BOOS national activities in 2016

part2 – Observeration and services

BOOS STG
CMEMS Ocean State Report: Baltic Sea inflow
Eutrophication, hypoxia, low sea level event
Eutrophication: summer bloom

**Figure 2.** Time series of summer bloom spatiotemporal coverage (day·km²) (1998-2016)
Eutrophication: bottom oxygen

Oxygen situation near the seabed in the Baltic Sea in 15 August 2014, 2015 and 2016, BAL MFC

Oxygen situation near the seabed in the Baltic Sea in August 2014, 2015 and 2016 © SYKE
Integrate Fixed platforms

Integrate Tide gauges

Integrate Moored buoys

Integrate Ferryboxes Vessels

Distribution of In-situ products

ftp.boos.org

BOOS + INSTAC
SMHI acquires data from

~300 fixed oceanographic stations
~10 ferryboxes + 5 icebreakers
~800 CT stations
in the Baltic Sea

Platforms

- Fixed platforms (FP)
- Tide gauges (TG)
- Moored buoys (MB)
- Ferrybox-lines (FB)
- Ice-breakers (FB)
- Monitoring stations (CT)
Coloured dissolved organic matter, CDOM

- fDOM measurements in several Alg@line ferries since 2011, in Utö since 2015
- Huge increase of CDOM from Bothnian Sea to Bothnian Bay. Late summer increase.
- Closer evaluation needed to fine-tune Baltic C-budget
Nurtient monitoring on M/S Finnmaid

- Water samples in 2015
Targets in the SHIP project directive:

- One common and harmonised Swedish tide gauge network
- Sea level data of better accuracy, continuous time series
- Open and faster access to quality controlled real-time and archive data
- Leads to that the objectives of the FAMOS Odin is achieved: safer and more cost effective shipping routes
Present Swedish tide gauge networks

- **Class I** Upgrade with logger
  - 26 stations (23 SMHI + 3 SMA)

- **Class II** Upgrade without logger
  - 27 stations (27 SMA)

- **Class III** Unchanged, temporary
  - 5 stations (3 SMHI + 2 SMA)

- **Class IV** Will be phased out
  - 5 stations (1 SMHI + 4 SMA)
Future Swedish tide gauge network

Real-time data in RH2000 from 53 stations
1-min values with 1 cm accuracy
Real-time QC + Archive MQC

- Class I: Upgrade with logger
  - 26 stations (23 SMHI + 3 SMA)
- Class II: Upgrade without logger
  - 27 stations (27 SMA)
- Class III: Unchanged, temporary
  - 5 stations (3 SMHI + 2 SMA)
Present work

• Specification for a procurement of two different sensor are finalized
• All stations will be connected to RH2000 (BSCD2000) in 2017
• Joint service organisation SMA-SMHI: levelling, maintenance, service personnel etc.
• Inventory of stations and test of equipment will continue
• Implementation of RTQC-routines to all data
Institute of Oceanology PAS
Typical r/v Oceania schedule
Physical oceanography
4 cruises per /year - route along the NS water inflow

Localizations of the main high resolution CTD/O₂ transect

Previously cruises (available data)
IOPAN: Argo floats

Trajectory of the first Argo float at the Southern Baltic. WMO 6902036, 29 November 2016 - 01 February 2017

Trajectory of the second Argo float at the Southern Baltic. WMO 3902100, 18 March 2017 - 11 May 2017
Argo floats
TS diagram, salinity and temperature profiles

WMO 6902036  WMO 3902100,
Block diagram of the SatBaltic Operating System

BASIC INPUT DATA:
- Satellite VIS, IR1, IR2, Microwave
- Global meteorological model data
- Routine meteo- and hydrological data

SATBALTIC OPERATING SYSTEM

DESAMBEM DIAGNOSTIC SYSTEM
- D0 INITIAL PROCESSING
- D1 ATMOSPHERIC PARAMETERS
  - clouds, AOT, ozone, water vapour
- D2 PHYSICAL PROPERTIES OF THE SEA SURFACE
  - temperature SST, ice cover ICE, solar irradiance E, radiation balance NET
- D3 BIOOPTICAL PROPERTIES OF THE SEA
  - surface chlorophyll a \( C_a(0) \), irradiance attenuation \( K_\lambda(\lambda) \), chlorophyll depth profile \( C_a(z) \), nutrients N, P, primary production PP
- D4 OTHER IDENTIFIED PARAMETERS
  - thermal fronts, upwellings, phytoplankton blooms, oil spills

