Volume 6 Spring 2015

NEWS FROM BOOS

NEW

FOCUS ON
SCIENCE AND DEVELOPMENT IN OPERATIONAL OCEANOGRAPHY

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UPCOMING EVENTS

5-7 May 2015
BOOS Annual Meeting and Scientific Workshop
Norrköping, Sweden

20 May 2015
International workshop "Salt water inflow 2014"
Warnemünde, Germany

20-22 May 2015
EuroGOOS AISBL Annual Meeting
Brussels, Belgium

28-29 May 2015
European Maritime Day
Piraeus, Greece

15-19 June 2015
10th Baltic Sea Science Congress
Riga, Latvia

17-19 November 2015
Gulf of Finland Year 2014 and Baltic Earth scientific forum
Tallinn, Estonia

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,

In this issue, there are some interesting articles about various aspects of operational oceanography, such as operational remote sensing of ice and application of profiling floats and seafloor climate stations in the Baltic. The issue also includes an introduction of the Institute of Oceanology of the Polish Academy of Sciences (IO PAN).

In the last decades major Baltic inflows have not happened often, but in last December it did. Leibniz Institute of Baltic Sea Research in Warnemünde (IOW) has launched a measuring campaign to record the saline water inflow. There is a short article about it in this issue and information about an upcoming international workshop in Warnemünde. Read the article for more information and registration.

There are some interesting events coming up – i.e. the Gulf of Finland 2014 trilateral cooperation forum in Tallinn, which will be arranged back-to-back with the Baltic Earth workshop. The Gulf of Finland Year 2014 is now over and it is time to take a look at all the results. Keep yourself posted with upcoming events at www.boos.org and be sure to take part.

Urmas Lips
BOOS chair

Baltic Operational Oceanographic System

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

NEWS

Gulf of Finland Trilateral Co-operation and Baltic Earth Scientific Forum

17-19 November 2015, Tallinn

Scope and objectives

2014 was the Gulf of Finland Year. The aim of the forum is to present the results of conducted scientific research and environmental assessment of the state of the Gulf.

Structure and topics

The forum is scheduled for three days with the focus on Gulf of Finland Year on 17-18 November and on Baltic Earth Programme on 19 November 2015.

The overall headline of the Gulf of Finland Year 2014 was “Ecosystem approach to the management of the Gulf of Finland”. The participants are invited to submit their contributions on the main scientific topics of the Gulf of Finland Year 2014:

1) Biological and geological diversity

2) Pollution and marine ecosystem health

3) Maritime traffic

4) Fisheries

5) Maritime spatial planning

In addition, the papers on topics of monitoring and assessment, eutrophication, and climate change are invited.

Baltic Earth workshop will be held in conjunction to the Gulf of Finland Year 2014 scientific forum. The papers advancing understanding of the Baltic Sea system (interrelated processes in the athmosphere, on land, and in the sea) are invited.

Important dates

Deadline for submission of abstracts: 7 September 2015
Information on abstract approval: 5 October 2015
Information on forum program: 19 October 2015
Deadline for registration 3 November 2015
Forum: 17-19 November 2015
Deadline for submitting full papers: 1 March 2016

Registration and abstract submission

Registration and abstract submission system will be available through the Gulf of Finland Year 2014 web site (www.gof2014.fi) in June 2015.

More specific information is yet to come, please check Gulf of Finland 2014 web page.

Local organizers

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EuroGOOS CONFERENCE 2014 STATEMENTS

EuroGOOS Conference was held in Lisbon, Portugal on 28-30 October 2014. Information about the event can be found at http://eurogoos2014.hidrografico.pt/. Full papers of presentations will be published as well as a special issue of Ocean Sciences is under preparation. The participants of the conference adopted Statements of the EuroGOOS Conference 2014 (see below). The next EuroGOOS Conference is planned for 2017 and most probably will be hosted by Norway.

Earth's climate is facing severe changes – the carbon dioxide levels are higher than ever, the melt of the ice sheets at Greenland and Antarctica are accelerating, and we experience more and unprecedented extreme weather conditions leading to large loss of life and damage to property. These changes also affect the physical and biogeochemical conditions of the ocean with the risk of shifting the marine ecosystem across the tipping point of irreversible change with consequent damaging loss of biodiversity.

The effects of climate change on the ocean will have an impact on all economic activities at sea that include shipping, fishery, energy, land-ocean interactions, coastal protection, sustainable environmental and ecosystem management, tourism and security. Therefore, there is a demand for timely delivery of high quality operational oceanographic services and products to support planning over short and long time scales, as they are fundamental for safe performance of marine and maritime activities. Moreover, there is a critical need to inform society, ocean governance and decision-making to support a future sustainable knowledge-based maritime economy.

User needs for regular, near real-time and quality-assured services require an operational approach across a wide range of societal benefit areas. This has triggered a new wave of marine knowledge innovation in order to fill the gaps and improve the quality and resolution of the services, e.g., seamless forecasting, an operational ecosystem approach and operational marine climate services.

