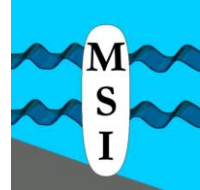




1918

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# **SWERA**

## **Marine Systems Institute**

### **Tallinn University of Technology – TUT**

**partner introduction**

**Tarmo Kõuts**  
Senior scientist

SYKE, Helsinki, 15.05.2014



**BONUS**

SCIENCE FOR A BETTER FUTURE OF THE BALTIC SEA REGION



1918

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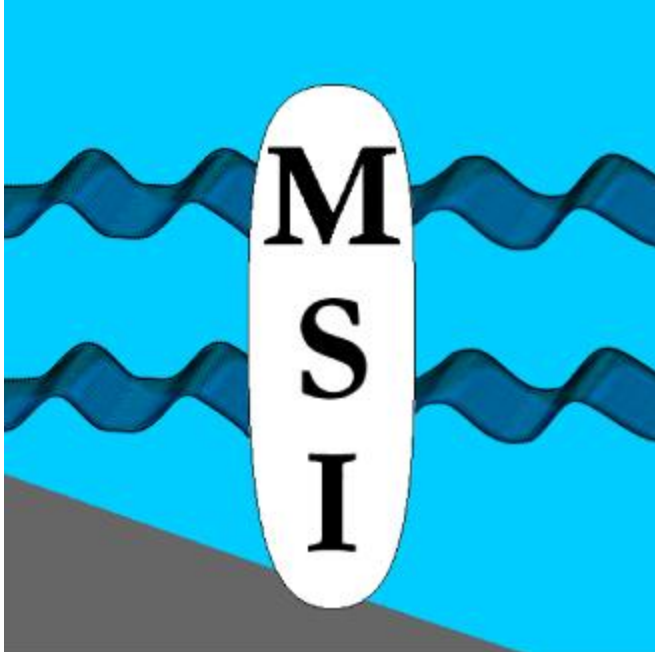
Founded in 1918  
14200 students  
1980 employees  
8 faculties  
3 research institutes  
Yearly budget –  
90 million EUR



# **Marine Systems Institute at Tallinn University of Technology**

**Founded 2002, groups active since mid-1960-s**

**Staff: ca 50, PhD 19**



**Former structures**

**1965-1972:**

**working group at TUT Sanitary Engineering  
Laboratory**

**1972-1990:**

**Baltic Sea Department, TA Institute of  
Thermophysics and Electrophysics**

**1990-1992:**

**Marine Physics Department, TA Institute of  
Ecology and Marine Research**

**1992-2002:**

**Marine Physics Department, Estonian Marine  
Institute**



1918

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# **Marine Systems Insitute**

## **Structure**

**Administration (Director: Jüri Elken)**

### **Research Units**

**Department of Marine Physics (Head: Urmas Lips)**

**Department of Ecohydrodynamics (Head: Urmas Raudsepp)**

**Laboratory of Marine Biochemistry (Head: Inga Lips)**

### **Teaching Unit**

**Chair of Oceanography and Meteorology (Head: Sirje Keevallik)**



# Marine Systems Insitute

## Research

### **Basic research: Baltic Sea water and matter exchange processes**

- basin-wide and coastal-offshore exchange processes in the NE water cycle loop;
- atmosphere-ocean interaction and marine forecasts;
- dynamics of coastal system, including suspended matter;
- processes controlling the estuarine pelagic ecosystem response.

### **Applied research:**

- operational oceanography (high-res observing systems, forecast models) ← GMES, EuroGOOS, BOOS, FerryBox etc
- impact studies ← industry
- observation technology

<b>Funding Structure:</b> (ca 1 MEUR)	<b>Governmental, incl. grants</b>	<b>45 %</b>
	<b>Research contracts</b>	<b>45 %</b>
	<b>International</b>	<b>10 %</b>



# Marine Systems Institute

## Education

**Curricula in Earth Sciences**

**Faculty of Science**

**Marine Systems Institute jointly with Institute of Geology**

**Master Studies**

**PhD Studies**

**Specializations**

**Geology**

**Oceanography and Meteorology**

**Master Students**

**(2 years)**

**ca 30**

**PhD Students**

**(4 years)**

**ca 30**

# Infrastructure

The Earth Sciences research equipment was obtained within the R&D infrastructure project “**Observatory of Coastal Zone Environment**”. (about 2 million EUR)

After international evaluation, the project started in 2007 and finished in early 2010.

Partners: **Marine Systems Institute** (oceanography), **Institute of Geology** (geology, isotope methods) and **Department of Environmental Engineering** of the Faculty of Civil Engineering (river and drainage basin studies).

**The project had three interlinked components:**

- Laboratory for analysis of geological and water samples
- Complex of field research equipment
- Research vessel

# **OPERATIONAL MONITORING OF HARBOUR** **DREDGINGS 2000-2013**

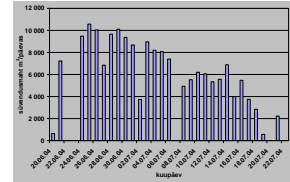




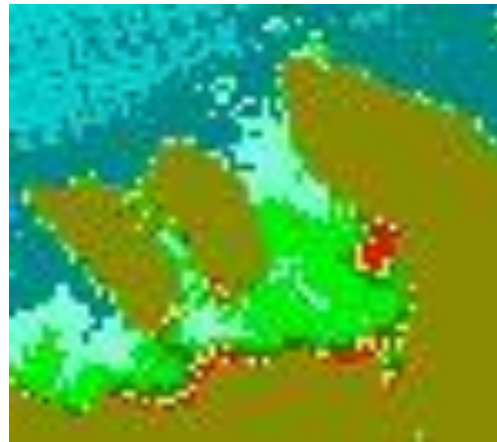
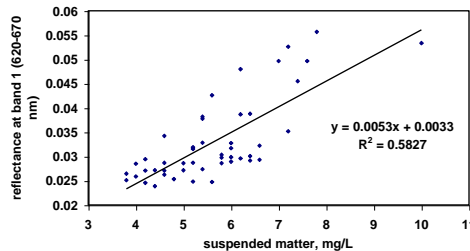
# OPERATIONAL MONITORING OF HARBOUR

