DMS and acetone measurements in the Arctic sea ice zone

Charel Wohl[1,2,3,a]

Anna E. Jones[3], William T. Sturges[2], Philip D. Nightingale[1,2,4], Brent Else[5], Brian J. Butterworth[6,7], and Mingxi Yang[1]

[1]Plymouth Marine Laboratory

[2]University of East Anglia

[3]British Antarctic Survey

[4]Sustainable Agriculture Systems

[5]Department of Geography

[6]University of Colorado

[7]NOAA Physical Sciences Laboratory

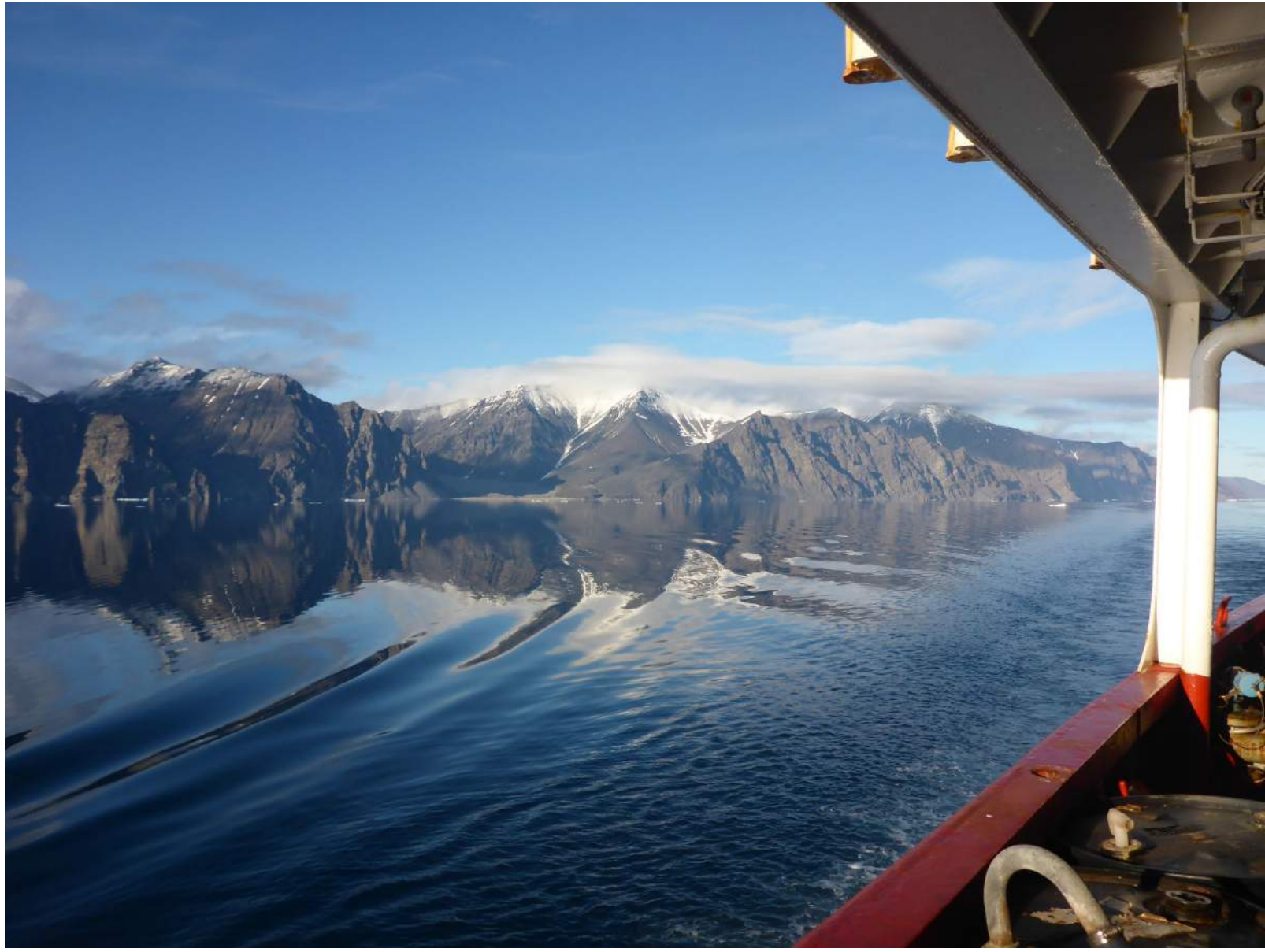
[a]now at: Institut de Ciències del Mar

Plan

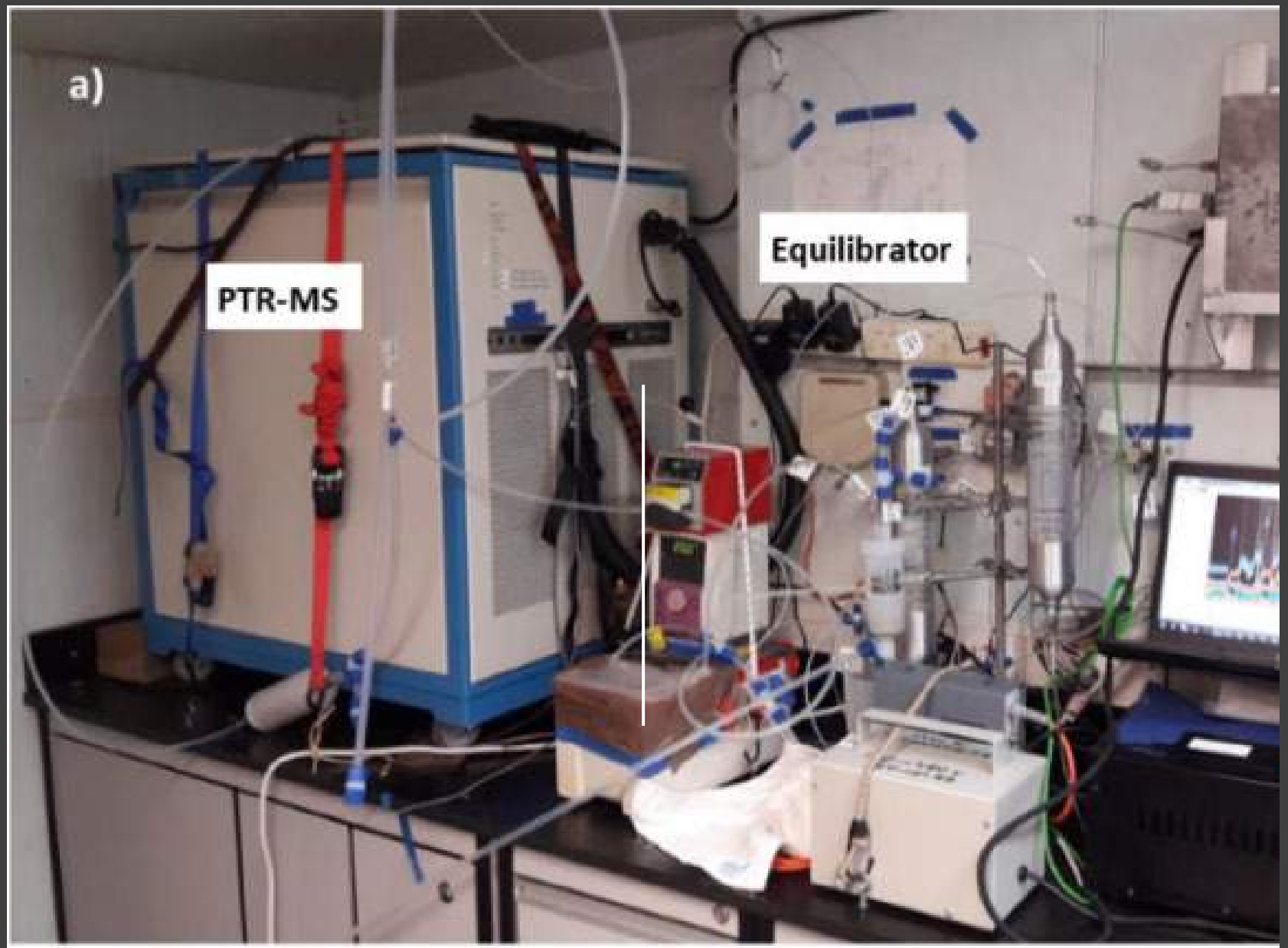
DMS in the Arctic sea ice zone **8 min**

