



Argo activities in the Baltic Sea

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Outline

- Baltic Sea challenges for Argos
- Experiments performed so far
- Control, Recovery
- Current activities, and future plans





Challenges in Baltic Sea

- Brackish water
- Heavily trafficked
- Seasonal ice cover
- Depth is often well under 100 meters

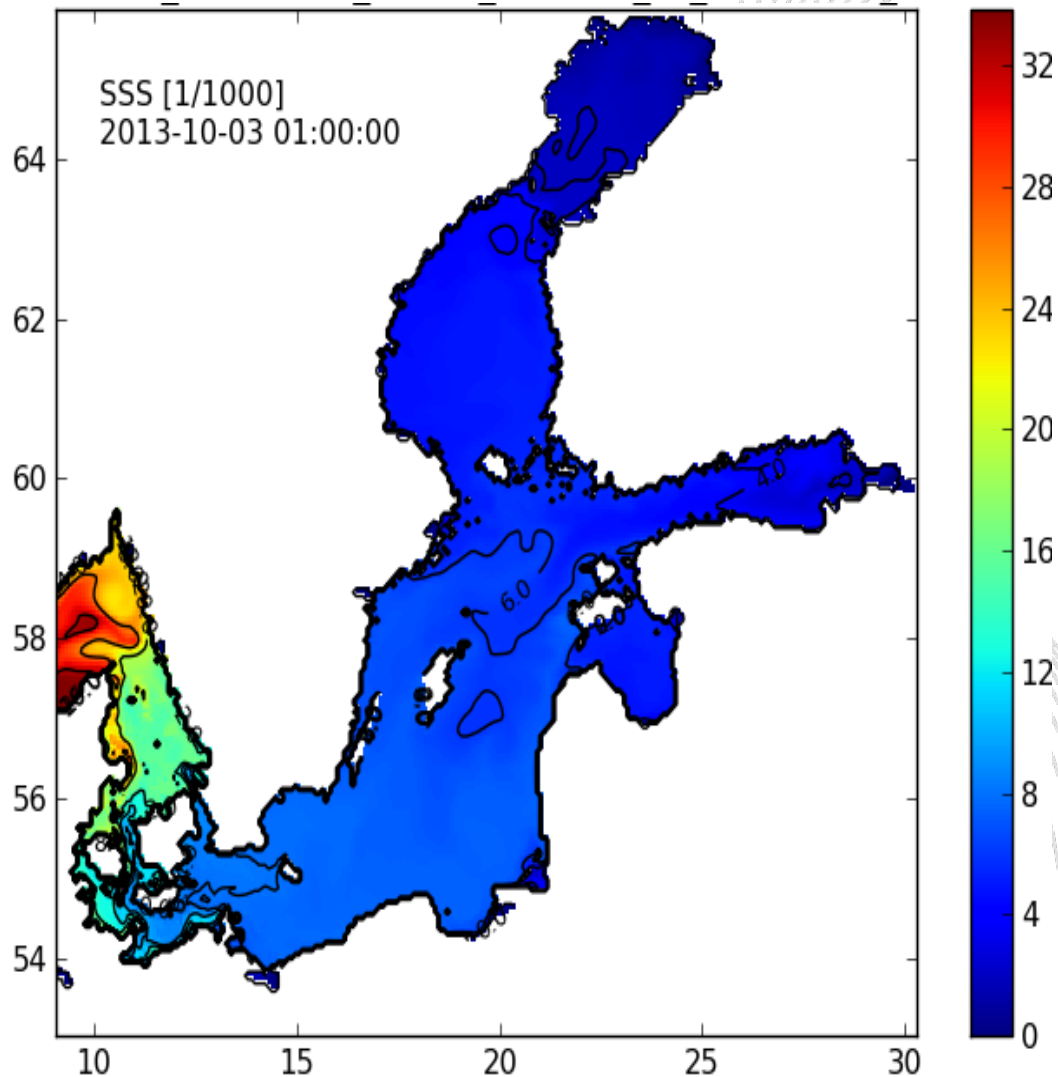


photograph by Petra Roiha, FMI

Email: simo.siiria@fmi.fi

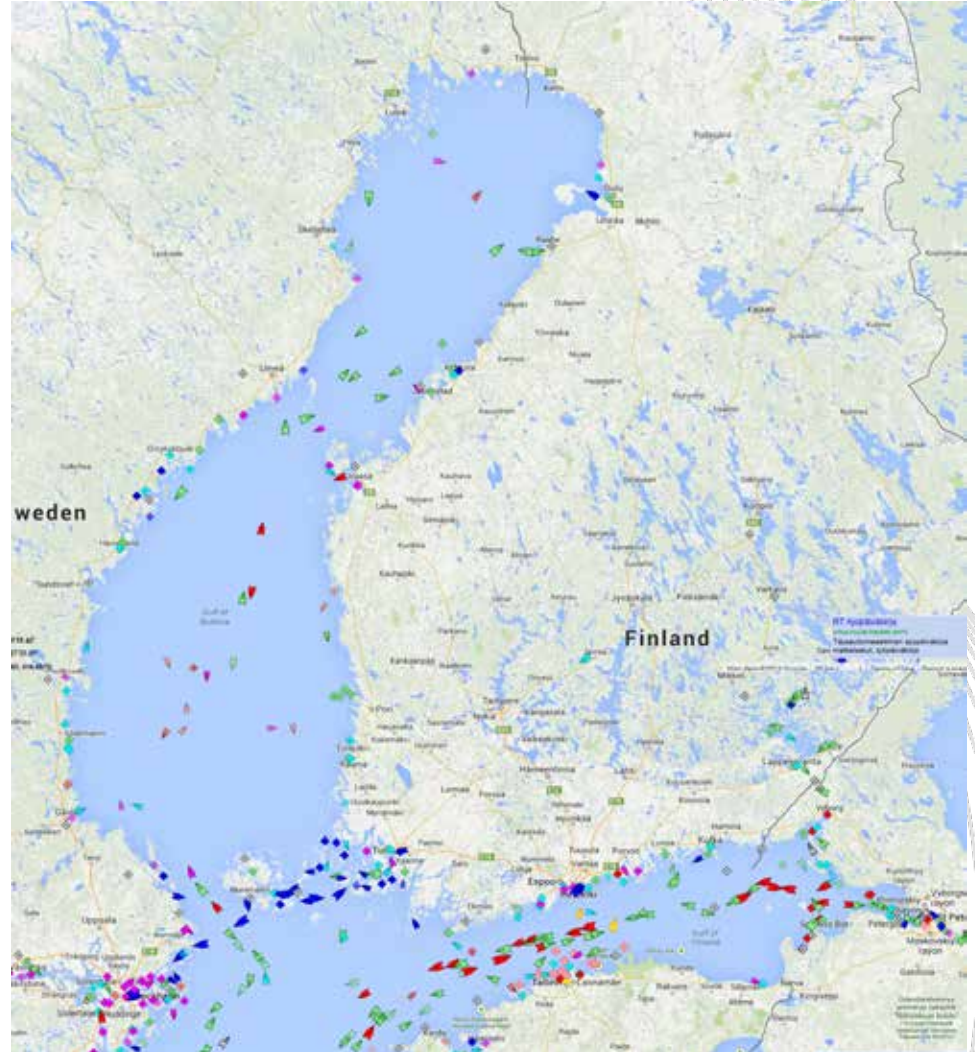
Challenge: brackish water

- Different salinity in different areas
- Stratification changes during the year
- Floats need to be balanced for certain area



Challenge: traffic

- Heavily trafficked
- Floats might get overrun/broken in many areas
- Undesired human interactions
- Fishing activities trawl etc.