## DREDGING

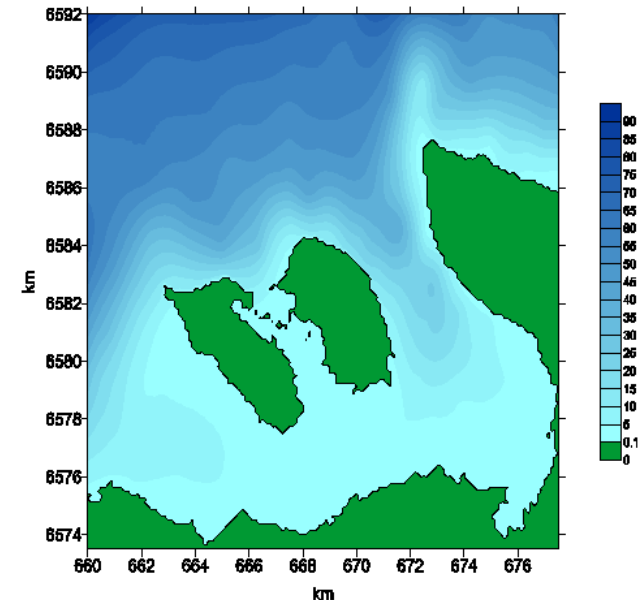
### 1. In situ measurements (CTD, turbidity, SPM concentration, CHLa, nutrients)



Relationship between remote sensing reflectance and suspended matter concentration



### 2. Satellite remote sensing MODIS, resolution 250m



### 3. Numerical modelling

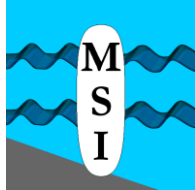
# Flood in Pärnu, 9 January 2005



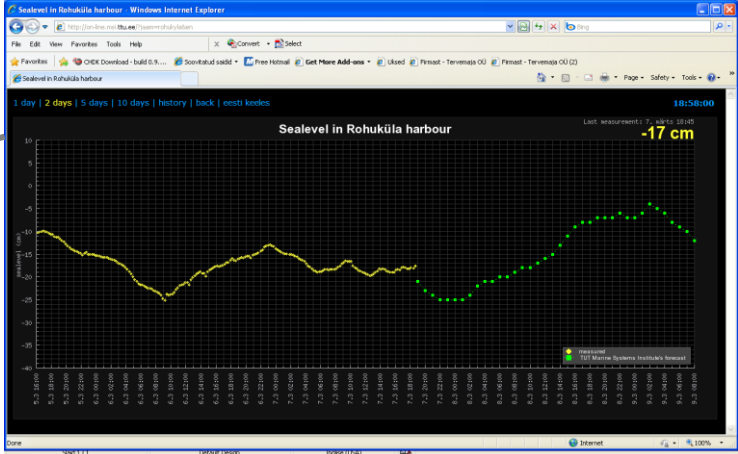
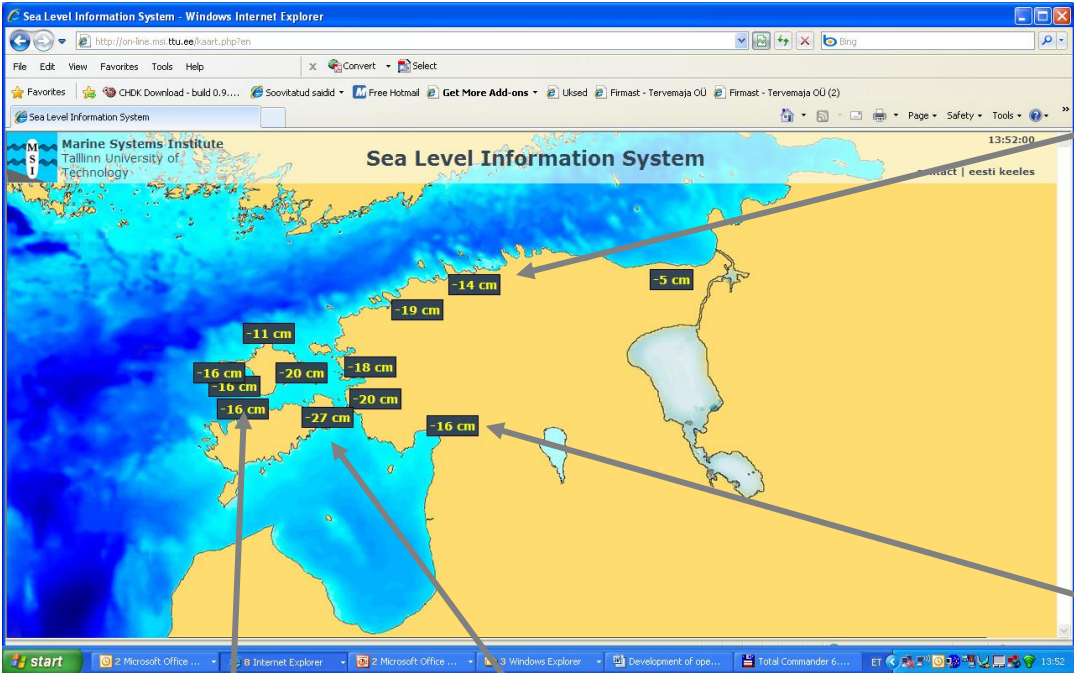


