CLEANSEANET SERVICE

DETECTING MARINE POLLUTION FROM SPACE

EMSA

CLEANSEANET
SERVICE OVERVIEW

CleanSeaNet is the European satellite-based oil spill monitoring and vessel detection service. It analyses images, mainly from synthetic aperture radar (SAR) but also from optical missions, to:

- detect possible oil on the sea surface, including illegal discharges of mineral oil
- identify potential polluters, and
- monitor the spread of oil during maritime emergencies.

The service was developed and is operated by EMSA, and is available to all EU member states, EFTA/EEA member states and acceding and candidate countries. The service is financed through the European budget, and is free of charge at point of use to EU authorities.

CleanSeaNet is based on the regular and widespread monitoring of European maritime areas using satellite images. These images are analysed in order to detect oil spills and vessels. When a possible oil spill is detected an alert message is sent to the relevant coastal state within 20 minutes of the satellite acquiring the image. The national authority then decides how to respond to the alert from CleanSeaNet and may send an aircraft or patrol vessel to verify the detection, and potentially to obtain confirmation that an illegal discharge is taking place. Vessels detected in the image may also be correlated with vessel position reports from other EU sources, increasing the likelihood of identifying the potential polluter and providing relevant authorities with valuable information to take further action, such as requesting an inspection in the next port of call.

Spills from vessels, offshore platforms and oil pipelines can severely pollute marine and coastal habitats causing damage to the natural environment and the economy. Oil pollution from vessels and platforms can be the result of:

- deliberate operational discharges for economic reasons, for example when a ship operator washes tanks at sea to save on time and costs involved in disposing of waste legally at port,

- negligence, such as poor maintenance of equipment, or

- spills which may occur following an accident or incident such as collision or grounding,

- rapid detection and early warning of marine oil spills allow national and regional coast guard authorities to catch polluters in the act of illegal discharges, and to respond quickly to emergencies in the case of large accidental spills.

WHICH MARINE POLLUTION PREPAREDNESS AND RESPONSE ACTIVITIES DOES CLEANSEANET SUPPORT?

The CleanSeaNet service supports three different types of activity undertaken by coastal states.

- **Routine monitoring:** Images are planned in advance to cover wide areas all year round, with the primary purpose of detecting vessels discharging substances like oil at sea, possibly illegally. These comprise the large majority of all CleanSeaNet services.

- **Emergency response:** Images can be acquired at short notice following an incident at sea, to check whether there has been a spill and if so to track the spread of oil subsequently.

- **Specific pollution monitoring operations:** CleanSeaNet supports EU administrations undertaking pollution monitoring and response operations and exercises.
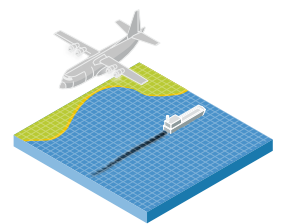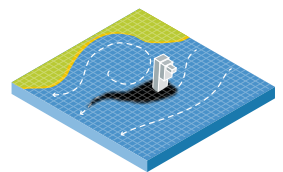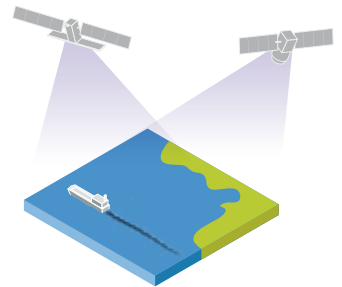
## WHAT TYPE OF INFORMATION DOES THE CLEANSEANET SERVICE PROVIDE?

A number of different earth observation-based products are available free of charge to the users through the service:

- Earth observation synthetic aperture radar (SAR) images

- Earth observation optical images

- SAR image derived wind information

- SAR image derived wave information

- Earth observation

  - Oil spill detection and polluter identification

  - Vessel detection

- CleanSeaNet alert reports (including detailed information on the possible oil spill detections, polluter identification, user specific alert information and detection classification based on user specific criteria).

HOW ARE OIL SPILLS AND VESSELS DETECTED BY SATELLITE?

CleanSeaNet monitoring is possible through the use of SAR and optical images. SAR images are the result of electromagnetic pulses generated by a radar, that are reflected by the ocean surface. By measuring the roughness of the sea surface, resulting images display features which stand out against the background; for example, vessels appear as bright spots, while oil spills appear as dark shapes. Images can be acquired regardless of weather conditions and cloud cover, and at any time of day or night.

