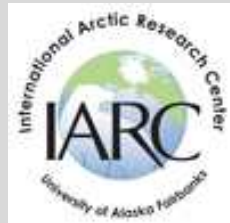


# NABOS II:

## *Observational Program along the Siberian seas*



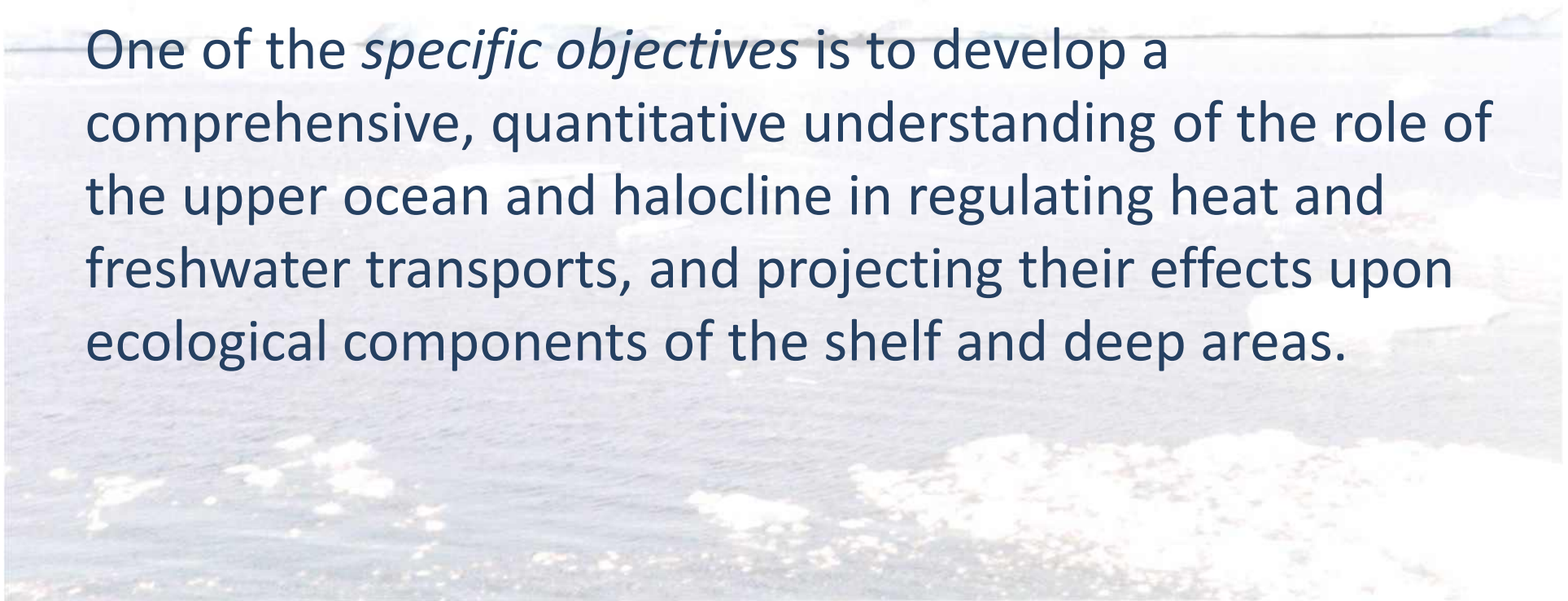
Igor Polyakov and NABOS-II team

International Arctic Research Center, University of Alaska Fairbanks  
Arctic and Antarctic Research Institute, St.-Petersburg, Russia  
Applied Physics Laboratory, University of Washington  
Institute of Marine Science, University of Alaska Fairbanks



Overarching goal of 2012-2017 study, as an element of the Arctic Observing Network: to compile a cohesive picture of climatic changes in the Eurasian and Makarov basins (EMB) of the Arctic Ocean.

One of the *specific objectives* is to develop a comprehensive, quantitative understanding of the role of the upper ocean and halocline in regulating heat and freshwater transports, and projecting their effects upon ecological components of the shelf and deep areas.



NABOS-2013  
"Akademik Fedorov"

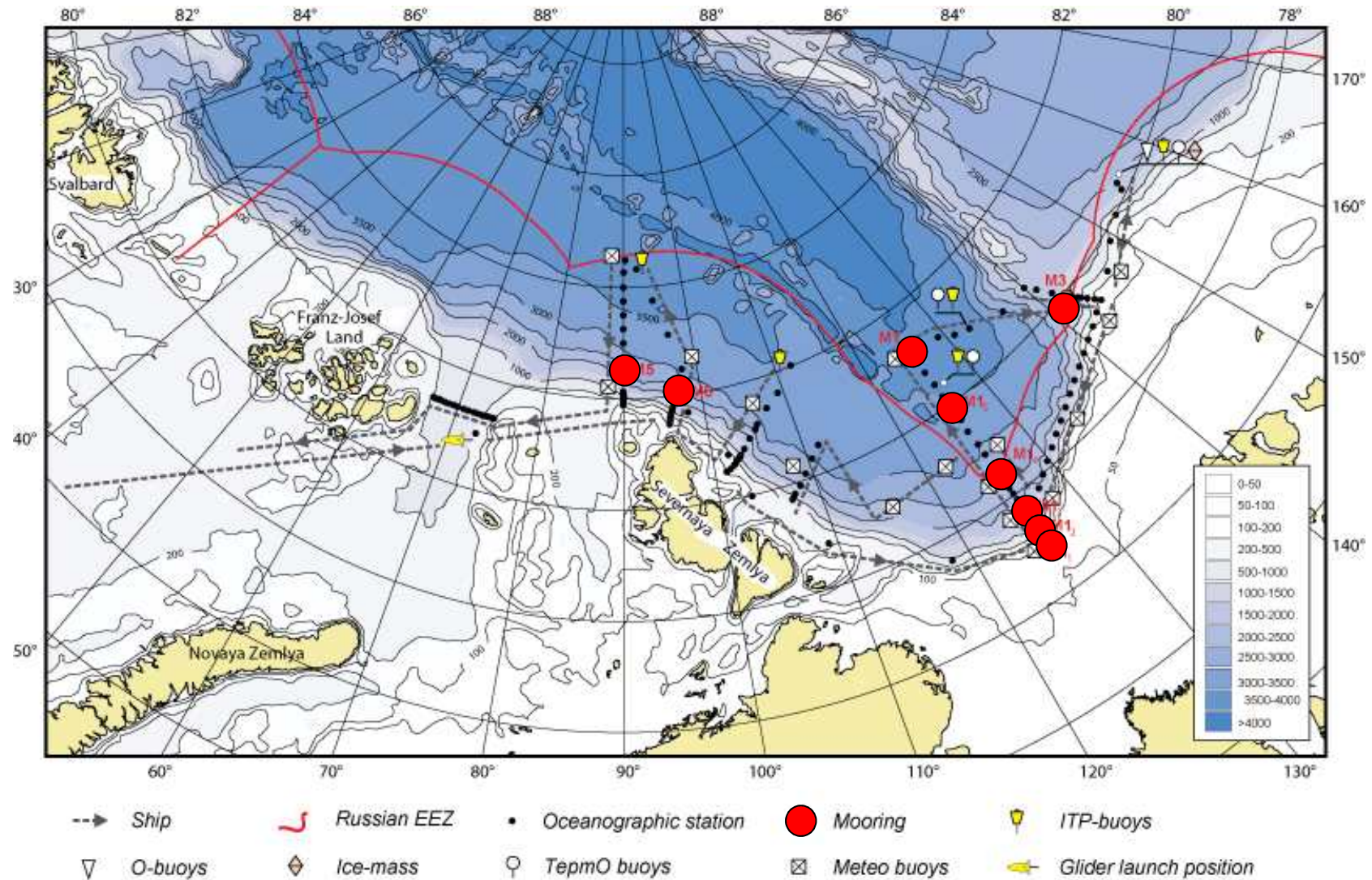


NABOS-2015  
"Akademik Tryoshnikov"