# Sea level Information System

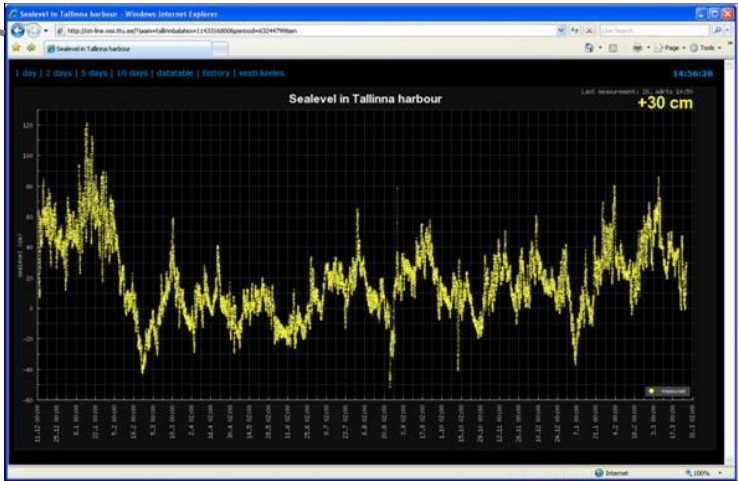
<http://on-line.msi.ttu.ee/kaart.php>



on-line data + 48h forecast



long-term data

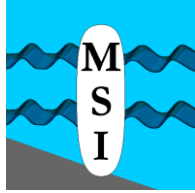


summer



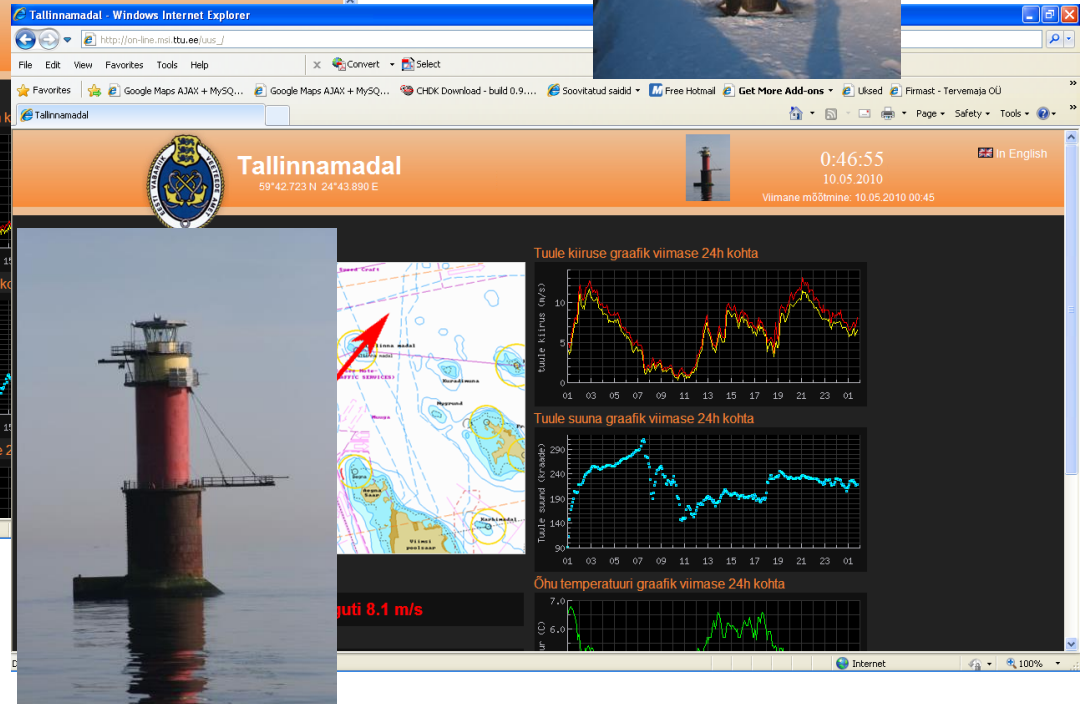
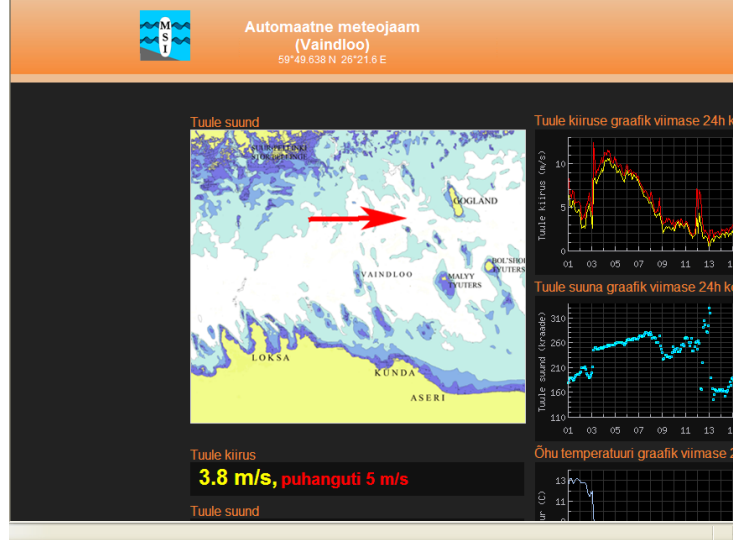
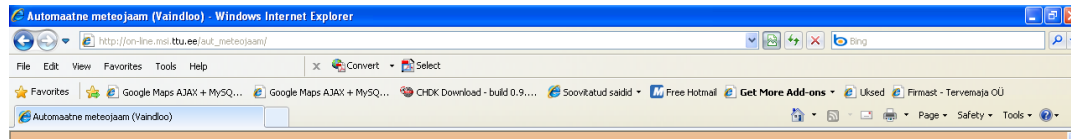
winter

# On-line marine weather stations



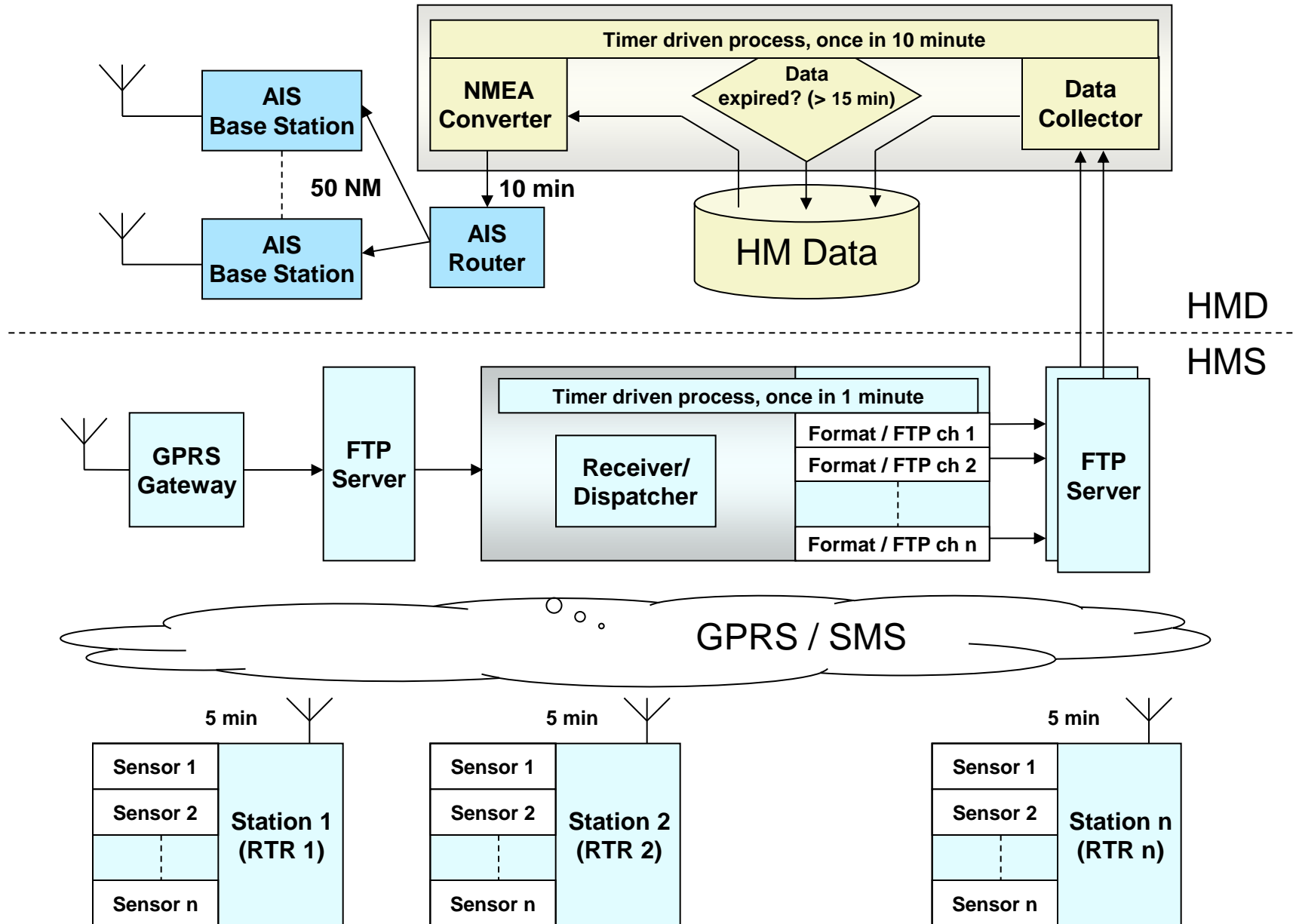
[http://on-line.msi.ttu.ee/uus\\_](http://on-line.msi.ttu.ee/uus_)

