Volume 4 Autumn 2013

NEWS FROM BOOS

NEW

FOCUS ON MODELS & NATIONAL FORECASTING SYSTEMS

IN THIS ISSUE

UPCOMING EVENTS

19-21 November 2013
EuroGOOS Annual Meeting
Brussels, Belgium

27-29 May 2014
IEEE/OES Baltic Symposium
„Measuring and Modelling of Multi-Scale Interactions in the Marine Environment“
Tallinn, Estonia

28-30 October 2014
EuroGOOS Conference
Lisbon, Portugal

NEWS FROM BOOS

is a publication of the Baltic Operational Oceanographic System. It is used to foster the co-operation between the BOOS members and to make the services and the information of operational oceanography in the Baltic visible for the public.

EDITORIAL

Dear reader,

Another autumn is ongoing, where the weather can be a bit rough from time to time. This brings about a growing interest in weather, storm surge and wave forecasts. Correspondingly, the latest issue of News from BOOS is dedicated to models and national forecast systems.

This issue of the BOOS newsletter offers you a variety of interesting articles. You can get an overview of the models used in Denmark, Finland, and Poland. In addition, a project is introduced that is developing a wave forecast mobile app for leisure sailors for navigating in the coastal regions in the Baltic Sea.

And last, but not least, enjoy reading about the activities of IOUG (Institute of Oceanography of the University of Gdańsk) and IOW (The Leibniz Institute for Baltic Sea Research Warnemünde).

Have a nice modelling and forecasting season!

Urmas Lips
BOOS chair

Baltic Operational Oceanographic System

BOOS

Baltic Operational Oceanographic System

describes the actual, anticipates the future, and classifies the state of the Baltic Sea!

NEWS

A multi-model ensemble (MME) for sea surface temperature, sea surface salinity and water transports with daily update is now freely available from the BSH web site!

In the project MyOcean-2 a methodology for producing uncertainty estimates for operational ocean forecast models in the Baltic Sea and the North Sea has been developed based on a multi-model approach. Models providing forecasts in the North Sea and the Baltic Sea by partners from MyOcean, the HIROMB/BOOS and NOOS community are included in the MME.

NetCDF files containing information about the MME of SSS and SST for Baltic and North Sea (mean, standard deviation, min, max, median, number of models) are produced on a daily basis.

The files are accessible via:

ftp://ftp.bsh.de/outgoing/opmodel/my_ocean/MME/

Figures showing the MME of transports along the NOOS and BOOS transects are accessible via:

BOOS: www.bsh.de/aktdat/modell/stroemungen/boos/mme_transporte/mme_bs_neu.htm

NOOS: www.bsh.de/aktdat/modell/stroemungen/noos/mme_transporte/mme_ns_neu.htm

Discover the hidden landscape of the Baltic Sea

The Baltic Sea Bathymetry Database (BSBD) gathers, visualizes and distributes data about the water depth -bathymetry- for the areas of all Baltic Sea countries.

The Baltic Sea Bathymetry Database offers complete, homogeneous and up-to-date Baltic Sea bathymetry data from official sources, i.e., all Baltic Sea national hydrographic offices under the umbrella of the Baltic Sea Hydrographic Commission. The BSBD web site is developed to meet the requirements of maritime and environmental planning as well as scientific research. The compiled bathymetry model has a resolution of 500m, featuring more than ten times as many data points as the currently available homogenous models and more data is regularly being added to the model.

The Baltic Sea Bathymetry Database is developed as part of the EU TEN-T project MONALISA (Motorways & Electronic Navigation by Intelligence at Sea). The development has also received funding from the Swedish Government.

More information on BSBD website:
http://data.bshc.pro

EuroGOOS is now an international non-profit organisation EuroGOOS AISBL *(association internationale sans but lucratif)* under Belgian law as agreed at the EuroGOOS Annual Meeting 2012.

The Royal Decree about the establishment of EuroGOOS AISBL was signed in February 2013. This completed the process of incorporation of EuroGOOS AISBL that has been taken about two years. Fourteen members of the former informal EuroGOOS consortium have already signed the Founding Declaration and it is expected that more institutes will join the EuroGOOS AISBL before the EuroGOOS Annual Meeting to be held in Brussels on 20-21 November 2013. We encourage BOOS institutes and agencies to become EuroGOOS AISBL members. This would foster operational oceanography in Europe and give more power to our Baltic voice at the European level.

The 9th Baltic Sea Science Conference (BSSC2103) held in Klaipeda on 26 - 30 August 2013 hosted a session of presentations about operational oceanography in the Baltic Sea – combining in-situ observations, remote sensing, and numerical modelling.

The aim of this session was to highlight recent and emerging developments in the field of operational oceanography, including observations (both, in-situ and remote sensing) and modelling. In total 7 oral presentations were given. Two of them were devoted to the wind waves and one to the sea level forecasting. Statistics of upwelling events and simulation of near-bottom oxygen conditions were topics of other papers. Advantages of vertically adaptive coordinates in numerical models of stratified seas were shown by Ulf Gräwe (IOW) and

uncertainty estimation in operational products using a multi-model-ensemble approach was introduced by Frank Janssen (BSH).

The programme of the BSSC2013 can be found at: http://corpi.ku.lt/bssc2013/index.php/programme

Convenors of the session and BOOS STG encourage operational oceanographers to participate more actively in the upcoming conferences, e.g. IEEE/OS Baltic Symposium to be held in May 2014 in Tallinn, Estonia, and EuroGOOS conference to be held in October 2014 in Lisbon, Portugal.

A few words about the work of BOOS STG

The BOOS Steering Group (STG) is a working committee responsible for execution of decisions of BOOS Annual Meetings (AM) and preparation of the following AM, including presentation of annual reports. The STG meets at least once, but usually twice a year. The main tasks of the STG are defined in the BOOS Memorandum of Understanding as: to prepare co-operation plans and propose activities to the AM and propose activities related to other frameworks outside BOOS.

From now on News from BOOS will start following the activities of BOOS STG and give in a few words an overview of their activities, work, and decisions. The most important task during this year is drafting the agreement on the BOOS observing system (OBS). This agreement will be crucial in order to secure delivery of observational data in the future for Copernicus marine service in the Baltic.

The aim is to suggest a draft text of the OBS agreement to the members well enough before the next AM.

Information about the STG meetings will be made available on the BOOS web site. The next STG meeting will take place after the EuroGOOS Annual Meeting (20-21 November 2013) in December 2013.

BOOS STG members are: Urmas Lips (Chair, MSI), Pekka Alenius (FMI), Iréne Lake (SMHI), Ole Krarup Leth (DMI), Jan Reißmann (BSH), and Marcin Wichorowski (IOPAN).

