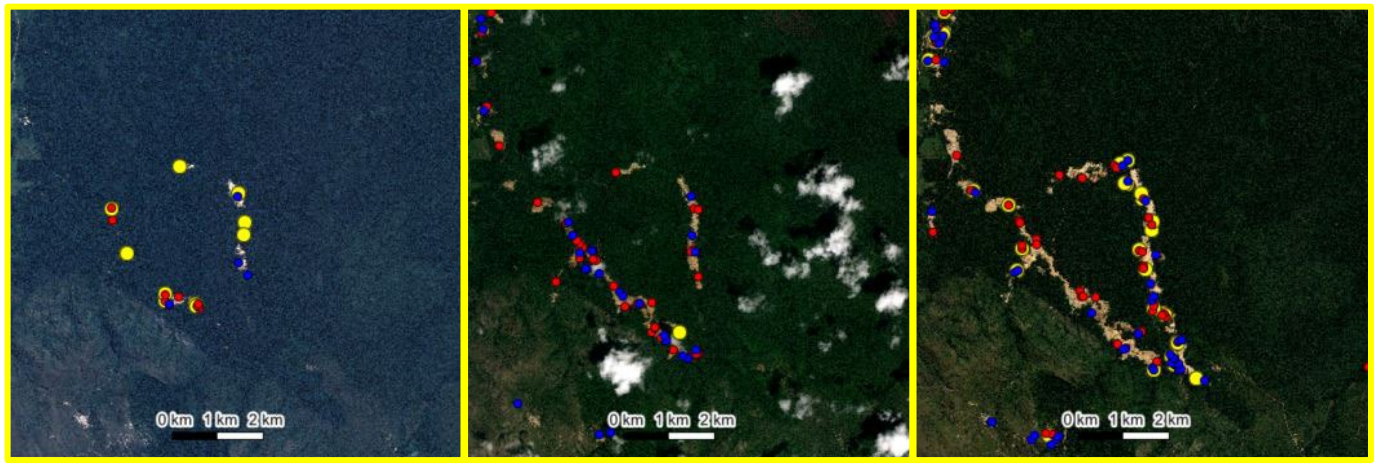
Country	Locations	Event Date	Event Type	Event Title	Event Description
Brazil	Vila Bela da Santíssima Trindade	18-Mar-24	Police operation	Police seize cocaine in Brazil's Mato Grosso state	In Vila Bela da Santíssima Trindade municipality, Civil Police (P kg of cocaine during an operation. Police arrested six suspects trafficking.
Brazil	Nova Porto Velho	18-Mar-24	Police operation	PRF seizes 10 tablets of Skunk on a bus in Mato Grosso	An inspection command was carried out by the Federal Highwa 231 of the BR-364 motorway. During the approach to a bus travell Brasília/DF, 10 (ten) tablets of Skunk (supermaconha) were foun
Brazil	Maués	20-Mar-24	Police arrest	PF arrests last target of operation against illegal mining	The Federal Police have arrested the latest target of Operation D aims to crack down on crimes related to the usurpation of federa from illegal mining in the region known as Filão dos Abacaxis, i
Brazil	Primavera do Leste	21-Mar-24	Police operation	Joint action between Civil Police and Federal Highway Police seizes weapons and ammunition in suspicious vehicle	A team from the Federal Highway Police (PRF) in the municipal Leste/MT seized 43kg of cocaine base paste.
Brazil	Pontes e Lacerda	29-Mar-24	Police operation	Federal Highway Police in Mato Grosso Make Major Drug Seizures	During surveillance operations in Mato Grosso, the Federal High several drug seizures of approximately 1 tonne of narcotics. In P approximately 1.10kg of Skunk, a variant of the narcotic cannabi
Brazil	Sorriso	30-Mar-24	Police operation	Federal Highway Police in Mato Grosso Make Major Drug Seizures	During surveillance operations in Mato Grosso, the Federal High several drug seizures. During an approach to a vehicle at km 73 in Sorriso, 7 kg of cocaine base paste and 1 kg of cocaine were f
Brazil	Cuiabá	30-Mar-24	Police operation	Federal Highway Police seize large quantity of drugs in inspection on BR-364	During a routine approach on BR-364, KM 319, towards Cuiabá/P Federal Highway Police (PRF) made a major seizure. A combine approached, where approximately 550kg of cocaine was found.
Brazil	Rio Maria	03-Apr-24	Police operation	PF shuts down illegal gold mining in Rio Maria/PA	The Federal Police launched an operation against illegal gold m crimes in the municipality of Rio Maria. Three sites were raided, to be operating illegally. A hydraulic excavator and a mining en
Brazil	Cuiabá	03-Apr-24	Police operation	PRF Dog Operations Team seizes drugs during inspection on BR-364	The Dog Unit of the Federal Highway Police (PRF) in Mato Gros an inspection at km 397 of the BR-364, near Cuiabá/MT. While a PRF's sniffer dogs indicated the possible presence of illicit sub
Brazil	Itaituba	06-Apr-24	Police operation	Federal Police carry out operation against illegal gold mining	The Federal Police carried out Operation Carapaça in which thr warrants were served, two of them in Itaituba/PA and one in the operation brought together more than twenty federal police office
Brazil	Vilhena	11-Apr-24	Police operation	PRF seizes another 400kg of narcotics in Vilhena	The Federal Highway Police (PRF) in Rondônia made another h During an inspection on BR-364, near Km 1.0, in the municipality 400kg of drugs were seized.
Brazil	Pontes e Lacerda	14-Apr-24	Police operation	PF joint action against illegal gold mining in Pontes e Lacerda/MT	The Federal Police, in a joint operation with the Federal Highwa the National Guard, GefronMT and CiopaerMT, completed the Addicted Gold, aimed at combating illegal gold mining and pro