Optical sensors include visible, near infrared and short-wave infrared wavelengths, producing images that are similar to the way in which the human eye sees the world.

| Low oil detection | Optimum oil detection | Low oil detection |
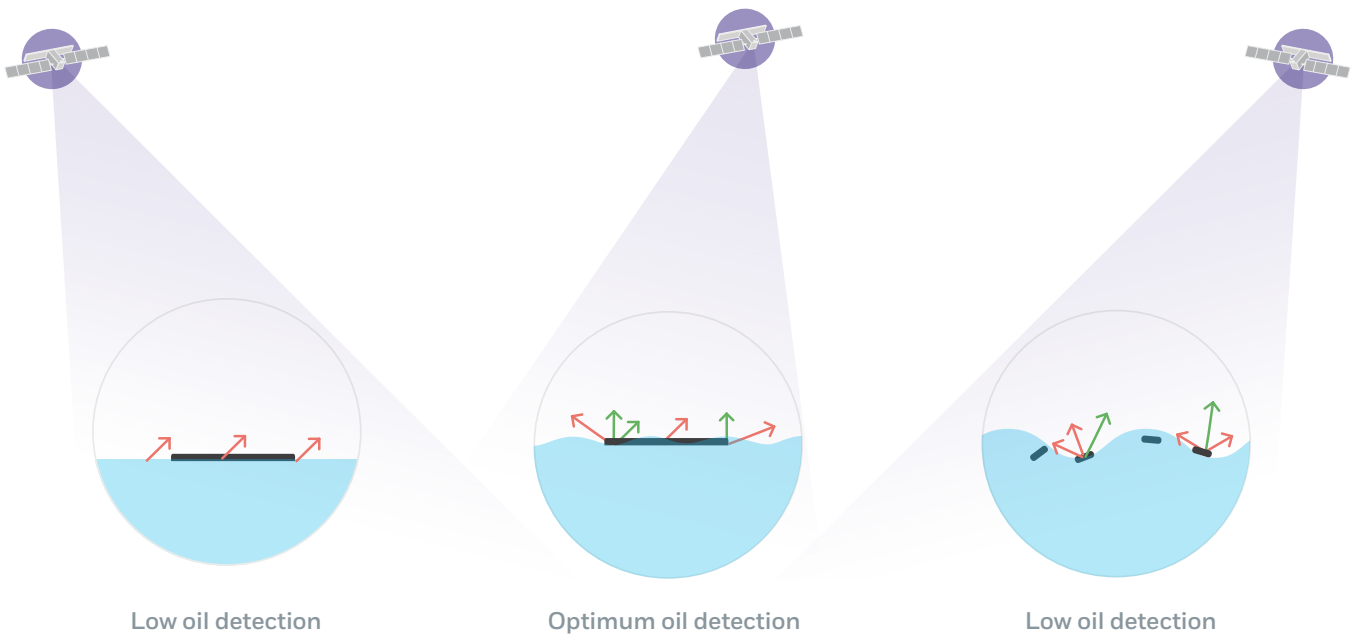
SENTINEL-1

The CleanSeaNet service began acquiring images from the European Space Agency (ESA) Sentinel-1 mission in October 2015. With this new platform the CleanSeaNet service was able to significantly improve the level of satellite coverage over European waters, whilst simultaneously reducing costs. The mission is composed of a constellation of two satellites, Sentinel-1A and Sentinel-1B, providing systematic monitoring over European waters. Over 85% of the images acquired by the CleanSeaNet service are from Sentinel-1.

COMBINING DIFFERENT TYPES OF MARITIME SURVEILLANCE INFORMATION FOR MORE EFFECTIVE MONITORING

The CleanSeaNet service supports the identification of polluters by combining the image taken by the satellite with vessel traffic information - such as vessel position and route data - from EU maritime applications and from other sources. EMSA manages an integrated platform which combines different types of data and displays it on a user-friendly interface (available on desktop, laptop and mobile devices). In addition to alert messages, which are sent directly to the coastal state concerned when a possible oil spill is detected in national waters, users can also log on to view more details of the oil spill detected and vessels in the vicinity.

EMSA also offers a Remotely Piloted Aircraft System (RPAS) service, which can be used to complement the CleanSeaNet service. RPAS can support monitoring and detection of illegal discharges by being deployed quickly to the site of the detection to provide confirmation of an oil spill and/or identification of a potential polluter.

