Volume 3 Spring 2013

NEWS FROM BOOS

NEW

FOCUS ON OBSERVATION PLATFORMS

IN THIS ISSUE

UPCOMING EVENTS

24-25 April 2013
5th Ferrybox Workshop
Helsinki, Finland

28-30 May 2013
BOOS/HIROMB Annual Meetings and scientific seminar
Tallinn, Estonia

26-30 August 2013
9th Baltic Sea Science Congress
Klaipeda, Lithuania

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,

A year has passed since the publishing of the first issue of this newsletter. There is a growing interest in the publication – both for publishing in it and reading it. The newsletter has also attracted attention outside the BOOS community. Which is great, for this is why it is being published in the first place: to make the services and information more visible for the wider public.

The third issue talks about various observation platforms. You can read about BSH's FINO station, DMI's combined buoy, and FMI's experiments with Argo floats; but also an overview of experience with COSYNA (Coastal Observing System for Northern and Arctic Seas) is given. The articles are nicely illustrated with photos and schemes.

And yet some member institutes are introduced in this issue, including the most recent member of BOOS: the St. Petersburg Branch of State Oceanographic Institute. As usual, the publication is also available on-line, on the BOOS web site.

Enjoy reading!

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!

FINO II – A NEW FIXED STATION FOR HYDROGRAPHIC MEASUREMENTS

Jan H. Reißmann

The FINO project is dedicated to accompanying research into offshore wind energy plants and their impact on the marine environment since 2002. It is founded by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). In the context of this project three fixed stations were built in the North and Baltic Sea, see Fig.1. These stations were mainly used for meteorological observations and measurements at the sea surface. However, FINO I and III in the North Sea were already also equipped with hydrographic measurement systems which deliver data within the framework of the German Marine Observation Network in the North and Baltic Sea MARNET operated by the Federal Maritime and Hydrographic Agency (BSH). In addition to the MARNET in the Baltic Sea, FINO II is now planned to be equipped with a hydrographic measurement system, too. This system is designed and will be installed, brought to operational service, and maintained mainly by the Leibniz-Institut für Ostseeforschung Warnemünde (IOW) on behalf of the BSH.

FINO II is located on the south-eastern edge of Kriegers Flak at 55° 0’ 25’’ N, 13° 9’ 15’’ E. The water depth at its location is about 20 m. The setup of the planned hydrographic measurement system is depicted in Fig. 2. Basically, measurements are made by a hydrographic chain on ten equidistant levels between 2 m and 20 m water depth. Conductivity, temperature, and pressure are measured at each level. Additionally, dissolved Oxygen (two sensors at each level), Chlorophyll A, and turbidity are measured at the 2 m, 12 m, and 20 m levels. The measurement of pH at these three levels will be prepared. Current speed and direction, wave height and direction as well as sea level will be measured by additional instruments placed on the sea floor at a distance of about 50 m away from the platform to ensure undisturbed measurements of these quantities. All measurements are done in a ten minutes cycle and internally stored by the instruments. Once every hour the stored data will be transferred from the hydrographic chain and the additional instruments on the sea floor to a platform computer by means of inductive and acoustic modems, respectively, and directly transmitted to land by satellite. The sea state parameters will be available in near real time at land even twice every hour.

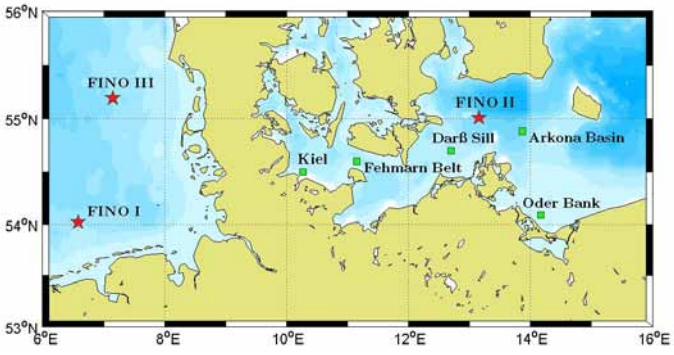

Fig. 1. Locations of the three FINO platforms and the Baltic Sea MARNET stations.

