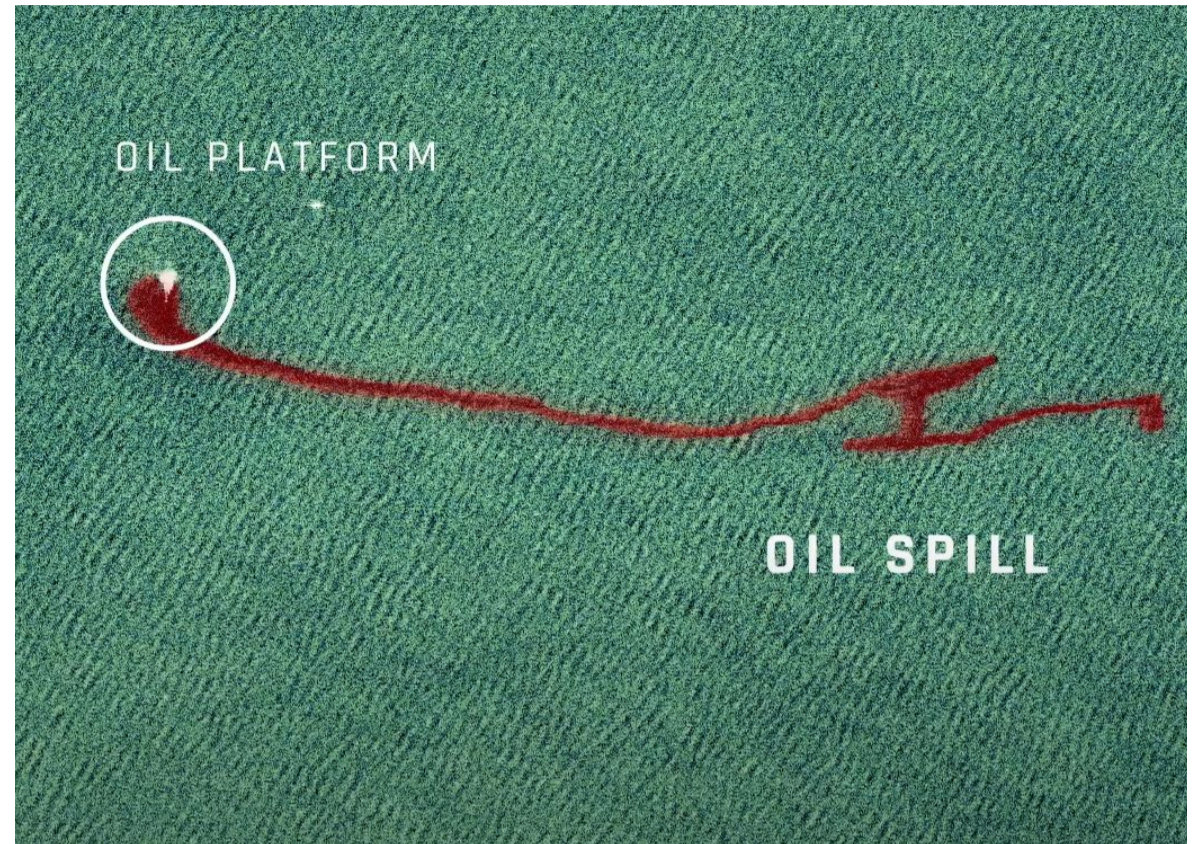