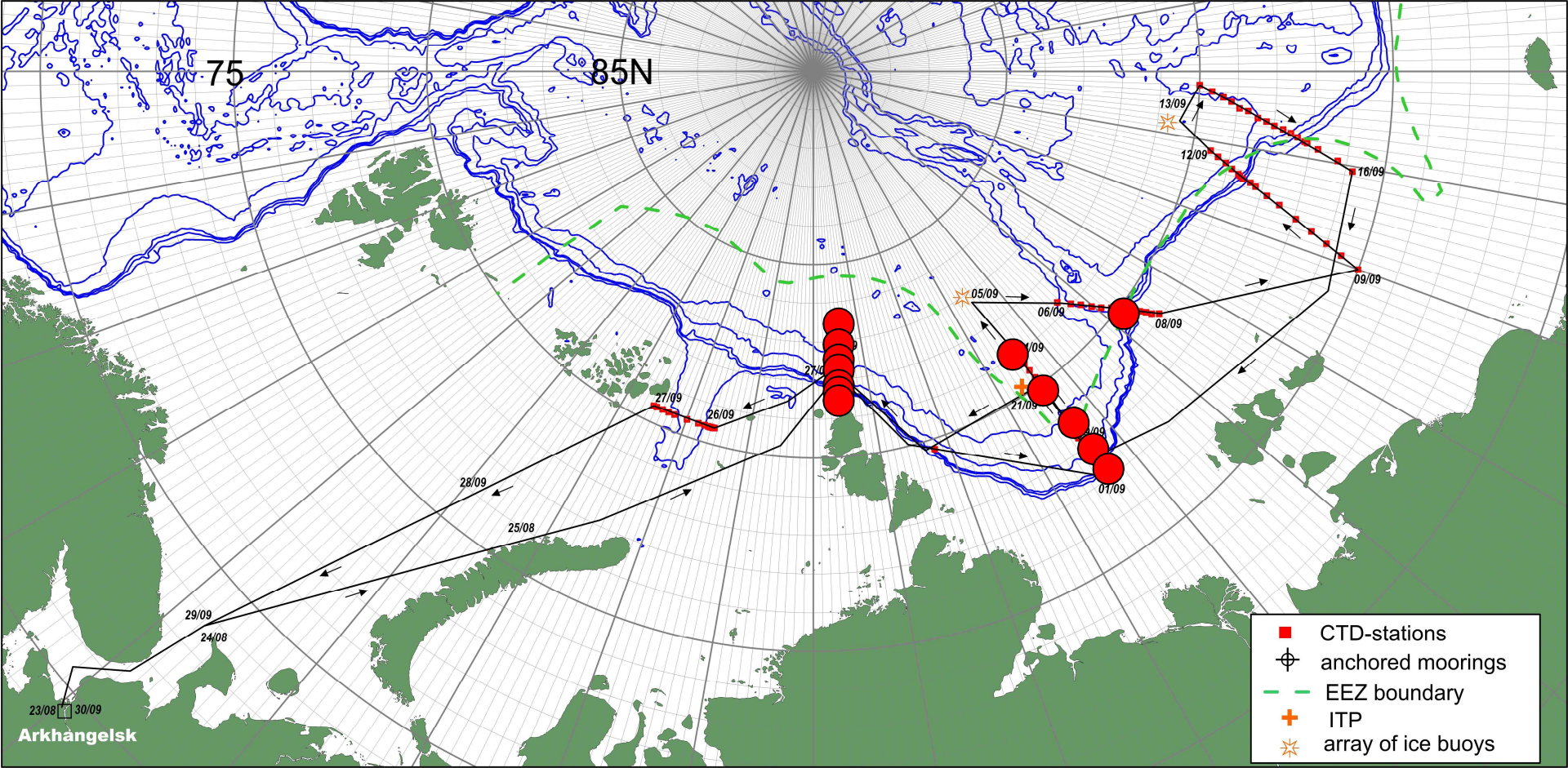


# 2013 field campaign





# 2015 field campaign

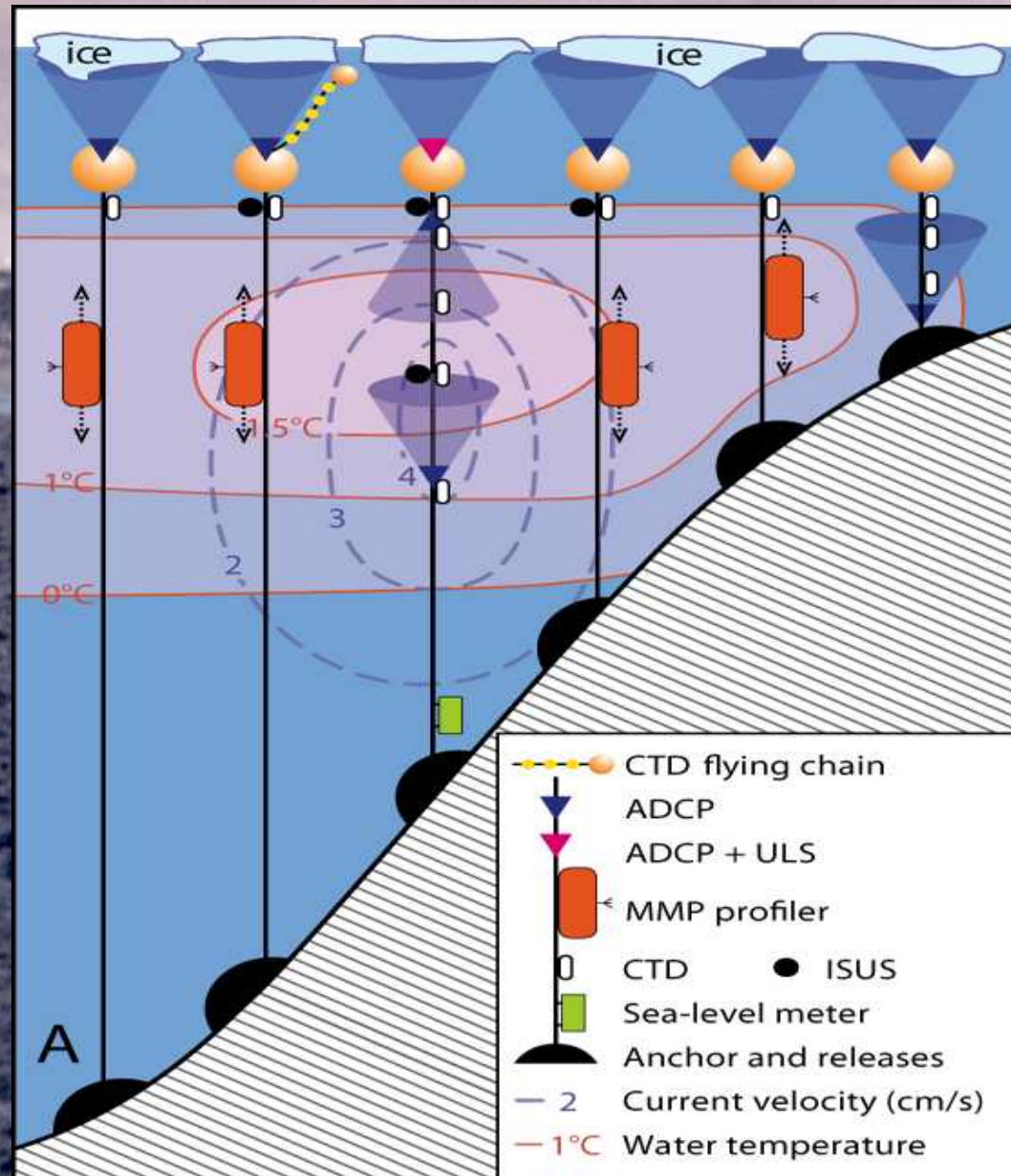


● - 13 deep-water moorings  
deployed in 2015

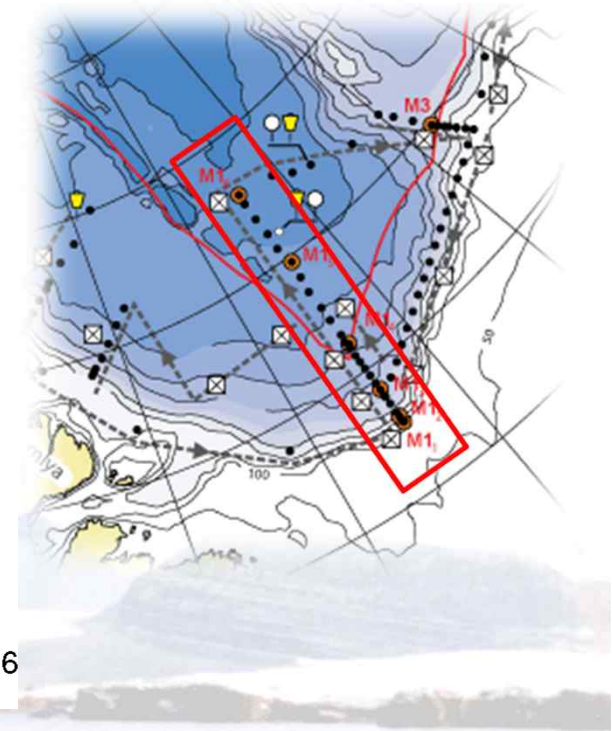
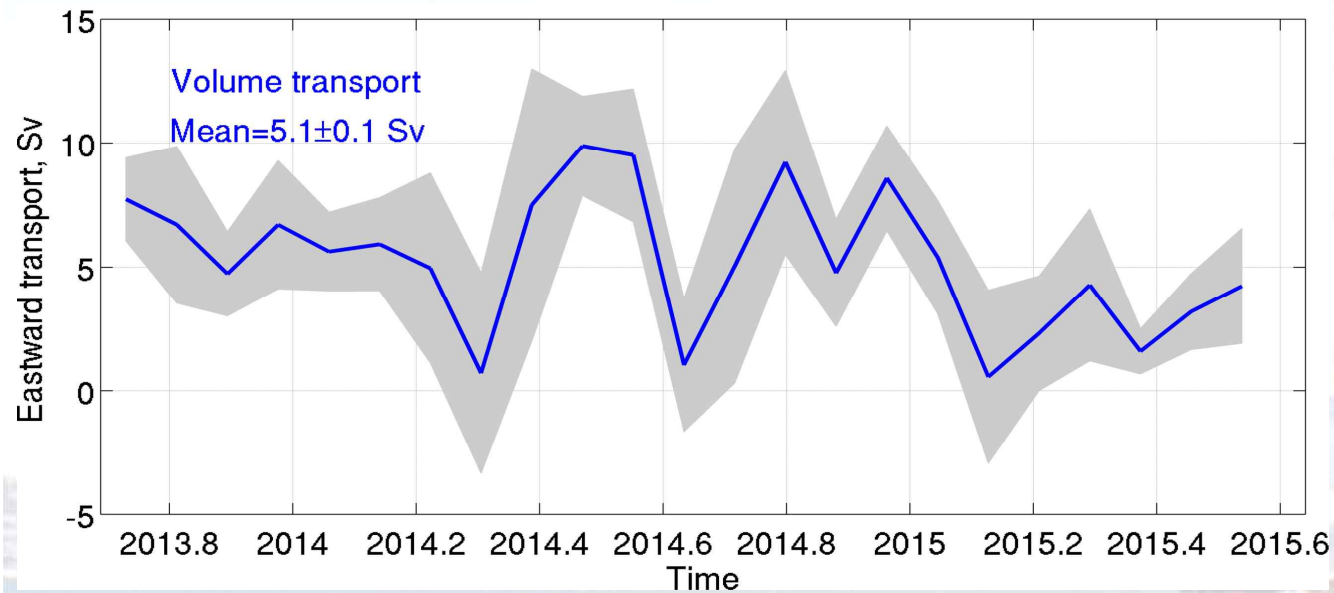


# Atlantic Water (AW) transport through the 125°E line

Mooring-based cross-slope section at the central Laptev Sea slope region (~125°E) deployed in 2013 and continued in 2015.