Figure shows an ongoing **security operation to destroy illegal mining** camps in the Sararé indigenous land. Source: Ministério da Justiça e Segurança Pública.

Operations: EO/OSINT Products generation

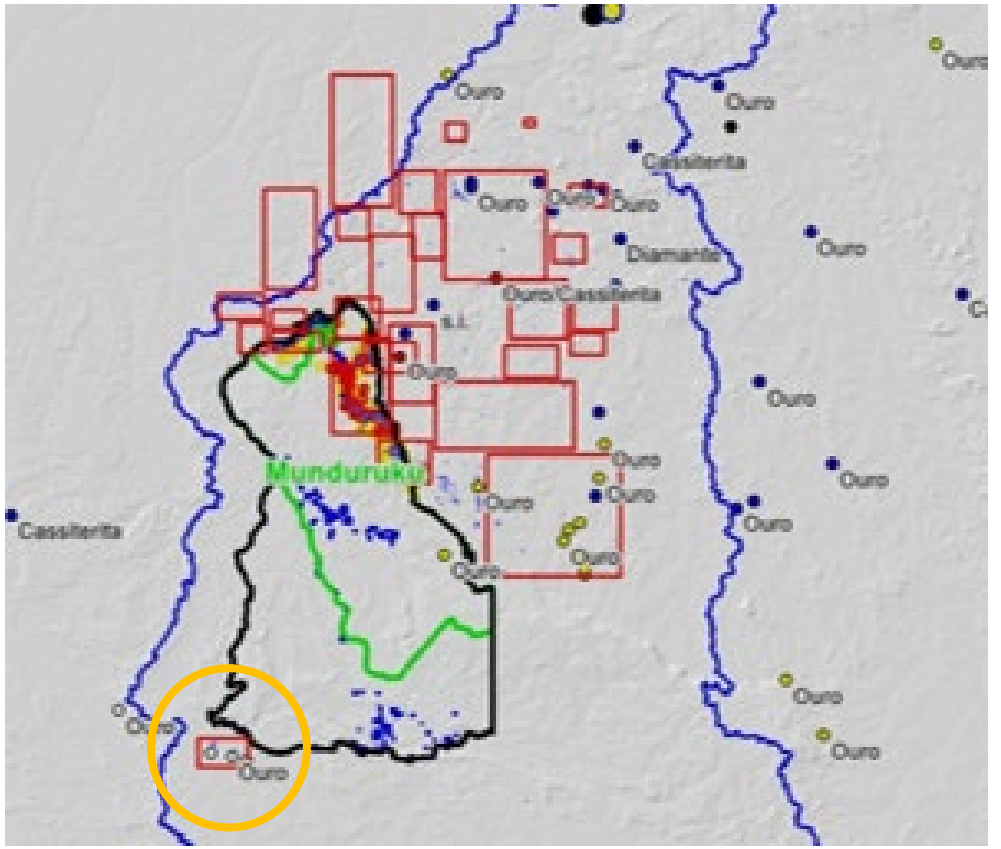
Continuous growth of alluvial mining activity

