MARINE RESEARCH CENTRE

5th FerryBox Workshop
- Celebrating 20 Years of Alg@line

April 24-25, 2013

Finnish Environment Institute (SYKE), Helsinki, Finland

Program and abstracts

Sponsored by:

MAA- JA VESITEKNIIKAN TUKI

JENA ENGINEERING

subCtech Subsea Technologies

FRANATECH

AMS SYSTEA

Photon Systems Instruments

AANDERAA a xylem brand

SYKE

5th FerryBox Workshop in April 2013

Celebrating 20 years of the Alg@line – Real time algal monitoring in the Baltic Sea - the 5th FerryBox Workshop will takes place 24-25 April 2013 at the Finnish Environment Institute in Helsinki, Finland

Alg@line is a part of the FerryBox community, which wants to improve and share the data and combined knowledge generated from the 'ship-of-opportunity platforms' (SOOP). The SOOP approach facilitates the monitoring of the highly fluctuating pelagic ecosystem through an extensive automated sampling method on board merchant ships.

Program

April 24, 2013

8:30-9:30	Registration
9:30-9:35	Seppo Kaitala & Mari Walls: Welcome
9:35-10:00	Juhani Kettunen: User-driven FerryBox Monitoring System – What is missing today?
10:00-10:30	Wilhelm Petersen: FerryBox Systems: State-of-the-art and incorporation in European observation networks
10:30-11:00	Coffee break
	Session 1
11:00-11:20	Hans Paerl: FerryMon: Ferry-based assessments of human and climatically-driven ecological change in the Neuse River-Pamlico Sound Estuarine system, North Carolina, USA
11:20-11:40	Maik Grunwald: Data analysis of overlapping FerryBox routes – All for one, one for all
11:40-12:00	Rikke Closter: FerryBox data used for calibration of an ecological Baltic Sea model – a strong supplement to traditional monitoring data
12:00-12:20	Alain Lefebvre: Combination of high frequency devices to characterize the phytoplankton community and the physico-chemical supporting parameters in the Eastern English Channel, the North Sea and the Dutch estuaries
12:20-13:50	Lunch + exhibition
	Session 2
13:50-14:10	Seppo Kaitala: Towards near real time validation of chlorophyll fluorescence
14:10-14:30	Heidi Hällfors: Northern Baltic Sea phytoplankton communities at the beginning and end of the 20th century – a comparison of historical and modern species data
14:30-14:50	Malin Mohlin: High resolution monitoring of near surface waters in the Baltic Sea and the Kattegat
14:50-15:10	Villu Kikas: Mesoscale and sub-mesoscale variability revealed by combining data from a Ferrybox system and autonomous buoy profiler in the Gulf of Finland in summers 2009-2012
15:10-15:40	Coffee break
	Session 3
15:40-16:00	Jenni Attila: The use of satellite data for monitoring water bodies – comparison with ferrybox data
16:00-16:20	Alexander Sokolov: Access to distributed marine databases on the Baltic Sea
16:20-16:40	Stefan Simis: Future-proofing the ferrybox – call for input!
16:40-17:20	Panel discussion
17:20-18:30	Posters + Exhibition
19:00-	Dinner

Program

April 25, 2013

	Session 4
9:00-9:20	Philipp Groetsch: Spatial variability of correlation between in situ Ferrybox and remote sensing measurements of chlorophyll a in a Baltic Sea summer bloom
9:20-9:40	Manolis Ntoumas: Assimilating Ferry Box data into the Aegean Sea model
9:40-10:00	Gonzalo González-Nuevo: Development of the automatic data processing system of the Instituto Español de Oceanografía surface water sampling network
10:00-10:20	Michael Haller: Application of continuous measurements on FerryBoxes to oxygen fluxes in the North Sea
10:20-10:50	Coffee break
	Session 5
10:50-11:10	Jukka Seppälä: An overview of spectral *in vivo* fluorescence methods for phytoplankton taxonomy
11:10-11:30	Christopher Aiken: ADCP installation in a ship-of-opportunity
11:30-11:50	Steffen Aßmann: New autonomous sensors for underway measurements
11:50-12:10	Mark Hartman: Understanding sea surface temperature measurements made by 4 different instrumental methods on a Ship of Opportunity
12:10-13:10	Lunch
	Session 6
13:10-13:30	Kai Sørensen: Determination of pH and pCO_2; New autonomous instrumentation for ferrybox
13:30-13:50	Luca Sanfilippo: New microLFA modules for on-line measurement of nutrients in ship of convenience application
13:50-14:10	Tobias Boehme: -4H- FerryBox: Automatic and remote controlled measurements for ships and measuring stations with special aspects to new designed flow through passive-, litter- and algae sampler and 1 year continuous measurements in Ny Ålesund (arctic)
14:10-14:30	Saskia Heckmann: Environmental monitoring using the OceanPack: a Robust, Flexible and Cost-efficient "Autonomous Underway Measurement System"
14:30-14:50	Final discussion

Program

Posters

Cindy Guillemet & Margot Choquer: Scientific data acquisition by sailing ships: The *OceanoScientific® Programme FERRYBOX*
Susan Hartman, Mark Hartman & David Hydes: *Karenia mikimotoi* observations from a ship of opportunity in the English Channel in relation to hydrographical and meteorological features
Jos Kokke: FerryBox: A solution for Rijkswaterstaat?
Anke Kremp, Karin Rengefors, Nina Lundholm, Sanna Suikkanen, Mireia Bertos, Carina Bunse, Susanna Gross, Sara Hardardottir, Ingrid Sassenhagen, Josefin Sefblom, Sirje Silvender, Conny Sjöqvist & Anna Godhe: Connectivity and transport patterns in the Baltic *Skeletonema marinoi* spring bloom: A joint Nordic Research Network (PRODIVERSA) study using ships of opportunity as a sampling platform
Ivan Kuprijanov, Andres Jaanus & Kaire Toming: Comparative analysis of phytoplankton monitoring methods in the Baltic Sea
Pierre Marrec, Thierry Cariou, Marie Latimier, Eric Macé, Pascal Morin, Marc Vernet & Yann Bozec: Spatio-temporal dynamics of biogeochemical parameters and air-sea CO_2 fluxes in the Western English Channel (WEC) based on Voluntary Observing Ship (VOS) measurements with a FerryBox system
Paola Ramirez von Holle and Christopher Aiken: Recent progress in Chile's SOO network “FOCA-MORSA”
Kevin Rousseeuw, Alain Lefebvre, Emilie Caillault & Denis Hamad: Detection of contrasted physico-chemical and biological environmental status using classification and modelling tools.
Pasi Ylöstalo, Stefan Simis, Kristian Spilling & Jukka Seppälä: Variability of the relationship between electron transfer rates and ^{14}C-based production in the Baltic Sea

Sponsors

Company	web page
-4H-JENA engineering GmbH, Germany	www.4h-jena.de
Aanderaa Data Instruments AS, Norway	www.aadi.no
Franatech GmbH, Germany	www.franatech.com
Photon Systems Instruments, Czech Republik	www.psi.cz
SubCtech GmbH, Germany	www.subCtech.com
SYSTEA SpA, Italy	www.systea.it.
Maa ja vesitekniikan tuki ry	www.mvtt.fi

ABSTRACTS (in the order of the program)

USER-DRIVEN FERRYBOX MONITORING SYSTEM – WHAT IS MISSING TODAY?

JUHANI KETTUNEN & SEPPO KAITALA

FINNISH ENVIRONMENT INSTITUTE, SYKE, FINLAND

In most cases we design and develop our monitoring systems from the viewpoint of data collection and measurements. We create and use fantastic machineries that generate fabulous sets of on-line data the use of which, too often, is modest. In the paper, we discuss and analyse ferrybox-system that could be built for data clients and information consumers. In our analysis, we look at the problem by using value-chain analysis. It clearly shows that we could multiply the number of our clients just by analyzing in more details the effectiveness and service orientation of our systems. We illustrate our results with practical recommendations.

FERRYBOX SYSTEMS: STATE-OF-THE-ART AND INCORPORATION IN EUROPEAN OBSERVATION NETWORKS

WILHELM PETERSEN

HELMHOLTZ-ZENTRUM GEESTHACHT, INSTITUTE OF COASTAL RESEARCH, GERMANY

The development and use of FerryBox systems as a cost-effective instrument for continuous observations of the marine environment has been well established during the last years. After completion of the EU-funded FerryBox project in 2005 systems have evolved to maturity and are since widely used around the coasts of Europe. The FerryBox community initially formed from the partners of this project provides mutual exchange of experience (www.ferrybox.org). The presentation will give an overview about existing FerryBox lines in Europe and beyond as well as discuss ongoing technical progress.