Challenge: Ice

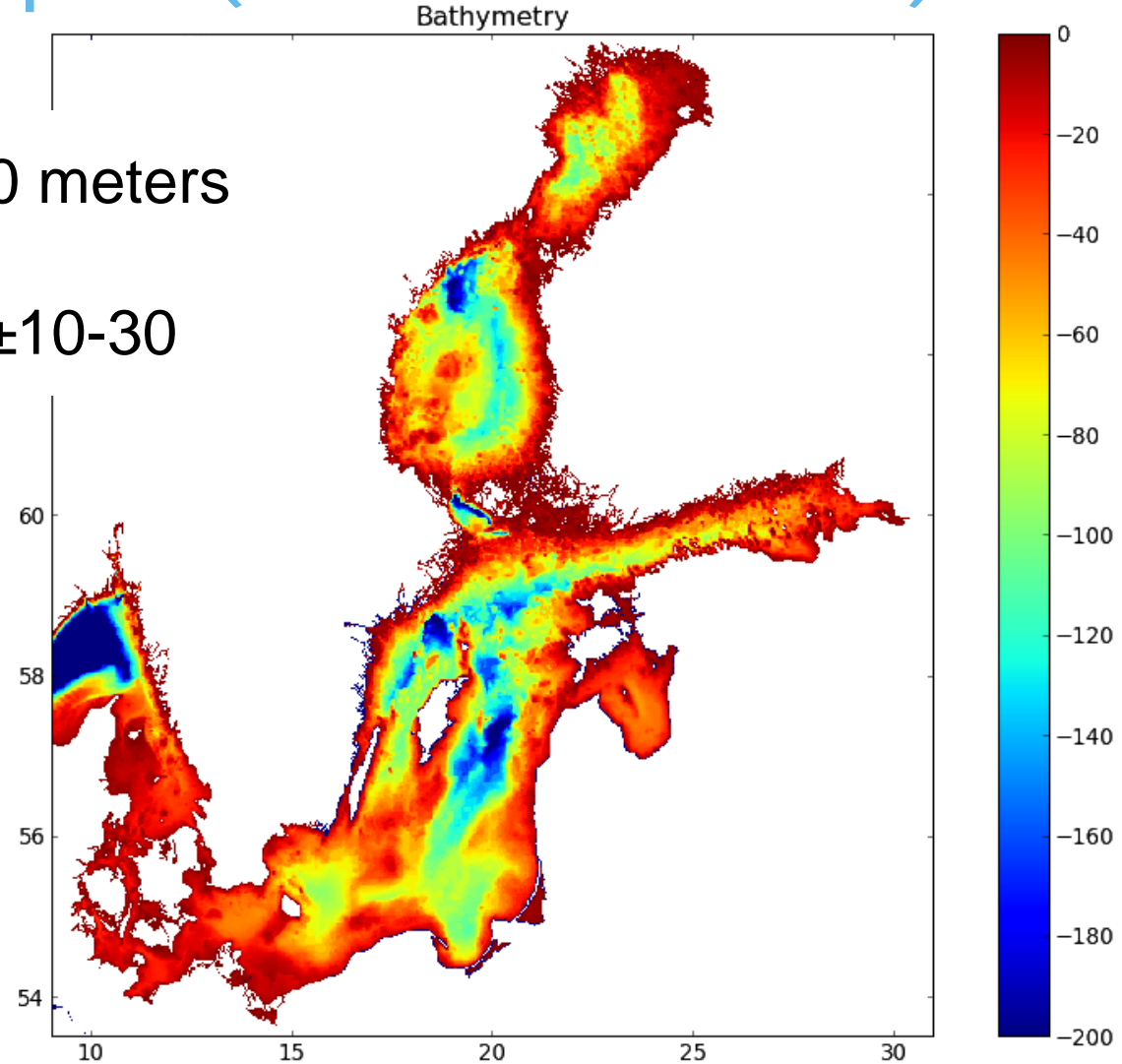
- Freezes partially during winter
- Float can't get through the ice
- Ice-avoidance functions
- In certain areas floats can operate only for a fraction of the year



31.3.2015

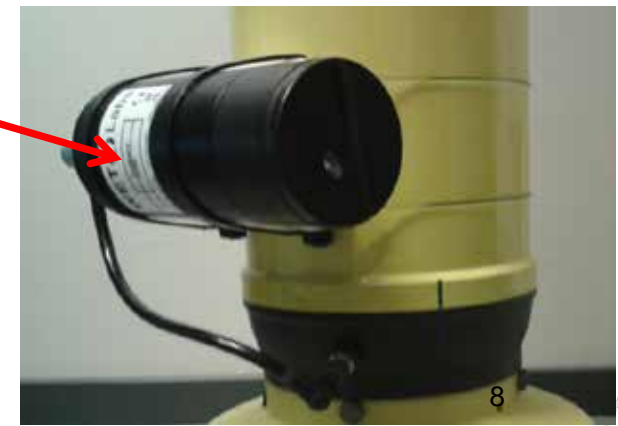
Challenge: depth(or lack of it)

- Depth is often well under 100 meters
- Normal buoyancy accuracy ± 10 -30 meters
- Depth varies quickly
- Bottom contact undesirable



APEX Argo floats

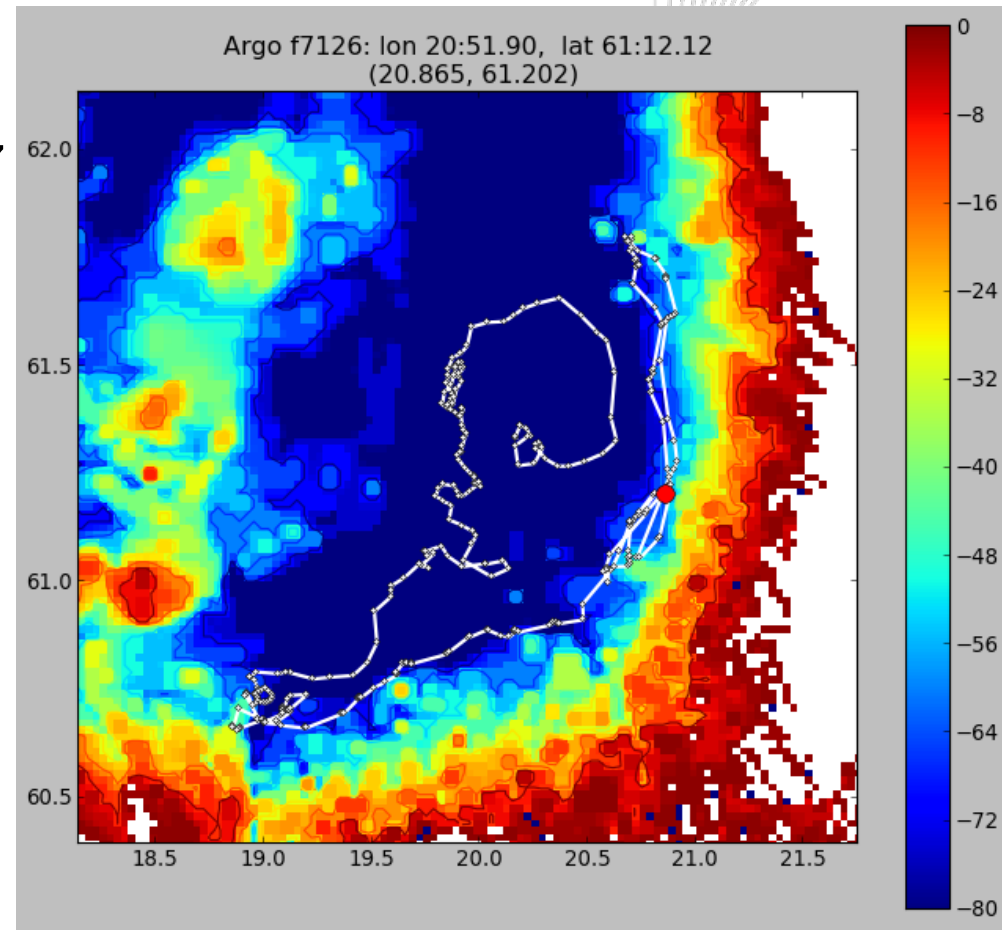
- WEBB Research
- Dimensions: 16.5 cm d x 127 cm long (+ 69 cm antenna)
- Mass: 25 kg
- Autonomy nominal: 4 years, 150 ascents
- Extra sensors tested:
 - Oxygen optode 4330
 - FLBBAP2, scattering meter



<http://www.webbresearch.com/apex.aspx>

First experiments 2012, Bothnian Sea

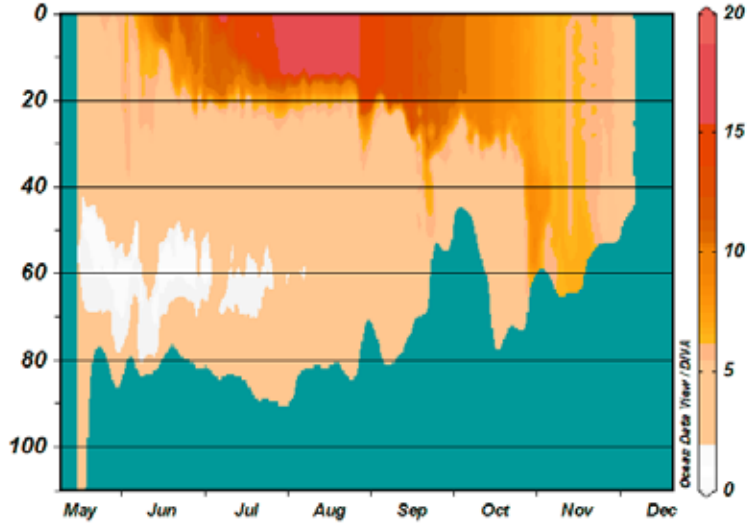
- Half a year mission from May 17 to Dec 5
- Over 200 profiles acquired
- Managed to stay all the time away from shores
- Required constant modifying of the program to avoid bottom contact