March 2023 December 2023 May 2024



Images © 2024 Airbus

The AOI (s) observed cover the region of the Tapajos River basin, respectively specific protected areas within the river basin.

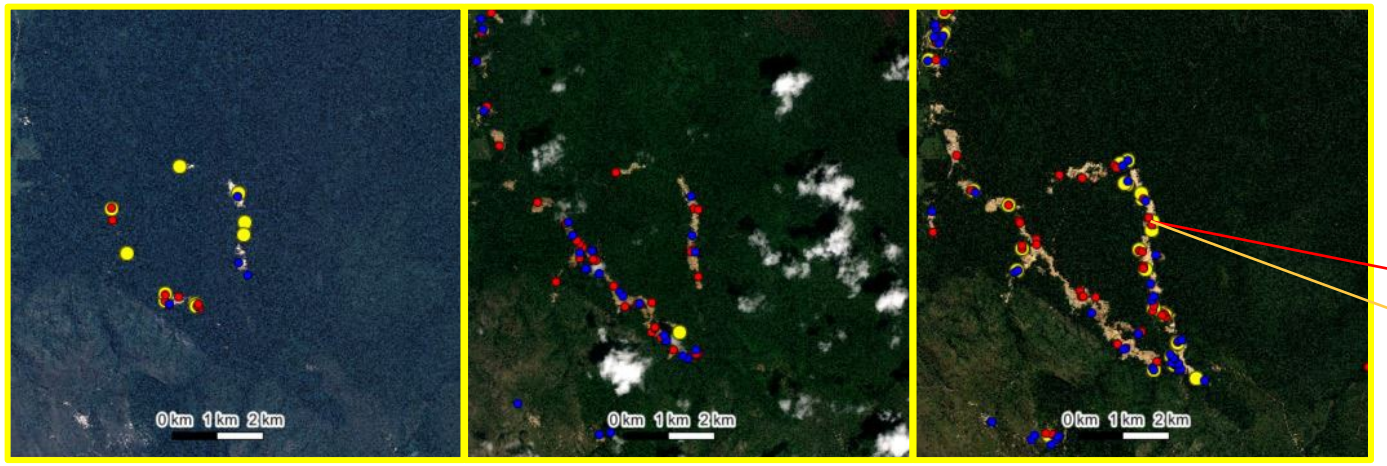


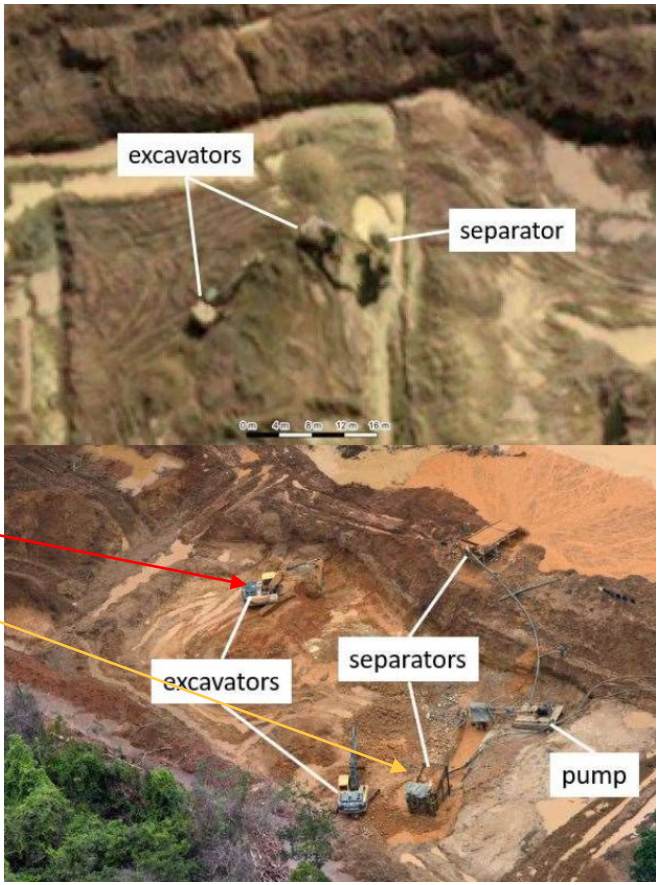