Acetone in the Arctic sea ice zone **8 min**

+ isoprene, acetaldehyde and methanol measured

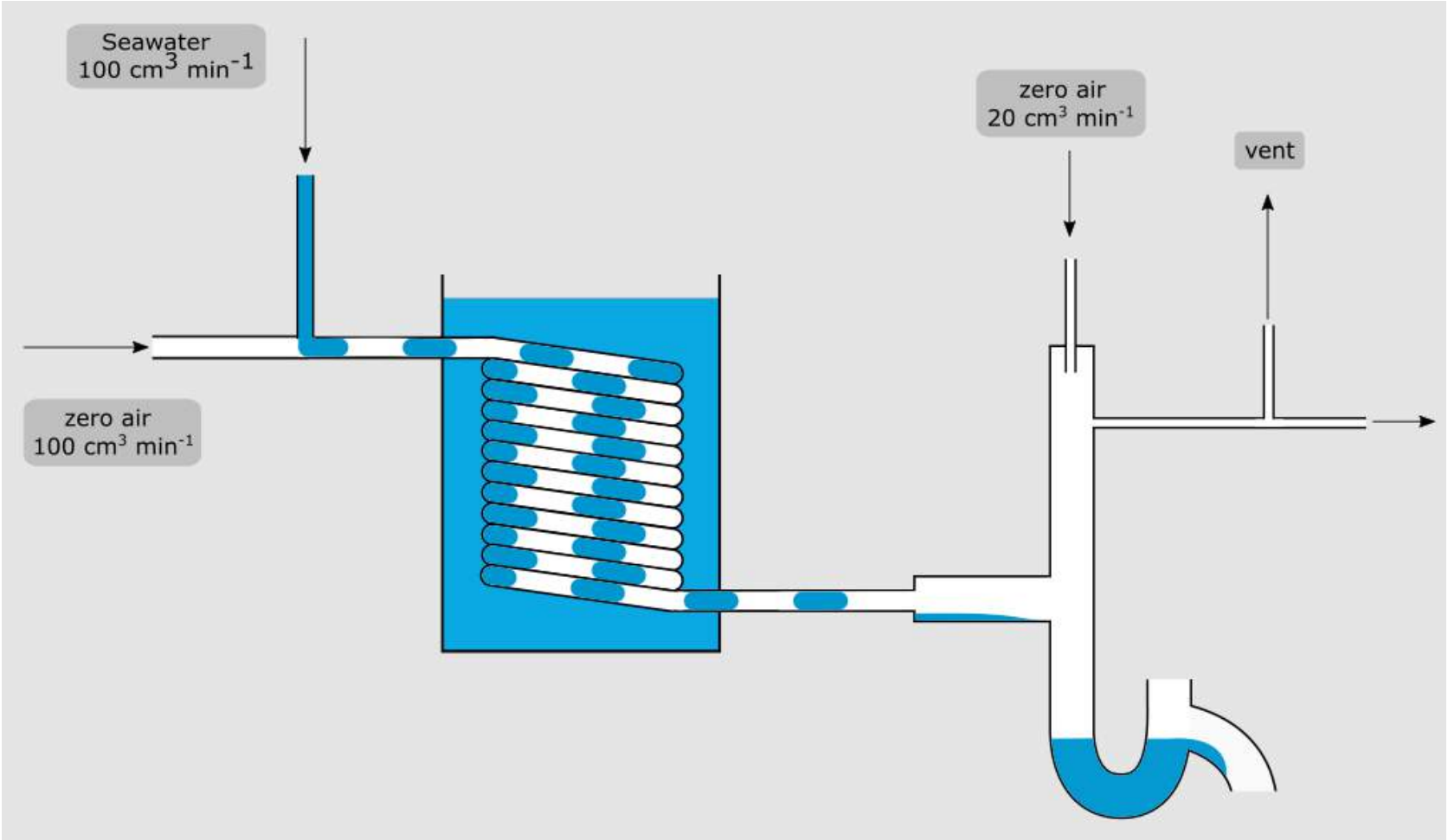


SFCE-PTR-MS



SFCE (segmented flow coil equilibrator)

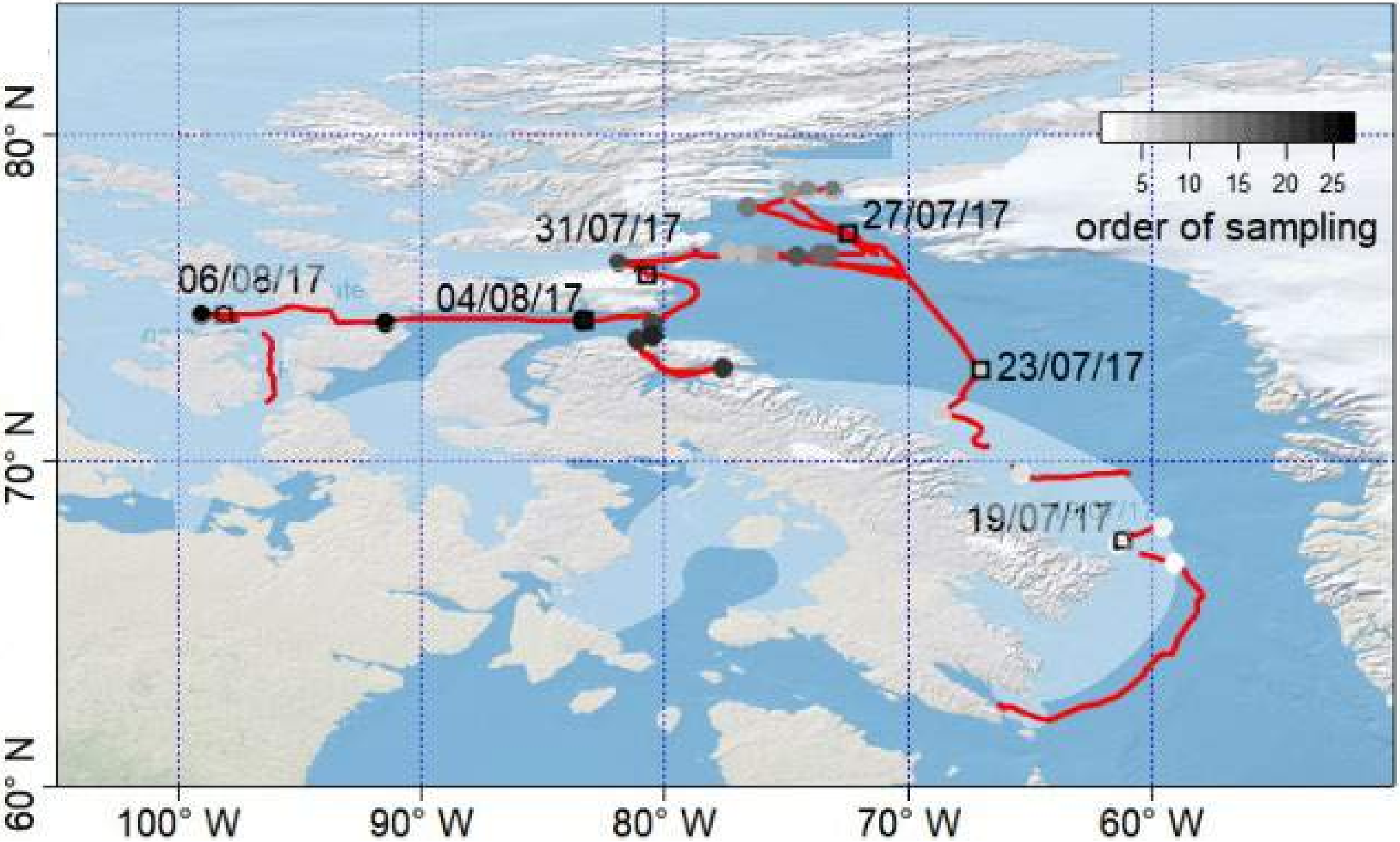
- Response time < 1 min
- Discrete and continuous
- Large range of compounds



