FerryBox Community

Integration of ferryboxes into multi-sensor marine observatories

Urmas Lips, Inga Lips, Villu Kikas, Nelli Rünk, Taavi Liblik,

Aet Meerits, Andres Trei, Peeter Laas, Irina Suhhova

Marine Systems Institute

Tallinn University of Technology

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Motivation and aim

Overall aim is to enhance predictability of marine ecosystem changes (both operational/short-term and long-term) and to build a system for continuous assessment of the marine ecosystem status

Motivation –

Models are not yet able to predict the changes with a required accuracy, e.g physical processes at scales relevant for phytoplankton dynamics; parameterization of biogeochemical processes; e.g. there are attempts to use in the models nutrient uptake ratios different from Redfield ratio to be able to simulate the observed dynamics in nutrients and Chl *a*

Phytoplankton species composition and timing of blooms vary from year to year significantly; conventional monitoring data are taken usually as verification / validation approach

Subsurface blooms are common phenomena, but their role is not clear and the phenomenon as well as vertical migration of cells not accounted in the models

Role of submesoscale processes – parameterization of subgrid processes

Equipment and data

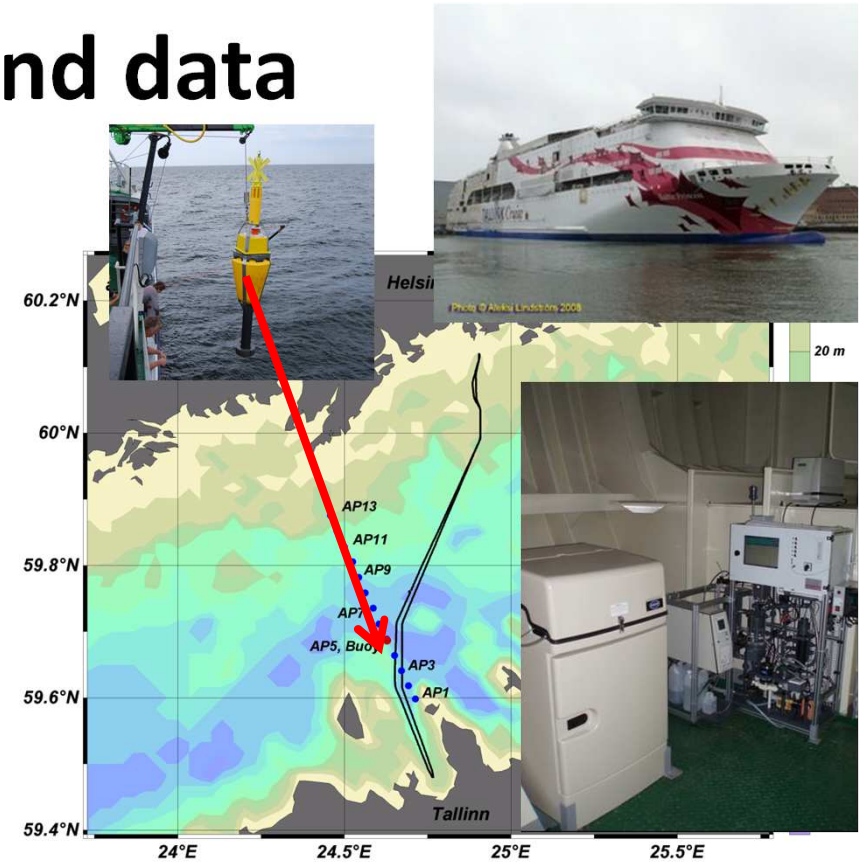
Ferrybox measurements: Tallinn-Helsinki, twice a day; water intake from the surface layer (4 m), sampling rate 20 s (spatial resolution about 160 m); temperature, salinity and Chl *a* fluorescence

Buoy profiler measures T, S, Chl *a* fluorescence; sampling interval 3 hours; profiles from 2 to 50

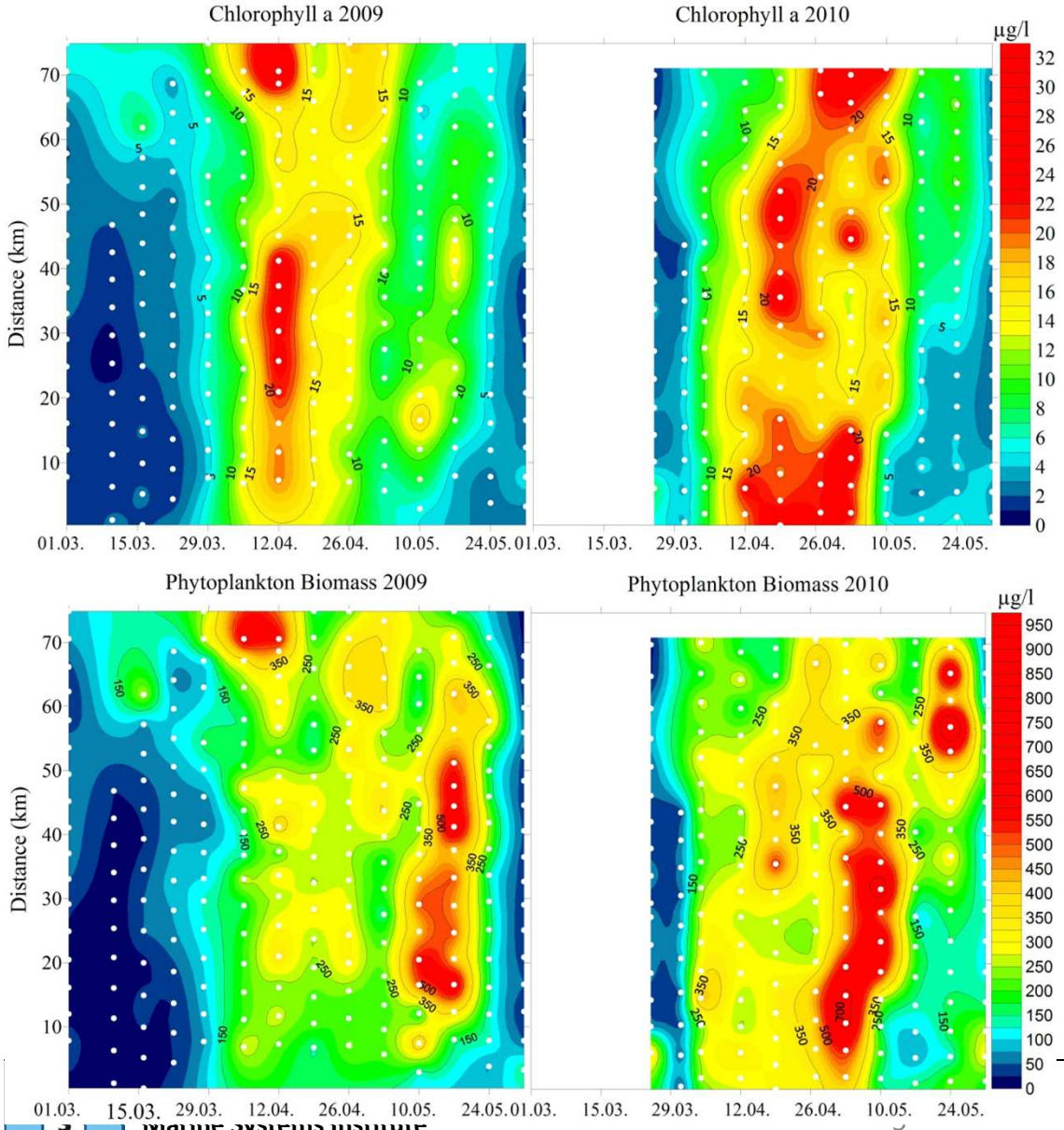
Data set from all systems available in 2009-2014

