xylem
Let's Solve Water

AANDERAA HYPACK SonTek YSI

Complex system solutions – coastal research

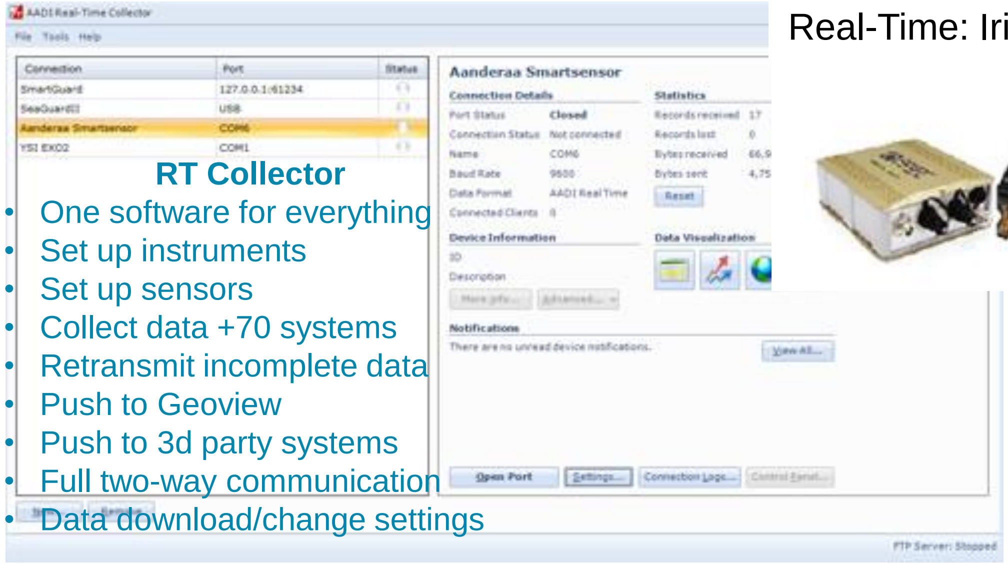
STIG OEN & DR. ANDERS TENGBERG

5TH OF OCTOBER 2022

Environmental Monitoring Workshop '22

RT Collector

- One software for everything
- Set up instruments
- Set up sensors
- Collect data +70 systems
- Retransmit incomplete data
- Push to Geoview
- Push to 3d party systems
- Full two-way communication
- Data download/change settings



Real-Time: Iridium,2G/3G/4G, AIS

Aanderaa sensors are smart

- Calculates internally, no post-processing needed
- Engineering data e.g. Sal/Dens, Average current, Waves
- Temp compensated measurements
- High quality Temp included
- Low Power

Geoview/Hydrosphere (Cloud)

- Displays & store data
- Windows database
- View on PC & Cellphone
- Zoom & historical data
- Alarms

SeaGuardII

Platforms

SmartGuard

Sensors in

- AiCap (Can Bus)
- RS232/RS422
- Analog

Communication out

- RS232/RS422
- IP
- USB
- XML format

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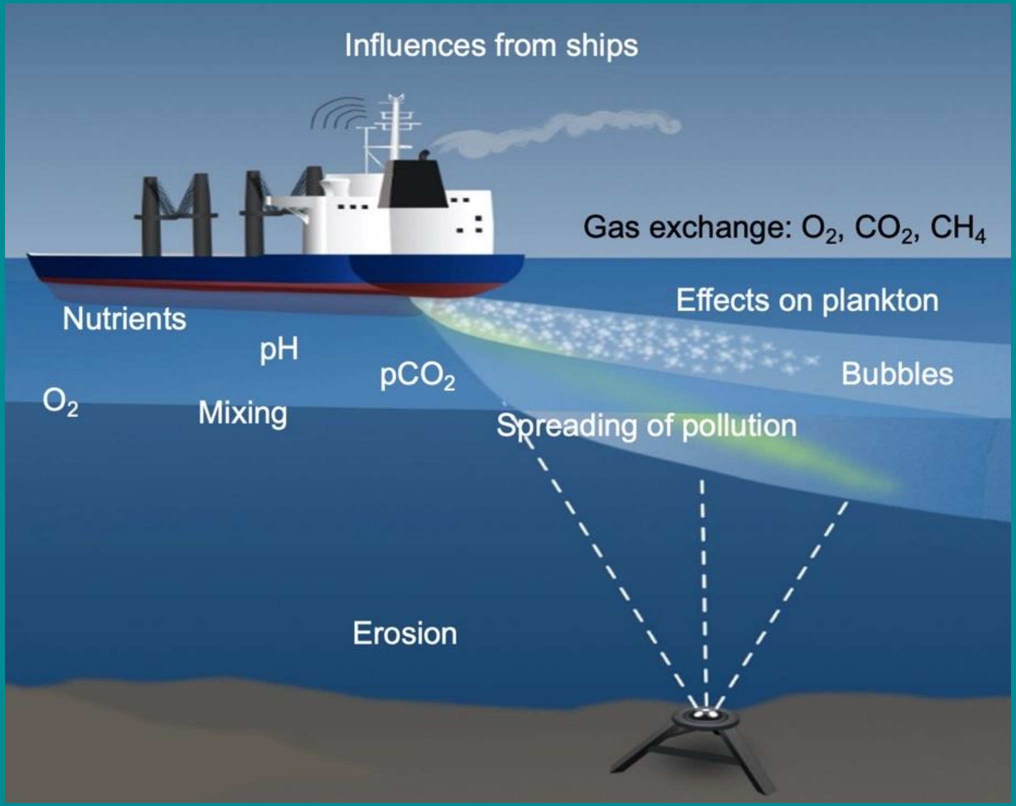
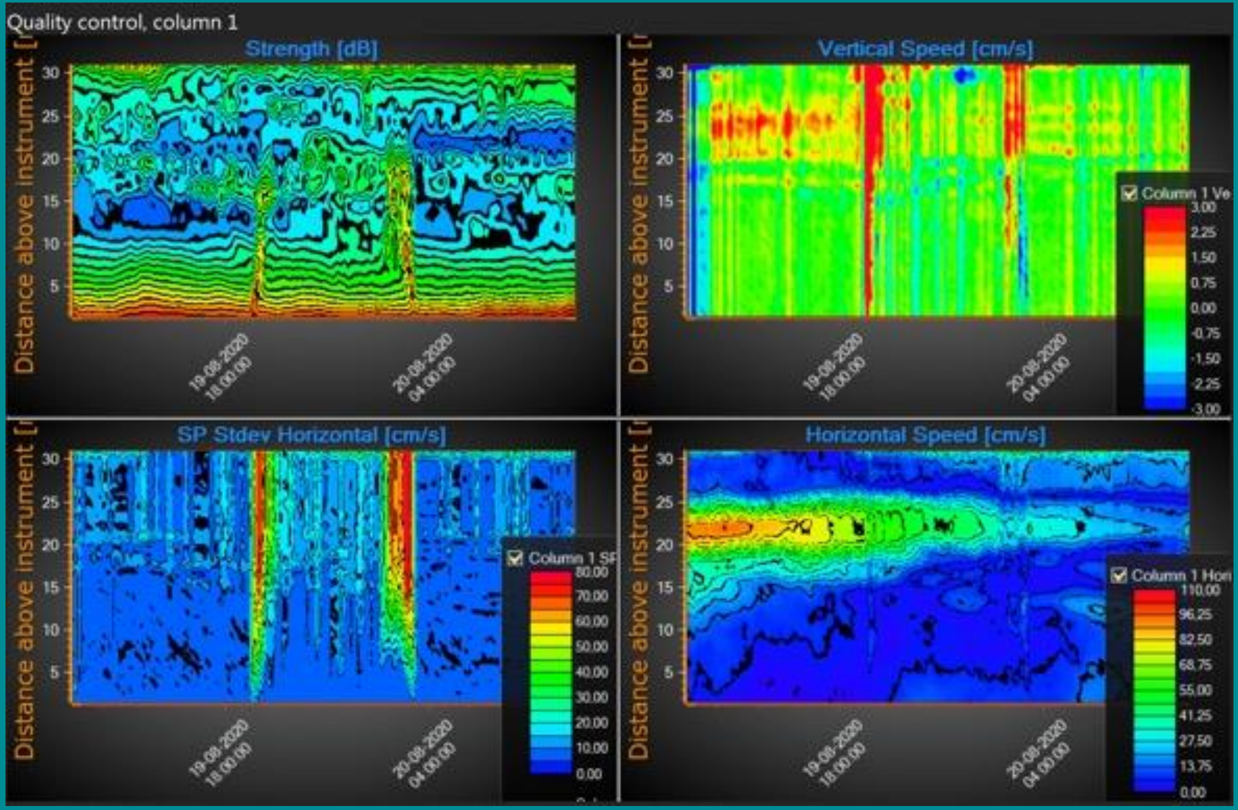
Project to study environmental effects of shipping





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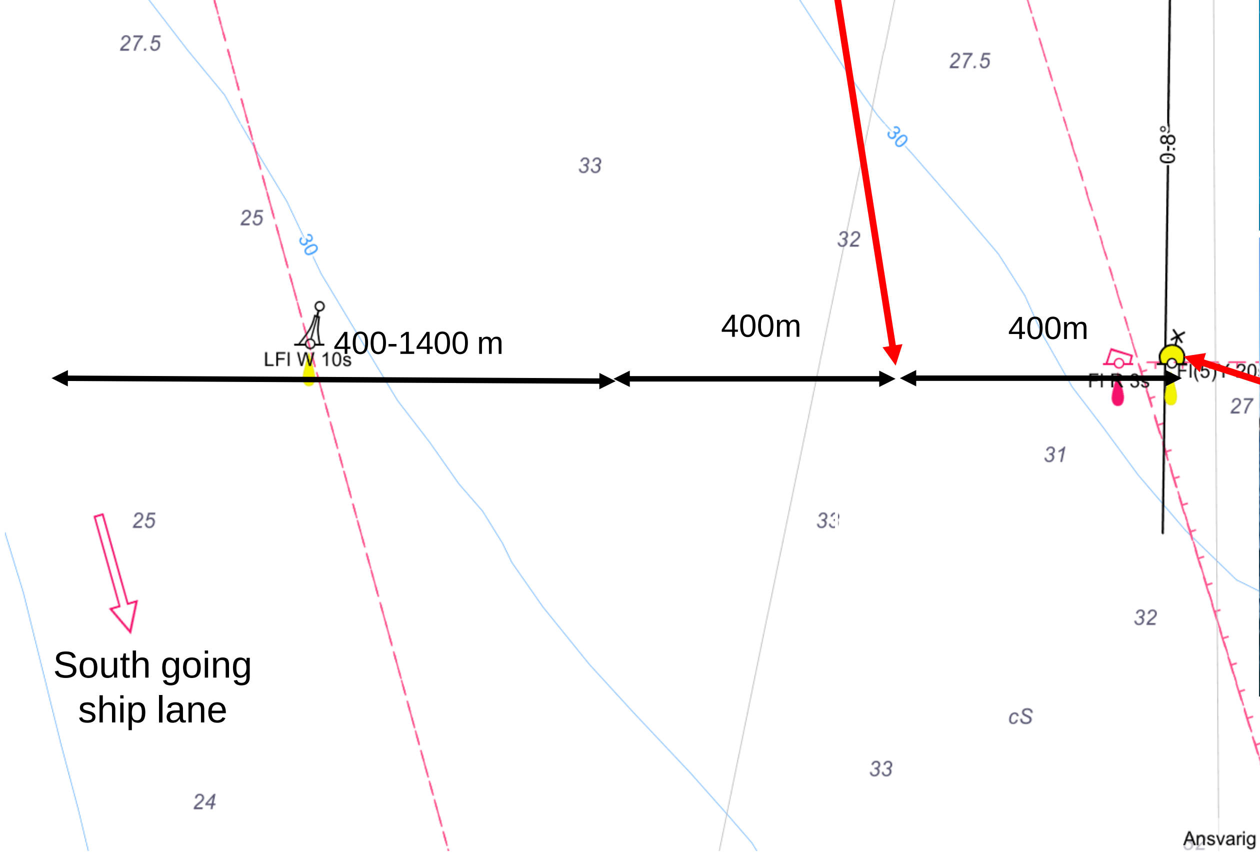
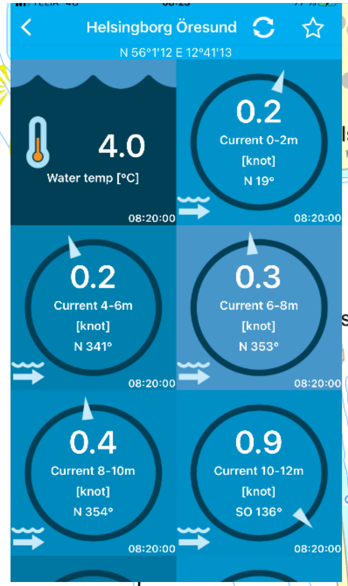
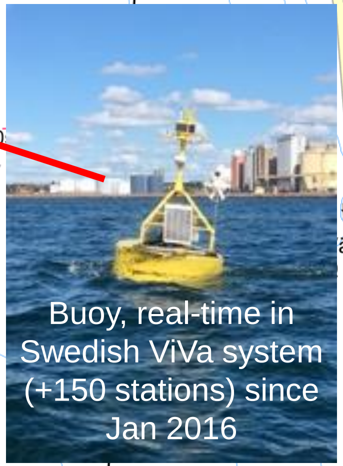
Deployments below ship lanes

