Observations of the carbonate system in the Baltic Sea area

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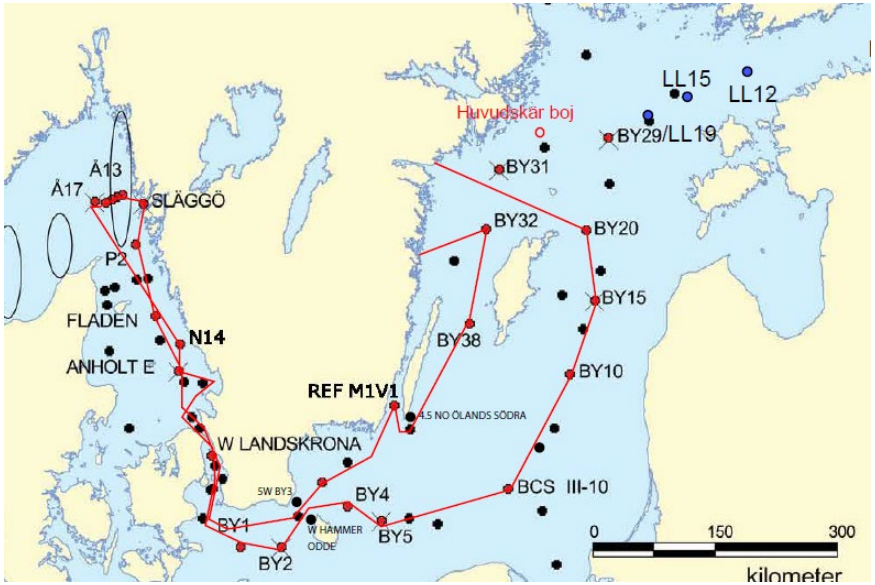
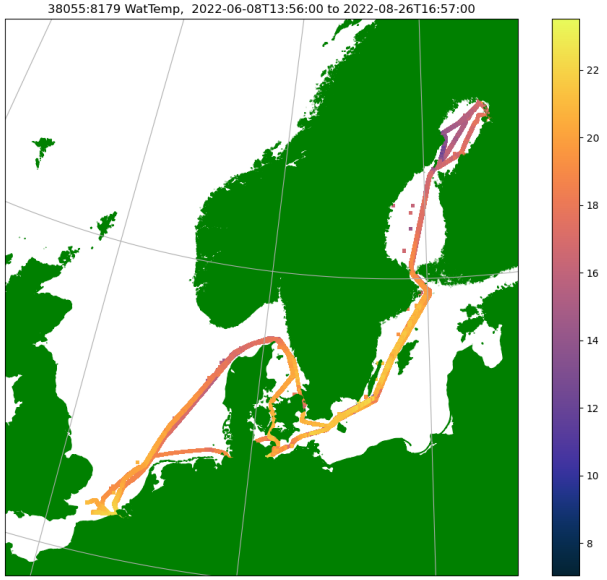
SMHI

Ferrybox Workshop
2022-09-27

SMHI carbonate systems





R/V Svea - background

SMHI

- Built in Vigo, Spain
- Operational since autumn 2019
- Owned by SLU, Swedish University of Agricultural Sciences
- SMHI responsible for several scientific instrument such as ferrybox, MVP, CTDs
- Main users are SMHI and SLU Aqua for marine monitoring and fish surveys

Ferrybox on R/V Svea

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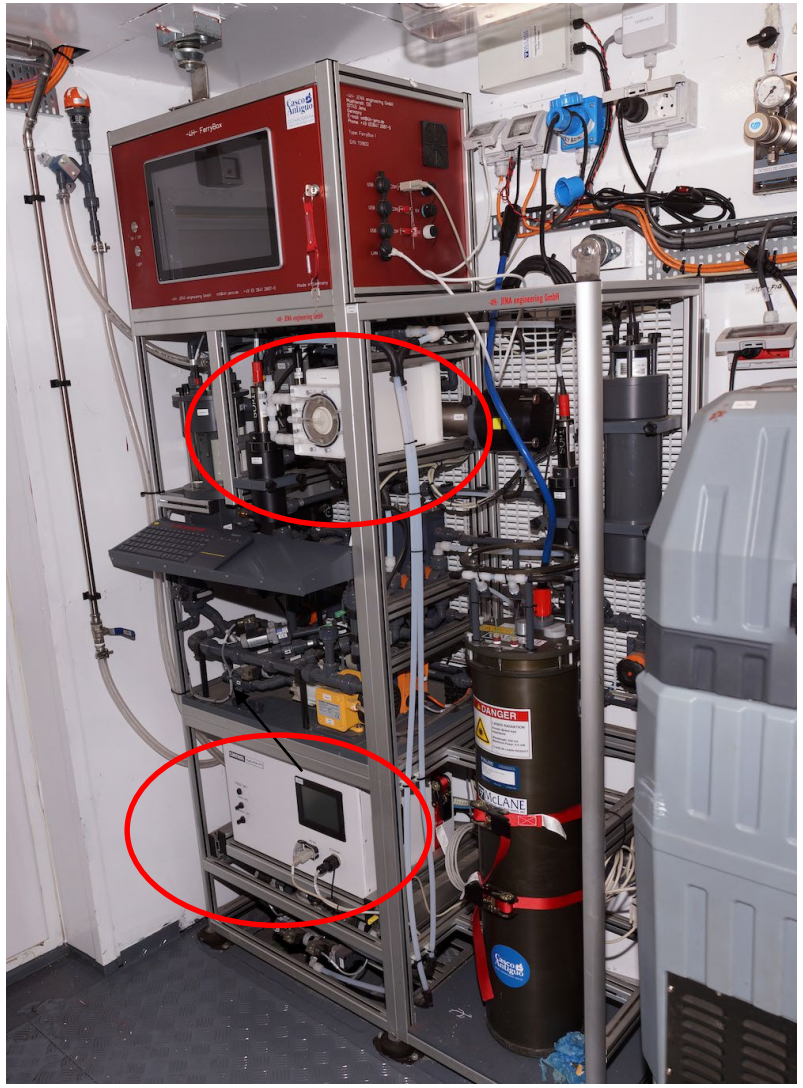
Sensors:

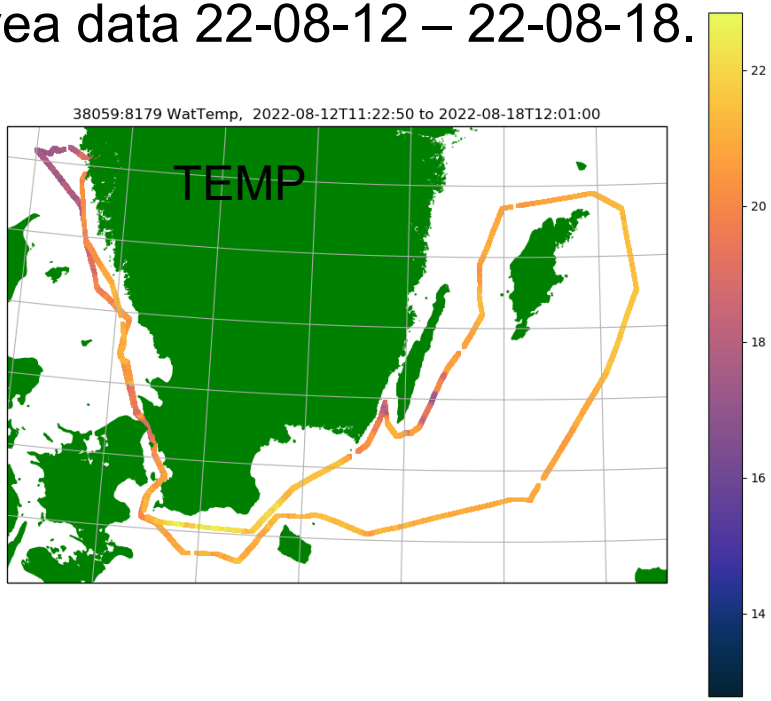
- Temperature SBE45 &38
- Salinity SBE45
- Spectrophotometric pH, HydroFIA/4HJena
- pCO_2 HydroC-FT/4HJena
- Chlorophyll fluor Wetlabs/SBE
- Turbidity Wetlabs/SBE
- Phycerythrin fluor Turner 7F
- CDOM fluor Trios NanoFlu
- Phycocyanin fluor Trios NanoFlu