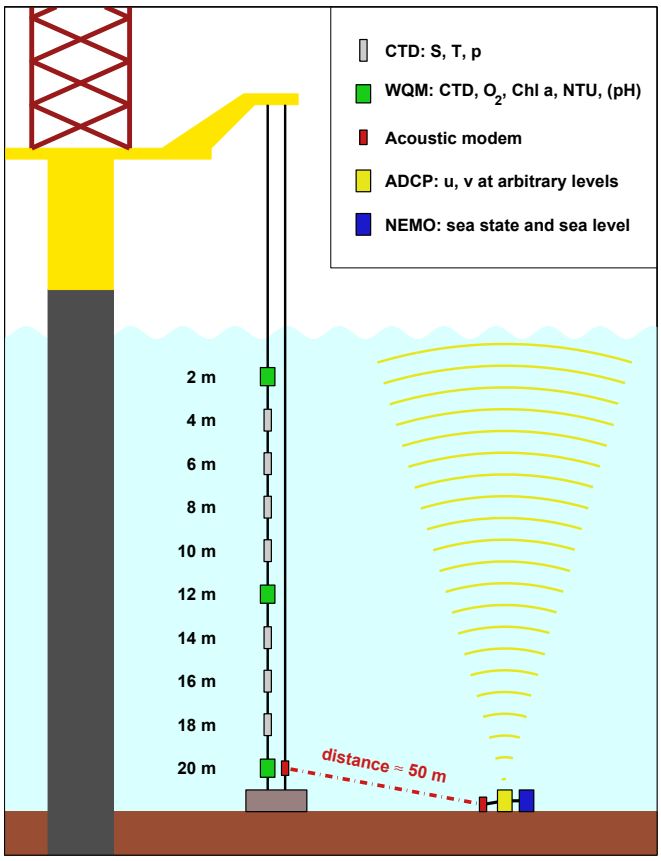

Fig. 2. The setup of the planned hydrographic measurement system at FINO II.

Currently the measurement system is assembled at IOW for laboratory tests. After the final adaptation of the platform davits holding the hydrographic chain and the additional cable of the acoustic modem for communication with the instruments placed on the sea floor, the measurement system will be mounted on FINO II. This is planned to be completed this summer. It is expected that the measurement system will be brought to operational service by the end of this year. The data will be delivered within the BSH MARNET although FINO is a BMU founded project.

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A COMBINED NAVIGATIONAL BUOY AND CURRENT METER

Palle Bo Nielsen

In the Great Belt, an apparently quite traditional, yellow navigation buoy rocks in the waves. However, if a skilled navigator passes by and looks closer, he will notice an unusual, little orange box at the top. What he cannot see, is a current meter mounted in bottom of the buoy measuring the current profile every 10 minutes and sending the data in real time to DMI in Copenhagen.

400 navigation buoys as potential platforms for current measurement

The navigational buoy is a traditional one that weighs 2,5-3 tons and is 6-9 meters long. A number of 400 exist in the Danish waters, usually positioned along the main shipping routes. But this one is equipped with an acoustic current profiler in the bottom and a combined compass and communication unit on the top. The modified buoy has now been in continuous operation for more than two month which demonstrates the success of the project ProOcean.

"The modifications we have made in the bottom and on the top are standardised, so that other navigation buoys can easily be upgraded to combined navigation and current meter buoys," Finn Milvertz says. He is electronics technician at DMI and strongly involved in ProOcean.

The development of this type of buoy started at the Danish Maritime Safety Administration (DaMSA) three years ago and is now continued as a co-operation between the DMI and the Danish Maritime Authority (DMA) as a consequence of DaMSA's closing down in 2011. The role of DMA is to provide workshop and ship facilities.

Fig. 1. The navigation buoy with a current profiler placed in the bottom ready for deployment in the Great Belt.

Traditional measurement of current threatened by sea ice

A traditional way of measuring current at sea is by means of an oceanographic buoy with current meters. This buoy is small compared with the navigational buoys. It is made of plastic and thus is sensitive to sea ice. It has to be withdrawn even in case of minor ice. It also needs floating markers around to protect it from the ship traffic.

Another method is by means of a current profiler placed on the sea bottom. It can operate during an ice season but requires power supply from an installation nearby, e.g. an off shore light house.

A marking buoy in itself

The new current meter buoy has several advantages compared to the oceanographic buoys and bottom-mounted current profilers:

1 - The buoy is made of iron and is therefore ice resistant. It needs to be withdrawn only during periods with extremely dense sea ice (has not happened in Danish waters during the past 30 years) and therefore opens for a high data coverage.