10 KEY FACTS ABOUT THE CLEANSEANET SERVICE

CLEAN SEA NET

16 April 2007
The service became operational

The service is available to:
28 coastal states[1]

Access to data from:
6 SAR satellites[2]

Access to data from:
14 optical satellites[3]

One image can cover waters of
up to 7 coastal states

Image size:
Up to 500 000 km²

Delivery timeliness:
Less than 20 minutes[4]

Monitors over:
3 million km² every day

Almost 5000 images
delivered every year

Detection of over 6000
possible spills annually

NOTES:
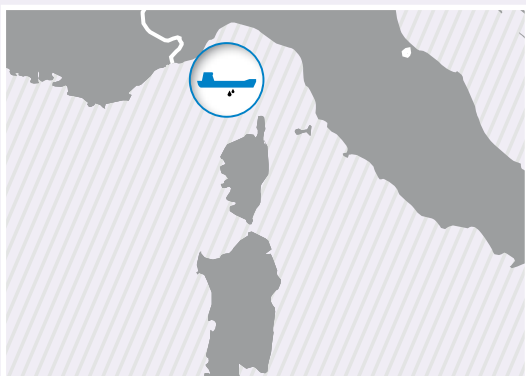[1] 23 EU coastal states, 2 EFTA coastal states, 3 candidate countries
[2] Sentinel-1A, Sentinel-1B, RADARSAT-2, TerraSAR-X, TANDEM-X, PAZ

[3] WorldView 1,2&3, Superview 1,2,3&4, GeoEye-1, Pleiades 1A & 1B, Deimos 2, EROS B, Spot 6 & 7
[4] From SAR satellite acquisition to user receiving all the information

Support to oil spill emergencies & clean-up operations

/ COLLISON BETWEEN TWO VESSELS

Mediterranean Sea (near Corsica)

On the morning of 7 October 2018, the roll-on/roll-off vessel *Ulysse* and general cargo ship *CSL Virginia* collided in the Mediterranean, 28 km north of Corsica.

The damage to the *CSL Virginia* resulted in the loss of an estimated 600 m³ of oil.

Following a request made by French and Italian authorities, additional Synthetic Aperture Radar (SAR) and optical imagery of the incident area was ordered.

In total, CleanSeaNet delivered 15 SAR and optical satellite images to monitor the extent and spread of the oil spill. Radar was used for open water, and optical was used to locate pollution closer to the coast and on the shore.

Brezzamare, an EMSA/EU chartered oil spill response vessel, arrived on site on the morning of 9 October and joined the oil recovery operations.

The first SAR image was acquired on 8 October, confirming an oil spill of 22 km long. A total of 11 SAR images were acquired; the spill at its longest point measured 50km, as seen in the images below.

Very high-resolution optical images were used to detect pollution along the coastline. These images can help overcome the technical limitations of using radar images close to the coast and provide a very detailed picture of the areas impacted by oil. For this specific emergency four optical images were delivered.
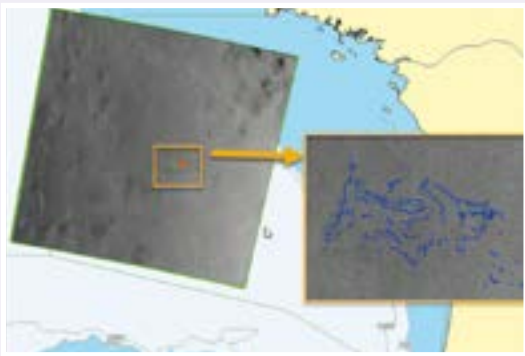
The French authorities provided feedback that the reports based on the images provided by EMSA were useful in terms of indicating the extent of the pollution and detecting additional areas that had been impacted.
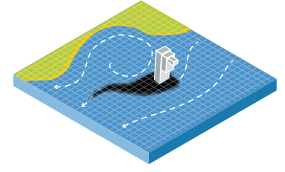
FIRE AND SINKING OF THE GRANDE AMERICA

Atlantic Ocean (Bay of Biscay)

On the evening of 10 March 2019, a fire was reported on board the vessel *Grande America*. The 27 persons on board abandoned the ship safely. The ship was quickly consumed by the fire and sank on the afternoon of 12 March. The ship was carrying 365 containers, of which about 20 remained floating on the sea surface, causing a potential threat to navigation.