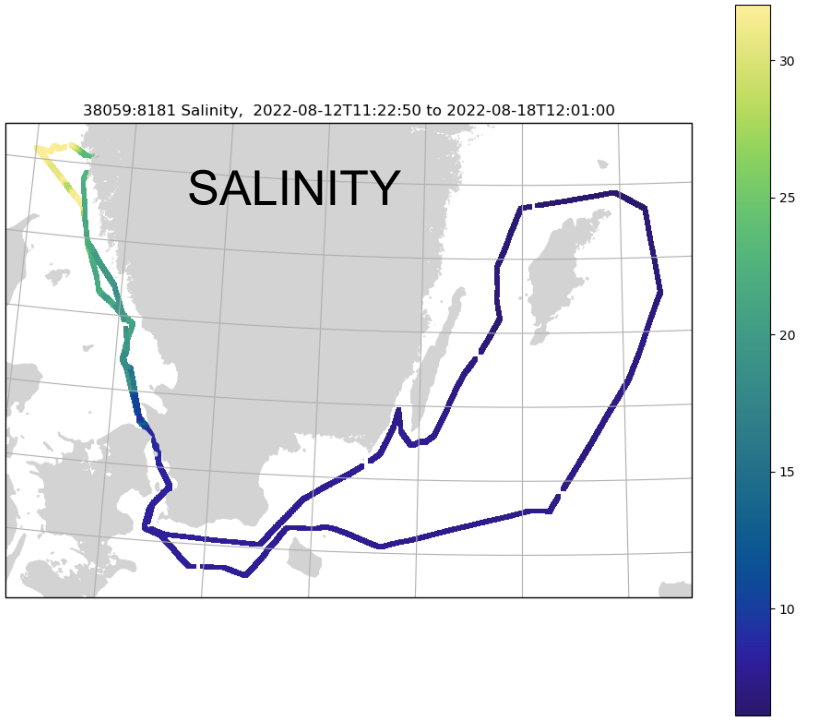
- IFCB McLane

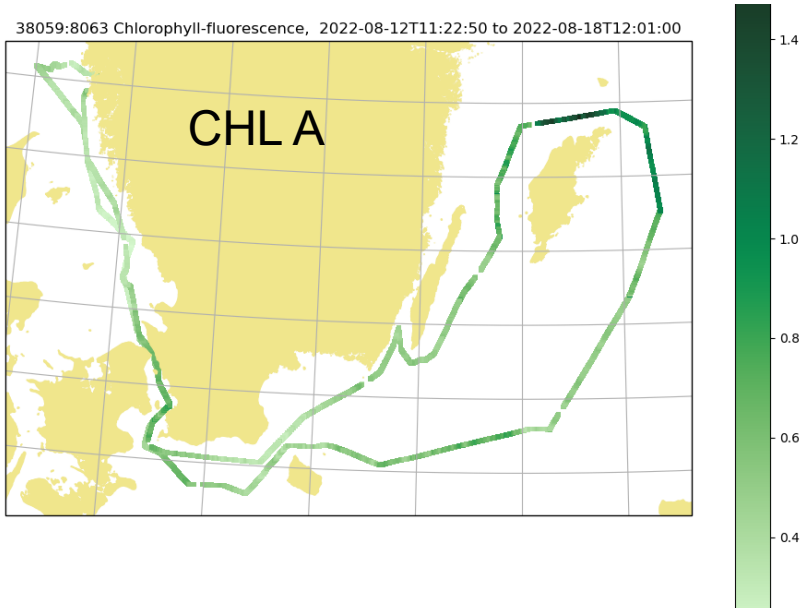
- Automated water sampling MAXX Sampler
- 4HSampler for automatic filtration of zooplankton

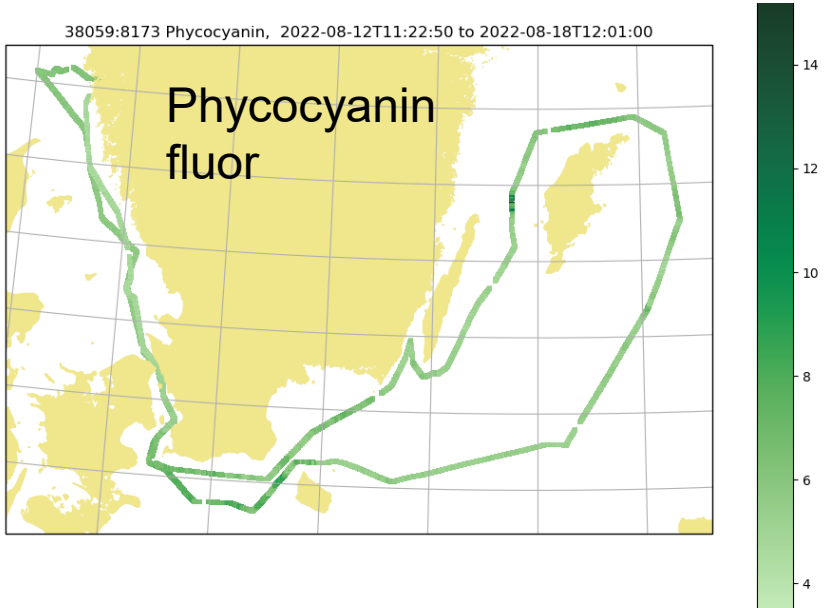


Svea data 22-08-12 – 22-08-18.









Carbonate parameters on R/V Svea

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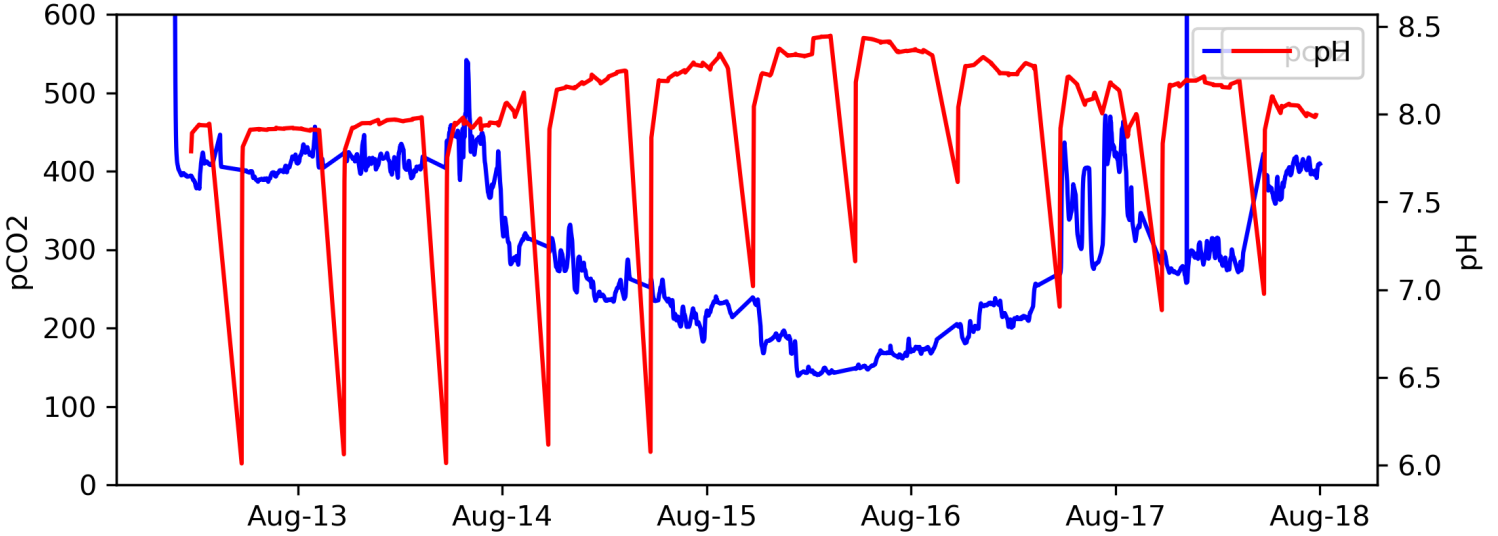
pCO2: HydroC-FT

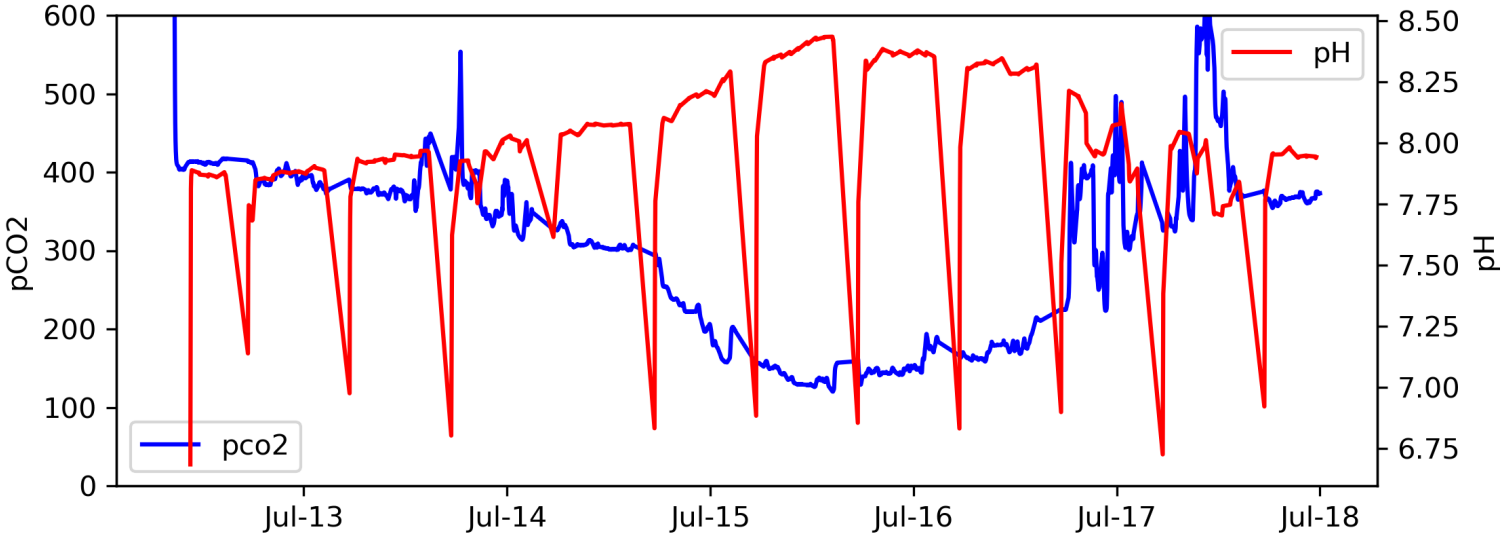
- Operational since spring 2020
- One calibration turn around so far
- Externally funded project for post processing of the data

pH: HydroFIA

- Start up work since spring 2020
- Problems with integration to the 4HJena software with respect to values selected for salinity and temperature
- After some updates the HydroFIA can now operate with its own setting (sample intervall etc) but still follow the measurement cycle of the ferrybox (wash cycle, harbour mode ec)
- Externally funded project for the work with getting the system operational during the regular monitoring crusies