2 - The buoy is of standard type, and the upgrade to a current meter buoy is cheap compared to the price of a dedicated oceanographic buoy or bottom mounted profiler.

Fig. 2. The bottom of the buoy with a current profiler mounted.

3 - The buoy is a marking in itself and thus needs no extra markings moored around. This reduces the deployment and operation costs.

4 - Power consumption is very low and only a small fraction of the ordinary consumption of the buoy. The batteries last for several years.

5 - The buoys of this type are already placed at about 400 positions in the Danish waters mainly along the main navigation routes. This allows for measuring currents cheap and easily at many places.

A current profile every 10 minutes

The current meter buoy is now delivering current profile data real time every 10 minutes to the users. The current profile data consist of the speed and direction for every meter from 3,5 m depth to the bottom (around 21 meter). The data from the uppermost reading are accessible via the DMI web site.

The prototype is running satisfactorily and only minor modifications are planned, e.g. streamlining the communication box to a more ice resistant one. The buoy will probably substitute the use of oceanographic buoys in Danish waters in the future.

*Fig. 3.*The top of the buoy with a box containing the communication equipment and a compass.

Palle Bo Nielsen is a physical oceanographer in the Centre for Ocean and Ice at the Danish Meteorological Institute working with sea level, tides, and communication.
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FINNISH METEOROLOGICAL INSTITUTE'S ARGO FLOAT EXPERIMENTS IN THE BALTIC SEA

Petra Roiha, Tero Purokoski, Simo Siiriä

In year 2011 Finnish Meteorological Institute started experimenting with two Argo floats in the Baltic Sea. The Argo floats have been used as essential tools in deep oceans for measuring salinity, temperature and other variables in areas that are too remote for regular cruises, but not in the shallow sea areas.

The Baltic Sea differs remarkably from other areas where Argo floats have traditionally been used: it is brackish, very shallow, heavily trafficked and the northern parts freeze during the winter. In the deep oceans the risk of collision with vessels or the bottom contact is practically non-existent. Keeping these issues in mind the first testing site for floats was chosen in the Bothnian Sea.

In 2010 FMI ordered two Apex floats to be deployed in the Baltic Sea. Before that FMI had had four floats measuring in the Sea of Greenland. Both of the Baltic Sea floats use two-way Iridium satellite connection so they can send the data to the FMI server and also receive new mission parameters for manoeuvering the floats. The floats have salinity, temperature and pressure sensors and are specifically balanced to work in the salinity conditions of the Bothnian Sea.

During years 2011 and 2012 few short technical experiments were made to assess the diving dynamics of the floats. Based on these test dives it was decided to deploy one float for a longer mission in 2012. Since the diving control algorithm of the Argo floats in general is too slow for the Baltic Sea, a joint project with the Aalto University was started with the aim to modify the other floats' firmware and thus enabling it to settle to the target dive depth quicker. These modifications were successfully tested in summer 2012, too.

The float for the longer mission was deployed on 17th of May on the deep outside of Pori with the Pori Coast Guard. It was recovered on 5th of December with Turku Air Patrol Squadron helicopter and rescue swimmer outside of Rauma. The float's mission lasted over half a year and the float measured over 200 salinity and temperature profiles.

The measurement cycle of the float was on average 24 hours. This is short compared to the regular deep ocean float, which normally has a cycle length of around 10 days. During the cycle the float spent most of the time in deep (50-70 metres) and made

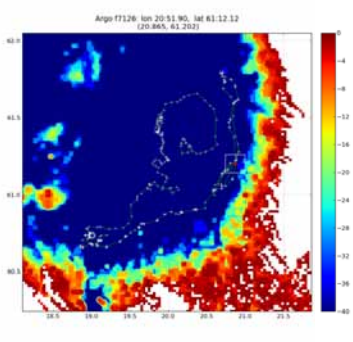

Fig. 1. Argo float's route during its mission from 17th May to 5th December. The red dot indicates the location where the float was recovered

