The BOOS modelling programme (BMP) – activities, working groups and plans

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BOOS
Baltic Operational
Oceanographic System

Mission

The BOOS modelling programme of the Baltic Operational Oceanography System BOOS coordinates and integrates the model development activities in the framework of BOOS. Its mission is to enhance and integrate seamless marine system modelling capacity from open sea to coastal-estuary continuum and from near-real time to climate scale for the national operational services around the Baltic Sea.

To fulfill this mission, the BMP has recently undergone efforts to update and define new research and development priorities supporting the strategic objectives of BOOS and EuroGOOS (Capet et al., 2020). Research collaborations within BOOS's modelling and observational programs and research groups outside BOOS have been organized in working groups (Fig. 1), to address common challenges and research interests.
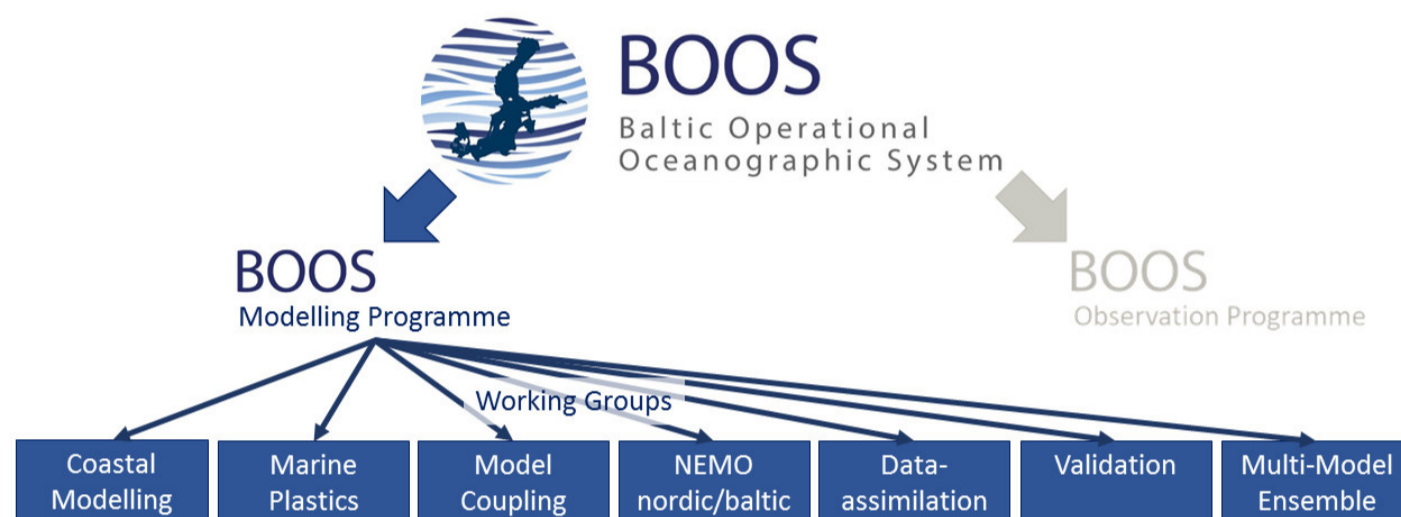

Fig. 1: The BMP and its working groups in the BOOS structure

The Modelling Programme

In response to a HELCOM (Helsinki convention on the Protection of the Marine Environment of the Baltic Sea Area) recommendation regarding the development of an oil drift model in the Baltic, Federal Maritime and Hydrographic Agency (BSH) and Swedish Meteorological and Hydrological Institute (SMHI) developed a High Resolution Operational Model for the Baltic (HIROMB). As a result, the HIROMB cooperation for the joint development of operational modelling was formed, which was contractually fixed in the mid-1990s and which was joined by other institutes in the following years. The main task was to provide a state-of-the-art operational, basin-wide forecast for all partners. In 2015, the cooperation moved under the umbrella of the Baltic operational oceanographic Service (BOOS, She et al., 2020) and had since been called BOOS modelling programme (BMP). Since the availability of a state-of-the-art operational basin-wide forecast is now ensured by the marine Copernicus service (CMEMS), the BMP has revised its mission in recent years.

Today the BMP consists of 17 partner institutes from all nine Baltic Sea countries. On a voluntary basis, the involved institutes support and inform each other on modelling activities, exchange know-how, methods and tools, whereby the BMP has either established working groups (Fig. 1) or strengthened networking activities through regular or targeted workshops. These provide a discussion forum for the identification of best practices and practical help for the implementation.