Raw data pH and pCO2, August 2022

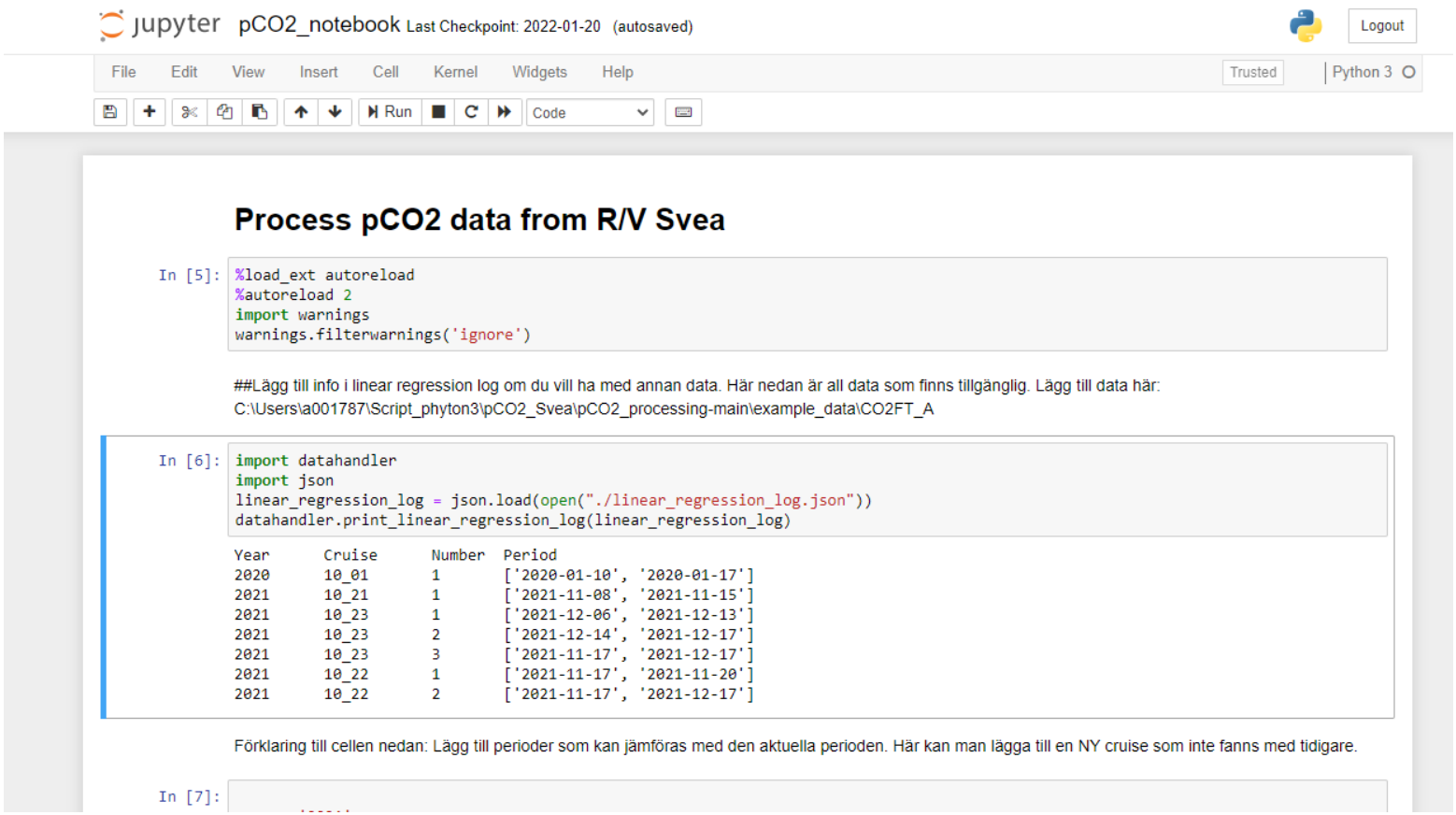




Post processing of HydroC-FT data

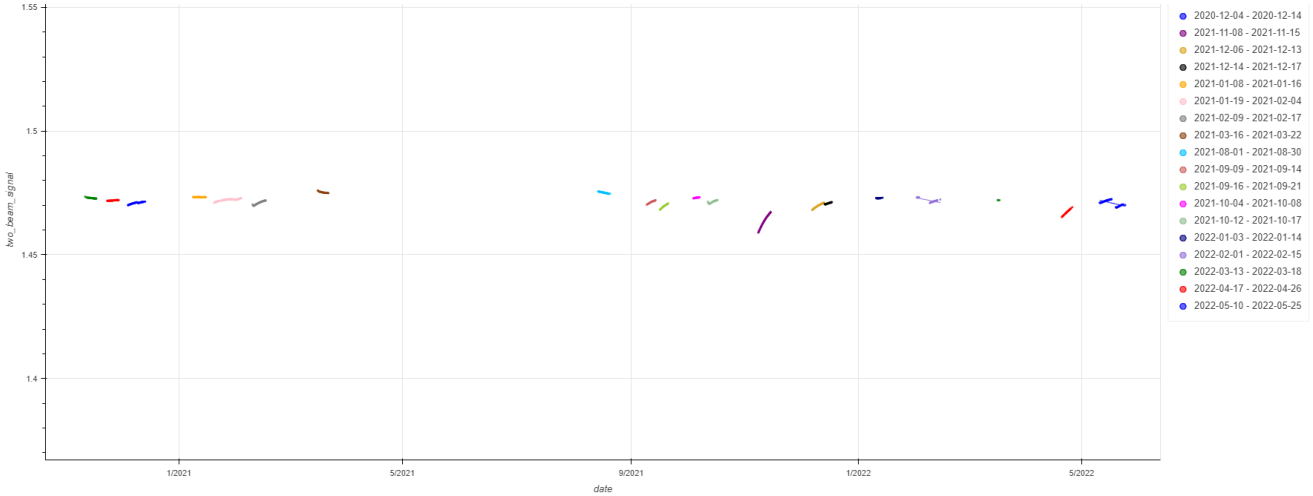
SMHI

- Jupyter notebook used to translate the processing manual from 4HJena into data processing.
- ICOS OTC also had a data reducition work shop in 2020 where this tool was used for processing.
- Availabe on GitHub



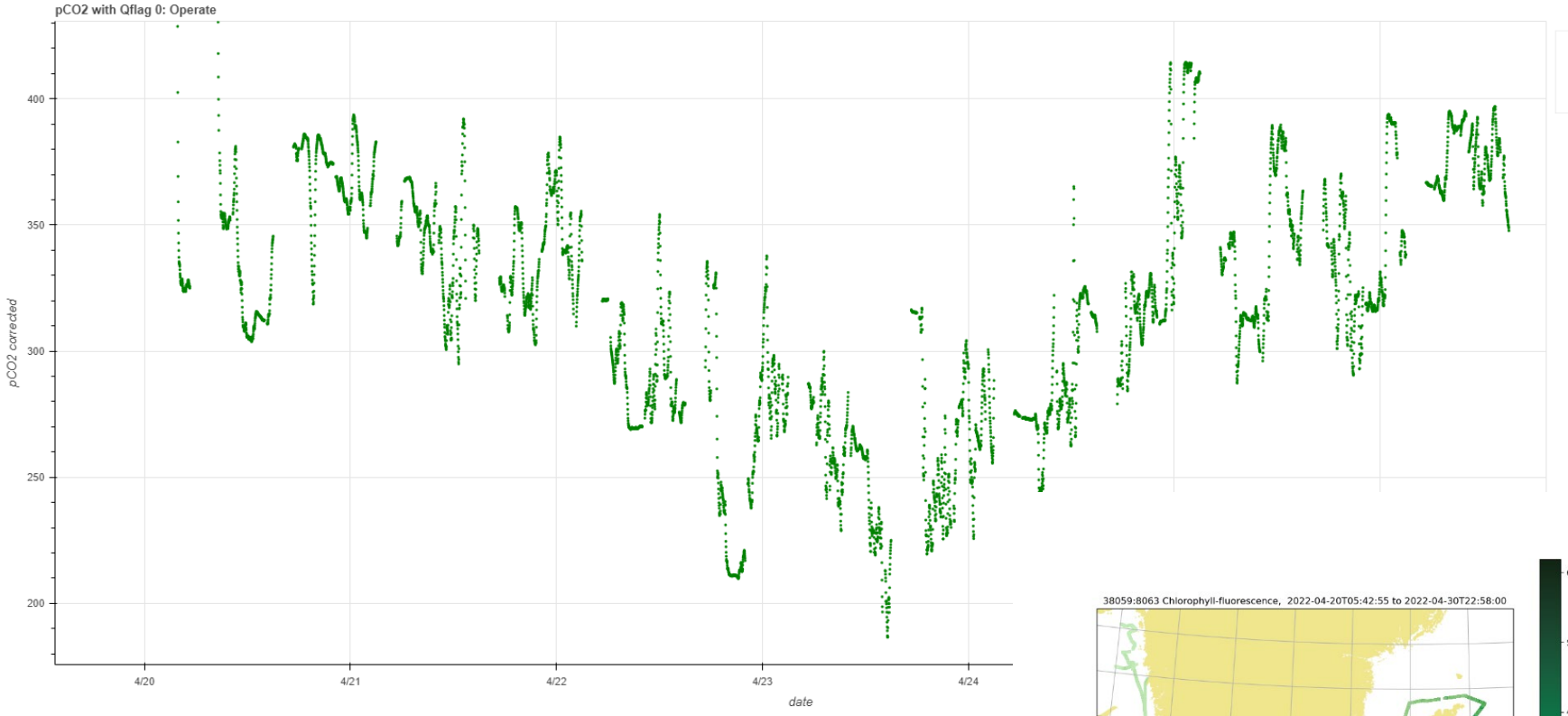
Example of post processing of HydroC-FT data