This challenge requires close communication and cooperation between industry, marine science and operational oceanography service providers to address user requirements, scientific challenges and the development of products and services. Recent surveys reveal important gaps in knowledge and data about the state of the oceans and regional seas, coupled physical-biogeochemical processes, seabed resources, marine life and risks to habitats and ecosystems. This calls for coordinated investments in basic marine research, establishing sustained in-situ European Ocean Observing System (EOOS) including an open and free data exchange via the existing ROOS Data Portals and EMODnet initiative, developments of very high resolution qualified coupled physical-biogeochemical models, and a sustained European Operational Oceanographic Service (Copernicus Marine Service) including national uptake initiatives.

Over the past 20 years, the EuroGOOS members have contributed to development of:

- Ocean forecasting via national and EU supported research,
- Improved use of new real-time observation technologies,
- Open and free real-time exchange of ocean observations and model forecast products,
- The Copernicus Marine Service and integration of European operational Oceanography,
- Numerous new operational oceanographic products and services.

EuroGOOS is therefore well-suited and prepared to play an active role in the future development of operational oceanography and marine services in Europe with particular focus to:

1. Identify European priorities for operational Oceanography; main focus will be to define research priorities and work with key European initiatives such as Copernicus, EMODnet and Marine Research Infrastructures. As part of this activity EuroGOOS will also work intensively to link with the research community, industry, users and EU policies.

2. Promotion of operational oceanography; especially through networking, publications, conferences, EuroGOOS webpage, social media and increased engagement with various organizations such as GOOS Regional Alliances, GEO, European Marine Board and JPI-Oceans.

3. Foster Cooperation; EuroGOOS will actively engage in close cooperation with key organizations on a global, European and regional scale to stimulate cross-fertilization between operational oceanography, marine research and technological innovation that will bring mutual benefits to all the communities.

4. Coordinate co-production of knowledge: to promote cost effective creation of operational observation and model based products and services through sharing of expertise and capabilities meeting the requirements of the users. EuroGOOS will aim to make best use of all its members capability to co-produce the knowledge and evidence for assessment of Good Environmental Status required by the Marine Strategy Framework Directive.

5. Sustained Ocean Observations; EuroGOOS will take a leading role to ensure coordination of the European contribution to sustained marine observational system through the promotion and rationalization of a European Ocean Observing System (EOOS). In this context, EuroGOOS will work closely with European Marine Board, EU Copernicus Marine Service, EMODNET, EU Marine Research Infrastructures, JPI Oceans, EEA, ESA, EUMETSAT as well as the climate community.

The EuroGOOS AISBL is ready to support the European marine and maritime community by focusing on the above five initiatives. It will use established networks with the scientific and user communities, and service providers, as well as links to industry and the public sector (global, EU, regional and national partners and authorities) to support interdisciplinary and collaborative cooperation focused on challenges of development and provision of high quality operational oceanographic products and services in the future.

Presentations at the 7’th EuroGOOS Conference have demonstrated an impressive high performance level within marine science and service provision by the EuroGOOS members, showing Europe to be extremely well positioned to take a global lead in the field of operational oceanography.

BALTIC INFLOW OF DECEMBER 2014

Dr. Michael Naumann, Dr. Volker Mohrholz, Dr. Günther Nausch

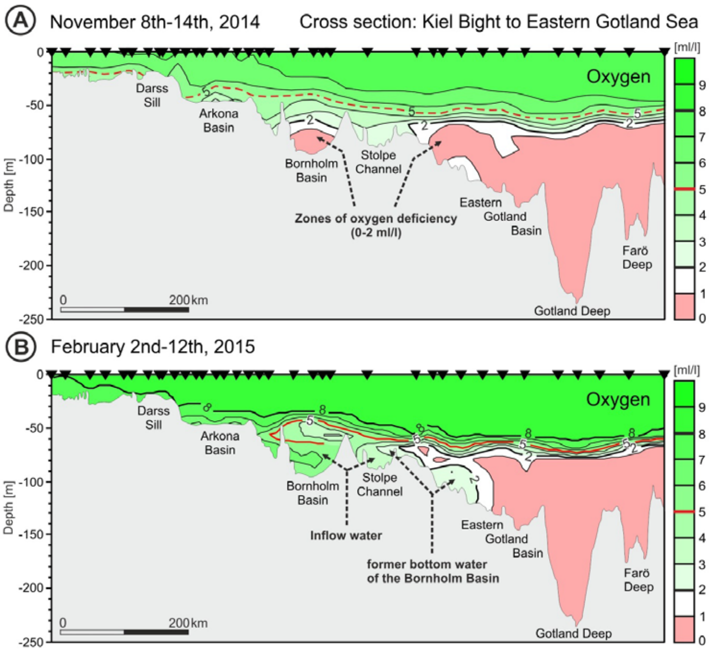
During the last decades, Major Baltic Inflows (MBI) became very seldom. However, in December 2014 a strong MBI brought large amounts of saline, and well oxygenated water into the Baltic Sea. The inflow volume and the amount of salt transported into the Baltic were estimated with 198 km^3 and 4 Gt, respectively. In the list of the MBI’s since 1880 this inflow is the third strongest event together with the MBI in 1913. It will most probably turn the entire Baltic deep water from anoxic to oxic conditions, with wide spread consequences for marine life and biogeochemical cycles. With a certain temporal delay, the changes will affect the surface waters, too.