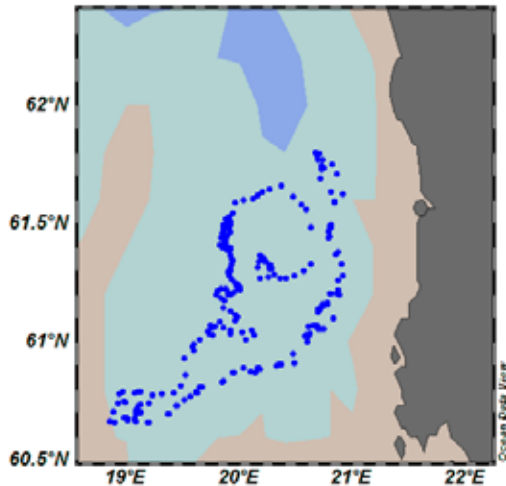


First experiments 2012, Bothnian Sea

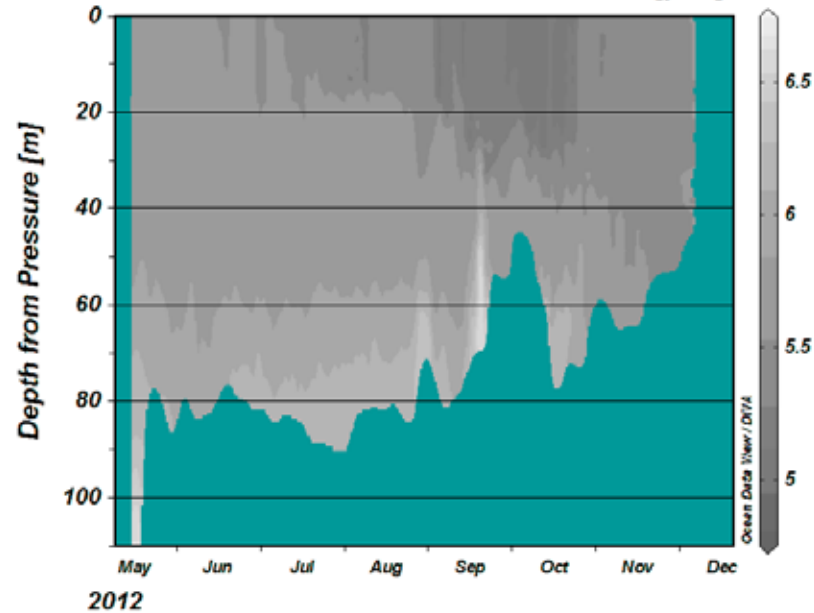
IN SITU ITS-90 SCALE var=TEMP [degree_Celsius]



2012

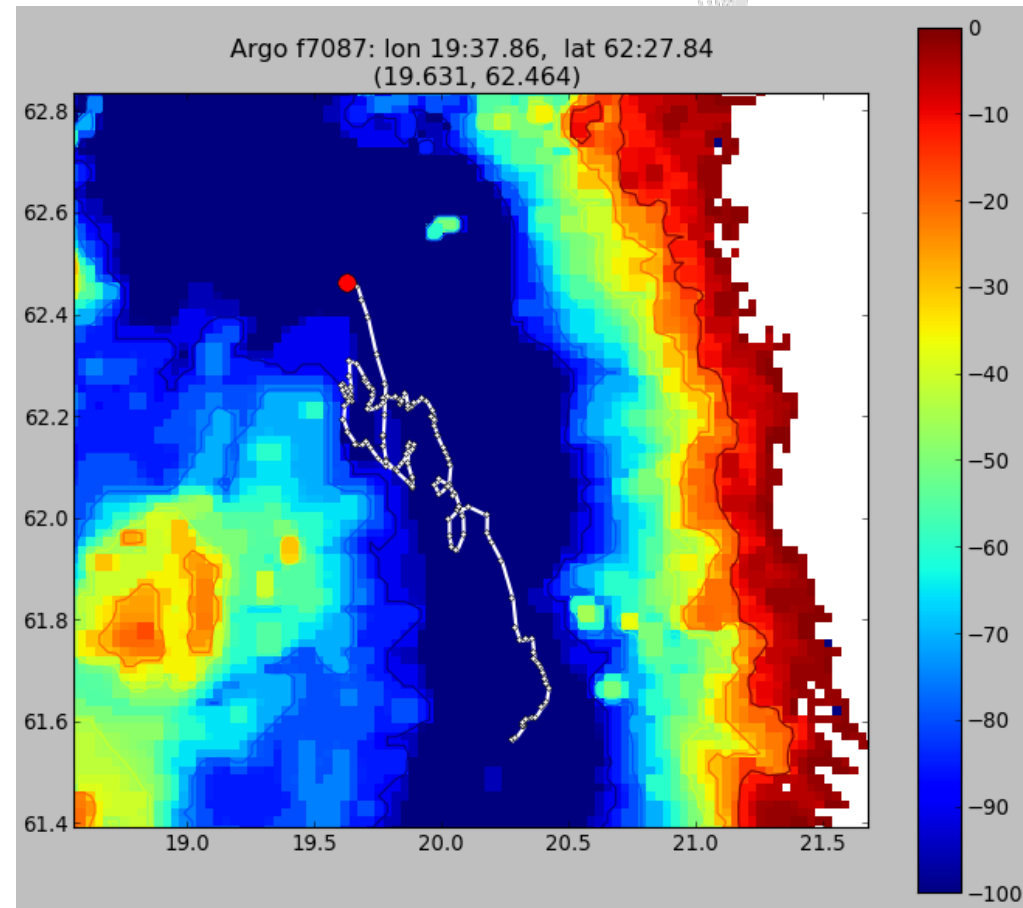


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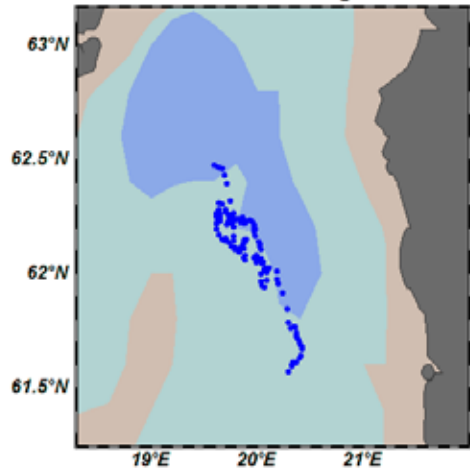
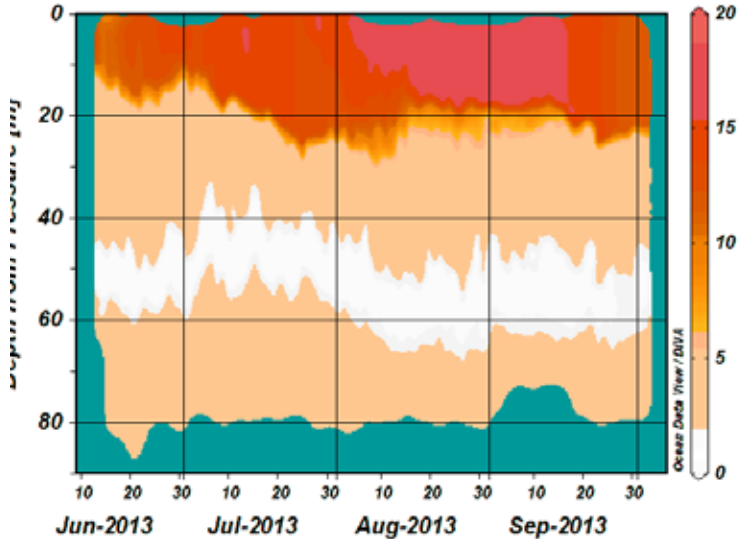
Second experiments (1/2) 2013, Bothnian Sea

- Fine-tuned software experimented
- ~4 month mission (from Jun 13 to Oct 2)
- Approx. 120 profiles acquired