SeaGuardII in mooring frame close to bottom
Sensors: DCPS, 2*O_2+2*Sal/Temp+2*Wave/Tide

Check out the free cell phone app, search for *"viva-vind & vatten"*

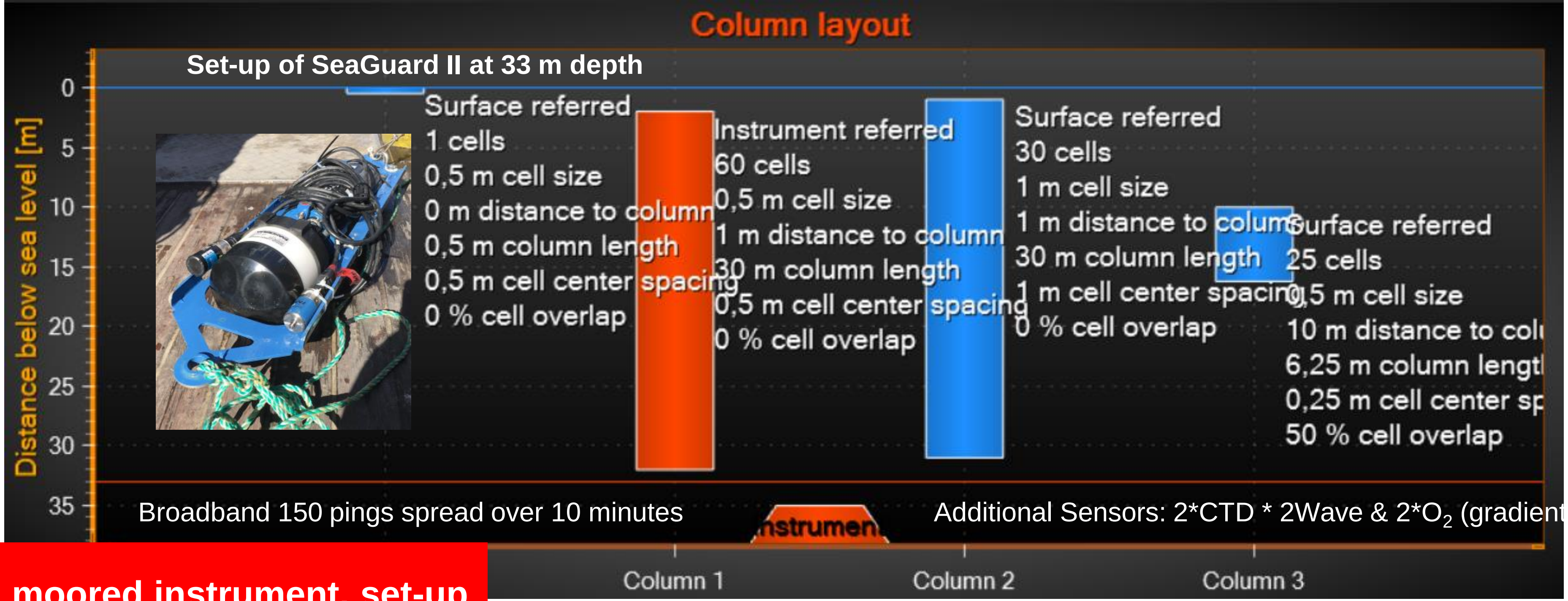


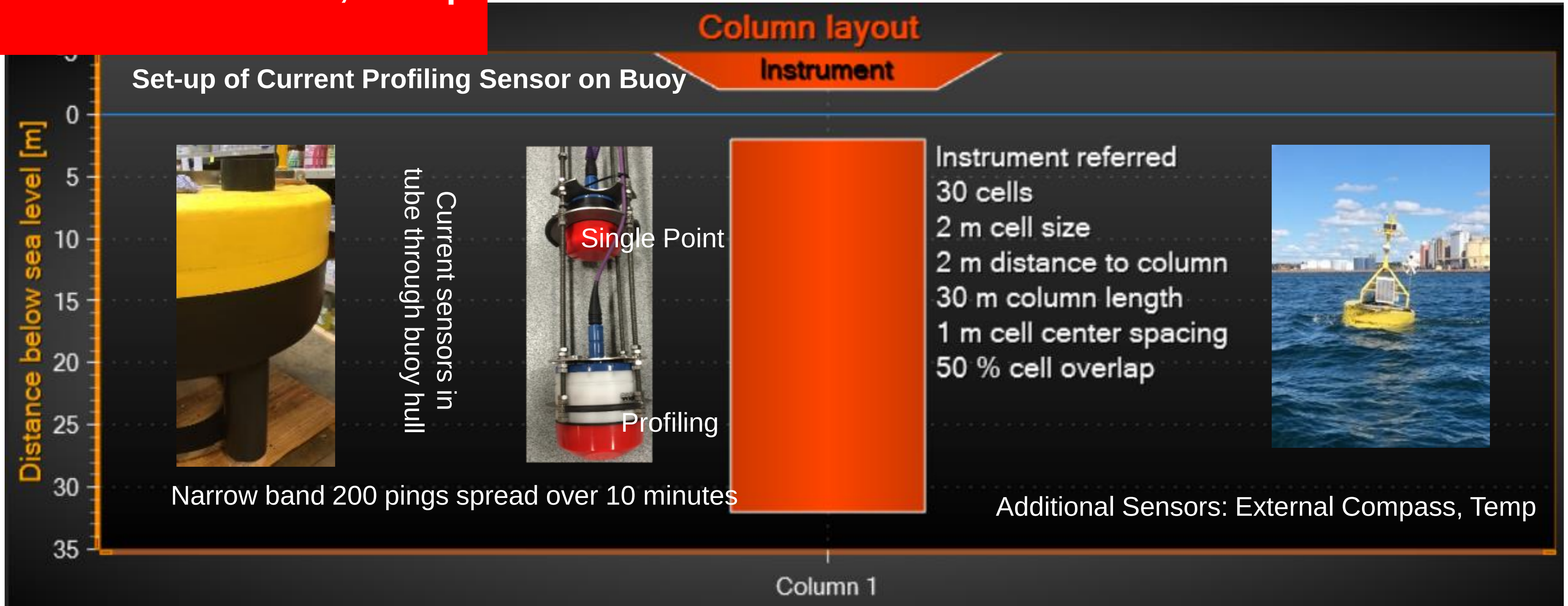




Buoy, real-time in Swedish ViVa system (+150 stations) since Jan 2016

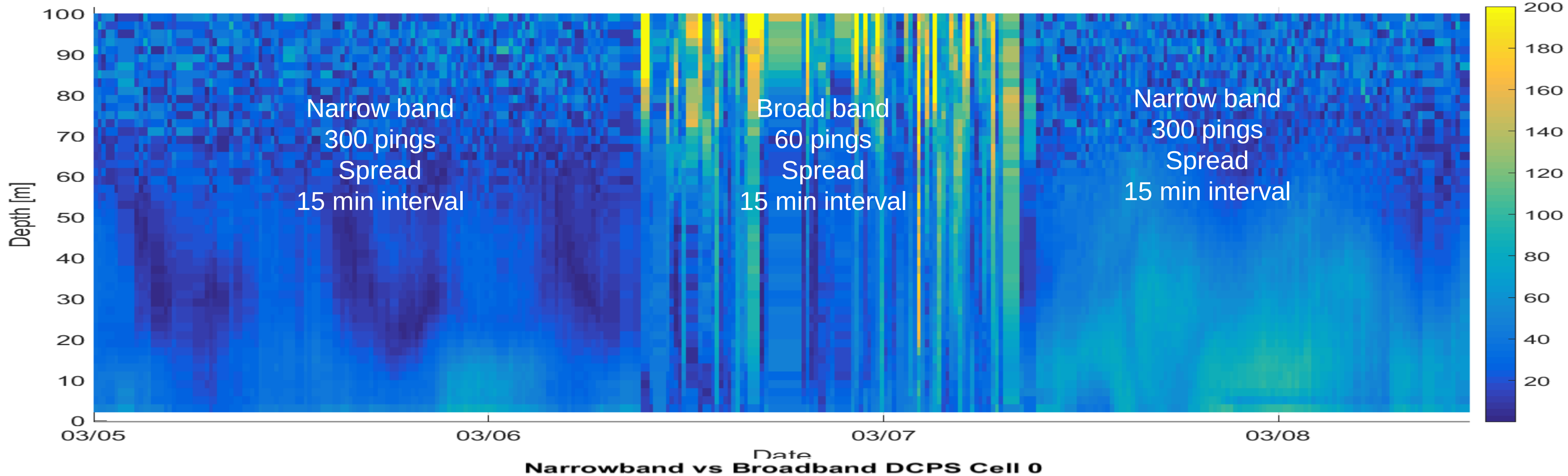
DCPS on buoy & moored instrument, set-up

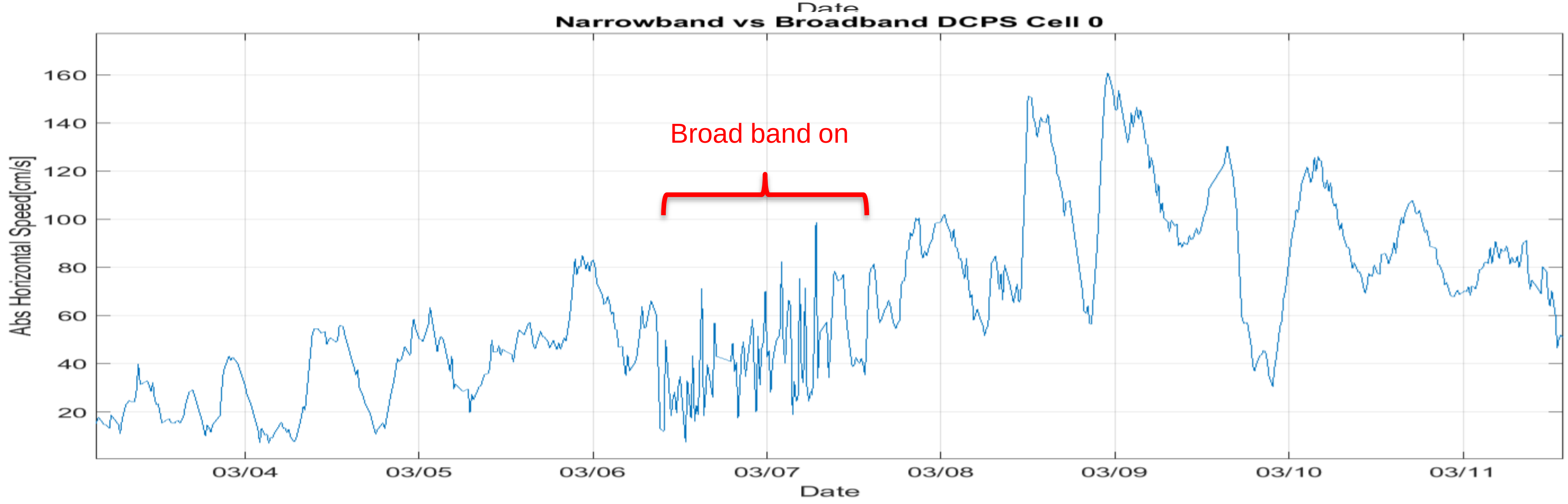




Broad band or Narrow band?