EMSA's CleanSeaNet satellite service was activated by the French authorities for the acquisition of additional satellite images.

The following day, two satellite images were delivered: one optical image to detect drifting objects and one SAR image to detect oil spills. Four containers were identified on the optical image as well as five other objects, potentially debris from the vessel. The SAR image detected a possible oil spill in the area where the vessel sank. The French authorities later confirmed the existence of an oil spill of $11\,km^2$.

From 15 March, two of EMSA's oil spill response vessels, as well as the remotely piloted aircraft system (RPAS) service, were made available to France to assist in clean-up operations.

Between 18 March and 2 April, an additional 55 images were delivered by CleanSeaNet over the Bay of Biscay to monitor the evolution of the spill and to provide support to the response operations.
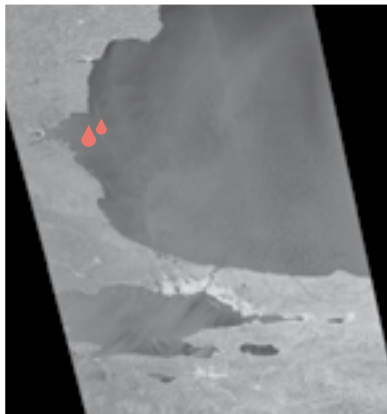
Routine monitoring

/ OIL LEAK FROM WRECK

Black Sea (Bulgaria)

On 12 August 2018, oil was reported on the beaches of Sozopol and Chernomorets, on the Bulgarian coast. The following day, a routine SAR image from the CleanSeaNet service detected a possible oil spill in the area, above the location of a known wreck.

The spill was confirmed on site, and samples identified the substance as heavy fuel oil leaking from the wreck of the vessel *M/V Mopang*, which had sunk in 1921, two nautical miles off the port of Sozopol.

It was estimated that around 60-70 m^3 of heavy fuel oil had been released into the environment, of an estimated 650 m^3 on board.

After the alert, the Bulgarian authorities immediately deployed booms, and divers sealed off the hull. The Bulgarian Maritime Administration contacted EMSA to request emergency assistance and decided to undertake an underwater operation to pump out the remaining fuel.

Additional satellite images were ordered to monitor the situation and assess the effectiveness of the protective measures. Between 20 and 31 August, EMSA delivered three optical and seven SAR images over the area.

The cleaning operations were concluded in the beginning of October, without any incident. EMSA made available 18 tonnes of dispersants to assist in case of further leaks.
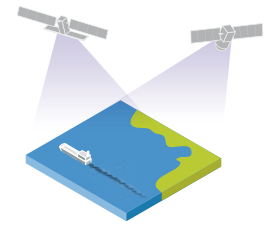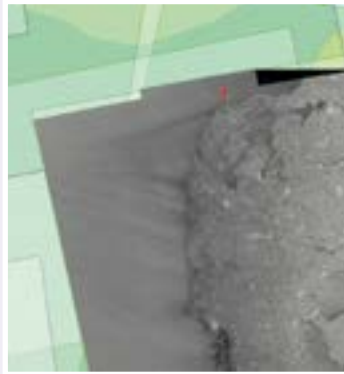
ILLEGAL DISCHARGE FROM TRAWLER


North Sea (Denmark)

A possible oil spill spreading over more than 4 km was detected in a routine CleanSeaNet service delivered over Danish waters in 2016, about 8 km from the coast. A CleanSeaNet alert was sent to the Danish Maritime Authority, with an indication of the possible source, a Danish trawler.

The captain of the trawler later admitted to the illegal discharge of oily fish waste within 12 nautical miles of the coast of Denmark.

The satellite image from Sentinel-1 was used as evidence in court against the polluter. The case was further substantiated with AIS vessel postion and other information and a positive confirmation on location by a search and rescue vessel sent to investigate the detection.

The polluter was found guilty and fined.

