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Argo floats as part of the Baltic Sea monitoring

Laura Tuomi, Simo Siiriä, Petra
Roiha, Noora Haavisto, Pekka
Alenius, Tero Purokoski, Antti
Westerlund

22.10.2019

EuroArgo Science meeting, Athens

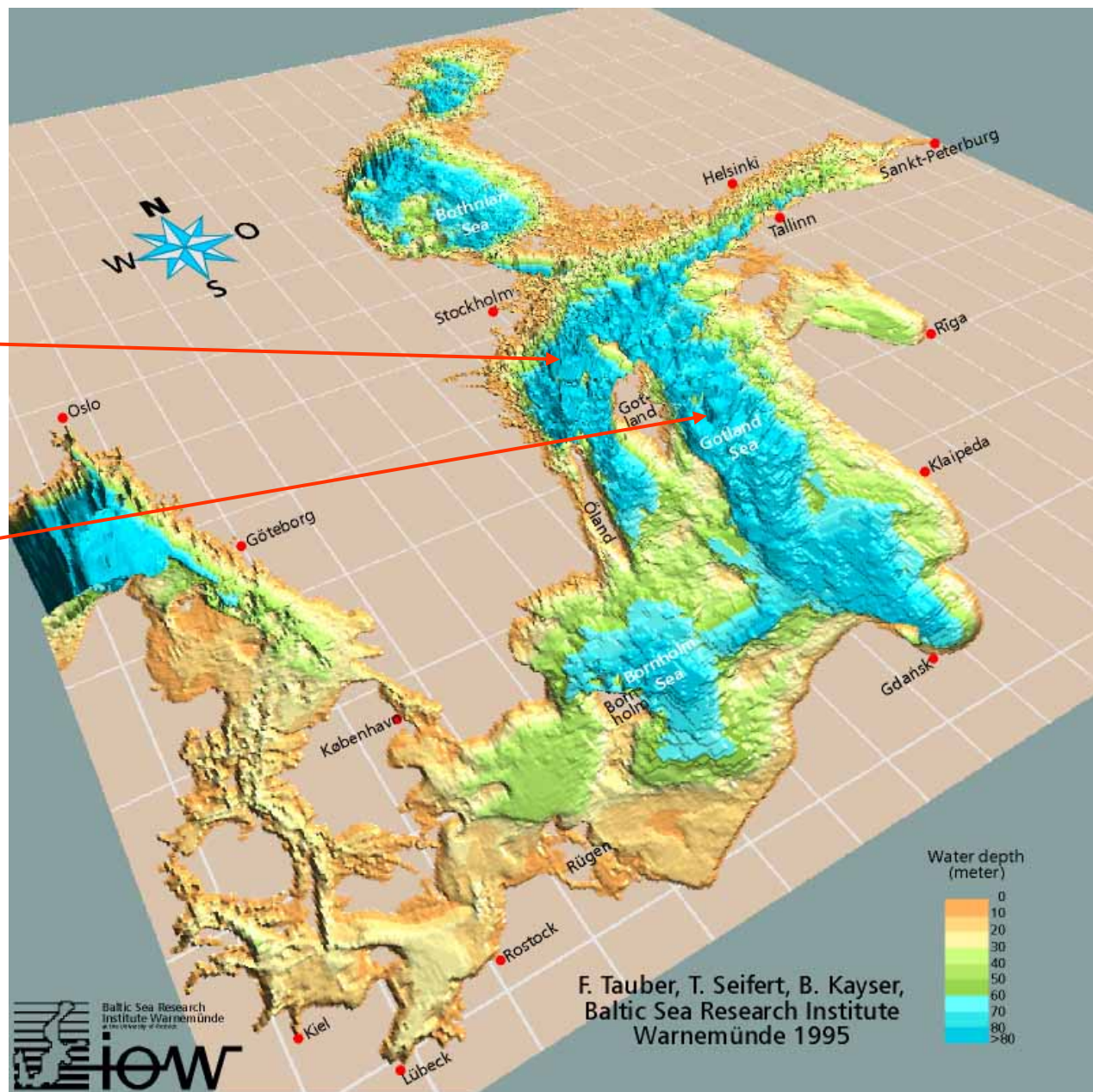


Baltic Sea

Mean depth 54m.

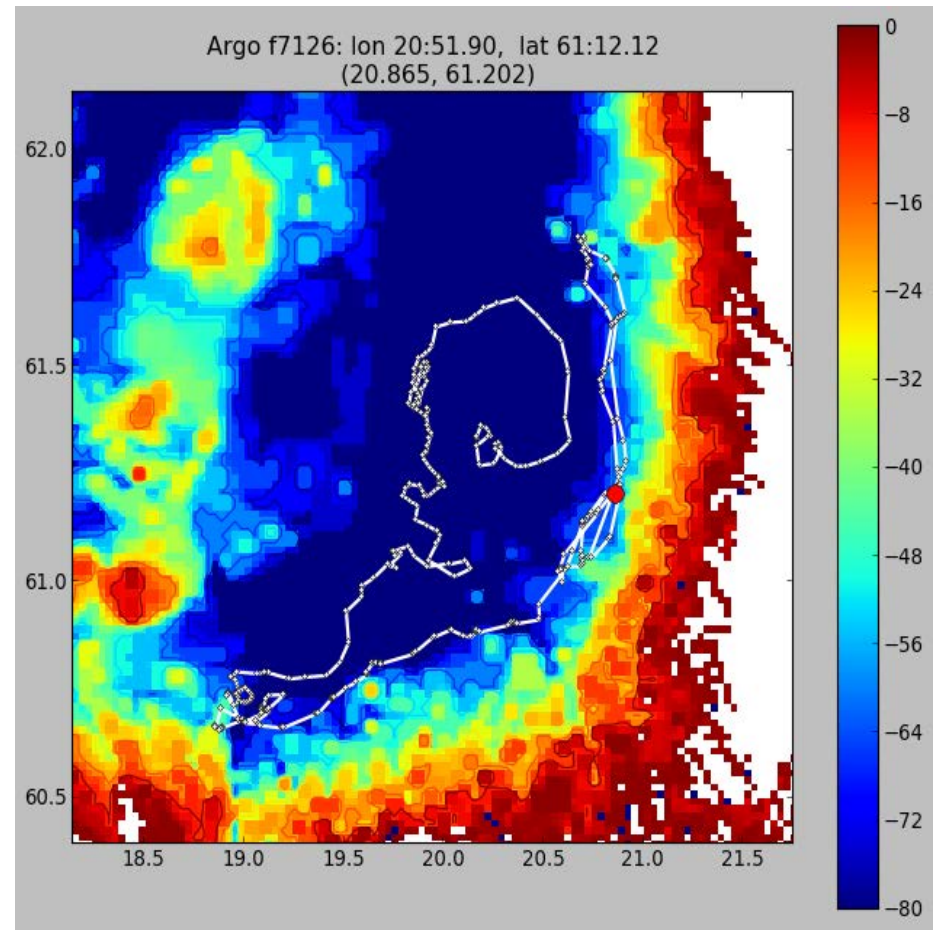
Landsort Deep
459m, BS max
depth

Gotland Deep
239m.



Baltic Argo floats – First experiments

- First mission was in the Bothnian Sea in 2012
- Over 200 profiles measure from May to Dec
- Success → Let's go for it!