- Broad Band saves power, lower noise per ping
- Broad Band not suitable for current measurements from rocking platforms
- Broad Band not suitable if current speeds are higher than 120 cm/s





Measuring currents from Sailbuoy, scientific paper

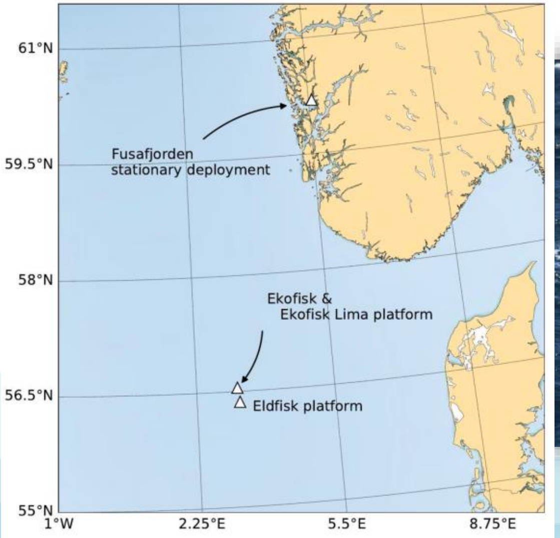
sensors

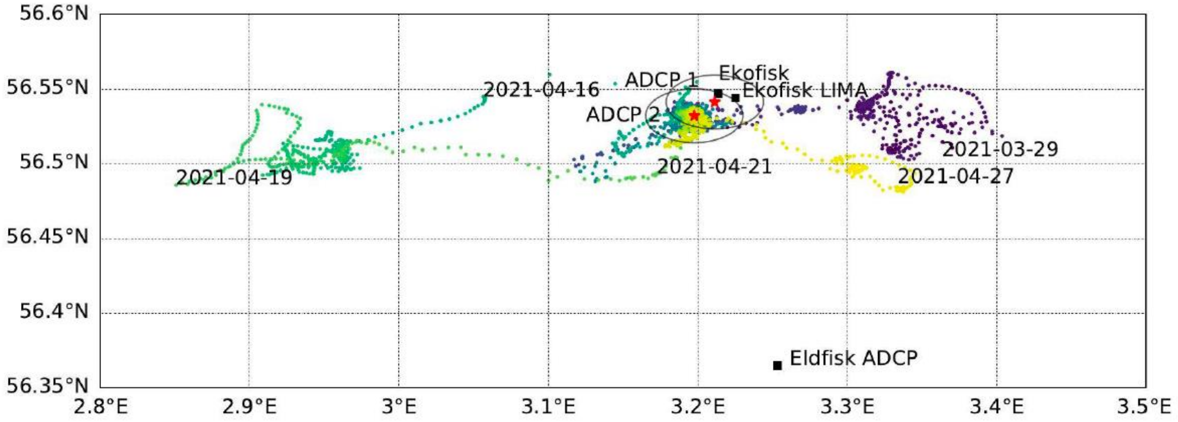
Article

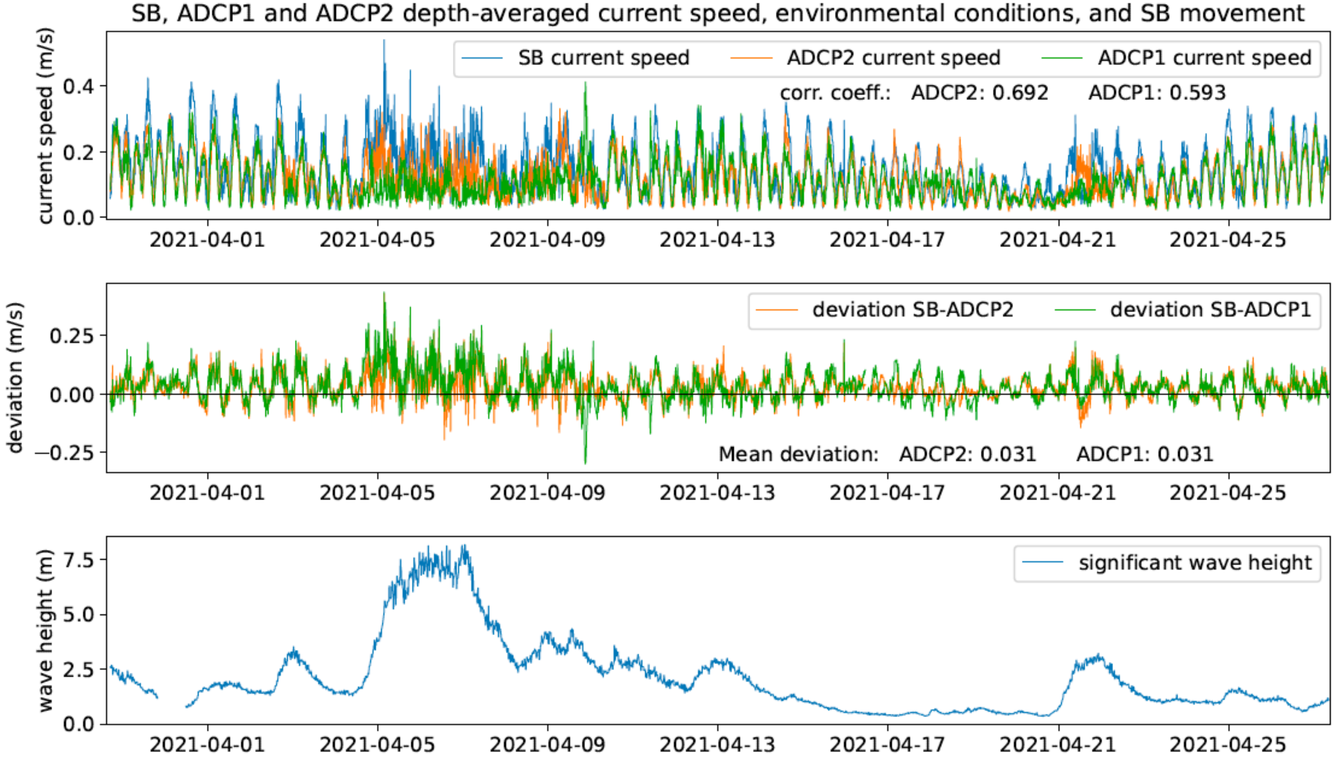
SailBuoy Ocean Currents: Low-Cost Upper-Layer Ocean Current Measurements

Nellie Wullenweber [1,2,3,4], Lars R. Hole [4,*], Peygham Ghaffari [5], Inger Graves [6], Harald Tholo [6] and Lionel Camus [5]

Abstract: This study introduces an alternative to the existing methods for measuring ocean currents based on a recently developed technology. The SailBuoy is an unmanned surface vehicle powered by wind and solar panels that can navigate autonomously to predefined waypoints and record velocity profiles using an integrated downward-looking acoustic Doppler current profiler (ADCP). Data collected on two validation campaigns show a satisfactory correlation between the SailBuoy current records and traditional observation techniques such as bottom-mounted and moored current profilers and moored single-point current meter. While the highest correlations were found in tidal signals, strong current, and calm weather conditions, low current speeds and varying high wave and wind conditions reduced correlation considerably. Filtering out some events with the high sea surface roughness associated with high wind and wave conditions may increase the SailBuoy ADCP listening quality and lead to better correlations. Not yet resolved is a systematic offset between the measurements obtained by the SailBuoy and the reference instruments of $\pm 0.03\,\mathrm{m/s}$. Possible reasons are discussed to be the differences between instruments (various products) as well as changes in background noise levels due to environmental conditions.