A NOVEMBER STORM CALLED FOR IMPROVEMENT OF THE DANISH STORM SURGE MODEL

Vibeke Huess & Palle Bo Nielsen

A storm passed Denmark 27 - 28 November 2011. In general, the storm surge model operated at DMI performed well for the Danish coasts, but in the Sound (between Denmark and Sweden) it was a tease. The first high water was predicted to be 0.6 m below the measured maximum in the Copenhagen harbor. Now the model is improved, and the error is reduced to 0.15 m.

Sea level difference of 2.5 m over 20 km

A storm in November 2011 resulted in high water situations along the coast line in the southern Kattegat area and along the coast line in the Sound. The strong north-westerly winds over the Danish area caused water from the North Sea, Skagerrak and Kattegat to move southwards towards the narrow Danish straits (the Belts and the Sound). Likewise, the strong north westerly winds caused the water in the most western part of the Baltic Sea - south of the narrow straits - to move eastwards.
The currents produced a very strong sea level gradient along the narrow straits.
Differences up to 2.5 m in sea level were observed between the tide gauge in Copenhagen and the tide gauge at the Drogden Lighthouse (Figure 1). The two tide gauges are less than 20 km apart and located in the southern part of the Sound but on each side of the threshold (depth of 7 m) at the southern entrance to the Sound.

A high water teased the model

Two high water situations occurred in the evening of 27 November and in the morning of 28 November. The storm surge model in operation in November 2011 predicted the two highs in the waters north of the Sound very well. Also the low water south

of the Sound was well predicted. However, the first and highest high water in the Sound was not forecasted well (Figure 2).

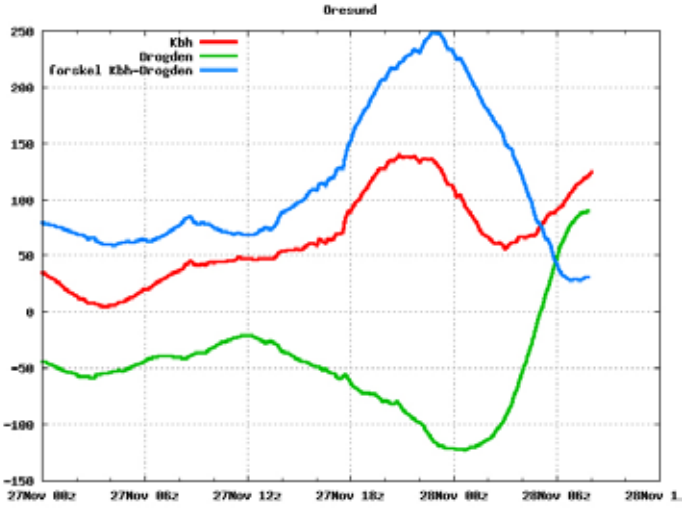

Fig. 1. The sea level difference between Drogden Lighthouse and Copenhagen 27-28 November 2011. At Drogden the sea level drops 1 m within 12 hours. At Copenhagen the sea level increases by nearly 1.0 m during the same time period. The difference between the two locations reaches its maximum of 2.5 m at midnight.
Data and graphics: Jacob Woge Nielsen, DMI.

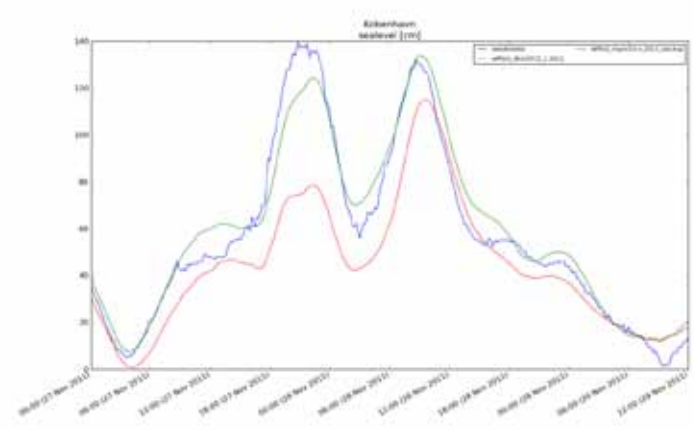

Fig. 2. Late on 27 November the sea level at Copenhagen increases because of a storm with northerly winds (blue curve). Over midnight, the sea level drops and then increases again to the same high level. The storm surge model in operation 2011(red curve) misses the first high but catches the second one reasonably well. The new, modified model set-up (green curve) is able to simulate both highs markedly better.
Data and graphics: Per Berg, DMI.

Adjustment of model depths and bottom friction

The failed predictions for the sea level led to an investigation of why the storm surge model system was not able to simulate the first of the two high waters in the Sound area. In the existing storm surge model set-up, the Sound is represented in a grid with a horizontal resolution of 0.5 nautical miles. The northern entrance to the Sound is very narrow between Helsingør on the Danish side and Helsingborg on the Swedish side. We decided to look further into how the model handles the flow of water into the Sound and within the Sound.

The modelers revised the representation of the 0.5 nm grid of the depths in the Helsingør-Helsingborg area. Especially the depths along the Danish coast were increased. Also the depths at the southern entrance to the Sound at the Drogden Channel were modified. Furthermore, the bottom friction in the model was investigated. The model tests showed that locally increased bottom friction, only in the Sound area, gave significantly better model simulation results.

Simulation of the November storm with a model run with all the new changes in the model set-up included was promising. The modeled sea level variations at Copenhagen improved the flow through the Sound, and the model system is now able to simulate both of the two high waters in the Sound area during the storm event (Figure 2, green curve).

Common ocean code platform

DMI has the national obligation in Denmark to forecast for storm surges along the Danish coast. The storm surge warnings are issued by the duty forecaster at DMI to the relevant authorities in Denmark as well as to the public via DMI's web page, national television and radio.

The same ocean code forms the platform for the Danish Storm surge model system and the MyOcean's Baltic model system. The ocean model is the HBM code (**H**iromb-**B**OOS-**M**odel). Slightly different versions and model set-up (area set-up, nesting areas, etc.) are applied for the Danish storm surge system and for the MyOcean Baltic set-up due to different scheduling and focus areas. But in general, all model development done at DMI for the North Sea- Baltic Sea region, either initiated within the MyOcean Baltic group or on behalf of issues identified within the Danish storm surge system,

goes into the same ocean model code system. The philosophy behind the common code is that it provides us with a code better than if we had to update two different model code systems.

Models for storm surge and circulation improved

The storm event in November 2011 is one example where the HBM code was improved by allowing different handling of local bottom friction maps. Therefore, a dedicated investigation to improve the national Danish storm surge warning system, led also to an improvement in the MyOcean Baltic group's common ocean model code and therefore to the MyOcean's Baltic forecasting products.

Also improvements in the HBM code done by the other partners in the MyOcean Baltic group may be included in the next upgrade of the code used for the storm surge model and so improve the national Danish storm surge system.

Vibeke Huess is a physical oceanographer and manages the Baltic model group in the MyOcean project.

Palle Bo Nielsen is a physical oceanographer working with sea level, tides and communication.