OSINT alert: Cluster of events collected around Sararè Indigenous Land

Operations: EO Products generation

Continuous growth of alluvial mining activity

March 2023 December 2023 May 2024

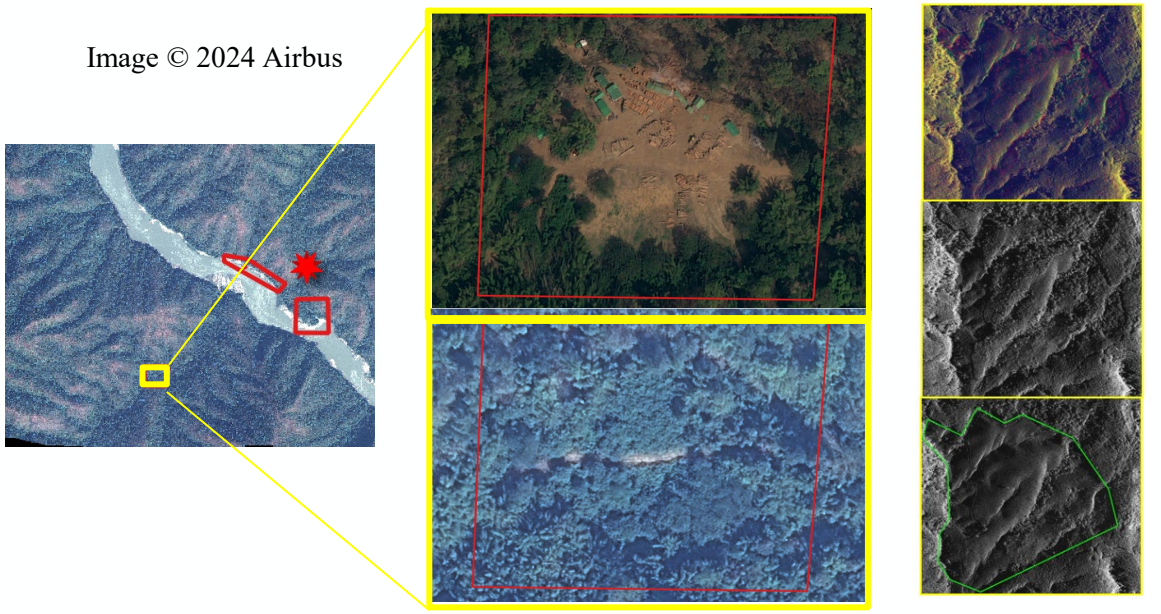




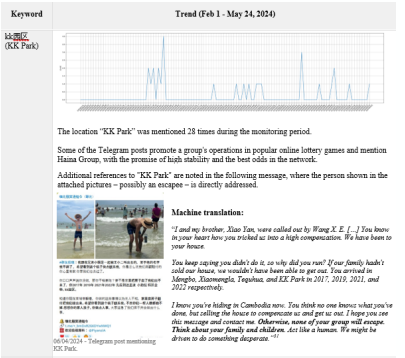
Use Case 2 – Illegal activities monitoring in Mekong region

