LAND MARINE ATMOSPHERE EMERGENCY MANAGEMENT CLIMATE CHANGE SECURITY

Copernicus

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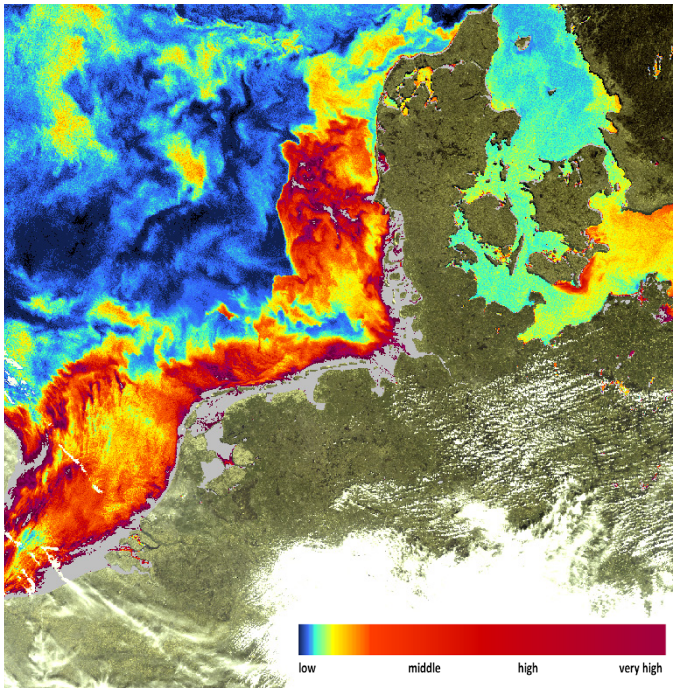
THE PLAGUE OF TOXIC ALGAE

None of the seas around Europe escape the phenomenon of algal blooms. These blooms result from the normal process of plankton growth in spring. However, some species of plankton can form harmful algal blooms (HABs) that pose an environmental hazard, affecting human and animal health, and even causing death. In recent years, the frequency and extent of HABs has increased considerably. Reasons for this include the increased discharge of substances such as fertilizers into the water from agricultural, industrial and urban activities. Scientists are currently investigating links between the frequency of algal blooms and changes in the temperature and salinity of oceans associated with climate change.

Copernicus and Earth observation satellites play a significant role in the detection and monitoring of algal blooms in marine ecosystems.

If early enough, algal bloom warnings provide the opportunity to make in situ measurements and determine if action is required to minimize the impact on aquaculture and human activities. Ocean models, coupled with the observational capacities of satellites, provide crucial information on the location, extent, and movement of blooms.

Ocean colour sensors, such as the former Envisat Medium Resolution Imaging Spectrometer (MERIS), can detect these tiny but harmful organisms from space as shown on the right-hand side in the image of the North Sea. In the future, Sentinel- 3's Ocean and Land Colour Instrument (OLCI) will offer enhanced ocean monitoring data.

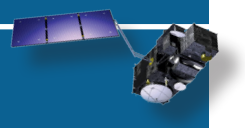


In 2008 a massive algal bloom in the North Sea affected coastal waters from Denmark to Belgium. The bloom lasted exceptionally long, starting in mid-April and declining only at the beginning of May. The species that formed the bloom was potentially toxic, especially for mussel beds. A 300 m spatial resolution MERIS image (background) acquired on 22nd of April 2008 allowed for estimation of algal concentration, in the map overlay showing low (blue, greenish) to high (dark orange, red) levels.

Source: Copernicus MarCoast Service (© 2011 Brockmann Consult) based on an algorithm from Freie Universität Berlin.

Facts

An algal bloom is the rapid multiplication of microscopic aquatic plants that concentrate as an intense bloom in the water. While individually harmless, in high numbers they may deplete oxygen in the water or produce toxins.



Costs

Algal blooms can:

> kill fish and shellfish,

> kill marine mammals and seabirds,

> cause serious illness in humans.

In Greece, Italy and Spain algal blooms result in costs of € 300+ million/year owing to:

> losses in commercial and recreational fishing,

> decreases in tourism,

> damage to ecosystems.

These losses threaten local economies and the livelihoods of coastal communities.

Policy Objectives

> EU Water Framework Directive

> EU Marine Strategy Framework Directive

> EU Integrated Maritime Policy

> EU Bathing Water Directive

Copernicus services

The Copernicus Marine Monitoring Service makes use of satellite data to provide regular and systematic reference information about the state of the oceans and European seas, thereby supporting applications such as the protection and the sustainable management of marine environment and the early detection of harmful algal blooms affecting aquaculture and human activities.

Example products:

> Biogeochemical analysis and forecasting for the global ocean and European regional seas

> Average concentration of surface chlorophyll to delineate high biomass near surface algal blooms

> Geophysical parameters such as sea-surface temperature and ocean currents

Sentinel contribution

Copernicus will support ocean monitoring with dedicated missions such as Sentinel-3 by:

> offering real-time monitoring capabilities at medium (300 m) spatial resolution with wide coverages

> increasing revisit times and assuring long term continuity

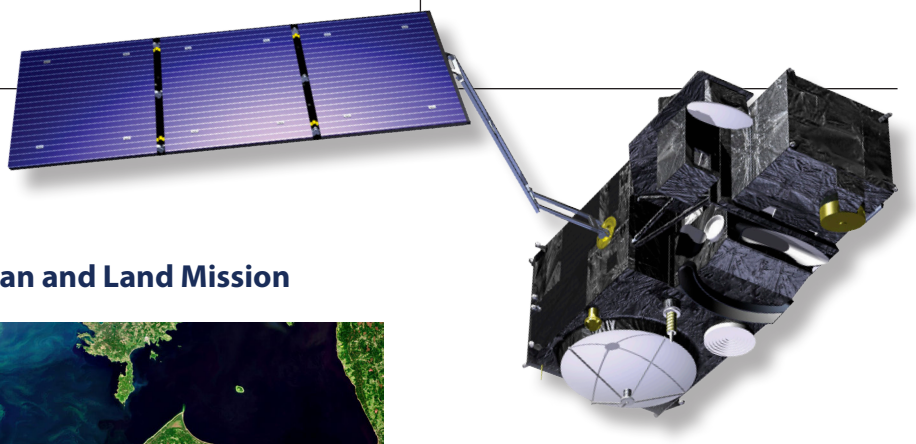
Next steps

> Deploy a robust and reliable space-based capacity for ocean monitoring and forecasting in Europe

> Improve data interpretation methods to distinguish harmful from non-harmful algal blooms

> Deliver forecasts directly to users by means of mobile phone and internet technology

> Continue work to develop, demonstrate, validate and inter-compare ocean colour products from current and future satellite missions



Sentinel-3

The Copernicus Medium Resolution Ocean and Land Mission

Extensive blooms of blue-green algae in the Baltic Sea were captured by the MERIS sensor on Europe's ENVISAT satellite on 11 July 2010.

Source: ESA

The colour of the surface waters of the ocean is not constant, but varies considerably. OLCI, which is one of the sensors to be carried on the Sentinel-3 satellites, will detect subtle differences in water colour and therefore be able to monitor algal blooms. OLCI will make observations at 300 m spatial resolution with 21 spectral bands. It will supersede MERIS on Envisat, which operated in 15 spectral bands. The first Sentinel-3 satellite is scheduled to launch in 2014.