

Frontex Report on Earth Observation for Border Management



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News

At the beginning of December 2025, Frontex [published](#) a new report examining how Earth Observation (EO) technologies can support national authorities managing the EU's external borders. The report entitled "[Earth Observation for Border Management](#)" explores where satellite and airborne data add the greatest value for border surveillance, where gaps remain, and which trends will shape future capabilities. It sets out how EO can be used to address border-related challenges, such as detecting illegal border crossings and smuggling activities, as well as supporting humanitarian operations, such as search and rescue.

The report explains the main EO technologies and platforms used in border monitoring, including different sensors and satellite systems, outlining their key characteristics, typical resolutions, technical strengths, and principal border management applications.

It also presents six border surveillance use cases for maritime border surveillance:

- Vessel detection and tracking;
- Coastal and pre-frontier monitoring;
- Cross-border crime monitoring;
- Land border surveillance;
- Monitoring of irregular migration.

For each of these six areas, the currently deployed technologies are described alongside identified gaps and limitations, supported by a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis.

Looking at cross-border crime monitoring, the report highlights how EO technologies significantly enhance situational awareness by providing high-resolution, all-weather surveillance across vast and remote areas. Satellite imagery is increasingly used by authorities to detect and disrupt cross-border criminal activity, offering both operational and evidentiary value relevant to legal practice. High-resolution images can reveal land-based smuggling routes through indicators such as newly created dirt roads, trails, fence breaches, or vehicle concentrations. EO technologies also support the detection of illicit crops and criminal sites, with multispectral, thermal, and hyperspectral data enabling the identification of illegal cultivation, hidden drug laboratories, or chemical traces linked to organized crime.

In the maritime domain, satellite radar and optical imagery have enabled major operations, including Frontex-coordinated operations resulting in the seizure of narcotics and large volumes of smuggled cigarettes. Satellite surveillance further supports border security in conflict- or terrorism-affected regions by monitoring troop movements, militant infiltration, and infrastructure changes. While the detection of underground

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tunnels remains technically challenging, repeated imagery can reveal surface disturbances indicative of tunnelling or fortification activities, thereby strengthening intelligence and enforcement actions.

In its final chapter, the report sets out the challenges in EO-based border management:

- Coverage versus persistence: While satellites provide wide-area coverage, current constellations do not offer continuous monitoring of any single location;
- Weather and lighting constraints;
- Resolution and identification limits;
- Data overload and analysis bottlenecks;
- Integration and interoperability challenges;
- Adversary countermeasures: Smugglers and migrants may use camouflage, operate during cloud cover or new-moon periods, deploy decoys, or exploit predictable surveillance patterns. There have also been instances of spoofing or the deliberate deactivation of tracking devices, and, in extreme cases, interference with navigation systems;
- Costs and accessibility;
- Privacy and ethical concerns: Balancing border security objectives with fundamental rights remains complex when authorities must ensure that EO data is used strictly for legitimate law-enforcement purposes and not for indiscriminate surveillance.

The EO report contributes to the Copernicus Border Surveillance Service (CBSS), where Frontex was entrusted to explore how space-based data can support EU Member States in tackling irregular migration and cross-border crime.

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