The availability of newly developed sensors expands FerryBox measurements to more biological relevant parameters which are of interest for the requirements of the Marine Strategy Framework directive (MSFD). The present state-of-the-art as well as the incorporation into integrated European observational systems will be discussed. Within the EU funded infrastructure project JERICO the technical harmonization as well as developing of a best practise guide for FerryBox systems will be a step further to high quality environmental data products. In the meantime most of European FerryBox physical data are collected centrally within the MyOcean project and data will be also available in the pilot portal for physical parameters in EMODnet.

FERRYMON: FERRY-BASED ASSESSMENTS OF HUMAN AND CLIMATICALLY-DRIVEN ECOLOGICAL CHANGE IN THE NEUSE RIVER-PAMLICO SOUND ESTUARINE SYSTEM, NORTH CAROLINA, USA

HANS PAERL, JOSEPH CROSSWELL, KAREN ROSSIGNOL, NATHAN HALL, ALAN JOYNER & BENJAMIN PEIERLS

INSTITUTE OF MARINE SCIENCES, UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL, U.S.A

The North Carolina (USA) unattended Ferry-Based Water Quality Monitoring Program, FerryMon, is being used to assess the impacts of climatic perturbations such as hurricanes and droughts, and human development, including nutrient over-enrichment, on water quality, algal bloom dynamics, nutrient and carbon fluxes in the Pamlico Sound System (PSS), the USA's second largest estuary. Two NC-DOT ferries deploy YSI 6600 sondes (temperature, salinity, *p*H, turbidity, chlorophyll *a* fluorescence) coupled to automated ISCO discrete sampling of nutrients, organics, and diagnostic algal photopigments. Recent upgrades include an Algal Online Analyzer and CO_2 partial pressure (pCO_2) sensor to expand FerryMon's long-term monitoring objectives. Real-time data transmission and remote control of sampling resolution and sensor tolerance yield greater flexibility for research and management interests, which include:

1. Characterizing harmful algal blooms that can be used as information to ensure boaters, recreationists and tourists that waters are safe for swimming, recreation and transportation.
2. Capturing acute impacts of major human and climatic disturbances in coastal waters. FerryMon recorded unprecedented air-water CO_2 fluxes and nutrient cycling rates after Hurricane Irene passed directly over the ferry route as it struck the US East Coast in 2011.

FerryMon's website (www.ferrymon.org) provides residents, tourists, fishermen and passengers daily information on water and habitat quality. The website also serves as a teaching tool for educational institutions (K-12), museums, the media, and public outreach programs. This information serves to improve public awareness of how human activities and climatic perturbations interact to determine water quality, habitat conditions and sustainability of the PSS.

DATA ANALYSIS OF OVERLAPPING FERRYBOX ROUTES – ALL FOR ONE, ONE FOR ALL

MAIK GRUNWALD & WILHELM PETERSEN

HELMHOLTZ-ZENTRUM GEESTHACHT, GERMANY

FerryBoxes installed on ships of opportunity (SoO) provide data of selected tracks on a regular basis. Within the European FerryBox Community several FerryBoxes are operated by different users. To gain a consolidated data set of parameters and to fill gaps, data from different FerryBoxes should be and could be combined.

Here we present a comparison of FerryBox data from different routes at three different crossing points located (i) in the south of Norway, (ii) in the south-eastern German Bight, and (iii) off the east coast of UK. Due to the fact that ships usually pass a certain point with a time difference, data were averaged for an area of ten to ten kilometres and for the entire calendar date of each passing. Thus, differences in datasets are obligatory but vary between parameters. While salinity is very sensitive to tidal influence, temperature is more balanced concerning temporal and special discrepancies. However, results of these intercomparisons end up with promising outcomes to combine data from FerryBox routes for a better general view and combined FerryBox datasets could be used for data assimilation to improve mathematical model results. Nevertheless, to enhance comparability, an intercalibration of sensors should be aspired. Additionally, data formats should be harmonized and data sets have to be made accessible to every community member, like in the MyOcean project. This would pioneer a more comprehensive exploration of the European Seas.

FERRYBOX DATA USED FOR CALIBRATION OF AN ECOLOGICAL BALTIC SEA MODEL – A STRONG SUPPLEMENT TO TRADITIONAL MONITORING DATA

RIKKE CLOSTER[1], ANDERS ERICHSEN[1], HANNE KAAS[1], JAN HENRIK ANDERSSON[1], THOMAS UHRENHOLDT[1] & LARS HANSEN[2]

[1]DHI, HØRSHOLM, DENMARK; [2]GRAS, KØBENHAVN K, DENMARK

Traditional monitoring data is typically measured with a monthly frequency, and thus reveals little information on timing, duration and maximum concentration of the sporadic algae blooms, which potentially can occur between two measurements. This challenges the calibration of ecological models, which predicts a dynamical pattern of the phytoplankton biomass. Through an EU FP7 project (CoBiOS) our ecological model for the Baltic Sea has been improved by supplementing the traditional monitoring data with FerryBox data on chlorophyll a and phycocyanin from the Northern Baltic Proper, Alg@line.

The FerryBox data proved to be a strong supplement to the traditional monitoring data. The high time resolution of the FerryBox data describes the temporal variability of algae biomass, and thus improves the calibration data for the model. In addition FerryBox data was used to illustrate the temporal variability along a transect from Germany to Finland, revealing large variation of the timing of the spring bloom, occurring 1-2 month earlier in the south-western part of the transect compared to the north-eastern part. Hence, relatively small inaccuracies of modelling result predicting the location and timing of hydrodynamic fronts may reveal very significant deviations when comparing with monitoring data.

COMBINATION OF HIGH FREQUENCY DEVICES TO CHARACTERIZE THE PHYTOPLANKTON COMMUNITY AND THE PHYSICO-CHEMICAL SUPPORTING PARAMETERS IN THE EASTERN ENGLISH CHANNEL, THE NORTH SEA AND THE DUTCH ESTUARIES.

ALAIN LEFEBVRE[1], FELIPE ARTIGAS[2,3], SIMON BONATO[2,3], VERONIQUE CREACH[4], MACHTELD RIJKEBOER[5] & MELILOTUS THYSSEN[6]

[1] IFREMER, BOULOGNE SUR MER, FRANCE. [2]UNIVERSITE DU LITTORAL COTE D'OPALE, FRANCE, [3] CNRS UMR8187 LOG, FRANCE, [4] THE CENTRE FOR ENVIRONMENT, FISHERIES AND AQUACULTURE SCIENCE (CEFAS), UK, [5] RWS CENTRE FOR WATER MANAGEMENT. THE NETHERLANDS, [6]CNRS UMR294, MEDITERRANEAN INSTITUTE OF OCEANOLOGY, FRANCE

In the frame of the DYMAPHY project (Interreg IVA "2 Mers Seas Zeeën" Programme), a Pocket Ferry Box (PFB, 4H-JENA©) coupled with a multiple-fixed wavelength spectral fluorometer (Algae Online Analyser, AOA, bbe©), a CTD probe and an automated pulse shape scanning flow cytometer dedicated to phytoplankton single cell analysis (CytoSense, Cytobuoy©) were implemented during scientific cruises in contrasted environment: the North Sea, the Eastern English Channel and the Dutch estuaries in 2011 and 2012. These instruments continuously quantify and determine phytoplankton community composition (in terms of spectral groups or at the genus/species level), and its variability, that is related to different environmental conditions. The high frequency sampling of the PFB (1 min), combined with high frequency biological parameters acquisition (1 min (AOA) and up to 10 min for the single cell level analysis) on contrasted areas allows to highlight spatial and temporal changes in the community which cannot be detected with conventional discrete sampling strategies frequently used in monitoring programmes. This study addresses that automated operational monitoring systems can measure at high frequency the variability of phytoplankton communities, as well as the supporting physico-chemical control parameters, in agreement with relevant spatial and temporal scales in order to properly address phytoplankton dynamics. This scale issue is very important when EU Member states are asked to implement the Marine Strategy Framework Directive to assess the Good Environmental Status at the marine region level (up to 200 nautical miles from shore) for several descriptors related, for example, to biodiversity, trophic network, eutrophication.

TOWARDS NEAR REAL TIME VALIDATION OF CHLOROPHYLL FLUORESCENCE

SEPPO KAITALA, JUKKA SEPPÄLÄ, PETRI MAUNULA & PASI YLÖSTALO

FINNISH ENVIRONMENT INSTITUTE (SYKE), FINLAND

In the year 2012 Alg@line ferrybox monitoring record along the Helsinki-Travemünde line has been carried out during 190 cruises. Although the Near Real Time records are transmitted every hour, displayd on the Batic Sea Portal and sent to MyOcean Data Portal, the use of the data is limited without validation against laboratory pigment analysis from water samples. Also photo-adaptation may play important role in fluorescence/Chlorophyll ratio. Due to the problems to install PAR sensor on the roof of the ferry, the Sun elevation was used as an axillary parameter to evaluate photo-adaptation. Also the impact of phycocyanin and turbidity was estimated in validation. Also physiological state of the phytoplankton cells has an effect on the fluorescence. Thus the inorganic nutrient availability was also included in the investigation. The aim of the study is to develop algorithm to convert the chlorophyll fluorescence to correspond better the chlorophyll content in the water and consequently used in NRT validation/assimilation of satellite data.