[http://on-line.msi.ttu.ee/aut\\_meteojaam/](http://on-line.msi.ttu.ee/aut_meteojaam/)



Real time meteorological data from offshore stations to support navigation, experimental studies, modelling etc.

# METOC data into AIS system



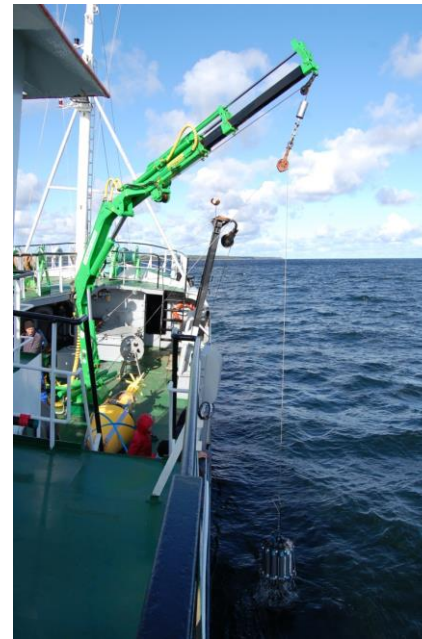


# EAS infrastructure investment project

## “Observatory for Coastal Zone Environment”

**Research Vessel SALME**  
**35 years old, rebuilt in 2009**

**32 m length, 202 GRT**



**New instruments for:**

**laboratories**  
**field work**

**Partners:**

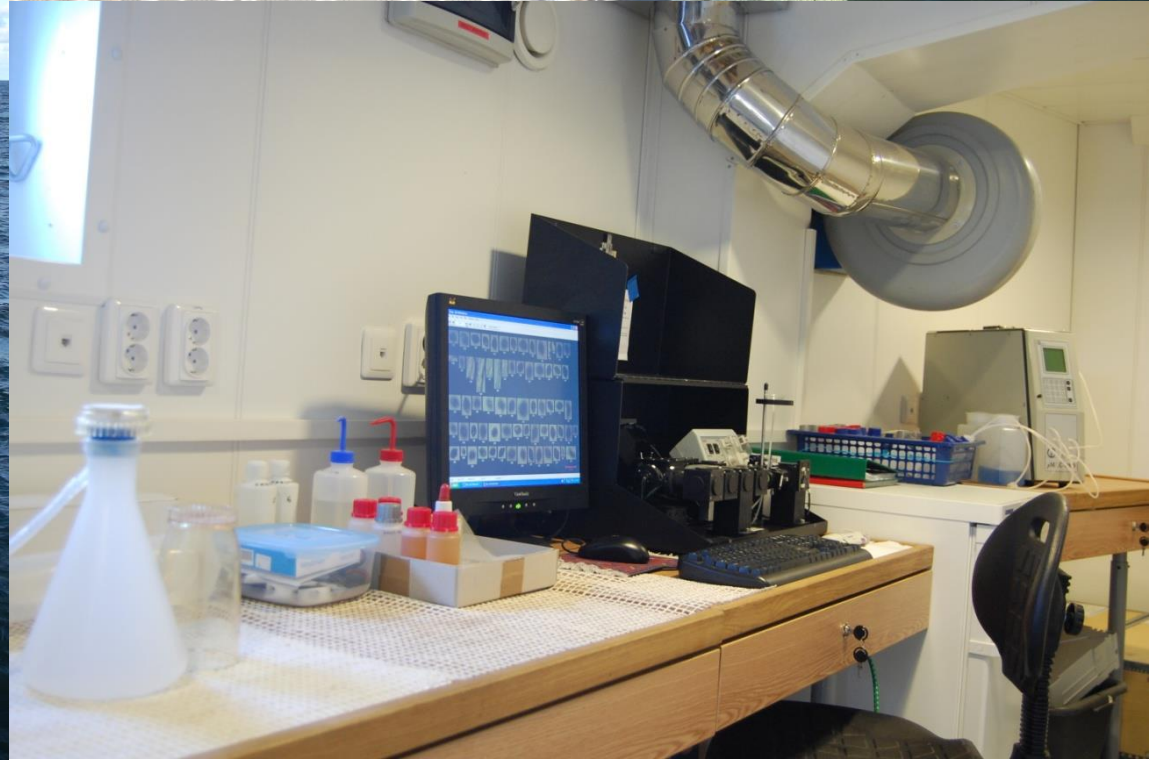
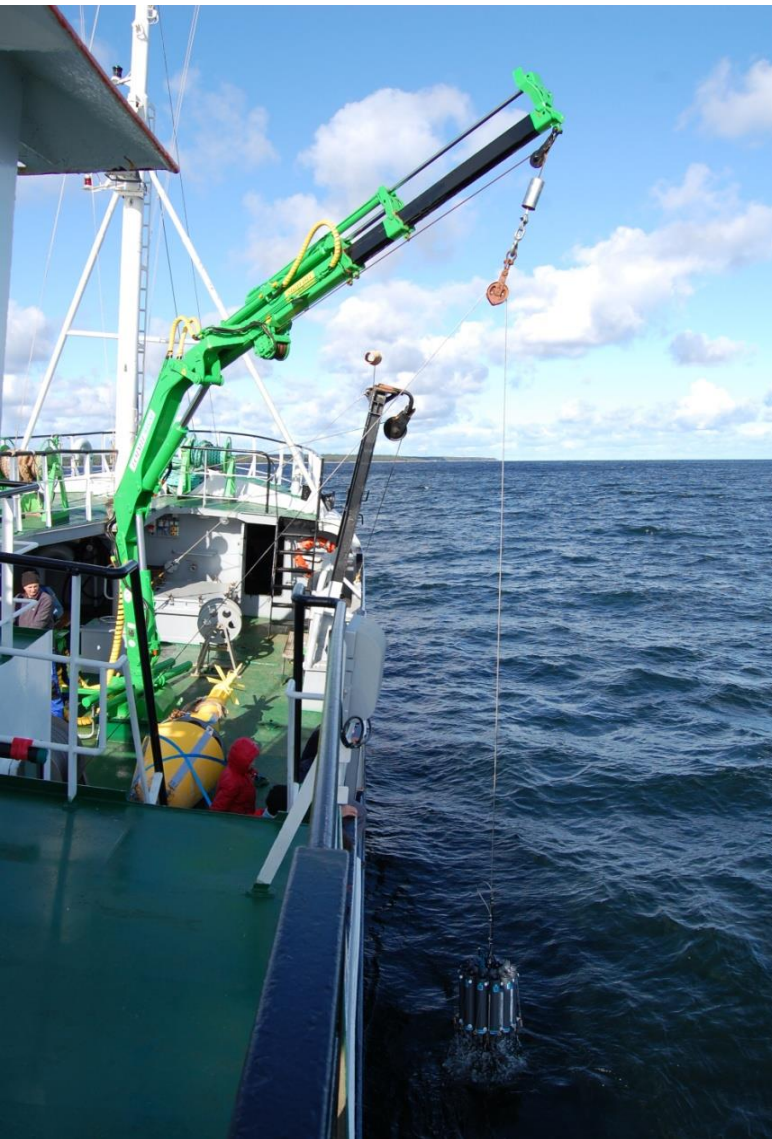
**TUT Institute of Geology**