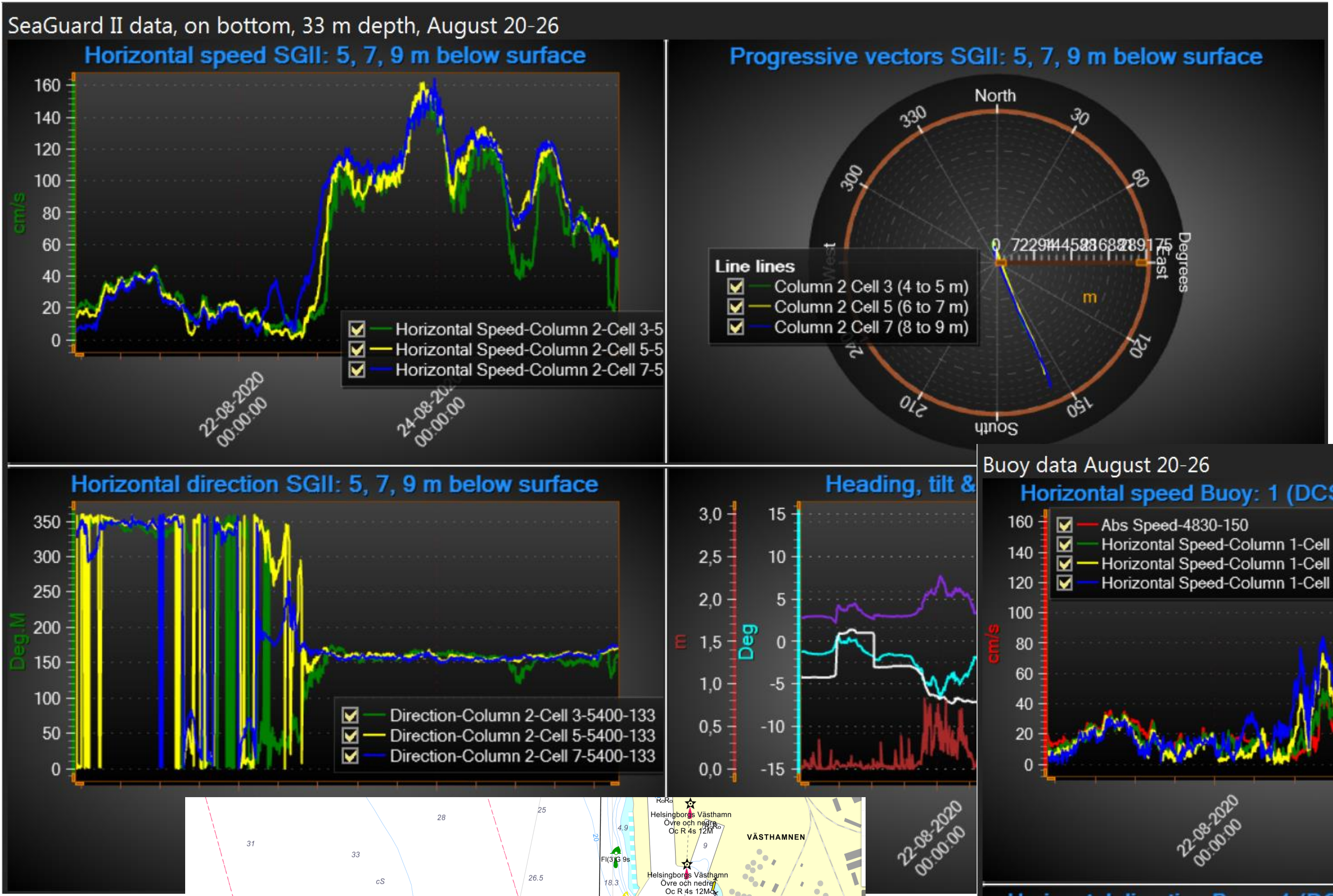


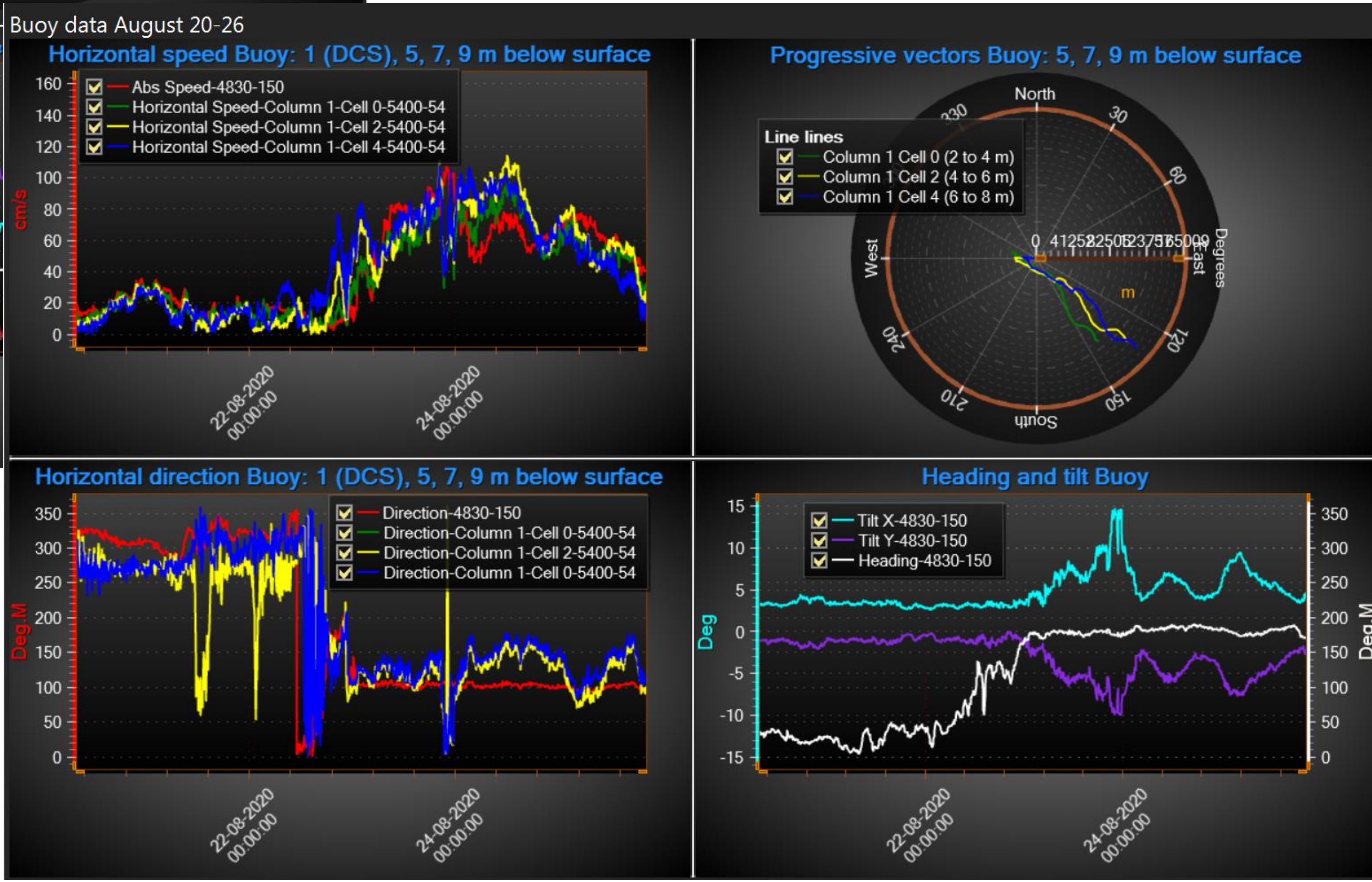


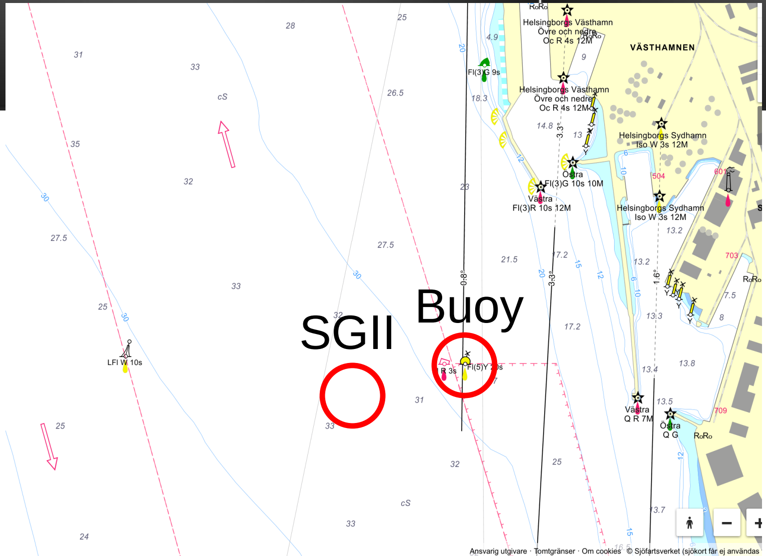


DCPS on buoy & moored instrument, results

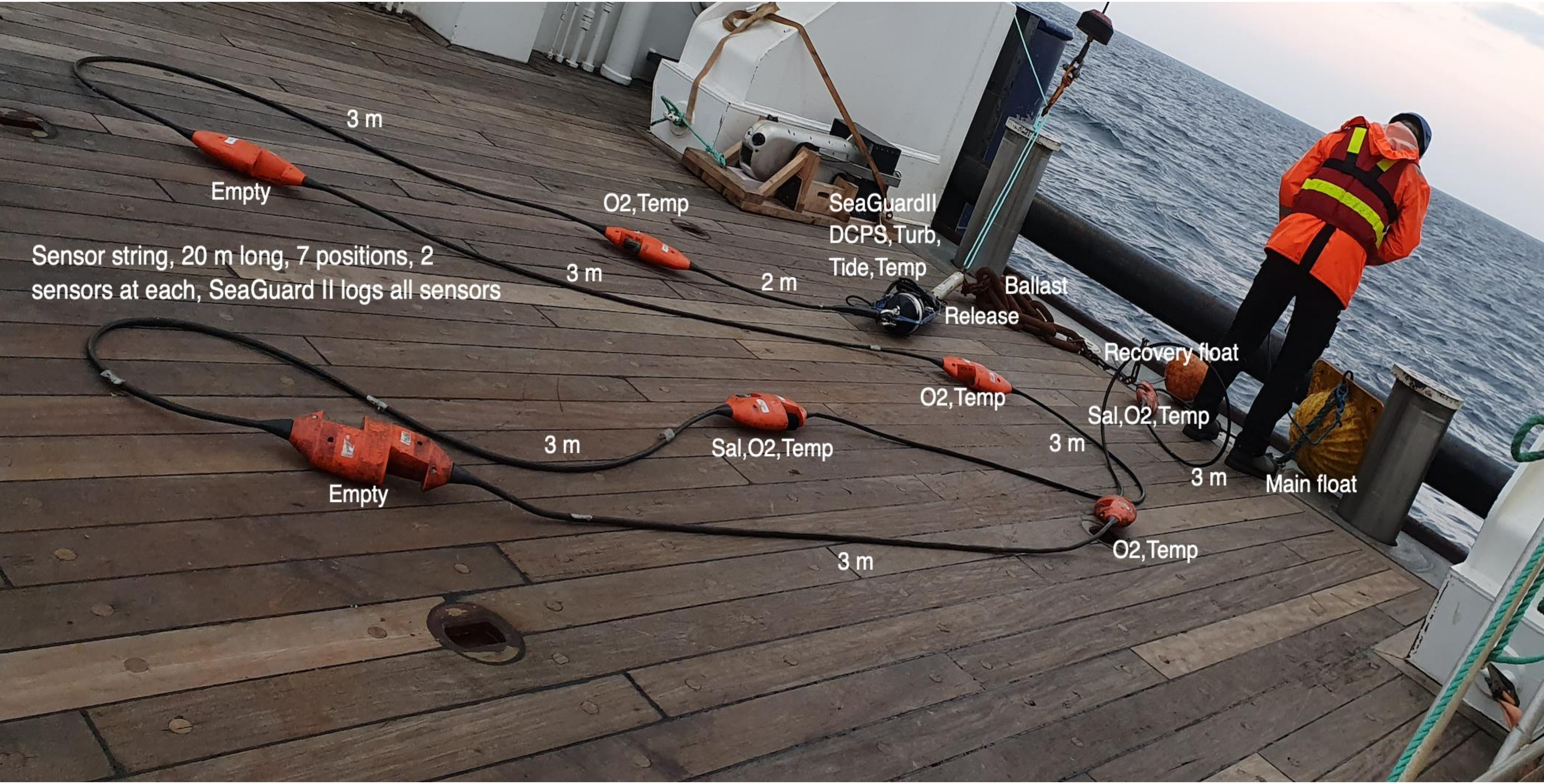
Two platforms are constantly moving, crucial with tilt & heading compensation for every acoustic ping. In AADI current sensors it is done automatically on the fly



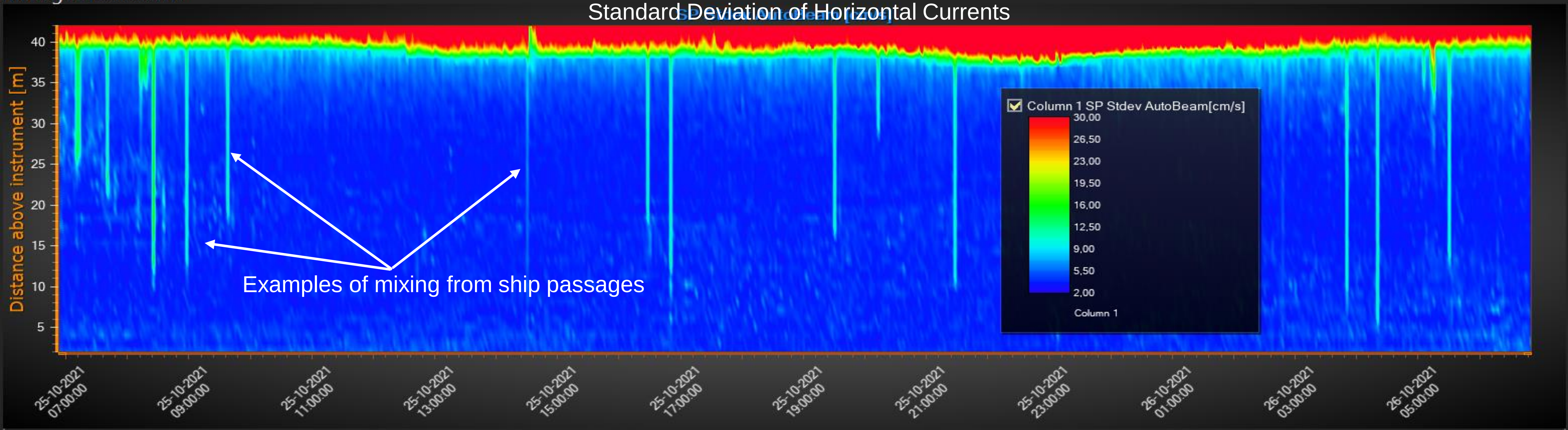


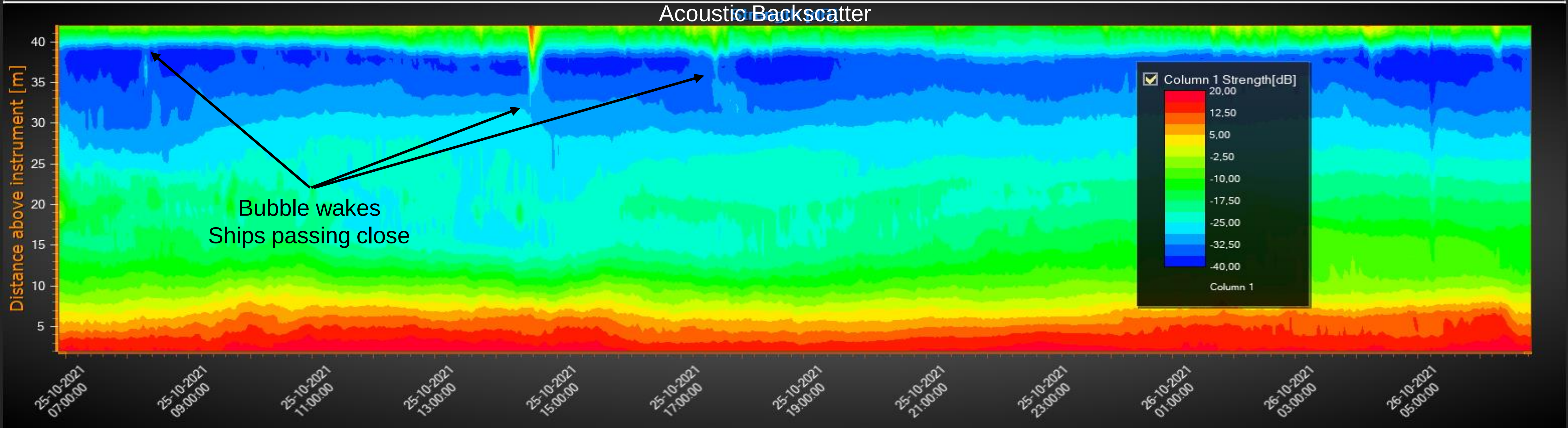


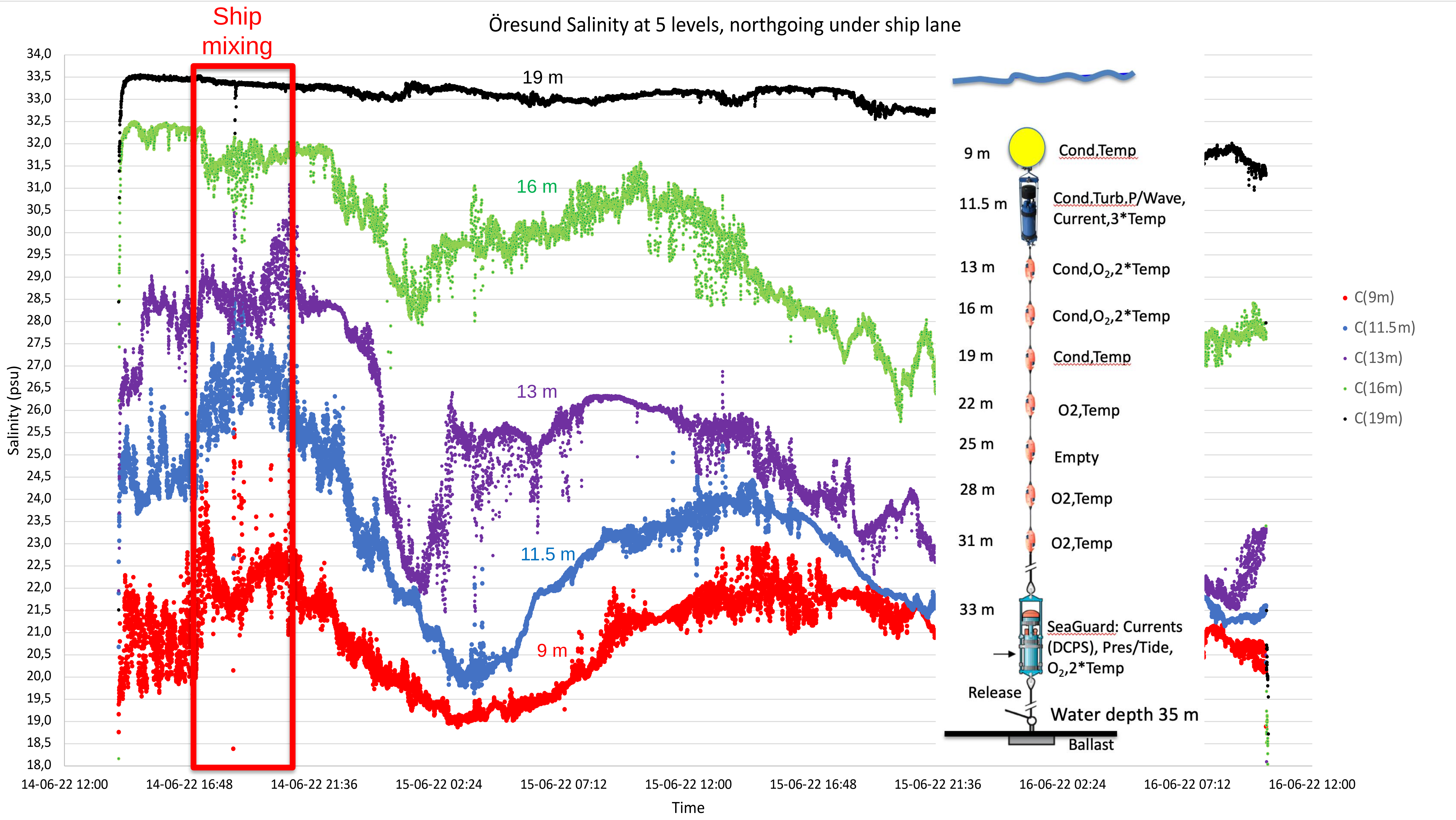
SeaGuardII string, Measurements under ship lanes