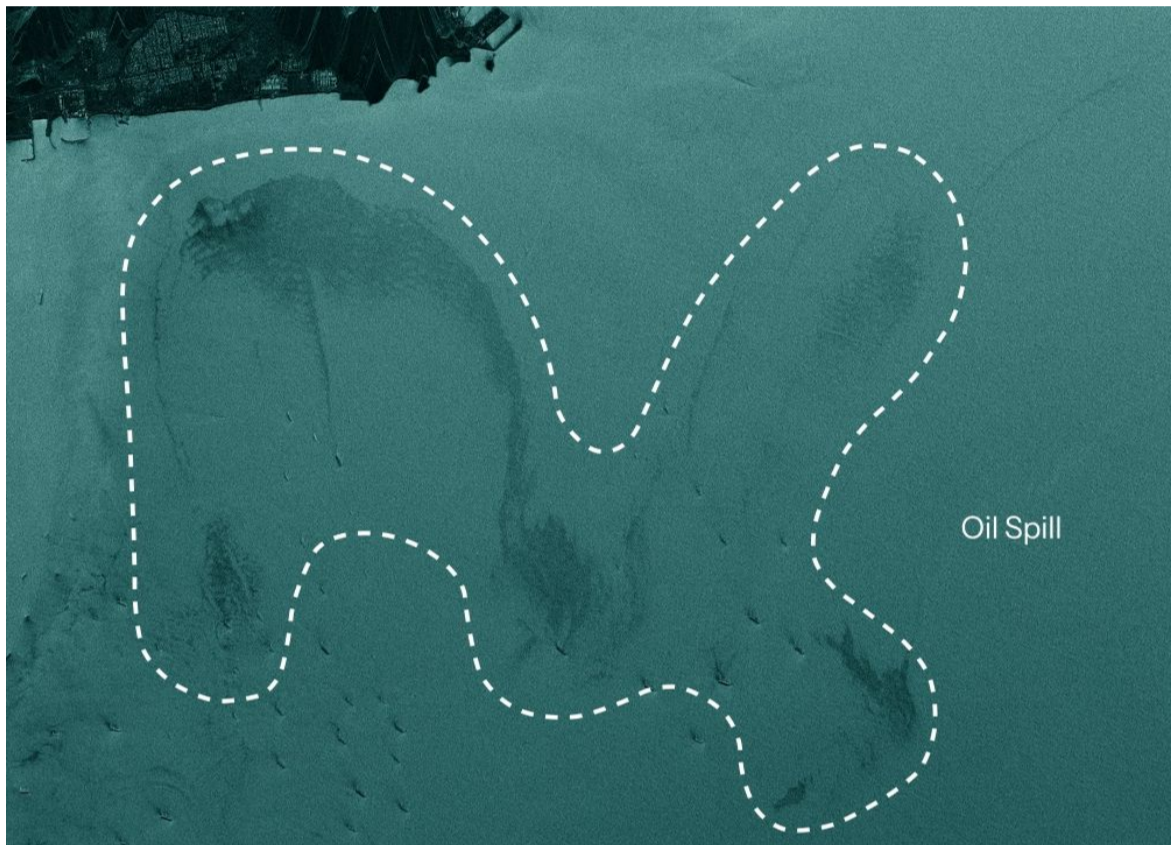