NORTHERN BALTIC SEA PHYTOPLANKTON COMMUNITIES AT THE BEGINNING AND END OF THE 20TH CENTURY – A COMPARISON OF HISTORICAL AND MODERN SPECIES DATA

HEIDI HÄLLFORS[1,2], HERMANNI BACKER[3],JUHA-MARKKU LEPPÄNEN[4], SEIJA HÄLLFORS[4], GUY HÄLLFORS[2] & HARRI KUOSA[4]

[1]UNIVERSITY OF HELSINKI, DEPARTMENT OF ENVIRONMENTAL SCIENCES, FINLAND, [2] TVÄRMINNE ZOOLOGICAL STATION, UNIVERSITY OF HELSINKI, FINLAND, [3]HELCOM (BALTIC MARINE ENVIRONMENT PROTECTION COMMISSION) SECRETARIAT, FINLAND, [4]FINNISH ENVIRONMENT INSTITUTE, MARINE RESEARCH CENTRE, FINLAND

Despite over 100 years of phytoplankton research in the Baltic Sea, little is known about how the species composition has changed during this period, characterised by severe anthropogenic eutrophication. Assessments of what the Baltic Sea used to be like, before the severe anthropogenic degradation, are needed to facilitate effective environmental protection measures required by Baltic Sea regional and European intergovernmental commitments. We compared the phytoplankton communities in the northern Baltic Sea using historical data from 1903–1911 and Algaline data from 1993–2005; to minimise effects of methodological differences we focused on occurrence frequencies. We found that the historical and modern communities differed regarding both species composition and the relative importance of taxonomical groups. The most obvious differences were the increase of dinoflagellates and decrease in the diatom:dinoflagellate ratio. Several shifts in the occurrence and seasonality of individual taxa transpired. For example, toxin-producing dinoflagellates of the genus *Dinophysis* occur considerably more frequently today, while the bloom-forming cyanophytes *Aphanizomenon flos-aquae* and *Nodularia spumigena* occurred commonly already 100 years ago. Examining our results in relation to environmental conditions we found that some changes may be symptomatic of climate change related pressures. However, statistical analyses revealed that an undefined 'period effect' was the most important factor separating the historical and modern communities. We interpret this 'period effect' as evidence for the direct and/or indirect influence of eutrophication. Our endeavour to identify occurrence-frequency based phytoplankton eutrophication indicators met however with difficulties as none of the candidates fulfilled the criteria of good stand-alone indicator species.

HIGH RESOLUTION MONITORING OF NEAR SURFACE WATERS IN THE BALTIC SEA AND THE KATTEGAT

BENGT KARLSON[1], KRISTIN ANDREASSON[1], MARIE JOHANSEN[1], SEPPO KAITALA[2], JOHAN KRONSELL[1], HENRIK LINDH[1], PETRI MAUNULA[2], MALIN MOHLIN[1], JUKKA SEPPÄLÄ[2], FREDRIK WALDH[1] & ANNA WILLSTRAND-WRANNE[1]

[1]SWEDISH METEOROLOGICAL AND HYDROLOGICAL INSTITUTE, OCEANOGRAPHY, SWEDEN, [2]FINNISH ENVIRONMENT INSTITUTE SYKE, MARINE RESEARCH CENTRE, FINLAND

The variability of near surface properties of the Baltic Sea and the Kattegat was investigated using sampling from research vessels in the Swedish National Marine Monitoring programme and by using a ship of opportunity with a FerryBox system with automated sampling and underway measurements. The FerryBox-system was mounted on a cargo vessel with a route covering the Gulf of Bothnia, the Baltic proper, the Belt Sea and the Kattegat twice a week. Data on temperature, salinity, oxygen and chlorophyll showed a high correlation between the underway measurements and the research vessel based measurements. Other parameters measured using the FerryBox-system include CO_2, turbidity and the fluorescence of phycocanin and coloured dissolved organic matter. The FerryBox-system was also used for collecting water samples of for laboratory analysis of salinity, coloured dissolved organic matter, total alkalinity, chlorophyll and phytoplankton.

MESOSCALE AND SUB-MESOSCALE VARIABILITY REVEALED BY COMBINING DATA FROM A FERRYBOX SYSTEM AND AUTONOMOUS BUOY PROFILER IN THE GULF OF FINLAND IN SUMMERS 2009-2012.

VILLU KIKAS, TAAVI LIBLIK, INGA LIPS & URMAS LIPS

MARINE SYSTEMS INSTITUTE AT TALLINN UNIVERSITY OF TECHNOLOGY, ESTONIA

Regular measurements using ferrybox (flow-through) systems are conducted between Tallinn and Helsinki in the Gulf of Finland since 1997. Since 2008 the ferrybox system has been installed aboard the Tallink Grupp passenger ferry Baltic Princess. Temperature, salinity and chlorophyll *a* fluorescence are recorded in every 20 seconds during two crossings of the Gulf of Finland a day. Water intake is located approximately 4 meters below the water level. The measurements have been used for monitoring and assessment purposes and in the studies of coastal upwelling events (the ferry line has very suitable position for that). However, these daily recordings provide information about the upwelling dynamics only in the surface layer. Since 2009 an autonomous buoy profiler is installed close to the ferry line in the southern part of the Gulf during summer months. Vertical profiles of temperature, salinity and chlorophyll *a* fluorescence are recorded from 3 to 50 meters with a time step of 3 hours. The main aim of the present paper is to describe inter-related horizontal and vertical variability (meso- and sub-mesoscale features, including upwelling and related filaments) of temperature, salinity and chlorophyll *a* by combining data acquired with the ferrybox system in the surface layer and vertical profiles measured by the buoy profiler. We relate the observed variability to the wind forcing and estimate the prevailing spatial (horizontal and vertical) scales of variability under different forcing conditions. In particular, we try to explain the occurrence of observed patches with high chlorophyll *a* concentration in the surface layer.

THE USE OF SATELLITE DATA FOR MONITORING WATER BODIES – COMPARISON WITH FERRYBOX DATA

JENNI ATTILA, SEPPO KAITALA, KARI KALLIO, HANNA ALASALMI, MIKKO KERVINEN & PIRKKO KAUPPILA

FINNISH ENVIRONMENT INSTITUTE SYKE, FINLAND

The reporting activities required by the EU water framework directive (WFD) and the marine strategy framework directive (MSFD) necessitate comprehensive collection of monitoring information from water bodies of Finland and adjacent water areas, including definitions of the status of these water bodies. The inclusion of EO methods and Alg@line ferrybox data together with other efficient techniques of measuring the state of Baltic Sea can assist in providing required monitoring actions, particularly in areas out of reach of traditional methods.

The northern Baltic Sea is characterized by fragmented coastline and thousands of islands of various sizes. MERIS and its follow-up instrument OLCI can provide the best functionality for the estimation of parameters related to chl-a and turbidity. This is related to both the spatial resolution of 300m as well as their band combination.

The comparison of monitoring methods is done using four different types monitoring methods: ferrybox, EO, traditional monitoring station data and mooring buoys. One comparison set shows the consistency of EO and Alg@line ferrybox transect data on the Baltic Proper. Other comparison is made on coastal waters of Finland showing time series calculated using EO, Alg@line, mooring buoys and traditional monitoring station data on WFD water bodies. Part of the validation is made using MERIS and MODIS satellite instrument data.

ACCESS TO DISTRIBUTED MARINE DATABASES ON THE BALTIC SEA

A. SOKOLOV[1], P. AXE[2], S. BOCK[3], S. KAITALA[4], O. H. MANSCHER[5], M. RODRIGUEZ-MEDINA[1], R. OLSONEN[4], I. PRIHA[6] & K. TIKKA[7]

[1]BALTIC NEST INSTITUTE, STOCKHOLM UNIVERSITY BALTIC SEA CENTRE, SWEDEN, [2]SWEDISH METEOROLOGICAL AND HYDROLOGICAL INSTITUTE, SWEDEN, [3]LEIBNIZ INSTITUTE FOR BALTIC SEA RESEARCH, GERMANY, [4]MARINE RESEARCH CENTRE, FINNISH ENVIRONMENT INSTITUTE, FINLAND, [5]DEPARTMENT OF BIOSCIENCE, AARHUS UNIVERSITY, DENMARK, [6]SIMSOFT OY, FINLAND, [7]FINNISH METEOROLOGICAL INSTITUTE, FINLAND

Baltic Nest Institute, Stockholm University (Sweden) in cooperation with Department of Bioscience/DCE, National Centre for Environment and Energy, Aarhus University (Denmark), Leibniz Institute for Baltic Sea Research (Germany), Finnish Environment Institute, Finnish Meteorological Institute and Swedish Meteorological and Hydrological Institute developed a data assessment system, aimed at providing tools for online analysis of marine environmental data (temperature, salinity, chemical properties) from distributed collection of databases on the Baltic Sea. Such approach allows users to have fast access to the most recent data from all major data providers and providers remain in control of their data. The system contains a web data portal, which provides concurrent access to distributed marine databases and presents information in a unified way. Two client programs use the data portal and provide tools to analyse the data.

