NOWCASTING AND FORECASTING OF MARINE DYNAMICS

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Operational oceanography is the very complex concept. There are some definitions of operational oceanography. Here are two the most commonly encountered and closely correspond to reality definitions of operational oceanography:

1. GODAE vision **(**http://www.bom.gov.au/bmrc/ocean/GODAE**):**

Operational Oceanography can be defined as a global system of observations, communications, modelling and assimilation, that will deliver regular, comprehensive information on the state of the oceans, in a way that will promote and engender wide utility and availability of this resource for maximum benefit to the community.

2. EuroGOOS vision**: (**http://www.eurogoos.org/index.php**)**

Operational Oceanography can be defined as the activity of systematic and long-term routine measurements of the seas and oceans and atmosphere, and their rapid interpretation and dissemination. Important products derived from operational oceanography are:

- nowcasts providing the most usefully accurate description of the present state of the sea including living resources
- forecasts providing continuous forecasts of the future condition of the sea for as far ahead as possible
- hindcasts assembling long term data sets which will provide data for description of past states, and time series showing trends and changes

Operational Oceanography proceeds usually, but not always, by the rapid transmission of observational data to data assimilation centres. There, powerful computers using numerical forecasting models process the data. The outputs from the models are used to generate data products, often through intermediary value-adding organisations. Examples of final products include warnings (of coastal floods, ice and storm damage, harmful algal blooms and contaminants, etc.), electronic charts, optimum routes for ships, prediction of seasonal or annual primary productivity, ocean currents, ocean climate variability etc. The final products and forecasts must be distributed rapidly to industrial users, government agencies, and regulatory authorities.

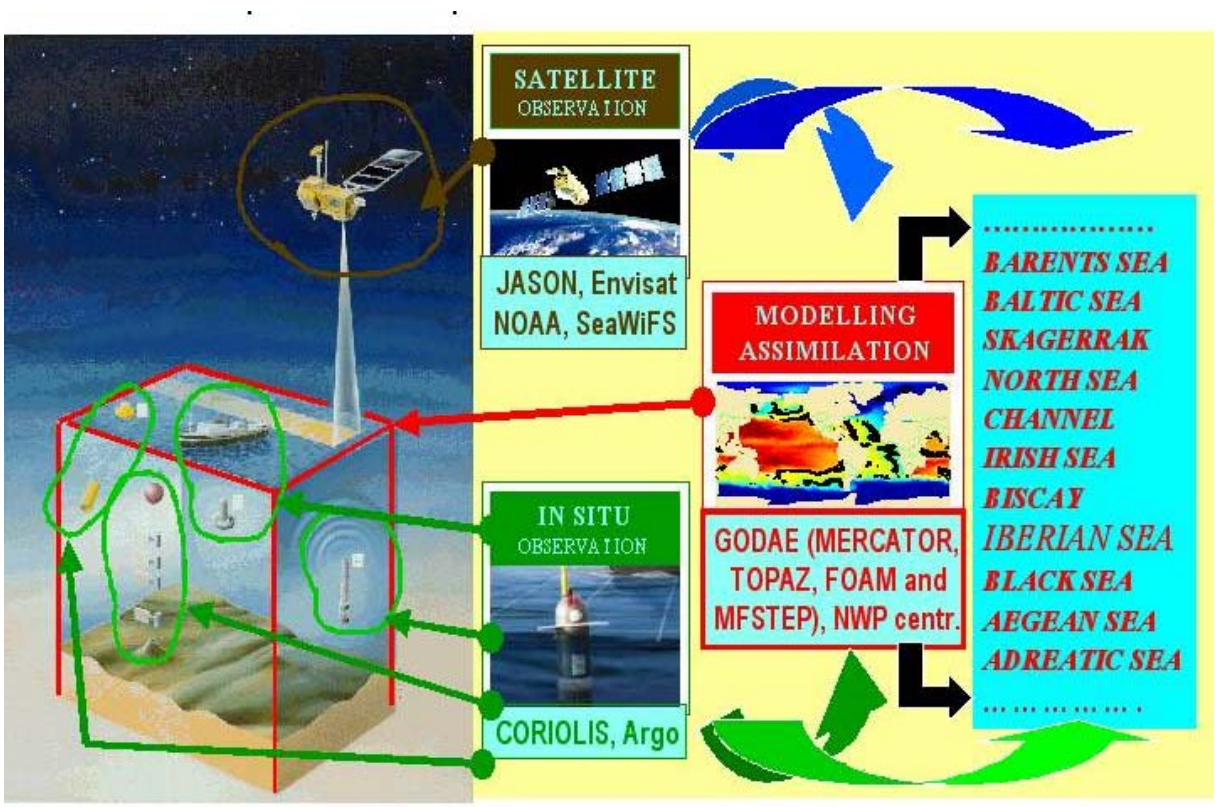

Fig. 1. Operational Oceanography : backbone for regular and routine provision of data and information in hindcast-nowcast-forecast mode for the Global ocean

Marine Research and Development

Marine research and development that ranges from the fundamental through to the applied end of the spectrum will always be necessary to support operational oceanography. Ultimately, new systems based on new technology and new understanding of the sea will permit long range forecasts which will be of great benefit in managing the seas and oceans, and in predicting changes and variability of climate. The role of marine R&D does not cease once a fully operational regional oceanographic forecasting system is in place. The WMO and national meteorological organisations have demonstrated that strong investment in Research and Development to support the equivalent meteorological operational capabilities is required to maintain the viability of an operational programme.

Interaction between marine research operational oceanography box leads to mutual benefits on both sides. Not only will operational oceanography depend upon results and technology developed by marine research institutes but also marine science will profit greatly from operationally acquired data and time series of the seas. Ultimately, these data might contribute to the development of new and complex ecosystem models that could one day allow a more precise forecast of living marine resources than is possible at present.

Users of Operational Oceanography

Users are those governmental services, SMEs and research institutions that make use of the products generated by operational oceanography. New products will generate new applications as well as help to protect the marine environment, improve safety for marine transport and construction activities on the seas, improve public health and quality of sea water, and provide warning and protection against marine and coastal hazards, floods, and coastal erosion. Different applications require different products. Thus, the identification of specific data and product requirements by different application sectors is an important task that has to be augmented by a sound socio-economic cost-benefit analysis (including those benefits for the environment that have not been assigned a direct economic value at the moment).

Black Sea Global Ocean Observing System - Black Sea GOOS

The association aimed to foster Operational Oceanography in the Black Sea region is the Black Sea GOOS . One of the objectives of the Black Sea Global Ocean Observing System is a promotion of the Nowcasting/Forecasting System of the Black Sea. The first phase in the realization of this goal is the development of the Pilot Nowcasting/Forecasting System of the Black Sea Circulation in the framework of project ARENA (A REgional capacity building and Networking programme to upgrade monitoring and forecasting Activity in the Black Sea basin) funded by the EU.

Fig.2. Pilot Nowcasting/Forecasting System of the Black Sea Circulation (http://www.arena.mhi.net.ua).