Onboarding: Indicators definition

- **EO** leveraged to monitor evidences of human activity and logistics around suspected sites through VHR SAR data, temporal development of physical infrastructures and land cover changes through VHR OPT.



- **OSINT** monitoring for specific Chinese language key words mentions, together with seizure data and other contextual information provided by law enforcement counterparts.

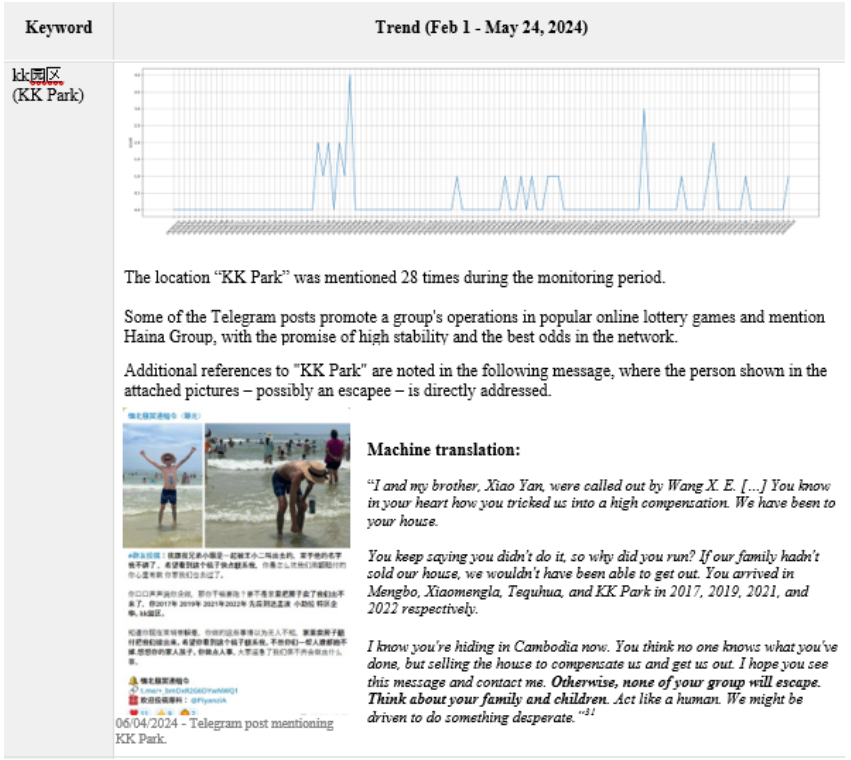


Opium poppies bloom in a field in the northern Laos (United Nations Office on Drugs and Crime)

Operations: OSINT Products generation

Keyword mentions trend monitoring - HENSOLDT Analytics

Track traditional and social media in multiple languages – Mandarin – to assess cybercrime and cyberscams as well as drug-related data. Mentions of the location "KK Park" in Mandarin Telegram channels/groups.



Keyword	Trend (Feb 1 - May 24, 2024)
kk园区 (KK Park)	

The location "KK Park" was mentioned 28 times during the monitoring period.

Some of the Telegram posts promote a group's operations in popular online lottery games and mention Haina Group, with the promise of high stability and the best odds in the network.

Additional references to "KK Park" are noted in the following message, where the person shown in the attached pictures – possibly an escapee – is directly addressed.

06/04/2024 - Telegram post mentioning KK Park.