In total 22 Scanfish surveys were conducted in 2010-2012 by a towed undulating vehicle (Scanfish) equipped by a Neil Brown Mark III C probe and 2 TriOS fluorometers (Chl *a* and phycocyanin)

In addition – water sampling and analyses



Spring bloom dynamics – GoF

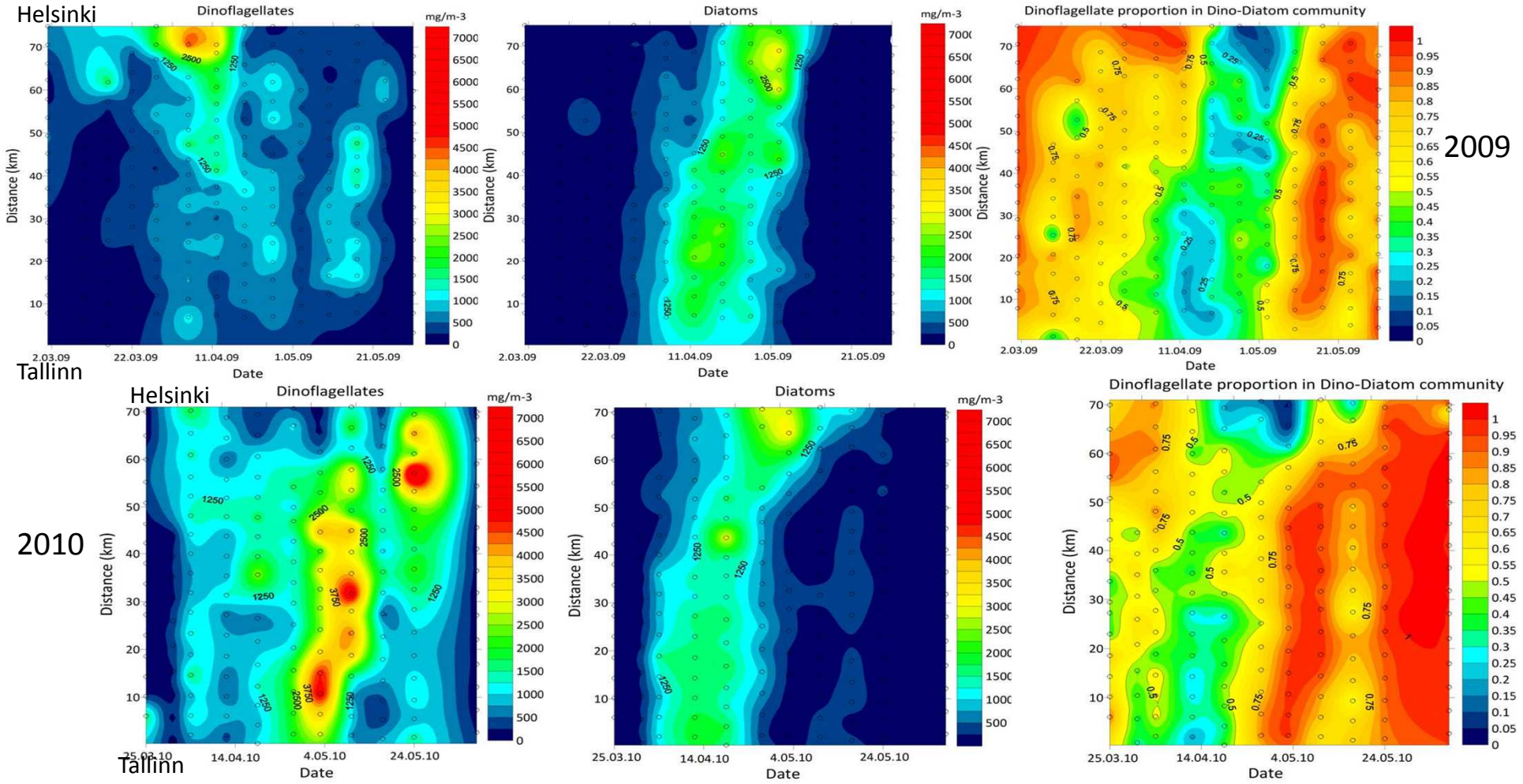


Spring bloom dynamics and heterogeneity is influenced by physical forcing – prevailing circulation in the surface layer and the development of stratification, including upward and downward movement of the seasonal thermocline.

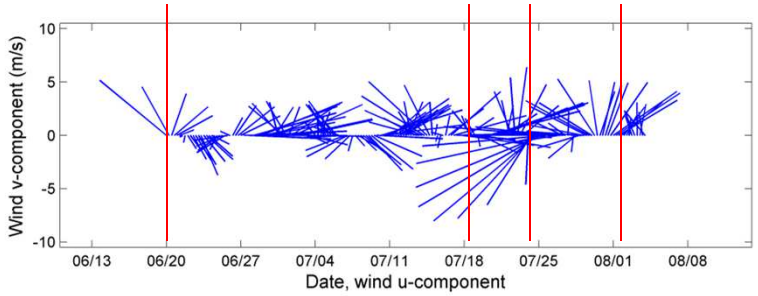
Chl *a* and carbon biomass dynamics ("phytoplankton") differ