Both are working in the Centre for Ocean and Ice at the Danish Meteorological Institute.

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OPERATIONAL OCEANOGRAPHIC MODELS AT FMI

Antti Westerlund, Pekka Alenius

The Finnish Meteorological Institute (FMI) has, by Finnish law, the responsibility to produce physical oceanographic services to the Finnish society. This includes warnings of dangerous oceanographic events, delivering oceanographic data and forecasts and the development of new modelling methods and tools. To fulfil this mandate, FMI operates and develops several operational oceanographic models, as well as participates actively in international modelling co-operations.

The core oceanographic forecasts currently produced by FMI's operational 24/7 forecasting system are sea level, wave, sea ice and hydrodynamic (currents, temperature, salinity) forecasts. Forecasts are produced up to four times a day, depending on the model. Sea level forecasts are created with an ensemble of sea level models, including the OAAS (Oleg Andrejev and Aleksandr Sokolov) model and the internally developed Wetehinen model. Model results from several BOOS partners are utilised, too, and the best water level forecast is shared with the BOOS community. Sea ice forecasts are created with the HELMI model (Helsinki Multi-category sea-Ice model) and wave forecasts with WAM. For hydrodynamic forecasts FMI uses HBM (HIROMB-BOOS Model). Also MITGCM is run for those users have not yet migrated to HBM results. Many models are run with both HIRLAM and ECMWF atmospheric forcing. Model products are used by FMI Oceanographic Services, who utilize the results for example to issue oceanographic warnings, by external customers and by the wider public via FMI web pages.

FMI participates in international oceanographic model development mainly in BOOS, HIROMB and MyOcean communities. At present our main

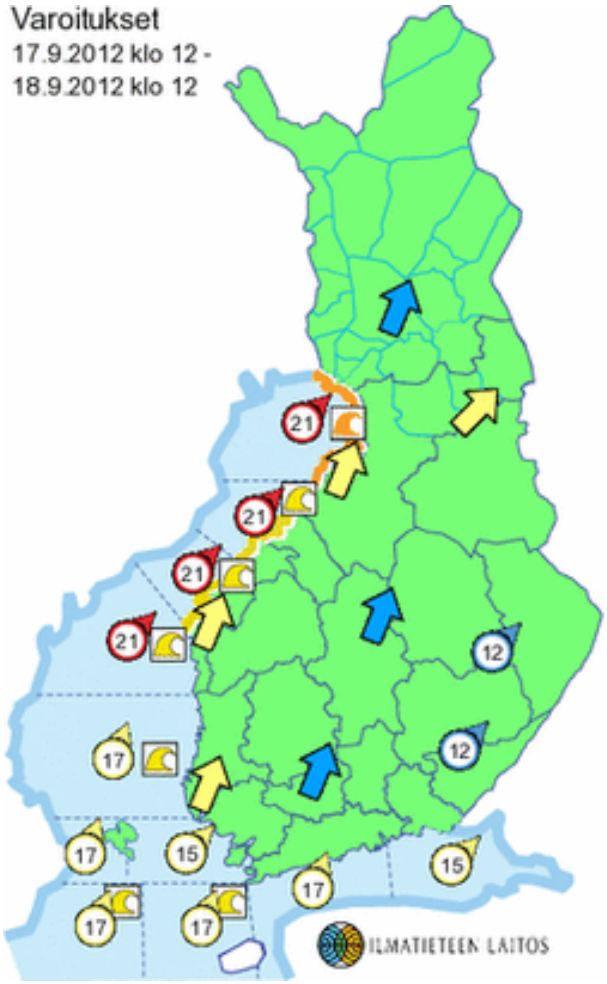

Fig. 1. Warnings issued by the FMI for 17th of September 2012.
The map shows high sea level warnings along the Bothnian coast (coloured shorelines) and wave height warnings (wave symbols) in the Gulf of Bothnia and northern Baltic Proper

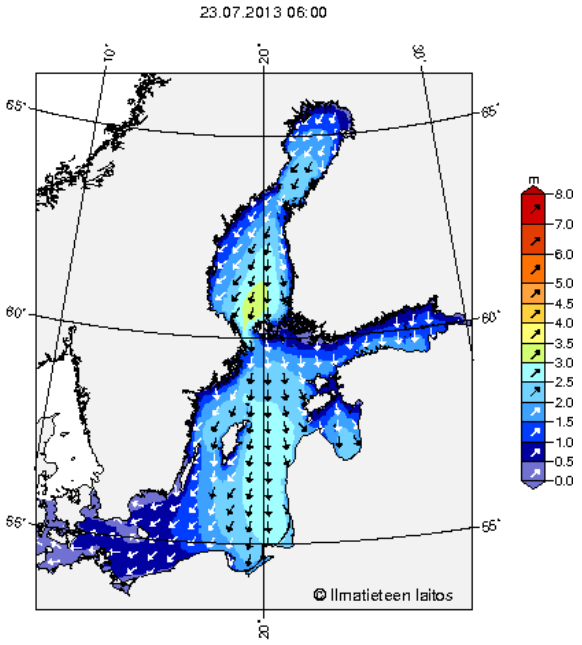

Fig. 2. Wave forecast issued by the FMI on its web page on 23rd of July 2013.

development foci in operational oceanographic modelling are data assimilation, Archipelago Sea wave forecasts and ensemble methods. The suitability of the NEMO model for operational activities is also being evaluated. NEMO is already actively used at FMI for research purposes, but exact schedule for full operationalisation has not been set yet. FMI is joining as a full member to the SeaTrackWeb (STW) consortium. This means possibilities to use STW with local atmospheric forcing and to take part in the development of the STW system, that has been proven to be a valuable and important tool for the Baltic Sea.

FMI offers its oceanographic forecasts and warnings on its website (http://en.ilmatieteenlaitos.fi/marine-weather-and-baltic-sea) and in the Baltic Sea Portal (http://www.itameriportaali.fi, in Finnish and Swedish). Starting from June 2013, many of the oceanographic model forecasts produced by FMI are also available in machine readable form through FMI open data initiative (http://en.ilmatieteenlaitos.fi/open-data). FMI has during the years found BOOS co-operation and operational exchange of data and forecasts of great value in Baltic Sea operational oceanography and wants to be an active part of that in the future, too.

Antti Westerlund works at the Finnish Meteorological Institute, Helsinki, in the Marine Dynamics and Modelling group. He is working on operational oceanographic forecasting systems and model development.
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Pekka Alenius is a physical oceanographer specialised in hydrography, currents and marine data and he has developed a cruise planning software package for Aranda. He works in the Marine dynamics and modelling group of Finnish Meteorological Institute, Helsinki.
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NAVIGATING IN COASTAL WATERS IS A CHALLENGE

Victor Alari

How it all started

Few years ago a leisure sailor dropped in at the Marine Systems Institute (MSI) to discuss possible joint development on wind wave forecast system which (1) could resolve the coastal areas of the Baltic Sea, (2) uses interactive mobile apps to deliver forecasts (3) and is regularly validated with remotely sensed and in situ data. Today the NAVIGATE project (funded by the Eurostars program) is tackling with the above mentioned objectives in order to provide high resolution forecast of spatial wave characteristics coupled with interactive ICT solution to support safer and optimal navigation of small vessels.