# Transports across the 125°E line



*Mean volume transport: 5.1±0.1 Sv*

*Mean AW heat transport: 9.6 ±0.4 TW*

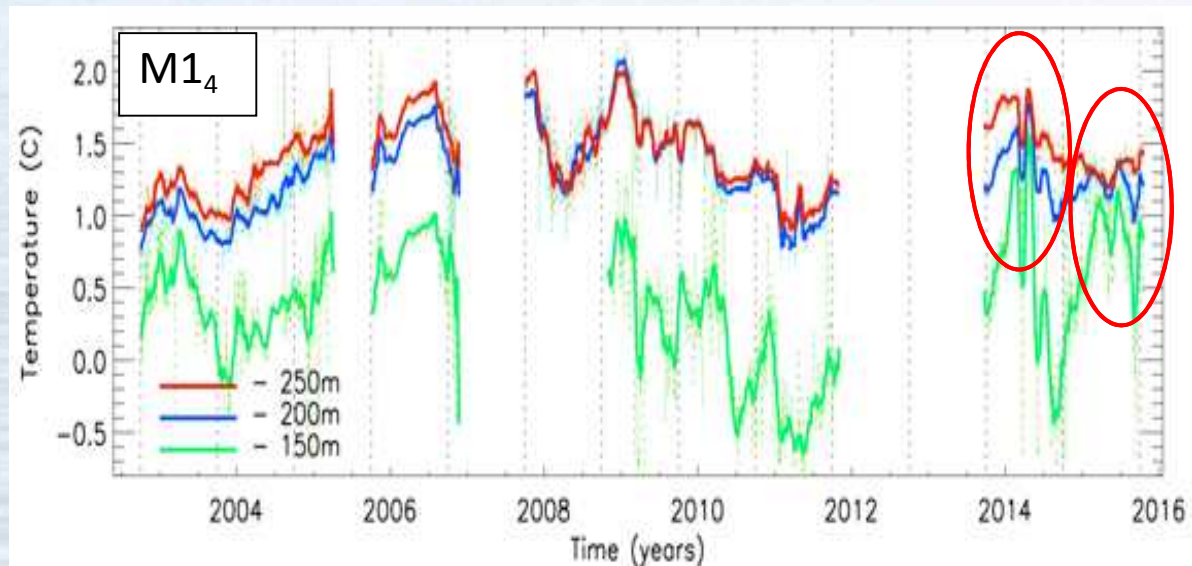
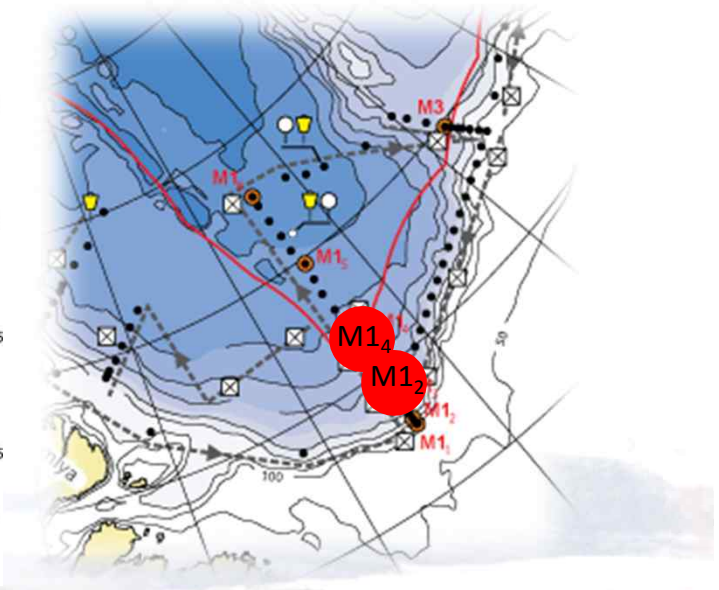
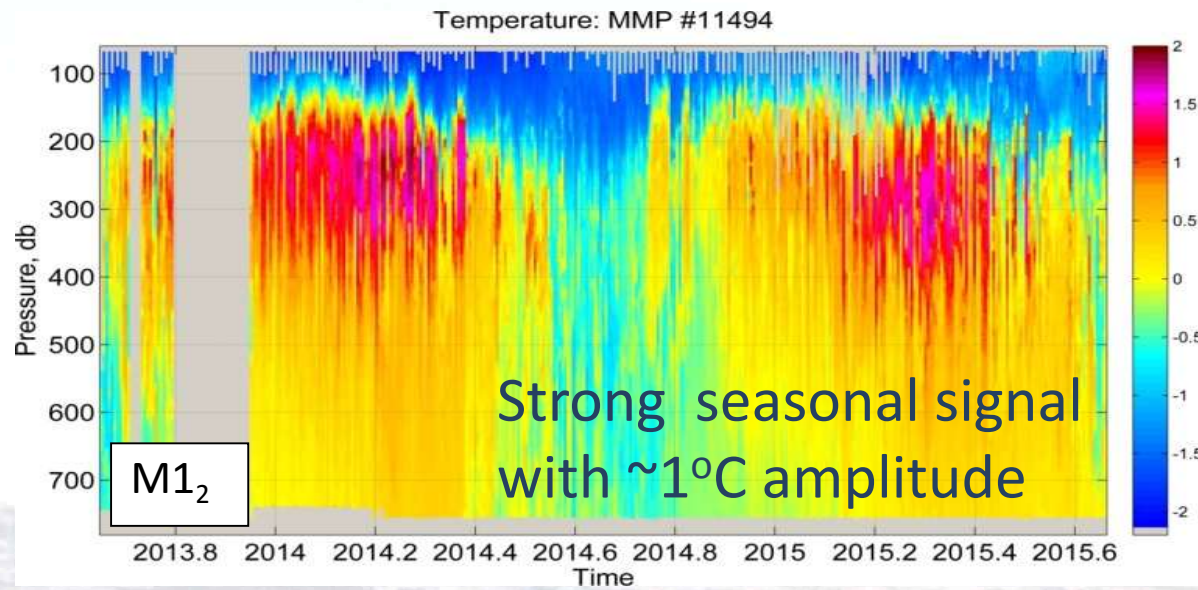
Comparing with the Fram Strait estimates :

1997-2010 mean water inflow is  $6.6 \pm 0.4$  Sv [Beszczynska-Möller et al. 2012]