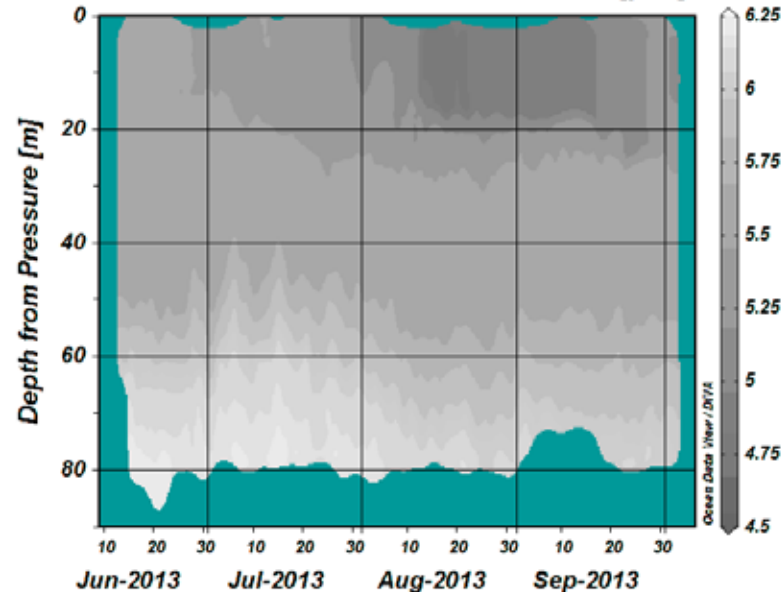


Second experiments (1/2) 2013, Bothnian Sea

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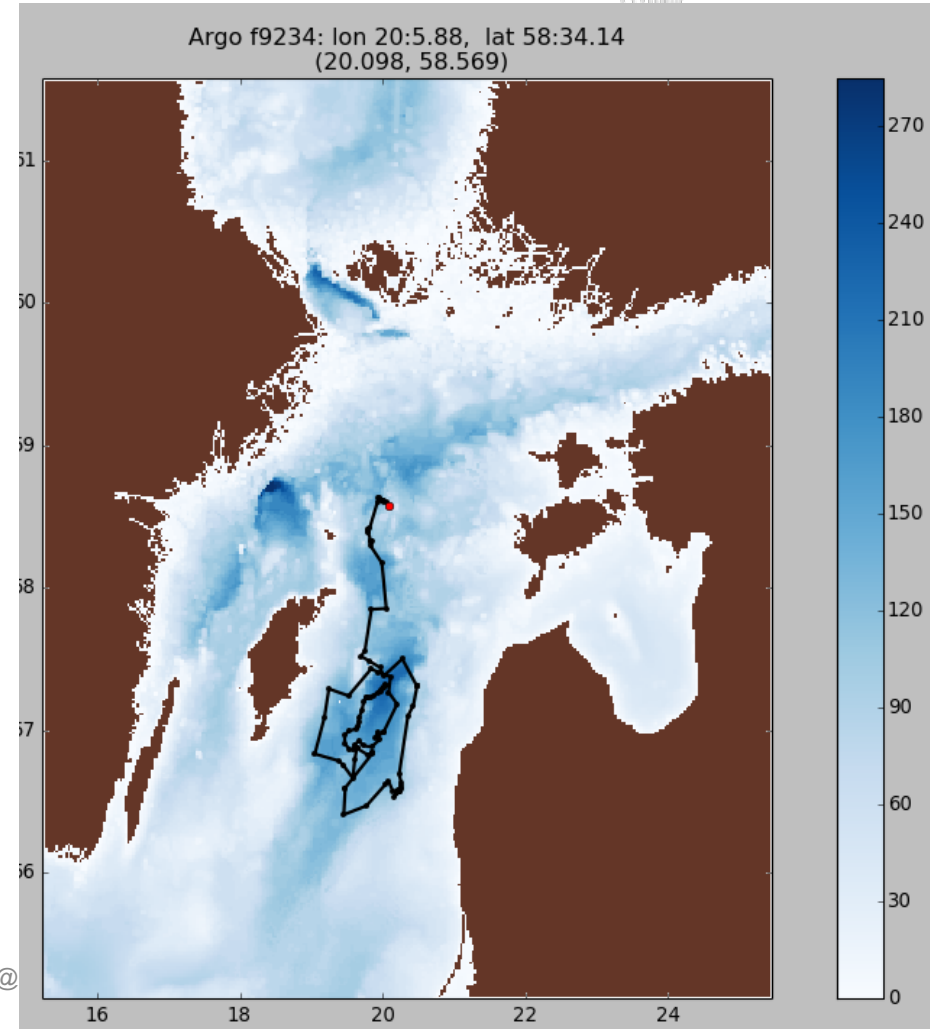


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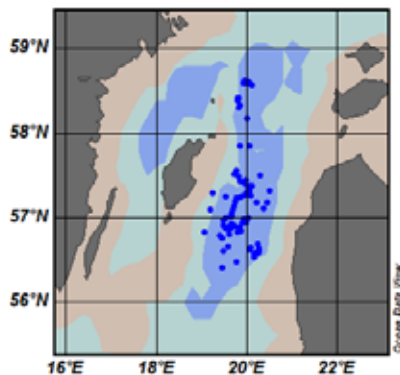
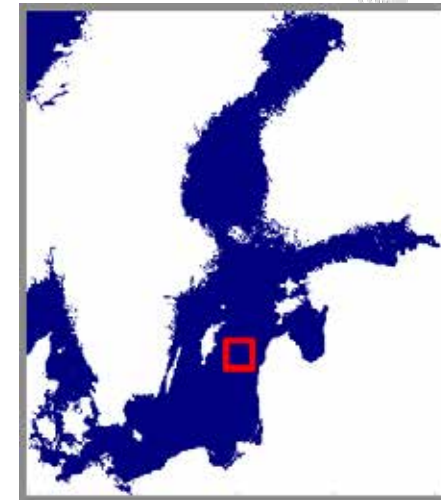
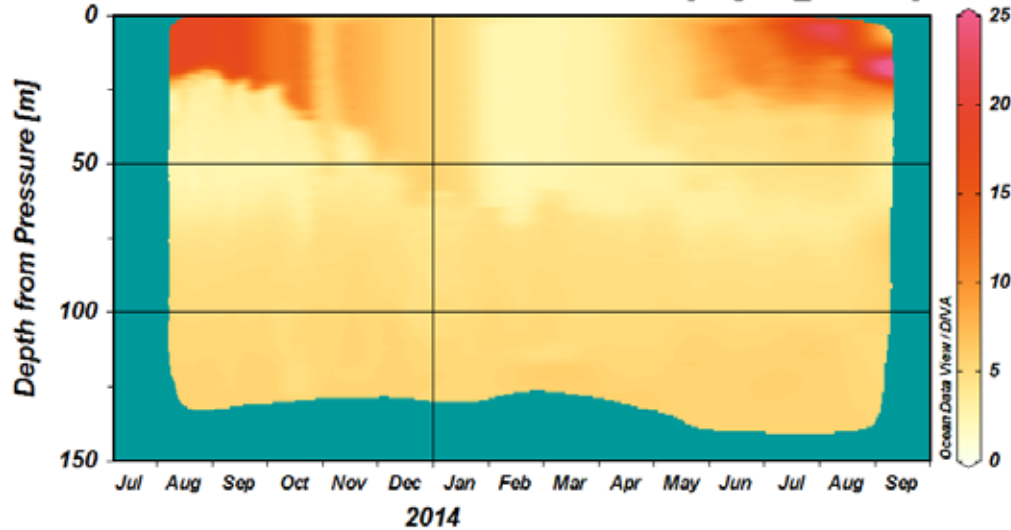
Second experiments(2/2) 2013-14, Gotland Basin

- "Deep" profile testing
- bio sensors testing
- deployed at Aug 14
- Managed to stay all the time away from shores

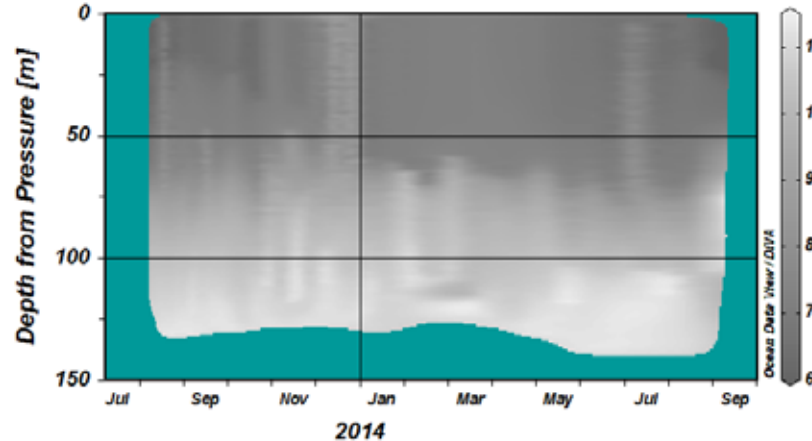


Second experiments(2/2) 2013-14, Gotland Basin

SEA TEMPERATURE IN SITU ITS-90 SCALE var=TEMP [degree_Celsius]