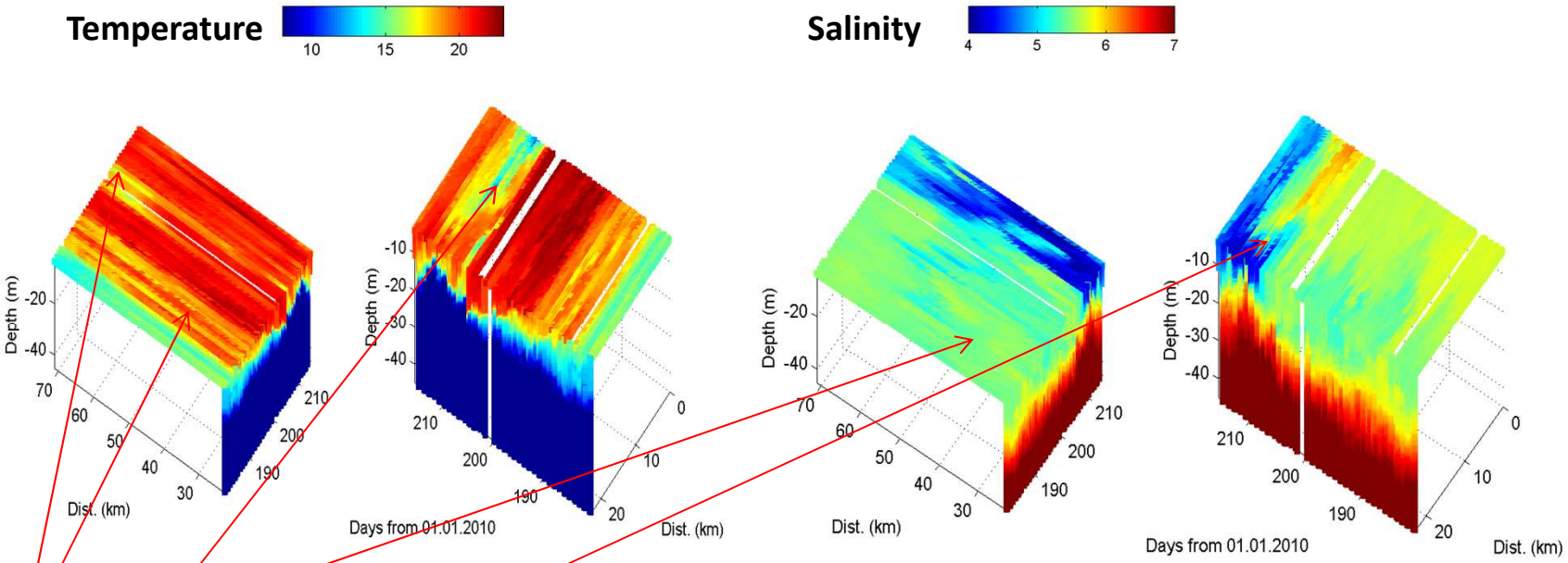
Lips et al., 2014, JMS

Spring bloom dynamics – GoF

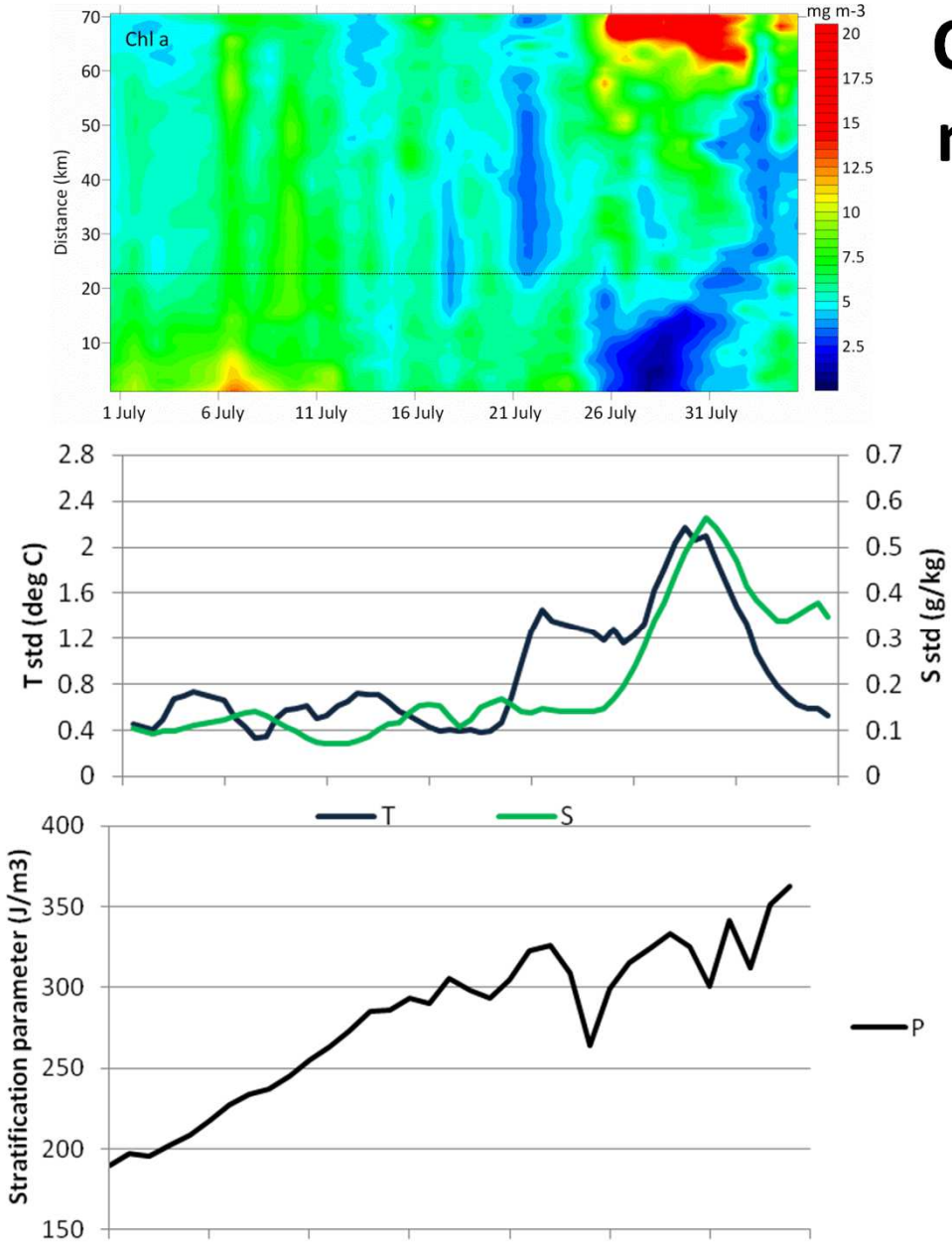


30.06-04.08.2010





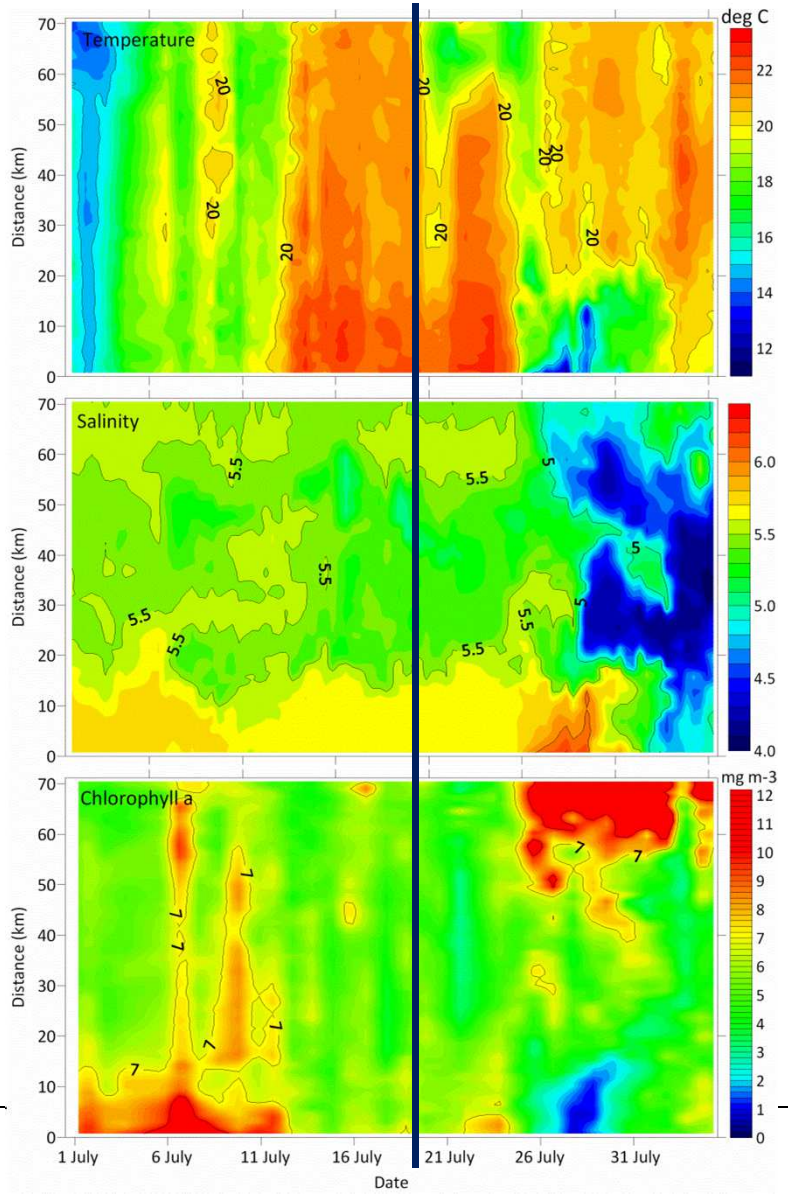
1. Weak or variable moderate winds, low variations of T and S across the gulf
2. Weak upwelling in the northern part and deepening of the thermocline in the southern part; moderate variations of T and S across the gulf
3. Strong upwelling near the southern coast, very high temporal variability (both in the surface layer and vertical stratification) and high variations of T and S across the gulf