Mixing & Backscatter







Öresund Salinity at 5 levels, northgoing under ship lane
Ship mixing
19 m
16 m
13 m
11.5 m
9 m
Salinity (psu)
Time
34,0
33,5
33,0
32,5
32,0
31,5
31,0
30,5
30,0
29,5
29,0
28,5
28,0
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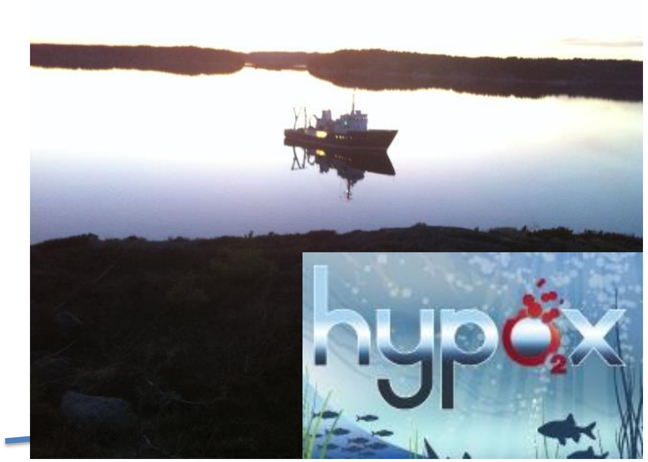
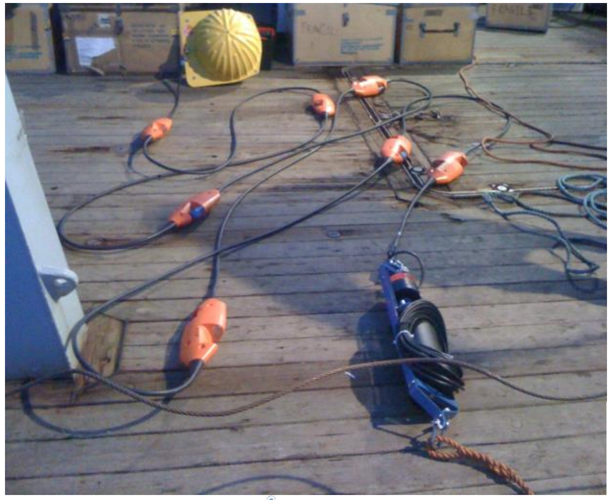
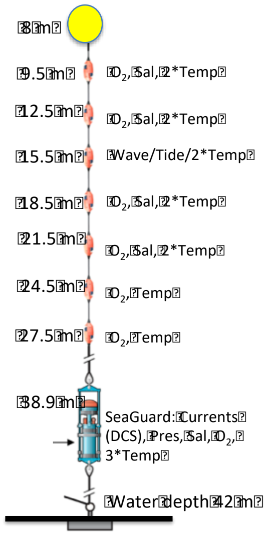
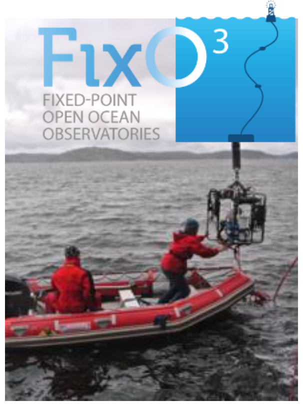
21,5
21,0
20,5
20,0
19,5
19,0
18,5
18,0
14-06-22 12:00
14-06-22 16:48
14-06-22 21:36
15-06-22 02:24
15-06-22 07:12
15-06-22 12:00
15-06-22 16:48
15-06-22 21:36
16-06-22 02:24
16-06-22 07:12
16-06-22 12:00
9 m Cond,Temp
11.5 m Cond,Turb,P/Wave, Current,3*Temp
13 m Cond,O2,2*Temp
16 m Cond,O2,2*Temp
19 m Cond,Temp
22 m O2,Temp
25 m Empty
28 m O2,Temp
31 m O2,Temp
33 m SeaGuard: Currents (DCPS), Pres/Tide, O2,2*Temp
Release
Water depth 35 m
Ballast
C(9m)
C(11.5m)
C(13m)
C(16m)
C(19m)

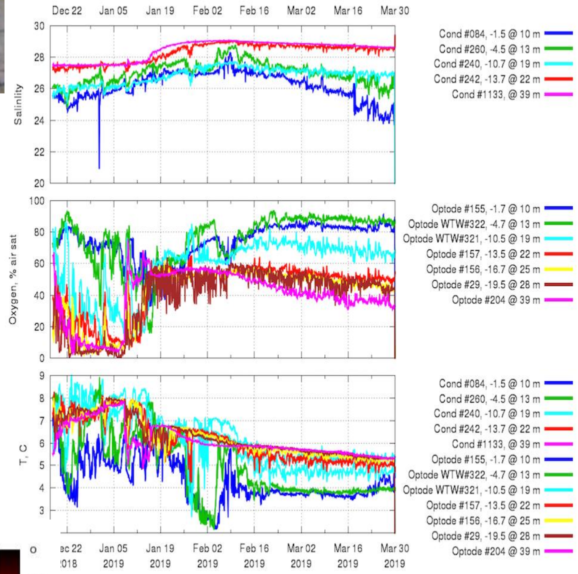
Examples of string solutions: Koljöfjord observatory, running 2011-2021

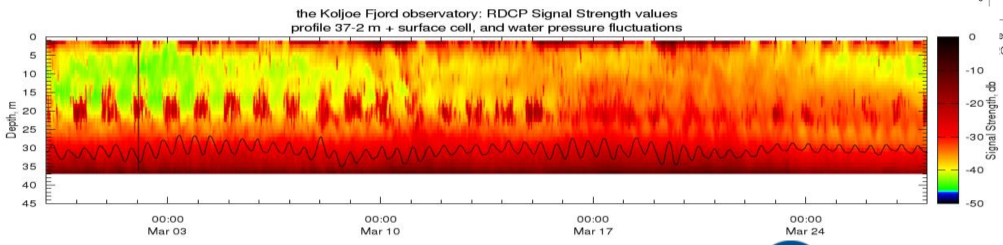












AVANCEZ 1829

UNIVERSITY OF GOTHENBURG

marum Research Faculty Universität Bremen

SENSEnet

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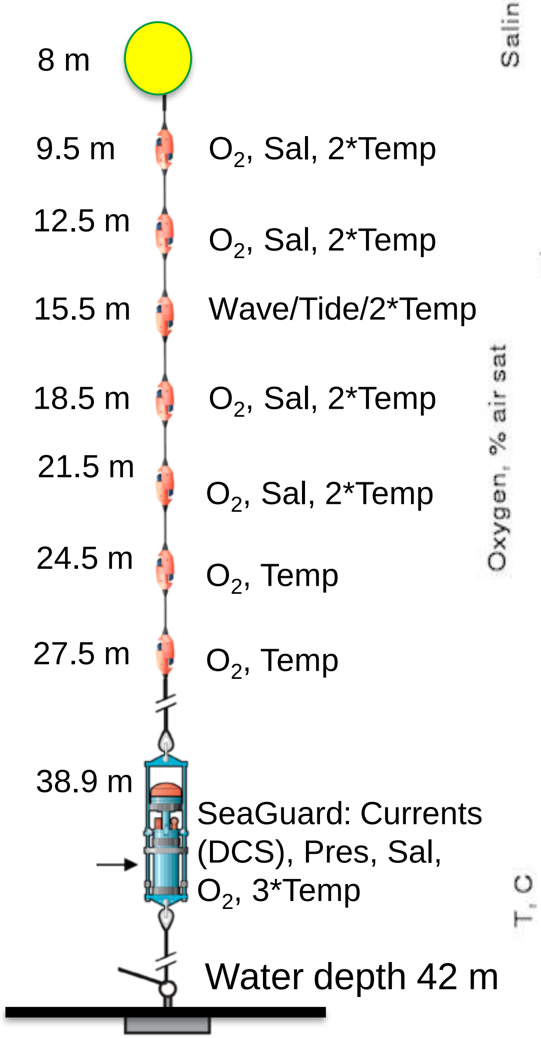
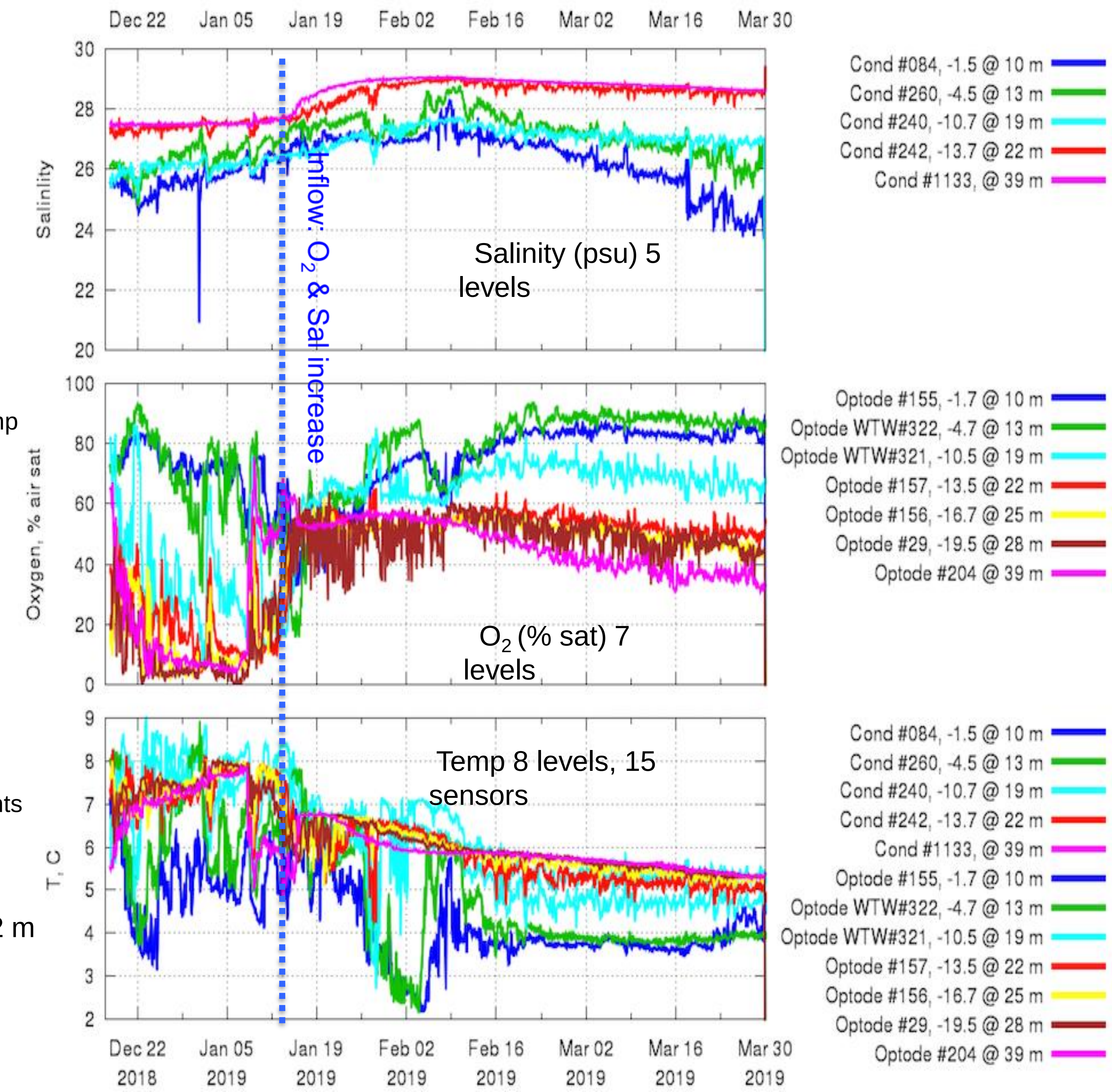
Typical basic configuration
Example of data





