LAND MARINE ATMOSPHERE EMERGENCY MANAGEMENT CLIMATE CHANGE SECURITY

Copernicus

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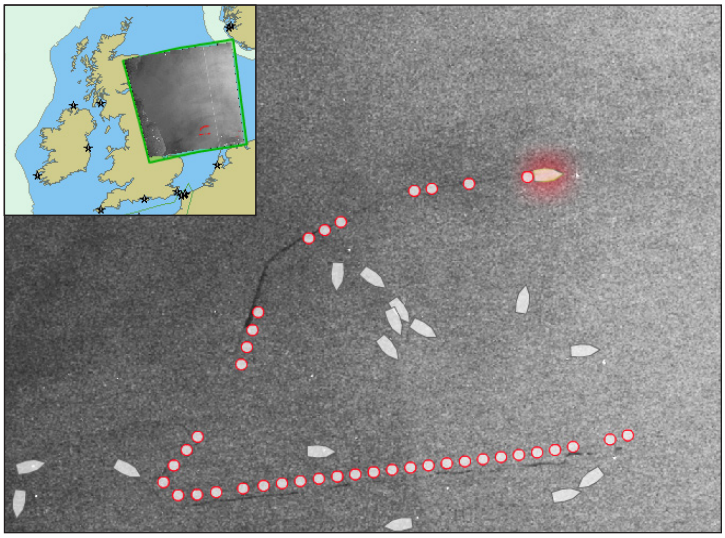
SPACE TECHNOLOGY REVEALS WHERE OIL POLLUTES THE OCEANS

Spills from vessels, offshore platforms and oil pipelines severely pollute marine and coastal habitats causing enormous damage to the natural environment and to the economy. Oil pollution from vessels and platforms is usually either a result of deliberate operational discharges or because of accidental spills. 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. Monitoring large sea surface areas with aircrafts is time-consuming and expensive, and is usually not a feasible option for pollution detection authorities. One satellite image can capture more than a hundred thousand square kilometres of sea surface, making this a very efficient way to check for oil spills.

Copernicus provides satellite based services to efficiently detect illicit discharges, identify polluters and track evolution of oil spills.

Satellite-based Synthetic Aperture Radars (SARs) are of particular relevance for oil spill detection, providing all-weather, day and night, wide area coverage measurements. CleanSeaNet, the European oil spill monitoring and vessel detection service, combines SAR data with other kinds of information (e.g. ship tracking data) to identify vessels in the proximity that might be potentially discharging oil. When such an event is detected, an alert message is rapidly sent (within 30 minutes) to the relevant authorities, enabling them to take further actions (e.g. inspecting the vessel).

For large scale emergencies, satellites support monitoring of the extent and evolution of the oil spill, supporting the planning of response and clean-up activities. As the volume of deep water oil production is forecasted to increase over the coming years, and oil production operators are increasingly required to operate independent pollution surveillance capabilities, satellite-based monitoring is expected to become a growing market for commercial services.



The CleanSeaNet service is operated by the European Maritime Safety Agency (EMSA) and provides operational near real-time support to 26 coastal states on a full time basis (24 hours, 7 days a week). In this image, acquired over the British North Sea, the vessels from the Automated Information System (AIS) are represented by the grey-filled polygons and the previous AIS reported positions for the potential polluter are marked as red circles. The potential spill can be seen clearly as a dark feature following the vessel track.

Source: EMSA

Facts

> Oil spill incidents occur frequently: between April 2007 to January 2011, CleanSeaNet has detected an average of about 2 spills per day in European waters.

Europe's most recent large disaster (Prestige accident, 2002) caused:

> 63000 tonnes of oil released into the sea of Galicia affecting almost 2000 km of the coast

> Economic losses and cleaning costs of more than € 770 million, excluding financial and future possible losses

Aerial surveys require at least 5 to 6 hours recognition flights, with total costs summing up to about € 1/km^2 - this is up to 150 times more expensive than satellite imagery.

Benefits

Satellite-based oil spill detection:

> captures the dimension of oil spills

> allows pollution control authorities to initiate actions before the oil drifts on-shore

> helps to detect illegal discharge and to organise recovery activities

Policy Objectives

> Water Framework Directive

> Marine Strategy Framework Directive

> MARPOL Convention

> Ship-Source Pollution Directive

Copernicus services

The Copernicus Marine Monitoring Service makes use of satellite data to provide information on ocean physics as input to support pollution risk assessment models.