Baltic Argo floats – specific features

- Strong density gradients → float needs to be balanced to match the expected densities of the target area.
- Heavy marine traffic → risk of collision
- Seasonal ice cover → ice avoidance algorithms needed
- Shallow depths → Possibility of bottom contact → constant monitoring of the float location needed.
- Proximity to coast: Floats can be recovered and redeployed after maintenance



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Photos: Petra Roiha



Argo floats – areas covered

FMI:

- Bothnian Sea, 2012 →
- Gotland Deep, 2013 →
- Bothnian Bay, 2017 →
- *EA-RISE: Northern Baltic Proper, 2020* →

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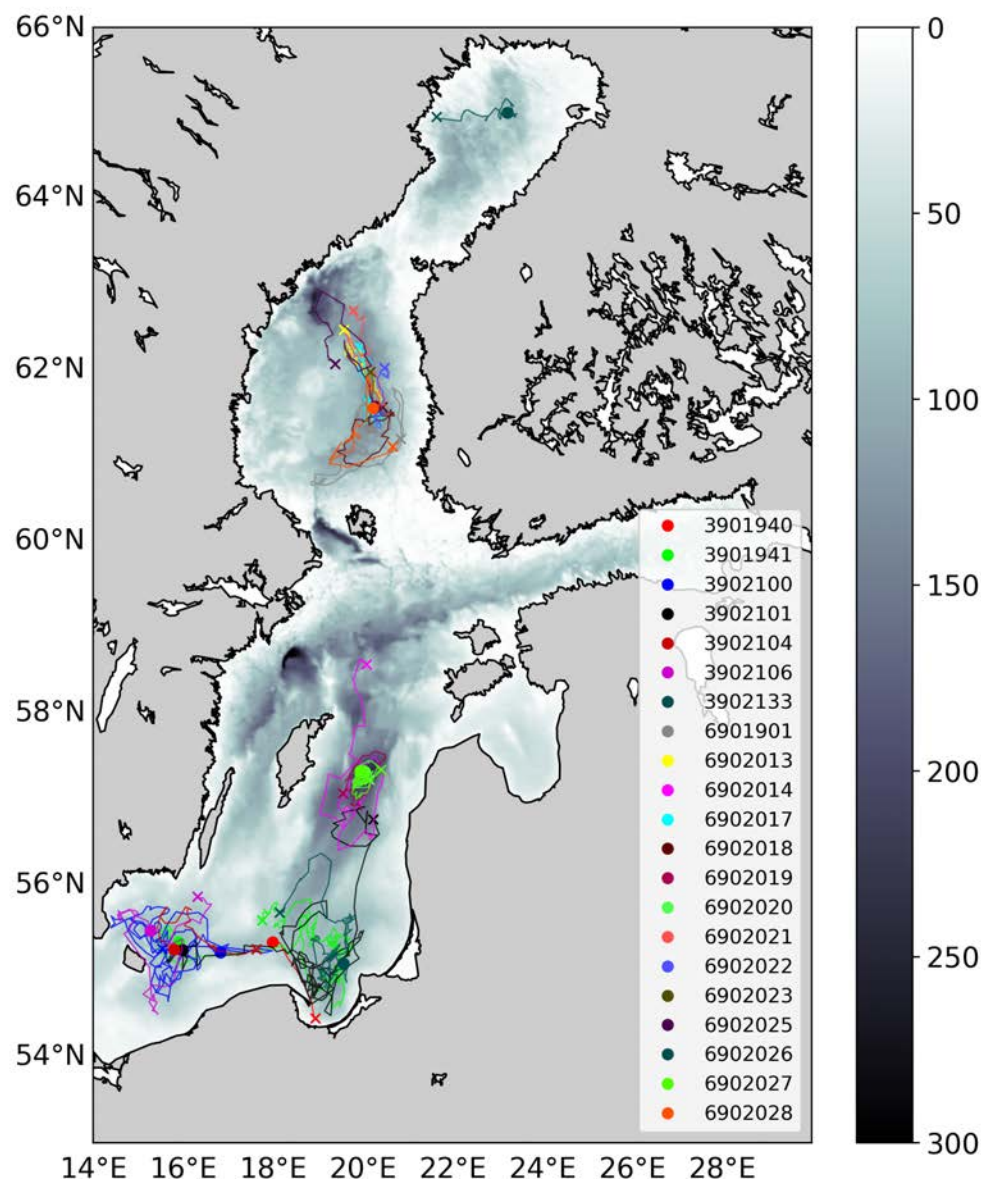
- Bornholm basin/southern Baltic Sea 2016 →

MOCCA project:

- Bothnian Sea, Gotland Deep, Bornholm basin, 2018 -

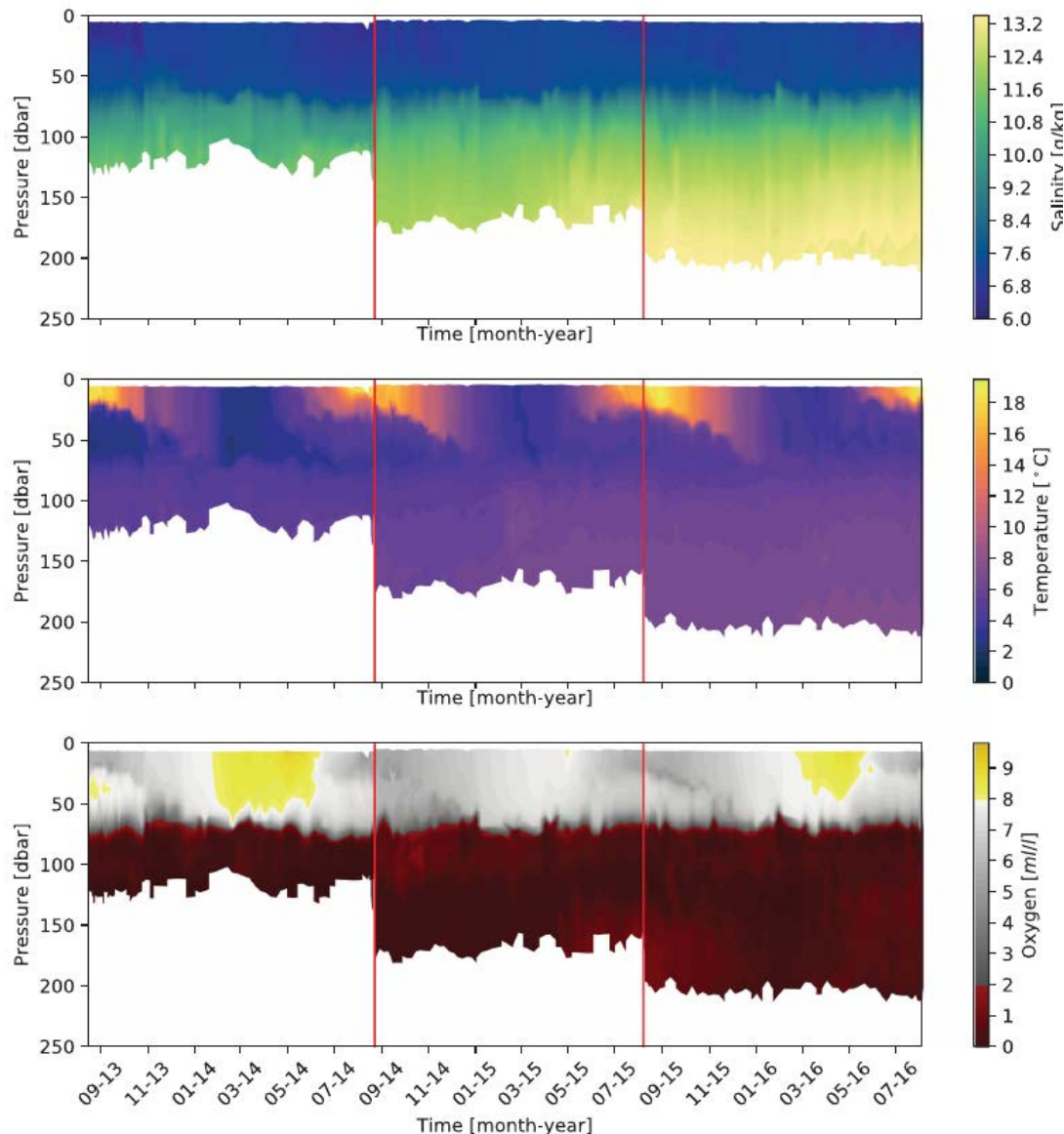
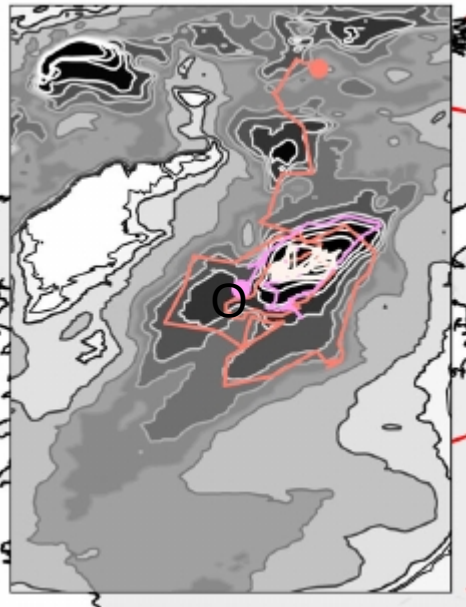