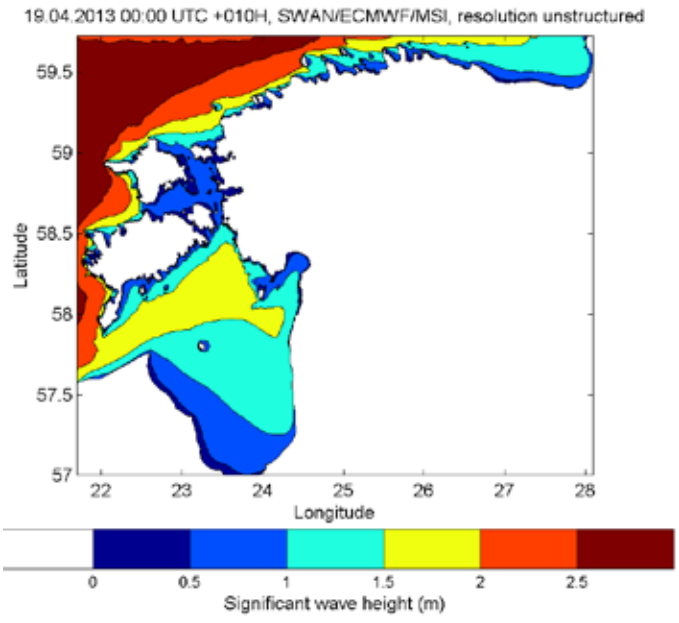

Fig. 1. How a wave forecast would look like for Estonian coastal waters. The fine detail of the wave field is resolved, defining the state of the art for Baltic Sea wave forecasts.

Where are we now

Currently a trial version of unstructured mesh wave forecast is ready (see a snapshot for Estonian coastal waters on Fig. 1) and several testings of optimal configuration of the model are in progress. What do I mean by optimal configuration? To be honest, the Baltic Sea is probably the worst place in the whole world to do wave modeling. Just look at how many islands there are, countless shallows, upwind fetch restrictions and multiple wave systems. And don't forget the ice! It takes much iteration to find the optimal solution and accurate model settings. We are quite fortunate that we can validate and improve our forecast model SWAN with the aid of TerraSAR-X imagery, where the unprecedented spatial resolution of 1 m enables us to really see how complicated and dynamic the coastal wave fields are. About ten in situ 1D wave measurements in Finnish Archipelago and a Waverider in Estonian marine waters forms the core database for validating temporal behavior of forecasted wave characteristics.

What will be the happy end

One of the objectives of BOOS is to improve the safety and efficiency of maritime transport and marine operations. The vision of NAVIGATE project is similar, though we focus and tailor our forecasts to the needs of leisure sailors, who most of the time navigate in coastal areas and archipelagos. At the end of NAVIGATE project (Spring 2014) the wave forecast for coastal regions of the Baltic Sea will be released to public. And like the water never stays still, why should we? New seas and people are waiting for high resolution forecasts.

Victor Alari (PhD) is a researcher in the Marine Systems Institute at Tallinn University of Technology. His interests in physical oceanography include multi-scale wind wave modeling, developing of wave models and particularly unstructured meshes, coupling of wave and circulation models.
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OPERATIONAL MODELING – THE CASE OF THE GULF OF GDAŃSK

Sergio das Neves

This article gives a brief summary of the procedures involved in the run of an operational model for the Gulf of Gdańsk.

For the last 3 years the Department of Oceanography of the Institute of Meteorology and Water Management – National Research Institute (IMWM-NRI) in Poland has been taking advantage of the DHI software tools, applied to a forecasting regional model for the Gulf of Gdansk.
A hydrodynamic model MIKE3 3D of DHI has been used for the simulation of the marine environment in this region of the Baltic Sea
http://baltyk.pogodynka.pl/index.php?page=2&subpage=9

Model simulations provide daily forecast of the sea currents (fig.1), salinity (fig.2) and water temperature (fig.3). The EKOLAB module which is a water quality module run upon the gulf hydrodynamics provides a forecast for nutrients distribution, e.g. nitrates (fig.4), phosphates (fig.5) and also for oxygen concentration (fig.6) and chlorophyll-a (fig.7).

Model daily run

The model is run every day in operational mode with initial conditions for meteorological and oceanographic data. Meteorological data such as clearness, wind conditions, humidity and air temperature from the local numerical model COSMO, are automatically imported to the MIKE model for the whole gulf area. A 24 hours forecast is then produced for the gulf region and a thermohaline pattern of the Gulf of Gdańsk - a volume data grid containing the distribution of the T/S and nutrient values is then generated.

A "warm start" run of the model has been adopted in order to reduce the model spin up time, which means that the saved T/S and nutrient fields from the previous forecast of the model are used to initialize the next simulation.

In addition, the hydrodynamic model takes into account the nutrients, chlorophyll-a and oxygen inflow into the Gulf of Gdańsk, by automatically importing once a day the daily measured values originating from rivers' discharge.

Data assimilation

In order to improve forecast quality, monitoring data has been used for reanalysis of the simulations and for generating quasi real thermohaline conditions after each monitoring cruise.

Temperature, salinity, chlorophyll-a and dissolved oxygen data measured every 2 months during cruises are processed to generate data files which in turn are read by MIKE software for creating a grid of points in a 5 layer scheme distribution (model is run for σ-coordinates). Generated grid points with new temperature, salinity, oxygen and chlorophyll-a data are interpolated for the whole Gulf of Gdansk using an inverse-distance weighted procedure.

Simultaneously, meteorological real data obtained from the database located in IMWM-NRI: wind direction and speed, clearness, relative humidity, air temperature and precipitation are provided for the whole hindcast period starting on the recent cruise date. The next step consists of running the model in hindcast mode for the whole time simulation backwards. An updated forecast is then generated, containing a quasi-real temperature, salinity, oxygen concentration and chlorophyll-a pattern which in turn will produce trustworthy initial conditions for further forecast simulations.