Due to a long lasting phase of easterly winds, the average water level of the Baltic Sea was considerably lowered in November. This was a perfect setting for the following inflow event. On December 3, at the Swedish gauge station Landsort Norra, which is representative for the average water level of the Baltic Sea, the lowest level of the year (-52 cm) was registered.

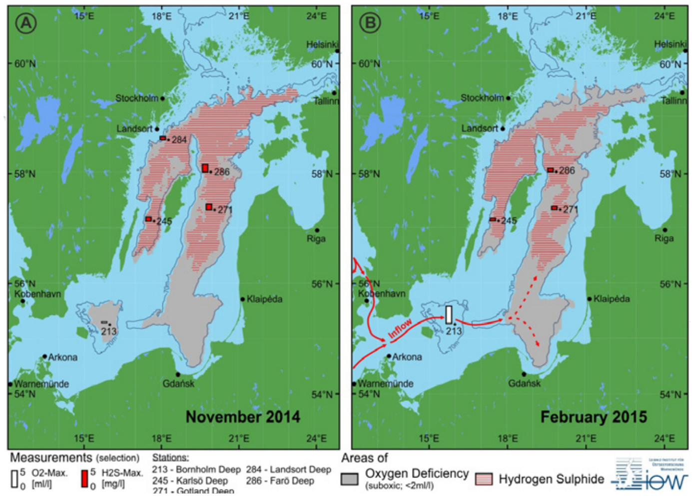
During the following three week phase of strong westerly winds, the water masses from the Kattegat were pressed through the narrow straits of the Great Belt and the Öresound into the western Baltic Sea. A continuous wind forcing caused an increase of the average water level of the Baltic Sea by about one meter by December 26. This corresponds to a total inflow volume of about 320 km^3.

In parallel the Leibniz Institute for Baltic Sea Research in Warnemünde started an intense and still ongoing measuring campaign to document the progress and the consequences of this largest event since 1951. To conclude the variety of activities and evaluate the outcome, an international workshop on **“Salt Water Inflow 2014”** will be held on May 20, 2015, in Warnemünde.

Registration is open until May 4, 2015 under
http://www.io-warnemuende.de/mbi-2015-international-workshop-may-2015.html



Changes in dissolved oxygen content in the water body along a transect from Kiel Bight to the Eastern Gotland Basin in the central Baltic Sea,
A) Situation in November 2014,
B) Situation at the beginning of February 2015
(Source: M. Naumann, IOW)



Comparative maps of areas with oxygen deficiency and hydrogen sulfide in the bottom-near water layer of the Baltic Sea at the time of
A - November 2014 (stagnation) and
B - February 2015 (salt water inflow).
Bars show the maximum oxygen resp. hydrogen sulfide concentrations of this layer for selected stations. The 70 m isobath serves for orientation and illustration of the deeper basins in the central Baltic Sea. *(Source: M. Naumann, IOW)*

Dr. Michael Naumann, Dr. Volker Mohrholz -both scientists at the Department of Physical Oceanography- and Dr. Günther Nausch, scientist at the Department of Marine Chemistry and coordinator of the IOW's monitoring activities.
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OPERATIONAL REMOTE SENSING OF BALTIC SEA ICE

Juha Karvonen

The Baltic Sea ice remote sensing is mainly based on Synthetic Aperture Radar (SAR) data. Hundreds of SAR imagery are acquired during each winter season (e.g. 2013-2014 546 RADARSAT-2 images, 202 Cosmo-SkyMed images and 215 TerraSAR/Tandem-X images).
Starting from November 2014 we have also been receiving SENTINEL-1a data from ESA and used it to compute ice thickness charts in a similar manner as for RADARSAT-2 data.
After image acquisition and data transmision from the data provider to FMI these images are rectified to a suitable map projection and calibrated at FMI. The mean delay from SAR image acquisition to ready-to-deliver projected rectified SAR imagewas 75 minutes in 2013-2014. This delay mainly consists of the data transmission.
From 2014 reception of SAR data (from SENTINEL-1 and Cosmo-SkyMed) can also be done by the FMI's Sodankyla ground station (SoGS) and using downlinking at SoGS will reduce the data transmission delays. Operational SENTINEL-1 reception at SoGS will start in spring 2015.

After calibration some ice products are produced automatically immediately after the data has been received and calibrated. The products produced operationally are ice concentration, ice thickness and ice drift, in addition to the rectified calibrated SAR imagery. Ice drift is computed only for image pairs covering the same area within a predefined time difference (two days).

The processed SAR imagery are then delivered to Finnish and Swedish ice breakers and maritime administrations through a specific ice data dissemination and rendering system closely integrated with the navigational system of the ice breakers.