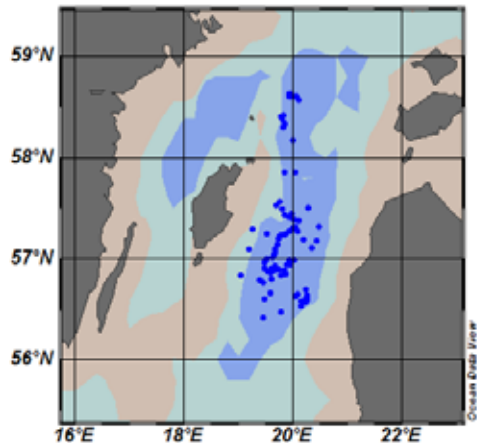
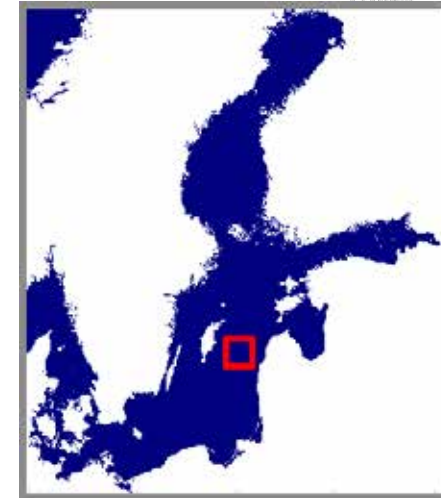
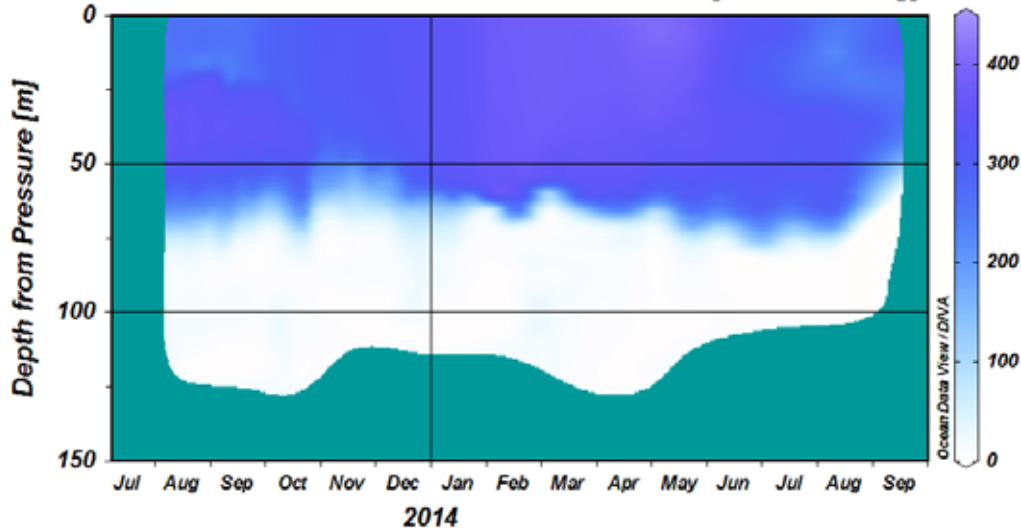
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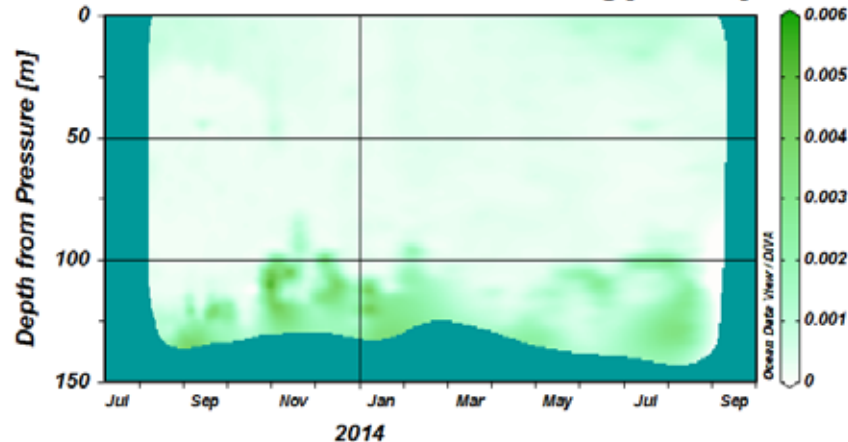


Second experiments(2/2) 2013-14, Gotland Basin

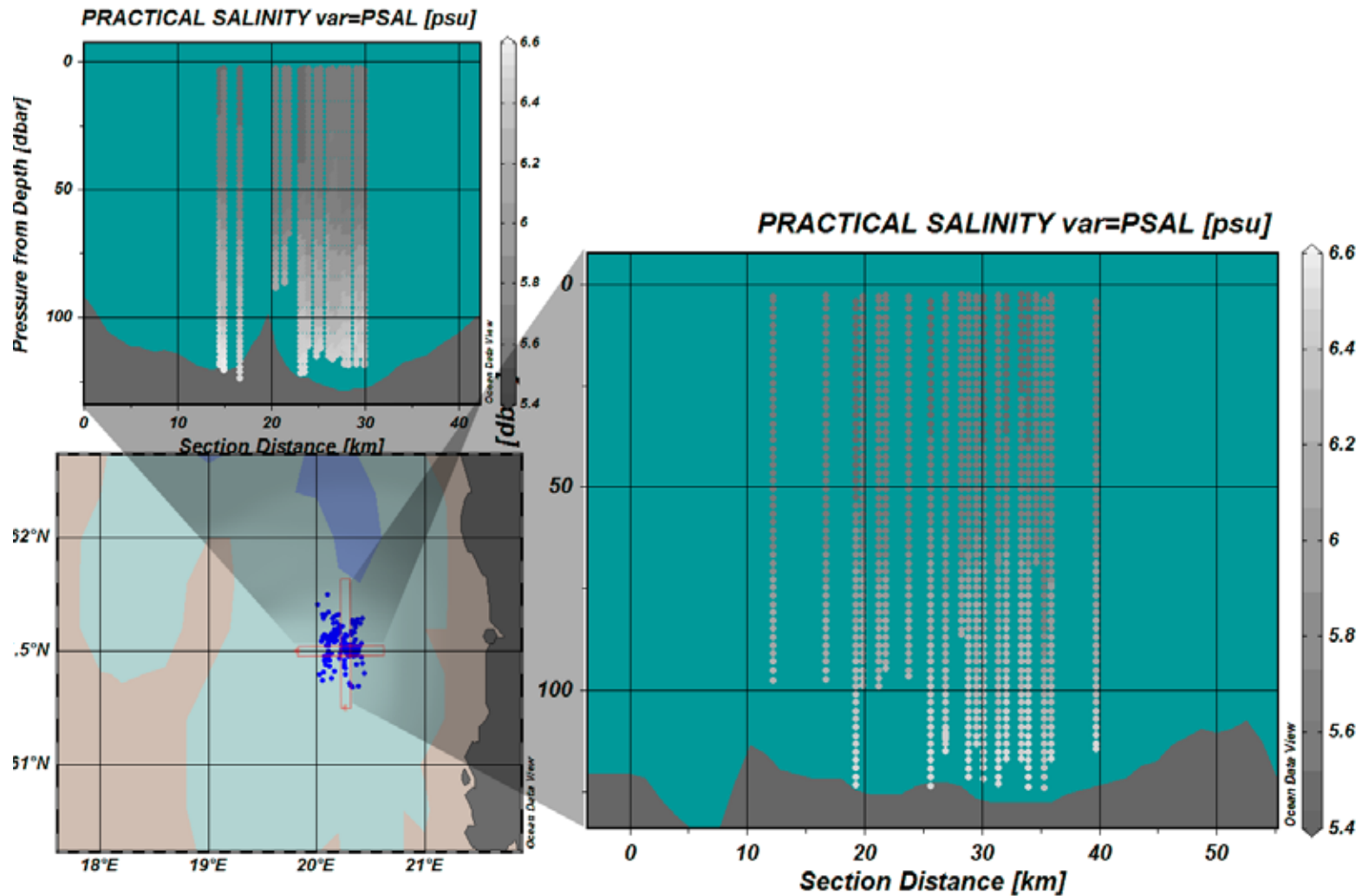
DISSOLVED OXYGEN var=DOXY [micromole/kg]