Włodzimierz Krzymiński has a master's degree in physical Oceanography from the University of Gdańsk and he is the manager of the Department of Oceanography and Baltic Monitoring of the Institute of Meteorology and Water Management – National Research Institute (IMWM-NRI) in Poland and the person who commands all the works that have been conducted with the model of the Gulf of Gdansk.
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Sergio das Neves is an oceanographer at the Maritime Branch of Institute of Meteorology and Water Management (IMWM) in Poland. He has a master's degree in physical oceanography from the Physics Department of Lisbon University in Portugal. During the recent 4 years he has been involved in operational oceanography by taking advantage of the DHI software tools, applied to a simulation model for the Gulf of Gdańsk, in the Department of Oceanography and Baltic Monitoring of the Institute of Meteorology and Water Management – National Research Institute (IMWM-NRI) in Poland.
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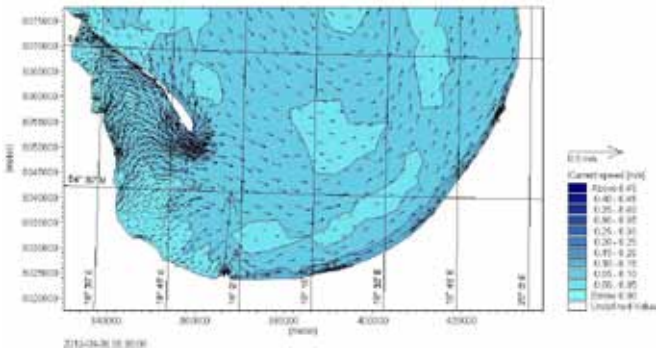

Fig. 1.
Daily forecast for current field distribution in the Gulf of Gdańsk.

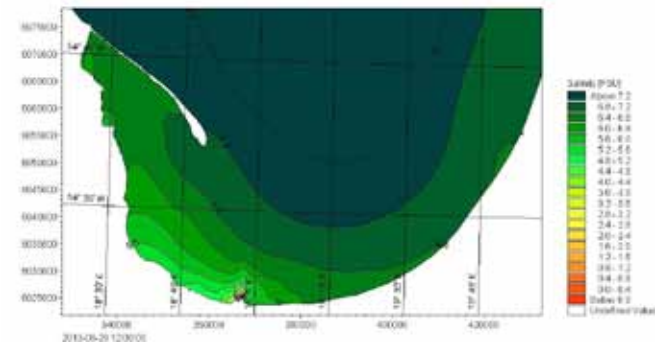

Fig. 2.
Daily forecast for salinity distribution in the Gulf of Gdańsk.

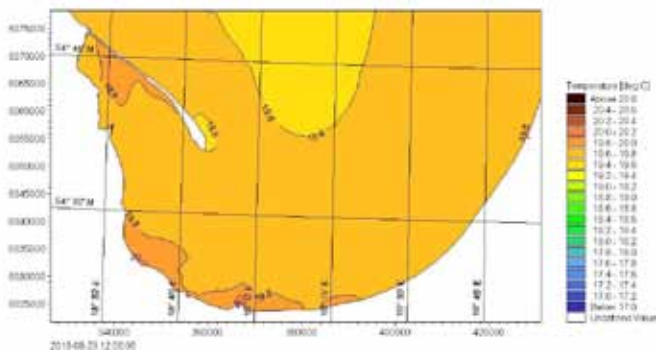

Fig. 3.
Daily forecast for the temperature field in the Gulf of Gdańsk.

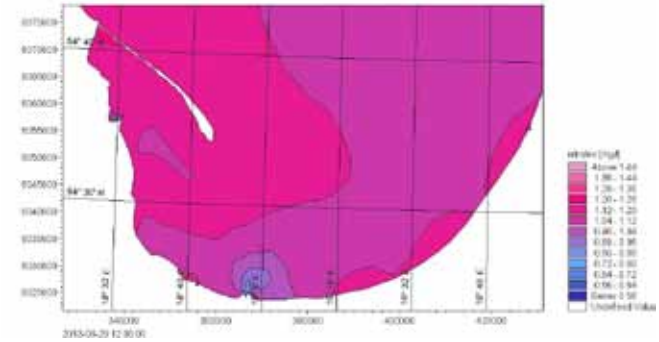

Fig. 4.
Daily forecast for nitrates distribution in the Gulf of Gdańsk.

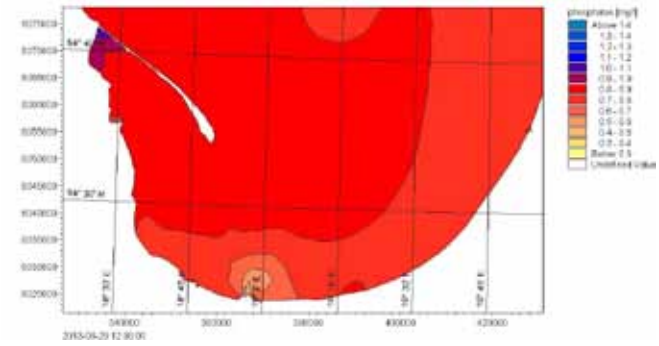

Fig. 5.
Daily forecast for phosphates distribution in the Gulf of Gdańsk

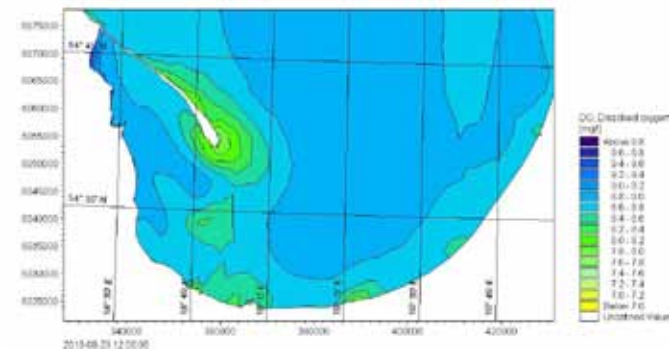

Fig. 6.
Daily forecast for oxygen concentration distribution in the Gulf of Gdańsk.

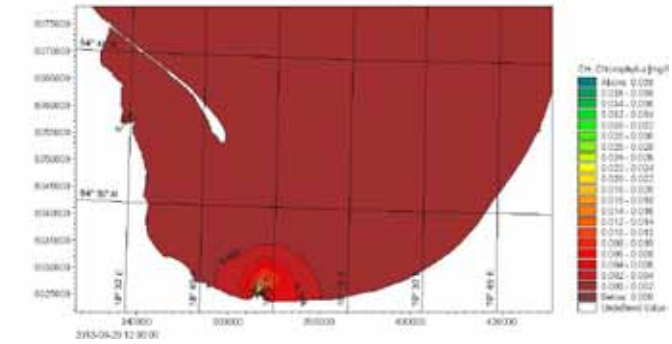

Fig. 7.
Daily forecast for chlorophyll-a distribution in the Gulf of Gdańsk.

FCOO MODELS AND FORECASTING SYSTEMS

Johan Söderkvist

GETM setups

A suite of nested setups of the General Estuarine Transport Model (GETM) is in operational forecasting use at Defence Center for Operational Oceanography (FCOO). The setups include a barotropic surge model of the North Atlantic with a horizontal resolution of 3 nm (NA3) and two baroclinic models with 60 vertical layers: an outer setup covering the North Sea–Baltic Sea area in 1 nm resolution (NS1C), and an inner setup with 600 m horizontal resolution (DK600) (Fig. 1). The model is forced by DMI HIRLAM weather forecast, a tidal model at the NS1C boundary, and river data from BSH and SMHI. The forecasts are updated every six hours. When improving the GETM setups, a series of hindcast studies are performed. For validation, we have been using observed sea-level from the BOOS data portal, DaMSA (DK), BODC, Rijkswaterstaat (NDL), Vlaamsehydrografie (BE), and Kartverket (NO). Observed salinity and temperature have been delivered by SMHI, NERI, and BSH.