Koljoefjord Publications

Contents lists available at ScienceDirect

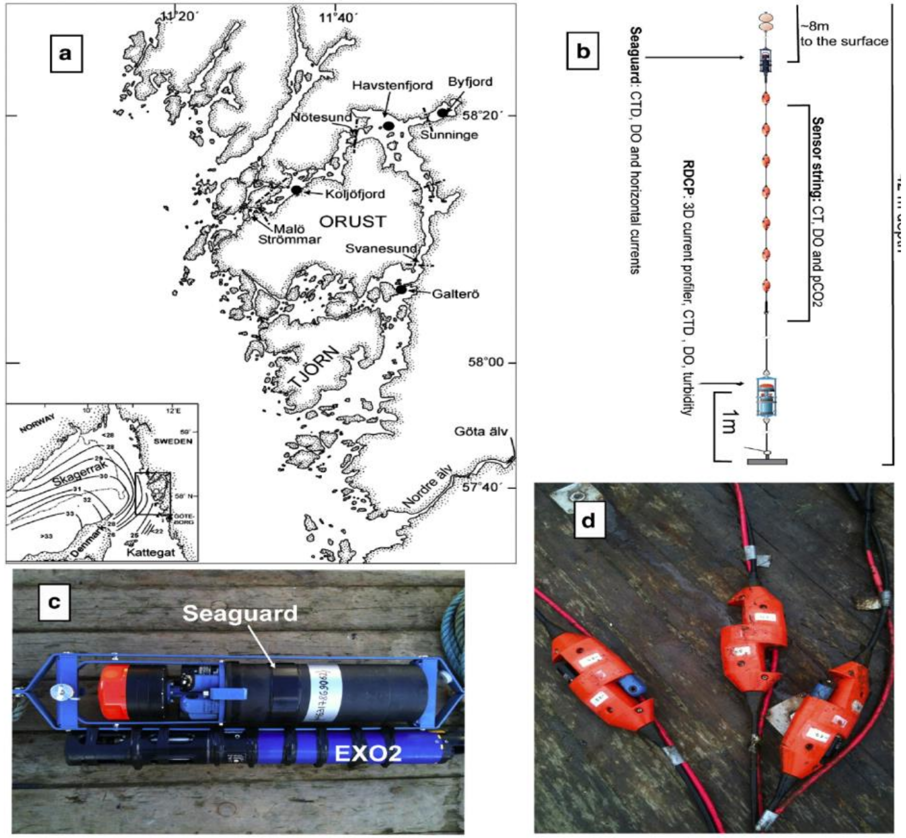
Journal of Marine Systems

journal homepage: www.elsevier.com/locate/jmarsys

Continuous long-term observations of the carbonate system dynamics in the water column of a temperate fjord

Dariia Atamanchuk [a,*], Mikhail Kononets [a], Peter J. Thomas [b], Jostein Hovdenes [c], Anders Tengberg [a,c], Per O.J. Hall [a]

[a] Department of Chemistry and Molecular Biology, Marine Chemistry, University of Gothenburg, SE-412 96 Gothenburg, Sweden
[b] Christian Michelsen Research AS, P.O. Box 6031, NO-5892 Bergen, Norway
[c] Aanderaa Data Instruments AS, Sanddalsringen 5b, P.O. Box 103, Midtun, NO-5828 Bergen, Norway

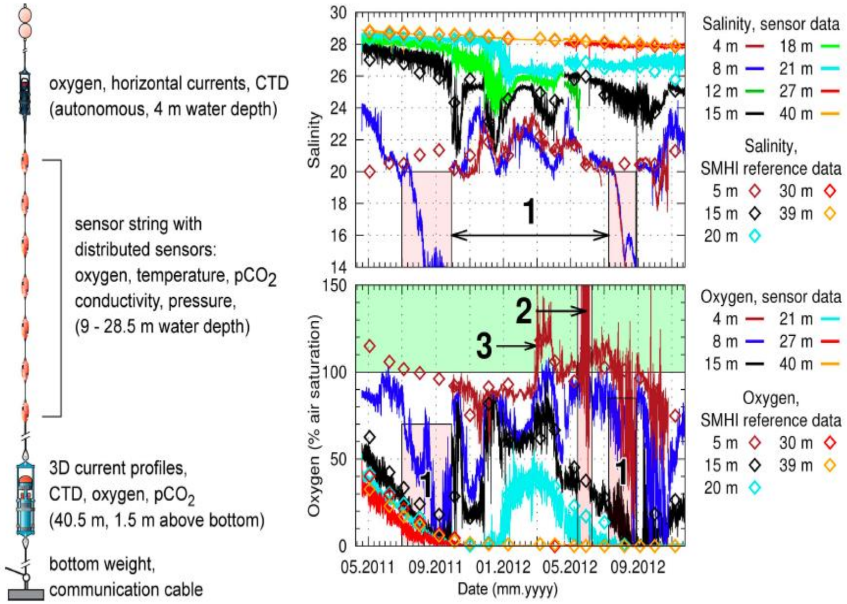


Biogeosciences, 11, 1215–1259, 2014
www.biogeosciences.net/11/1215/2014/
doi:10.5194/bg-11-1215-2014

Biogeosciences Open Access

Investigating hypoxia in aquatic environments: diverse approaches to addressing a complex phenomenon

J. Friedrich[1,2,a], F. Janssen[2,3,a], D. Aleynik[4], H. W. Bange[5], N. Boltacheva[6], M. N. Çagatay[7], A. W. Dale[5], G. Etiope[8,9], Z. Erdem[7,b], M. Geraga[10], A. Gilli[11], M. T. Gomoiu[12], P. O. J. Hall[13], D. Hansson[14], Y. He[1,c], M. Holtappels[3], M. K. Kirf[15], M. Kononets[13], S. Konovalov[16], A. Lichtschlag[3,d], D. M. Livingstone[17], G. Marinaro[8], S. Mazlumyan[6], S. Naeher[15,e], R. P. North[17,f], G. Papatheodorou[10], O. Pfannkuche[5], R. Prien[18], G. Rehder[18], C. J. Schubert[15], T. Soltwedel[2], S. Sommer[5], H. Stahl[4], E. V. Stanev[1], A. Teaca[12], A. Tengberg[13], C. Waldmann[19], B. Wehrli[15], and F. Wenzhöfer[2,3]



Koljoefjord Publications

Automatic water mixing event identification in the Koljö fjord observatory data

Markus Götz[1,3] · Mikhail Kononets[2] · Christian Bodenstein[1,3] · Morris Riedel[1,3] · Matthias Book[3] · Olafur Petur Palsson[3]

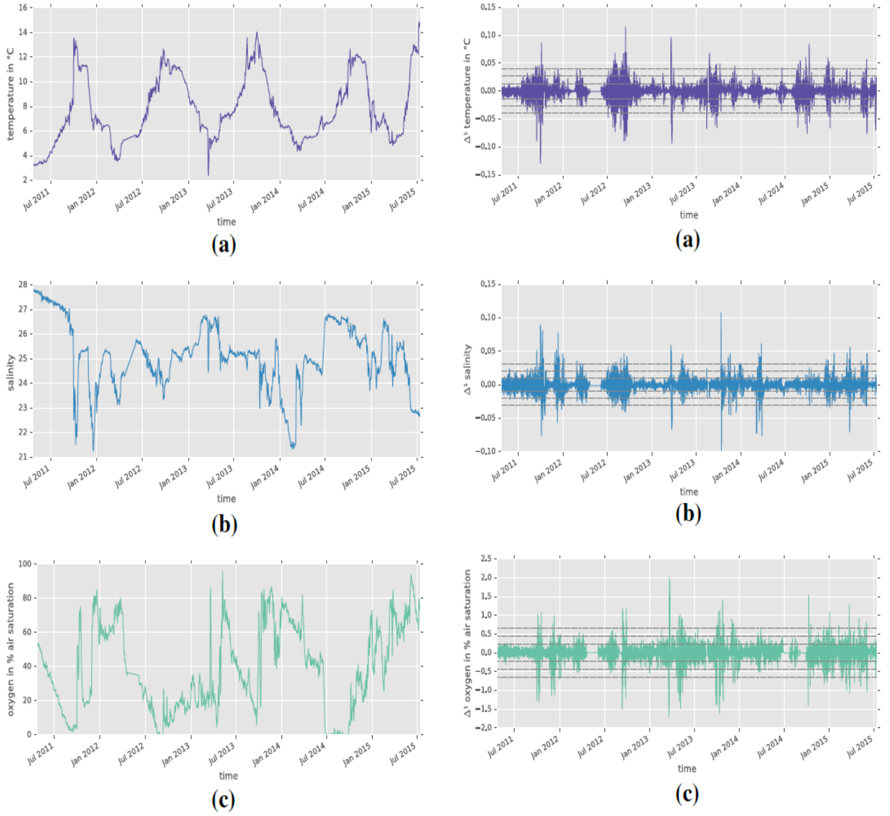


Fig. 5 One-step difference of the signals, including one, two and three

LIMNOLOGY and OCEANOGRAPHY: METHODS

Limnol. Oceanogr.: Methods 12, 2014, 63–73

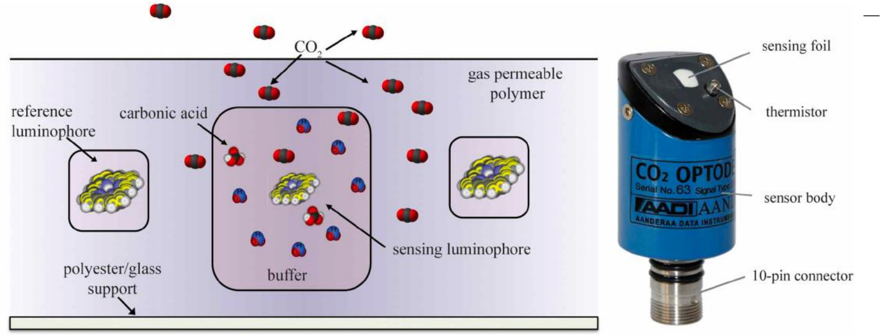
Performance of a lifetime-based optode for measuring partial pressure of carbon dioxide in natural waters

Dariia Atamanchuk[1], Anders Tengberg[1,2], Peter J. Thomas[3], Jostein Hovdenes[2], Athanas Apostolidis[4], Christian Huber[4], and Per O.J. Hall[1]*

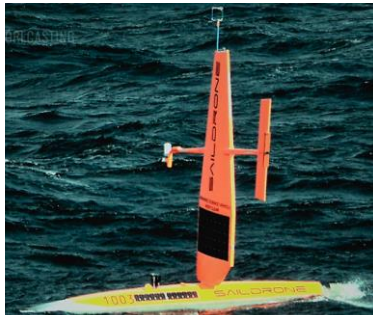
[1]Department of Chemistry and Molecular Biology, Marine Chemistry, University of Gothenburg, SE-412 96 Gothenburg, Sweden
[2]Aanderaa Data Instruments AS, NO-5828 Bergen, Norway
[3]Christian Michelsen Research AS, NO-5892 Bergen, Norway
[4]PreSens GmbH, 93053 Regensburg, Germany

Abstract

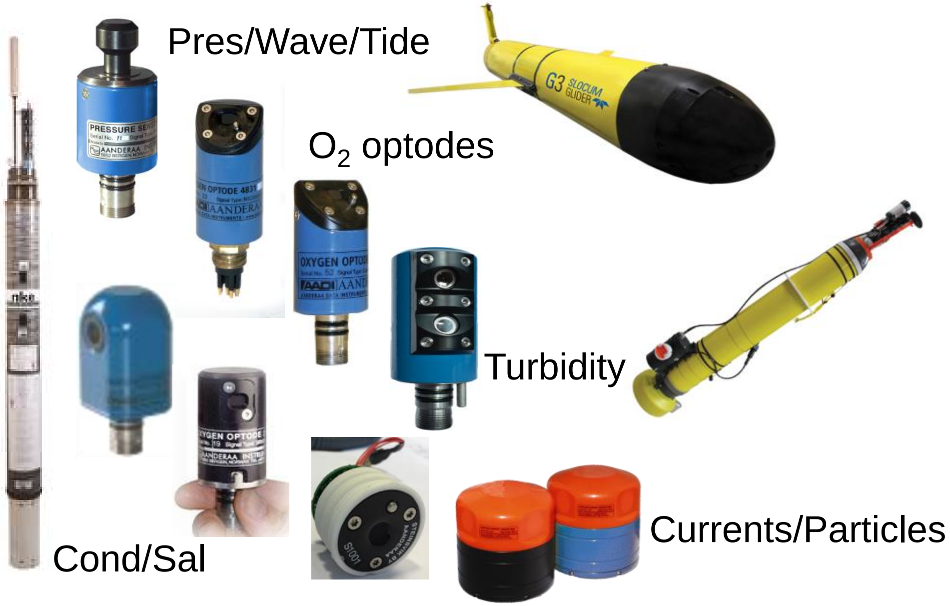
This article reports the performance of an improved, newly developed, compact, low power, lifetime-based optical sensor (optode) for measuring partial pressure of dissolved CO_2 gas (pCO_2) in natural waters. The results suggest that after preconditioning, these sensors are stable in water for time periods longer than 7 months. The wide dynamic range of about 0-50000 µatm opens possibilities for numerous applications of which some are presented. In normal marine environments with pCO_2 levels of 200-1000 µatm, the best-obtained precision was about ±2 µatm, and the absolute accuracy was between 2-75 µatm, depending on the deployment and the quality of the collected reference water samples. One limitation is that these sensors will become irreversibly poisoned by H_2S and should thus not be deployed in sulphidic environments.