Machine translation:

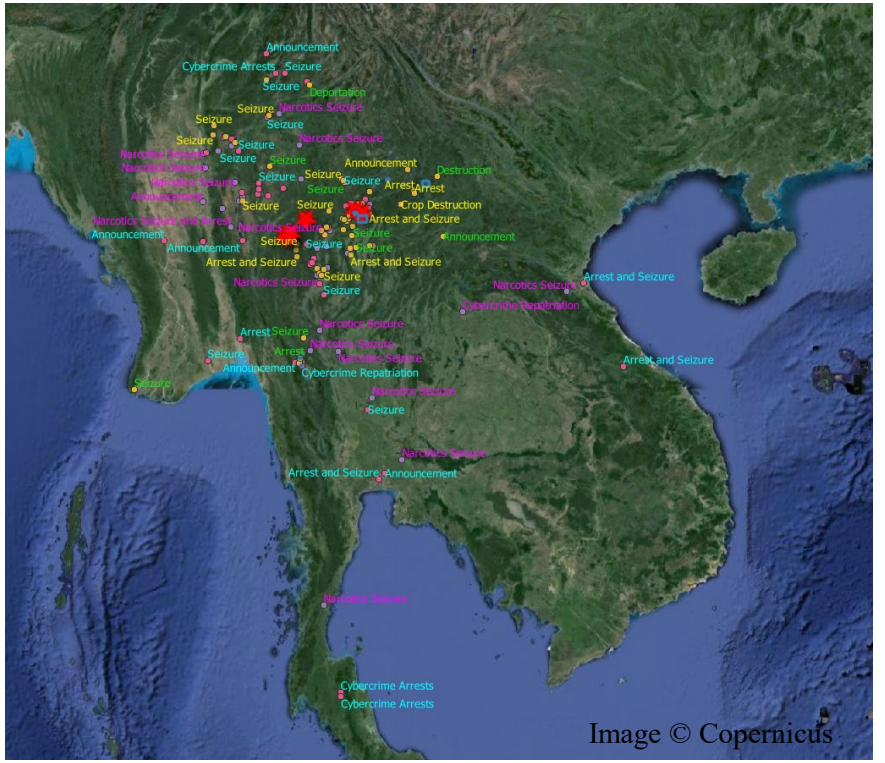
"I and my brother, Xiao Yan, were called out by Wang X. E. […] You know in your heart how you tricked us into a high compensation. We have been to your house.

You keep saying you didn't do it, so why did you run? If our family hadn't sold our house, we wouldn't have been able to get out. You arrived in Mengbo, Xiaomengla, Tequhua, and KK Park in 2017, 2019, 2021, and 2022 respectively.

I know you're hiding in Cambodia now. You think no one knows what you've done, but selling the house to compensate us and get us out. I hope you see this message and contact me. ***Otherwise, none of your group will escape. Think about your family and children.*** *Act like a human. We might be driven to do something desperate."*[31]

Security Analysis Results - JANES

Monitor online sources (news outlets, social media, investigations reports), information provided by local law enforcement counterparts, and local media in different languages to track and document evolving reports on security events as per the scope and AOIs.



Operations: EO Products generation

- **e-GEOS**

Activity analysis monitoring through SAR images. Activities detected:

1. Border crossing raft changing position
2. Opening/closure of entrance gate

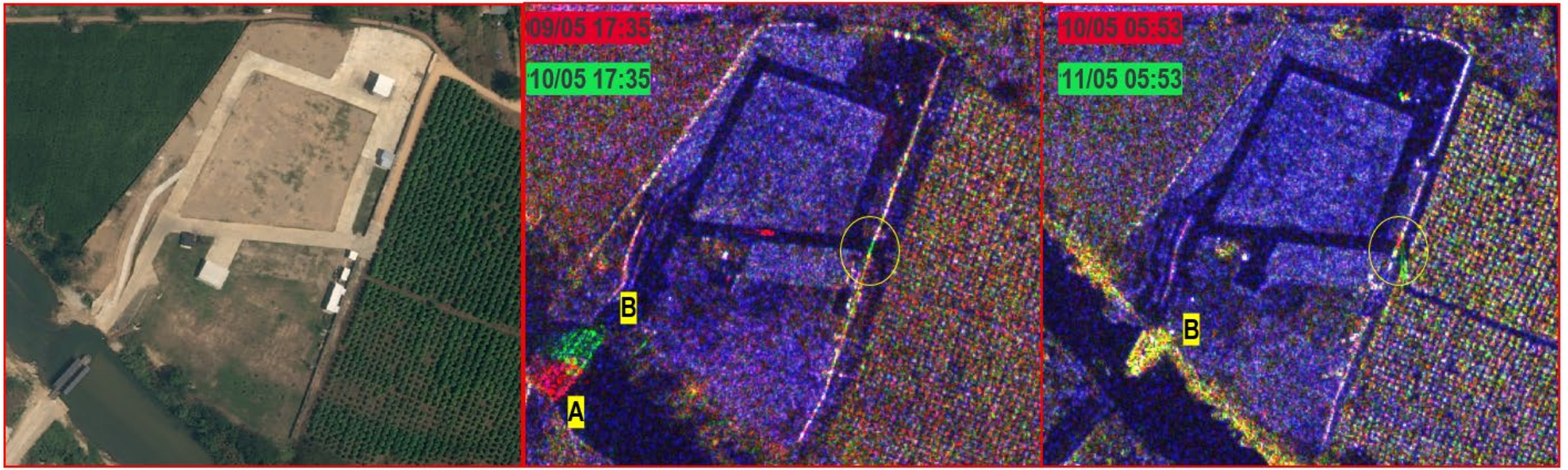
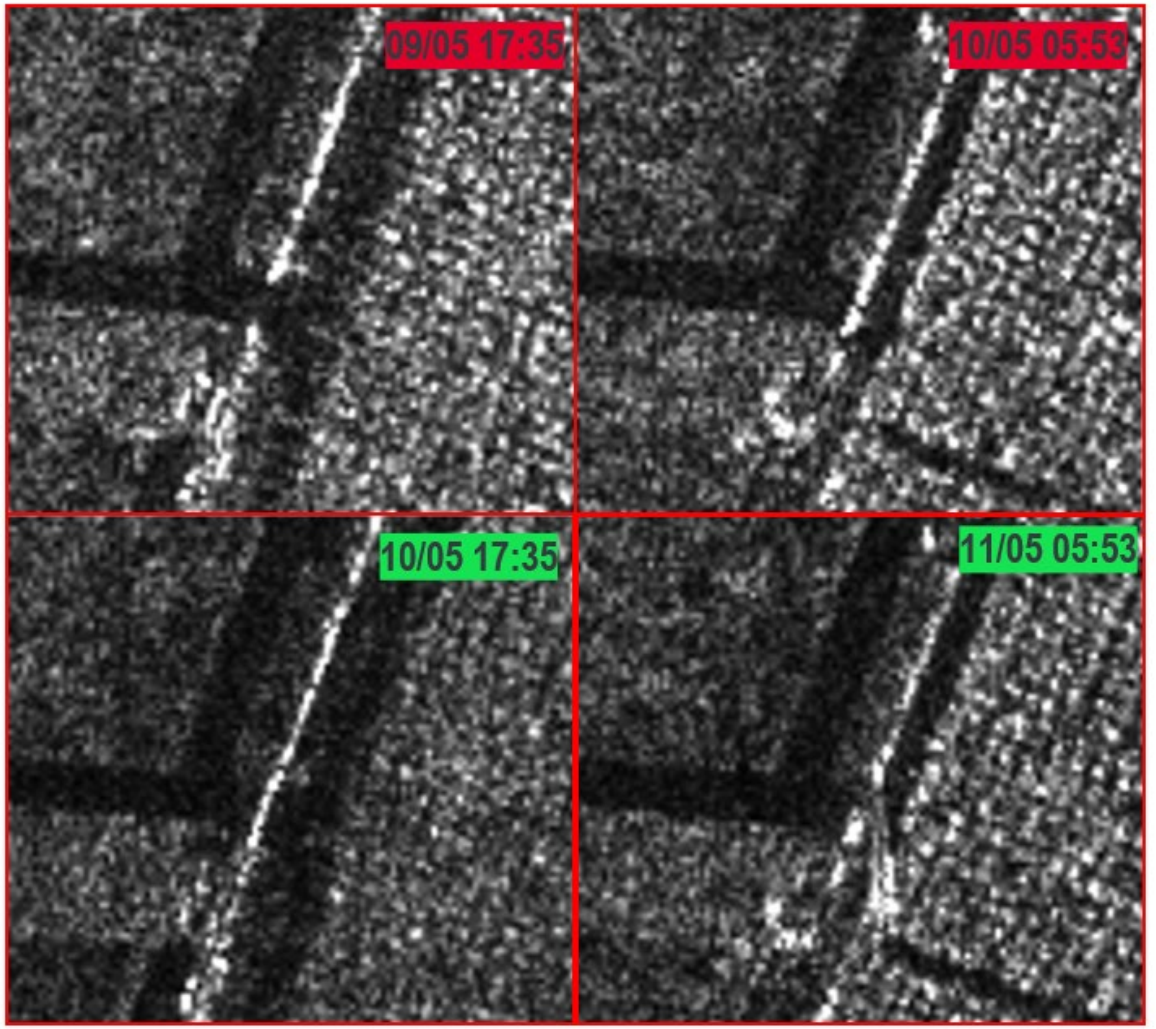