The DAS - Data Assimilation System (http://nest.su.se/das/) accesses databases through the data portal and allow analysing the raw data and creating gridded data, which can be used as initial fields for 3D hydrodynamic models.

A decision support system Nest (http://nest.su.se/nest/) developed and maintained at the Stockholm University as a tool to support decision-making at international negotiations regarding the Baltic Sea environment also uses the data portal to access marine data, provide access to the raw data and perform time-series analysis.

The data portal designed to output data in a common format (CSV) for further post-processing using other software. It makes the system open to develop another client programs for data analysis.

FUTURE-PROOFING THE FERRYBOX – CALL FOR INPUT!

STEFAN SIMIS & SEPPO KAITALA

FINNISH ENVIRONMENT INSTITUTE SYKE, MARINE RESEARCH CENTRE, FINLAND

Ferryboxes are the most extensive source of in-situ observations of surface water quality in the Baltic Sea, and are a growing activity in coastal seas and oceans world-wide. Commercial systems are available, while custom-built solutions are also in wide use. Ferrybox systems in the Baltic Sea have evolved over 20 years, but are they also ready for decades to come? Is the ferrybox community ready to implement standard methods?

The BALMON project, commissioned by the European Space Agency, explores the feasibility of current and future *in situ* and remote water quality monitoring in the Baltic Sea. Ferryboxes are expected to play a major role in the sustained, near-real time delivery of quality-assured *in situ* observations. Emerging methods and data services must be supported from data collection to data dissemination.

In this talk, we present a vision of the ferrybox system of the future: what functionality is expected, and how can this be achieved? In discussing this vision, we welcome any and all contributions by users, developers, scientists, and manufacturers of ferrybox sensors and systems to identify further requirements for the design and operation of integrated ferrybox solutions. A draft document will be made available for discussion.

SPATIAL VARIABILITY OF CORRELATION BETWEEN IN SITU FERRYBOX AND REMOTE SENSING MEASUREMENTS OF CHLOROPHYLL A IN A BALTIC SEA SUMMER BLOOM

PHILIPP GROETSCH[1,2,3], STEFAN SIMIS[4], MARIEKE ELEVELD[2], STEEF PETERS[2,3]

[1] TARTU OBSERVATORY, ESTONIA, [2]VU UNIVERSITY AMSTERDAM, INSTITUTE FOR ENVIRONMENTAL STUDIES (IVM), THE NETHERLANDS, [3]WATER INSIGHT, THE NETHERLANDS, [4]FINNISH ENVIRONMENT INSTITUTE SYKE, FINLAND

The Baltic Sea is a great challenge for remote sensing applications because of its unique specific inertial optical properties (sIOPs), the typically low backscatter intensities and spatially highly variable vertical mixing situations. As a result, current water remote sensing algorithms are known to produce inaccurate water constituent concentration values. However, the absolute concentration values are of little importance when analyzing spatial variability. In this study spatial variability of a data set capturing the temporal evolution of the 2005 summer bloom in the central Baltic Sea is analyzed. The data set covers the bloom development with ten high resolution remote sensing images (MERIS FR) and in situ Algaline match-ups along a transect through the bloom. Two retrieval algorithms were used to obtain CHLa concentrations from the remote sensing measurements. A band ratio algorithm was applied to the atmospherically corrected satellite images. In addition, the neural network-based WeW/FUB algorithm was used to process top-of-atmosphere radiances. A moving window procedure rendered spatial correlations between these remote sensing derived CHLa products and the in situ measurements. The pre- and post-bloom scenes result in higher average correlations than the peak-bloom scenes. The spatial variability of the correlation was found to be increasing substantially during the bloom development. It is hypothesized that a stratified vertical mixing situation during the peak bloom scenes gives rise to both, lower average correlation and the increased spatial variability.

ASSIMILATING FERRY BOX DATA INTO THE AEGEAN SEA MODEL

G. KORRES, G. PETIHAKIS, M. NTOUMAS

INSTITUTE OF OCEANOGRAPHY, HELLENIC CENTRE FOR MARINE RESEARCH

Operational monitoring and forecasting of marine environmental conditions is a necessary tool for the effective management and protection of the marine ecosystem. It requires the use of multi-variable real-time measurements combined with advanced physical and ecological numerical models. Towards this a FerryBox system was originally installed and operated in the route Piraeus – Iraklion in 2003 for one year. Early 2012 the system was upgraded and moved to a new High-Speed ferry travelling daily in the same route as before. This route is by large traversing the Cretan Sea being the largest and deepest basin (2500 m) in the south Aegean Sea. The upgraded system includes temperature, salinity, fluorescence and turbidity, dissolved oxygen and pH sensors. The HCMR Ferry Box is today the only one in the Mediterranean and thus it can be considered as a test case.

In order to assess the impact of the Ferrybox SSS data in constraining the Aegean Sea hydrodynamic model which is part of the POSEIDON forecasting system, these data were assimilated into the model using an advanced multivariate assimilation scheme based on the Singular Evolutive Extended Kalman (SEEK) filter which is a simplified square-root extended Kalman filter that operates with low-rank error covariance matrices as a way to reduce the computational burden. The assimilation system merges on a weekly basis the background model solution with the AVISO gridded ($1/8^{o}$) absolute dynamic topography (ADT) observations for the Aegean Sea area, gridded ($1/16^{o}$) AVHRR SST data, T/S ARGO profiles and temperature profiles from any available XBTs over the area, using the time evolving filter statistics. The AVISO gridded maps of absolute dynamic topography are produced by merging all available satellites into one regional product available at near real time for the Mediterranean Sea. During the period mid-June 2012 – mid January 2013 additionally to the standard data set of observations, daily SSS data along the ferry boat route from Piraeus to Iraklion were assimilated into the model. Intercomparisons between the control run of the system (model run that uses only the standard data set of observations) and the experiment where the observational data set is augmented with the Ferrybox SSS data shows interesting results about their impact on SSS prediction and on other predicted model variables as well.

DEVELOPMENT OF THE AUTOMATIC DATA PROCESSING SYSTEM OF THE INSTITUTO ESPAÑOL DE OCEANOGRAFÍA SURFACE WATER SAMPLING NETWORK

GONZALO GONZÁLEZ-NUEVO, JOSE MANUEL CABANAS, MANUEL RUIZ VILLARREAL, ELENA TEL, PABLO OTERO, JESUS GAGO & ALICIA LAVIN

INSTITUTO ESPAÑOL DE OCEANOGRAFÍA (IEO), SPAIN

The Instituto Español de Oceanografía (www.ieo.es) has implemented a surface water sampling network in part of its fleet. This network is formed by one local (Navaz), two regional (Ramon Margalef y Angeles Alvariño) and two oceanic (Cornide de Saavedra y Miguel Oliver) research vessels. Each of them was instrumented with a SeaBird 21 thermosalinometer and a Turner 10 Fluorometer. The vessels work in the Iberian Peninsula, Balearic Islands and Canary Islands. Their activity is more intense in Galician and Cantabric coast due to their base port is located in Vigo.

As part of the projects Raia and Raiaco (www.observatorioraia.org) an automatic data processing system was developed to manage all the information generated in quasi-real time by this surface sampling network. The data of each vessel is send daily to a processing center. The developed software applies quality control subroutines and prepares the data to save it into local databases and generates preliminary graphical outputs.

All the network data are stored in a Thematic Realtime Environmental Distributed Data Services server (THREDDS) to facilitate its access by scientific community and its visualization by means of Open Geospatial Consortium (OGC) standard services. Using this infrastructure an ad-hoc web data-viewer was developed (www.indicedeafloramiento.ieo.es).

This effort in TSG data gathering and efficient distribution is helping the use of TSG data for evaluation of ocean models routinely run in the area. The system is already giving information on the exchange of water between the Galician Rias Baixas and the shelf, the variability in the position of river plume fronts or the spatial variability of chlorophyll concentration. In conclusion, this system can be an important part of any monitoring system in the area.

APPLICATION OF CONTINUOUS MEASUREMENTS ON FERRYBOXES TO OXYGEN FLUXES IN THE NORTH SEA

MICHAEL HALLER & WILHELM PETERSEN

HELMHOLTZ-ZENTRUM GEESTHACHT, INSTITUTE OF COASTAL RESEARCH, GERMANY

The monitoring of marine environments in coastal seas is still a challenge when continuous and reliable observations are needed. In context of acidification and eutrophication of the oceans as well as climate warming, research is needed for the evaluation of quantitative values regarding the cycles of oxygen and carbon. The gas exchange between ocean and atmosphere being part of the oxygen cycles is used for estimation of net primary production. These processes of gas exchange are strongly influenced by temperature, salinity and wind speed. Empirical functions are used for parameterisation of the gas transfer velocity and have been under discussion in recent years.