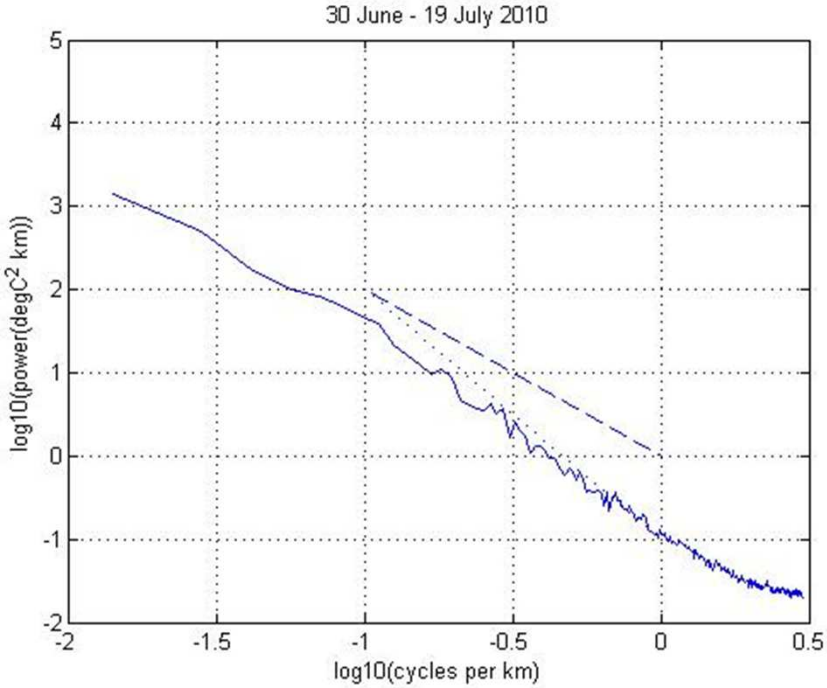


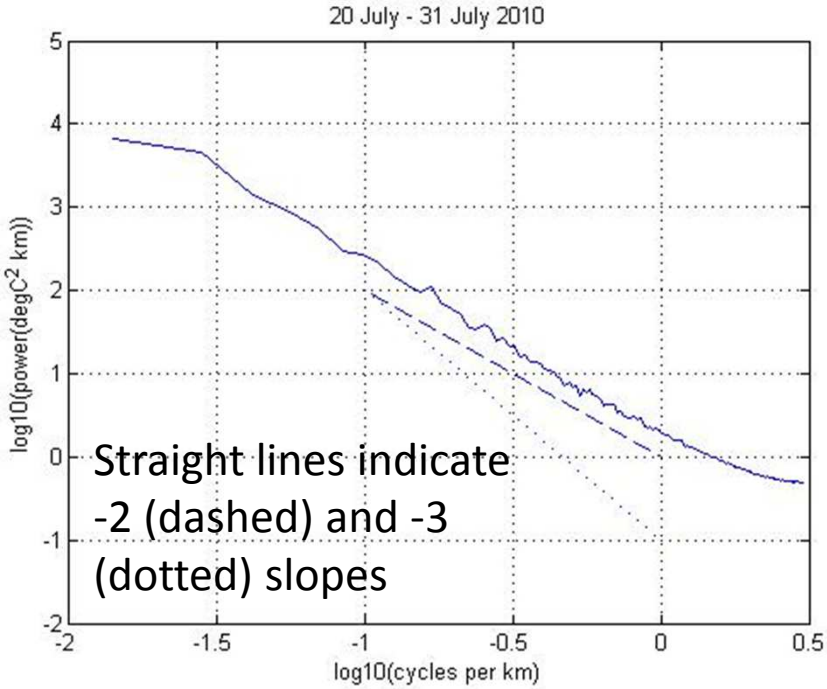
Chl *a* dynamics related to meso- and submesoscale variability (July 2010)

- The highest Chl a concentrations were measured in the northern part of the ferry route after a moderate upwelling event there and simultaneously with the intense upwelling event near the opposite coast
- The variations of temperature and salinity were the highest during this period as well
- At the buoy station in the southern part of the gulf, high temporal variability in vertical stratification was observed simultaneously with the formation of a high Chl *a* patch