Green: State_Measure
Red: State_wash
Blue: State_zero



Zeroing data from 2021 and 2022.

Processed pCO2, April 2022



2022 processed HydroC-FT data

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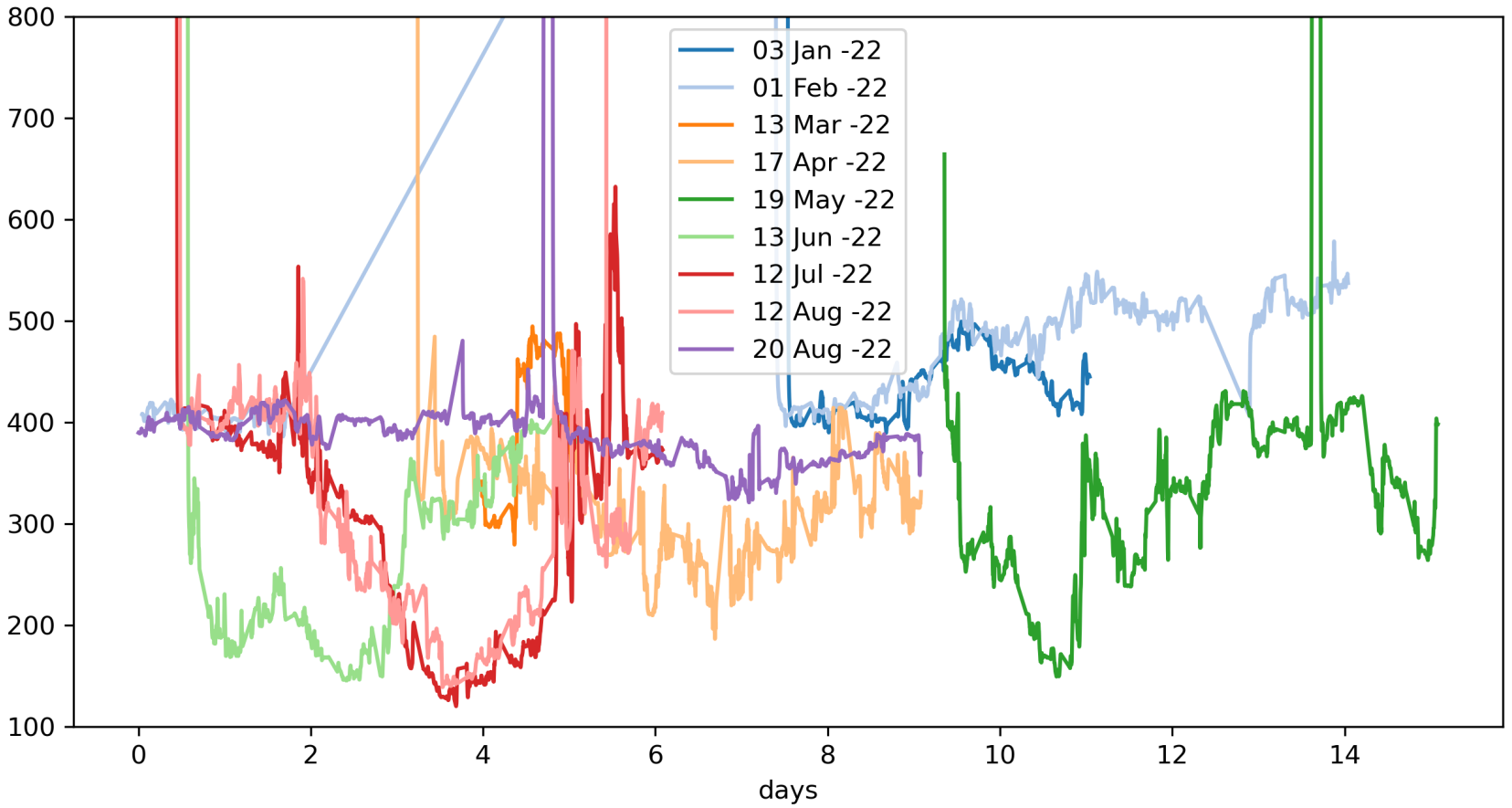

Change of pH sensor for discrete measurements

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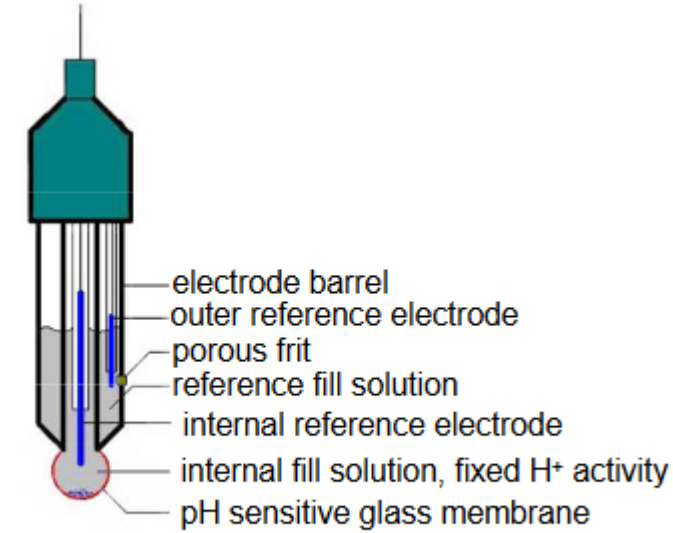
NBS-electrode: 1994 – on going



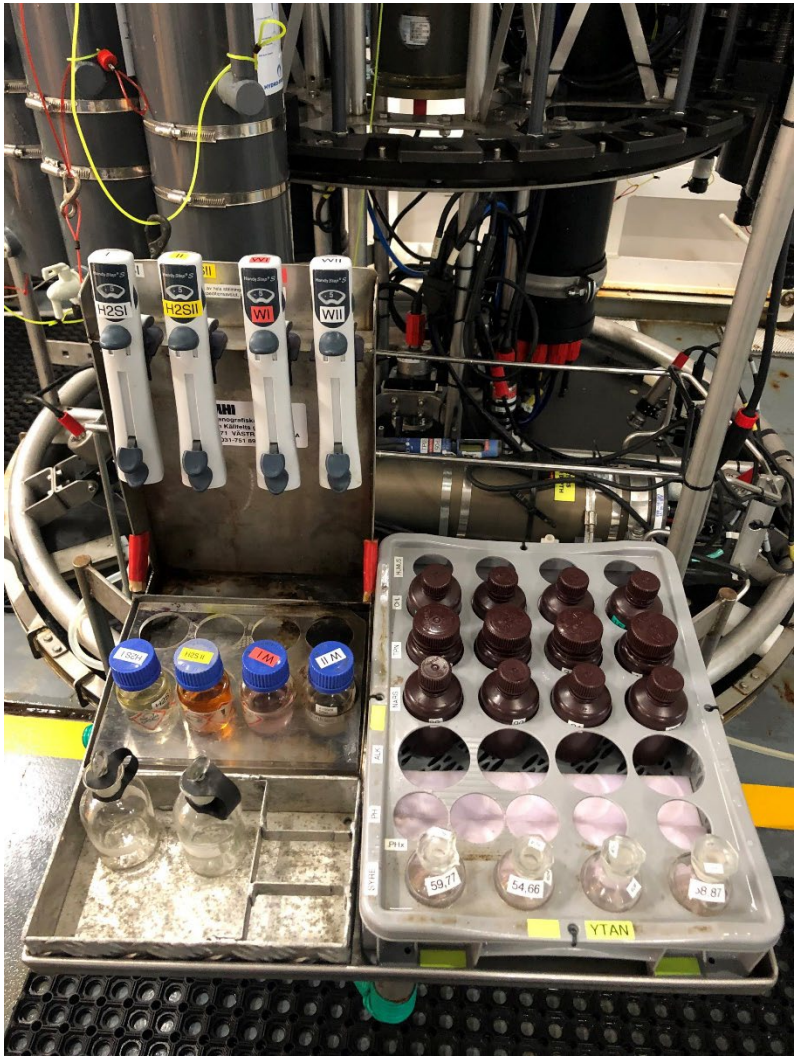
http://upload.wikimedia.org/wikipedia/commons/e/e9/Glass_electrode_scheme.jpg

HydroFIA bought from 4HJena during autumn 2021.