Two-year mean AW heat influx is  $36 \pm 6$  TW [Schauer & Beszczynska-Möller 2009]



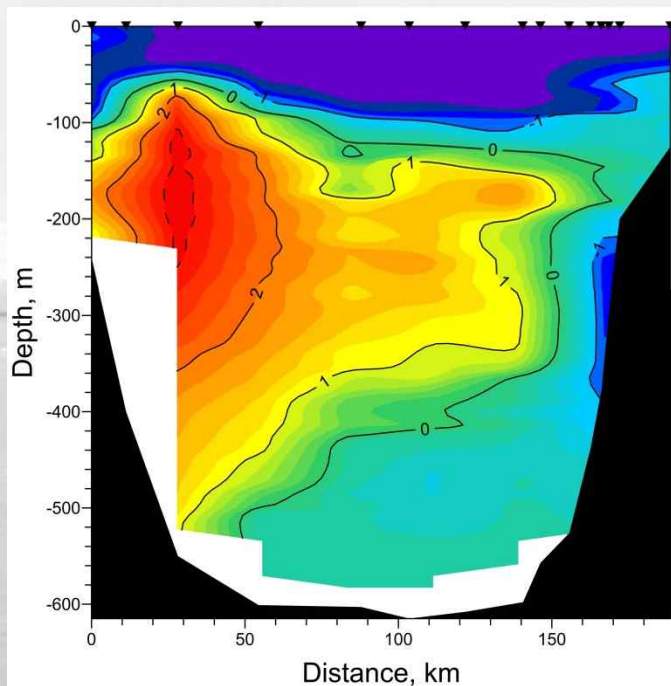
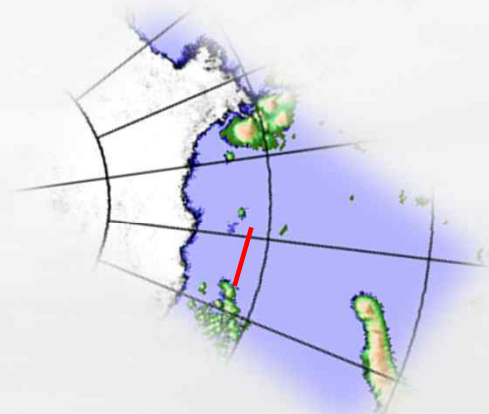
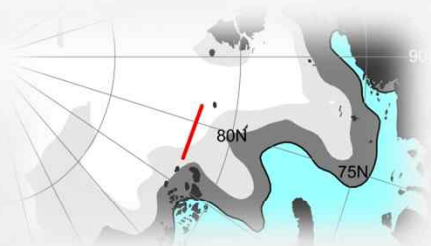
# Seasonality of AW temperature



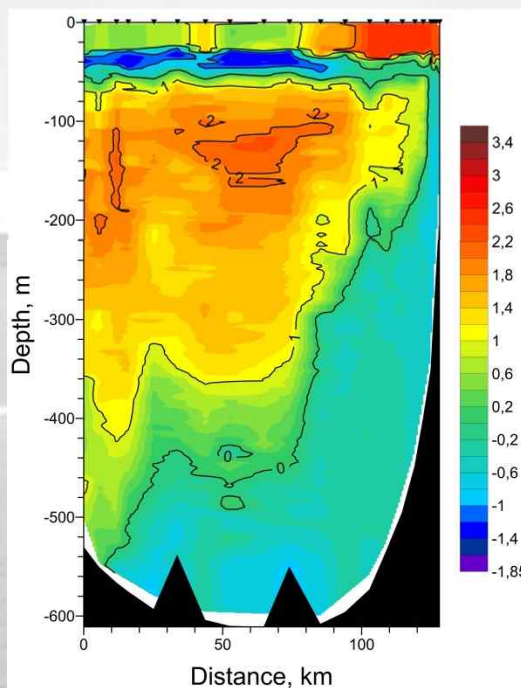
Enhanced seasonal signal in the halocline (green line) in winters of 2013-14 and 2014-15



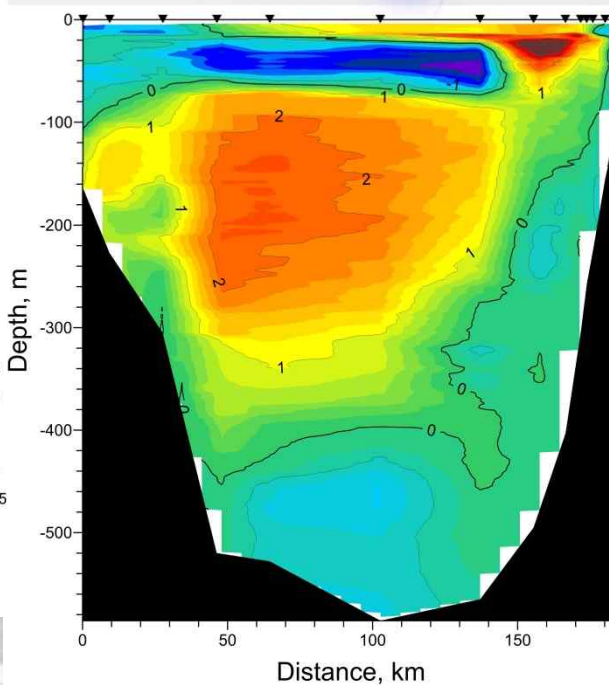
# Upper ocean temperature anomalies enhanced in recent years



August 1996, «Polarstern»



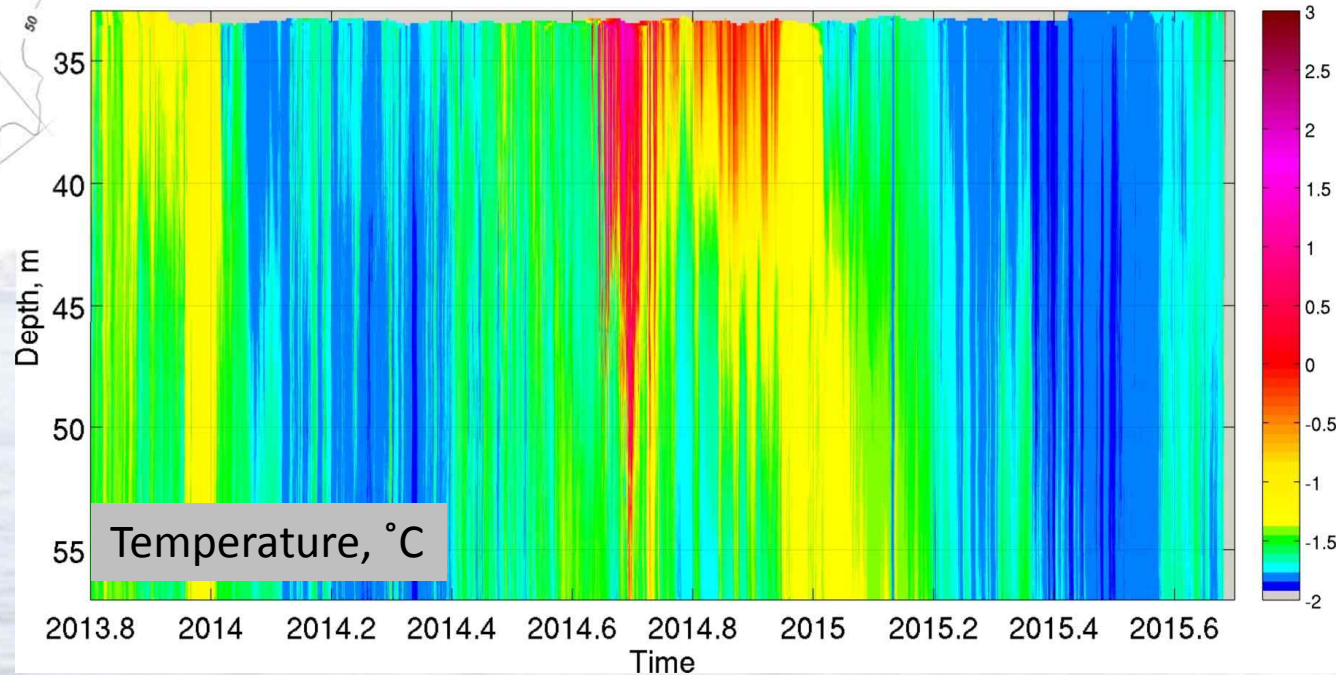
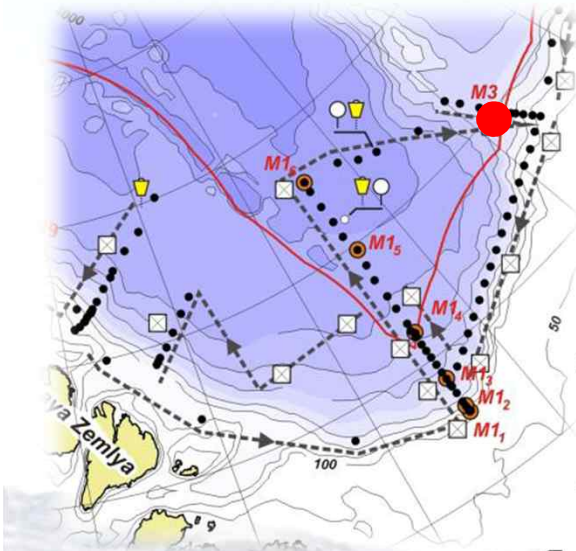
September 2013,  
«Ak. Fedorov»