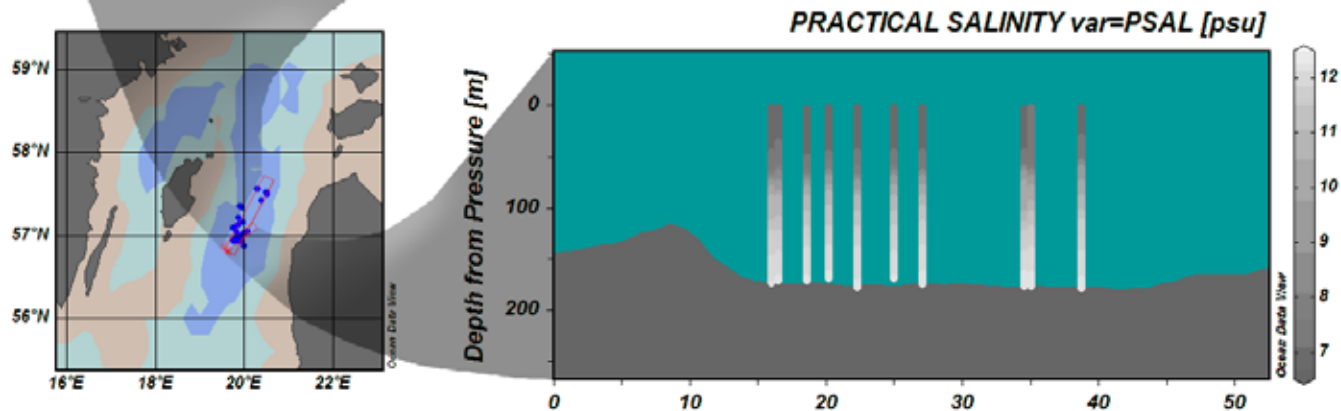
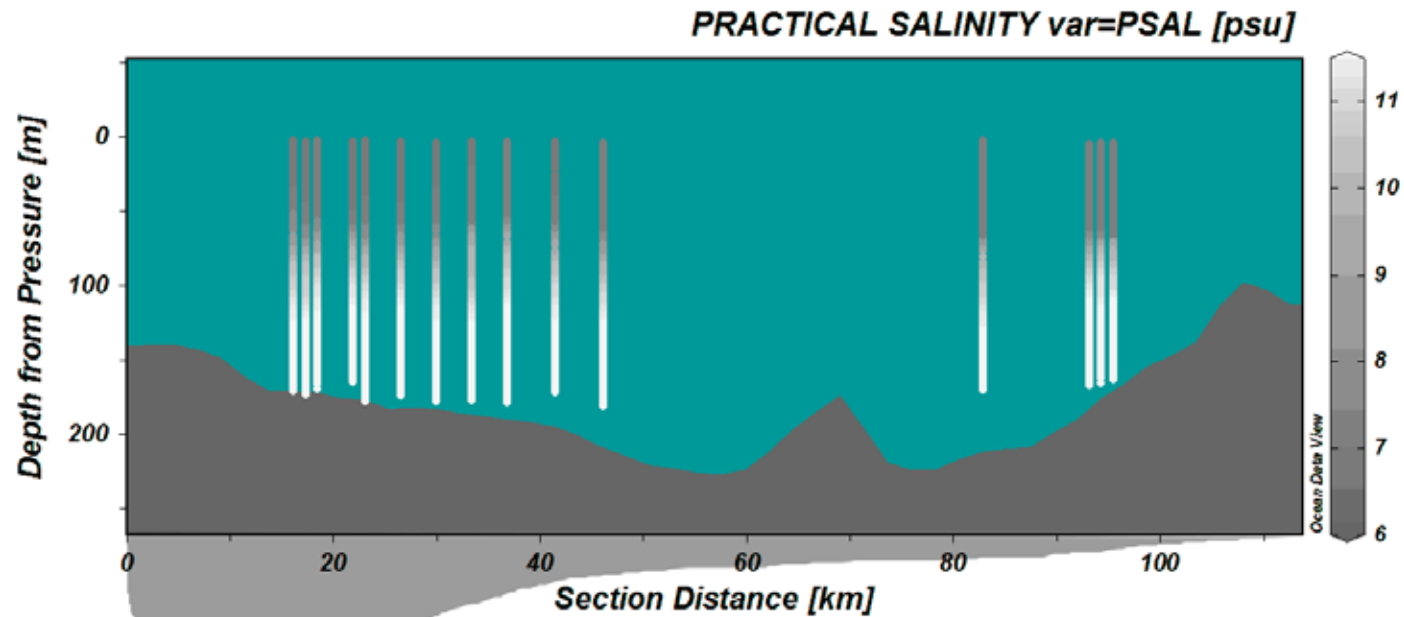
Scattering [$m^{-1} sr^{-1}$]



Bathymetry and stability, Bothnian Sea



Bathymetry and stability, Gotland basin



How to recover an Argo float

- As Baltic Sea is rather small, floats can be picked up
- Float is set to recovery mode
- Sends GPS location, stays afloat and waits for rescue
- Not always possible, sending a ship to pick one up is rather expensive

photographs by Petra Roiha, FMI



Current activities

- Testing Argos with ice
- Applying data for model validation
- Experimenting with data assimilation
- Application to process studies



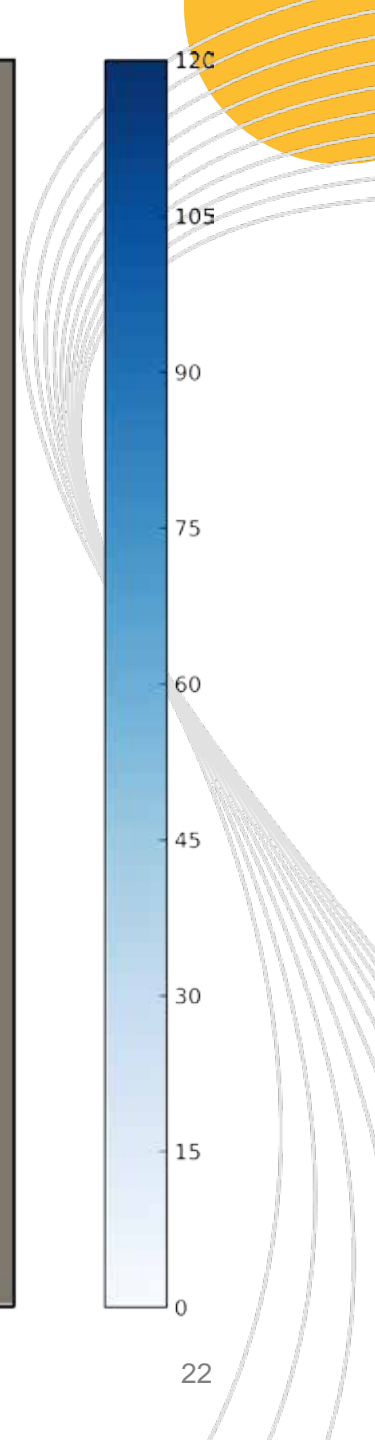
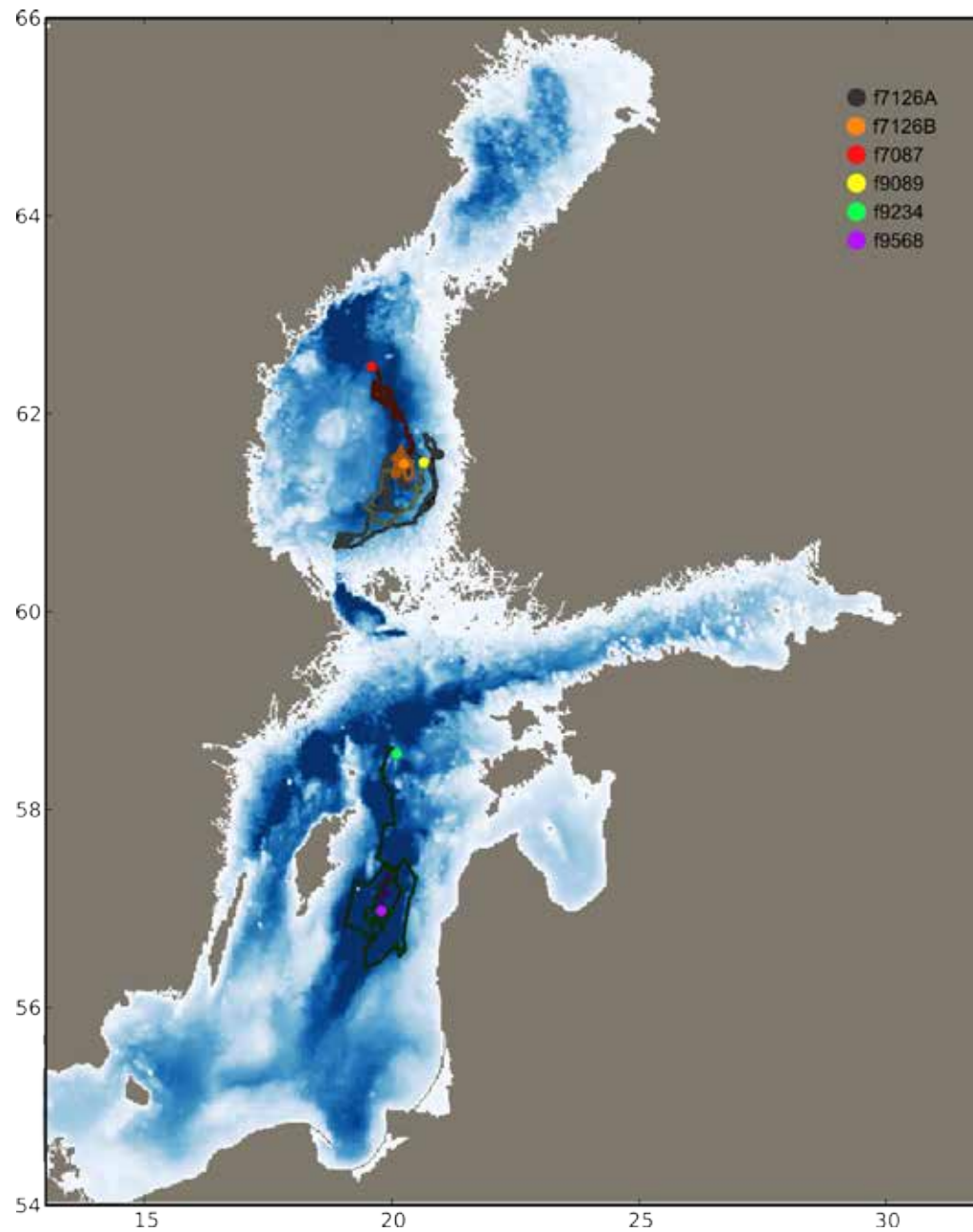
Further Plans