In this study we present data analyses of FerryBox transects in the North Sea covering a time period of several years. Onboard the FerryBox systems, optodes provide continuous measurements of dissolved oxygen concentrations. Together with temperature and salinity observations as well as wind field information derived from ECMW model reanalyses, the air-sea exchange of oxygen has been calculated for coastal zones. FerryBox systems on ships of opportunity provide continuous measurements over a longer timescale along transects in coastal oceans. Depending on the ship routes, the time interval at one point is about 1-2 days, so weekly data of oxygen anomalies are usable for the estimation of oxygen fluxes. Details of the analyses procedure as well as results will be presented.

However, this kind of analysis needs precise dissolved oxygen measurements as changes in oxygen concentration are small. So regular calibration of oxygen optodes is crucial and the errors concerning the estimated oxygen fluxes will be discussed.

AN OVERVIEW OF SPECTRAL *IN VIVO* FLUORESCENCE METHODS FOR PHYTOPLANKTON TAXONOMY

JUKKA SEPPÄLÄ, SEPPO KAITALA, MIKA RAATEOJA, STEFAN SIMIS & PASI YLÖSTALO

FINNISH ENVIRONMENT INSTITUTE, SYKE, FINLAND

Major taxonomic phytoplankton groups differ in their pigmentation and thus in the shape of their spectral fluorescence signal. Fluorometers using selective excitation of accessory pigments and recording either chlorophyll *a* or phycobilin fluorescence emission have been developed to derive phytoplankton group-level taxonomic information. We give an overview of the available instruments, which can be integrated on FerryBox systems. Especially we review their applicability for phytoplankton studies in the Baltic Sea.

In the Baltic Sea, phycocyanin fluorescence has been routinely applied since 2005 to detect filamentous cyanobacteria blooms. Taxonomic, technical and environmental challenges in the phycocyanin detection are reviewed based on field and experimental data and tests with various instruments.

Phycoerythrin signal in the Baltic Sea has a more diverse origin. Size fractionation and FlowCAM analyses of cells indicate that phycoerythrin fluorescence may arise from picocyanobacteria, larger cyanobacteria species, cryptomonads, some dinoflagellate species and ciliate *Myrionecta rubra* – all abundant during summer months.

Recording chlorophyll *a* excitation spectra provides more detailed information on group specific accessory pigments. Experimental data-sets from the Baltic Sea are analysed to find which wavelengths carry out the most of the taxonomically related information. Various computational and statistical methods to analyse spectral data are briefly compared.

ADCP INSTALLATION IN A SHIP-OF-OPPORTUNITY

CHRISTOPHER AIKEN & PAOLA RAMIREZ VON HOLLE

PROYECTO FOCA-MORSA, CHILE

In this talk we discuss both the how and the why of installing an acoustic Doppler current profiler (ADCP) in the merchant vessel M/N Condor. While recent decades have seen a proliferation in the availability of synthetic currents from ocean circulation models, there are in fact still relatively few actual measurements of ocean velocity, especially below the surface. Vertical transects from moving vessels can provide a revealing picture of ocean velocity structure that is often not readily apparent from fixed moorings. In the case of Chile, the character of the complex 3d structure of the ocean circulation is a key element in the extremely productive fisheries of the Humboldt current system, and hence ocean velocity monitoring can play an important role in managing the various services provided to society by the marine ecosystem. As its route covers over half the length of Chile's 4000+ km coastline and crosses the shelf a number of times, the M/N Condor represents a very convenient platform for monitoring the state of the coastal circulation. The various technical challenges involved in the installation will be discussed and some preliminary results presented.

NEW AUTONOMOUS SENSORS FOR UNDERWAY MEASUREMENTS

STEFFEN AßMANN, CARSTEN FRANK, JOCHEN WOLLSCHLÄGER, WILHELM PETERSEN

HELMHOLTZ-ZENTRUM GEESTHACHT, INSTITUTE OF COASTAL RESEARCH, GERMANY

Autonomous measurement systems have been developed for a numerous of analytes. These developments are important for monitoring the strong dynamics especially in coastal areas with a high spatial and temporal resolution. Here we present a set of new sensors designed for automated measurement systems (e.g. FerryBoxes) with focus on monitoring biogeochemical processes in seawater. Newly developed robust and reliable analyzers based on Sequential Injection Analysis (SIA) for measurements of nutrients such as o-phosphate (o-PO_4), nitrate (NO_3), and ammonia (NH_4) can be used to determine the status of eutrophication. In addition a full characterization of the carbonate chemistry is possible with the newly developed, highly accurate, optical pH and alkalinity (A_T) sensor on the basis of spectrophotometric absorbance measurements. Furthermore, the development of a Point Source Integrating Cavity Absorption Meter to a flow-through system (ft-PSICAM) can help to discriminate different water constituents and phytoplankton taxonomic groups from full absorption spectra in order to e.g. identify bloom-forming groups that potentially develop into harmful algal blooms. This new ensemble of sensors gives the opportunity to expand the spectrum of measureable parameters in underway systems towards more biological related variables and offers the opportunity for long-term continuous monitoring of the dynamics of biogeochemical processes in the ocean.

UNDERSTANDING SEA SURFACE TEMPERATURE MEASUREMENTS MADE BY 4 DIFFERENT INSTRUMENTAL METHODS ON A SHIP OF OPPORTUNITY.

MARK HARTMAN

NATIONAL OCEANOGRAPHY CENTER, UK

Few oceanographic measurements are as fundamental or well understood as temperature. It impacts on other measurements and is also important from the perspective of air-sea gas exchange, climatology and biological processes. A Ferrybox system underwent development and was installed aboard the Pride of Bilbao ferry from 2002 through 2010. Initially and primarily temperature within a flow through housing was used to calculate salinity, realisation of the effect that its difference to the in situ temperature made to air-sea gas exchange calculations in 2005 prompted installation of an hull mounted thermistor (SBE48). Working with other groups on the ferry has provided data from a sea surface radiometer Infrared SST (ISAR) and towed thermistors (CPR). A great advantage of hull mounted thermistors over other methods of measuring in-situ temperature is their ease of mounting against the ship's hull. However, there has been some uncertainty in the ability of hull thermometry to represent the true in situ temperature. An improvement of 0.25° C towards the true value of the in situ temperature was realised through insulation against the ambient internal temperature of the ship in 2008. Comparison of the different data sources has enabled spatial and temporal comparisons of the sensor temperature differences and shown that regional stratification can have an influence. A key development has been a procedure for calculating the delay and mixing within the flow through system. A comparison of contemporaneous measurements by the four sensors types during 2009 & 2010 is reported and a quantitative relationship between the measurements presented. The analysis procedure may be helpful to other FerryBox operators.

DETERMINATION OF pH AND pCO_2; NEW AUTONOMOUS INSTRUMENTATION FOR FERRYBOX

KAI SØRENSEN[1], EMANUELE REGGIANI[1], MICHEL MASSON[2], ANDREAS KRÜGER[2], MARIT NORLI[1], RICHARD BELLERBY[1], PIERRE JACCARD[1], EVGENIJ YAKUSHEV[1] & TOBIAS STEINHOFF[3]

[1]NORWEGIAN INSTITUTE FOR WATER RESEARCH, [2]FRANATECH GMBH, [3]GEOMAR

The assessment of anthropogenic impact on marine carbon system is increasingly demanding the deployment of instrumentation capable to detect changes at the level necessary to understand and estimate future trends. A national monitoring program of marine acidification has started in Norwegian waters including the coast and urgent demand for cost effective monitoring systems and instrumentation is highly needed.

The installed Norwegian Institute for Water Research (NIVA) Ferrybox system (www.ferrybox.no) allows performing continuous measurements of temperature, salinity, turbidity, dissolved oxygen and chlorophyll-a fluorescence. Deck sensors also make it possible to measure the marine reflectance (ocean color) to be used for satellite validation and algorithms developments. The water intake at the ship is positioned at about 4 m depth and the water is pumped through the sensors measurements compartments. The system is equipped also with a refrigerated 24 x 1 liters sampler allowing automatic sampling in remotely chosen positions. This network of monitoring systems will now be equipped with sensors for measuring pCO_2 and pH in a combined approached to be able to explore the high frequent variation in the carbon speciation of the surface waters. Ships of opportunity's transects offer cost effective way for ocean acidification surveying.

A new installation combining autonomous pCO_2 and spectrophotometric pH detection will be installed in 2013. The latter is based on an effective set-up for high resolution absorbance detection. Using a suitable dye injection, the determination of seawater pH has been tested at the prototype level and a unit capable to reach high precision is currently under development at NIVA. Recently advances in direct pCO_2 sensing by means of a combined membrane technology and a new detector system have made it possible to couple the two measurement systems in a compact, reliable Ferrybox set-up requiring minimal maintenance, thus providing an excellent data source from ocean surface aiming to a better estimate of CO_2 fluxes during extended periods.