Dual measurements started on Svea during spring 2022 and will continue for at least one year.

Procedure

- Winkler bottles are used for the HydroFIA samples
- Operate the HydroFIA through the Webb interface
- 10-12 CRM replicats (Dickson) are analyzed in the beginning of each cruise.
- 10-12 CRM replicats are also analyzed on the Ferrybox HydroFIA directly afterwards.



Prel. result summer 2022

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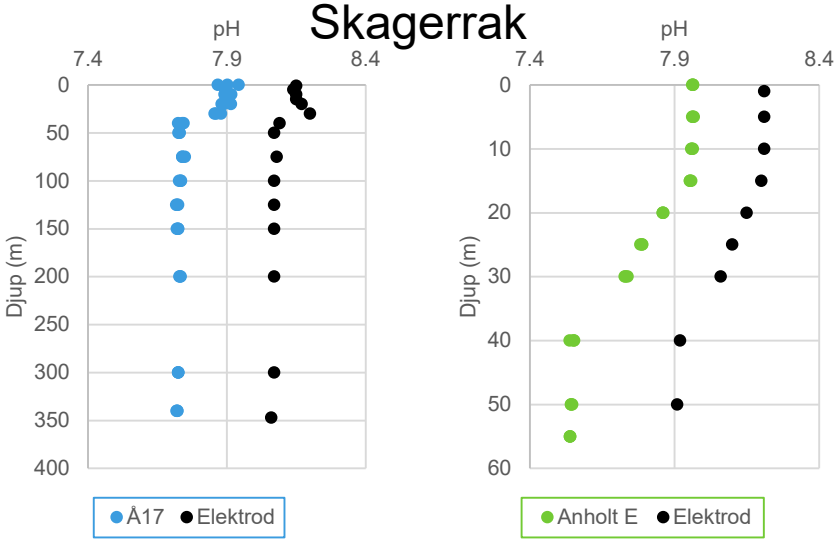
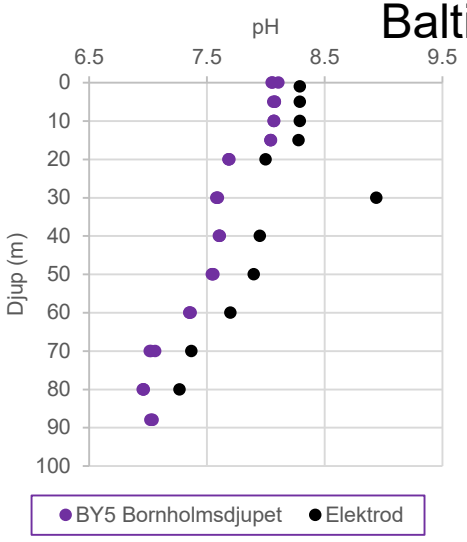
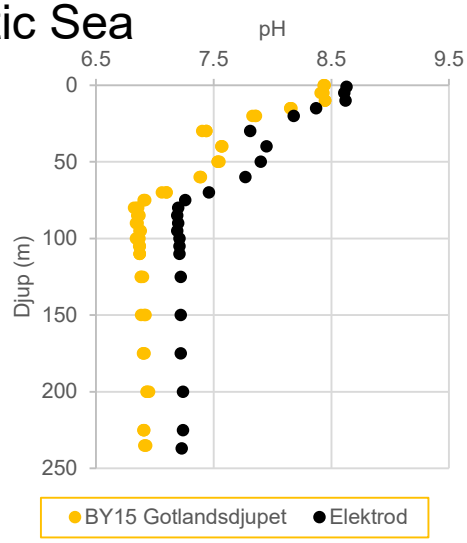
Skagerrak



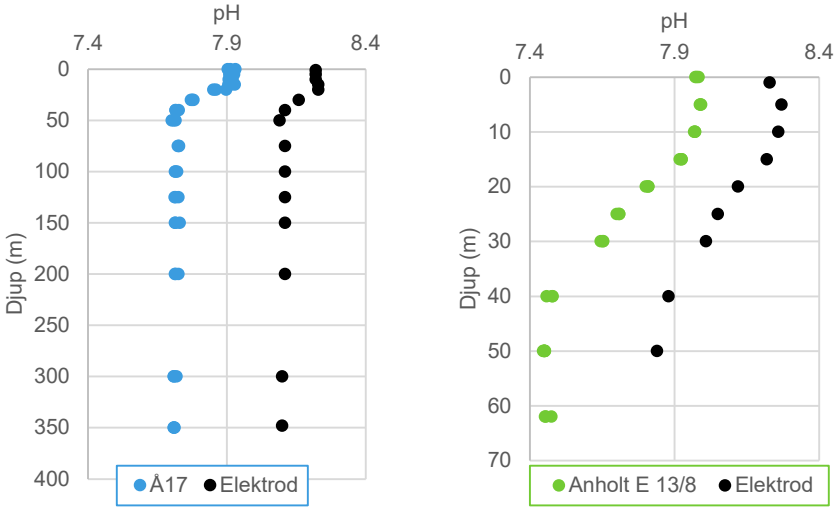
July

Baltic Sea

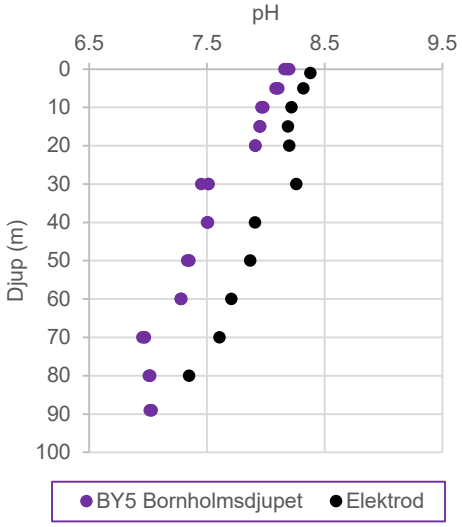


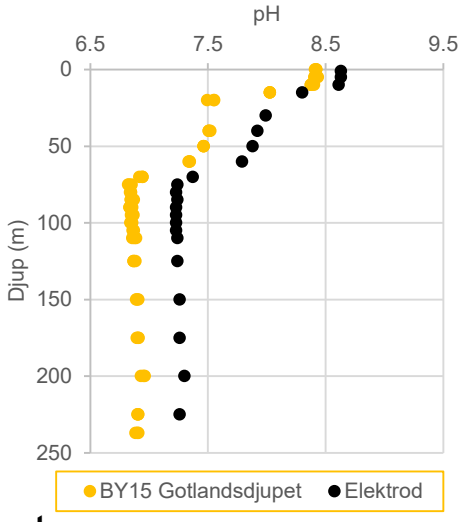


July



August





august

FerryBox on Tavastland: Background

SMHI

- **2009**: SMHI and SYKE start collaboration and cooparation with M/S Tavastland (former TransPaper). Route: Gotenburg-Lubeck-Oulu-Kemi-Lubeck-Gothenburg.
- **2010**: Installation of the ferrybox is complete. The design is a copy of the SYKE ferrybox on Finnmaid.
- **2015**: Change of route: Lubeck-Oulu-Kemi-Lubeck
- **2022**: Change of route and installation of new ferrybox from 4HJena