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Baltic Sea - Gotland Deep

- Typical measurement interval once a week. Can be shortened to one day or even half a day.
- Can be changed during mission to have higher temporal coverage during interesting events



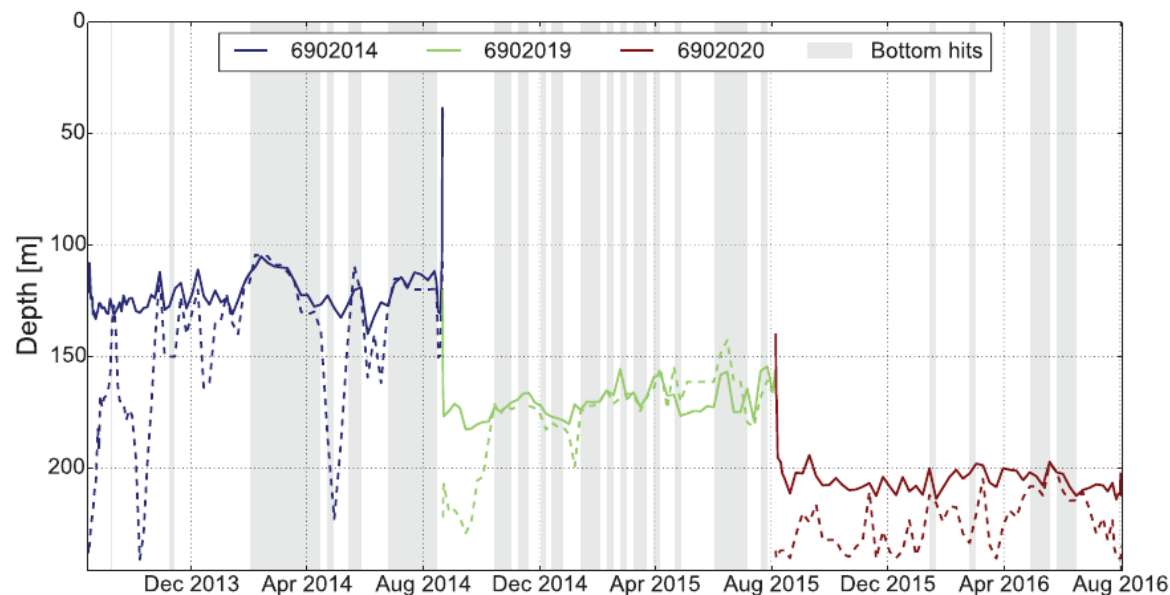
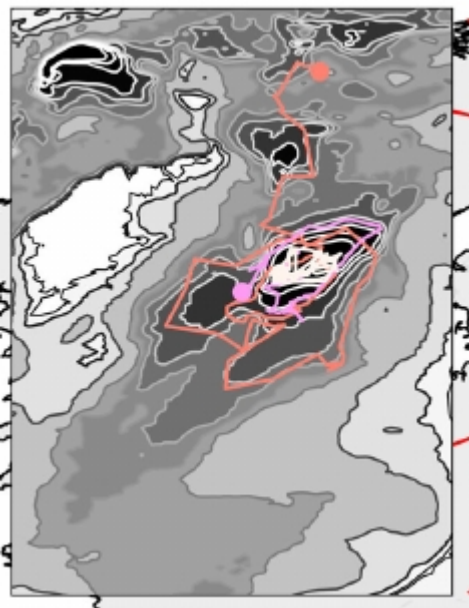
Siiriä et al.
2019



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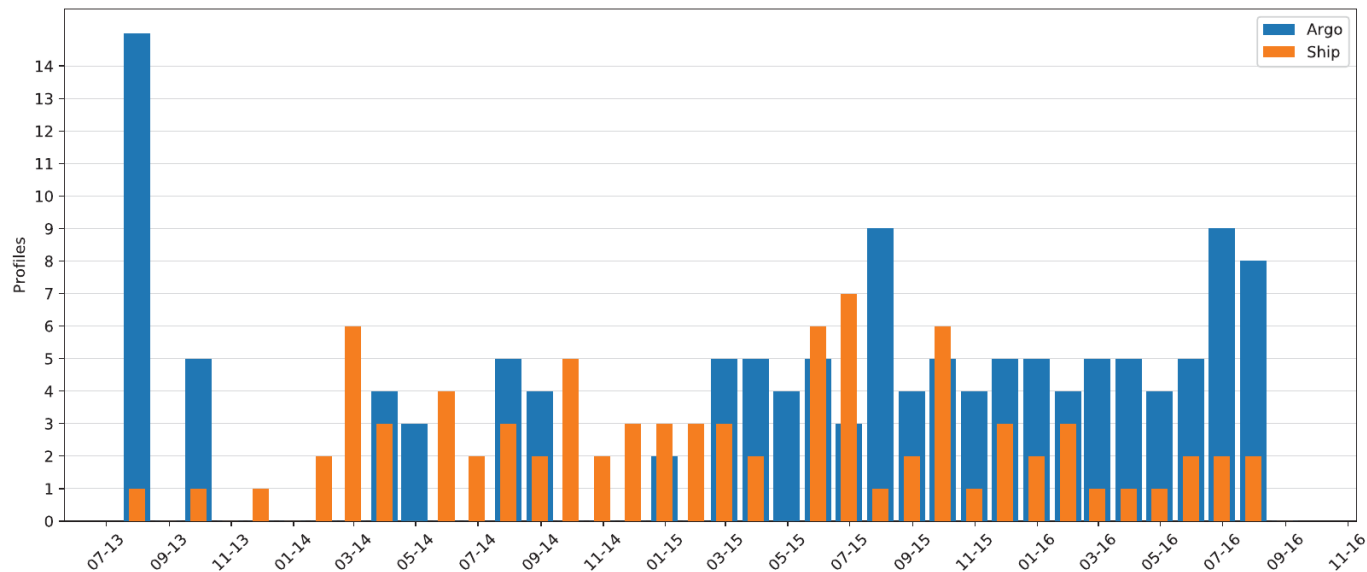
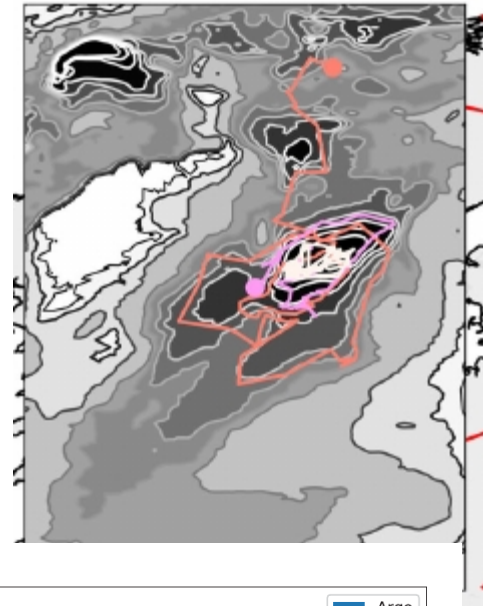
Baltic Sea – bottom contacts

- When operating in shallow areas, bottom contacts can't always be avoided. Floats survive them fairly well.