Working Groups

Coastal modelling Working Group
For the third group which was newly established during last year, the main focus is a better representation of near-shore processes in wind, wave, circulation and biogeochemical model, e.g. wave shoaling and breaking, turbulent kinetic energy injection, wave-induced drift and very high resolution set-up.
Seamless modelling capacities are already developed ensuring coastal-estuary to open sea continuum (Fig. 2)

Marine plastics Working Group
The focus of this working group, also established in 2020, lies on developing modelling tools to simulate the sources, pathway and fate of micro-, meso- and macroplastics in catchment, inland waters and in the sea. An Eulerian microplastic drift model developed in the Horizon 2020 project CLAIM (*www.claim-h2020project.eu*) is capable of modelling multi-category microplastic transport in rivers, lakes, coastal and open sea (Fig. 2).
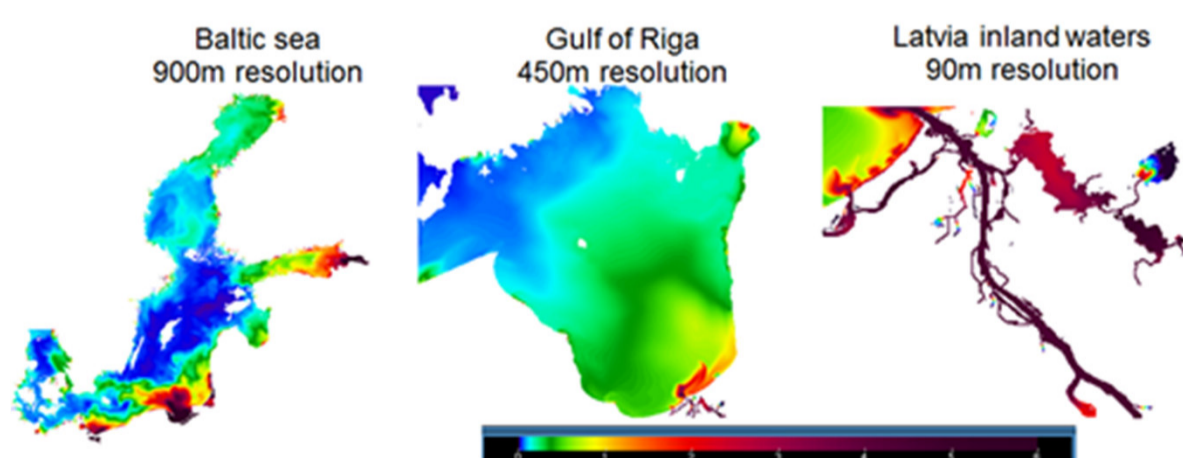

Fig. 2: Microplastic concentration modelled by a two-way nested seamless modelling system HBM in inland waters, coastal and open sea.