Example products:

> Ocean physics analyses and forecasts

> Hydrodynamic forecasts for all regional seas

Sentinel contribution

The upcoming Sentinel-1 SAR instrument provided by Copernicus will offer:

> an all-weather, day and night supply of near real-time imagery

> an enhanced capability to capture the surface flow information on top of the higher resolution sea surface roughness

> improved support for the mapping of oil spill events

Next steps

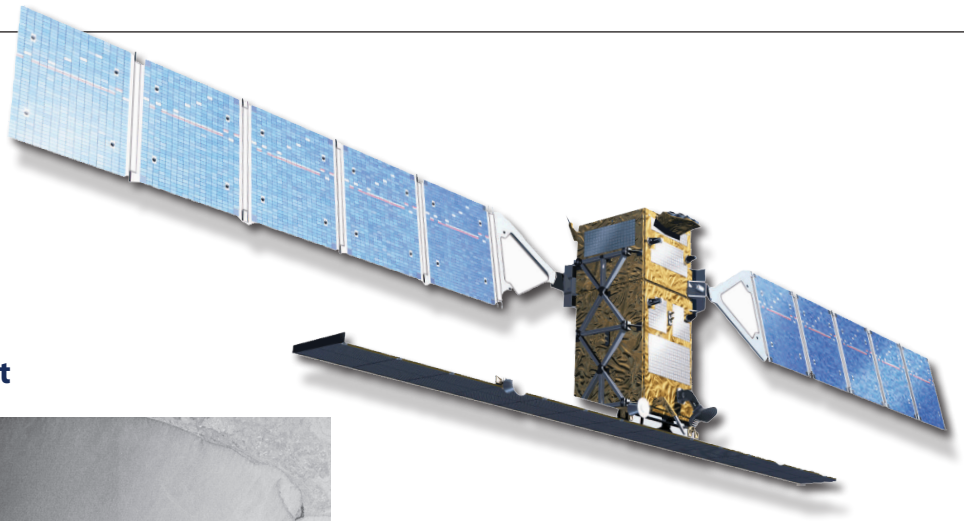
> Integrate a wider range of radar data to improve update times

> Verify new techniques to detect oil spills with recently launched satellite SAR instruments

> Improve fusion of SAR data with high resolution ocean colour data to reduce the false alarm rates in reported oil spill detections

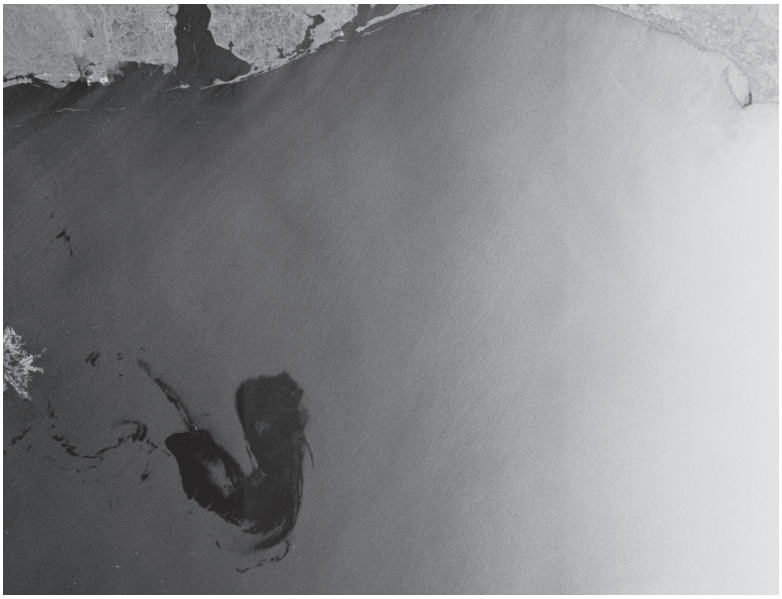
> Extend operational surveillance to oil platforms and other static sources

> Foster cooperation with maritime authorities outside of Europe



Sentinel-1

ESA's upcoming SAR instrument



The 2010 Deepwater Horizon disaster caused millions of barrels of crude oil to be released into the Gulf of Mexico over 87 days. It was declared as an unprecedented environmental catastrophe and the biggest off-shore spill in the history of the United States. Recently, the owning company agreed with the US Department of Justice to a payment of over € 1.9 billion for restoration and conservation of the marine and coastal environments, ecosystems and bird and wildlife habitat in the area. In this image, acquired by Envisat's Advanced Synthetic Aperture Radar (ASAR) instrument on 09 May 2010, the oil spill is visible as a black whirl in the otherwise light grey coloured Gulf of Mexico.

Source: ESA

The upcoming Sentinel-1 satellite allows a timely, synoptic and precise mapping of oil spills based on a Synthetic Aperture Radar (SAR). Radars are particularly suitable to sense oil slicks because the presence of oil profoundly changes the characteristics of the radiation which is scattered by the sea surface. Clear surfaces are characterised by wind-generated capillary waves that scatter the radiation of the radar also back to the radar itself. The presence of oil, damping down the capillary waves, reduces the reflected power measured by the radar: for this reason oil slicks appear as dark areas on an otherwise brighter sea.

Radars can also take measurements during night time and through thick cloud covers. This means that Sentinel-1 will be able to detect the oil leaking from platforms or tankers even during the night or in bad weather conditions, thus ensuring enhanced monitoring frequency and early detection capabilities.