Gotland Deep – Argo floats vs. traditional monitoring

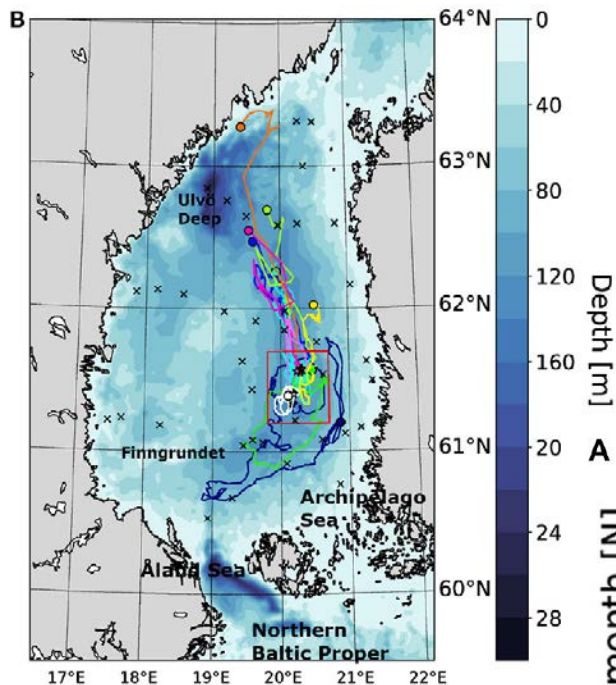
- Monitoring station BY15 (the Gotland Deep) is one of the most visited 'deep' monitoring stations in the Baltic Sea.
- Argo floats compliment the information provided by traditional monitoring cruise



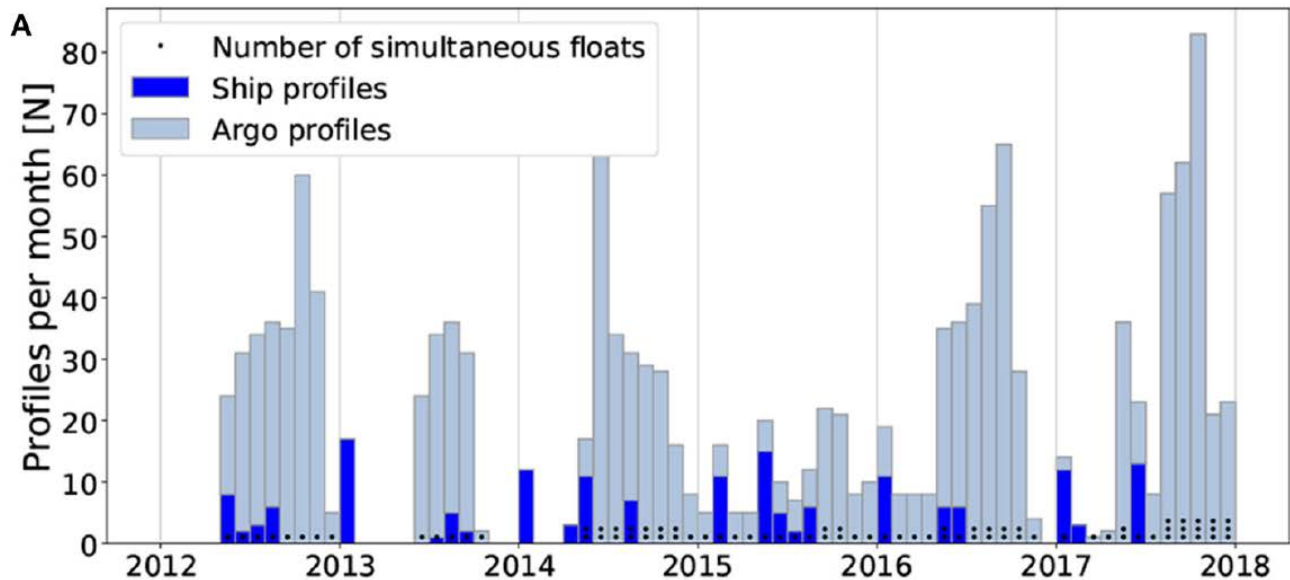
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Siiriä et al. 2019

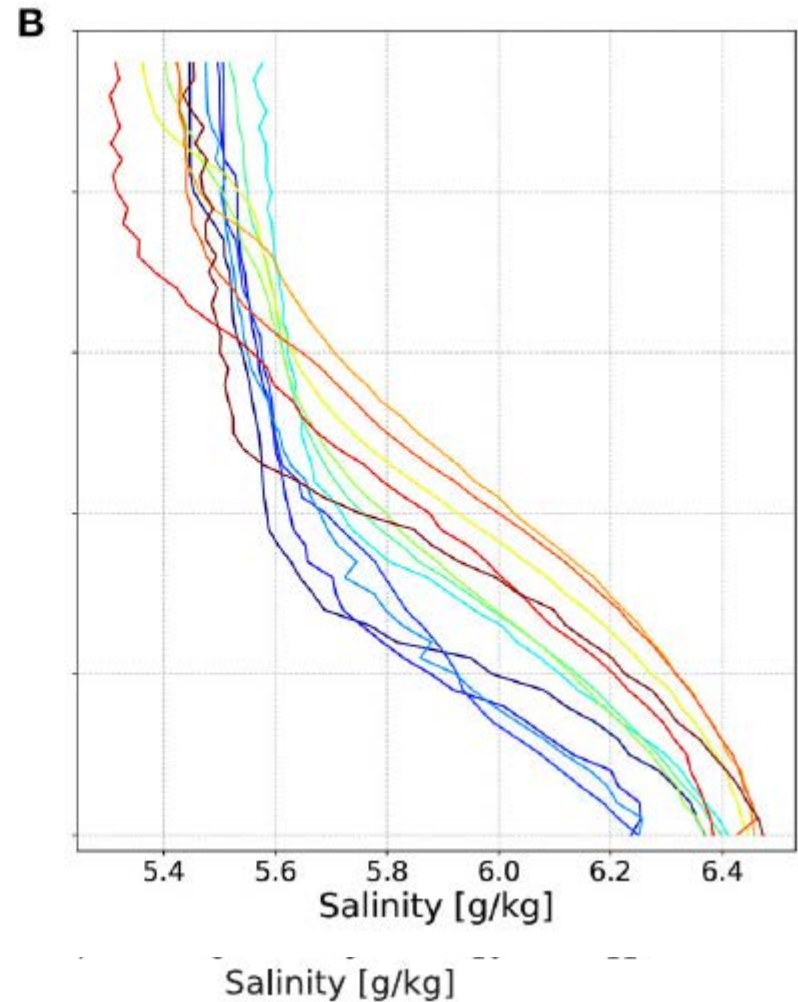
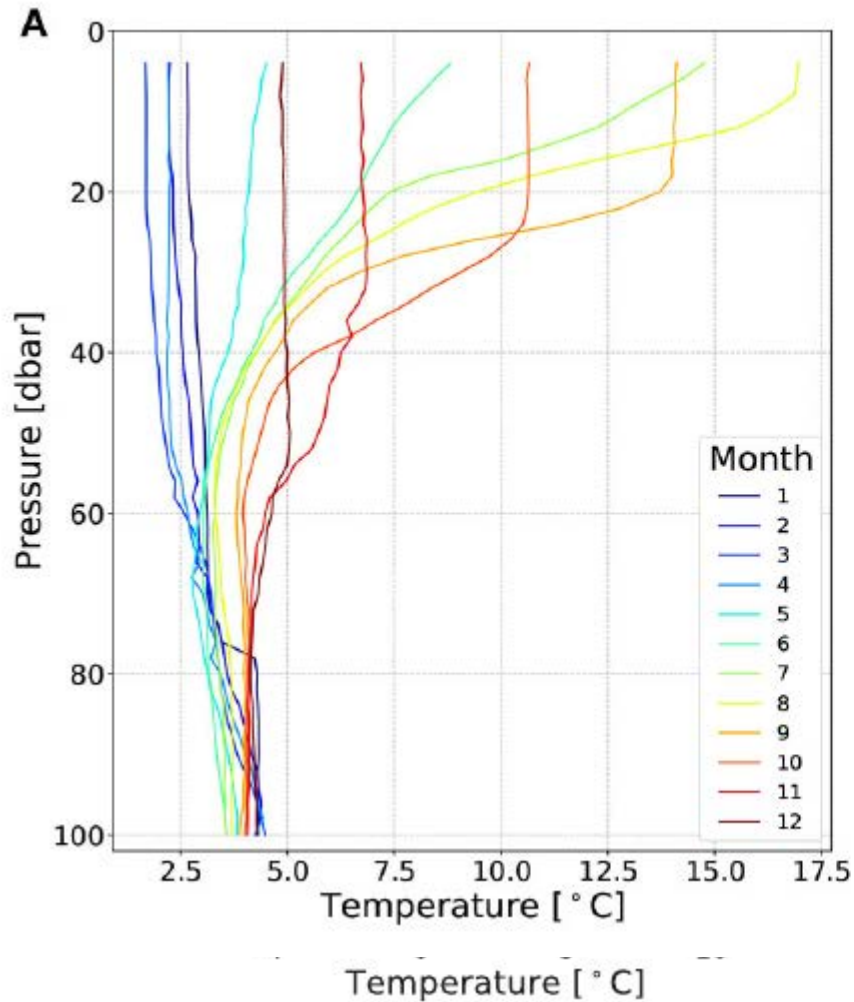
Bothnian Sea – Argo floats vs. traditional monitoring