**TUT Marine Systems Institute**

**Department of Environmental Engineering**



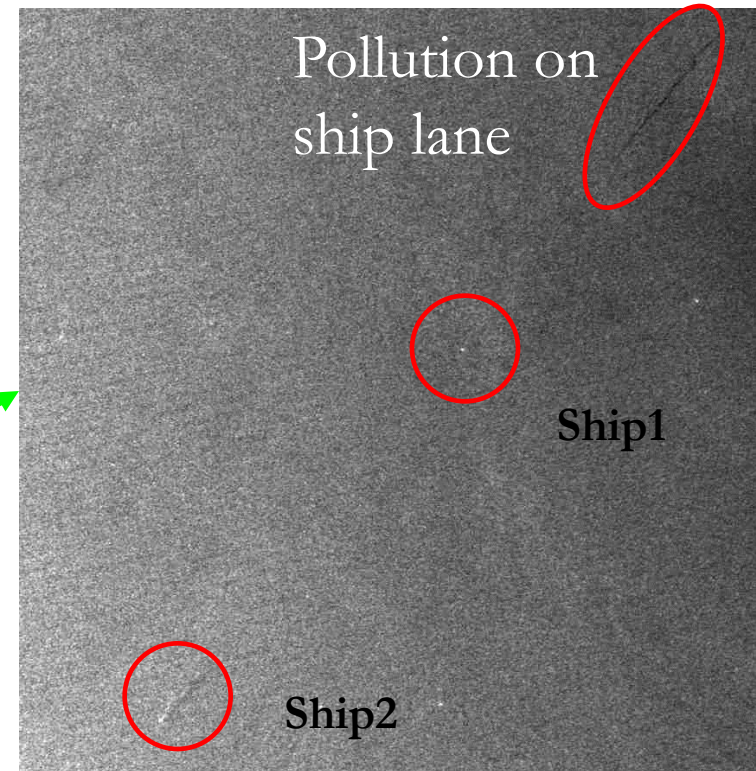
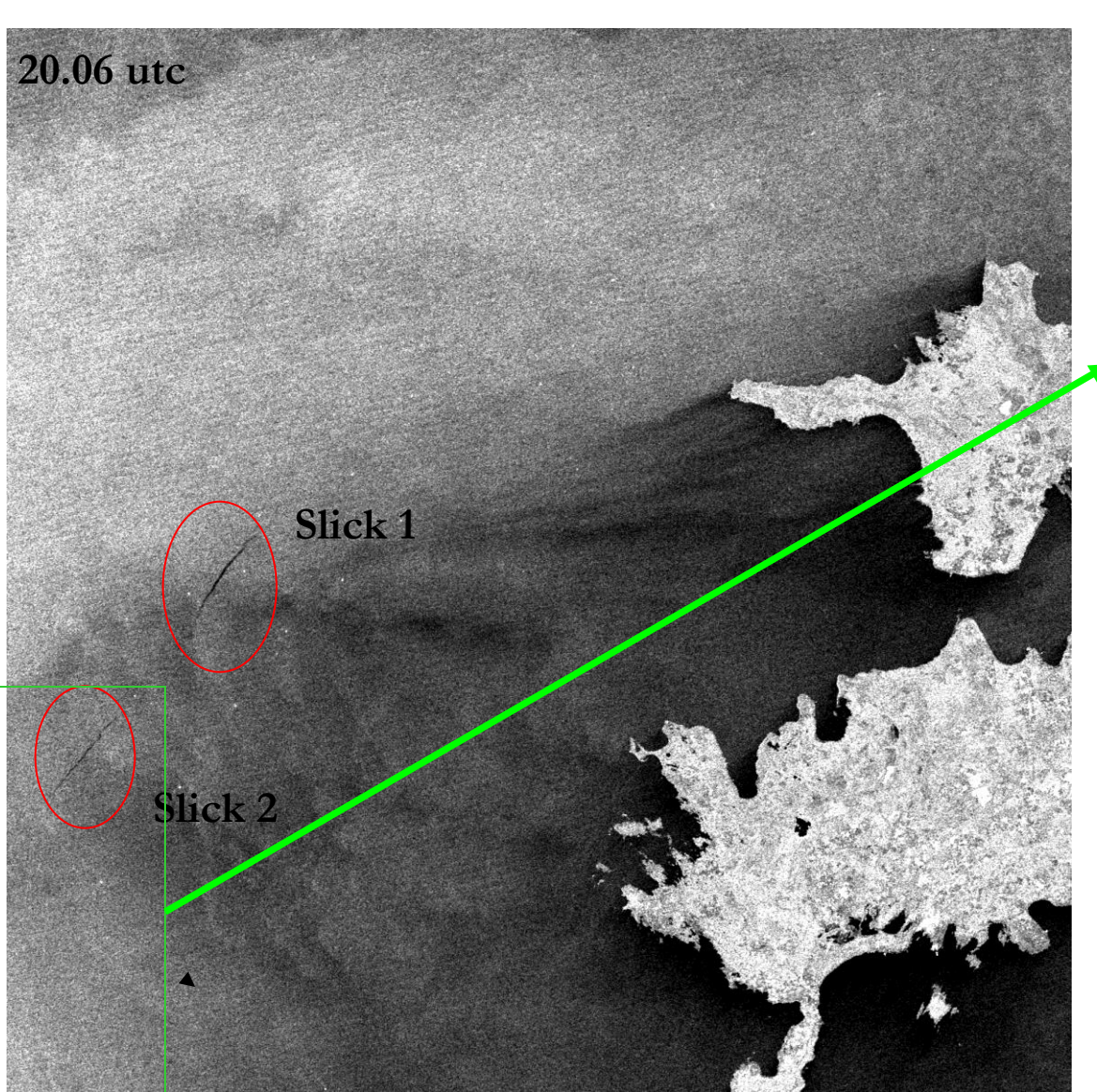
# Sampling