September 2015  
«Ak. Tryoshnikov»

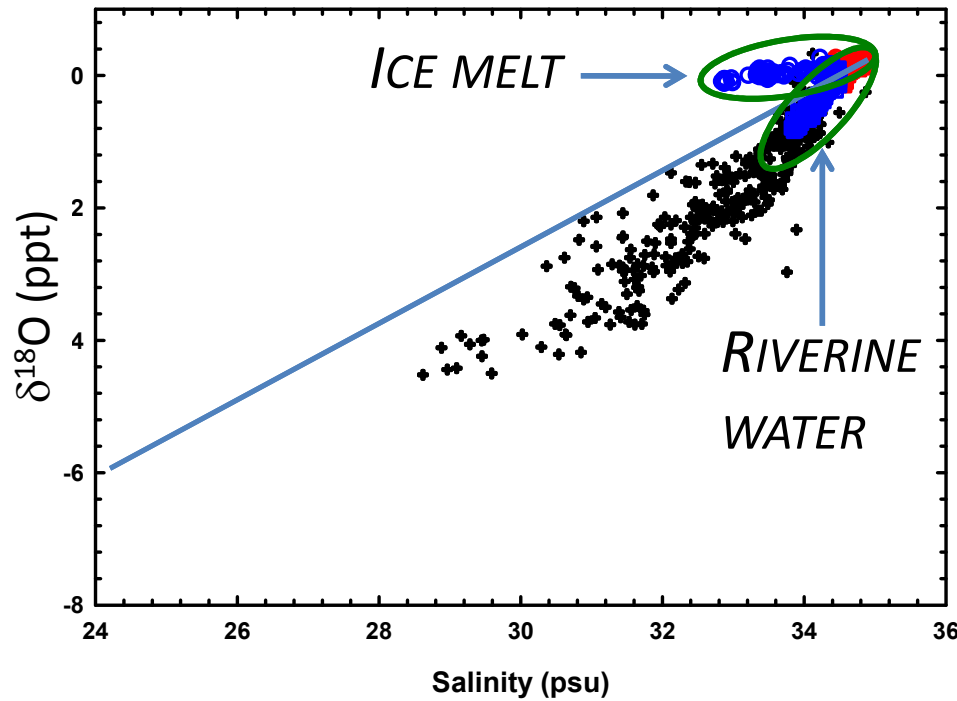
# Upper ocean temperature exceeded 3°C in summer 2014

*M3 mooring record shows  $T > 3^{\circ}\text{C}$  at 35m*

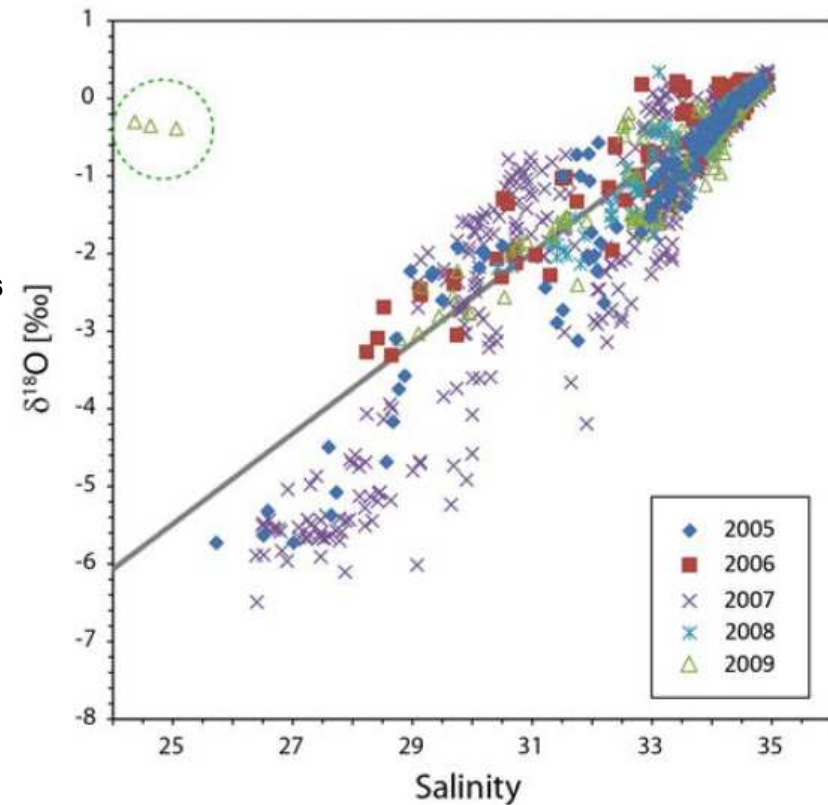




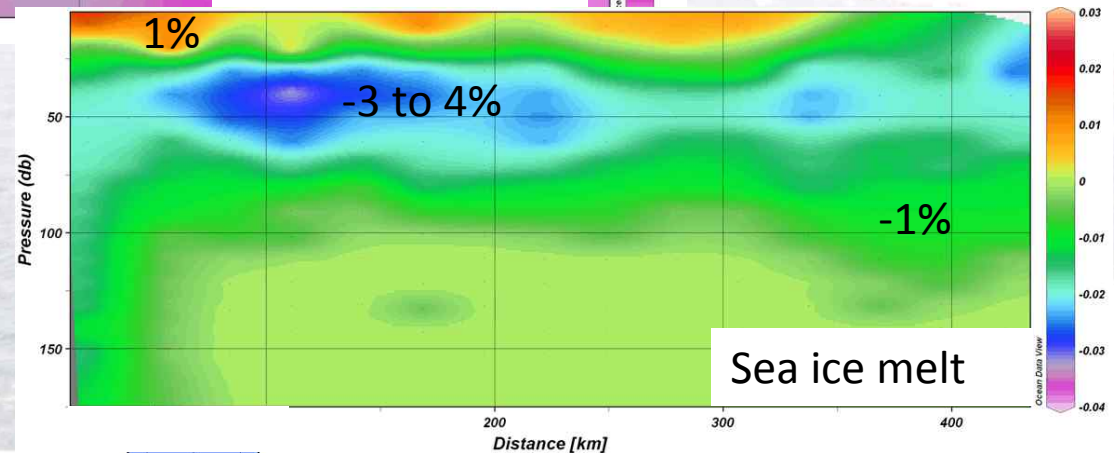
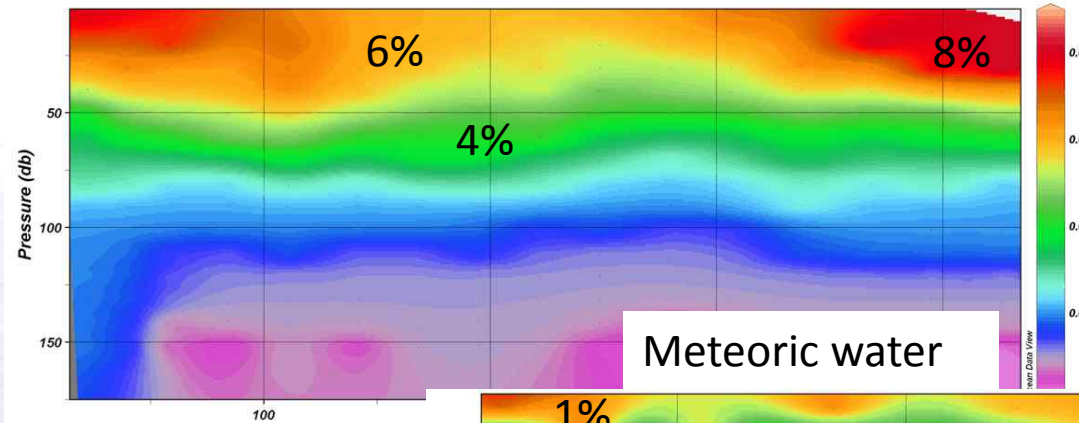
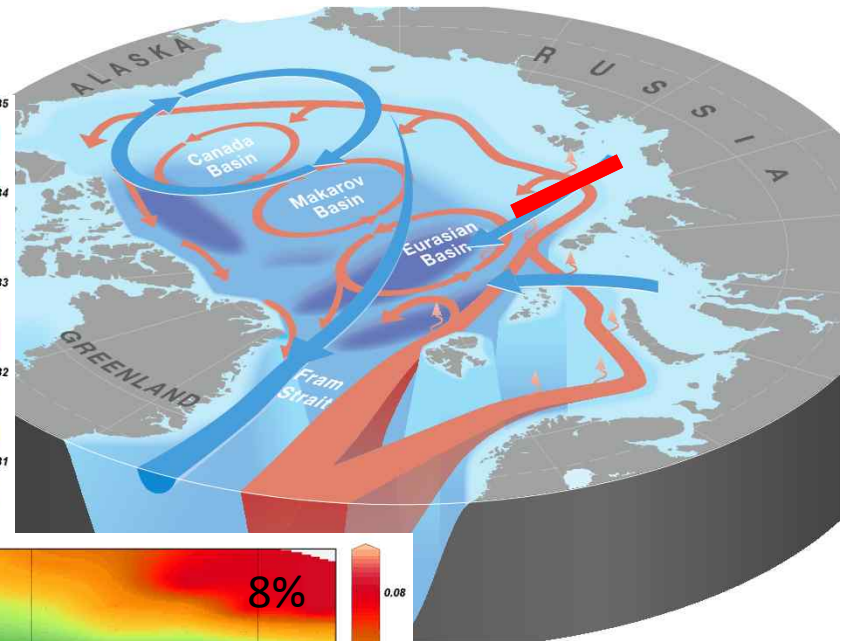
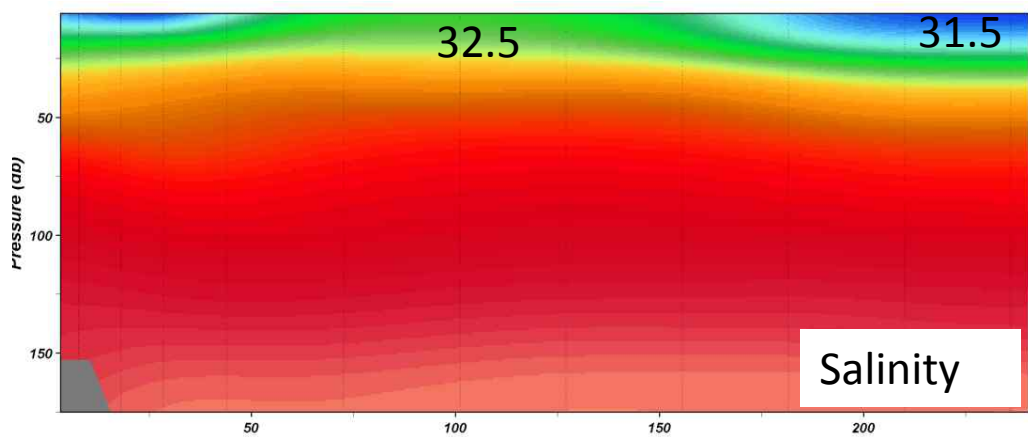
# Oxygen isotopes separate contributions of riverine and ice-melt waters