WW3 setups

FCOO uses WaveWatch III to produce wave forecasts four times a day. The model is forced by DMI HIRLAM weather forecast. There are three nested setups that cover the i) North Atlantic, ii) North Sea to the Baltic Sea, and iii) inner Danish waters.

Dissemination

Forecasts from GETM and WW3 are presented on the website ifm.fcoo.dk; from eastern North Sea to the southern Baltic Sea. Time series of observed and forecasted sea-level at Danish stations are also presented on the website. The GETM forecasts also provide online information to Search and Rescue operations, marine exercises, and Vessel Traffic Services in the Great Belt and the Sound.

Fig. 1. Model setup for three nested domains running operationally at DaMSA: 3 nm barotropic surge model (NA3), and 1 nm (NS1C) and 600 m (DK600) 60 layer baroclinic models.

SeatrackWeb

Together with SMHI and BSH, FCOO runs and develops Seatrack Web, an operational oil drift forecasting system for spill response purposes. The system covers the Baltic Sea area and the eastern part of the North Sea. The system is available on-line, which allows users to start a simulation and have the results presented in their local computer. On the basis of the most recent wind and current forecasts, the drift model calculates the drift and spreading using a Lagrangian particle tracking technique. Weathering processes such as evaporation, vertical dispersion and formation of water-in-oil emulsions are calculated. The results are presented on a map as particle clouds at different times along with various geographic information. Seatrack Web is supported by the HELCOM contracting parties and has been used by authorities in the countries surrounding the Baltic Sea for about 20 years.

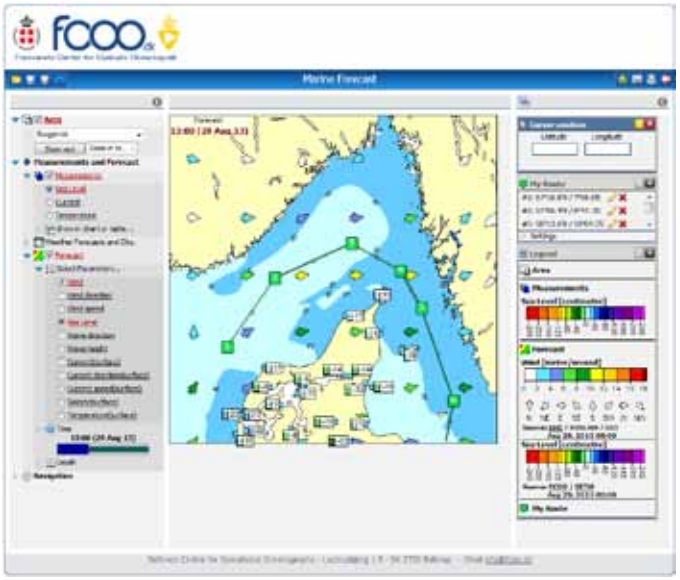

Fig. 2. Marine forecast snapshot

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The Institute of Oceanography of the University of Gdańsk

WHAT IS GOING ON IN THE IOUG

Aleksandra Dudkowska

The Institute of Oceanography (IOUG) is a unique institution of higher education in Poland that has been training students in oceanography since the 1970s. The Institute is a unit of the University of Gdańsk, and is located in Gdynia (see photo). The IOUG staff consists of 150 researchers, technicians and PhD students, who work in the following disciplines: Physical Oceanography, Marine Biology, Marine Chemistry and Marine Geology. The Hel Marine Station located at the tip of the Hel Peninsula is also part of the Institute. IOUG is presently equipped with one research vessel "OCEANOGRAF-2". Next year a new one, modern and specialised r/v OCEANOGRAF will be entered into exploitation.

Educational activities

Our study programme offers courses for both undergraduate and postgraduate students. They can choose among the following pathways:

Marine Physics, Marine Biology, Protection and Management of Marine Resources, Marine Ecobiotechnology, Marine Geology, Marine and Atmospheric Chemistry. The students get also practical training at sea on the institute's boat and on research vessels of co-operating institutions.

Research

The Institute conducts interdisciplinary research in all aspects of marine science with special attention to coastal zone of the shelf seas. It focuses primarily on the southern Baltic Sea and particularly the Gulf of Gdańsk but other regions including polar zones are also investigated. The principle areas of research include the following:

- sea dynamics, operational forecasting of hydrodynamics of the Baltic Sea including waves (WAM, SWAN), currents and sea level and other parameters like water temperature, salinity, etc. (M3D),
- developing numerical modelling of ecohydrodynamics of the Baltic Sea on regional and local sea scales,
- developing methods for the analysis of satellite and aerial images of the sea and coastal areas,
- investigation of acoustic waves scattering by fish, zooplankton and benthic organisms,
- research on interaction of sound waves with the sea floor; development of sediment recognition techniques based on hydroacoustic methods,
- interdisciplinary approach for coastal waters with a special focus on designated NATURA 2000 areas,
- pollution evaluation of marine environment and coastal ecosystems,
- support of marine ecosystem management.

The Department of Physical Oceanography of the IOUG contains four research sections: Laboratory of Sea Dynamics, Laboratory of Remote Sensing and Spatial Analysis, Laboratory of Marine Acoustics and Laboratory of GIS and Geostatistics. The physical oceanography group is engaged in study of sea hydrodynamics and physical properties of seawater and processes taking place in the coastal waters of the southern Baltic, particularly in the Gulf of Gdańsk.

Satellite remote sensing methods are used to estimate physical and biological properties of seawater, the sea surface temperature, the surface chlorophyll concentration as well as to analyse such phenomena like coastal upwelling events or spreading of inland waters into the coastal area (see Figure 1). The remote sensing techniques are also implemented for assessing solar energy reaching the sea surface and ice cover of the Baltic Sea.