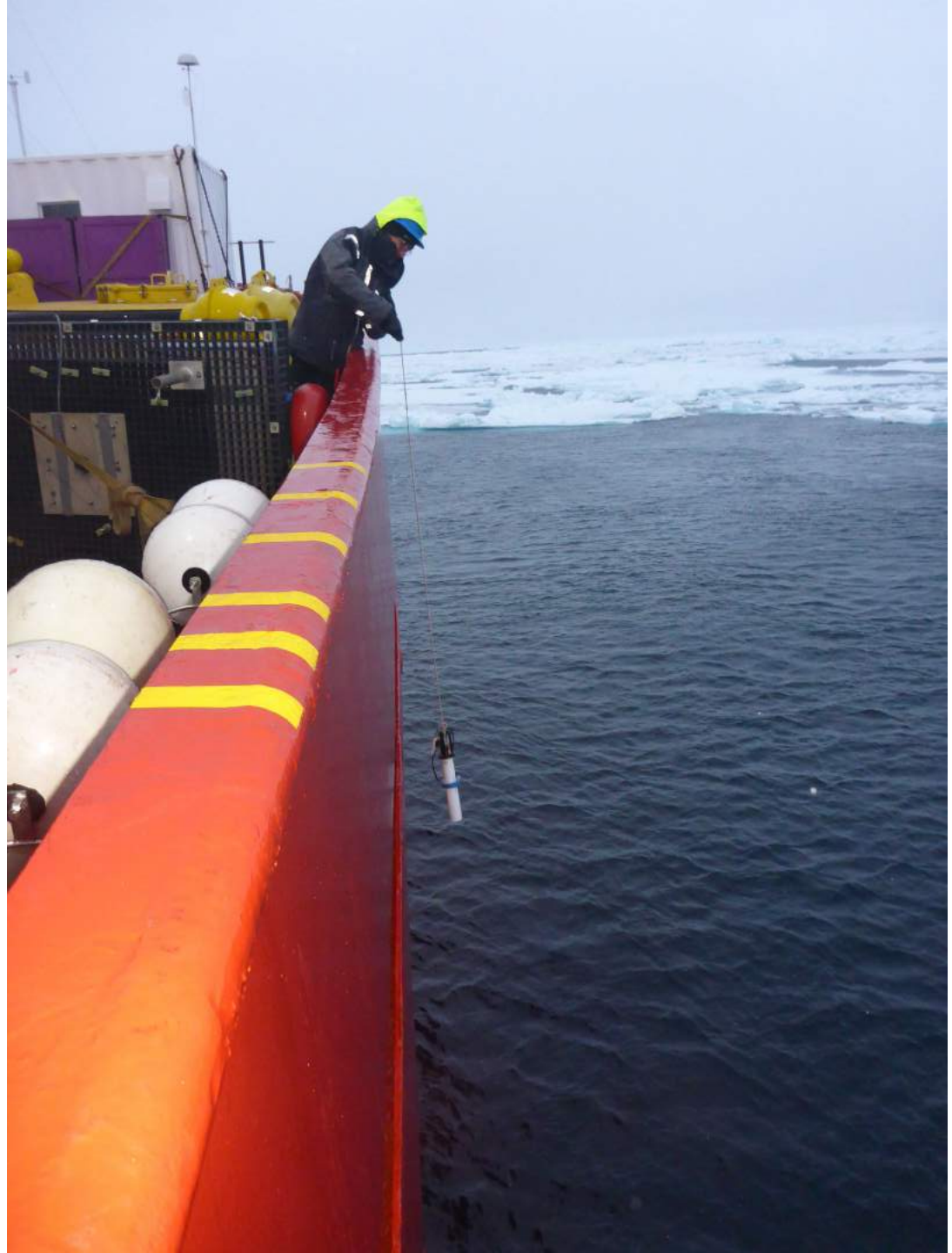
Segmented flow coil equilibrator coupled to a proton-transfer-reaction mass spectrometer for measurements of a broad range of volatile organic compounds in seawater

Charel Wohl[1,2,3], David Capelle[4], Anna Jones[3], William T. Sturges[2], Philip D. Nightingale[1,2,5], Brent G. T. Else[6], and Mingxi Yang[1]

Arctic sea ice and VOCs


80° N
70° N
60° N
100° W
90° W
80° W
70° W
60° W
5
10
15
20
25
order of sampling
27/07/17
31/07/17
06/08/17
04/08/17
23/07/17
19/07/17


CGDT
NO.1

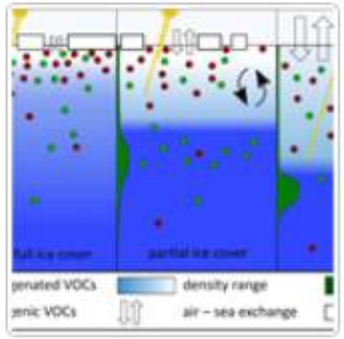


Biogeosciences, 19, 1021–1045, 2022
https://doi.org/10.5194/bg-19-1021-2022

Research article

17 Feb 2022

Sea ice concentration impacts dissolved organic gases in the Canadian Arctic



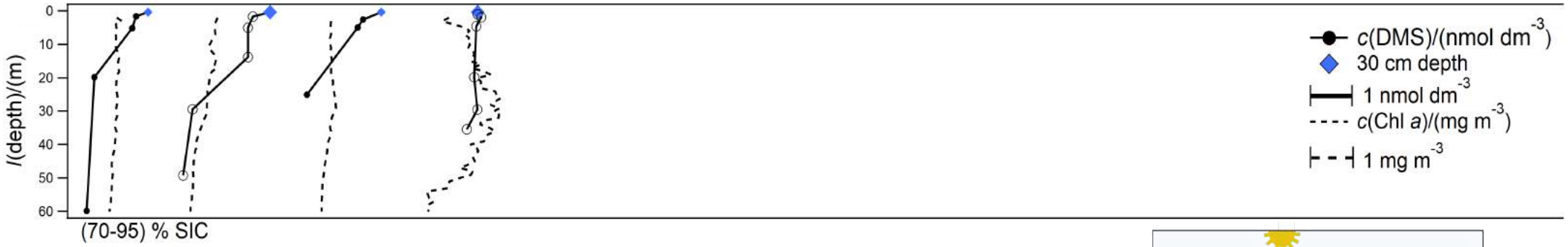
Charel Wohl[1,2,3,a], **Anna E. Jones**[3], **William T. Sturges**[2], **Philip D. Nightingale**[1,2,4], **Brent Else**[5], **Brian J. Butterworth**[6,7], **and Mingxi Yang**[1]