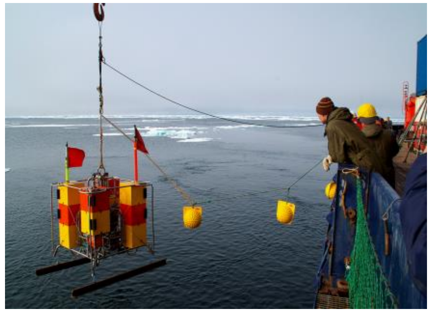
Aanderaa sensors on Autonomous moving platforms

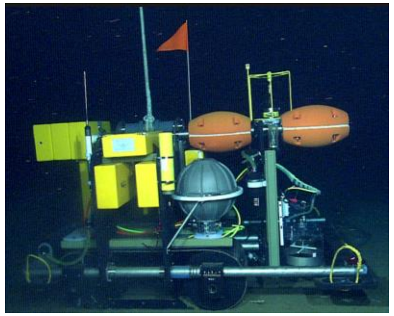


Water column profiling



Bottom





Rivers/Hydrology/ Hyporheic

Birkel (2013), Malcolm (2006, 2008, 2010), Soulsby (2008)

Surface Roaming

Ghani (2014)

Technology evaluation

Tengberg (2006), McNeil (2014), Bittig (2018)

Animal-borne

Bailleul (2015)

Buoys

Jannash (2008), Bushinsky (2013)

AUV

Clark (2012)

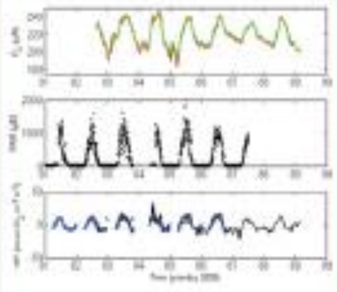
+200 Scientific Papers

Gliders

UV antifouling

Nicholson (2008, 2017), Pizarro (2016), DeYoung (2018), Queste (2018)

Gradients



McGillis (2011), Champenois (2012), Atamanchuk (2015)

...e zones

Oguri (2015)

Incubators

Draze... ...mer (2008), Ca... Almroth (2012)... (2013), Niemisto (20...

Ferry boxes

Hydes (2009), Hartman (2014)

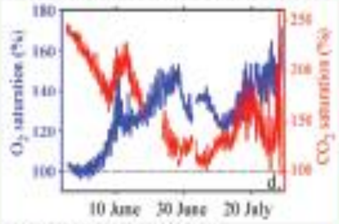
Carbon Capture & Storage

Atamanchuk (2015)

Well boat for fish transport

Thomas (2017)

Lake Metabolism

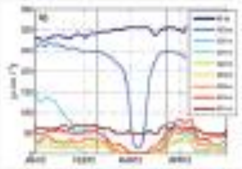


Peeters (2016)

Argo floats

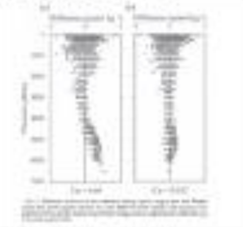
Körtzinger (2004), Johnson (2010), Fiedler (2013), Takeshita (2013), Johnson (2015), Wolf (2018)

Moorings



Stramma (2014), Viktorsson (2012)

Cabled CTD



Uchida (2008)

Chryosphere

Bagshaw (2016)

Deployment of SeaGuard in Marmara Sea during earthquake

SeaGuard: Deployed on bottom lander at 700 m in Marmara Sea (Turkey), Earthquake with turbidity current, lander tipped over. Current (single point), Temp, Oxygen, Salinity, Pressure/Tide

SeaGuard: In water: 6 months,
60 min interval

Reference data: No, atmospheric measurements before/after deployment, comparison with quartz pressure, multiple temp,

Publication(s): Yes

Detection of arrival of turbidity current by backscatter.

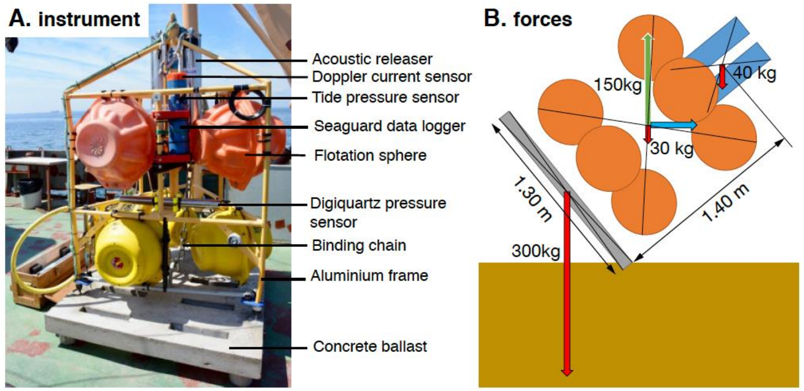


Figure 2. Instrumented frame. (A) photo of the instrumented frame before deployment. (B) Sketch showing forces applied to the elements of the instrumented frame in water. The red arrows represent the weight in water of the cement ballast, of the instrumented frame and of the acoustic release system on top. The green arrow represents the buoyancy of the flotation spheres. The blue arrow represents the current drag, which depends on current speed and instrument tilt.

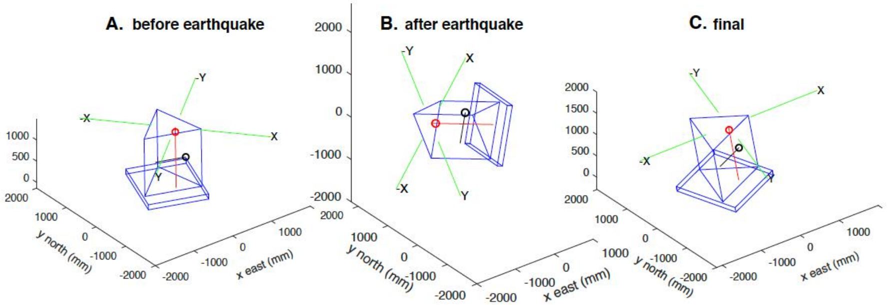


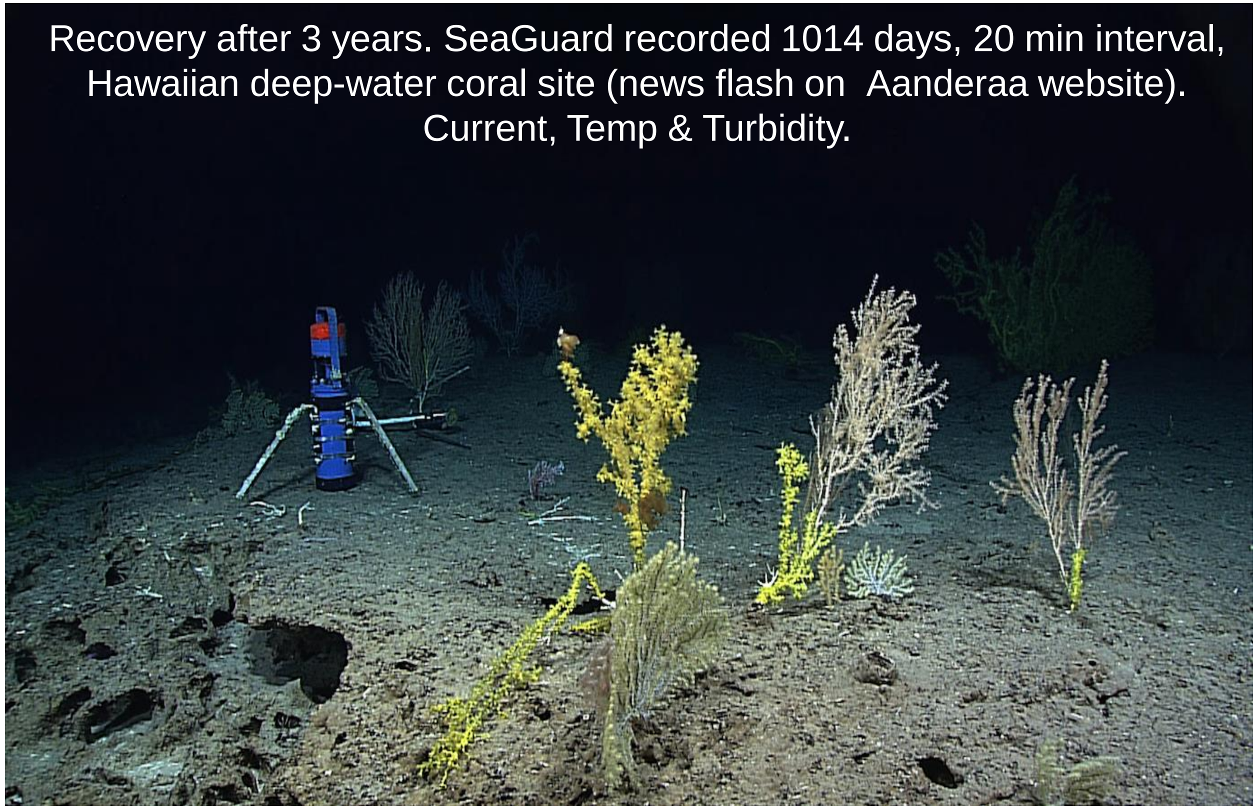
Figure 3. Reconstruction of frame position based on instrument tilt-meter and compass data: (A) before the earthquake; (B) Tilted, between, 25 minutes and 10.5 hours after earthquake; (C) back in nearly upright position 11 hours after earthquake. Position of Digiquartz pressure sensor (black circle), Aanderaa tide sensor (red circle) and Doppler current meter beam cells (green segments)

https://doi.org/10.5194/nhess-2021-323
Preprint. Discussion started: 22 November 2021

Natural Hazards and Earth System Sciences
Open Access
Discussions

Slow build-up of turbidity currents triggered by a moderate earthquake in the Sea of Marmara

Pierre Henry[1], M Sinan Özeren[2], Nurettin Yakupoğlu[3], Ziyadin Çakir[3], Emmanuel de Saint-Léger[4], Olivier Desprez de Gésincourt[4], Anders Tengberg[5], Cristele Chevalier[6], Christos Papoutsellis[1], Nazmi Postacıoğlu[7], Uğur Dogan[8], Hayrullah Karabulut[9], Gülsen Uçarkuş[3], M Namık Çağatay[3]



En bøye kommer opp gjennom isen under toktet i Weddellhavet i 2017. (Foto: Jerome Demanges)

Reddet utstyr i Antarktis og fikk opp uventede data

AGU100 ADVANCING EARTH AND SPACE SCIENCE

Geophysical Research Letters

RESEARCH LETTER

10.1002/2017GL076320

Seasonal Outflow of Ice Shelf Water Across the Front of the Filchner Ice Shelf, Weddell Sea, Antarctica

E. Darelius[1] and J. B. Sallée[2]

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Key Points:
- A 4-year long mooring record shows seasonal outflow of ISW across the western part of the Filchner ice shelf front
- We hypothesize that the outflow is linked to observed changes in the stratification through PV dynamics
- The outflow of ISW across the eastern part of the ice shelf front is more persistent