The new system will increase our knowledge about the inter-annual changes of pH and pCO_2 in this challenging study area, and increase the input data for estimates of ocean acidification. This presentation will give an overview of the latest development and the prototype testing.

NEW MICROLFA MODULES FOR ON-LINE MEASUREMENT OF NUTRIENTS IN SHIP OF CONVENIENCE APPLICATION

P. MOSCETTA, L. SANFILIPPO

SYSTEA S.P.A., ITALY

Continuous, high frequency data is a critical source of information for the understanding of seasonal chemical and biological changes in marine environments since they allow real-time estimation of nutrient dynamics, primary and secondary production as well as timely assessment of C, N, P fluxes associated with biogeochemical cycling.

All of these issues have been the focus of SYSTEA R&D activities from the very beginning. In particular, the flagship product was a line of compact on-line analyzers (Micromac-1000), which has been consistently implemented during the years. This instrumentation has been thoroughly tested by scientific institutions specialized in marine ecosystem and used successfully by several European Institutions for ship of convenience applications. SYSTEA is currently among the very few companies worldwide able to offer such kind of automated solutions.

An innovative very compact microfluidic based autonomous measurement module, based on micro LFA technology, was specifically designed and built to be integrated in ship of convenience application for the detection, at trace levels, of nutrient parameters (orthophosphates, ammonia, nitrites and nitrates) and silicates, using well known and tested spectrophotometric wet chemistries and, specifically for the determination of ammonia, an advanced fluorimetric method.

The small reactor (1.5 mL µLFR), featuring sealed Teflon based hydraulics, enables extremely low reagents consumption and allows plug-in handling of reagents and calibrants for easier maintenance on board.

For a direct integration to ship of convenience measurement control systems, a easy-to-configure option was included which allows external management of the fully autonomous analyser via a RS-232 serial port.

-4H- FERRYBOX: AUTOMATIC AND REMOTE CONTROLLED MEASUREMENTS FOR SHIPS AND MEASURING STATIONS WITH SPECIAL ASPECTS TO NEW DESIGNED FLOW THROUGH PASSIVE-, LITTER- AND ALGAE SAMPLER AND 1 YEAR CONTINUOUS MEASUREMENTS IN NY ÅLESUND (ARCTIC).

TOBIAS BOEHME

-4H- JENA ENGINEERING GMBH, KIEL, GERMANY

During this session some new designs of 4H-FerryBoxes will be presented. The new system offers solutions from very small portable basic systems (15 kg) to full equipped measuring container operable on supply vessels. The layout of the new system gets more and more adapt to application and scientific questions of the Customers. New on the 4H Ferrybox systems is the opportunity to control the whole system via network. The PC or laptop with the software for operation and data acquisition could be located far away from the flow through unit in a dry area of the ship/boat. This new developments increases the application area from very hot tropical areas to very could arctic environment. Since spring 2012 a 4H-Ferrybox system with antifouling unit is located in Ny Ålesund and worldwide the first continuous winter measurements of the water parameters below the ice formation could be realized. This system is coupled via network to an underwater winched camera system to determinate the seasonal composition and quantity of fish spices. Some first results of this measurement will be presented. In cooperation with CEFAS a new automatic sampler for litter, algae and toxic substances (passive sampler) was developed and will be introduced. These samplers are position and event controlled and could realized automatic measurement for the water framework directive during “normal” cruises of RV.

ENVIRONMENTAL MONITORING USING THE OCEANPACK: A ROBUST, FLEXIBLE AND COST-EFFICIENT "AUTONOMOUS UNDERWAY MEASUREMENT SYSTEM"

SASKIA HECKMANN, STEFAN MARX

SUBCTECH GMBH, GERMANY

Permanent monitoring of water quality parameters is very important to understand environmental processes around the world. However, the possibilities to get permanent, high quality data are limited. After many years of research there is still a need for more sophisticate technology to measure and to understand the interaction of, for example, greenhouse gases like CO_2 with the environment.

The company SubCtech used their long lasting experience to develop the modular *OceanPack* System which is nowadays used by public authorities, science and industry.

The system approved especially while used in difficult conditions such as high sediment yield (up to 10,000 FTU), growing bio-fouling (the Wadden Sea), waves and spray (27ft Racing Yacht (*OceanoScientific*® Programme)).

After three years of application SubCtech is proud to present different data collected using the AUMS (Autonomous Underway Measurement System) *OceanPack* on different kind of ships. Form large research vessels e.g. RV Belgica and RV Polarstern doing Sea-Air-Exchange measurements to middle size sailing ships e.g. La Louise and Bark Europa performing water quality measurements in hardly sampled regions like around Greenland and Antarctic.

POSTERS

SCIENTIFIC DATA ACQUISITION BY SAILING SHIPS: THE OCEANOSCIENTIFIC® PROGRAMME FERRYBOX

CINDY GUILLEMET & MARGOT CHOQUER

SAILINGONE, FRANCE

The *OceanoScientific® Programme* provides the international scientific community free of charge with scientific data collected at the ocean - atmosphere interface in sea areas subject to little or no scientific exploration.

In November 2006 began a collaboration with the French institutes IFREMER, Météo-France, INSU/CNRS and GEOMAR (Ger.) and later on with the University of Maine and the Laboratory of Oceanography of Villefranche-sur-Mer.

The tool of the *OceanoScientific® Programme* is the *OceanoScientific® System* (OSC System), which will be industrialized as from summer 2014. This is a "Plug & Play" equipment for the automatic acquisition and transmission by satellite of at least twelve scientific parameters - formatted according to the standards of UN agencies - related to climate change. Current parameters are: wind speed, wind direction, air relative humidity, air temperature, sea level pressure, SST, SSS, pCO2, photoactive radiation, fluorescence, pH and turbidity. Several test and development campaigns have been organized for the various prototypes of the OSC System, named *OceanoScientific® Campaigns*.

The aim of the Programme is now also to carry out expeditions on 16-meter sailing ships especially designed for scientific use, the NAVOSE® - that is to say in French: Navire A Voile d'Observation Scientifique de l'Environnement. The aim is to collect scientific data at the ocean - atmosphere interface and to release autonomous scientific equipment in sea areas subject to little or no exploration. As from 2013, scientific expeditions will be carried out every year around the Antarctica. The first expedition is scheduled from next October to March 2014.

KARENIA MIKIMOTOI OBSERVATIONS FROM A SHIP OF OPPORTUNITY IN THE ENGLISH CHANNEL IN RELATION TO HYDROGRAPHICAL AND METEOROLOGICAL FEATURES

SUSAN HARTMAN, MARK HARTMAN & DAVID HYDES.

NATIONAL OCEANOGRAPHY CENTRE, SOUTHAMPTON

Unusually high chlorophyll values (~ 14 mg chl m^{-3} at 5m depth), recorded on a ship of opportunity (SOO) in July 2010, indicated the occurrence of a potential Harmful Algal Bloom (HAB) in the Western approaches of the English Channel. This bloom, located at 49.7°N, 3.2°W was observed via complementary datasets. These included *in situ* data to identify factors related to bloom initiation, data from samples collected for plant pigment and taxonomy analysis and information from satellite maps to follow geographical bloom development. The relationships between chlorophyll-fluorescence, temperature, salinity and wind speed were examined. The intense summer bloom predominantly consisted of the dinoflagellate *Karenia mikimotoi* and followed an increase in sea surface temperature (18.5 °C). A mid-channel bloom of this magnitude was last seen in 2003 along the SOO route when the peak biomass occurred at the same location and coincided with the least saline, warmest water and lowest wind speeds over a 4 year period. In both years the *Karenia mikimotoi* blooms were associated with lower density waters (rho<1025.7kgm-3). This study demonstrates that the SOO time series of continuous *in situ* measurements and frequent sampling is a useful tool in identifying and tracking HAB events.

FERRYBOX: A SOLUTION FOR RIJKSWATERSTAAT?

JOS KOKKE

RIJKSWATERSTAAT NORDZEE, THE NETHERLANDS

In the Netherlands Rijkswaterstaat recognizes that a lot more knowledge of the marine ecosystem can be gained by using ferrybox measurement time series. Within Rijkswaterstaat the use of the ferrybox on the survey ship Zirfaea as a platform for instrument testing is strongly advocated.
Nevertheless the long term interest of Rijkswaterstaat in ferrybox developments is to effectively assess the eutrophication status of the North Sea by cost efficient replacement of our traditional low rate shipborne measurements on predefined discrete locations by high rate autonomous measurements along selected transects.
With this poster we wish to communicate the challenges which we still face on different levels before reaching the above situation:
1. The infrastructure aboard the ship(s) on which the ferrybox is mounted, including water inlet, pump system and ferrybox instrumentation, has to be such that measurements and sample analyses will indisputably represent the properties of the water taken outside the ship;
2. The set of 'proven technology' measurement instruments on the ferrybox will have to be completed, at least for the monitoring of all relevant eutrophication parameters including nutrients, phytoplankton and algae species composition, and preferably also for the most important chemical substances;
3. A new strategy for biogeochemical monitoring of the North Sea has to be developed and set in place; in that process the incorporation of ferrybox measurements should be carefully considered.