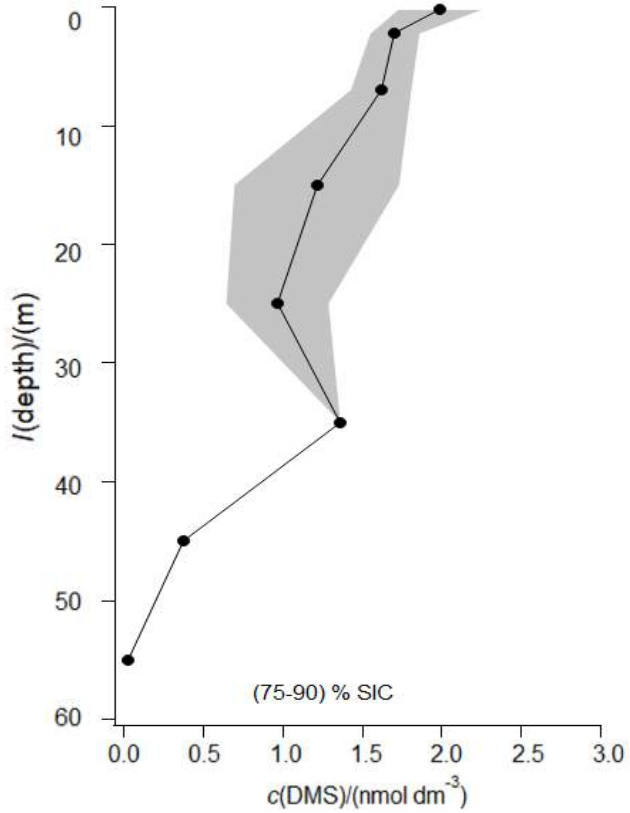
[1]Plymouth Marine Laboratory, Plymouth, PL1 3DH, UK
[2]Centre for Ocean and Atmospheric Sciences, School of Environmental Sciences, University of East Anglia, Norwich, NR4 7TJ, UK
[3]British Antarctic Survey, Natural Environment Research Council, Madingley Road, High Cross, Cambridge, CB3 0ET, UK
[4]Sustainable Agriculture Systems, Rothamsted Research, North Wyke, Devon, EX20 2SB, UK
[5]Department of Geography, University of Calgary, Calgary, Alberta, T2N 1N4, Canada
[6]Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, Colorado, USA
[7]NOAA Physical Sciences Laboratory, Boulder, Colorado, USA
[a]now at: Department of Marine Biology and Oceanography, Institut de Ciències del Mar, Barcelona, 08003, Spain

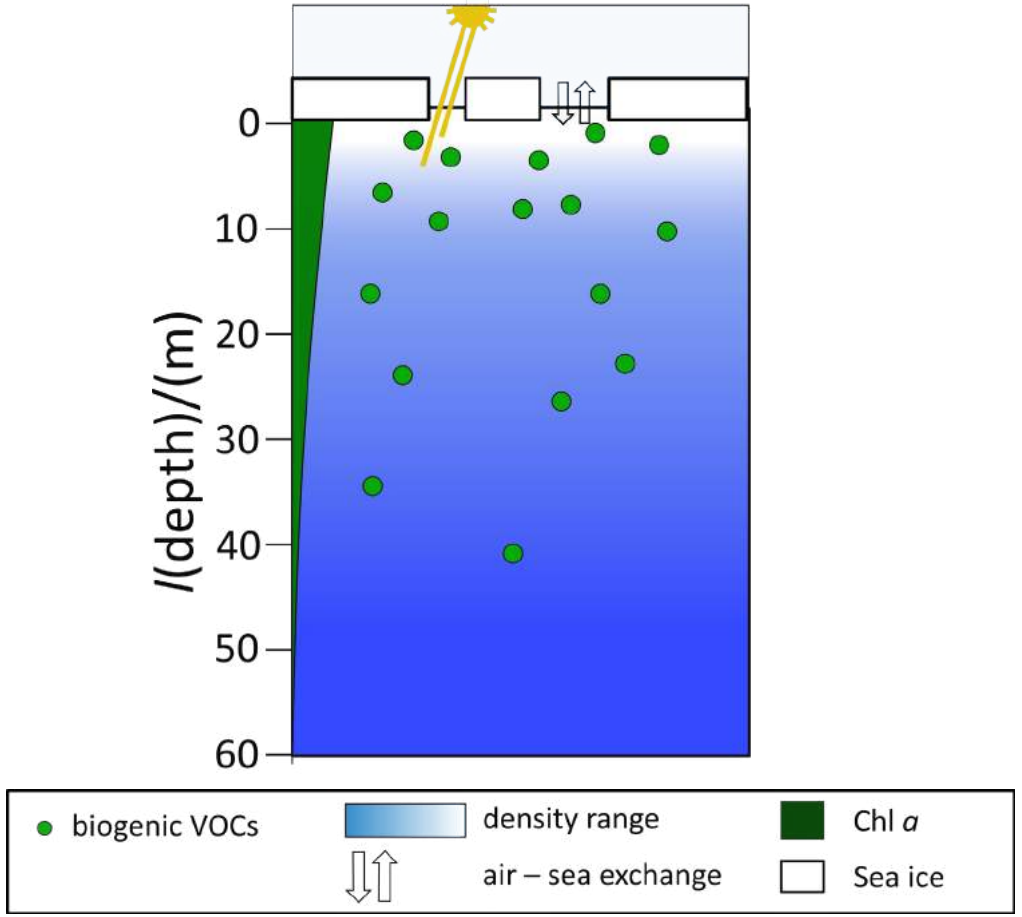
Correspondence: Charel Wohl (charel.wohl@gmail.com) and Mingxi Yang (miya@pml.ac.uk)

Received: 23 Sep 2021 – Discussion started: 13 Oct 2021 – Revised: 29 Dec 2021 – Accepted: 07 Jan 2022 – Published: 17 Feb 2022