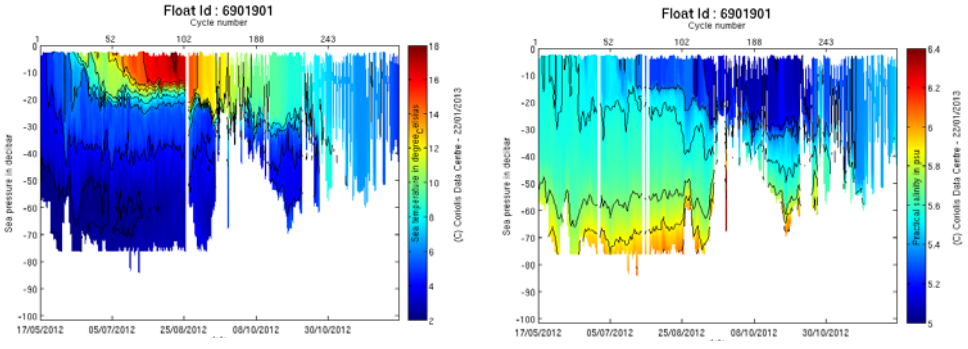

Fig. 2. Temperature and salinity profiles measured during the mission

one profile on its way to the surface. During the float's mission the duration of the cycle and diving depth were changed depending on the weather conditions and water depth. The float worked extremely reliably, even during the storms, and the FMI server received 100% of the profiles.

In spring 2013 two floats will be deployed to the Bothnian Sea.

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Tero Purokoski works at Finnish Meteorological Institute in Marine Technology Services group as a technical expert. He has been involved in numerous oceanographic instrumentation projects.

Simo Siiriä is a postdoc developing computational models and data-assimilation in the Marine Dynamics and Modelling group in the Finnish Meteorological Institute.

TEN YEARS OF pCO_2 MEASUREMENTS AT IOW

Bernd Schneider

Studies have been performed of the marine CO_2 system for about 20 years at the Baltic Sea Research Institute in Warnemünde. The investigations are mainly aimed at quantification of the net community production and the relationship with the availability of nutrients. They are thus closely related to the eutrophication of the Baltic Sea. Measurements of the CO_2 partial pressure (pCO_2) are an ideal tool for such studies since the production and mineralization of organic matter are accompanied by the consumption or release of CO_2. Furthermore, due to the slow equilibration with atmospheric CO_2, the biological signal is conserved for a long time in the surface water. After a series of research cruises it was recognized that the high temporal and spatial variability requires an autonomous measurement system deployed on a SOOP line. Thanks to the cooperativeness of the scientists and technicians responsible for the Finnish Alg@line Project, it was possible to install in 2003 a fully automated pCO_2 measurement system on cargo ship "Finnpartner" that was later on replaced by the "Finnmaid". In 2005 the system was complemented by a device for the continuous recording of the oxygen concentrations and since 2009 also methane is included in the measurements. The ship commutes

Fig. 1. "Finnmaid"

regularly at 2 – 3 day intervals between Lübeck and Helsinki and since 2009 visited occasionally also Gdynia (Fig. 1).

The pronounced seasonality of the surface water pCO_2 in the Baltic Proper is illustrated in Fig. 2 which shows the mean pCO_2 in the eastern Gotland Sea (encircled area in Fig. 2) observed in the years 2004 – 2011. During late autumn and winter, deep mixing transports CO_2 to the surface and causes a pCO_2 that exceeds the atmospheric CO_2 and makes this region a source for atmospheric CO_2. A sudden drop of the pCO_2 below the atmospheric level occurs with onset of the spring plankton bloom and the surface water becomes a sink for atmospheric CO_2. The minimum is observed by mid-May and the pCO_2 starts to increase again until mid-June. This is due to the rising temperature while regenerated production takes place which has only a minor effect on the CO_2 budget. A second pCO_2 minimum

is observed in July and reflects another major bloom event that is based on nitrogen fixation. In the following weeks the pCO_2 is increasing again due to mineralization of organic matter and deep mixing and goes finally beyond the atmospheric value.

The data facilitated an estimate CO_2 gas exchange balance which showed that the Baltic Sea is a weak sink for atmospheric CO_2. But, more important, transferring the pCO_2 to seasonal changes in the total CO_2 concentrations and accounting for the CO_2 gas exchange, yielded rates for the net community production. Their relationship to the concentrations of nitrate and phosphate provided new insights in the factors controlling the chronology and intensity of spring/summer production in the Baltic Sea.

