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WEB SITES

IES Global Environment Monitoring Unit:
<http://ies.jrc.ec.europa.eu/gem.html>
IES Research Action PROCAS – Protection
and Conservation of European Seas:
<http://ies.jrc.ec.europa.eu/procas.html>
Environmental Marine Information System:
<http://emis.jrc.it>

CUSTOMERS

DG Environment
DG Fisheries and Maritime Affairs
Baltic Marine Environment Protection
Commission (Helsinki Commission)
OSPAR Commission for the Protection of the
Marine Environment of the North-East
Atlantic
Black Sea Commission
United Nations Environment Programme
(UNEP) – Mediterranean Action Plan
European Environment Agency (EEA)

POLICIES SUPPORTED

Thematic Strategy on the Protection and
Conservation of the Marine Environment –
COM (2005) 504
Green Paper: Towards a future Maritime
Policy for the Union – A European vision for
the oceans and seas – COM (2006) 275
Directive establishing a framework for
Community action in the field of water
policy – 2000/60/EC
Directive concerning urban waste-water
treatment – 91/271/EEC
Communication on Integrated Coastal Zone
Management: A strategy for Europe –
COM (2000) 547

Supporting the recovery of European regional seas

Marine eutrophication, i.e. the over-enrichment of water by nutrients producing undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned, is a major issue of concern in European regional seas. Marine eutrophication is considered to be the cause of various biological effects such as green tides, phytoplankton blooms, deep-water anoxia and fish population changes. In order to tackle the problem, satellite remote sensing of chlorophyll concentration is used by the IES to provide estimates of the biological productivity, being complemented by *in-situ* measurements for validation purposes. Long-time series of chlorophyll concentration help in evaluating the impact of nutrient reduction (or increase) in coastal and marine waters. In addition, the numerical modelling of the physical and biological processes is used by the IES to better understand and assess the specificities of the different European regional seas in relation to the eutrophication phenomena.



The Acqua Alta Oceanographic Tower in the Northern Adriatic Sea is a key element for the validation of the ocean colour products of the IES

Through its marine research activities, the IES is building a comprehensive knowledge base in support of European policies related to the marine environment and the intergovernmental marine regional seas bodies, such as the Helsinki Commission and Black Sea Commission. Specific emphasis is given to the Baltic Sea and Black Sea because these are suffering particularly from high nutrient loads in their coastal waters. Restoring the ecological health of these endangered ecosystems will not only help the environment, but also bring economic benefits, e.g. in fisheries and tourism.

*Did you know that about 1 million tons of nitrogen
and more than 30,000 tons of phosphorus
enter the Baltic Sea every year
either as waterborne or airborne inputs?*

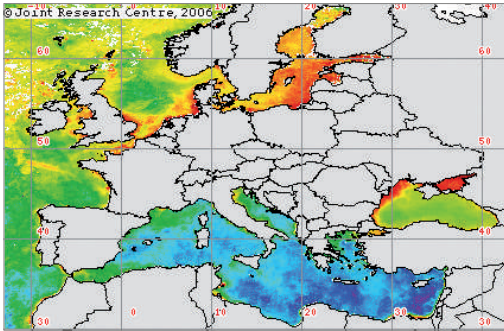
Results achieved

- Completion of a European Environmental Marine Information System with navigation and query capabilities.
- Successful measurement campaigns in the Baltic Sea, Black Sea and Mediterranean Sea to support the validation of products derived from satellite remote sensing.
- Comparative assessment of satellite remote sensing products from the SeaWiFS, MODIS and MERIS sensors.
- Autonomous radiometer systems operational in the Baltic Sea to support satellite ocean colour validation activities.
- Coupled physical-biochemical model for carbon and oxygen dynamics in the Baltic Sea completed.



Development of indices for marine eutrophication

Spatial indices using satellite and numerical model data provide decision-makers as well as the general public with easily understandable information about the risks associated with eutrophication. These indices must take into account the different physical and biological condition of Europe's regional seas. In this context, two spatial indices addressing specific aspects of the eutrophication of coastal marine ecosystems (oxygen depletion risk and physical vulnerability) have been further developed by the IES to include temporal variability on a European scale.



Monthly average of chlorophyll concentration in European Seas in June 2005: the red colour indicates very high concentrations

The so-called OXYRISK and PSA indices blend hydro-dynamical model data with remote sensing data to provide a temporal distribution of the risk of oxygen depletion near the sea-bed in European coastal seas (depth < 100 m). The indicators provide large-scale maps, which can help European policy managers to identify problematic areas ("hot spots") where a more detailed analysis through *in-situ* sampling should be performed. The OXYRISK and PSA map products are made available by the IES on a monthly basis, and therefore offer a synoptic and dynamic view of the oxygen depletion risk and physical vulnerability in European coastal areas. Both indices show that some regions of the Baltic Sea, the Belt Sea, the Kattegat and the North-Western Adriatic Sea, among others, are particularly sensitive to these eutrophication risks.

Highlight

KEY PUBLICATIONS

Druon J.N., Schrimpf W., Dobricic S., Stips A. (2004): Comparative assessment of large-scale marine eutrophication: North Sea area and Adriatic Sea as case studies. *Marine Ecology Progress Series* 272: 1-23.

Helsinki Commission (2004): Thematic Report on Validation of Algorithms for Chlorophyll a Retrieval from Satellite Data of the Baltic Sea Area (Editor W. Schrimpf). *Baltic Sea Environ. Proc.* 94: 44 pp.

Mélin F., Berthon J.F., Zibordi G. (2005): Assessment of apparent and inherent optical properties derived from SeaWiFS with field data. *Remote Sensing of the Environment* 97: 540-553.

Zibordi G., Holben B., Hooker S.B., Mélin F., Berthon J.F., Slutsker I., Giles D., Vandemark D., Feng H., Rutledge K., Schuster G., Al Mandoos A. (2006): A Network for Standardized Ocean Color Validation Measurements. *EOS Transactions of the American Geophysical Union* 87 (30): 293-304.

Lilover M.J., Laanemets J. (2006): A simple tool for the early prediction of the cyanobacteria *Nodularia spumigena* bloom biomass in the Gulf of Finland. *Oceanologia* 48 (5): 213-229.

MAIN RESEARCH PARTNERS

Baltic Sea Research Institute Warnemünde (IOW), Rostock, Germany
University of Sofia, Bulgaria
Bulgarian Academy of Science – Institute of Oceanology, Varna, Bulgaria
National Environment Research Institute (NERI), Roskilde, Denmark
Swedish Meteorological and Hydrological Institute, Norrköping, Sweden
French Research Institute for Exploitation of the Sea (IFREMER), Issy-les-Moulineaux, France
National Institute for Geophysics and Vulcanology (INGV), Rome, Italy
Tallinn University of Technology, Estonia
University of Plymouth, United Kingdom
Hellenic Centre for Marine Research (HCMR), Athens, Greece

Challenges ahead

- Operational production of marine eutrophication risk indices for all European regional seas.
- Implementation of a coupled physical-biochemical model for carbon and oxygen dynamics for the North Sea and Mediterranean Sea.
- Calibration of satellite remote sensing products in all European regional seas.
- Identification of nutrient thresholds in European marine and coastal waters with regard to eutrophication.

Benefit for Europe

The marine research activities at the IES help to monitor progress in the restoration and recovery of the European regional seas by developing and applying advanced tools using satellite remote sensing and numerical modelling and hence, improving our knowledge and understanding of marine ecosystem functioning.

*Robust science
for
policy making*