The derived products (ice thickness, ice drift and ice concentration) are also available through the MyOcean EC project web site (http://myocean.eu) and some products through the icemar EU project user interface (http://icemar.eu). The main SAR data source are the RADARSAT-2 and SENTINEL-1 imagery which have two polarization channels enabling improved analysis of ice parameters compared to single-channel SAR instruments. Because SENTINEL-1a HV channel is not fully calibrated yet, we have not been able to produce SENTINEL-1a based ice concentration yet, but ice thickness products utilizing the HH channel only have been produced operationally.

The FMI SAR products processing and dissemination chain is described in Fig 1.

Examples of the ice thickness and ice concentration products based on RADARSAT-2 are shown in Figures X and Y. The ice thickness mosaics based on RADARSAT-1 data and SENTINEL-1a data are shown in Fig. ZZ.

Dr. Juha Karvonen has been working in the field of earth observation and remote sensing since 1997. Before that he worked in the field of industrial machine vision.

He received the M.Sc. (Tech), Lic. Tech. and Dr. Sc. (Tech) degrees from Helsinki university of Technology (Aalto University since 2010) 1991, 1996 and 2006, respectively, in information and computer sciences and digital signal processing.

His Dr. Sc. thesis was dealing with remote sensing of sea ice by SAR.

He is currently working as a senior research scientist in the remote sensing research group and Finnish Ice Service, which are parts of the Finnish Meteorological Institute, developing EO products for winter navigation.

His main research interests are digital signal and image processing, SAR and other EO data processing, sea ice, and operational marine services.

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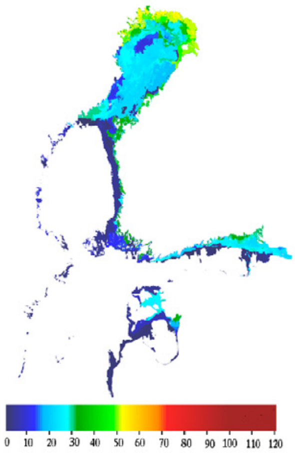

Fig. X. SAR-based ice thickness estimate for the Baltic Sea, Feb 7, 2014

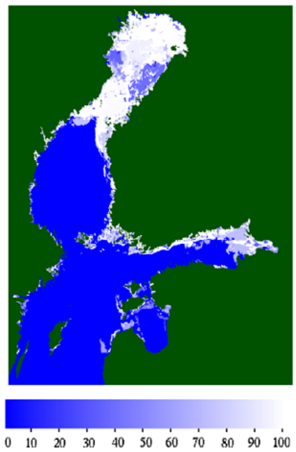

Fig. Y. SAR-based ice concentration estimate for the Baltic Sea Feb 7, 2014.

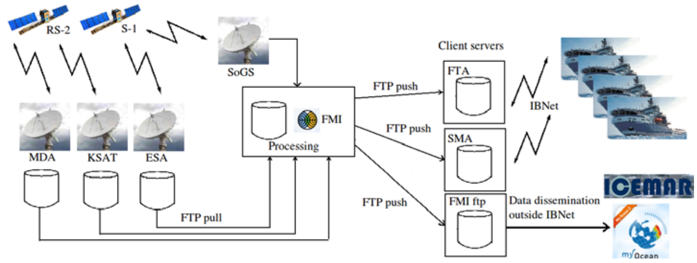

Fig. Z. The FMI SAR products processing and dissemination chain. SAR data flows faster through the Sodankyla ground station (SoGS).

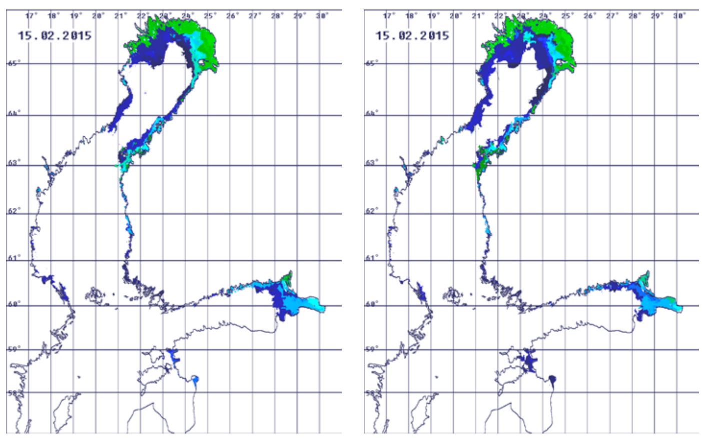

Fig. ZZ. Ice thickness mosaics of Feb 15, 2015 from RADARSAT-2 and SENTINEL-1a. The mosaics represent the latest available data from the satelites.

USING PROFILING FLOATS IN THE BALTIC SEA

Karin Borenäs, Sian de Koster, Henrik Lindh, Sverker Skoglund, and Fredrik Waldh

Background

SMHI received funding from the Swedish Environmental Protection Agency for a proposal to investigate the use of profiling floats in SMHI's operational oceanographic network.