Supporting Information:
- Supporting Information S1

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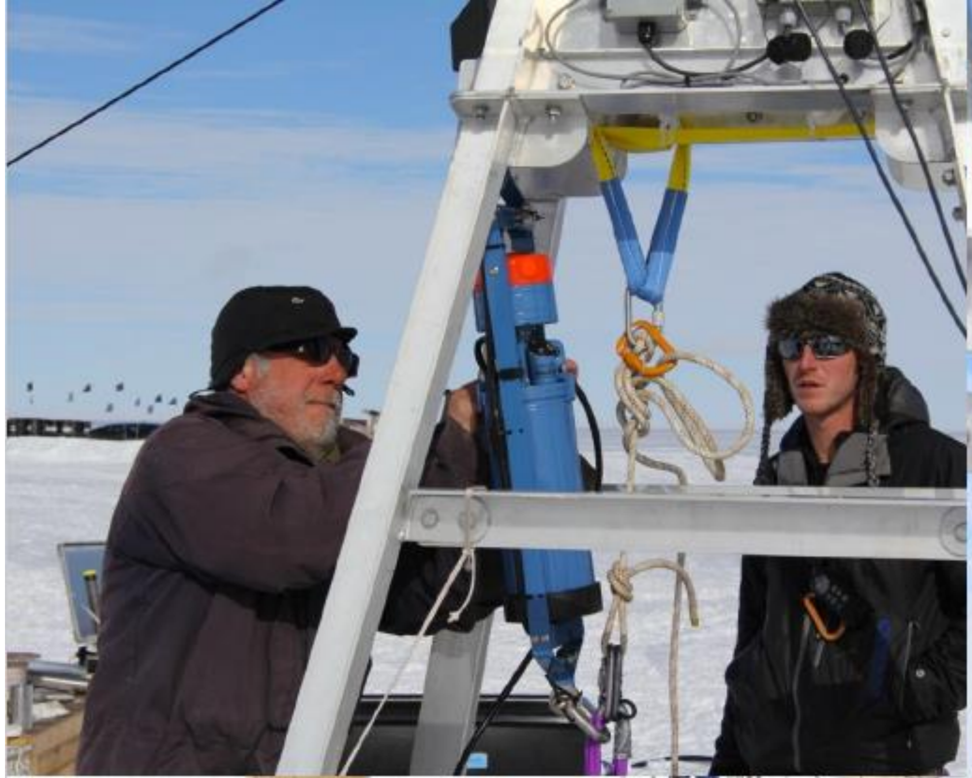
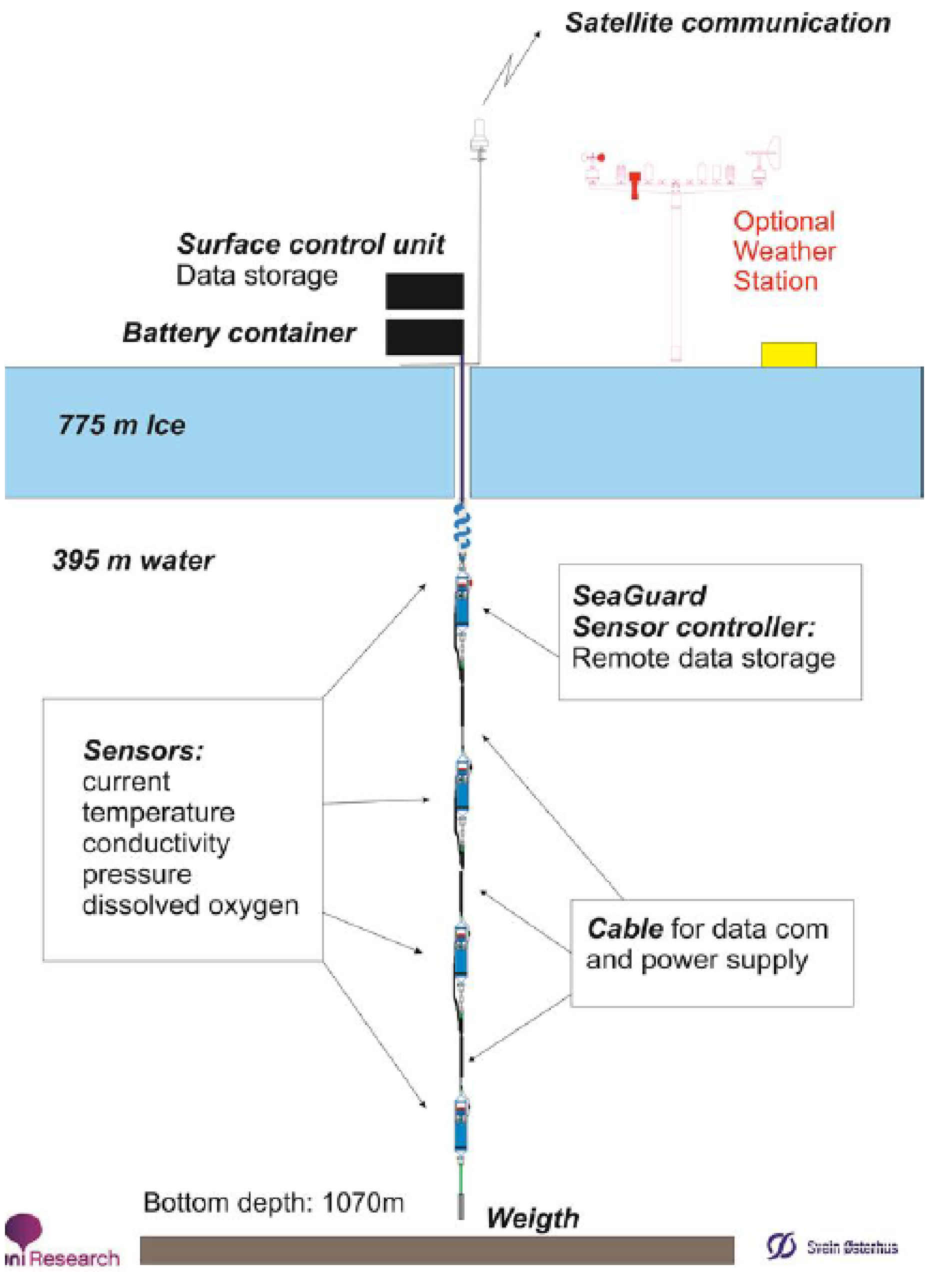
Abstract The ice shelf water (ISW) found in the Filchner Trough, located in the southern Weddell Sea, Antarctica, is climatically important; it descends into the deep Weddell Sea contributing to bottom water formation, and it blocks warm off-shelf waters from accessing the Filchner ice shelf cavity. Yet the circulation of ISW within the Filchner Trough and the processes determining its exchange across the ice shelf front are to a large degree unknown. Here mooring records from the ice shelf front are presented, the longest of which is 4 years long. They show that the coldest ($\Theta = -2.3$°C) ISW, which originates from the Ronne Trough in the west, exits the cavity across the western part of the ice shelf front during late austral summer and early autumn. The supercooled ISW escaping the cavity flows northward with a velocity of about 0.03 m/s. During the rest of the year, there is no outflow at the western site: the current is directed eastward, parallel to the ice shelf front, and the temperatures at the mooring site are slightly higher ($\Theta = -2.0$°C). The eastern records show a more persistent outflow of ISW.





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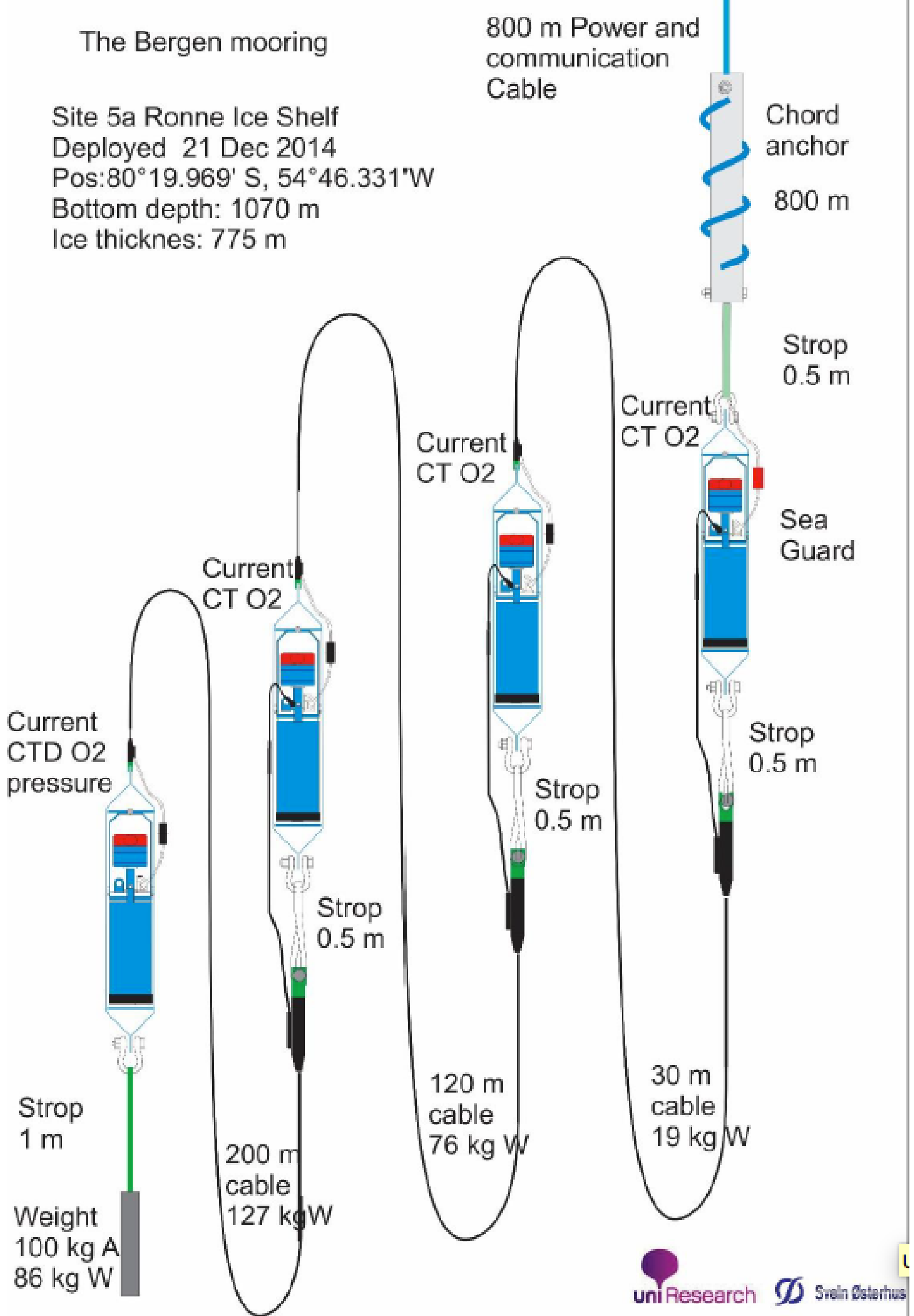

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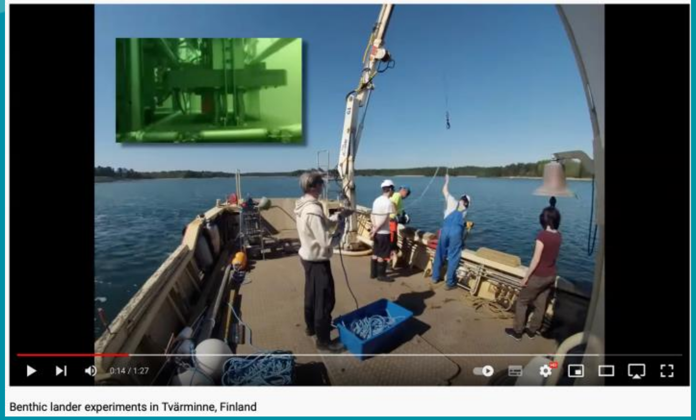

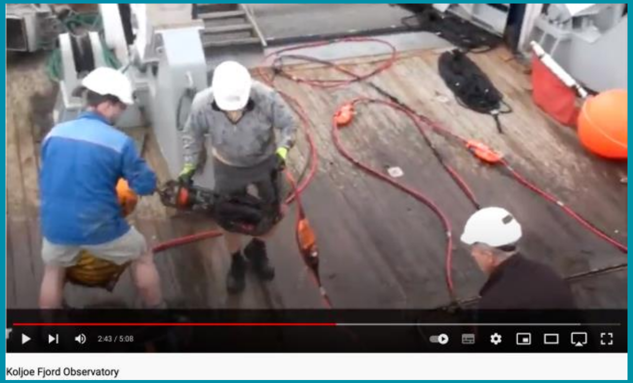

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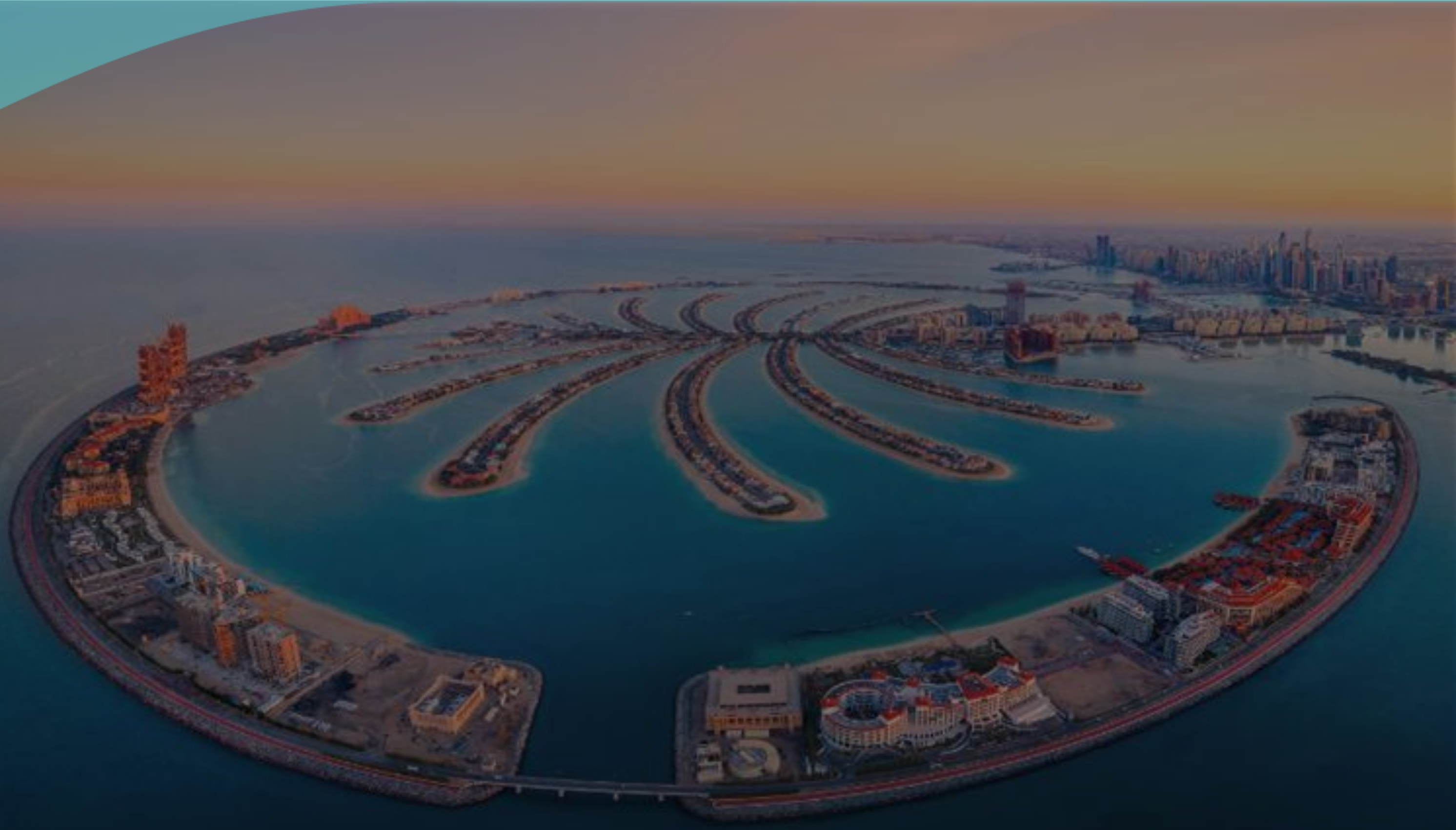

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