Tavastland parameters

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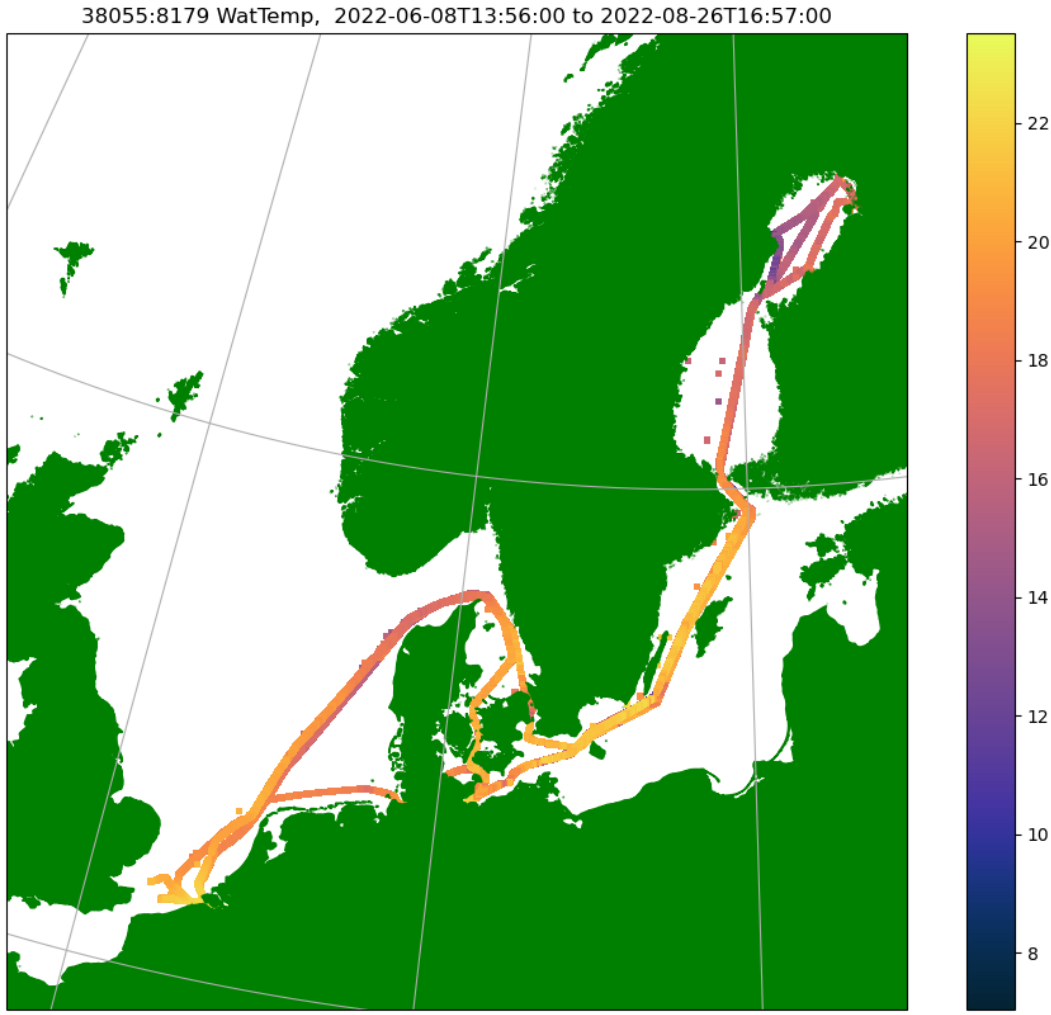
In water, 3 m depth
- Flow rate
- Temperatur
- Salinity
- Oxygen
- Chlorofyll fluorescence
- Phycocyanin fluorescence
- CDOM fluorescence
- pCO_2

In air
- Temperature
- Pressure
- Irradiation, PAR
- CO_2

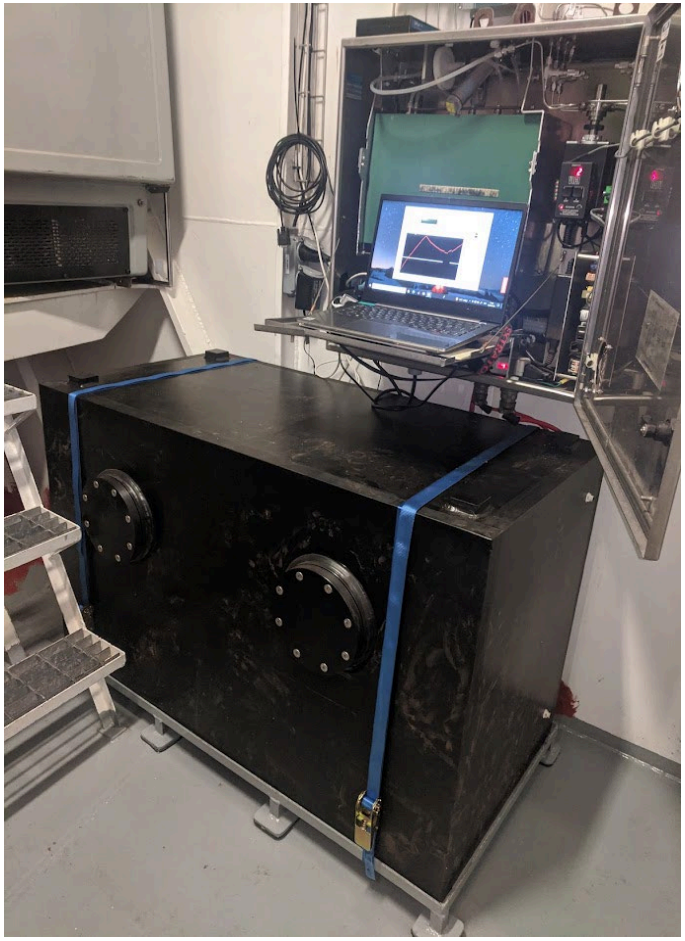


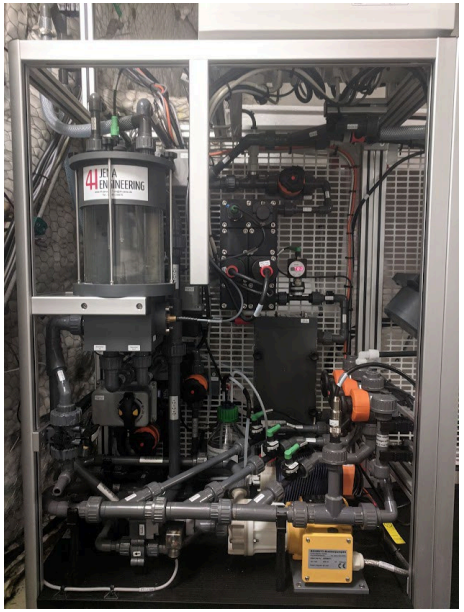
Demounting of old ferrybox

SMHI

Installation of new ferrybox from 4HJena

SMHI

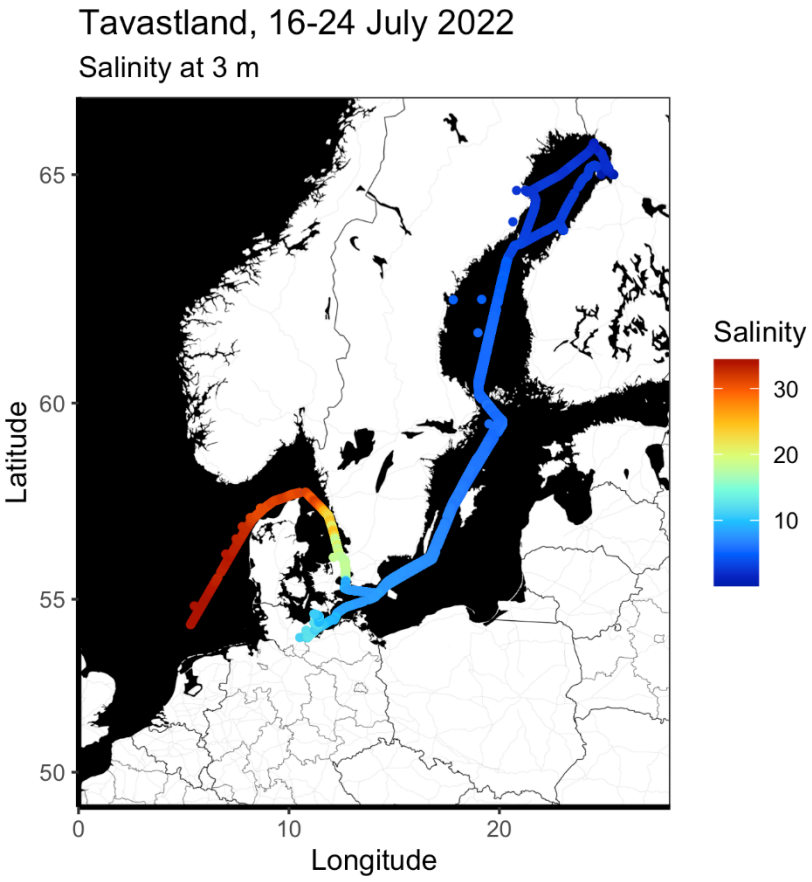


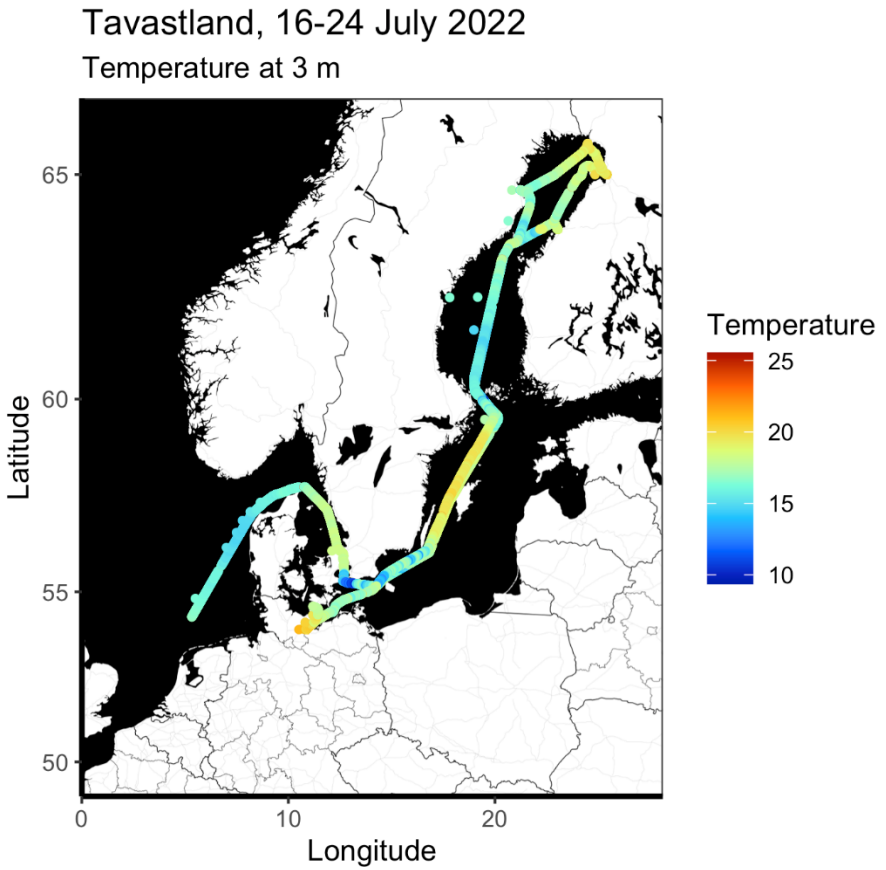


- 1 intake pump and 1 out cast pump
- 1 internal debubbler and 1 external debubbler
- 1 large waste water tank
- Communication between ferrybox GO system for salinity, temperature and pressure

