Rapid Environmental Assessment

The OPEC Rapid Environmental Assessment (REA) uses data assimilation to blend numerical models with observations to provide the best available simulated data product. The OPEC REA demonstrates that coupled oceanographic/marine ecology models can be operationalized in order to interpolate and extrapolate experimental observations to areas and time periods not covered by existing observational networks.

In addition, REAs provide an indication of ecosystem properties which cannot be measured in near real time (e.g., phytoplankton species) or are difficult to observe (e.g., foodweb structure). Such estimates can be updated in quasi-real time, by exploiting the causal relationships which constrain the dynamic of those properties to those of measured properties (e.g., a model which produce skilled assessment of nutrients and chlorophyll is likely to produce reasonable estimates of primary production and, possibly, of secondary production).

This approach has allowed the integration of operational observation networks and operational ecological models to provide a valuable and efficient method of adding value the monitoring of ecosystem properties.

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Background

The development and implementation of policy and management of the marine environment requires knowledge of the current status of the ecosystem.

Current marine monitoring systems provide limited coverage in space and time of ecosystem properties. The aim of Rapid Environmental Assessment (REA) is to make available in near real time the best available estimates of the current state of the environment to users.

OPEC has developed and demonstrated this capability, by providing information on the key environmental indicators for the recent past. The service is aimed at supporting policy, environmental management and other downstream services.
Using REAs in marine management

The OPEC REA data products have been produced for the Baltic Sea, Black Sea, Mediterranean Sea and the NE Atlantic. The data streams can be accessed from the OPEC data portal (http://www.portal.marineopec.eu) and include:

- Temperature
- Salinity
- Nutrients (nitrate, phosphorus, silicate)
- MLD
- Oxygen
- Primary Production
- Chlorophyll
- Plankton biomass
- pH

These indicators have been chosen for their relevance to the Marine Strategy Framework Directive, in particular, biodiversity, foodwebs and eutrophication descriptors of Good Environmental Status (GES). For example the assessment of GES requires the definition of a baseline reference for an indicator in order to quantify how the ecosystem is changing. Figure 1 shows that the annual mean chlorophyll in the Mediterranean was higher in 2012 than the average of the previous 10 years, implying the system was more productive than average.

The potential of the REA to provide data coverage in the absence of data is illustrated in figure 2. The data coverage provided by ocean colour satellites is poor during winter due to a combination of latitude and cloud cover. By assimilating the satellite data into the model we can extend the coverage to the whole region. In the overlapping areas, model and satellite estimates agree qualitatively in pointing out relatively high concentrations along the British and Norwegian coasts and low concentrations in the central and northern North Sea.

Summary

Marine OPEC research has demonstrated a capability to make a Rapid Environmental Assessment of marine ecosystems in European regional seas. The models demonstrate skill for a range of indicators including temperature, oxygen, nutrients and chlorophyll. In combination with baseline climatologies provided by the regional hindcasts, they allow stakeholders to assess whether the current state of the ecosystem differs significantly from the long term mean.