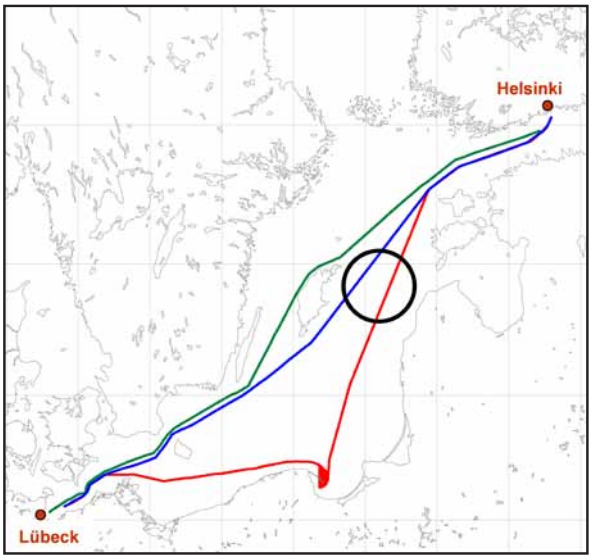

Fig. 2. Route of SOOP „Finnmaid". The circle indicates the area for which the mean pCO_2 in Fig. 2 were calculated.

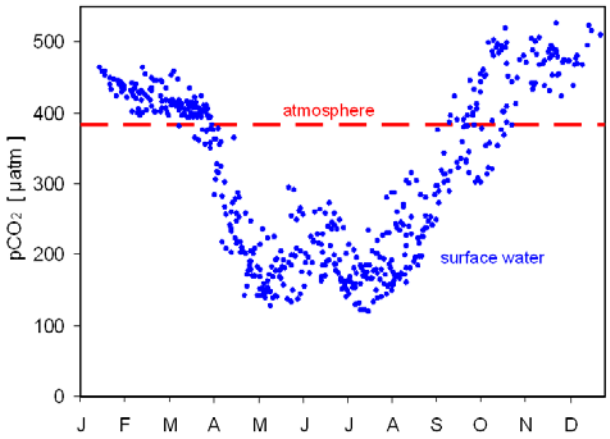

Fig. 3. Surface water CO_2 partial pressures (pCO_2) in the eastern Gotland Sea (see Fig. 2) during 2004 – 2011 and the mean atmospheric pCO_2 .

Bernd Schneider is a chemical oceanographer at the Leibniz Institute for Baltic Sea Research in Warnemünde. His research focuses on the marine CO_2 system of the Baltic Sea and the relationship to biogeochemical processes.
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COSYNA: COASTAL OBSERVING SYSTEM FOR NORTHERN AND ARCTIC SEAS

Christiane Eschenbach

The North Sea hosts unique ecosystems, provides numerous services to society, and mediates important matter fluxes with significant impacts on regional water quality and the global climate. Current observations reveal changes in biogeochemistry and food webs, but neither the causes nor consequences of these shifts are known. A key question is how the numerous interactions between physical, biogeochemical and ecological parameters of coastal seas can be best described and how they will evolve in future.

COSYNA established an operational, integrated observational system for the German shelf sea which is spatially distributed but highly coherent and maintained over a long period. The mission of COSYNA is to develop and test analytical systems for the operational synoptic description

of the environmental status of the North Sea and Arctic coastal waters. COSYNA aims to provide knowledge tools that can help authorities and other stakeholders to manage routine tasks, emergency situations and evaluate trends.

Providing a number of pre-operational "products" on a routine basis, COSYNA aims to reduce the gap between operational oceanography and the various users of data and forecasts of the state of the North Sea. Users include - among others - science, administration, fishery, renewable energies, tourism, and nature conservation. COSYNA products range from time series at various locations and regular maps of e.g. currents, waves, salinity, temperature, chlorophyll, oxygen, etc., to routine short-term forecasts (days) for these parameters. COSYNA has an open data policy, providing real-time or near real-time data and forecasts to the public via internet.

The challenge of obtaining a synoptic description of the key state variables of the North Sea and their physical, chemical and ecological drivers and responses can only be addressed by enhanced modelling capabilities in combination with continuous observations. Thus, the main characteristic of the COSYNA system is its integrated approach which combines observations and numerical modelling.
Observations comprise different in situ techniques as well as remote sensing by radar from shore and from space by satellite. In situ observations are based on a combined package of sensors situated on fixed and mobile platforms. Key physical, sedimentary, geochemical and biological parameters are observed at high temporal resolution in the water column and at the water-sediment and water-atmosphere interface.