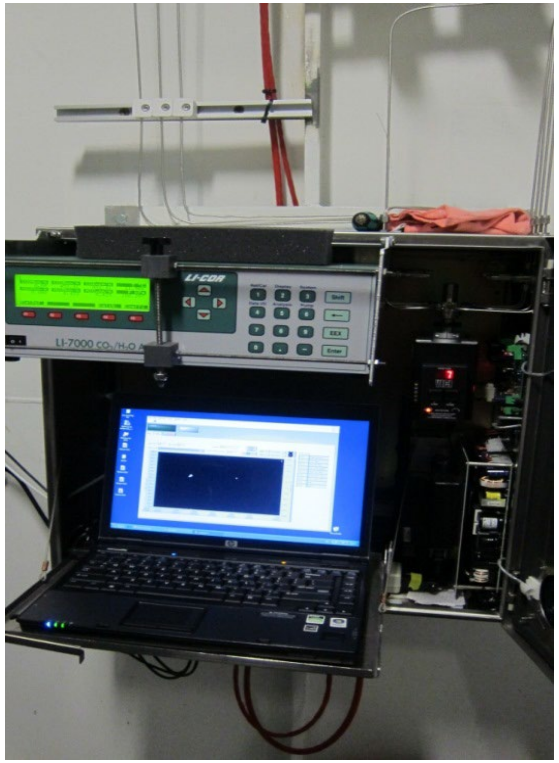
Raw data August 2022

SMHI



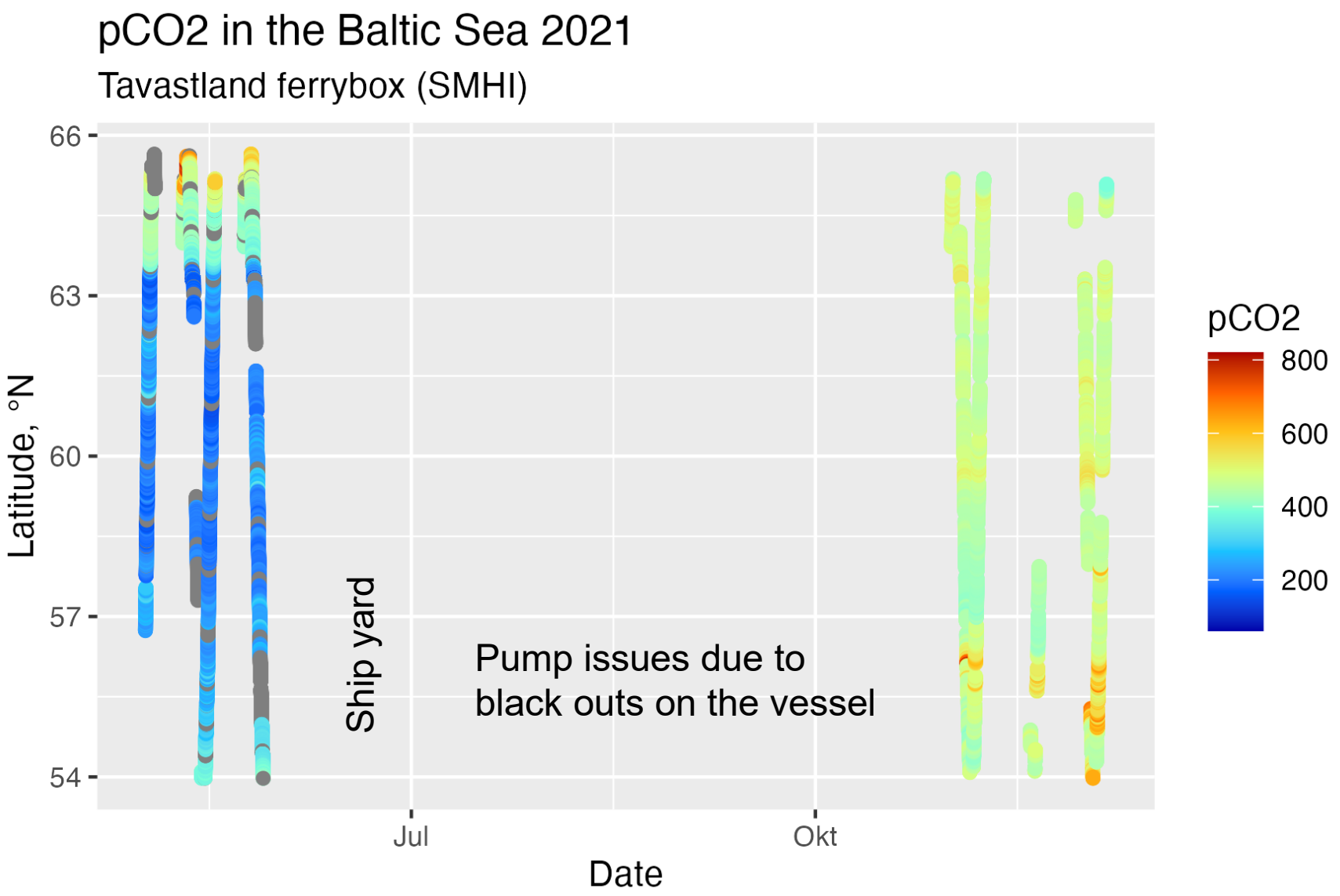


GO system on Tavastland



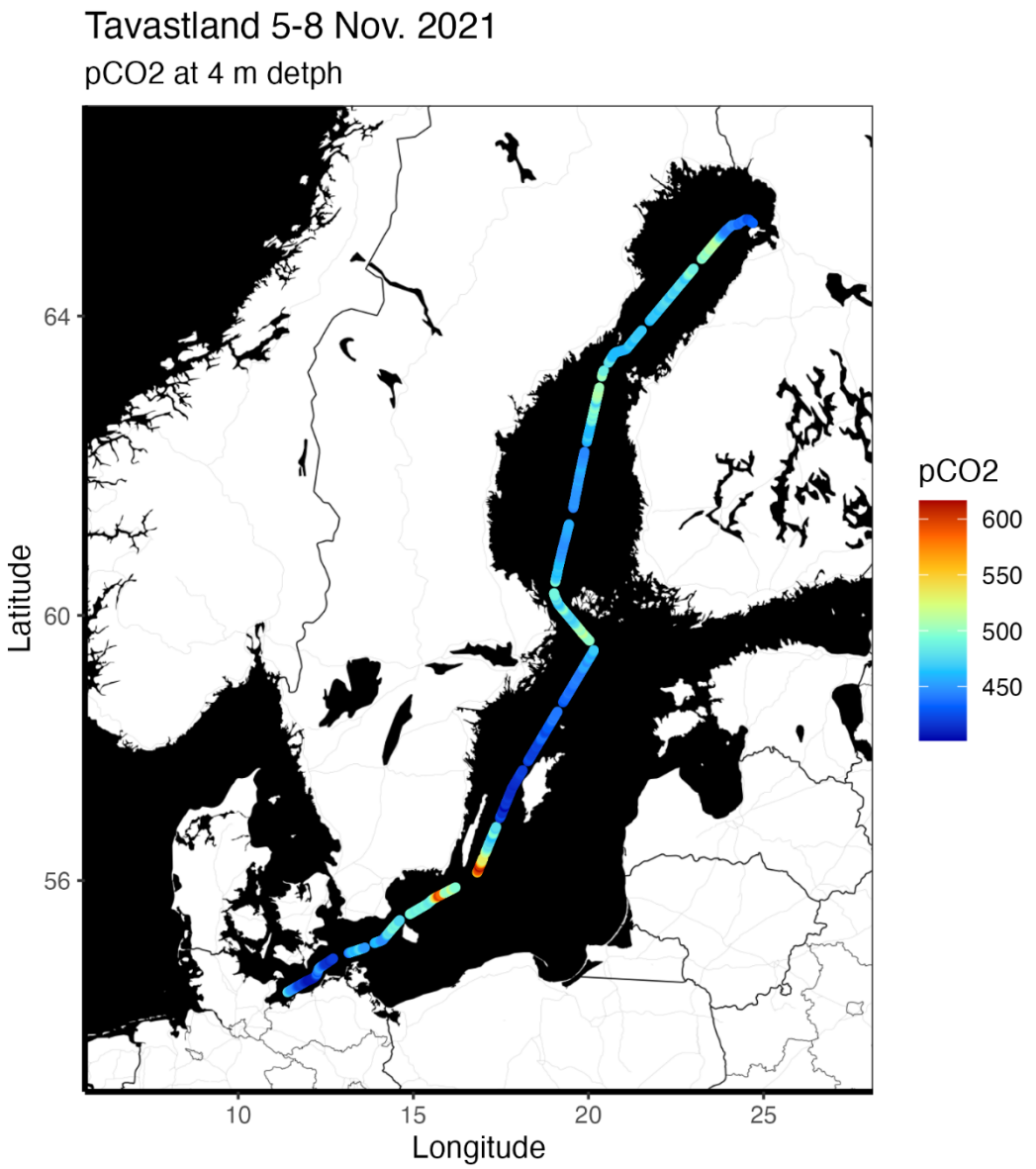
- **2021**: Funding start from ICOS Sweden.
- ICOS labelling process started and now in stage 2 (data colletion for 4-6 months).
- Data submitted to Socat för a number of months 2020 – 2021.
- National funding through ICOS Sweden for equipment renewal: new LICOR 7180 (CO_2/CH_4) bought in 2022.