Ferrybox observations 30.06-04.08.2010

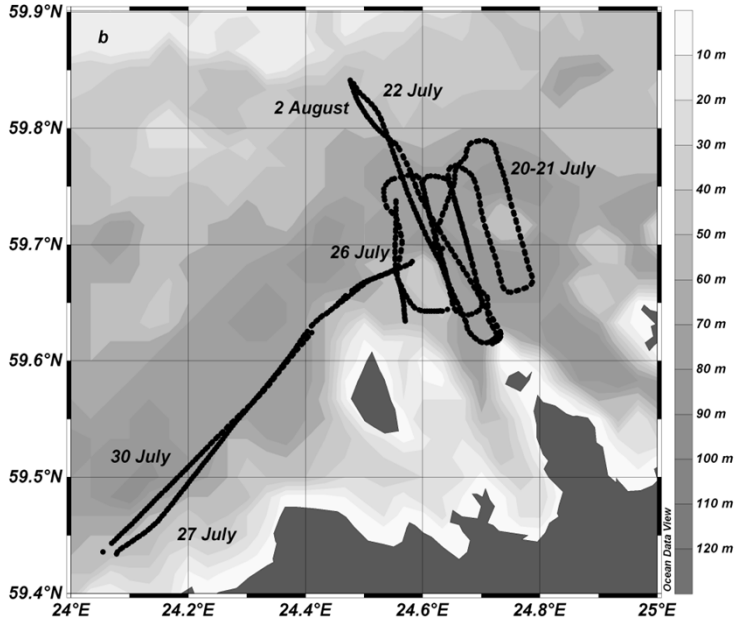






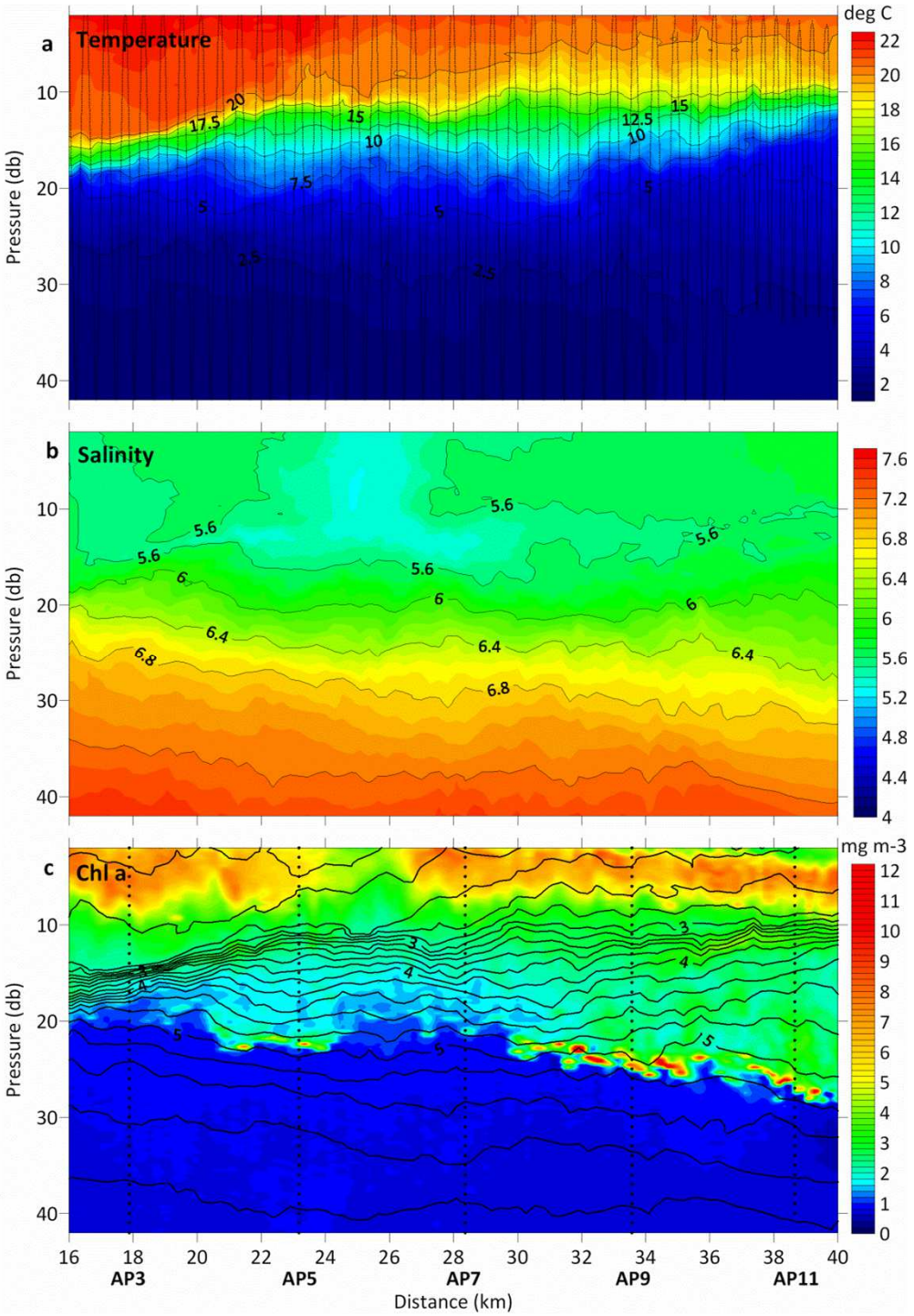
Straight lines indicate -2 (dashed) and -3 (dotted) slopes

Scanfish survey on 22 July 2010



Layered vertical distribution of salinity and especially Chl *a* was observed. Patches of high Chl *a* were related to meso- and submesoscale features in the thermocline. Most intense subsurface maxima were situated within the anticyclonic mesoscale eddies and filaments.

Lips & Lips, 2014, Deep-Sea Res II



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Spatial spectra in the thermocline layer

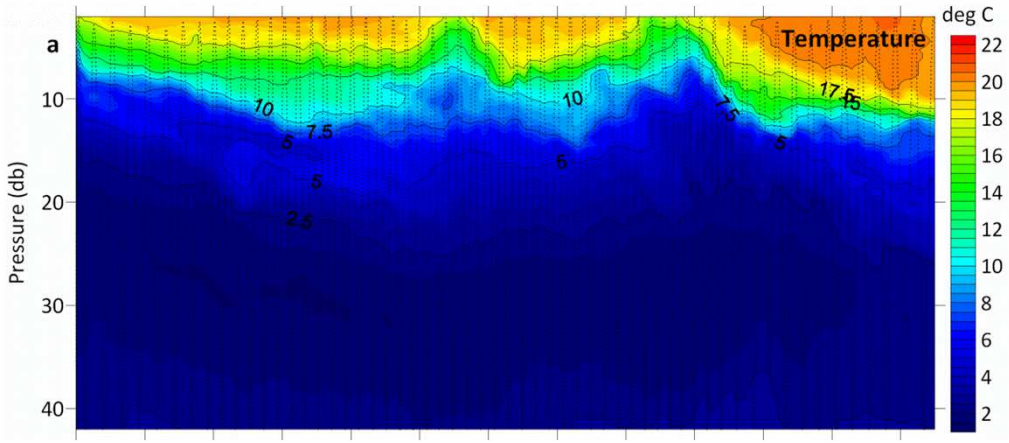
Spatial spectra were calculated from gridded data (gridding to equal grid step of 0.3 km)

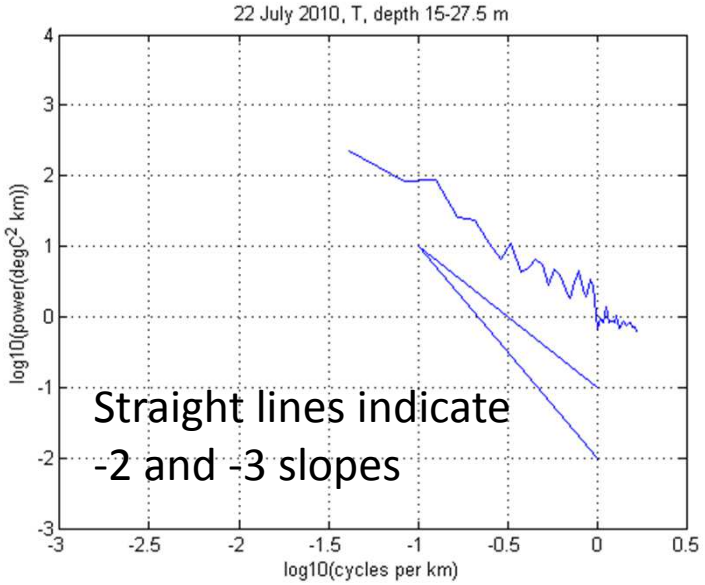
At each pressure level (step 0.5 db) spectra were calculated

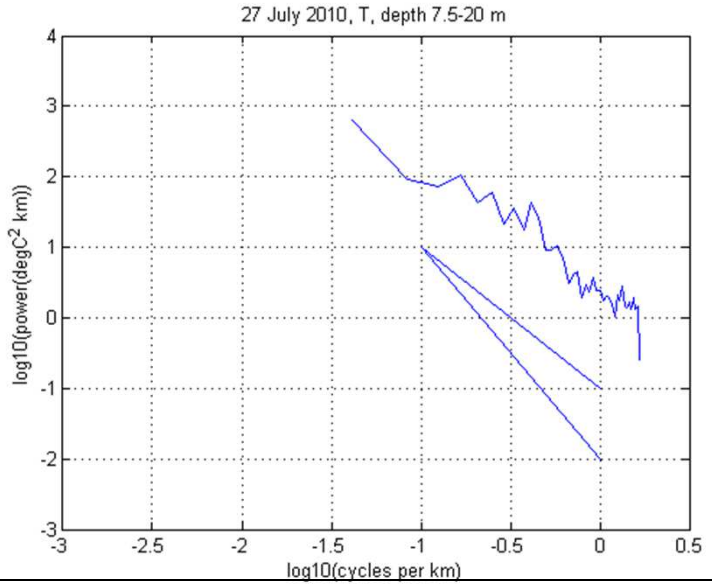
After that an average spectrum was obtained in a predefined depth layer