Simulation models with different levels of spatial resolution are used to estimate hydrodynamic and biogeochemical (ecosystem) state variables at times and locations for which observations are not available. Of particular importance for COSYNA is the ability to provide forecasts of different parameters concerning ocean waves, circulation, and suspended matter. By using data assimilation procedures, the reliability of now-casts and short-term forecasts is much improved.

Data management organizes the data streams between the observation sites and central storage systems situated at HZG and the partner institutions. It also sees to quality control and data documentation. The COSYNA data portal gives a comprehensive presentation of all COSYNA measured and modelled data and metadata and makes them available to users.

COSYNA is financed and co-ordinated by the Helmholtz-Zentrum Geesthacht Centre for Materials and Coastal Research GmbH. The scientific work is carried out together with partners from Helmholtz-Association, universities and monitoring authorities.

Dr. Christiane Eschenbach is a member of the COSYNA Management Team. E-mail: Christiane.Eschenbach@hzg.de

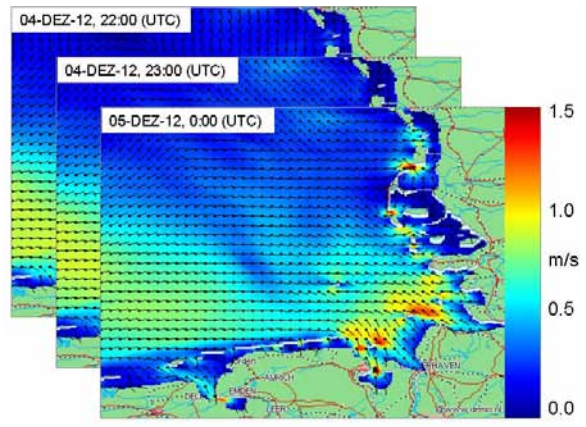

Fig. 1. COSYNA product: Pre-operational surface current fields in the German Bight (snapshot from the COSYNA Data Portal)

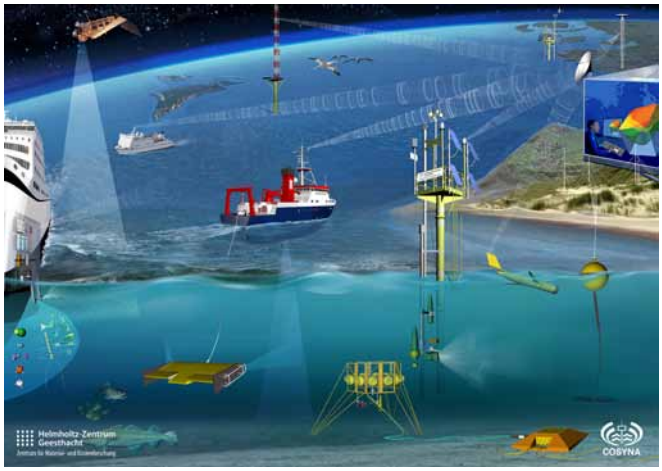

Fig. 2. COSYNA overview

A FEW WORDS ABOUT HELMHOLTZ-ZENTRUM GEESTHACHT

Heidrun Hillen

A total of about 890 employees is involved in coastal and materials research as well as regenerative medicine at the Helmholtz-Zentrum Geesthacht Centre for Materials and Coastal Research (until 2010 GKSS Research Centre). The Centre is located in Geesthacht near Hamburg and at the Teltow site in the South of Berlin. As a member of the Helmholtz Association of German Research Centres, the largest scientific organization in the country, the Helmholtz-Zentrum Geesthacht is engaged in long-term activities in the fields of materials and coastal research that are making a major contribution to resolving the large and pressing issues facing society and the scientific and business worlds. Our scientists work on high-performance materials for the cars and aircrafts of tomorrow, environmentally-friendly technologies, new materials for the field of medicine. They explore future climate change and the management of the coastal and marine environment.

Heidrun Hillen is one of the press officers of HZG. E-mail: Heidrun.Hillen@hzg.de

THE ACTIVITIES OF ST. PETERSBURG BRANCH OF STATE OCEANOGRAPHIC INSTITUTE

Konstantin Smirnov

St. Petersburg branch of SOI (SBP SOI) is the newest member of the BOOS consortium, having joined in 2012. SPB SOI was founded on 1st of August, 1951 as part of the Federal Agency for Hydrometeorology and Environmental monitoring (ROSGYDROMET), Ministry of Natural Resources and Environment of Russian Federation. SPB SOI has 5 laboratories and 18 scientists.