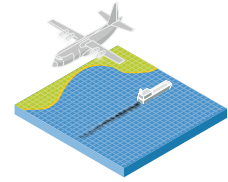## SPILL NEAR COASTLINE
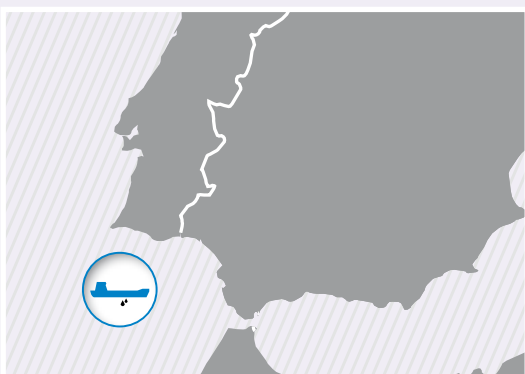
Atlantic Ocean (Portugal)

On 2 January 2017, the CleanSeaNet service alerted the Portuguese Maritime Authority of four spills detected on a Sentinel-1 image. One of the spills was just 2.24 km off a sensitive coastal area, in the Algarve region (south of Portugal). Modelling of the likely drift of the oil spill indicated that the spill would reach the shore.

Two days later, a lighthouse keeper confirmed pollutants on the beaches, and a cleaning operation was initiated. This was later identified as palm oil through samples collected by the Portuguese Environment Agency.

By 10 January 2017, the cleaning was concluded by the local maritime authorities with the help of volunteers.

Routine monitoring

/ POLLUTER CAUGHT RED-HANDED

North Sea (Netherlands/Germany)

A CleanSeaNet alert regarding a possible oil spill spanning the waters of the Netherlands and Germany was sent on 26 October 2015 to the Netherlands Coast Guard.

A Netherlands Coast Guard aircraft was immediately dispatched to the location, and the source of the pollution was identified as a chemical tanker performing a tank washing operation.

Pictures taken from the aircraft showed residues being discharged via a hose above the waterline and a second one below the waterline. The shipmaster was contacted and confirmed that tank washing of palm oil was taking place, and that this was in accordance with the relevant regulations.

As the vessel berthed in Hamburg port, the German authorities took over the case and investigations on board began. Since the discharge pipe was above the waterline, the German prosecutor found the operation to be in violation of the regulations and a fine was issued.

Support to operations and exercises

OPERATION CASCADE

Atlantic Ocean (Portugal)

Between 28 May and 1 June 2019, the Portuguese authorities organised the EU Civil Protection Exercise 'Cascade '19'. It aimed to foster cooperation between European Union national administrations and EU agencies and to test response procedures in case of a multiple emergency scenario (e.g. earthquakes, flooding, maritime pollution).

More than 6 000 participants from Portugal, Spain, France, Belgium, Germany and Croatia participated in the exercise.

EMSA was involved in an offshore pollution response scenario in the vicinity of Setubal. EMSA's response assets, the oil spill response vessel *Bahia Tres* and an RPAS quadcopter, were deployed on site, under the coordination of the Portuguese National Maritime Authority.

Satellite images were provided showing the four response vessels deployed together with three popcorn slicks used to simulate oil.

OPERATION TOUR D'HORIZON

North Sea

CleanSeaNet is regularly used to support coordinated anti-pollution operations, such as the Tour d'Horizon (TdH). The TdH programme is coordinated by the Bonn Agreement with the participation of coastal states adjacent to the North Sea. This operation includes aerial surveillance of offshore oil and gas installations, as well as vessels transiting the area.

Following a request by the country organising the TdH operation, and upon the analysis of the flight plan, EMSA proposes a list of additional CleanSeaNet satellite acquisitions. This ensures that if there is a possible pollution detected on an image, aerial assets are already in place to make a closer inspection without delay.

COMBATTING POLLUTION

The CleanSeaNet service is based on the regular acquisition of radar satellite images, which are analysed to detect possible oil spills on the sea surface. CleanSeaNet is linked to national and regional oil spill response and law enforcement chains. When a possible oil spill is detected in national waters, an alert message is delivered to the relevant authority, which decides on the best course of action. By providing pollution detection, the service supports coastal states' actions to detect and then combat deliberate or accidental pollution in the marine environment.

ABOUT THE EUROPEAN MARITIME SAFETY AGENCY

The European Maritime Safety Agency is one of the European Union's decentralised agencies. Based in Lisbon, the Agency's mission is to ensure a high level of maritime safety, maritime security, prevention of and response to pollution from ships, as well as response to marine pollution from oil and gas installations. The overall purpose is to promote a safe, clean and economically viable maritime sector in the EU.

Get in touch for more information

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