Levels of spectra are clearly higher in the strongest part of the thermocline

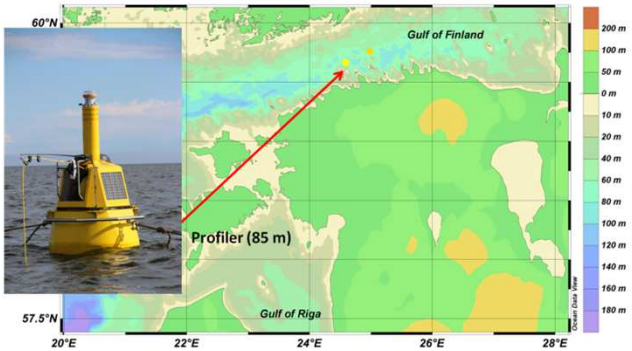
Spectral slopes are close to -2, similarly to the surface layer

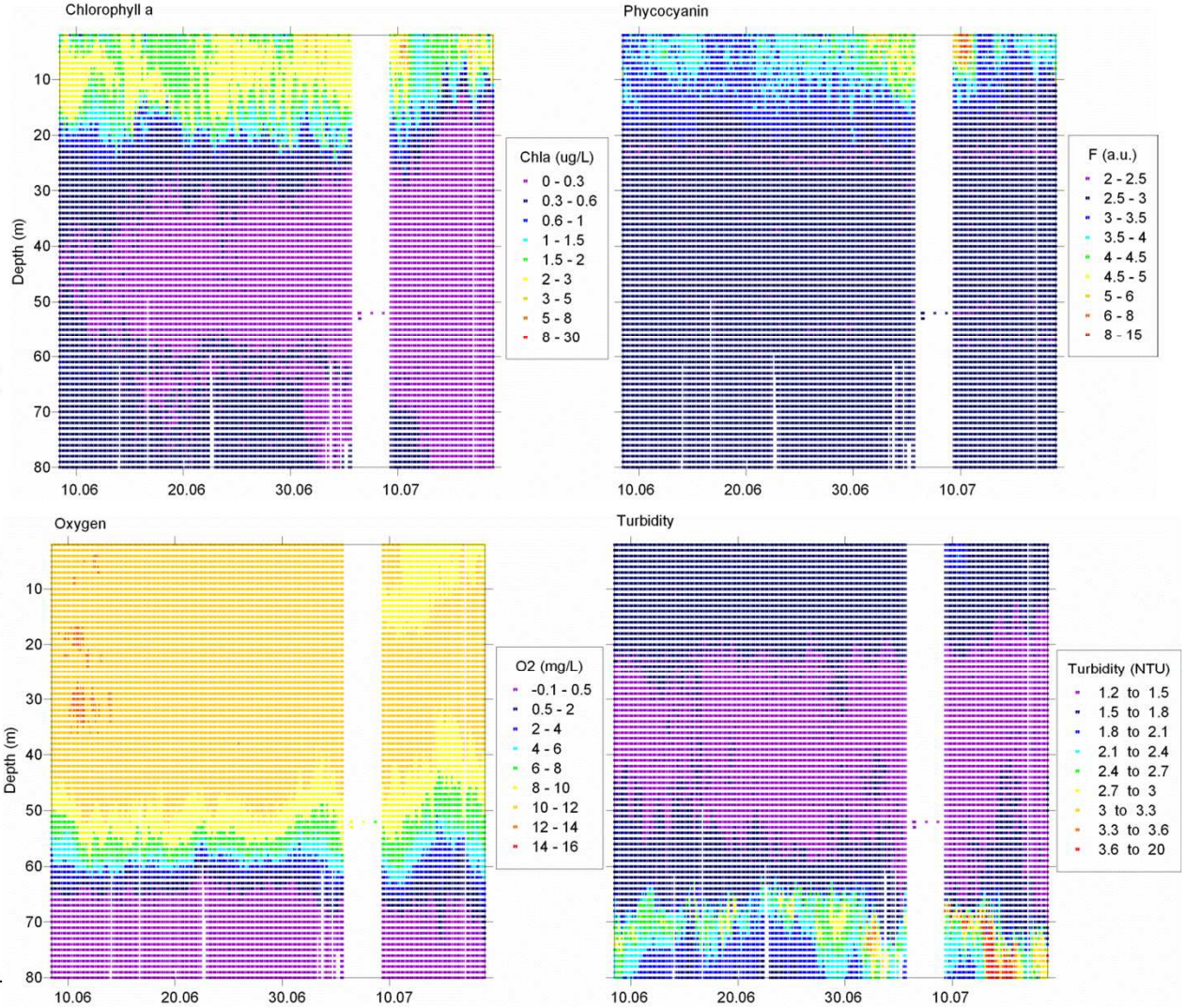






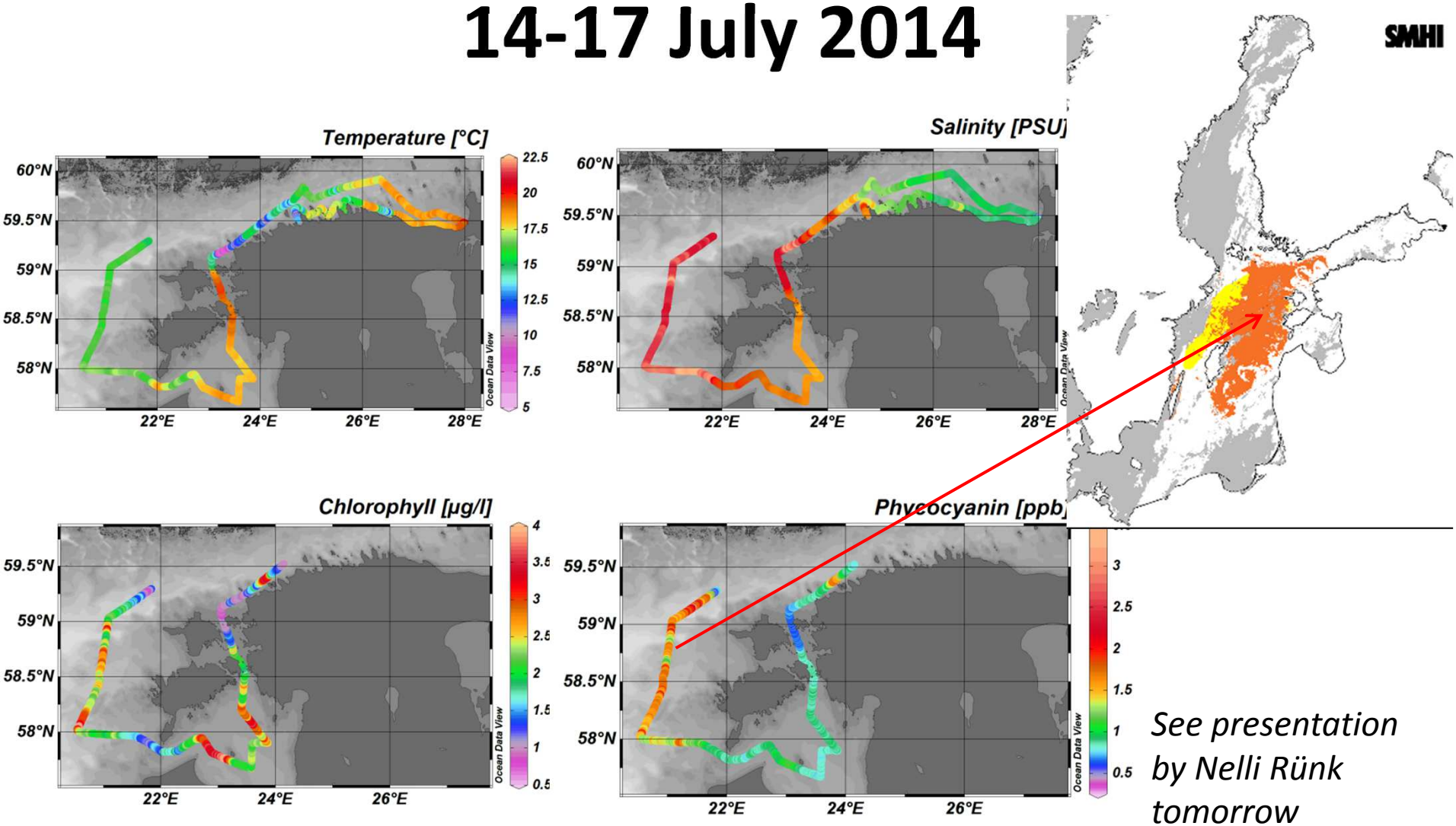
Variability of dissolved oxygen, turbidity, Chl a and phycocyanin (GoF)





