

BOOS Strategy 2016-2020

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BOOS Vision 2020

Baltic Operational Oceanographic System (BOOS) has been established in 1997 with an aim to promote and develop an operational oceanographic infrastructure including routine collection, interpretation and presentation of in situ and satellite data. According to the Memorandum of Understanding adopted in 2015, BOOS has the following two main programmes: BOOS Modelling Programme and BOOS Observation Programme. The Modelling Programme is a continuation of the former consortium of operational marine forecasting agencies (HIROMB) established in 1995 to support the implementation of the HELCOM Recommendation 12/6 1991 regarding development of an oil drift forecasting system.

The main aim of the present BOOS is to coordinate, harmonize and develop operational oceanographic observation, information and forecasting systems for the Baltic Sea. It comprises operational agencies and research institutes from all countries bordering the Baltic Sea.

The main milestones of the BOOS development were formulated in the BOOS Plan (1999-2003), BOOS Strategy Plan 2004-2010 and BOOS Vision 2015. Many strategic objectives of the BOOS Vision 2015 have been achieved, but the organization has to be developed further to meet the emerging needs of society and stakeholders.

The new Strategy has to take into account the essential developments at the European level, such as the establishment of Copernicus marine service. BOOS should closely co-operate with other regional operational oceanographic organizations, e.g. via the working structures of EuroGOOS.

BOOS Vision 2020 is that BOOS and its members are the main providers of operational oceanographic services for the local, national, regional and European users in the Baltic Sea area. To achieve this goal, BOOS will focus on the development and coordination of activities in the following key priority areas:

- 1) Service Development.
- 2) Observations.
- 3) Forecasting systems.
- 4) Communication and promotion.
- 5) Research and Development.

Service Development

(Which services do we have and which should we develop? BOOS should be the consortium for Baltic Sea-wide services. This part is missing)

Operational oceanography in coastal areas has recently by EuroGOOS been identified as one of the major emerging areas to support sustained socio-economic development. Access to accurate marine warnings in the coastal area is important to millions of people in the Baltic Sea region (of the 85 million people living in the Baltic Sea catchment area almost 20 million people live in the coastal area, i.e., within 10 km of the coast). While existing ocean forecasting systems are able to predict, for example, sea level with reasonable accuracy in the Baltic Sea only recently has this information been coupled in research projects to inundation models to predict, e.g., inland flooding of lower-lying land. Such flooding events may have large economical and human consequences. Further efforts should be to better explore the full potential of ocean state forecasting information (both deterministic and ensemble based) in engineering, coastal, environmental and social sciences.

Observations, including remote sensing (draft by Urmas Lips, MSI; *remote sensing part is missing – IOPAN*)

The main goals of the strategy in the field of in-situ observations are:

- to develop further the multi-platform interdisciplinary network of real-time in-situ observations to meet the requirements of Copernicus marine service, marine environment monitoring, climate change studies, maritime affairs and marine research and innovation;
- to sustain the network of coastal stations and contribute to the establishment of a common reference sea level system;
- to expand and guarantee the sustainability of Ferrybox network in the Baltic Sea, e.g. to re-establish the routes across the southern Baltic Proper, to the Gulf of Riga and eastern part of the Gulf of Finland, to enlarge the set of sensors in the systems (including pCO₂, ground truth for remote sensing, etc.);
- to develop further the network of fixed stations in the coastal and open sea areas providing near real-time data through the whole water column (including buoy based or submersed profilers, fixed sensor chains, bottom mounted sensors etc.);
- to expand the network of wave buoys (find solutions for sustainable observations in the Baltic Proper, Gulf of Riga, etc.);
- to complement the near real time current measurements in the Belts and the Sound with similar systems in the straits connecting Baltic Sea sub-basins;
- to develop network of Baltic Sea Argo floats;
- to establish a Baltic Sea glider port and initiate the programme of long-term glider sections in the Baltic Sea;
- to include into the near real-time data exchange the research vessel based observations (CTD casts, flow-through measurements, etc.);
- to promote near real-time data delivery for the operational services and users;
- to promote active participation of BOOS member representatives in the EuroGOOS task teams.

Remote sensing

Increased, in the recent years, the quality and accessibility of the remote sensing data have strong impact on evolution of operational oceanographic observation. Some well-known limitations of satellite data (e.g. cloud cover blocking satellite signal for ocean color and SST sensors, information usually limited to the only surface waters) can be in many cases overcome by merging remote sensing data with data from forecasting systems, providing together, in many cases, the best available complex information about marine environment.

BOOS mission will be to promote the development and use of satellite remote sensing data to increase the quality and capacity the Baltic observational systems, especially in synergy with developed models and collected in situ observations.