# Example of oil spill detection from SAR imagery

(2 March, 2008 )



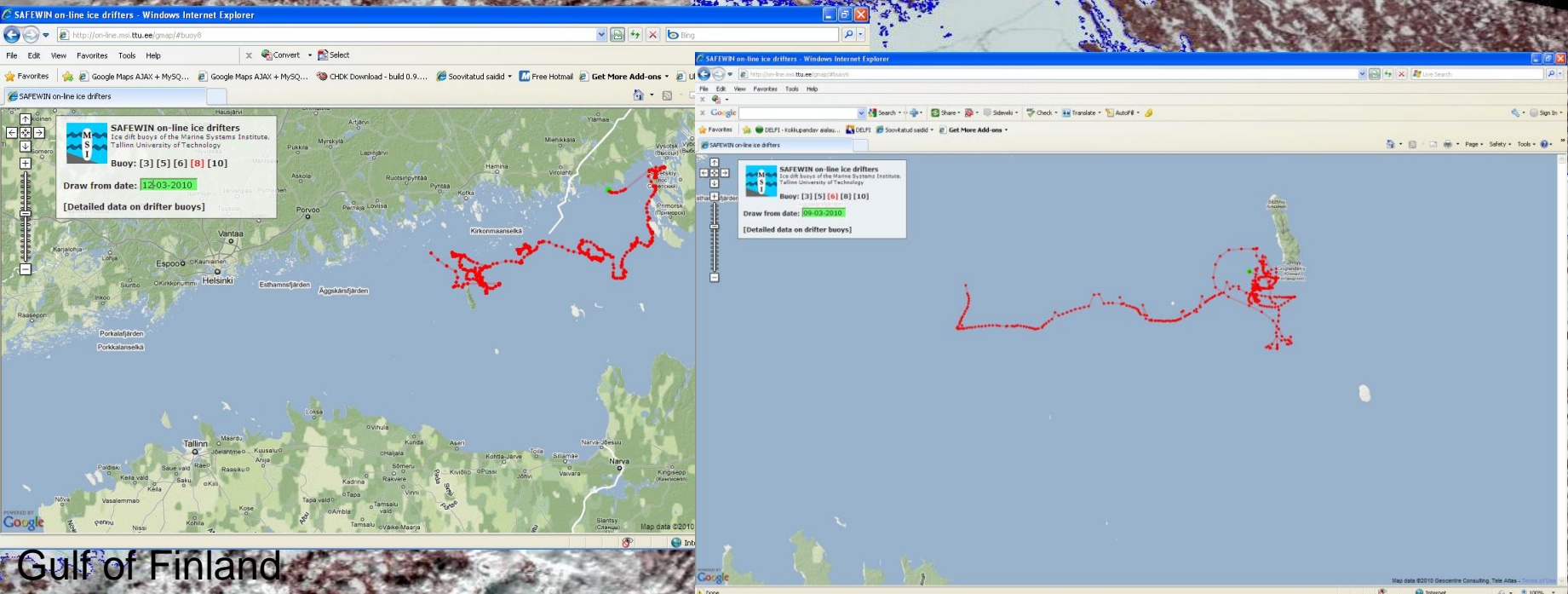
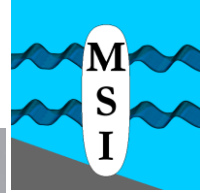
Ship1 coordinates –  
 $58^{\circ}17,94'N$ ,  $20^{\circ}24,56'E$ .



# Light on-line surface drifters

[http:// on-line.msi.ttu.ee/msibuoy](http://on-line.msi.ttu.ee/msibuoy)

<http://on-line.msi.ttu.ee/gmap>



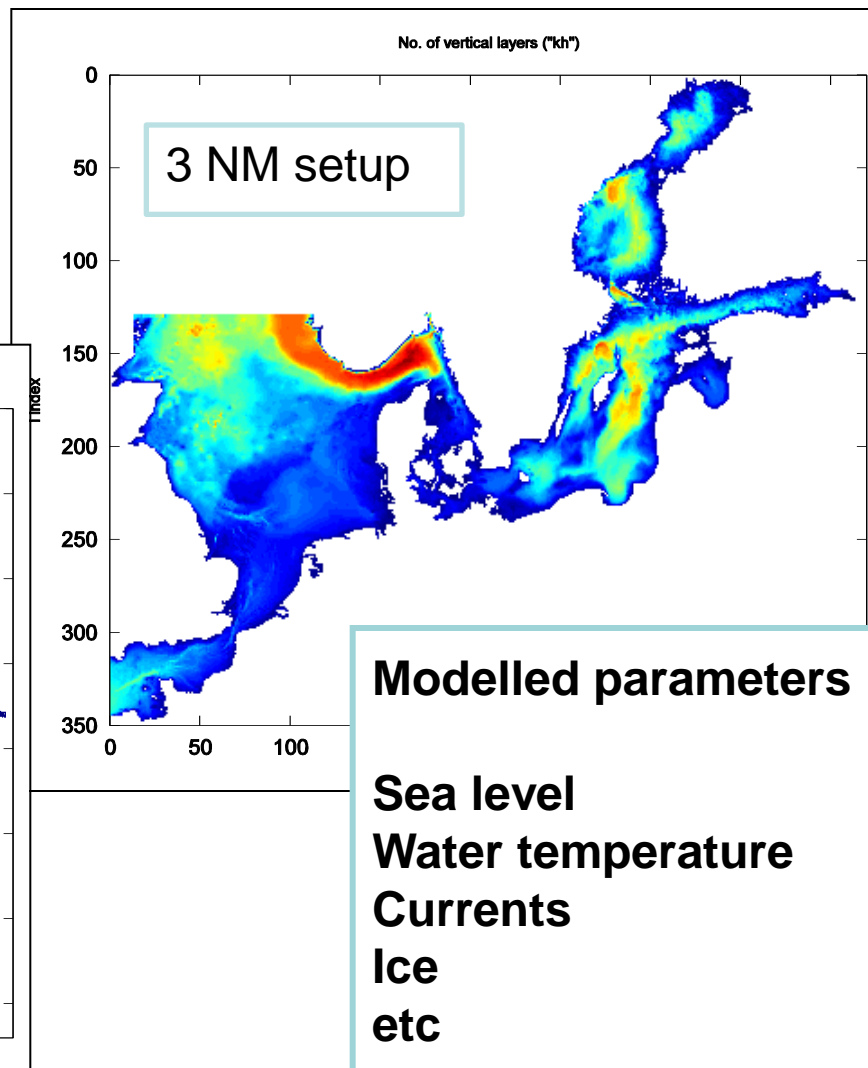
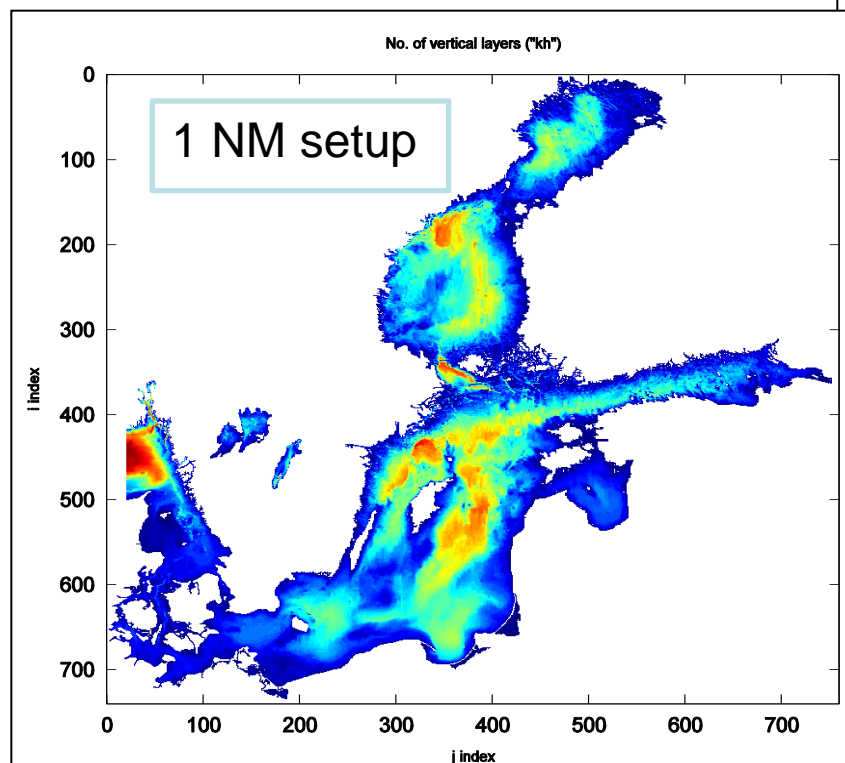
Long-life, compact drifters with **real time data transfer ability**.  
Application area: **ice drift** and **surface current** measurements.  
Applications: navigation support, search and rescue, oil spills  
as well model validations, ice dynamics studies etc.