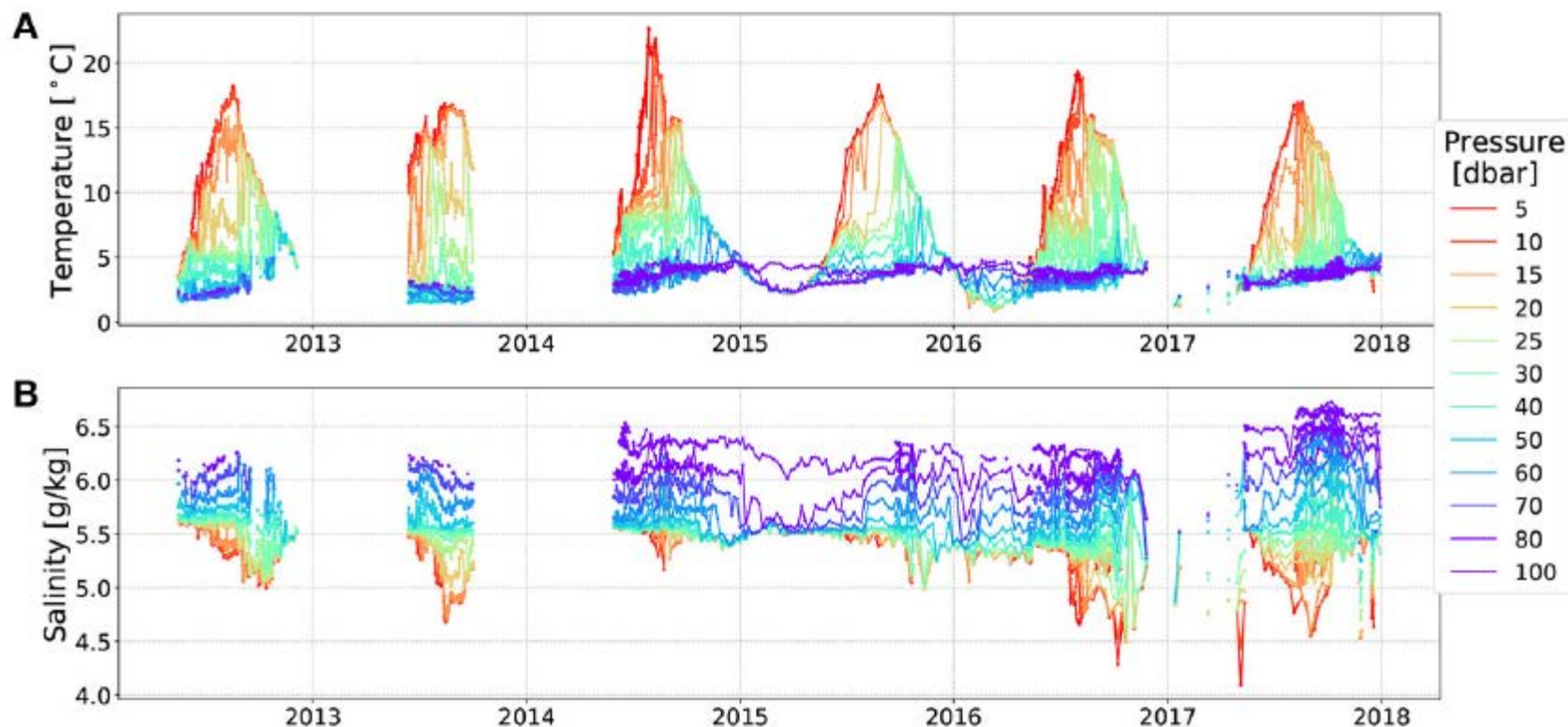
In Bothnian Sea, the traditional monitoring is done only 3 times a year and the number of additional T/S-profiles provided by Argo floats is considerable.