Researchers of the Laboratory of Satellite Oceanography work under the leadership of Dr. Eugeniy Zakharchuk (director of SPB SOI). They process, analyze and interpret satellite information obtained in visible, infra-red and microwave spectral ranges to research the Baltic, Barents and White seas and other regions of the world's oceans. The researchers work with satellite information: they obtain data of surface temperature and sea-level; calculate fields of sea currents; study low-frequency waves and synoptic eddies and determine areas with upwelling and downwelling in the ocean. They also determine areas with high wind waves and calculate the depth of upper quasi-homogeneous layer in the ocean. And last but not least - their field of work also includes numerical realization of dynamic and thermodynamic models of ocean and research of eutrophication of different sea areas.

Researchers lead by Konstantin Smirnov in the Laboratory of Probabilistic Analysis and Modeling of Oceanographic Processes work on elaboration of the probabilistic analysis methods and algorithms applied to oceanographic and meteorological data to determine features and regularities for the spatial and temporal variability of conditions in the oceans and seas. One of the most important recent results of the laboratory includes work describing vertical structure of currents. The analysis uses statistical methods for generalization of three-dimensional current velocity vector ADCP profiles (on example of currents of the Gulf of Finland). Another significant result is the estimation of variability of cyclonic trajectories in the Baltic region for the last 3 decades.

Research topics of the Laboratory of the Baltic Sea Problems (under the leadership of Dr. Natalia Tikhonova) include processes in natural conditions that are simulated on the basis of hydrodynamic and ecosystem models, methods of probabilistic theory and mathematical statistics. The laboratory uses databases of instrumental observations from expedition measurements over a 100-year-period for preparing references of hydrometeorological and hydrochemical sea regime. One of the most interesting results is the identification of the Neva floods waves as the baroclinic topographic waves. It was shown that during the formation and development of the most significant sea level rises in the Neva Bay, stratification in the Gulf of Finland remained despite storm conditions. The baroclinic character of the flood wave is indicated by significant changes in the dispersion of currents with depth with their directions reversing, as it occurs in the first baroclinic mode wave.

The Laboratory of Wind Wave (under the leadership of Honoured Scientist Dr. Izrail Davidan) deals with wind wave modeling in different regions of the world's oceans, including the Baltic Sea. The laboratory compares different models' results with wave buoy data.

The Laboratory of Tidal Phenomenae (under the leadership of Dr. Gennady Voinov) investigates physical peculiarities of tidal development and propogation in arctic seas. The tide physics are researched in the whole scope of tidal fluctuations based on a new methodological approach to their computing and analysis. The laboratory is also looking to elaborate numerical hydro-dynamical models to calculate tidal level fluctuations and currencies in the arctic seas.

Before initiation of bottom station with ADCP&YSI 6600

Konstantin Smirnov's professional interests include statistical analysis of various meteorological and oceanographical data, practical oceanography of the Baltic and Arctic seas, development of new statistical methods, MatLAB & Fortran programming.
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UNIVERSITY OF LATVIA

Laboratory for Mathematical Modelling of Environmental and Technological Processes

Anita Piliksere

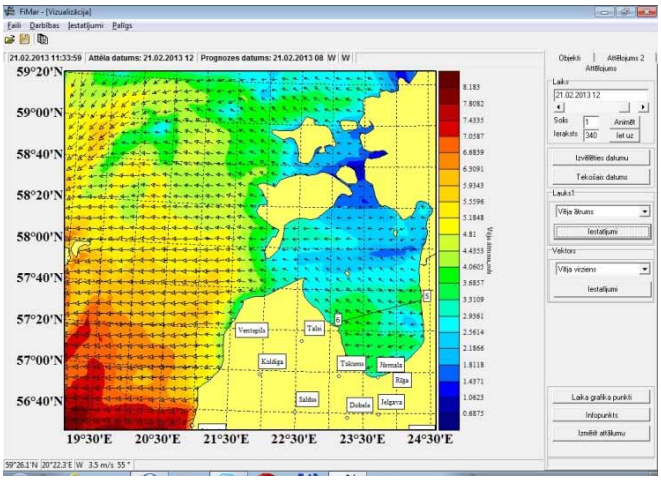
The Laboratory for Mathematical Modelling of Environmental and Technological Processes (VTPMML) is part of University of Latvia, Faculty of physics and mathematics. The laboratory was created by a team of people devoted to mathematical modelling. As can be seen from the long name VTPMML has two groups specialised in the environment and technologies. The main research interests of the latter group are in coastal hydro- and morphodynamical processes, river hydraulics and hydrodynamics, groundwater filtration, water quality, atmosphere and climate.