# HIROMB model, core setups



**HIROMB – a three-dimensional operational ocean circulation model**

**60 hour forecast 4 times a day**



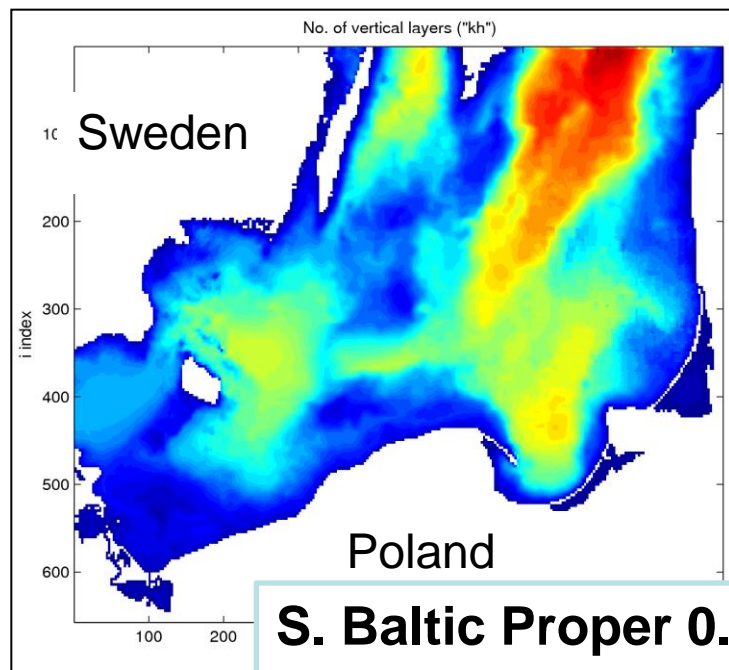


# HIROMB local setups

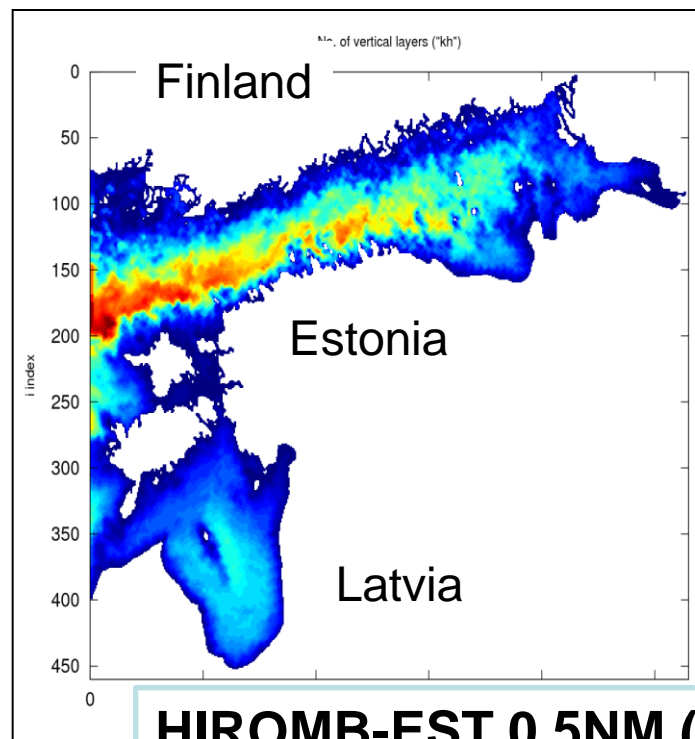


**Local setups nested to core setup**

**More detailed forecasts**



**S. Baltic Proper 0.33NM (MIG)**

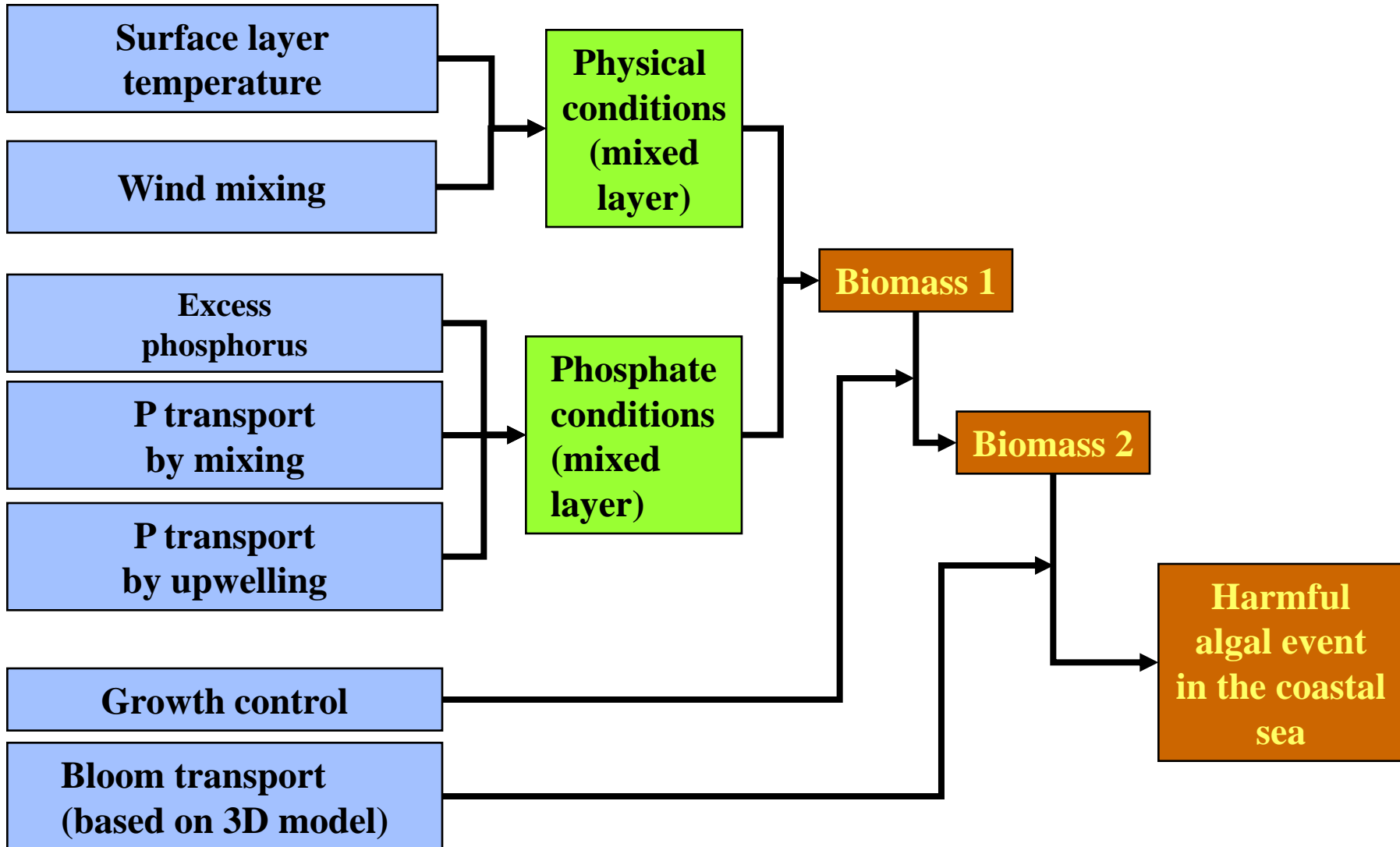


**HIROMB-EST 0.5NM (MSI)**

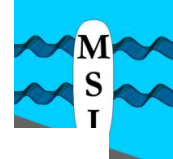
# Fuzzy logic model for *Nodularia spumigena* bloom:

- 1) Biomass 1- expected biomass in the open sea
- 2) Biomass2 – suppresses unrealistic increase of modelled bloom biomass

Input into the model



# Larger international projects



**BalticSeaNow.info** - Innovative participatory forum for the Baltic Sea

**SNOOP** - Shipping-induced NO<sub>x</sub> and SO<sub>x</sub> emissions - operational monitoring network

**SAFEWIN** - Safety of Winter Navigation in Dynamic Ice

**EuroFLEETS** - Towards an Alliance of European Research Fleets

**ECOSUPPORT** - Advanced tool for scenarios of the Baltic Sea ECOsystem to SUPPORT decision making

**MyOcean** - Development and pre-operational validation of upgraded GMES Marine Core Services and capabilities

**ECOOP** - European Coastal Sea Operational Observing and Forecasting System

**SEADATANET** - Pan-European Infrastructure for Ocean & Marine Data Management



# BONUS

SCIENCE FOR A BETTER FUTURE OF THE BALTIC SEA REGION

## SWERA WP1

Partners in charge: TUT, SYKE, CHALMERS, Alfons Håkans

### Objectives

to survey Swedish, Finnish and Estonian wreck registers and identify wrecks having the most significant potential for oil pollution.

to study certain wrecks as case objects by underwater cameras and diving

## **Task 1.1** Review of the Estonian, Finnish and Swedish wreck registers and selection of case wrecks for this study (**TUT, SYKE, Chalmers**)

Wreck registers will be studied and the present version of the VRAKA model will be used for the analysis to sort out wreck types. As wreck description in registries tend to be out of date in some cases, additional information will be collected from Maritime Museums and possibly other sources of information dealing with underwater archeology or possibly relevant organizations.