Profiling floats have been on the market for many years and are used operationally in the global oceans, but not in Swedish maritime areas. The indications were that they could also work in the Baltic. The purpose of the project was to purchase 2 or 3 different floats and test how useful they could be.

Equipment

A profiling float is a piece of equipment that can sink and rise through the water column by controlling its density, for example by pumping oil in or out of a rubber bladder.

Sensors on the instrument measure parameters such as temperature and salinity as it rises through the water column. When it reaches the surface the float sends the measured data together with its GPS position via satellite or internet to a dedicated receiver.

These floats, often called Argo floats, are used internationally to gather data from the global oceans (see www.argo.net). At the beginning of 2015 there were 2750 floats distributed over the whole globe. These floats follow the ocean currents and therefore also provide some information about water transports.

SMHI decided to purchase the following two floats:

- A NEMO float from the German company Optimare with sensors for temperature, salinity, oxygen and position
- An ARVOR-C float from the French company NKE that has been developed for the continental shelf, with sensors for temperature, salinity, and position.

Both floats were equipped with Iridium senders, and the data arrived at SMHI as emails.

Results

The first tests were made in a protected inlet outside Nyköping during one day in September 2011, where the maximum depth was about 70 m. A simple buoy system was constructed to keep the floats stationary so that they could profile along a line.

The NEMO float did not profile at all, and instead lay horizontally in the water. The ARVOR-C float carried out all of the test profiles and sent data to SMHI. However the float only sent temperature data and its position. No salinity values were received. It turned out that the manufacturer had not calibrated the ARVOR-C for salinity values in the Baltic waters, i.e. under 10 psu.

In autumn 2012 the ARVOR-C was again tested together with a very simple buoy system in the Stockholm archipelago with varying depths down to about 40 m. The float did not send any observations in shallow waters but in deeper areas the buoy system worked well and the float sent observations even when there were 2-3 m waves. There were still no salinity observations.

In 2013 the NEMO float was released freely in the Skagerrak north of Skagen. The float still did not do any profiling but sent surface data for position, temperature, salinity and oxygen every 12 hours in near real time for about 6 weeks. It drifted northwards towards the Norwegian coast and captured some small-scale eddies before being caught in the Norwegian coastal current. The speed increased and salinity decreased. Eventually the float drifted into a fjord and lost contact with SMHI. The float has still not been found.

In 2014 an updated control program for the ARVOR-C float was received and three short tests were made in Gothenburg harbour. Salinity measurements were received even for low salinities, but the salinity pump shut down at depths of less than 5 m to avoid contamination in the measurement cell.

In November 2014 the ARVOR-C float was reconfigured and tested for one day on the Baltic coast near Norrköping. The float carried out the profiles and sent data for temperature, salinity and position via satellite. The float was deployed and retrieved by two people in a small inflatable boat.

Following this success a 10-day test was planned in the Stockholm archipelago together with the Swedish Navy. The float was configured to profile every 4 hours from a depth of 42 m up to the surface, and was anchored to the buoy system described in Figure 3. The actual depth was 46 m which left a

2 m margin so that the float would not get stuck in the mud on the bottom. At deployment, reference measurements for temperature and salinity were made using a hand-held CTD.
All measurement data was received by SMHI as expected, within 15 minutes of being sent. The temperature measurements from the float agreed well with the reference values, but the salinity measurements differed by 0.1 psu both at the surface and for bottom measurements. The supplier (NKE) is looking into this.
The test showed that the anchoring system worked well but is easier to use from a smaller boat.

Experiences

The NEMO float from Optimare disappeared in a Norwegian fjord so it is has not possible to evaluate its performance or determine why it did not profile correctly.
It took far too long to sort out the problems with the ARVOR-C float from NKE. Initially there were a lot of communication problems with NKE and in addition the ARVOR-C User Manual was unsatisfactory, poorly presented and with missing information. Another problem is the communication between the ARVOR-C and the PC program which is carried out in using cryptic commands in a terminal window. This is acceptable for simple systems but is difficult and time consuming to manage for a complex system like the ARVOR-C float.
Another issue is the ability of the float to profile in a stratified water column. The instrument's capacity to traverse stratified water is governed by the volume of the oil pump in relation to the volume of the instrument. This capacity is further limited by the friction along the rig line in this case, and this friction increases with stronger currents.
The landing feet on the float (6 steel spikes) can get stuck in mud, so it is important to construct the buoy system so that the instrument never reaches the bottom.