Oil spills detection using ICEYE's SAR technology

G. Pawlak, F. Ortmanns, J. Bordet

General Information

ICEYE was founded in 2014 and is now the **world's largest constellation of SAR satellites**. ICEYE Ltd. is a Polish-Finnish manufacturer and operator of these satellites.



Sensor

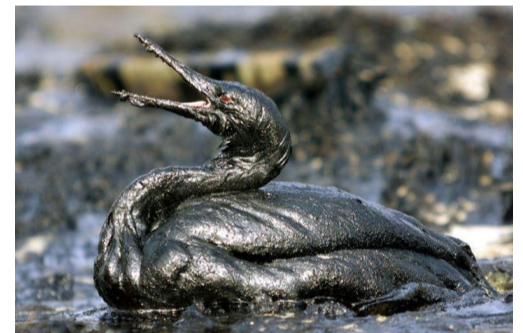
The **Gen4 SAR satellite** operates in the **X-band**, offering an **imaging bandwidth of 1200 MHz**, and delivers resolutions down to **16 cm**. With the full constellation, it achieves a **revisit time of under 15 minutes**. Performance depends on imaging mode, allowing users to trade off between resolution and coverage depending on mission needs.

- **Dwell mode** provides the **highest image fidelity from a single look**, extracting unmatched detail with reduced noise. It offers **resolutions of 25 cm, 50 cm, and 1 m** across a **5 × 5 km scene**.
- **Spot mode** is designed for object identification and precise change detection, achieving **up to 50 cm resolution** with a **scene size of up to 15 × 15 km**.
- **Strip mode** enables wide-swath coverage for monitoring large land or sea areas, with a **3 m resolution** across a **30 × 50 km scene**.
- **Scan and Scan Wide modes** cover the largest areas, making them ideal for maritime applications such as oil spill monitoring and dark vessel detection. They offer **15 m and 27 m resolutions**, with scene sizes ranging from **100 × 100 km** up to **200 × 600 km**.

Oil Spills

- **Human caused release of liquid petroleum** into the environment (mostly marine ecosystem)
- It pose a significant **environmental and economic threat**
- The source might be **hard to detect**, and it's very important to secure it as soon as possible
- A **rapid reaction** is necessary to **stop the leakage** and spread of the oil

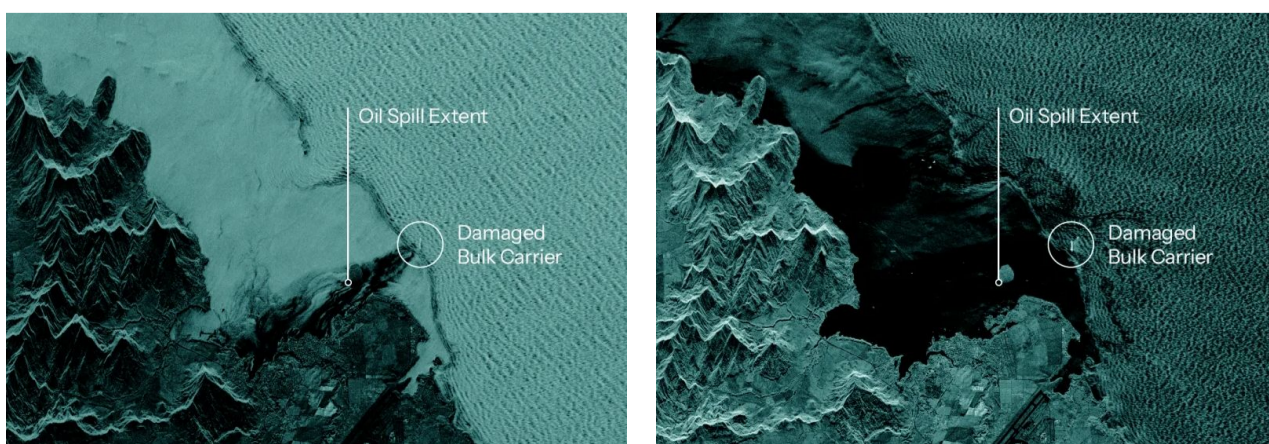
Oil spills caused by vessels may represent up to 80% of the total amount globally, and they are very harmful to the environment.



Why this sensor is relevant

The SAR technology offers several advantages:

- It can **generate images through fog or clouds** - the microwaves used not being affected by those - **day or night** since it is an active sensor imaging method.
- SAR provides an **effective way of detecting oil spills** that can be further improved using machine learning techniques, automating a process that is otherwise quite difficult. This is highly valuable since oil spills are **very bad for the environment**.
- The **High revisit + wide coverage** from ICEYE constellation ensures quick detection, enabling almost real-time monitoring.
- Oil spills create **damped capillary waves** that appear as distinct dark patches in SAR backscatter. This physical interaction is **highly reliable for detection** when SAR is compared to optical sensors that may miss spills if water is already dark or under low-light conditions.



5 days →

Sources

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