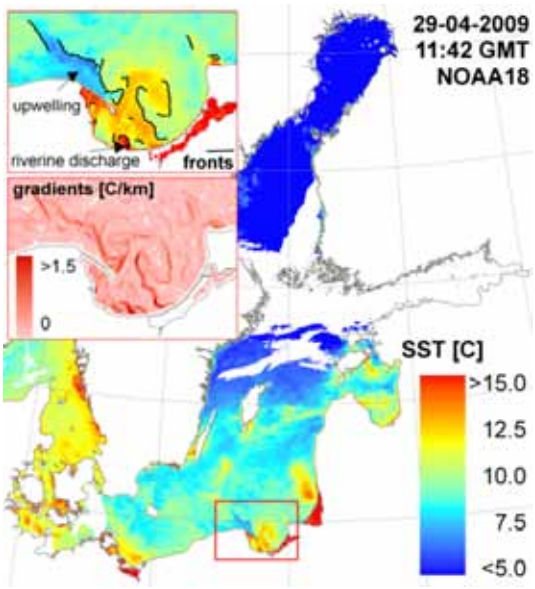

Fig. 1. Sea surface temperature distribution and its derivatives (maps of temperature gradients and location of thermal fronts) based on satellite data

Theoretical analysis methods as well as the numerical and parametric modelling are used to study the interaction of the sea, the atmosphere and the continental hydrosphere and also hydrodynamic and ecological processes. Among the models used the following work operationally:

- M3D is the hydrodynamic model with data assimilation of physical parameters (see Figure 2). This model runs as operational, assimilating sea level data observed by the net BOOS system in the Baltic, 3D distribution of T/S observed and recorded by net of buoys as well as the SST delivered daily by DMI.
- ProDeMo (Production and Destruction of Organic Matter Model) is the ecosystem part of the M3D model that has been developed and applied to the Baltic Sea. It describes nutrient cycles, oxygen conditions and the parameterization of water-sediment interactions.
- The wind wave modelling by the use of WAM (Wave Model) was implemented in the Institute

in 2000. Figure 3 shows the WAM forecast of significant wave height for the storm in February 2011. The operational wind wave forecasting system for the Baltic Sea and the Gulf of Gdańsk based on the WAM setup developed within the EU-research project HIPOCAS is under development in the Institute now. Recently, a coupled ocean circulation-wave model POM08 (Princeton Ocean Model 2008) is being implemented based on Mellor et. al. (2008).

National and international projects

In recent years the Institute of Oceanography has been involved in several national and international projects. Among those related to operational oceanography were HIPOCAS (Hindcast of Dynamic Processes of the Ocean and Coastal Areas of Europe), ECOOP (European COastal-shelf sea OPerational observing and forecasting system) and currently underway: PROZA (Operational decision-making based on atmospheric conditions) and SatBaltic (Satellite Monitoring of the Baltic Sea environment).

The task of the project PROZA implemented in IOUG is to develop a coupled wave-current model for the Baltic Sea and the Gulf of Gdańsk working in operational mode. The coupled wave-current nested models together with systematic routine measurements of the sea and atmosphere parameters will compose a basis of a hydrometeorological forecasting and warning system which is being developed within PROZA.

The main aim of the SatBaltic project is to prepare and set in motion the technical infrastructure and practical operational procedures for the efficient, routine monitoring of the states of the Baltic environment. The task of IOUG is the production of maps of the sea's structural and functional characteristics, including the temperature distributions, ice cover, and the dynamic state of the sea surface and the occurrence of upwelling.

Dr Aleksandra Dudkowska is a physicist graduated from the University of Gdańsk. Her research interests are focused in sea dynamics and particularly in currents and wave processes including their numerical modelling. She is also interested in statistical physics and in the physics of complex systems.
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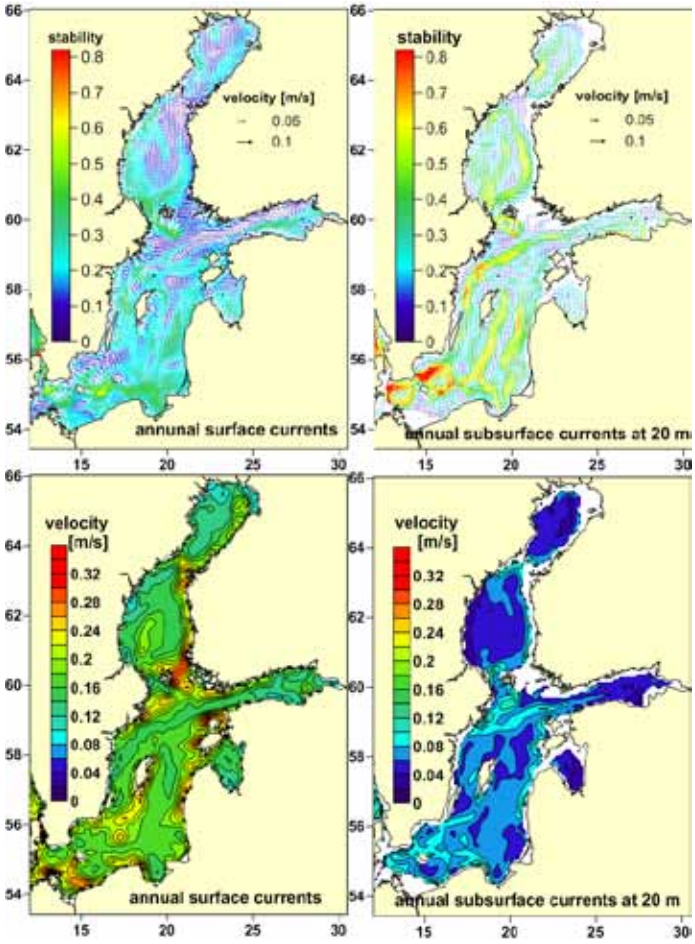

Fig. 2. Annual averaged (1958-2001) surface and subsurface currents of the Baltic Sea calculated by M3D model.

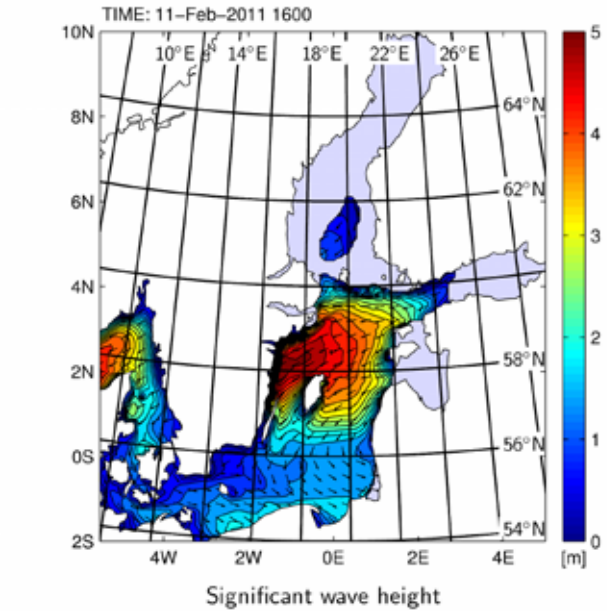

Fig. 3. The WAM model forecast

THE LEIBNIZ INSTITUTE FOR BALTIC SEA RESEARCH WARNEMÜNDE IN SHORT

Barbara Hentzsch

The Leibniz Institute for Baltic Sea Research Warnemünde (in short: IOW) is a public research institute. Its legal status is that of a public-law foundation. The IOW´s mission is to conduct interdisciplinary marine research in coastal seas, with special emphasis on the Baltic Sea. It has four departments representing the disciplines of physical oceanography, marine chemistry, biological oceanography and marine geology. An instrumentation group is affiliated with the department Physical Oceanography. The departments work jointly on a long-term research programme with the research foci "Small and mesoscale processes", "Basin-scale Ecosystem Dynamics", "Changing Ecosystems" and "Coastal Sea and Society".