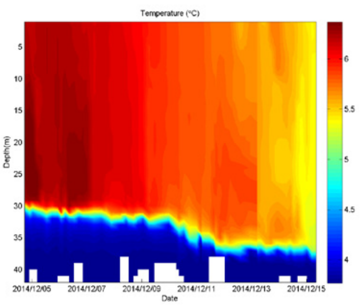

Figure 1. Time series for temperature produced during tests in December 2014 in the Stockholm archipelago

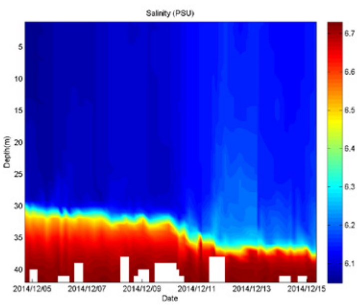

Figure 2. Time series for salinity produced during tests in December 2014 in the Stockholm archipelago

Future possibilities

These tests have shown that a profiling float with a buoy system can be used operationally in the Baltic archipelago and lakes. The entire water column is covered with one sensor package, with a resolution of 0.5 – 1 m, and the investment and service costs are a lot lower than conventional systems with sensors at fixed levels. The whole system can be deployed and recovered from a small boat which dramatically reduces the boat costs compared to a conventional buoy system.
The capacity of the float to pass through stratified water is limited so it is important to choose the right float. This limitation can cause additional problems if the float is operating in areas with stronger currents since the friction along the rig line and guide is increased.
A profiling float could be released to drift freely which would work in most Swedish waters. This is a very simple way to get a lot of data, but can easily become stranded, trapped in fishing equipment or disappear some other way.
SMHI will continue to investigate the usefulness of profiling floats.

Professor Karin Borenäs is the head of the Ocean Environment department and reviewed the time series data (karin.borenäs@smhi.se)
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Henrik Lindh works at the Observations department and was the Project Manager as well as carrying out some field work (henrik.lindh@smhi.se)
Sverker Skoglund works at the Observations department as a technician and field worker (sverker.skoglund@smhi.se)
Fredrik Waldh works at the Information department as a data manager and also carried out some field work (fredrik.waldh@smhi.se)

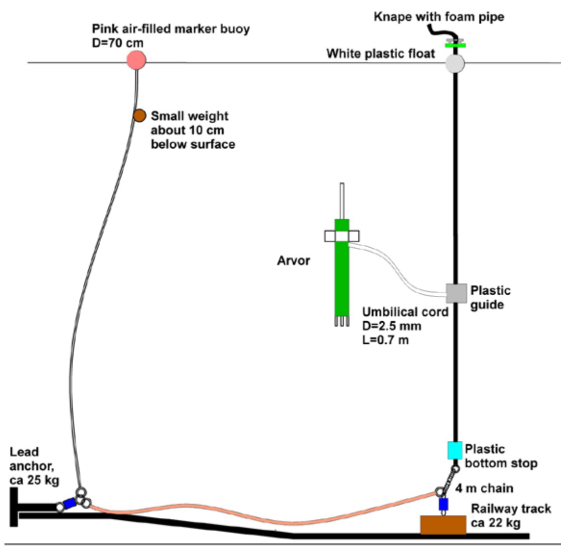


Figure 3. Anchoring system for the profiling float during tests in December 2014 in the Stockholm archipelago (depth 46 m).

SEAFLOOR CLIMATE STATIONS

Daniel Bergman-Sjöstrand, Karin Borenäs, Tomas Johansson, Sian de Koster, Henrik Lindh, and Arne Svensson

Background

There is a shortage of information about the oxygen fluctuations in the deep waters of the Baltic and the Kattegat, both in open waters and near the coast. Other parameters are also of interest such as temperature, salinity and currents. SMHI received funding from the Swedish Environmental Protection Agency for a proposal to test the use of seafloor climate stations.

Equipment

The following equipment was purchased for three identical bottom systems:
• Aquadopp Single Point Current Meter from NORTEK A/S
• MicroCAT temperature, salinity and oxygen sensor from Sea-Bird Electronics, Inc.
• Acoustic release mechanism from InterOcean Systems Inc. (to enable the observing station to release its anchor and float up to the surface)
• Stainless steel for the base construction of the rig
Three rigs for the measurement instruments were constructed and produced in the Observation department's workshop at SMHI in Norrköping.

Deployment

One of the systems has been place south of Öland during the autumn, and another one is currently at 19 metres depth in the Bay of Laholm on the west coast of Sweden. A diagram showing how the systems are anchored can be found in Figure 2.

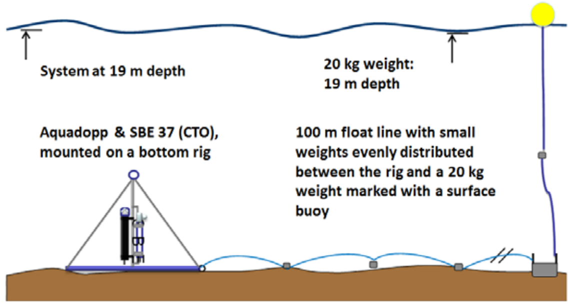


Figure 2. Anchoring with a surface buoy

Preliminary results

Figure 3 shows a sequence of time series from the measurement point L9 in the Bay of Laholm. Note in particular the variation of the oxygen levels with time. Comparisons with the monthly samples from L9 have not yet been made.

Experiences

The preliminary time series that have so far been obtained from the seafloor systems have been of great interest to oceanographers, both at SMHI and elsewhere. The systems are flexible and can be used in sheltered bays or in open seas down to a depth of 250 metres. The measurement systems can easily be replicated.