The main goals of the strategy are:

- to support and promote development and validation of remote sensing algorithms designed for specific Baltic waters

- collecting and sharing of in situ observation for validation of remote sensing data
- to promote development of methods for assimilation of remote sensing data into Baltic models
- to promote development of methods for synergic use of satellite data together with models and in situ observations
- to support development and integration of regional observational systems based on satellite remote sensing data, also in the context of Copernicus marine service
- to promote the use of remote sensing data for the operational services and various users

Coastal radars

Forecasting and forecasting systems (draft by Ole Krarup Leth, DMI)

Operational ocean forecasting in the Baltic Sea has mainly been of national concern, and most countries bordering the Baltic Sea run nationally funded ocean forecasting systems. In supplement to the national systems, the EC is funding the development of a European regional ocean forecasting system which includes also the Baltic Sea. This is part of the Copernicus Marine Environmental Monitoring Service (CMEMS).

The special conditions of the Baltic Sea, being located at high latitudes, having strong stratification, deep basins and complex coastline require:

- high model resolution;
- modelling systems, allowing for, e.g. two-way nesting with high model resolution in areas of particular interest such as narrow straits and archipelagos;
- the use of unstructured grids and flexible mesh;
- coupled modelling approach (ocean circulation, sea ice, waves, sediment transports, ecosystem, etc.),
- extensive usage of operational data-assimilation techniques;
- general focus on coding standards, efficient numerical schemes and best practices for maximum utilization of computational resources.

Such an approach will require extensive collaboration across scientific disciplines and geographical borders in the Baltic Sea region and more fundamentally, this will require strategic decisions at a national/partner level as maintenance, development and the running of such complex systems is extremely expensive and cannot likely be done by one single partner.

In the future it is expected that data-assimilation will be more widely used in operational forecasting. Existing multi-model ensemble approach developed in CMEMS will be further developed and exploited. Coupled ocean, ice, wave and ecosystem models will be developed, and further extended to reach seamless forecasting capacity.

Communication and promotion (draft by Laura Tuomi, FMI)

BOOS mission is to be the key provider of services and information to European and regional users in Baltic Sea area. BOOS data, products and services benefit many maritime sectors, such as shipping, coastal and offshore planning and construction, maritime spatial planning and leisure activities. These data, products and services are distributed freely through BOOS and its members.

BOOS also provides data for several regional and European operators such as Copernicus CMEMS,

EMODNET, and HELCOM.

Communication and promotion should raise awareness of BOOS both for internal and external users. Internal users are the BOOS members. External users include governmental, regional and local agencies, industry, marine conventions, policy makers etc. Means of internal communication include email-lists, annual meeting, workgroup meetings and steering group meetings. In addition to this web-page (www.boos.org), newsletter and seminars/workshops are used for both internal and external communication.

BOOS web-page (www.boos.org)

- The BOOS services are distributed and promoted through BOOS web-page (www.boos.org) The web-page is central information source of all BOOS activities, products and services.
- In the web-page the relevant Baltic Sea forecast products and observations are provided with an easy access. The products can include combined products from several institutions and individual institutional products.
- The data distribution services and building of combined products in the BOOS web-page should, where ever applicable, base on the data distribution infrastructures BOOS members have build e.g. to fulfill the requirements of the INSPIRE-directive. Also other data distribution methods can be used, such as ftp-sites.
- The BOOS web-pages need to be kept up to date with easily accessible and understandable structure. This requires responsible persons from BOOS members for monitoring, up-keep and development of web-page.

Newsletter

BOOS Newsletter is produced once (or twice) a year for outreach and to promote new and improved services and products and inform about new research activities.

Research and Development (draft by Jan H. Reißmann, BSH)

In continuation of the research and development activities in BOOS up to now, the main target of BOOS always has to be to keep the system and the products at a state as close as possible to latest research results and newest technology, while exclusively following matured and recognised concepts feasible in operational oceanography. Consequently, BOOS Research and Development has to **envisage the new emerging fields in operational oceanography** in the coming years. Furthermore, **latest technologies and methods** in oceanography with potential to fill gaps in the operational system **have to be evaluated and incorporated** if reasonable.

The most striking new fields in operational oceanography which need research and development in the coming years are:

- coastal waters
- operational ecology

Some specific topics the BOOS Research and Development activities should focus on in the coming years are (list not exhaustive and in arbitrary order):

- improvement of remote sensing products such as ocean colour, altimeter/SAR applications
- more measurements in the water column also utilising new technologies
- higher condensed information in operational indices describing the system state, e.g. upwelling, environmental parameters, spatial distributions
- operational model validation for absolute errors and uncertainties in complement to pure model uncertainties for multi ensemble
- next generation models: revise the model of the system (physics) instead of model tuning
- monitoring of new crucial quantities such as noise and marine litter, in particular plastic and paraffin