*Two distinct regions: one (western) is dominated by sea-ice melt, another region (eastern) is dominated by riverine water*



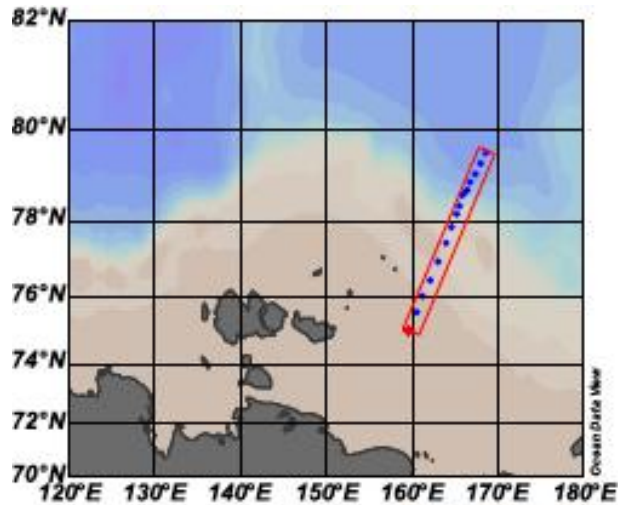
# EB composition of water masses



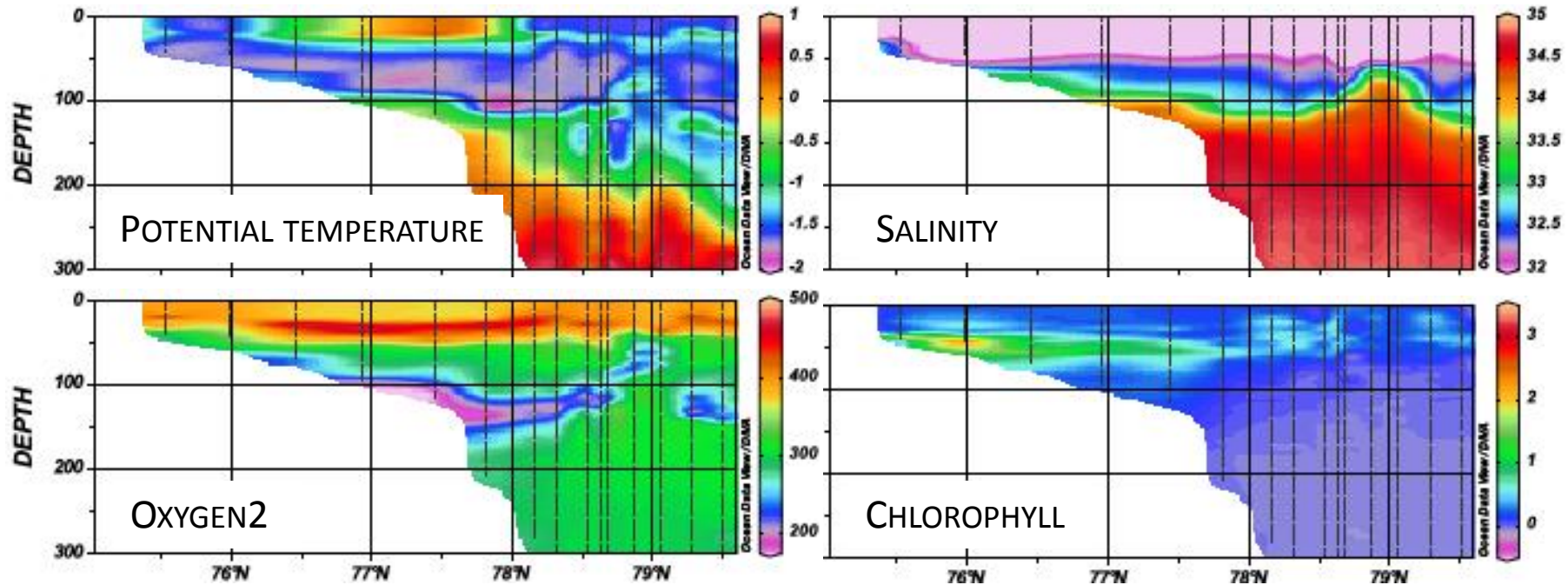
*Riverine water dominates sea-ice melt water in the central Laptev Sea region*



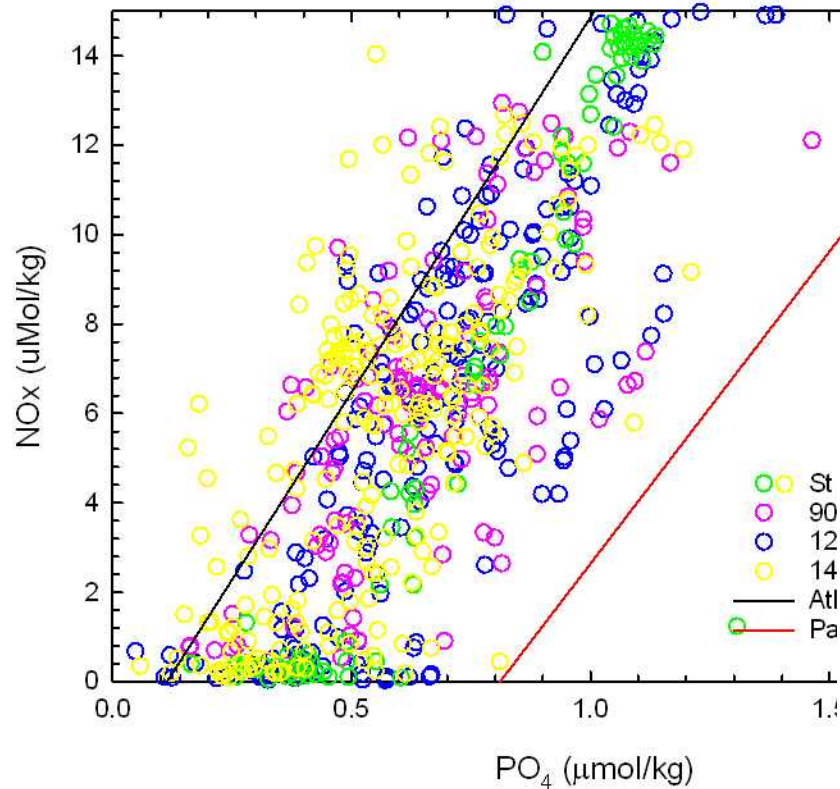
# 2015 East Siberian Sea: a) Upwelling, b) Chlorophyll