Figure 1. A seafloor system including the complete "U system" for anchoring, designed for a depth of 40 metres and ready for deployment. SMHI's "Sensorita" is shown to the left. Photo: Henrik Lindh

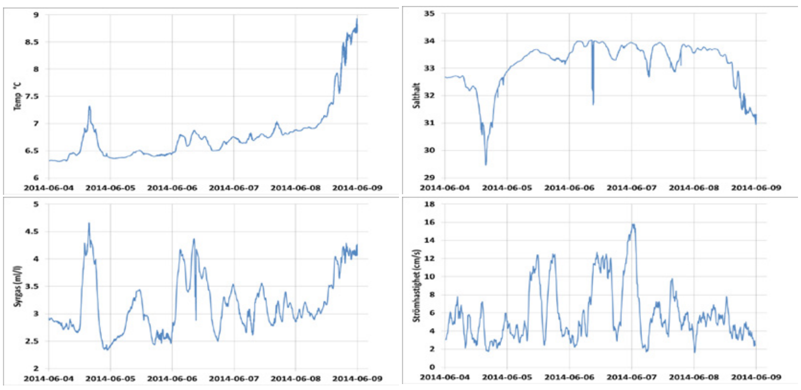


Figure 3. Observations from measurement station L9 in the Bay of Laholm during the period 2014-06-04 – 2014-06-09.

Recommendations

Maintenance of the seafloor systems involves cleaning, battery replacement and periodic calibration of the SeaBird instruments. Small boats can be used to handle the systems.

Anchoring with an Acoustic Release is recommended if there is any risk of collision with a marker buoy, see Figure 4. There may also be a risk of trawling in some places which will need to be taken into account. Before deployment in a new position, a basic seafloor survey should be carried out. The seafloor should be hard and smooth at the anchoring point. If it is muddy or uneven then the equipment should be anchored as shown in Figure 5.

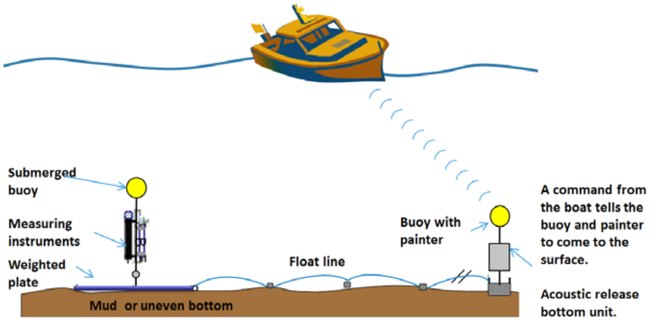


Figure 4. Anchoring with an Acoustic Release instead of a surface marker

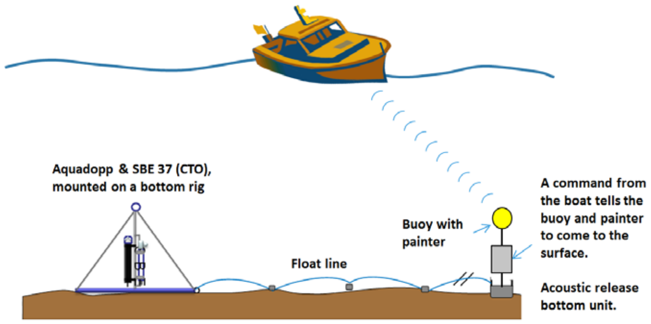


Figure 5. Anchoring on a muddy or uneven sea floor.

Daniel Bergman-Sjöstrand works at the Ocean Environment department as a field worker (daniel.bergman-sjostrand@smhi.se). Professor Karin Borenäs is the head of the Ocean Environment department and reviewed the time series data (karin.borenäs@smhi.se). Tomas Johansson is a mechanic at the Observations department and constructed the base of the rig for the stations (tomas.johansson@smhi.se). Sian de Koster works at the Forecasting department and did the editing and translating (sian.dekoster@smhi.se). Henrik Lindh works at the Observations department and was the Project Manager (henrik.lindh@smhi.se). Arne Svensson worked at the Ocean Environment department and configured the instruments (no longer working at SMHI).

SEA ICE PROBABILITY IN GULF OF RIGA ESTIMATED FROM REMOTE SENSING IMAGERY

Laura Siitam, Rivo Uiboupin, Liis Sipelgas

Gulf of Riga is well known for its seasonal ice cover. The ice cover season starts between late November and early January. The length of the ice season which can last until late April is in the range of 1-5 months. The use of remote sensing methods gives a good spatial overview of the ice conditions. Satellite image analysis was performed for years 2003-2011, from December to April. In total 366 images with 250 m resolution, from Moderate Resolution Imaging Spectro-radiometer (MODIS) were used to map the ice cover probability in the Gulf of Riga. The ice cover probability maps indicates the percentage of time that each pixel is covered by ice.