Baltic Sea – seasonal variability

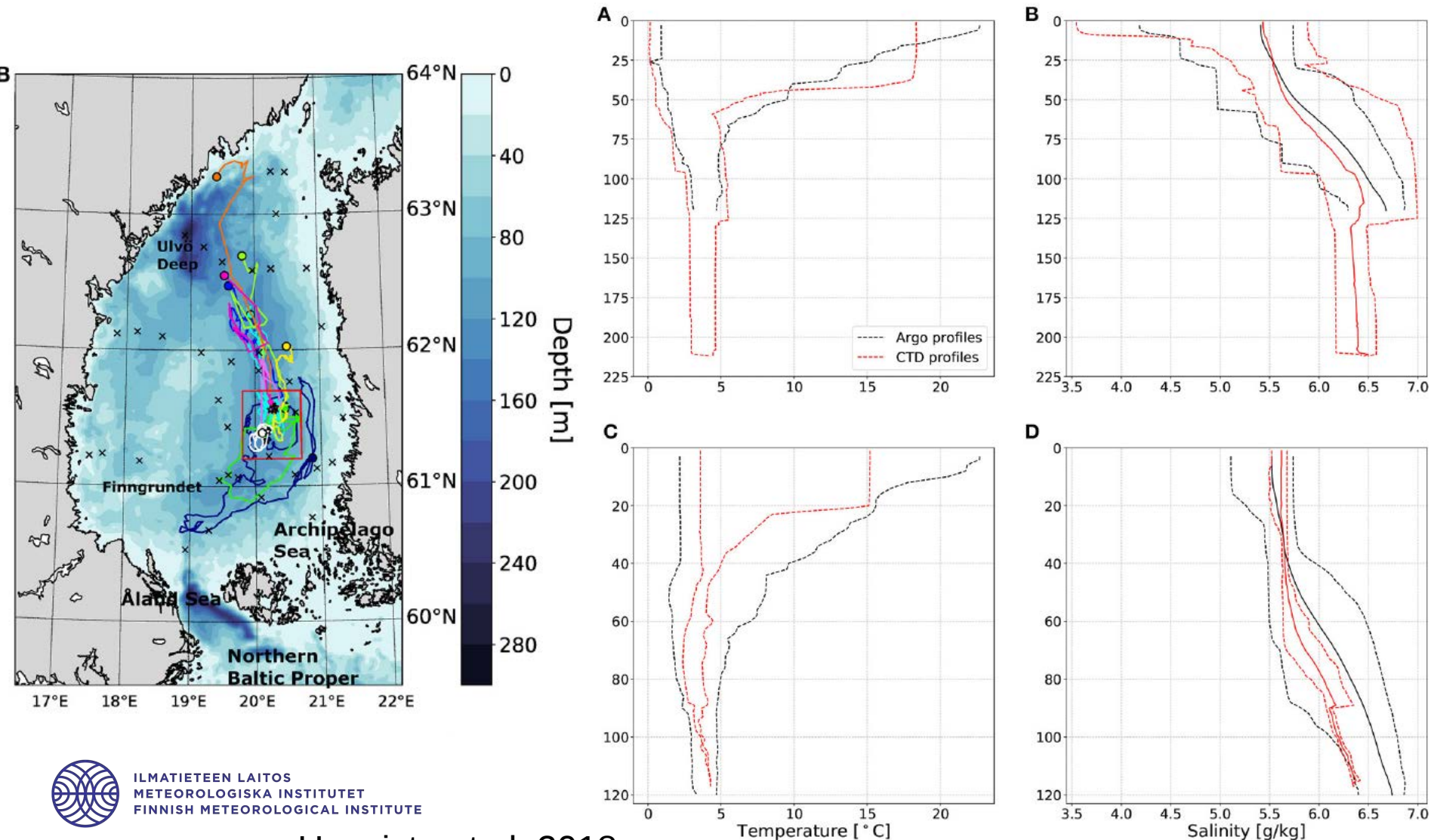


Baltic Sea – seasonal cycles



Haavisto et al. 2018

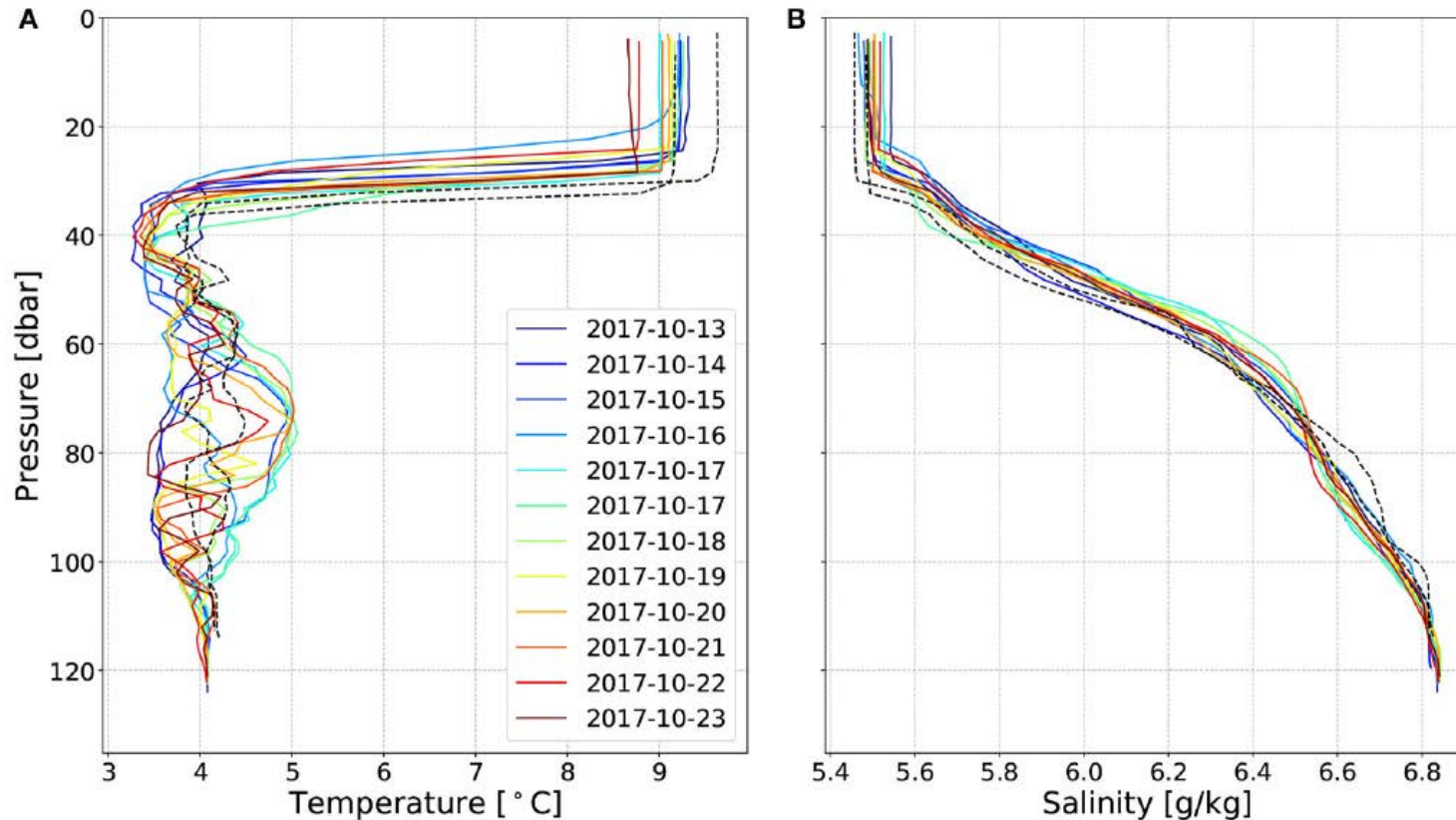
Baltic Sea Argo floats vs. traditional monitoring



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Haavisto et al. 2018

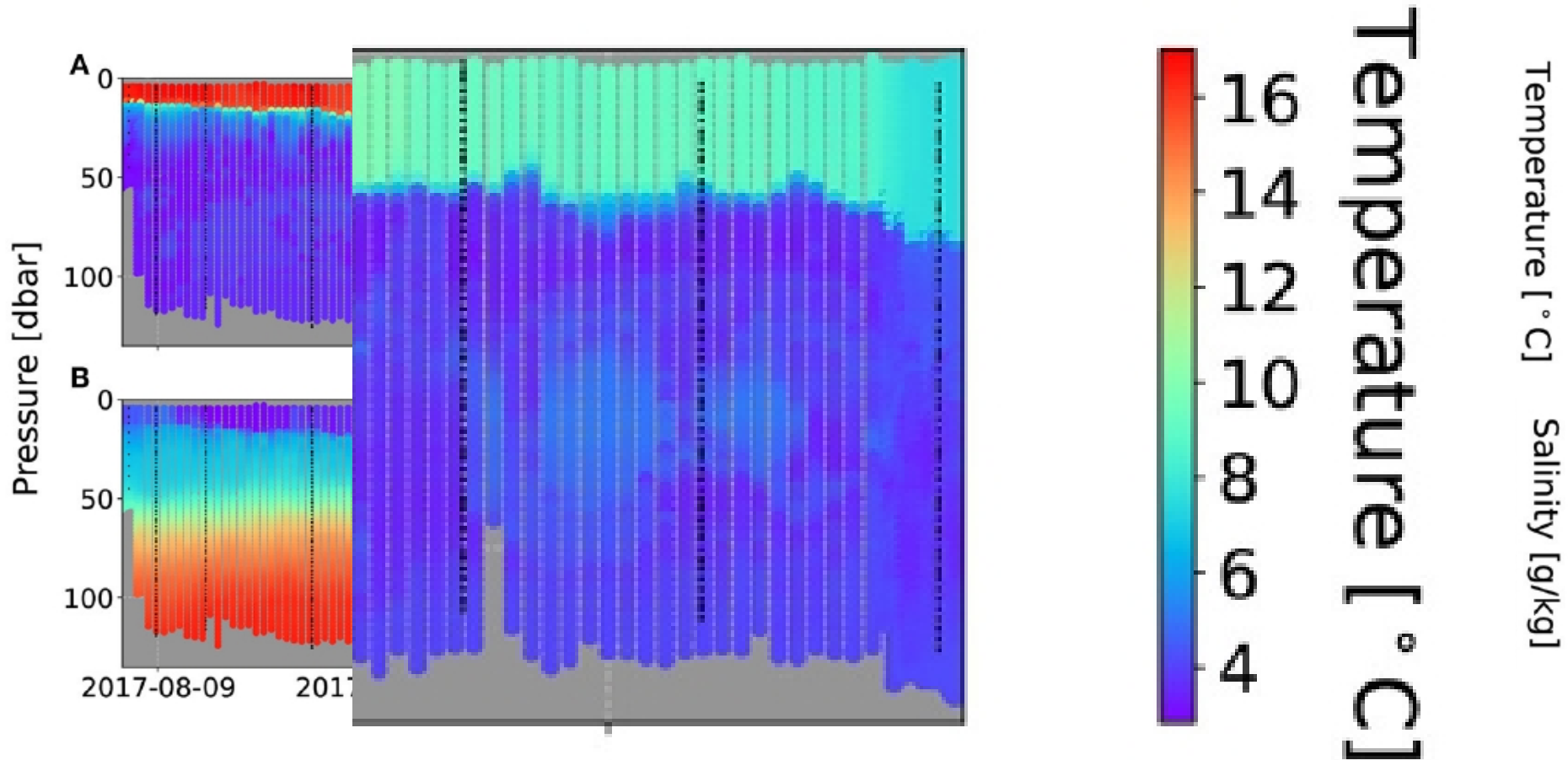
Baltic Sea – measuring short-term events