- Continue to deploy Argos
- More automatic mission control?
- Assimilation of Argo data into circulation models
- Measuring the major Baltic inflow



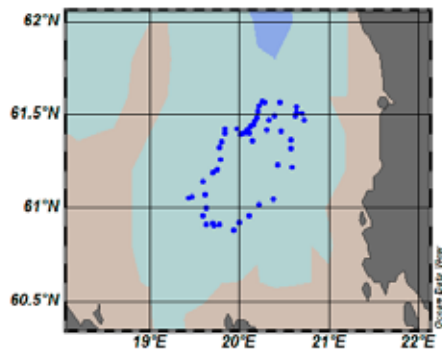
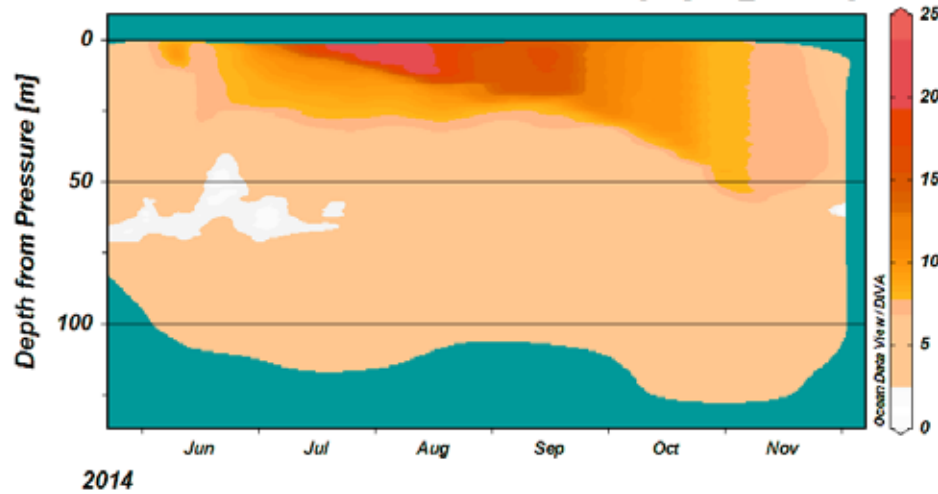


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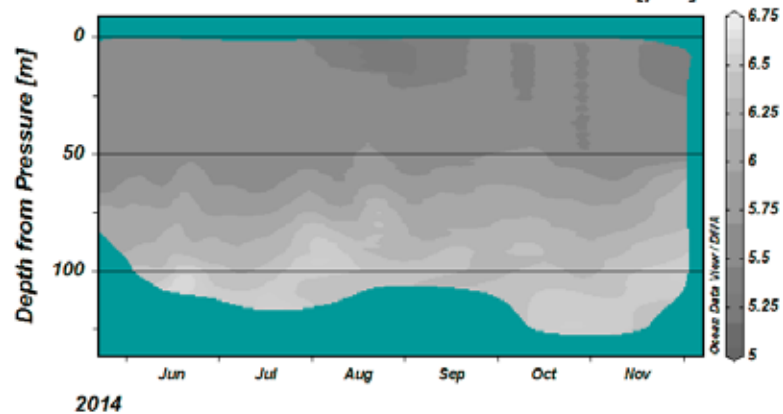


Extra Images

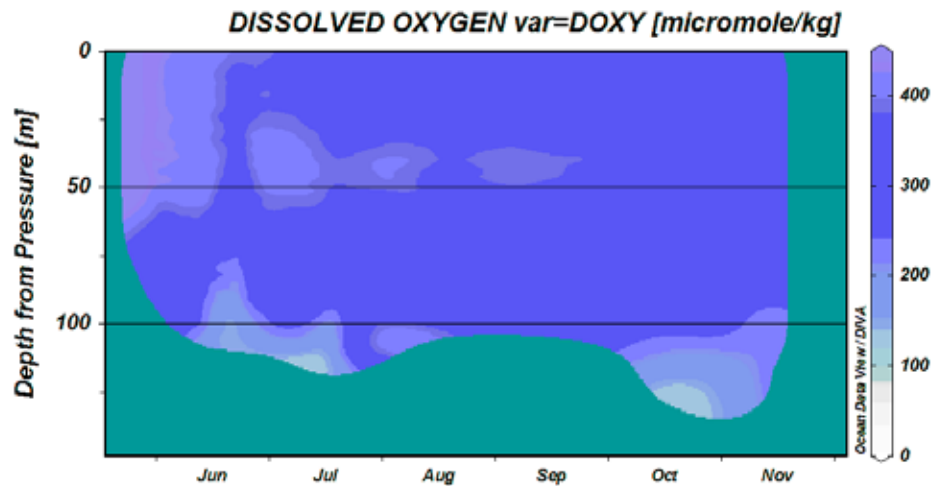
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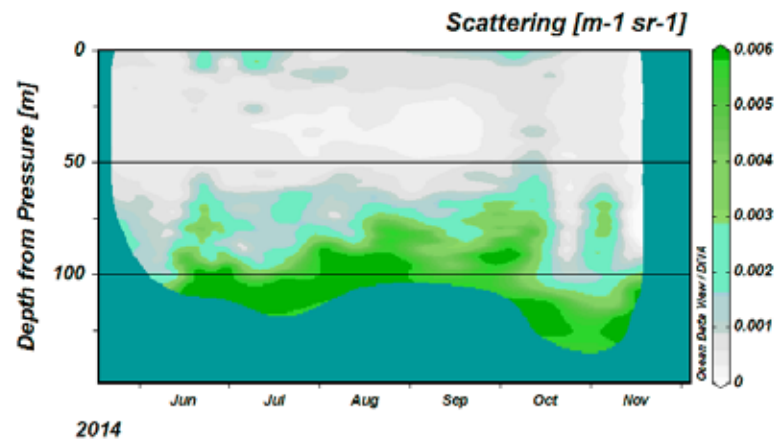
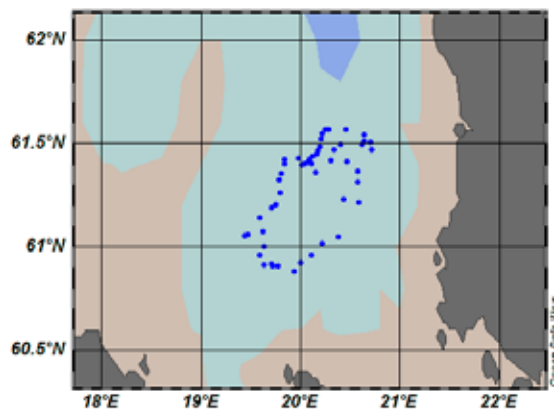
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Extra Images