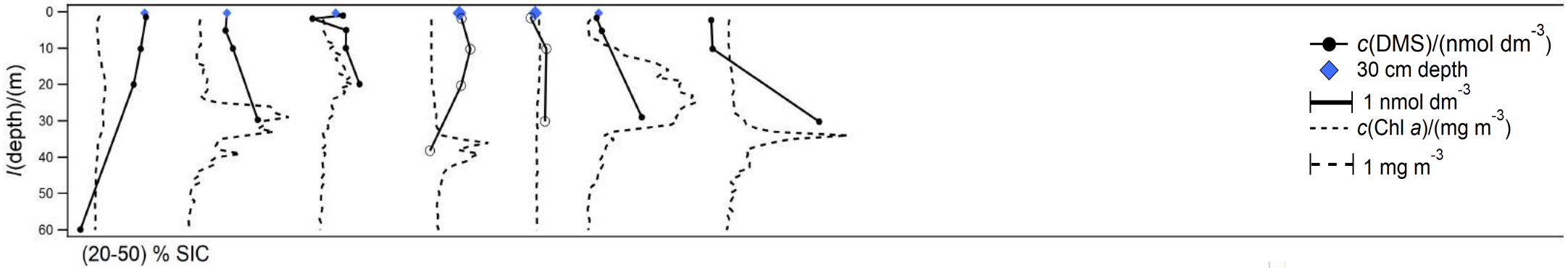
DMS: Near-full ice cover

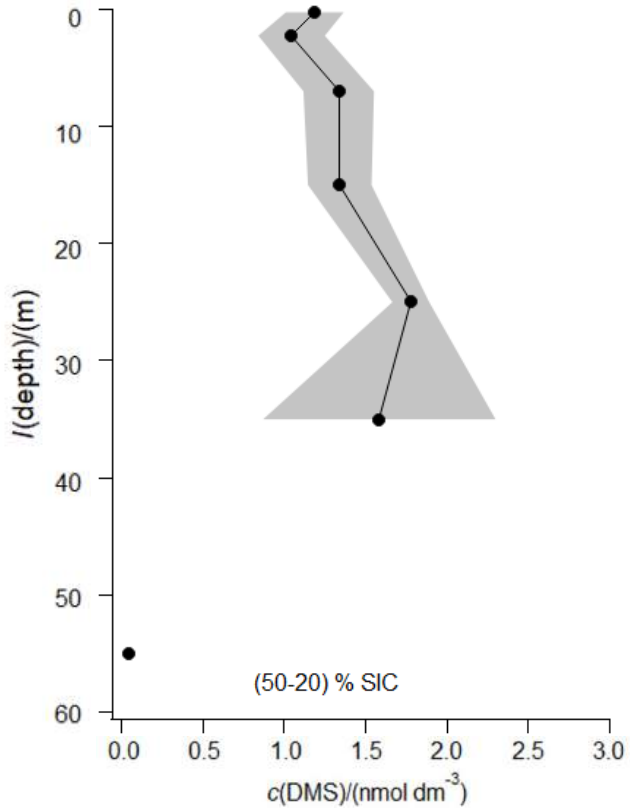


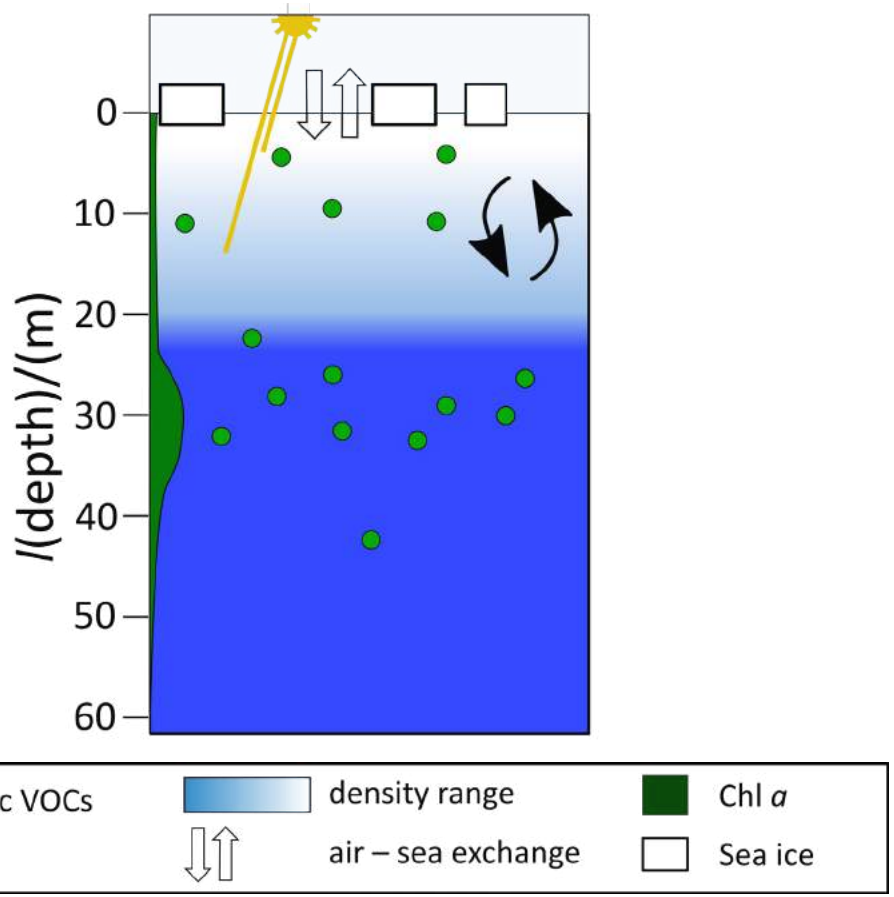




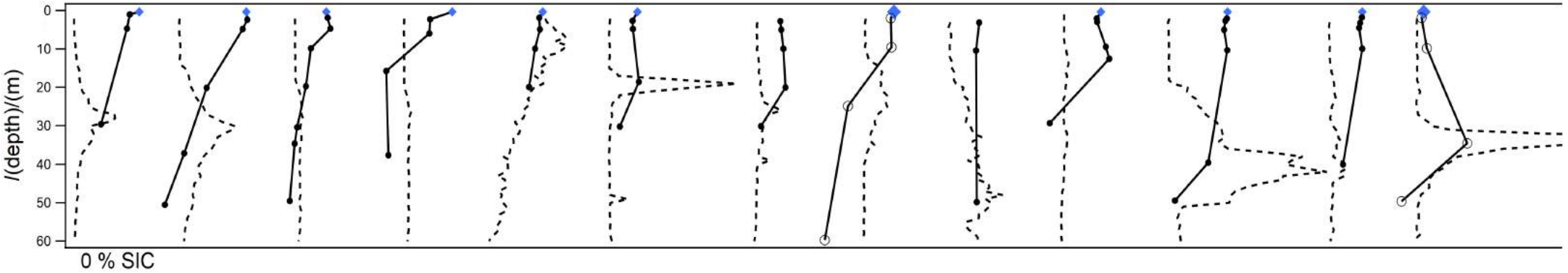
DMS: Partial ice cover

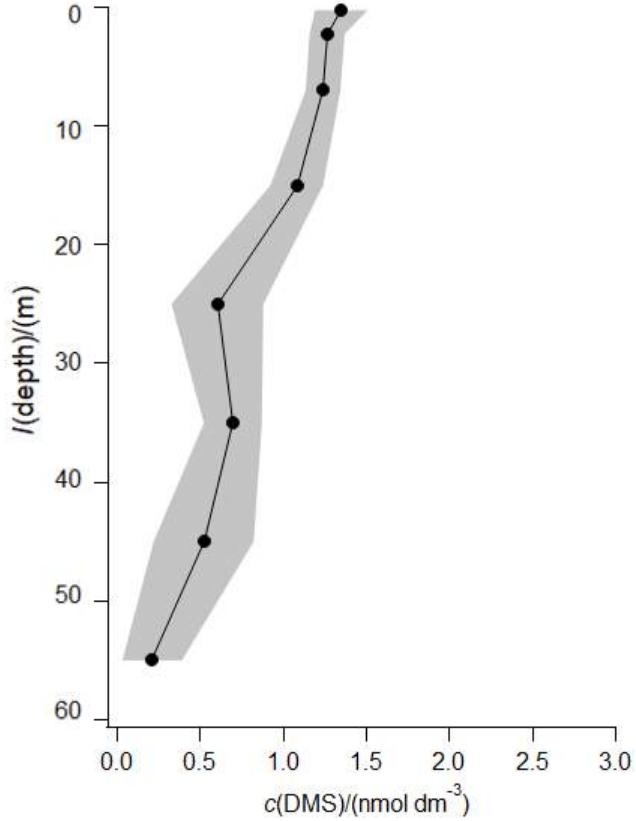


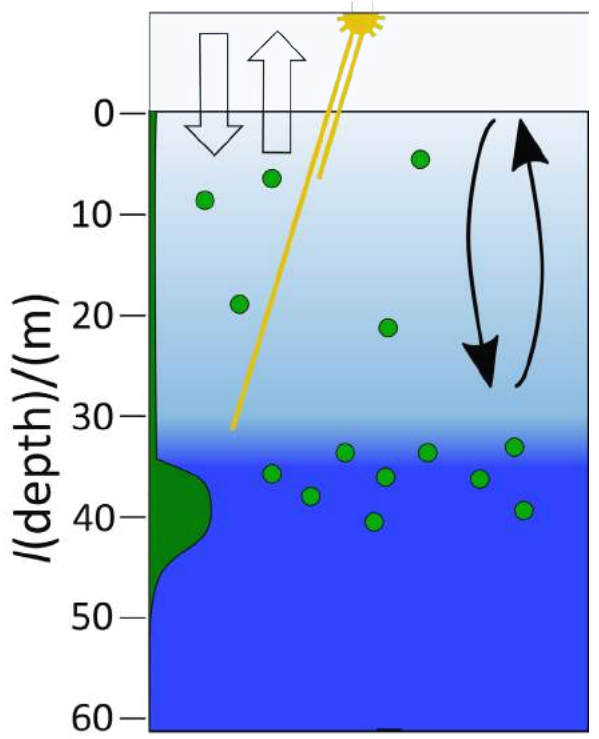




DMS: ice-free

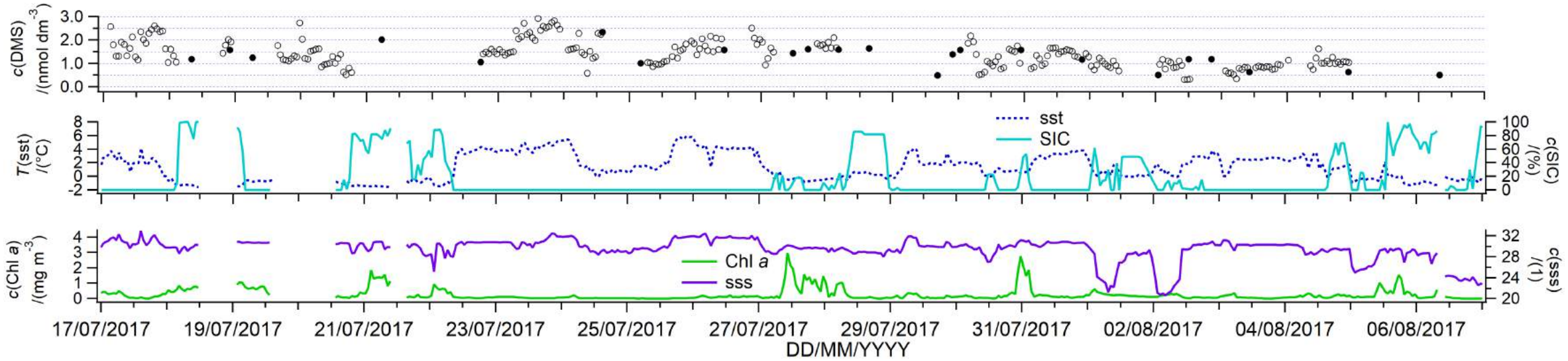






c(DMS)/(nmol dm^{-3})
30 cm depth
1 nmol dm^{-3}