Multi-Model-Ensemble (MME) Working Group
This working group is a very good example for a close cooperation of many BOOS members. Multi-Model predictions of surface and bottom temperature and salinity, surface currents, water transports and sea level at several gauges around the Baltic Sea (An example is shown in Fig. 3) based on real-time exchange of observations and multiple forecast data is produced. The daily forecasts are provided via the BOOS website *www.boos.org*. In particular the prediction skill of sea level, which is certainly the most important parameter of the daily forecast of most operational institutes, is significantly improved by using the MME approach (Golbeck et al., 2015).
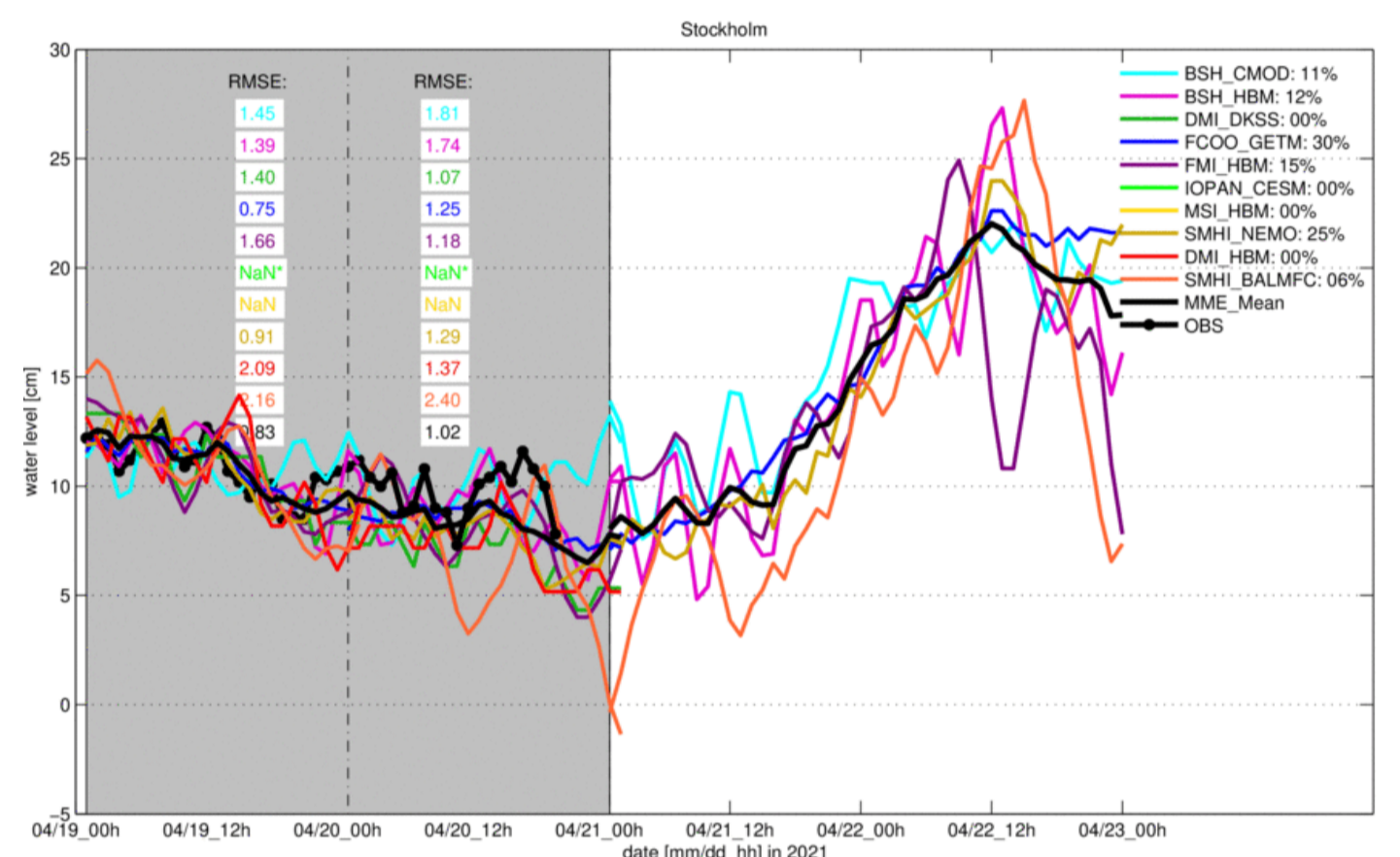

Fig. 3: MME water level forecast product for the Stockholm gauge from 21 April 2021. The observations of the last 2 days, as well as the forecasts of various models and the weighted MME mean are shown. The proportion of individual models in the weighting is also given - this proportion results from the RMSE of the last two days.

Nemo Working Group
The partners work on a common model, whereby the development should take place at code level of the ocean model NEMO (*www.nemo-ocean.eu*) with regard to the special requirements for the Baltic Sea region. This group can thereby make use of the work of the NEMO Nordic cooperation, which has already been existed for some years.

Data assimilation Working Group
After years of only informing each other about their data assimilation activities once a year, the partners of this working group are now working together on one common assimilation approach based on the PDAF code (*pdaf.awi.de*).

Model coupling Working Group
The overall task of this in 2020 newly established working group is the coupling of several model components towards a complete Earth system model. For this purpose, experience and model components are exchanged between the partners. Coupling of the ocean, waves and atmosphere addresses hereby the complex interactions between the different components, considering the nonlinear feedback between them.

Validation Working Group
On code basis this working group is developing common evaluation software written in the programming language python. Of course, there is also an intensive exchange about new validation methods and possibilities.

Summary

The BMP has recently revised and adapted its mission to reflect the research and development interests of a larger and more diverse community. Having abandoned the focus on just one model system during the transition from HIROMB to the BMP, the BMP is now addressing an even broader range of topics and models. In order to fulfil the mission of enhancing and integrating seamless marine modelling capacities with all its challenging subtasks, research institutes and developer groups also from outside the BOOS community are involved in the working groups.

References

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