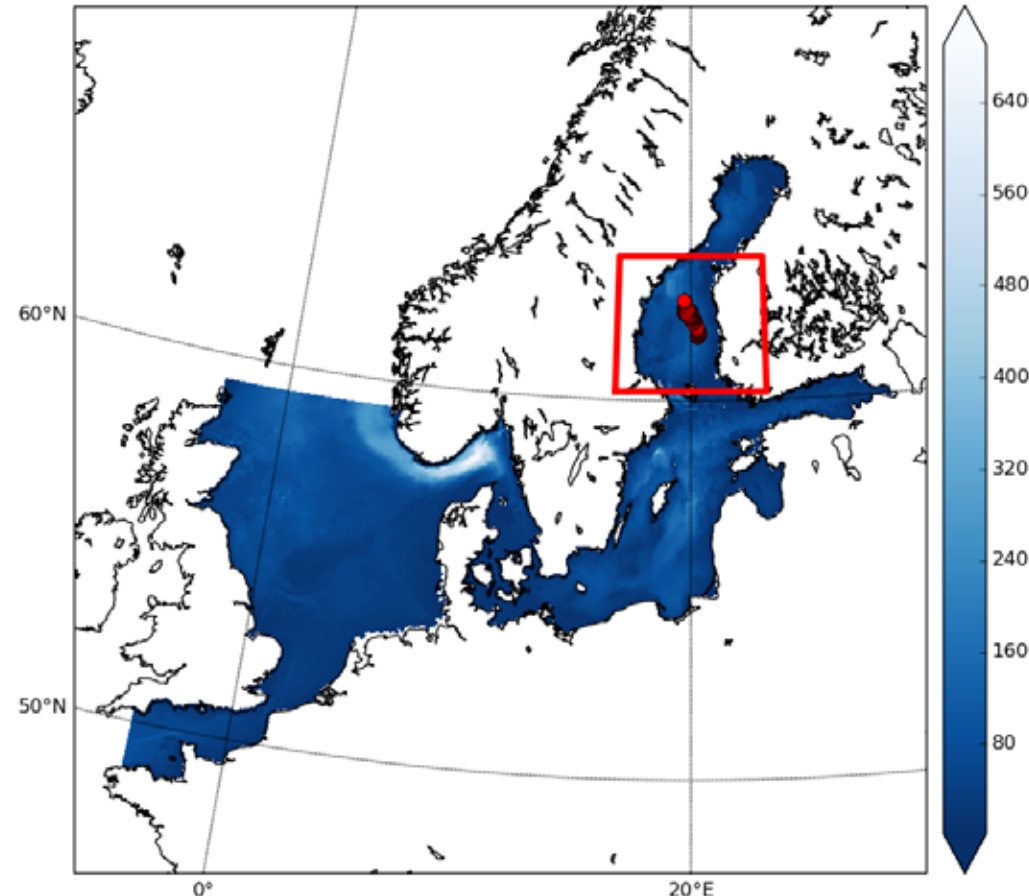


2014



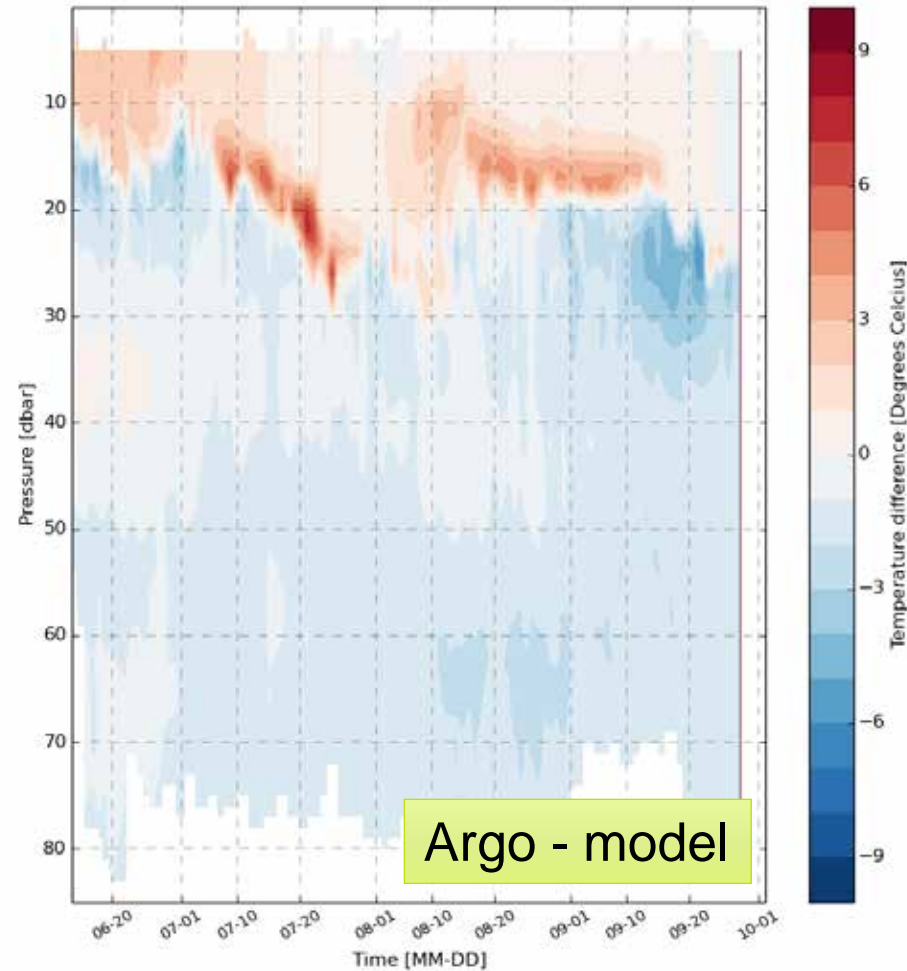
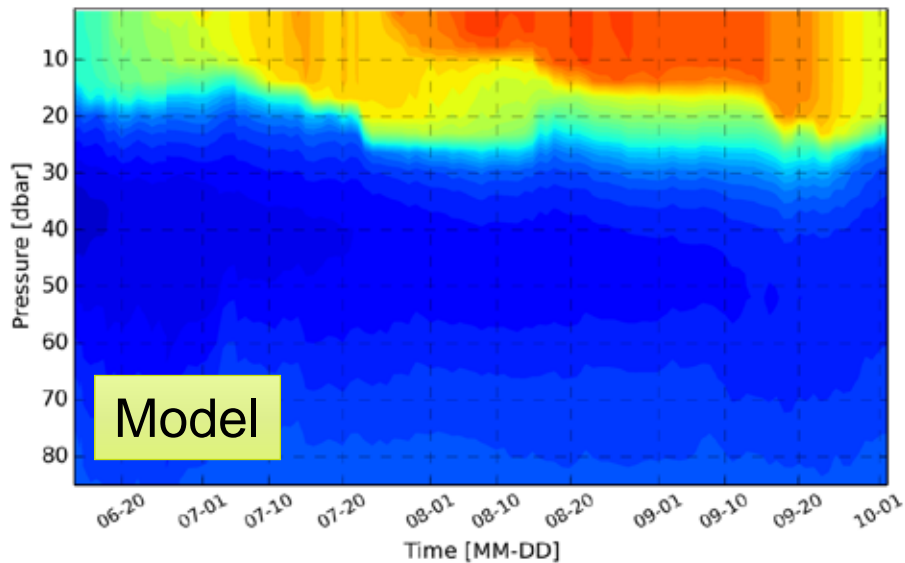
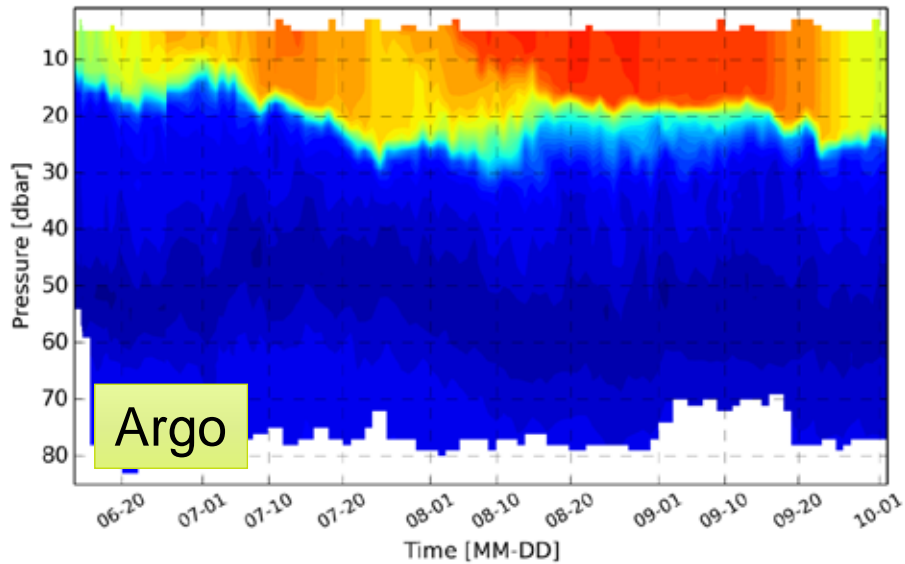
NEMO 3D model at FMI

- NEMO 3.3.1
- Baltic Sea - North Sea grid
- based on the NEMO NORDIC configuration (Hordoir et al., 2013)
- FMI-HIRLAM atmospheric forcing
- 2 NM resolution
- 56 vertical layers
- Jun-Dec 2013





Results: temperature



Model results sampled along buoy route, Jun-Oct 2013



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