c(Chl *a*)/(mg m^{-3})
1 mg m^{-3}

biogenic VOCs
density range
air – sea exchange
Chl *a*
Sea ice

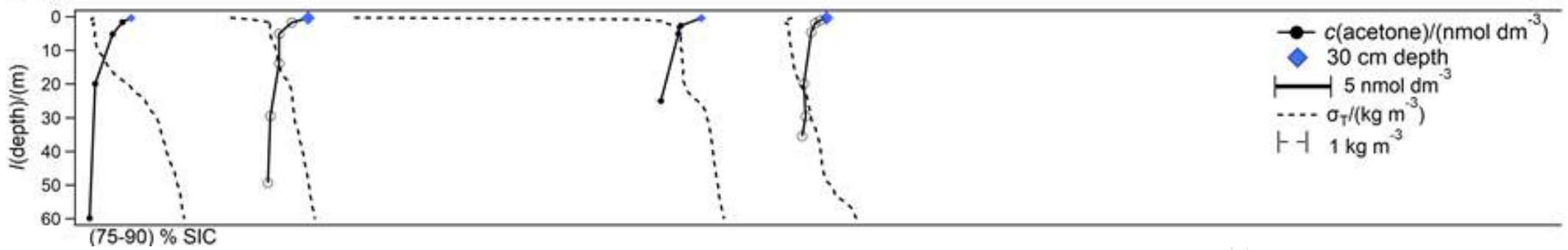


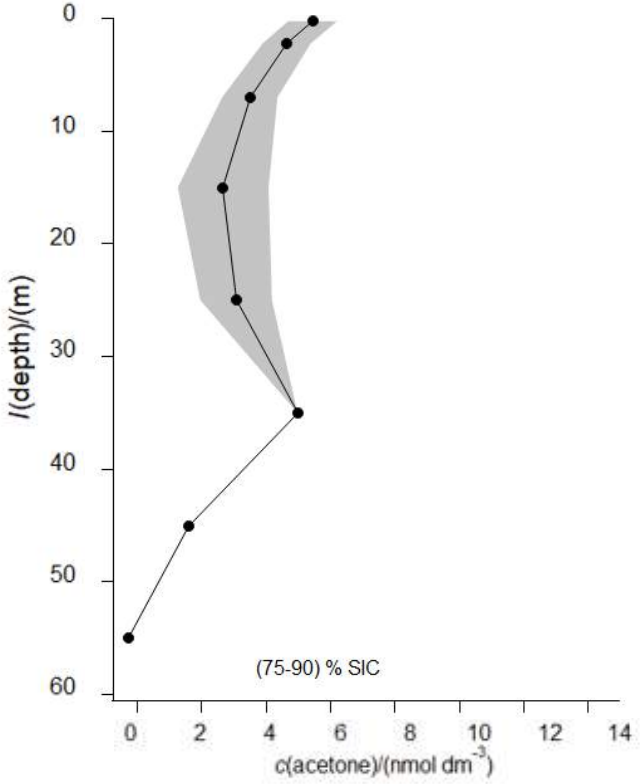
Mean DMS **1.42 nM**

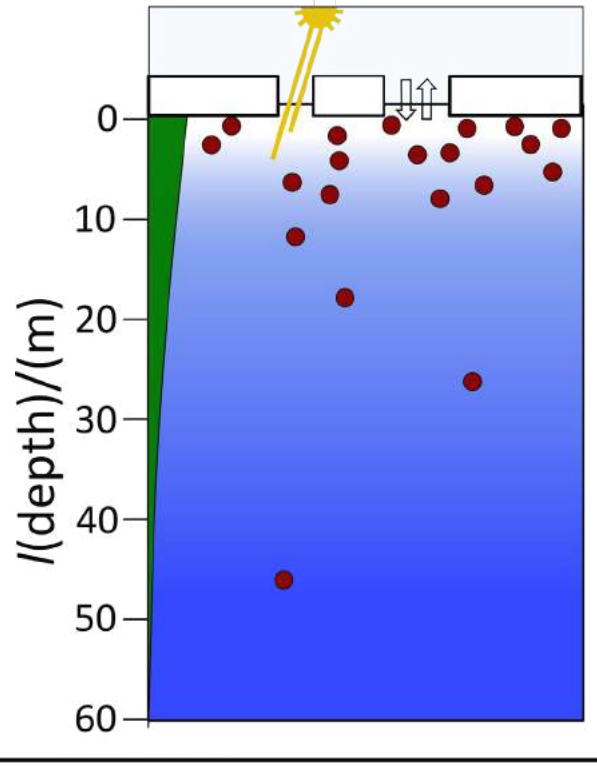
-> agreement with Gali et al. (2019) satellite

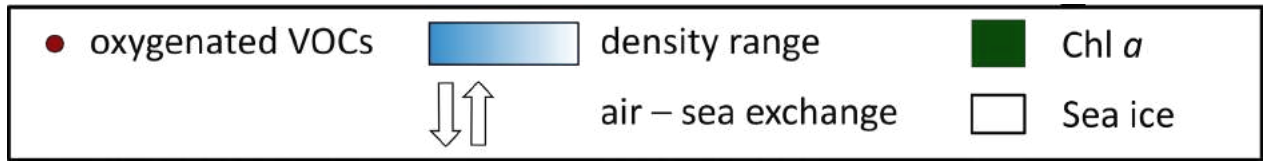
-> lower than previous measurements, probably sampled after DMS peak