## **Task 1.2** Classification of selected wrecks, potential for oil spill **(TUT, SYKE, CHALMERS)**

Wrecks lay at different depths and accordingly hydrodynamic conditions around wrecks could be quite different. Also age and condition of wrecks vary in large extent. Classification of wrecks for further study will be performed taking into account above named circumstances.

## **Task 1.3** Field study of selected wrecks (TUT)

Selected wrecks will be studied by underwater camera and diving. Condition of wrecks will be estimated as well hydrodynamic conditions around by *in situ* measurements . Possible wreck salvage operations organized by SYKE in 2014-2015 will be linked to this project execution (SYKE)

## **Task 1.4** Parameterization for ORRA (**SYKE, Alfonshakans**)

Parametrization of wreck types for oil removal operations is basic phase for WP3 objectives. In order design and execute successful salvage and oil removal operations a new approach is required to assess the realistic possibilities to conduct the oil removal with certain cost-benefit ratio. Each wreck and her environmental location has its own characteristics affecting on the oil removal technology. Defining the baseline factors and their interactions a novel analyses tool can be designed, also given the advice for the WP4 toolbox planning.



## **Deliverables** (brief description and month of delivery)

M1.1 Systematization of wrecks performed (M2)

M1.2 Wrecks for case study identified (M3)

M1.3 Study of case wrecks performed (M6)

M1.4 Public seminar on wreck classification and survey involving stakeholders (M8)

D1.1 Report on wreck classification, potential for oil pollution (M6)

D1.2 Case study of typical wrecks in Estonian waters (M8)

D1.3 Parameterization of wreck types for ORRA (M9)