CONNECTIVITY AND TRANSPORT PATTERNS IN THE BALTIC *SKELETONEMA MARINOI* SPRING BLOOM: A JOINT NORDIC RESEARCH NETWORK (PRODIVERSA) STUDY USING SHIPS OF OPPORTUNITY AS A SAMPLING PLATFORM

ANKE KREMP[1], KARIN RENGEFORS[2], NINA LUNDHOLM[3], SANNA SUIKKANEN[1], MIREIA BERTOS[4], CARINA BUNSE[4], SUSANNA GROSS[5], SARA HARDARDOTTIR[3], INGRID SASSENHAGEN[2], JOSEFIN SEFBLOM[5], SIRJE SILDEVER[6], CONNY SJÖQVIST[1], ANNA GODHE[5]

[1]FINNISH ENVIRONMENT INSTITUTE, SYKE, FINLAND, [2]LUND UNIVERSITY, SWEDEN, [3]UNIVERISTY OF COPENHAGEN, DENMARK, [4]LINNAEUS UNIVERSITY, KALMAR, SWEDEN, [5]UNIVERISTY OF GOTHENBURG, SWEDEN, [6]TALLINN UNIVERSITY OF TECHNOLOGY, ESTONIA

In the Baltic Sea the spring phytoplankton bloom is the most important contributor to the annual new production. Typically it starts in the south in February, continues developing along the S/N gradient through March and peaking in late April in the North. While the coastal blooms are genetically differentiated and likely to be seeded by local benthic resting stages, the origin and the extension of open sea blooms is not clear. It has been commonly postulated that the Baltic spring bloom “travels” northward. However, it is not clear if such successive spreading is a result of northward transport of one southern Baltic population by surface currents, or whether it is successively “spreading” because of phased local initiation due to gradual warming. The goal of this survey is to study connectivity and potential transport pattern within the Baltic spring bloom using temporal and spatial genetic structure information of the spring bloom diatom *Skeletonema marinoi. S marinoi* is one of the most abundant members of the Baltic spring phytoplankton community and present throughout the entire Baltic. The species has been studied extensively in monitoring programs and population genetic tools are available. We record and analyze the genetic structure of *S. marinoi* isolates grown from bloom samples (surface water) taken during 4 successive cruises in March and April 2013 along the N-S transect through the Baltic proper. Sampling was performed using the Algaline sampling platform onboard Finnmaid, a “ship of opportunity” that automatically takes in water samples in regular intervals across the passage through the Baltic Sea. This presentation will give an overview of the study and evaluate the use of ships of opportunity in phytoplankton ecology research.

COMPARATIVE ANALYSIS OF PHYTOPLANKTON MONITORING METHODS IN THE BALTIC SEA

IVAN KUPRIJANOV, ANDRES JAANUS, KAIRE TOMING

ESTONIAN MARINE INSTITUTE, UNIVERSITY OF TARTU, MÄEALUSE 14, 12618 TALLINN, ESTONIA

Spatial and temporal distribution of algal blooms in marine environments is highly variable. Ships of opportunity have become a cost-effective and reliable basis for implementing instruments of quasi-continuous high-frequency observations of environmental parameters. Ferrybox data represents the transect area and the upper surface layer as the ship creates turbulence when moving, although the water inlet is located at ~5 meter depth. Large spatial resolution of the satellite imagery is limited by sampling depth, atmospheric conditions and needs constant in situ validation procedures.

Chlorophyll *a* data that serves as a proxy of phytoplankton biomass from two Ferrybox flowthrough systems and from remote sensing images were compared to improve the quality of large scale monitoring of phytoplankton spring blooms. The comparison of data sets showed linear relationships with different levels of variation indicating that different observation methods capture similar spatial dynamics of phytoplankton. The period of analysis of Ferrybox and satellite data covered spring period between 10th April and 6th May 2011 and between 4th and 9th April 2012. For analysis of 2011 data MODIS/Aqua images (with 1000 m resolution) and for 2012- MERIS images (with 300 m resolution) were acquired. The study area covers Northern Baltic Sea region: western Gulf of Finland, Baltic Proper and the Archipelago Sea.

Observations derived from parallel Ferrybox systems (with max time-lag between 5h and 12h) indicated significant linear relationships. The best fit of chlorophyll *a* in situ fluorescence between the two ferrybox transects was observed in Aprill 2012 (R^2=79% ; MAE=1.93 a.u. with max values 31.7 and 20.7 a.u.). Statistical modelling showed that calculated temporal and spatial distance between the nearest points of measurements throughout overlapping ferry routes do not have significant influence on differences between comparable chlorophyll *a* values

MODIS data applied for comparative analysis explained variation in chlorophyll fluorescence data within a wide range (R^2 =1%-68%). Values derived from MERIS satellite exposed good fit for chl *a* fluorescence in comparison with both flowthrough systems (R^2=47%-76%) showing similar patterns of phytoplankton biomass distribution both in the Baltic Proper and the western Gulf of Finland.

The obtained results can be used to improve open sea monitoring of phytoplankton spring blooms, however, the limitations of Ferrybox techniques and satellite imagery should be taken into account by large scale data validation.

SPATIO-TEMPORAL DYNAMICS OF BIOGEOCHEMICAL PARAMETERS AND AIR-SEA CO_2 FLUXES IN THE WESTERN ENGLISH CHANNEL (WEC) BASED ON VOLUNTARY OBSERVING SHIP (VOS) MEASUREMENTS WITH A FERRYBOX SYSTEM

PIERRE MARREC, THIERRY CARIOU, MARIE LATIMIER, ERIC MACÉ, PASCAL MORIN, MARC VERNET & YANN BOZEC

CNRS, STATION BIOLOGIQUE DE ROSCOFF, FRANCE, UPMC UNIV. PARIS 06, STATION BIOLOGIQUE DE ROSCOFF, FRANCE

Voluntary Observing Ships (VOS) allow covering regularly extended areas at a lesser cost. Ships of opportunity are now equipped with automated ocean observing systems including several sensors. A FerryBox have been installed on the Armorique ferry (Brittany Ferries) which cross up to 3 times a day the Western English Channel (WEC) between Roscoff (France) and Plymouth (UK) for two years. Temperature, salinity, dissolved oxygen concentration, fluorescence and partial pressure of CO_2 (since April 2012) were recorded continuously along the ferry track. Sensors were calibrated bimonthly with discrete measurements during return crossing. Calibrated data since April 2012 will be presented in order to observe the short-scale variations of these biogeochemical parameters in the WEC. These high-frequency data provide new insights into the CO_2 system dynamics in the WEC where air-sea CO_2 fluxes present a high spatio-temporal variability. In coastal ecosystems high-frequency and extended pCO_2 data are presently relatively sparse regarding the diversity of these systems. In the context of climate change driven by the raise of atmospheric CO_2 due to anthropogenic activities, a better knowledge of air-sea CO_2 flux dynamics is essential and particularly in marginal seas.

RECENT PROGRESS IN CHILE'S SOO NETWORK "FOCA-MORSA"

PAOLA RAMIREZ VON HOLLE & CHRISTOPHER AIKEN

PROYECTO FOCA-MORSA, CHILE

Over the last 6 years the FOCA-MORSA project (Ferries Observando los Canales Australes – Mercantes Observando la Region Sud Americana) has steadily developed a ship-of-opportunity based monitoring network for the Chilean coastal zone. Chile is blessed with an enormous and resource rich EEZ, but lacks sufficient infrastructure to adequately monitor, and hence manage, its marine territory. Considering this, a major focus of FOCA-MORSA is to build a long term and sustainable monitoring infrastructure of the ocean state that spans the EEZ, for which keeping costs low is essential. While many FerryBox systems are designed to be completely autonomous, we highlight our positive experiences from engaging the ship's crew in the project. By embracing their enthusiasm for the project and their willingness to participate, we are able to incorporate our flow-trough system into the ship's circuit, rather than keeping it isolated. The involvement of the crew yields rewards beyond the cost savings and the improved system reliability. We outline the current state and future plans for the network.

DETECTION OF CONTRASTED PHYSICO-CHEMICAL AND BIOLOGICAL ENVIRONMENTAL STATUS USING CLASSIFICATION AND MODELLING TOOLS.

KEVIN ROUSSEEUW[1], ALAIN LEFEBVRE[1], EMILIE CAILLAULT[2] & DENIS HAMAD[2]

[1] UNIVERSITÉ LILLE NORD DE FRANCE – CENTRE IFREMER MANCHE MER DU NORD, FRANCE, [2]UNIVERSITÉ LILLE NORD DE FRANCE ULCO/LISIC, FRANCE

Many fixed or embedded water acquisition systems are available and collect a huge amount of data (physical and biological parameters with high spatial and/or temporal resolutions). A good knowledge of these data is a hard task because of the important variability in ecosystems dynamics and the nature of the data (aberrant or missing due to sensor failure or maintenance, communication errors). Few of the existing databases dedicated to high frequency (HF) monitoring programmes takes benefice from the specific HF-oriented methodologies. These aim to optimize analysis and propose some modelling to allow an optimal interpretation of the marine water quality and ecosystems functioning.