Research at the IOW focuses on observations and modelling of ecosystem changes and their underlying processes in marginal seas and shelf regions. It aims to acquire an in-depth understanding of the functions of the ecosystem with the overall objective to differentiate between natural variability and anthropogenically triggered changes.

IOW scientists seek to understand the processes that occur in the different compartments of our model ocean, the Baltic Sea. These insights are used to decipher its history. Data from a long-term observation programme allow the detection of natural fluctuations, trends and anthropogenically driven shifts. In addition, the data are used to construct "what-if " model scenarios as future projections.

The long-term observation data from the Baltic Sea, collected and hosted at the IOW, are a valuable treasure for the entire coastal sea research community and are characteristic of the IOW's work. In conjunction with ongoing monitoring programmes, these time series ensure high-quality data support for hydrodynamic and ecosystem models and enable the institute to analyse trends.

The IOW contributes significantly to the sound scientific knowledge that is needed in order to implement the marine strategy for the Baltic Sea, thus playing a vital role in this process. Therefore, the institute closely cooperates with ministries, agencies and authorities, at both the federal and state level. The Federal Maritime and Hydrographic Agency (BSH) has entrusted the IOW with the Baltic Sea Monitoring Programme, to which the Federal Republic of Germany and the other countries bordering the Baltic Sea committed themselves in the Helsinki Convention. Besides, the IOW runs for the BSH three autonomous measuring stations in the western Baltic Sea (at Darss Sill, in the Arkona Basin and Odra Bight) which deliver oceanographic data from different water levels around the clock.

The nine IOW professors are simultaneously members of the universities in Rostock and Greifswald.

For sea going work, the IOW scientists have r/v Elisabeth Mann Borgese (length o.a.: 56.50 m) and r/v Maria S. Merian (length o. a.: 94.80 m) at their disposal.

In total, round about 200 employees are working with the IOW. The mean annual basic budget amounts up to 15 Mio Euro. In addition, a mean value of 9 Mio Euro is acquired per year.

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LEIBNIZ INSTITUTE FOR BALTIC SEA RESEARCH WARNEMÜNDE

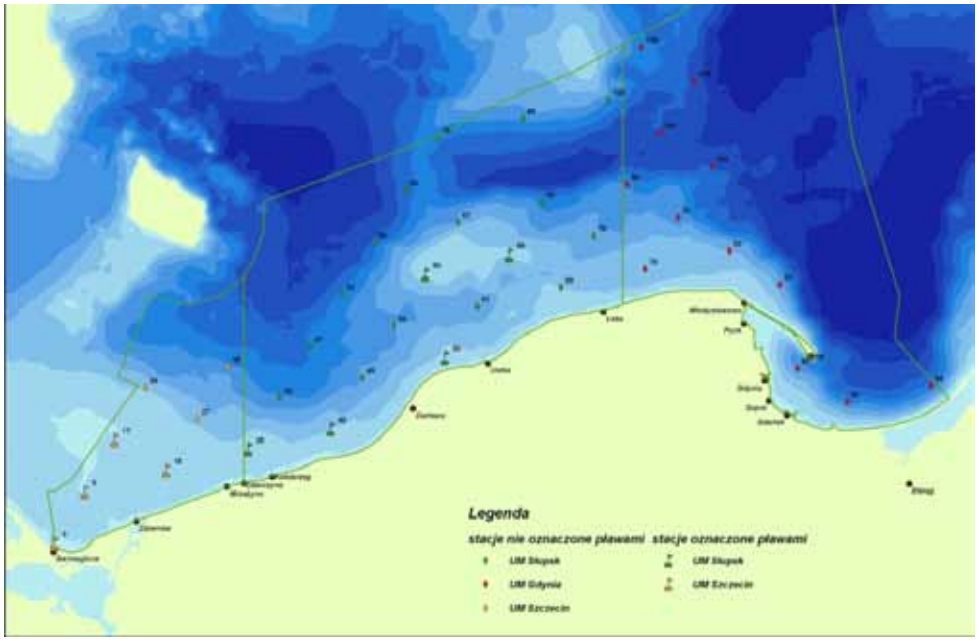

Fig. 1. Map showing the locations of the anchor sets of hydroacoustic equipment containing the recording POD devices, in the polish sector of the Baltic Sea.

PROJECT SAMBAH IN POLAND

Sergio das Neves

Static Acoustic Monitoring of the Baltic Sea Harbour Porpoise – is an international project funded by LIFE+, involving all EU countries around the Baltic Sea, with the ultimate goal to secure the conservation of the Baltic Sea harbour porpoise.The Maritime Branch of IMWM-NRI in Gdynia has been a partner in the project SAMBAH since 2011, cooperating with the Marine Station of the University of Gdansk in Hel in the task of deployment/retrieval of monitoring hydroacoustic Cetacean Porpoise Detectors C-POD devices in the Polish Baltic Sea. These devices capture and record the sounds emitted by baltic porpoises. This project is the basis for the development of new research methods in order to obtain information on the number of individuals and porpoises migration routes in the sea. The Department of Oceanography of IMWM-NRI was responsible for the deployment of the mooring systems – anchor sets - to which the underwater acoustic devices were attached, and lately, for their retrieval from the water, after a 2 years recording period.

In similarity with the remaining Baltic countries involved in the project, mooring systems in the Polish Economic Zone of the Baltic Sea, were placed in the bottom of the sea, at the points specified by the project (fig.1) in a total of 39 sets, in places where bottom depth varies from 10 to 70m. The devices were deployed from onboard of R/V Baltica during two cruises between 19th March and 1st April 2011. Another cruise was carried out by IMWM-NRI from 12th to 18th June 2013 in order to take the moorings out form the sea. In addition, in both cruises, a CTD hydrology mapping and an ADCP currents profiling were carried out by IMWM-NRI, in the area covered by SAMBAH mooring points. Collected data provided important tools to have a better understanding of the environmental conditions taking place during both actions.

Check http://www.sambah.org
for more information and results of the project.

SURVEY CRUISE SCHEDULES

BSH - www.bsh.de/en/Marine_uses/Science/Research_vessels/index.jsp

IMWM-NIR - www.mir.gdynia.pl/?page_id=12

MSI - www.ttu.ee/institutes/marine-systems-institute/research-vessel

SYKE - www.itameriportaali.fi/en/aranda/aranda_matkat/en_GB/2013

R/V Ludwig Prandtl

Ideas/topics for the coming issues of the newsletter are welcome!

All contributions to the newsletter (news, links to research cruise schedules, articles, photos, new projects etc.) are welcome to Mairi Uiboaed, project manager at Marine Systems Institute (mairi.uiboaed@msi.ttu.ee).

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