

Advanced remote sensing products to monitor the water quality of the Belgian coastal zone

A satellite-based chlorophyll-a product was developed to meet the Water Frame Directive requirements.

The challenge

The Belgian coastal zone located in the Southern Bight of the North Sea is largely eutrophied due to riverine, atmospheric and transboundary inputs of land-based nutrients which results in the excessive development of undesirable phytoplankton species, such as *Phaeocystis globosa*. This phenomenon affects the marine ecosystem in a negative way as it disrupts the food chain and results in the deposit of thick layers of odorous white foam on the beach. Sustainable management of this type of marine ecosystems requires detailed information of their dynamics.

While traditional seaborne observations are still considered as the main monitoring tool, there is a need to use optical remote sensing as a supporting tool to achieve the monitoring requirements with severe resource constraints of available ship time and manpower.

“Optical remote sensing is necessary to bypass severe resource constraints of ship time and manpower.”

Georges Pichot, Management Unit of the North Sea Mathematical Models

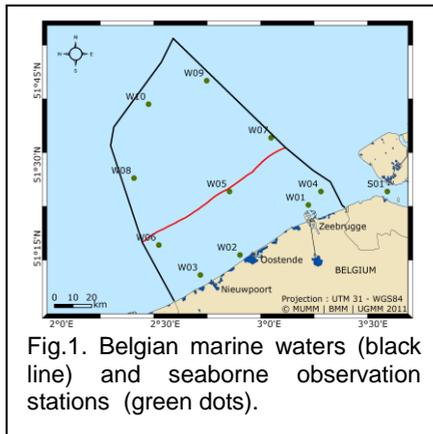
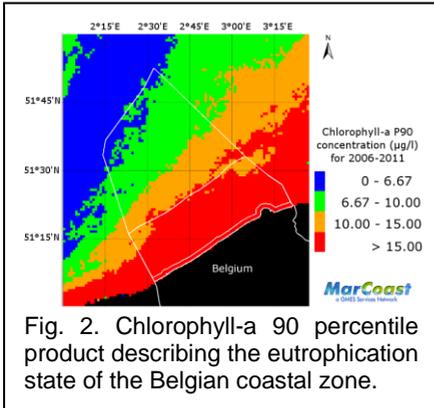


Fig.1. Belgian marine waters (black line) and seaborne observation stations (green dots).

Benefits to citizens

Everyone aspires to live in a healthy environment and public authorities in Belgium are making a particular effort to transform this right into a reality. Belgium follows international initiatives such as the European Water Framework Directive (WFD) and Marine Strategy Framework Directive (MSFD) with the main objective of maintaining a 'good' status of all waters (surface, ground, coastal). Operational monitoring is an essential part of the implementation of these directives to evaluate the effects of measures undertaken to improve critical situations, such as the eutrophication state. It is here that satellite remote sensing comes into play as it provides information with a spatial coverage and temporal frequency that is unmatched by traditional seaborne observations.



The space based solution

The eutrophication status of the Belgian coastal zone is established by monitoring the chlorophyll-a concentration as it is a proxy of phytoplankton biomass. More specifically, the indicator of choice for WFD is the chlorophyll-a 90 percentile for the phytoplankton growing season (i.e. March-November incl.) of 6 consecutive years expressed in $\mu\text{g/l}$. In Belgium, seaborne measurements are made 7-9 times in average per growing season in 10 stations distributed over the Belgian coastal zone (Fig. 1). These numbers are too low to calculate chlorophyll-a 90 percentile values with sufficient accuracy.

To answer this need for information, The Management Unit of the North Sea Mathematical Models (MUMM) has developed a MERIS-based remote

sensing product within the MarCoast-2 project funded by the European Space Agency (ESA). This Chlorophyll-a 90 percentile product (Fig. 2) is generated using daily standard chlorophyll-a products of 6 consecutive years providing in average 35-40 observations per growing season per pixel of 1 km. The resulting classified map provides a spatial overview of the eutrophication state of the Belgian coastal zone showing the problematic area in red. These specialized map products, combined with reports containing validation results and derived statistics, are delivered to the Belgian Federal Public Service of Health, Food Chain Safety and Environment to support the coordination of actions needed to reach a 'good' environmental status of the Belgian waters by 2020.

Outlook to the future

On April 8th 2012, all communication with the Envisat satellite was lost. This resulted in an abrupt stop of daily MERIS chlorophyll-a products. ESA plans to launch the Sentinel 3A satellite early 2014. Until then the main source of ocean colour data for Europe will be the American MODIS-AQUA sensor which is also beyond its nominal lifetime. A timely launch of the Sentinel satellites will be crucial to ensure the continuation of the MarCoast-2 water quality monitoring services.

www.marcoast.eu

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