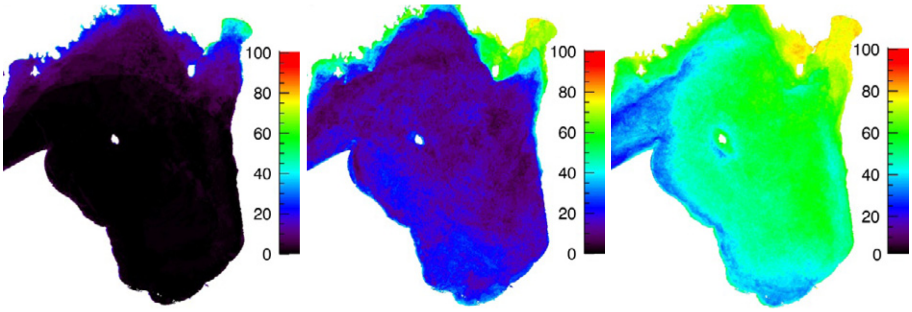
Inter-annual variability of ice conditions depend on meteorological conditions. Remote sensing data analysis revealed that winters can be, divided into three classes/scenarios based on ice probability: severe, medium and mild.

In case of mild winters (Fig 1a) almost the entire Gulf of Riga was most of the time ice free. Even shallow coastal regions have ice probability below 50%. During mild winters the ice conditions are very volatile, easily affected and dependant on wind forcing.

In case of winters with medium ice conditions (Fig 1b) the ice cover probability of the coastal areas during the ice season is between 50%-70%. In the open area of Gulf of Riga the ice probability is less than 20%. Ice conditions in medium winters are dynamic. Besides the coastal fast ice belts, the ice is almost all the time in motion.

During severe winters (Fig 1c) almost all of the Gulf of Riga freezes over. Pärnu Bay and other coastal areas have ice probability over 80% and on the open part of Gulf of Riga more than 50%. Generally the ice conditions in severe winters are more stable compared to average winters. However, during ice melt period significant drift of large ice masses can occur.

Figure 1 . Maps showing ice probability with 250 m spatial resolution during different winter scenarios: (a) mild winters 2006/2007, 2007/2008 and 2008/2009, (b) medium winters 2003/2004 and 2004/2005, (c) severe winters 2002/2003, 2005/2006, 2009/2010 and 2010/2011. Images are showing the percentage of time, that each pixel was covered by ice.



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IO PAN ON A NUTSHELL

Marcin Wichorowski

The mission of the Institute of Oceanology of the Polish Academy of Sciences (IO PAN) is to carry out innovative, high-quality research to increase knowledge of the processes and phenomena taking place in the marine environment. Research results are applied to support the sustainable use of marine resources and the conservation of the marine environment.

Within the last 30 years IO PAN has been continuously developing expertise in interdisciplinary studies of the Baltic Sea and other european shelf seas, with a special focus on the arctic waters. The Institute is one of the leading centres investigating Baltic water circulation, biogeochemistry, ecosystem biodiversity and health, marine bio-optics and remote sensing. The s/y Oceania, research vessel owned by IO PAN, has an unlimited cruise range and is engaged for more than 250 days every year.

IO PAN is a member of EuroGOOS, BOOS and ArcticROOS. In recent years dynamic growth of IO PAN's involvement in partnerships, networks and consortia aiming to address important questions regarding the study, exploration and exploitation of the marine environment has been conducted. IO PAN makes effort to consolidate and reinforce scientific, research, organisational and financial potential to carry out large-scale scientific projects together with the Sea Fisheries Institute in Gdynia, the Institute of Meteorology and Water Management, the State Institute of Geology and the Maritime Institute in Gdańsk as PolMar (consortium of Polish Marine research institutes). IO PAN is also member of MORCEKO (Marine Eco-Energy and Eco-System Centre) aiming to develop new technologies, enabling renewable energy resources available in the Baltic Sea and on the Polish coast. The Centre comprises the Institute of Fluid Flow Machinery (PAN), the Gdańsk University of Technology, the Maritime Institute in Gdańsk, the Gdańsk Ship Design and Research Centre and the Pomeranian Special Economic Zone PLC.

IO PAN is also actively involved in FP6 and FP7 Programmes, BONUS Plus, Poland-Norway grants, Poland-USA cooperation and the COST Programme. The most relevant activities for BOOS are:

AWAKE2 – The aim of the project is to understand the interactions between the key components of the climate system in the Svalbard area through development of the analytical models and use of existing numerical models to study the shelf circulation, air-ice-sea interactions and climate changes.

SatBałtyk – Satellite Monitoring of the Baltic Sea Environment. This research project aims to prepare and deploy the technical infrastructure and operational models for the efficient routine monitoring of the state of the Baltic environment.

ZSPDO – Integrated Oceanographic Data and Information Processing System -project aiming to establish the data centre infrastructure capable to process and store large archives of oceanographic data.

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SURVEY CRUISE SCHEDULES

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

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

IO PAN - http://www.iopan.gda.pl/oceania/PLAN_2015.pdf

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

SYKE - http://www.syke.fi/en-US/Services/Research_vessels

S/Y Oceania

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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