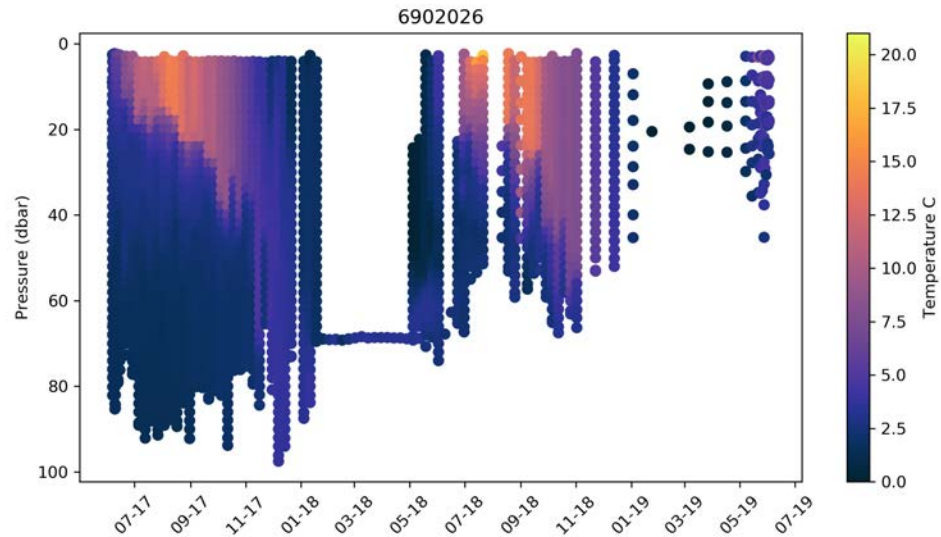
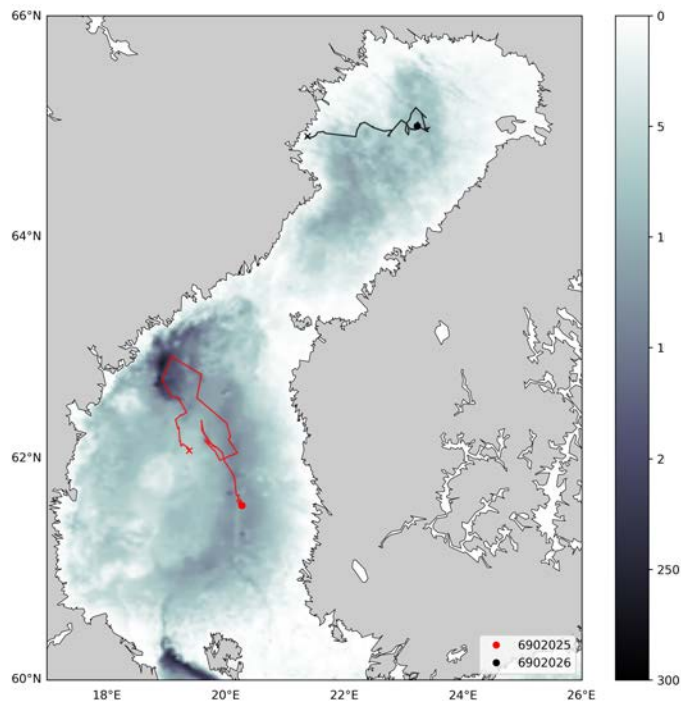
Haavisto et al. 2018



Baltic Sea – measuring short-term events



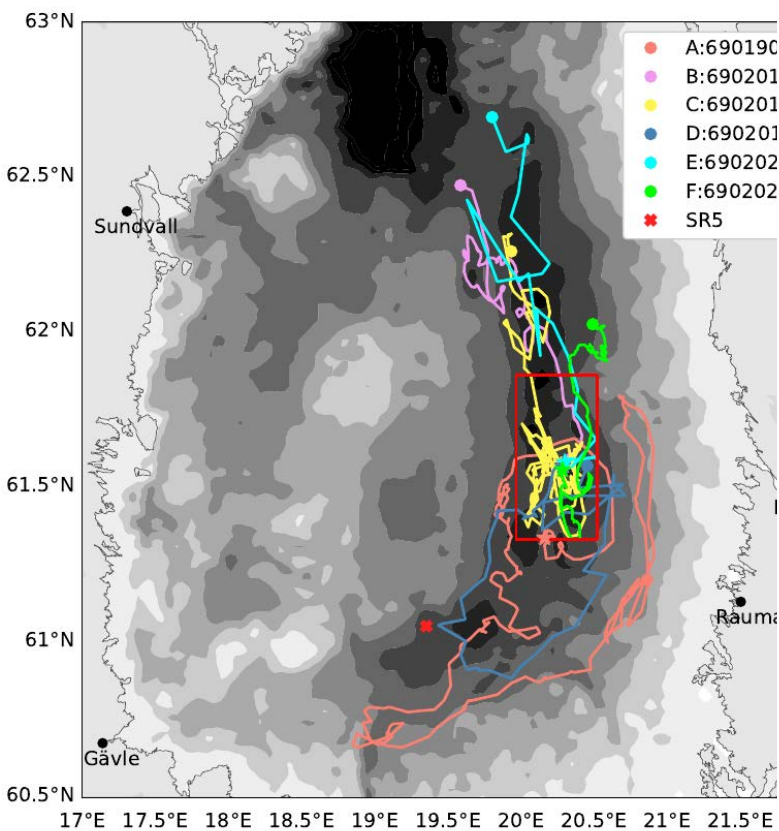
Baltic Sea – measuring all year around in seasonally ice-covered seas



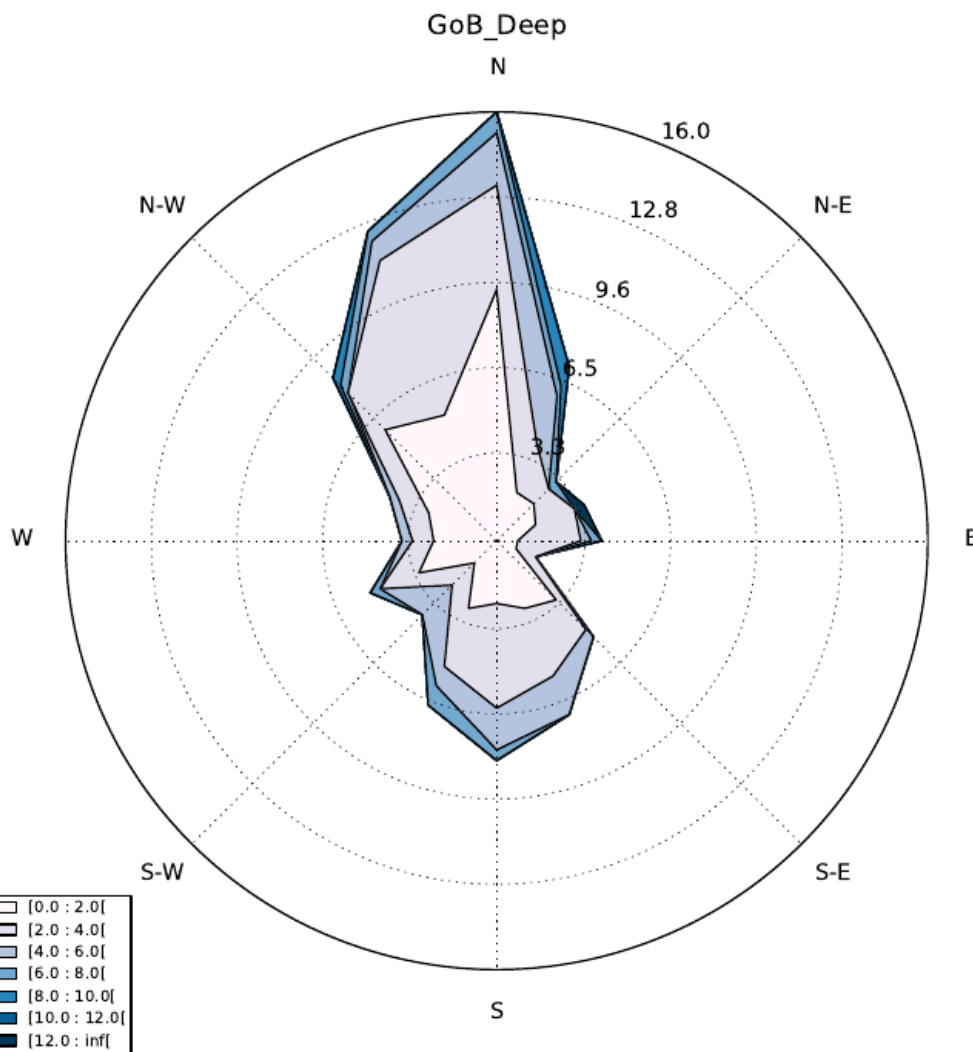
Interested to see and here about ice avoidance and operating in shallow areas? See poster no. 12 by Simo Siiriä: Adapting Argo floats to the Baltic Sea: Lessons learned.