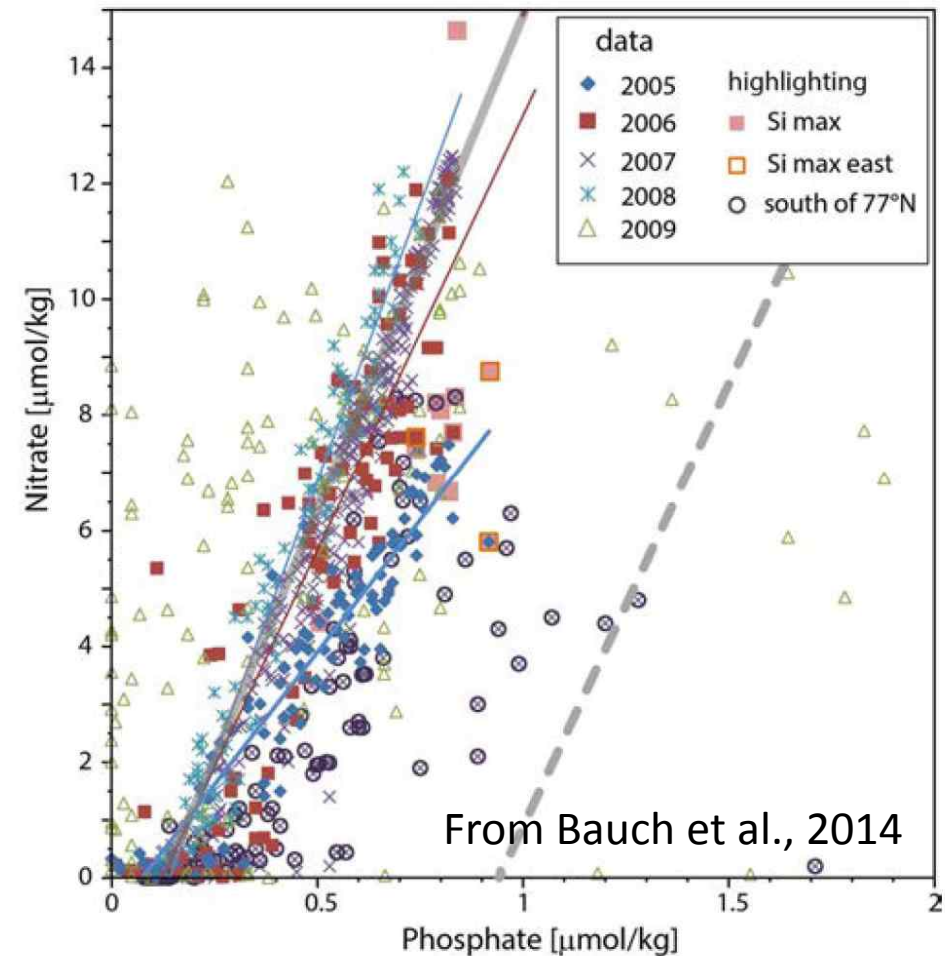
*Upwelling carries nutrients from deeper water potentially causing the bloom (as seen in chlorophyll distribution) and oxygen depletion*



# Nutrients show denitrification in 0-250m layer

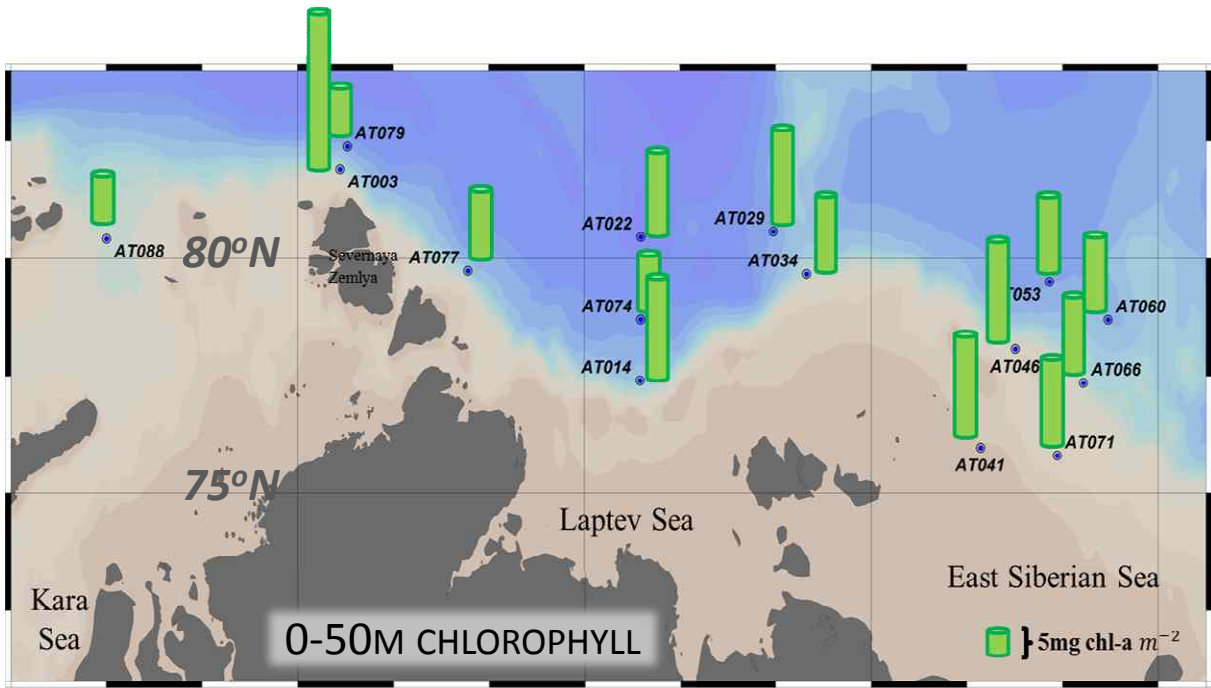


When compared to historical NABOS data, we are seeing a reduction in the N/P ratio, perhaps resulting from increased denitrification on the shelves.

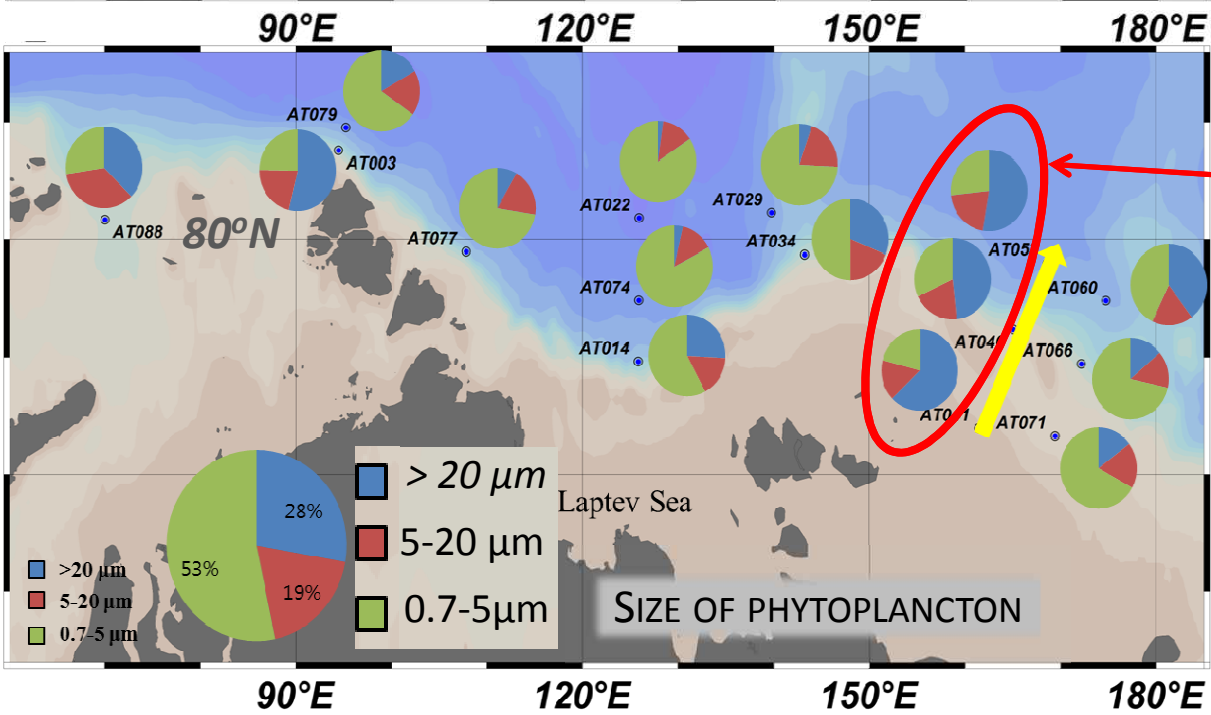


From Bauch et al., 2014





The amount of biomass doesn't change much.