Image © 2024 Airbus

COSMO-SkyMed image © ASI, Processed and distribuited by e-Geos

Operations: EO Products generation

Sequence of 4 SAR acquisitions at 12hours time interval



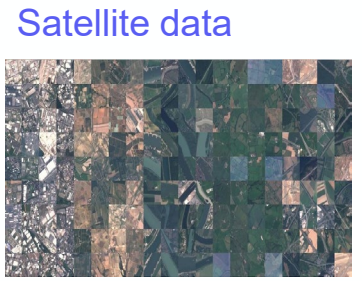
COSMO-SkyMed image © ASI, Processed and distribuited by e-Geos

Integrity data & secure transmission

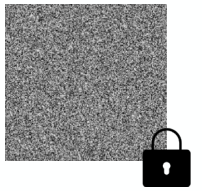
The core: providing AI services on encrypted data - DHIRIA

NEED:
The processing of EO/OSINT needed to detect illegal activities data by third-party software services may impact privacy when sensitive data are involved.

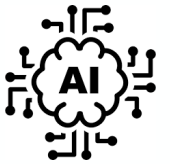
Team developed a deep learning-based Demo on privacy-preserving satellite image classification



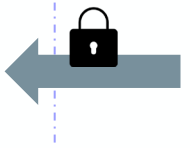
Encryption

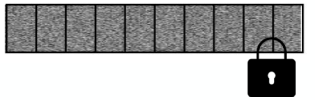


WebApp

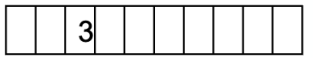


AI processing of encrypted data for Land Use and Land Cover Classification





Decryption



Land Use and Land Cover Classification

Open-source library SEAL:
CKKS HE encryption scheme
Public and secret keys are generated

Amazon Web Services (AWS):
EC2 for computation and S3 for storage

Key Findings and General Considerations

Key Findings and general considerations

- **EO/OSINT** integration approach provides very useful insights, with best results when media assessment and security analysis can be geolocated
- The outcome of the combined analysis depends on the nature of the phenomenon under consideration.
- Training activity for transfer knowledge
- EO/OSINT excellent tool to drive attention on specific areas when complementary data are available
- Adoption of project outcomes into local enforcement laws still to be discussed with end user but preliminary feedback are very encouraging

Q&A Session

Thank you for your kind attention!