Acetone: Near-full ice cover

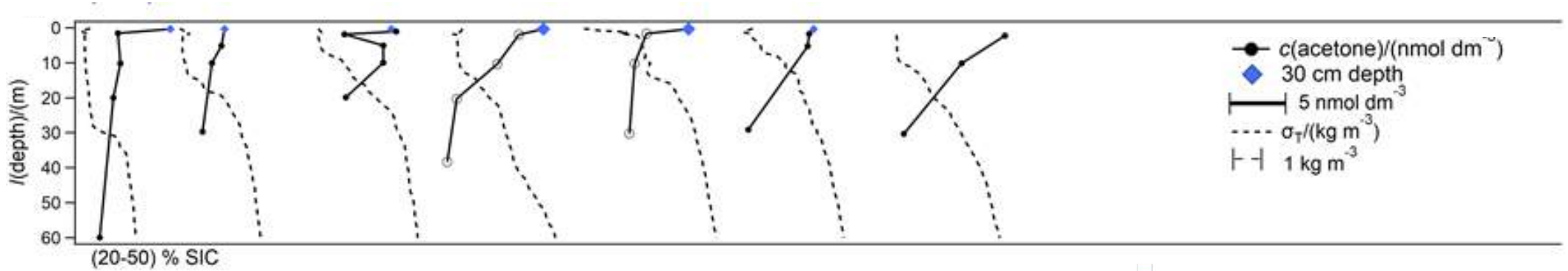


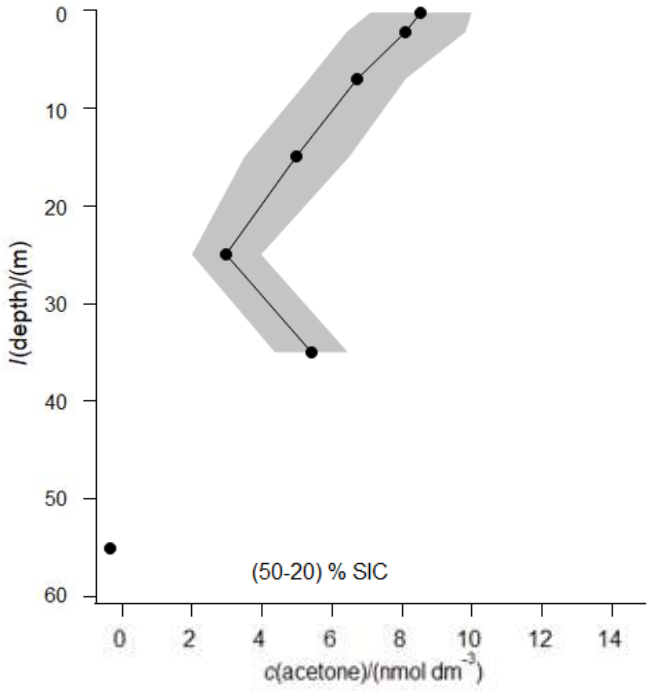


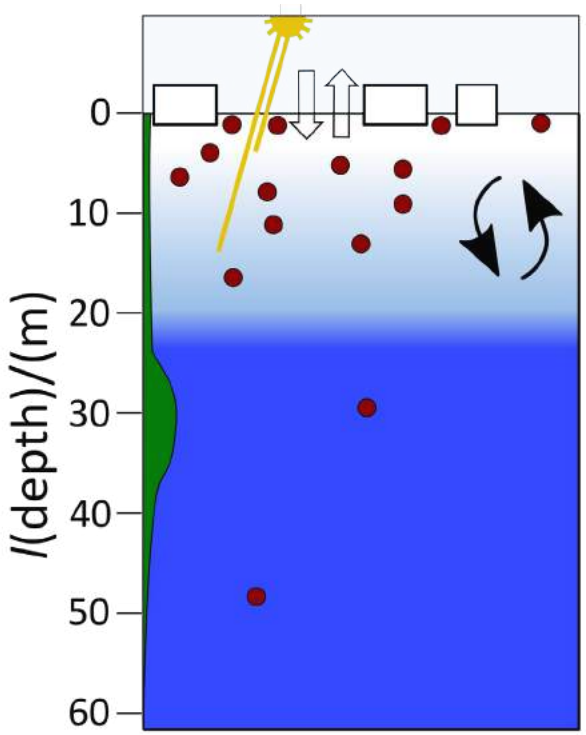


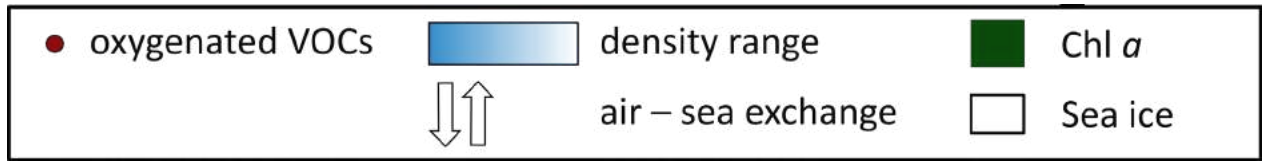


Acetone: partial ice cover

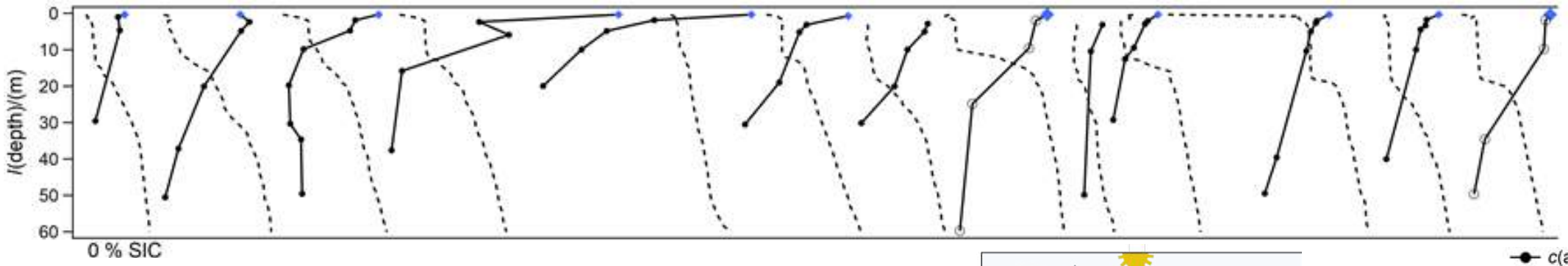