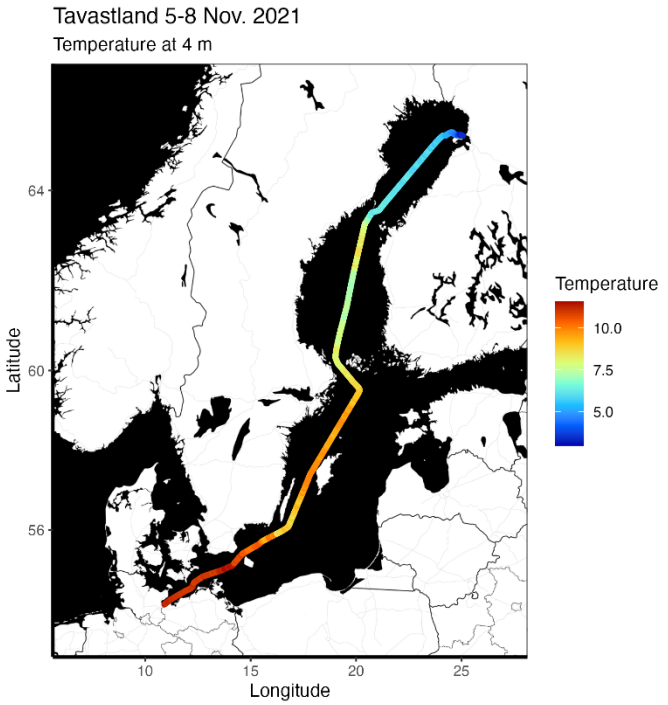
Data submitted to SOCAT

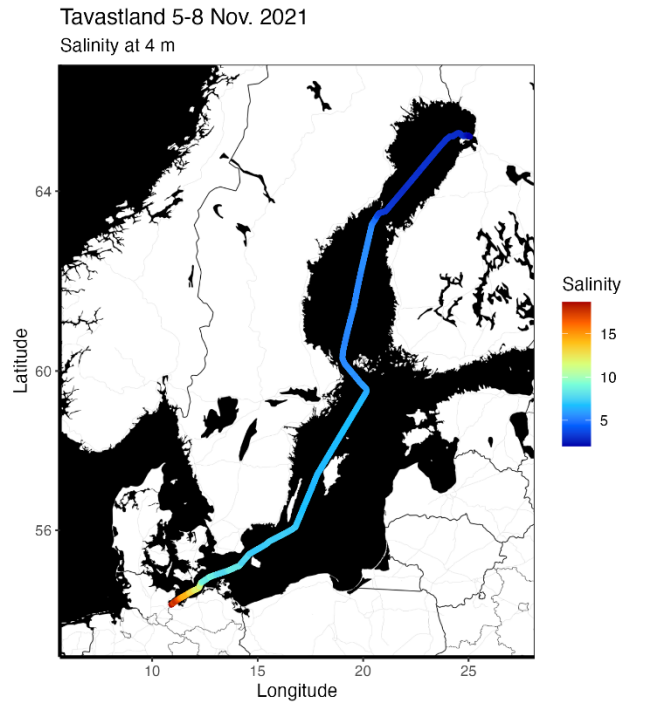


Acknowledgement to Tobias Steinhoff for data compilation and Socat submission!

Example from November 2021







Ongoing work

SMHI

TAVASTLAND:

- Labelling process started
  - Metadata submitted
  - Meauring period right now

- ICOS standard gases installed on Tavastland during Spring 2021

- Calibration of SBE45 and SBE38 is performed by IOW

- Quality control of the biogeochemical sensors after the change of the ferrybox

SVEA:

- Finish data processing work for HydroC-FT

- QC using data processing tool and data storage in house in order

Thank you!
Questions?

Acknowledgements:
- Crew on Tavastland
- Vessel technicians and crew on Svea

Future work...

SMHI

- Possibly feed the Webb interface with a txt-file with salinity values

- Possibly change the monitoring program for pH
  - do we need a sample from every discrete depth possible?
  - Do we sample the stations that are most representativ for that basin?

- QC Control of data

- Data delivery in house and to external data bases

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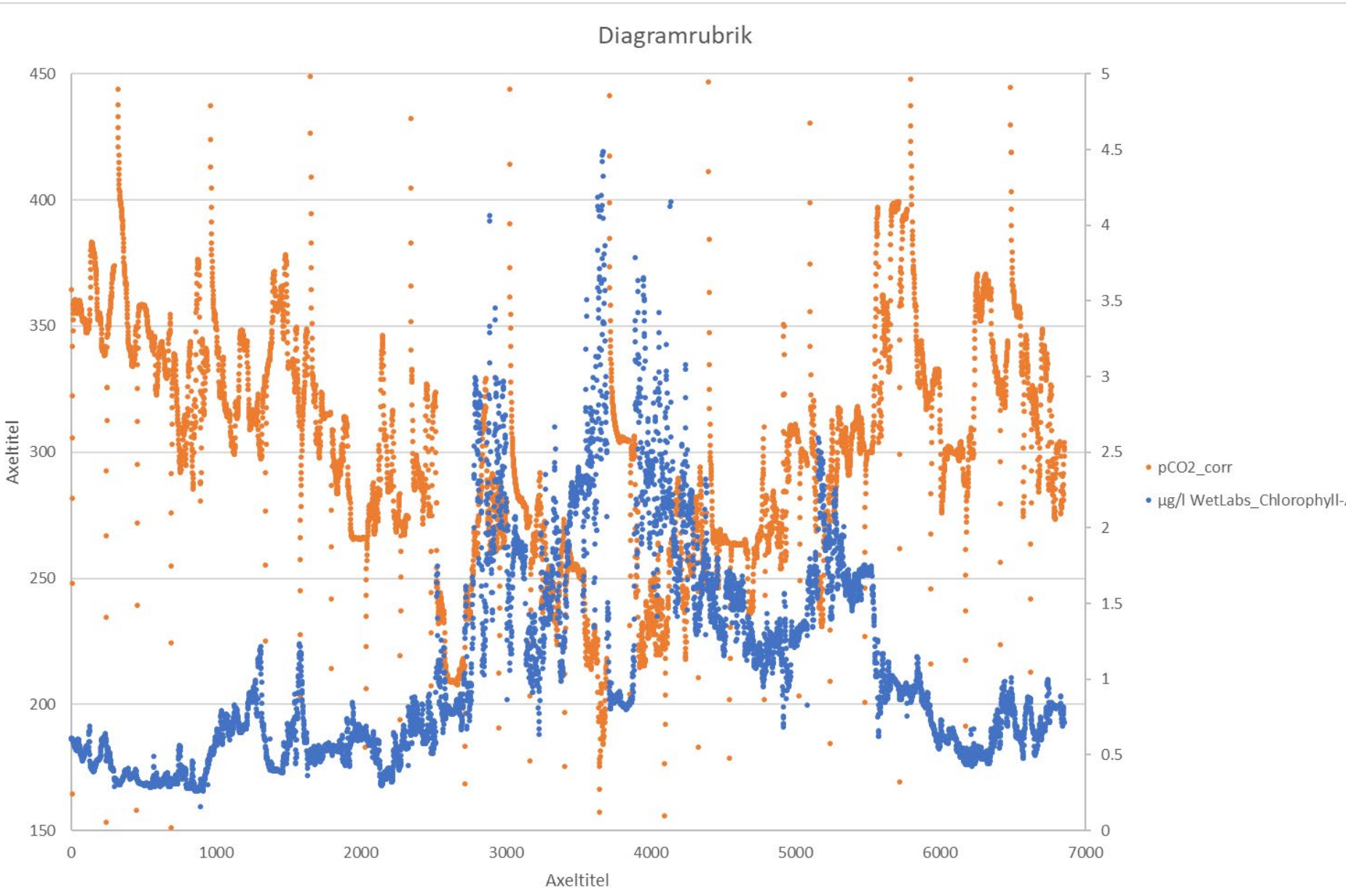
Raw data Svea expedition: April 20 – 25



Data submitted to SOCAT

SMHI