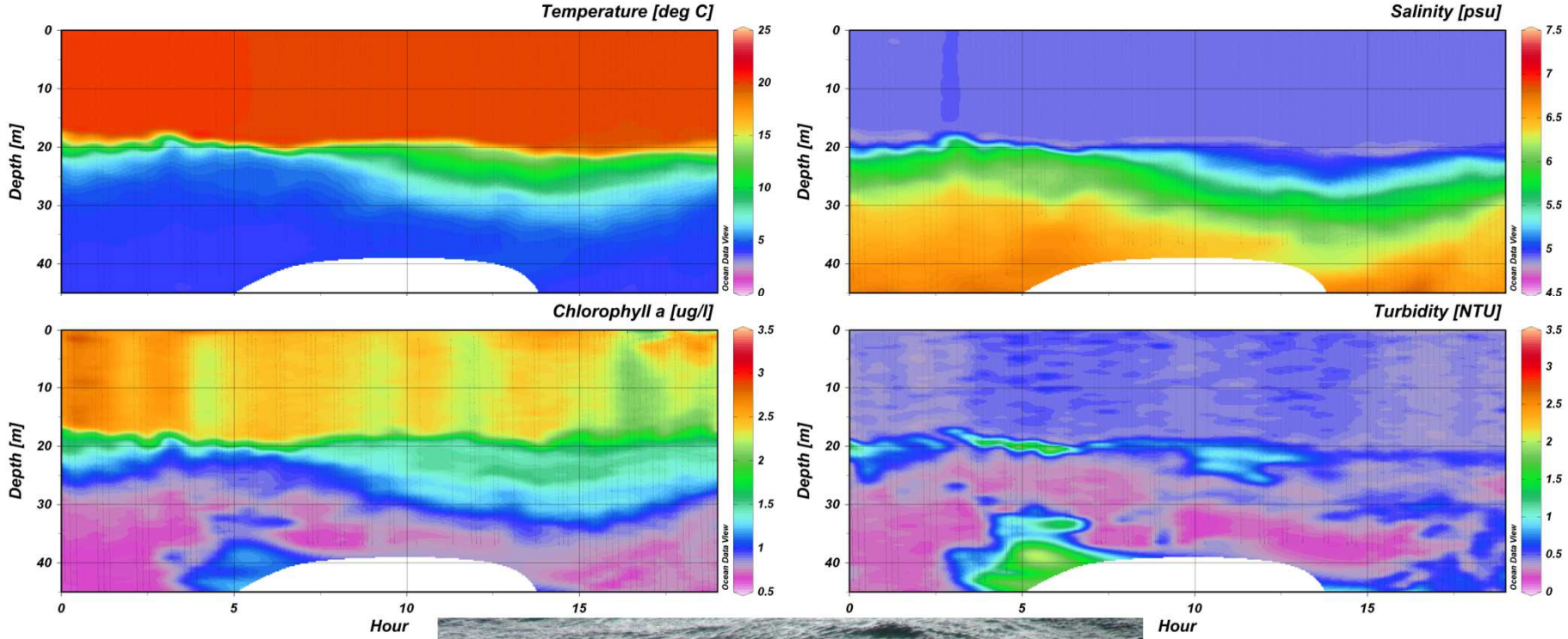
Cruises, R/V Salme, August 2014

Ferrybox data from R/V Salme
14-17 July 2014

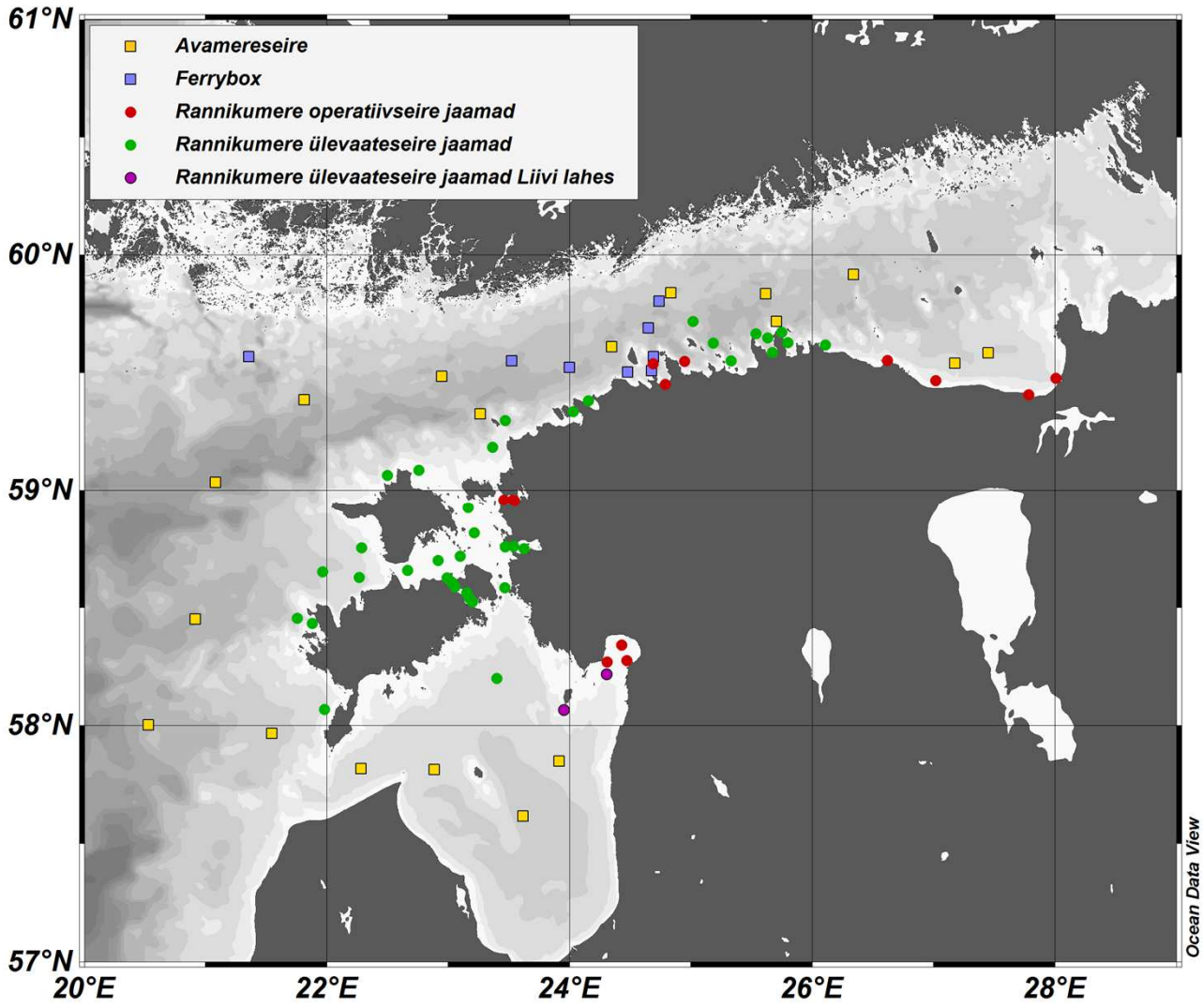


See presentation by Nelli Rünk tomorrow

Glider data from 18-19 August 2014



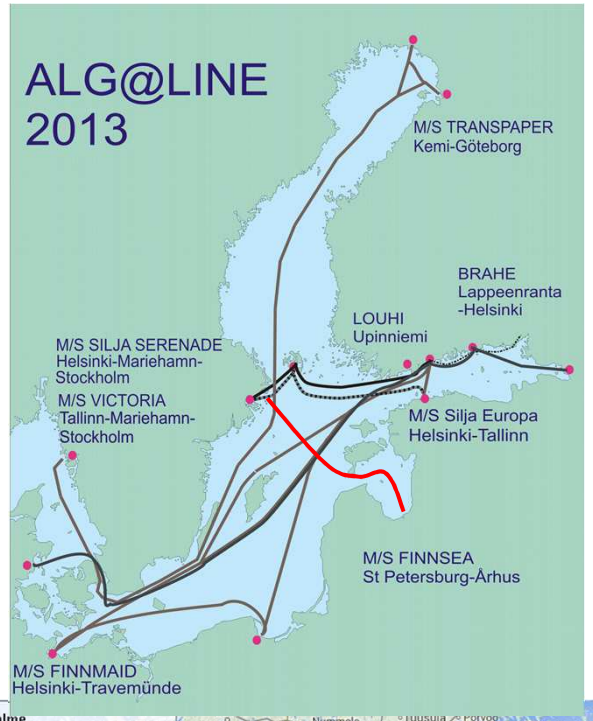
New monitoring program (will be published in September 2014)

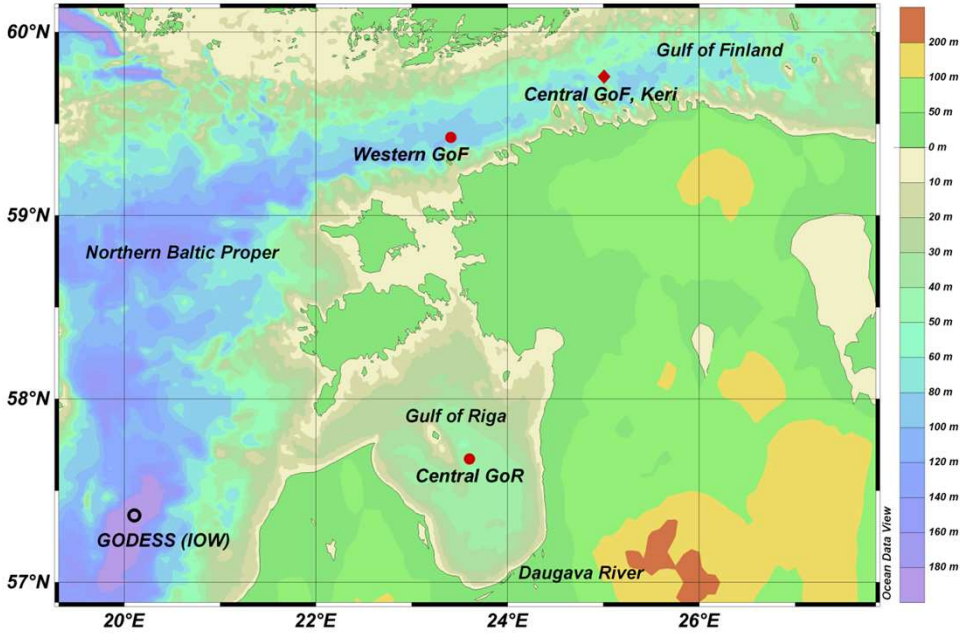


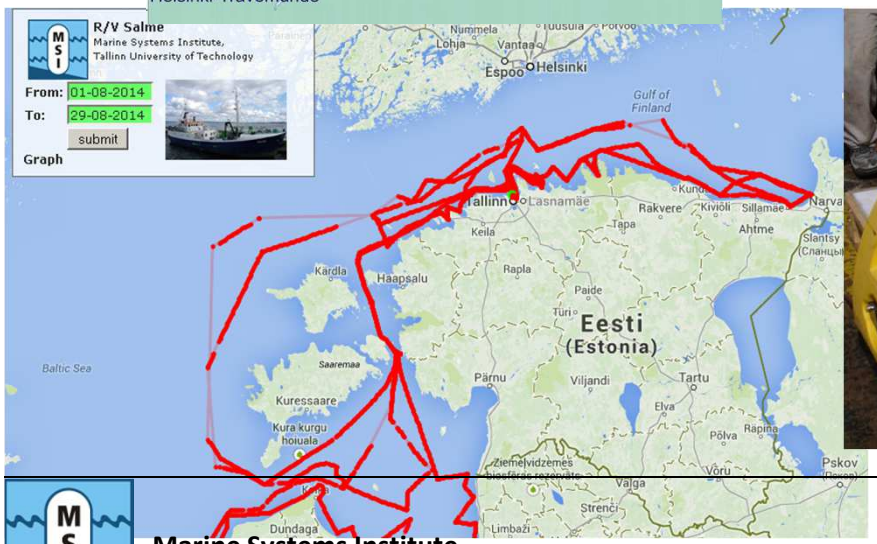
Eutrophication assessment

Gulf of Finland **EST-005** *Muuga-Tallinn-Kakumäe bay*	
Quality element	**Assessment EQR**
BIOLOGICAL ELEMENTS	
Phytoplankton	
Chlorophyll-a concentration [1]	MODERATE
Phytoplankton biomass [1]	POOR
Benthic macroflora	
Benthic macroflora depth distribution	MODERATE
Fucus vesiculosus depth distribution	GOOD
Proportion of perennial species	GOOD
Benthic macroflora depth distribution[3]	MODERATE
Fucus vesiculosus depth distribution[3]	MODERATE
Proportion of perennial species[3]	MODERATE
Large invertebrates	
Large invertebrates ZKI_1	MODERATE
Large invertebrates ZKI_2	MODERATE
Large invertebrates FDI	GOOD
Large invertebrates KPI	GOOD
PHYSICAL-CHEMICAL ELEMENTS	
Total nitrogen (TN) [1 2]	GOOD
Total phosphorus (TP)[1 2]	MODERATE
Transparency Secchi disk method	MODERATE

Combination of systems







Cabled station near Keri island (still under construction)

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Thank you for attention!

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Investing in your future

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EESTI-ŠVEITSI KOOSTÖÖPROGRAMM
ESTONIAN-SWISS COOPERATION PROGRAMME

Urmas Lips, Inga Lips, Villu Kikas, Nelli Rünk, Taavi Liblik, Aet Meerits, Andres Trei, Peeter Laas, Irina Suhhova
Marine Systems Institute at Tallinn University of Technology