Satellite-based applications for maritime safety and security

Synthetic Aperture Radar (SAR) satellites such as Germany’s TerraSAR-X or the ESA’s Sentinel-1 are equipped with an active radar antenna and thus able to provide image data of the ocean and frozen waters almost independent of weather conditions, cloud cover or daylight. Information that can be extracted are:

- Meteorological parameters like wind and sea state
- Positions and sizes of icebergs drifting in open water, and the type and movement of sea ice in polar regions
- Topographic changes in coastlines and river deltas, and the shifting of narrow channels, sandbanks and shellfish stocks in the Wadden Sea
- Estimation of underwater topography
- Positions and extents of oil slicks
- Positions, properties and routes of ships
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The information obtained yields a maritime overview useful for improving ocean safety (e.g. environmental protection, fishery control) and security concerns (e.g. border surveillance).

Near real time processing of satellite data

Information such as the wave height or the positions of icebergs and oil spills are automatically extracted from high-resolution satellite data and delivered to maritime users in near real time. In order to serve information as up-to-date as possible, data from a variety of satellites are combined, eg. TerraSAR-X, Sentinel-1, or RADARSAT-2.

Oil spill detection: Radar backscattering characteristics change when oil is present on sea surface. This makes mapping of oil spills possible. With quick reports, response clean-up operations in case of maritime accidents can be supported by spaceborne surveillance.

Ship detection: Position reports from ships (AIS) received by satellite makes global monitoring of ship traffic possible and complementary radar imaging satellites can identify non-reporting ships. The monitored ship traffic helps to pursue oil polluters or prohibited fishery.

Meteo-marine parameters: The current sea state can be estimated from image spectra, and high resolution wind fields from observed sea surface roughness. These parameters aid the planning, construction and servicing of offshore wind parks, and moreover improve weather models and forecasts.

Automatically detected ships (red) in a TerraSAR-X image taken over Baltic Sea. Positions are fused with AIS tracks (colored lines).

Oil spills in the Mediterranean Sea, detected on a Sentinel-1 image.

Significant wave height

Wind field over the southern North Sea, derived from a TerraSAR-X image.

Underwater topography around Rottnest-Island, Australia, estimated from TerraSAR-X data.

The algorithms for near real time (NRT) value adding developed in Bremen and services are provided from DLR’s national ground segment Neustrelitz.
Sea ice and icebergs: In polar waters, sea routes can become impassable within hours because of drifting ice. The mapping of sea ice and icebergs makes it possible to adjust sea routes and reduce the risk of accidents. In cases of damage, rescue efforts are facilitated by consulting up-to-date satellite images.

DLR at a glance

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