Stations AT041 – AT053:  
*Larger diatoms dominate samples. Further research is needed and nutrient data may clarify the story.*

Looking into the future of the program





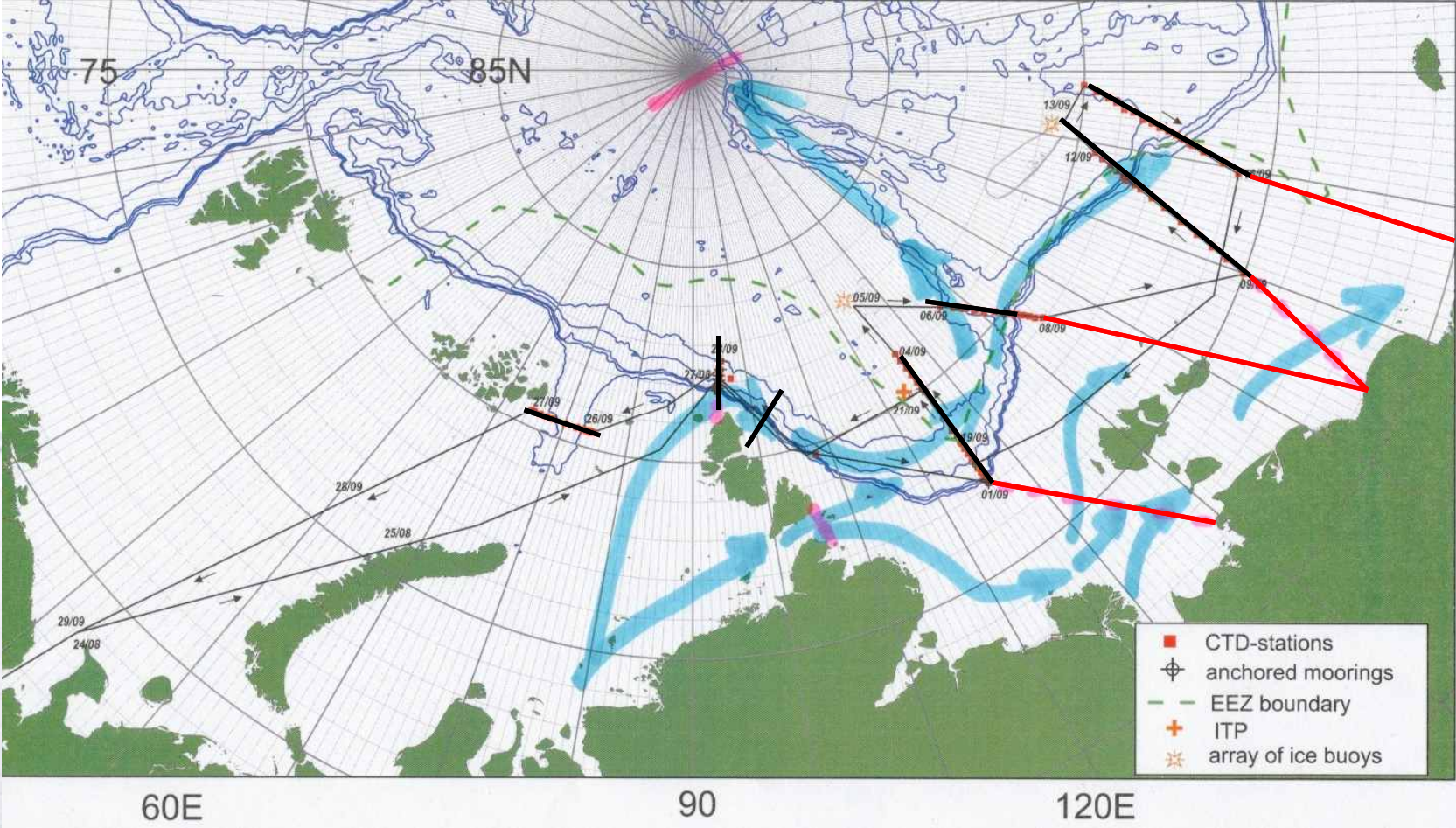
# Motivation: Catchment area of the Arctic Ocean showing the annual discharge (km<sup>3</sup>) of major Arctic rivers



- Major riverine transport of freshwater in km<sup>3</sup>
- Arctic watershed area
- Boundaries of major catchment areas

The Laptev and East Siberians seas / eastern Eurasian/Makarov basins is the transit area for the most of the Arctic riverine water

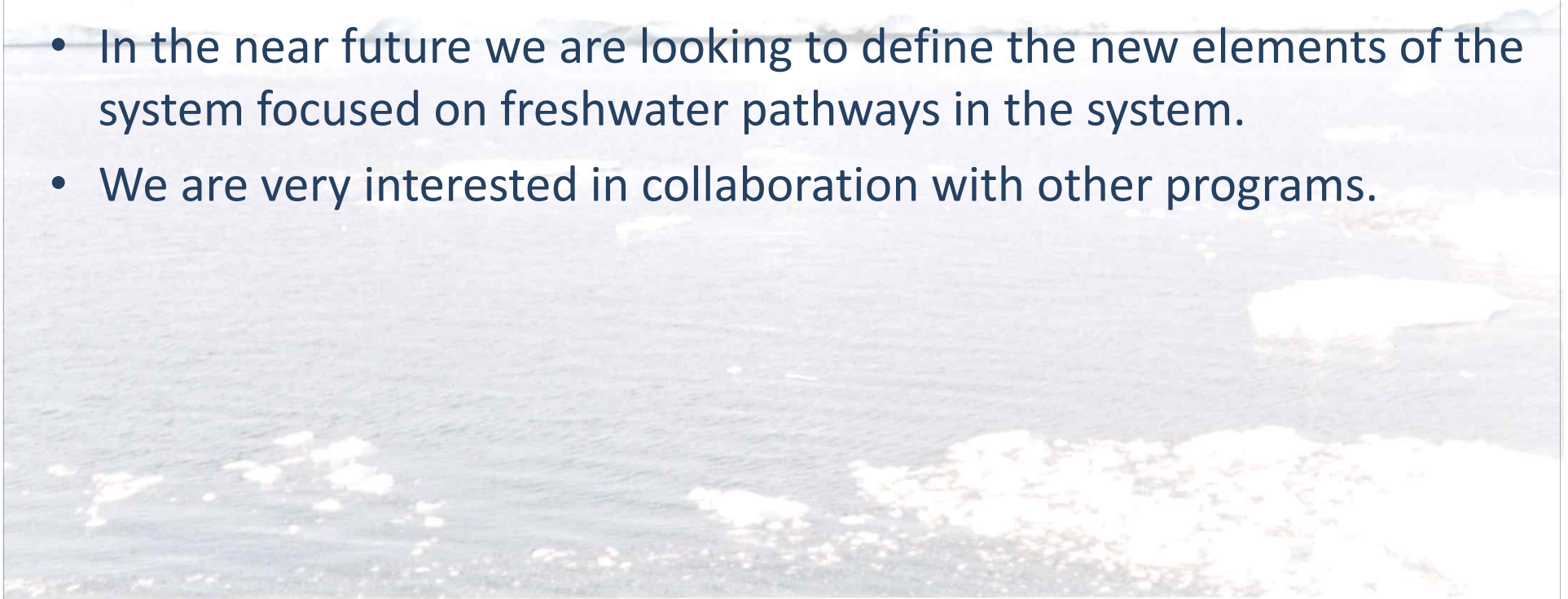
# Planning the future





# Conclusions

- 2013-15 data were instrumental for quantifying along-slope water, heat and salt transports and detecting an exceptionally strong warming in the halocline in the eastern Eurasian Basin.
- NABOS II has a young but goal-oriented chemical program with promising early results.
- In the near future we are looking to define the new elements of the system focused on freshwater pathways in the system.
- We are very interested in collaboration with other programs.



# Acknowledgements

The program is funded by:



*National Science Foundation*



*National Oceanic and  
Atmospheric Administration*