Baltic Sea – estimating currents

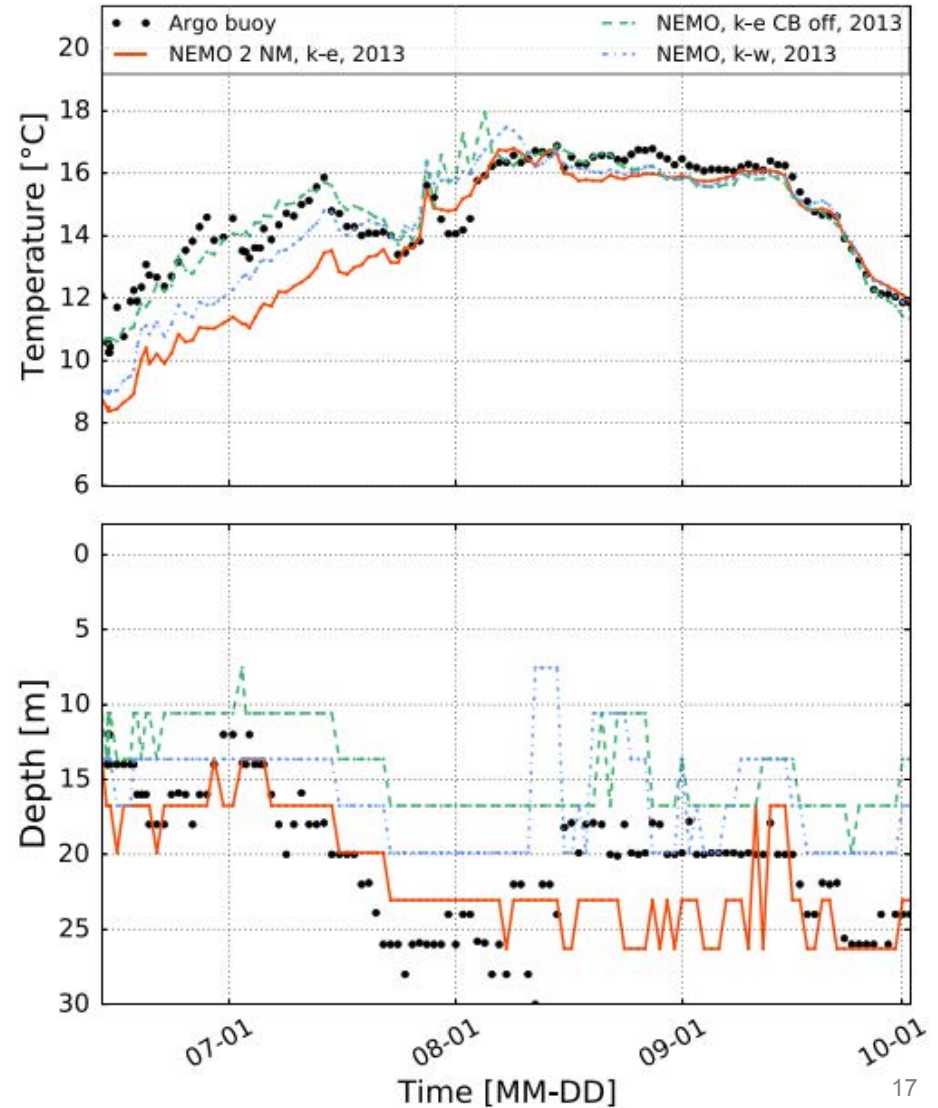
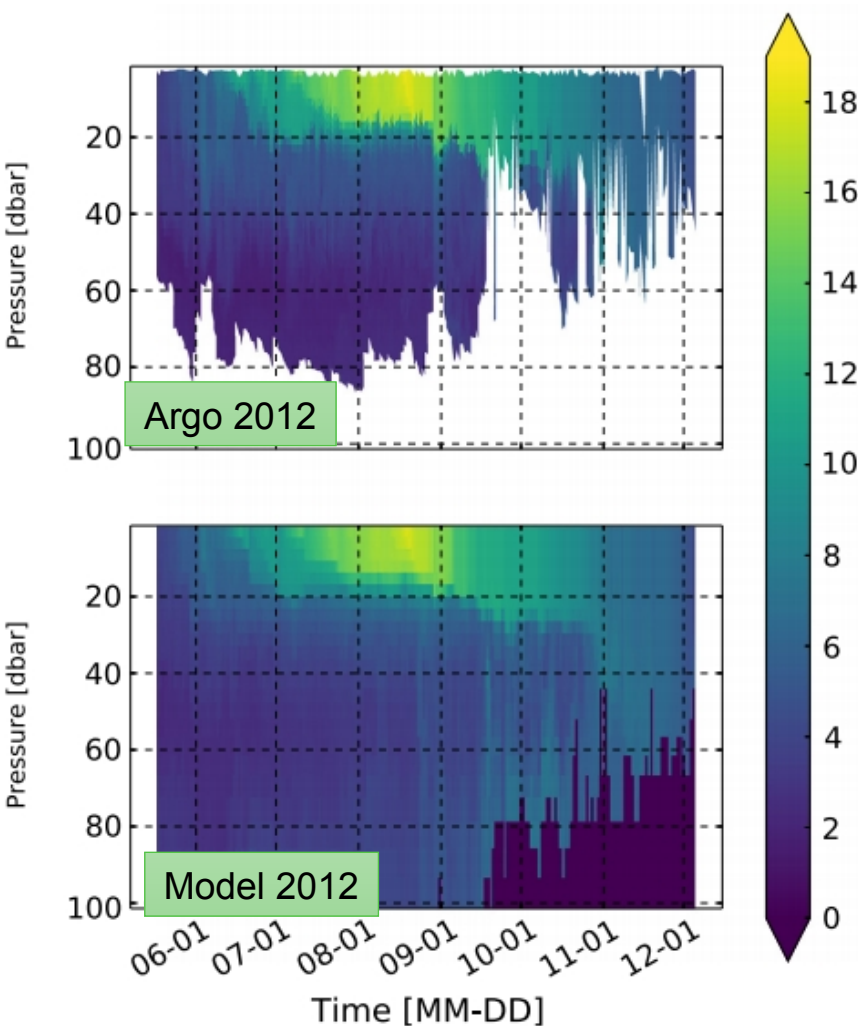


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Roiha et al. 2018

Argo floats – improving models



Argo floats – At present and in the future

- FINMARI - AF FIRI funding to purchase Argo floats for the Baltic
 - 2017: 1 bottom parking float
 - 2018: 1 T/S float
 - 2018: 4 T/S+O₂
 - 2019: 1 bottom parking float, 4 T/S+O₂ floats
- Euro-Argo RISE project (H2020) , 2019 – 2022
 - New measurement area: the Northern Baltic Proper, 1 new T/S float
 - Improving ice sensing algorithms → enhancing year-round operations in the Baltic
 - Testing new sensors: RBR CTD → measurements closer to the surface
 - Testing new sensors: New BGC sensors to be tested in the Baltic



Baltic Sea Argo floats – More information

FINMARI, www.finmari-infrastructure.fi



Euro-Argo RISE,

<https://www.euro-argo.eu/EU-Projects/Euro-Argo-RISE-2019-2022>

Publications about Baltic Sea Argo floats:

Haavisto N, Tuomi L, Roiha P, Siiriä S, Alenius P, Purokoski T, 2018: Argo Floats as a Novel Part of the Monitoring the Hydrography of the Bothnian Sea Frontiers in Marine Science Vol. 5. <https://www.frontiersin.org/article/10.3389/fmars.2018.00324> doi: 10.3389/fmars.2018.00324

Roiha P, Siiriä S, Haavisto N, Alenius P, Westerlund A, Purokoski T, 2018: Estimating Currents From Argo Trajectories in the Bothnian Sea, Baltic Sea. Frontiers in Marine Science Vol. 5. <https://www.frontiersin.org/article/10.3389/fmars.2018.00308> doi: 10.3389/fmars.2018.00308

Siiriä S., Roiha, P., Tuomi, L., Purokoski, T., Haavisto, N., and Alenius P., 2019. Applying area-locked, shallow Argo floats in the Baltic Sea monitoring. Journal of Operational Oceanography. <https://doi.org/10.1080/1755876X.2018.1544783>

Westerlund, A. and Tuomi, L.. 2016. Vertical temperature dynamics in the Northern Baltic Sea based on 3D modelling and data from shallow-water Argo floats, Journal of Marine Systems, 158, 34-44.





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Thank you for your attention!

Poster no. 12 by Simo Siiriä: Adapting Argo floats to the Baltic Sea: Lessons learned.