BALTFOSS PROGNOSTIC SYSTEM
- B0 INITIAL PROCESSING
- B1 WEATHER MODEL
  - pressure \( p \), wind speed \( U_{10} \), humidity, air temperature, ...
- B2 MODELS:
  - HYDRODYNAMIC, THERMODYNAMIC
    - SEA ICE
    - temperature SST, \( T \), salinity S, currents \( v \), sea level, ice properties
- B3 ECOHYDRODYNAMIC MODELS
  - chlorophyll a, nutrients, biomass of different taxonomic groups of phytoplankton
- B4 OTHER PREDICTED PARAMETERS
  - thermal fronts, upwellings, phytoplankton blooms, oil spills

CURRENT structural and functional properties of the sea

CALIBRATION / VALIDATION DATA
(buoys, ships, shore stations)

PREDICTED structural and functional properties of the sea

Data transfer for an overcast sky (lack of satellite data for the DESAMBEM algorithm)

Data transfer for a cloudless sky (data assimilation to improve the ECOSAT algorithm)

Data transfer always required to make the most of the DESAMBEM and ECOSAT algorithms

blue letters in the description denote parameters computed directly from data supplied by one satellite

red letters in the description denote parameters computed from data supplied directly or indirectly by several satellite sources, and / or by the SatBaltic System
First testing deployment of the Stolpe Channel Buoy

Example of results from February
• about 4-5 bio-optical cruises each year
• 20-80 stations on the each cruise
• one of the goals - calibration and validation of satellite data
SatBałtyk buoy

Measuring buoy SatBałtyk (Gulf of Gdańsk)
19°01.00'E, 54°26.30' N

Atmospheric parameters
- Downward shortwave irradiance (range 285-2800 nm)
- Air temperature
- Wind speed and direction
- Atmospheric pressure
- Relative humidity

Underwater parameters on 0, 1 and 5 m
- Water temperature
- Salinity
- Dissolved oxygen
- chlorophyll a
- CDOM fluorescence
- Light absorption and attenuation
- Downward and upward irradiance
Monthly averages of daily primary production in 2010 - 2015
In Gdansk Bay

1. PP in March increased from 2010 to 2015 by 30%
2. PP annual max in summer has two lows in 2012 and 2016
IOPAN other activities on the Baltic

Acoustics:
- ....
- underwater noise

Marine Chemistry and Biochemistry
- ....
CHEMSEA - Chemical Munitions Search & Assessment
MODUM - Towards the Monitoring of Dumped Munitions Threat
DAIMON Decision Aid for Marine Munitions:
how to proceed with the identified and mapped warfare objects
Finnish Meteorological Institute

FMIs Argo history – ARGO_FIN

• 2010 July, Atlantic Ocean since then
• 2011 first short tests in the Baltic Sea
• 2012 May –December first long deployment in Bothnian Sea
• 2013-2014 August, first long deployment in Gotland Deep
• Now, 21 Argo missions, 5 active in May 2017
  • 10 missions in the Atlantic/North Sea, 3 active in May 2017
  • 11 missions in the Baltic, 2 active in May 2017
• Baltic Sea floats reused
• Data from the 21 floats is available in Coriolis Argo data center
• Finland is a partner in Euro-Argo (FMI is representing unit)
Challenges in Baltic Sea

- Brackish water and large variations in density → Floats need to be balanced for a certain area
- Heavy marine traffic → risk of collision
- Seasonal ice cover → ice avoidance algorithms
- Shallow depths → constant monitoring needed, buoyancy accuracy $\pm 10$-$30$ m

NOTE! It has turned out that standard floats work in the Baltic Sea.

photograph by Petra Roiha, FMI
First experiments in the Bothnian Sea in 2012

- Half a year mission
  May 17 -> Dec 5, 2012
- Over 200 profiles acquired
- Managed to stay all the time away from shores
- Required constant modifying of the diving instructions to avoid bottom contact
Argo's in Gotland basin