The laboratory has been participating in several significant projects regarding atmosphere and oceanographic processes. VTPMML is a partner in MyOcean/MyO2 projects of the Seventh framework programme. Early this century the laboratory developed an information system FiMar for the delivering, visualisation, and analysis of data on marine meteorological and operational oceanography for the Baltic Sea and North Sea. FiMar is used as a decision support tool for navigation, marine search and rescue, fighting oil spills and mine sweeping purposes by Latvian Navy since 2004. Nowadays it is based on meteorological observation system (by Latvian Environment, Geology and Meteorological Centre), operational oceanographic (MyOcean2/Danish Meteorological Institute/in-house OO model) and meteorological (DMI, GFS) products.

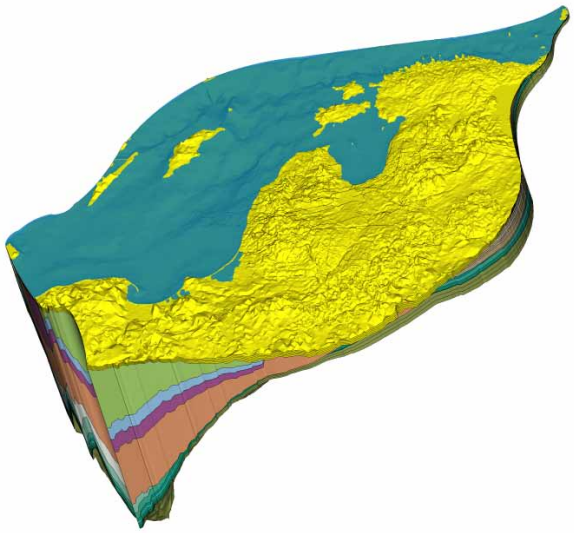
The laboratory has recently started working towards developing atmosphere modelling (numerical weather prediction) capabilities that opens opportunities in research in atmosphere - sea interaction. One of the recently finished projects with strong atmosphere component was INTERREG Latvian-Estonian "GoRWIND: Gulf of Riga as a resource for WIND energy". The goal of this 2-year activity was to find the best locations for wind energy development in cooperation with other Latvian and Estonian institutions accounting for both the potential for energy production and the environmental factors.

Research related to assessment of climate change contains mainly project-driven activities related to quantifying the influence of climate change in the territory of Latvia. Nevertheless it comprises of general research such as (1) development of the bias correction methods of the currently available individual future climate projections, (2) analysis of the ensemble of the bias corrected future climate projections, (3) impact studies of the future climate change on derived climate indicators and climate related processes in Latvia.

Last but not least the geological and groundwater model for the whole Baltic Artesian basin which was developed in 2009-2012 in co-operation with our colleague geologists from Latvian and Tartu universities should be mentioned. We believe that numerical studies of interaction of sea- and groundwater are yet to come!



FiMar - analysis tool for marine meteorological and operational oceanography information.



Model of geological structure of Baltic Arthesian basin

WEB resources:
www.modlab.lv, www.lu.lv, www.puma.lu.lv,
http://gorwind.msi.ttu.ee/home/info

Dr. math. Anita Piliksere is a researcher at University of Latvia, Faculty of Physics and Mathematics, Laboratory for Mathematical Modelling of Environmental and Technological Processes
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SURVEY CRUISE SCHEDULES

BSH - http://www.bsh.de/en/Marine_uses/Science/Research_vessels/index.jsp
IMWM-NIR - http://www.mir.gdynia.pl/?page_id=12
MSI - http://www.ttu.ee/institutes/marine-systems-institute/research-vessel
http://www.ttu.ee/institutes/marine-systems-institute/research-vessel
SYKE - http://www.itameriportaali.fi/en/aranda/aranda_matkat/en_GB/2013/

SYKE's R/V Aranda

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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