Implementation of such methodologies has been applied to the MAREL Carnot (Ifremer's instrumented buoy) signal database, which contains 16 parameters collected every 20 minutes and 3 nutrients parameters every 12 hours.

We propose an unsupervised clustering method (kmeans) aiming at being able to detect characteristic clusters without any a priori biologic knowledge. With K=5 clusters, the classification highlights the main biological dynamic of the phytoplankton. The method is able to detect changes in phytoplankton biomass in response to changes in environmental conditions but also to detect rare forcing events such as inputs of huge amount of nutrients which explain the development of regional-controlled minor blooms surimposed on the main pattern generally observed in temperate coastal waters.

The next step is to predict the dynamic of the phytoplankton blooms (included Harmful Algal Blooms) and to develop early warning system by coupling unsupervised or semi-supervised clusterings and Markovian process theory.

VARIABILITY OF THE RELATIONSHIP BETWEEN ELECTRON TRANSFER RATES AND ^{14}C-BASED PRODUCTION IN THE BALTIC SEA

PASI YLÖSTALO, STEFAN SIMIS, KRISTIAN SPILLING & JUKKA SEPPÄLÄ

FINNISH ENVIRONMENT INSTITUTE, MARINE RESEARCH CENTRE, FINLAND

Active fluorescence methods, and fast repetition rate (FRR) fluorometry in particular, could present a rapid and non-intrusive way to study aquatic primary production without the practical constraints of traditional methods (O_2 evolution or ^{14}C uptake). Fluorescence methods allow a high observation frequency and autonomous operation from ferries or buoys.

Despite technical advances and increased commercial availability, fluorescence-based productivity tools have not become established in monitoring programs, partly due to uncertainties in the conversion from the electron transfer rate (ETR) in photosystem II (that is observed with the fluorometric techniques), to the ecologically more meaningful rates of carbon fixation.

Here, we present results from a series of field studies in the Baltic Sea, carried out to assess the sources of variability in the conversion factor (CF) from fluorometry-based ETR to ^{14}C-based productivity, so that the fluorometric method may be implemented in environmental monitoring.

LIST OF PARTICIPANTS

Name	Organization	E-mail
Ahlman Mikaela	Centre for Economic Development, Transport and the Environment for Uusimaa , FI	mikaela.ahlman@ely-keskus.fi
Aiken Chris	Proyecto FOCA-MORSA, CL	chris@foca.cl
Aßmann Steffen	Helmholtz-Zentrum Geesthacht, DE	steffen.assmann@hzg.de
Attila Jenni	SYKE, FI	jenni.attila@environment.fi
Boehme Tobias	4H-JENA engineering, DE	tboehme@4h-jena.de
Boer Michael	4H-JENA engineering, DE	boer@4h-jena.de
Choquer Margot	SailingOne – OceanoScientific, FR	mch@oceanoscientific.org
Closter Rikke Margrethe	DHI Water Environment Health, DK	rmc@dhigroup.com
Enqvist Jonna	SYKE, FI	jonna.enqvist@environment.fi
Etholen Anita	SYKE, FI	anita.etholen@environment.fi
Farcy Patrick	Ifremer, FR	patrick.farcy@ifremer.fr
Frias Manuel	Helcom, FI	manuel.friasvega@helcom.fi
Glockzin Michael	IOW, DE	michael.glockzin@io-warnemuende.de
González-Nuevo Gonzalo	Instituto Español de Oceanografía, ES	gonzalogonzaleznuevo@gmail.com
Gorringe Patrick	EuroGOOS AISBL, BE	patrick.gorringe@eurogoos.eu
Groetsch Philipp	Water Insight, NL	groetsch@waterinsight.nl
Grunwald Maik	Helmholtz-Zentrum Geesthacht, DE	maik.grunwald@hzg.de
Guillemet Cindy	SailingOne – OceanoScientific, FR	cg@sailingone.com
Haller Michael	Helmholtz-Zentrum Geesthacht, DE	michael.haller@hzg.de
Hartman Mark	The National Oceanography Centre, UK	mch@noc.ac.uk
Hartogs Marc	Rijkswaterstaat, NL	marc.hartogs@rws.nl
Heckmann Saskia	SubCtech, DE	marx@subCtech.com
Houben Andrea	Rijkswaterstaat, NL	andrea.houben@rws.nl
Heltne Jarle	Aanderaa Data Instruments AS, NO	jarle.heltne@xyleminc.com
Hällfors Heidi	Helsinki City Environment Centre, FI	heidi.hallfors@hel.fi
Jaanus Andres	Estonian Marine Institute, EE	andres@sea.ee
Jaccard Pierre	NIVA, NO	pierre.jaccard@niva.no
Kaitala Seppo	SYKE, FI	seppo.kaitala@environment.fi
Kallio Kari	SYKE, FI	kari.y.kallio@environment.fi
Kettunen Juhani	SYKE, FI	juhani.kettunen@environment.fi
Kikas Villu	Marine Systems Institute, EE	villu.kikas@msi.ttu.ee
Kirbach Christoph	CONTROS Systems & Solutions, DE	c.kirbach@contros.eu

Kokke Jos	Rijkswaterstaat, NL	jos.kokke@rws.nl
Kremp Anke	SYKE, FI	anke.kremp@environment.fi
Kuprijanov Ivan	Estonian Marine Institute, EE	ivan.kuprijanov@ut.ee
Lefebvre Alain	IFREMER, FR	alain.lefebvre@ifremer.fr
Lehtinen Sirpa	SYKE, FI	sirpa.lehtinen@environment.fi
Lohse Detlev	bbe Moldaenke, DE	dlohse@bbe-moldaenke.de
Marx Stefan	SubCtech, DE	marx@subCtech.com
Masson Michel	Franatech, DE	m.masson@franatech.com
Maunula Petri	SYKE, FI	petri.maunula@environment.fi
Mohlin Malin	SMHI, SE	malin.mohlin@smhi.se
Møller Sørensen Mikkel	MacArtney, DK	mms@macartney.com
Nenonen Susanna	SYKE, FI	susanna.nenonen@environment.fi
Norli Marit	NIVA, NO	marit.norli@niva.no
Ntoumas Manolis	Hellenic Centre for Marine Research, GR	mntou@hcmr.gr
Oja Johanna	SYKE, FI	johanna.oja@environment.fi
Paerl Hans	UNC-CH Institute of Marine Sciences, US	hans.paerl@unc.edu
Petersen Wilhelm	Helmholtz-Zentrum Geesthacht, DE	wilhelm.petersen@hzg.de
Petihakis George	Hellenic Centre for Marine Research, GR	gpetihakis@hcmr.gr
Pitkänen Heikki	SYKE, FI	heikki.pitkanen@environment.fi
Raateoja Mika	SYKE, FI	mika.raateoja@environment.fi
Ramirez von Holle Paola Andrea	Proyecto FOCA-MORSA, CL	paola@foca.cl
Rantajärvi Eija	SYKE, FI	eija.rantajarvi@environment.fi
Reggiani Emanuele	NIVA, NO	emanuele.roberto.reggiani@niva.no
Ritzmann Anne	Coastal Research Station, DE	Anne.Ritzmann@nlwkn-ny.niedersachsen.de
Roiha Petra	Finnish Meteorological Institute, FI	petra.roiha@fmi.fi
Sanfilippo Luca	SYSTEA SpA, IT	luca.sanfilippo@systea.it
Sawkins Mike G.	MacArtney, UK	mgs@macartney.com
Seppälä Jukka	SYKE, FI	jukka.seppala@environment.fi
Sicner Michal	Photon Systems Instruments, CZ	michals@psi.cz
Simis Stefan	SYKE, FI	stefan.simis@environment.fi
Sivyer Dave	Cefas, UK	dave.sivyer@cefas.co.uk
Skjeie Bjørn Ove	Franatech, DE	info@franatech.com
Sokolov Alexander	Baltic Nest Institute, SE	alexander.sokolov@su.se
Sørensen Kaj	NIVA, NO	kai.sorensen@niva.no
Tamminen Timo	SYKE, FI	timo.tamminen@environment.fi
Taupier-Letage Isabelle	IFREMER, FR	isabelle.taupier.letage@ifremer.fr
Vahtera Emil	Helsinki City Environment Centre, FI	emil.vahtera@hel.fi
Walls Mari	SYKE, FI	mari.walls@environment.fi
Westbrook Guy	P&O Maritime, IE	guy.westbrook@marine.ie
Ylöstalo Pasi	SYKE, FI	pasi.ylostalo@environment.fi