- Fine-tuned programming
- "Deep" profile testing
- Bio sensors testing
- Deployed at Aug 14, 2014
- Managed to stay all the time away from shores
Current activities

- Testing Argo floats in ice conditions
- Continue applying data for model validation and development
- Experimenting with data assimilation
- Application to process studies
- Some manuscripts under construction
Argo data available in Coriolis

• Coriolis Argo-page:  http://www.coriolis.eu.org/Data-Products/Data-Delivery

• All floats in a list:  http://www.ifremer.fr/co-argoFloats

• One float by number (e.g. 6902024):


• Also via MyOcean data selection:

  http://www.ifremer.fr/co-dataSelection/?theme=myocean

NOTE! In Coriolis data is available both as ASCII (csv) and netCDF (nc)
Navigation buoys
Integration of marine metoc data into AIS system
+ additional wave data

AIS Router software

Internet connection to AIS network

AIS messages M21, M12, M14, M8

AIS Server/
VHF System

Signal analyse

Wave Height
WHAPAS

Hydro-Meteo

HMS-HMD

GPRS
SMS

GPRS
IP

FrontEnd software PaSS

AtoN Server

Integration of marine metoc data into AIS system + additional wave data
Use of buoy motion data for wave estimate

3D motion data acquisition:
- 5 samples in 1 second (3x2B binary)
- 150 second registration time
- 15 minute/ 4 times in hour – interval
  Continuous registration

Motion data transmission:
- TCP/IP over GPRS, AtoN monitoring
- 15 min interval (3kB binary, 12kB/hour)
  Continuous – 72kB/hour

Motion data analysis:
- Timely filtering
- Mathematical analysis
- Calibration with reference data

Wave data output:
- Record to data base
- Save special text file
- Broadcast via AIS Router
Validation of wave data obtained from the buoys

- Pressure sensor based wave gauge
- 2 measurement periods
  - 3 weeks each
- September and November 2010
Web-based user interface:

22 wavebuoys in Estonian waters + 12 stationary pressure gauges

on-line.msi.ttu.ee/metoc
GRACE PROJECT

Start year: 2016
End year: 2019
Coordinator: Kirsten Jørgensen, Finnish Environment Institute (SYKE)
WP leaders: Tarmo Kööls TUT, Jaak Truu UTARTU, Thomas-Benjamin Seiler RWTH, Kim Gustavson AU, Susse Wegeberg AU, Kirsten Jørgensen, SYKE
Financier: EU Horizon 2020 grant No 679266
Partners: 13 participants Read more

ABOUT GRACE

The project focuses on developing, comparing and evaluating the effectiveness and environmental effects of different oil spill response methods in a cold climate. The results of the project will contribute to the development of effective and environmentally friendly oil spill response actions and mitigation of potential environmental damages.
Outline of PAH concentration measurements

- Analysed 55 ship voyages (16.02 – 11.04.2017), 960 datapoints each, 52 800 in all e.g. very good ensemble for statistical analysis
- Max PAH concentration 0,36 µg/l
- Remarkable variability of PAH concentrations near the coasts and open sea
- General pattern of PAH concentration spatial distribution seems to be stable
- No sudden concentration rises which directly would indicate the oil spills, have been detected during the observation period, all PAH concentrations stay far below those defining the oil spill
- Some anomalies of PAH concentrations were noticed and could be investigated further – although amplitude of such anomalies were in same order with UviLux sensor signal/noise level
Summary

• Asset for in-situ oil detection and monitoring is developed based on FerryBox technology and equipped with on-line data management

• Test of the system on board M/S BALTIC QUEEN performed and 2 month of data 52 800 single measurement points statistically analyzed, further analysis foreseen

• Measured PAH concentrations are not absolute values, but rather than relative, but still variability patterns could be estimated

• Fouling problem should lessen, when new cleaning system (more frequent) will be operational

• Validation of UviLux sensor against lab analysis is foreseen in May 2017, report in August 2017
Estonian Marine areas Information System – EMIS

Operational model HCM-EST, [http://emis.msi.ttu.ee](http://emis.msi.ttu.ee)

Viewer based on static layers

Dynamic viewer based on godiva

Still under construction but better than nothing

Data download based on OpenDAP