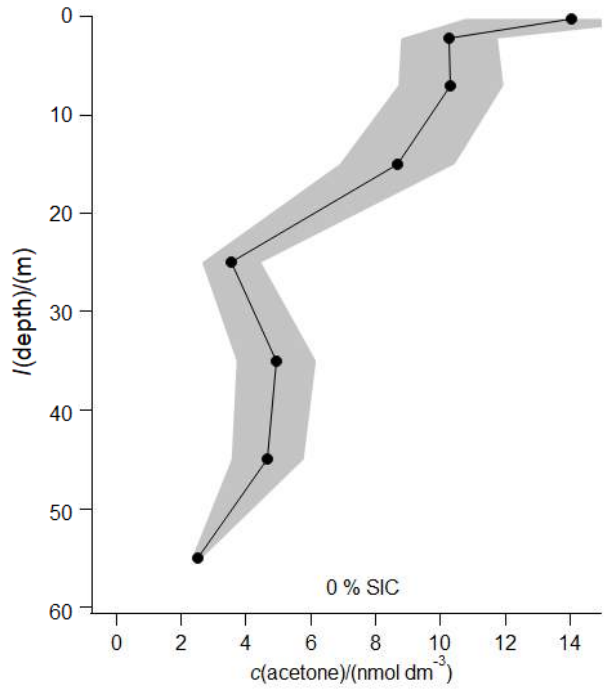


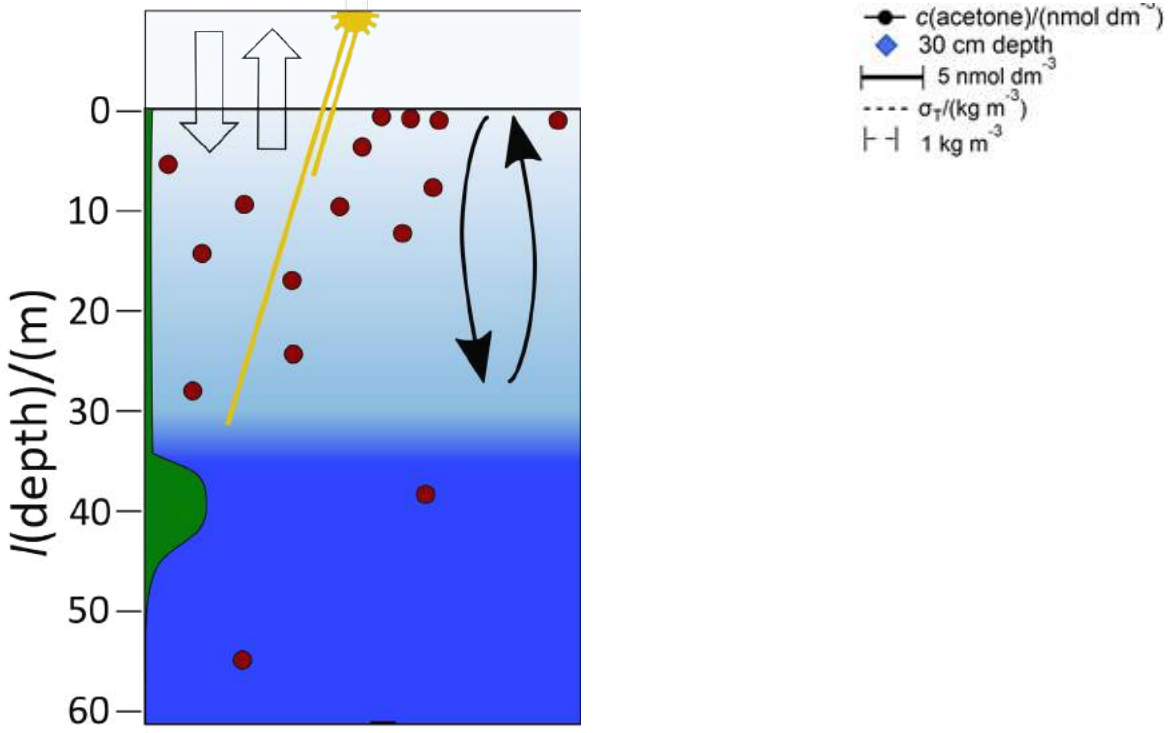


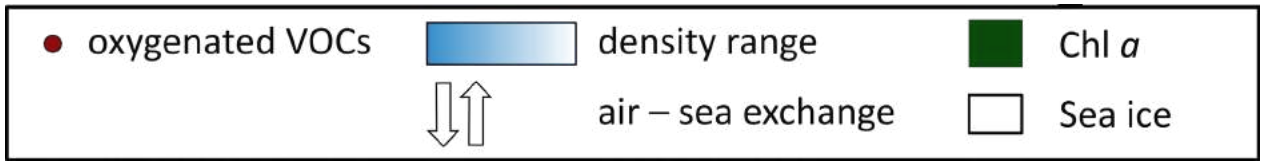


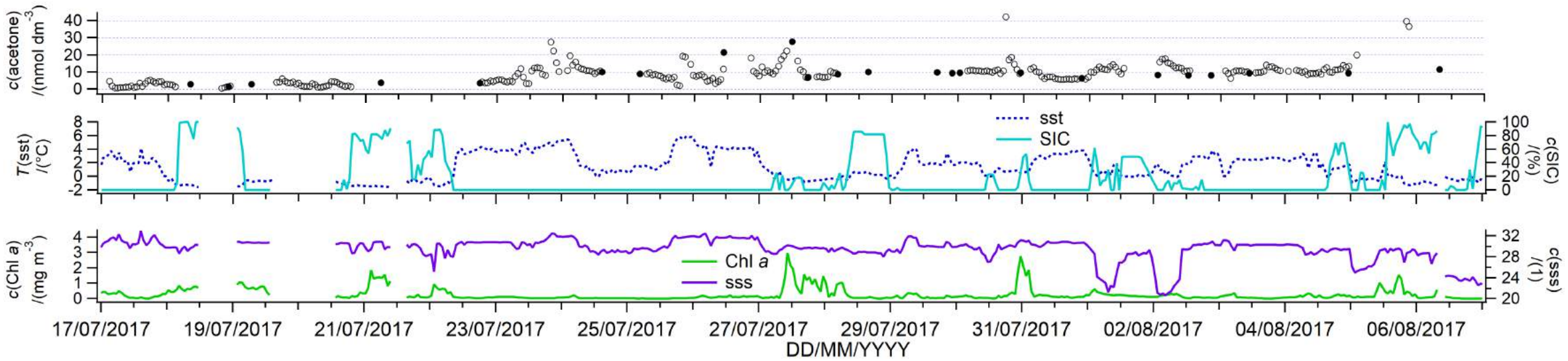
Acetone: ice-free







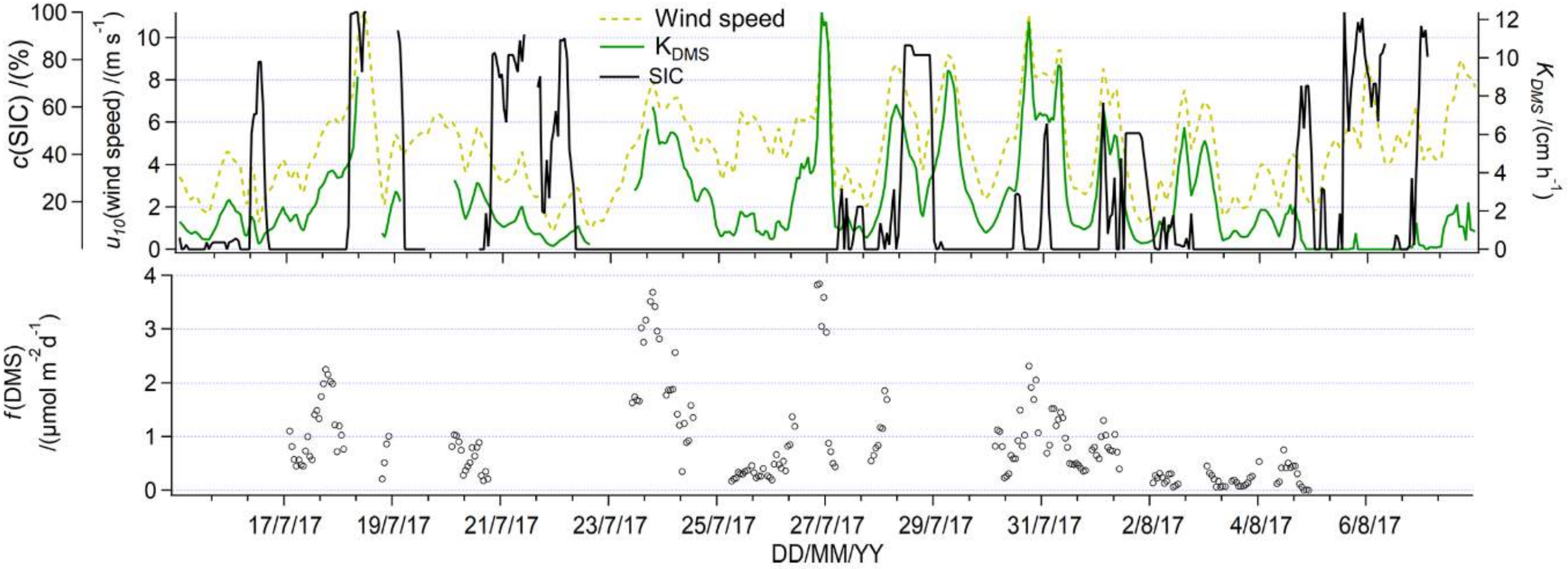




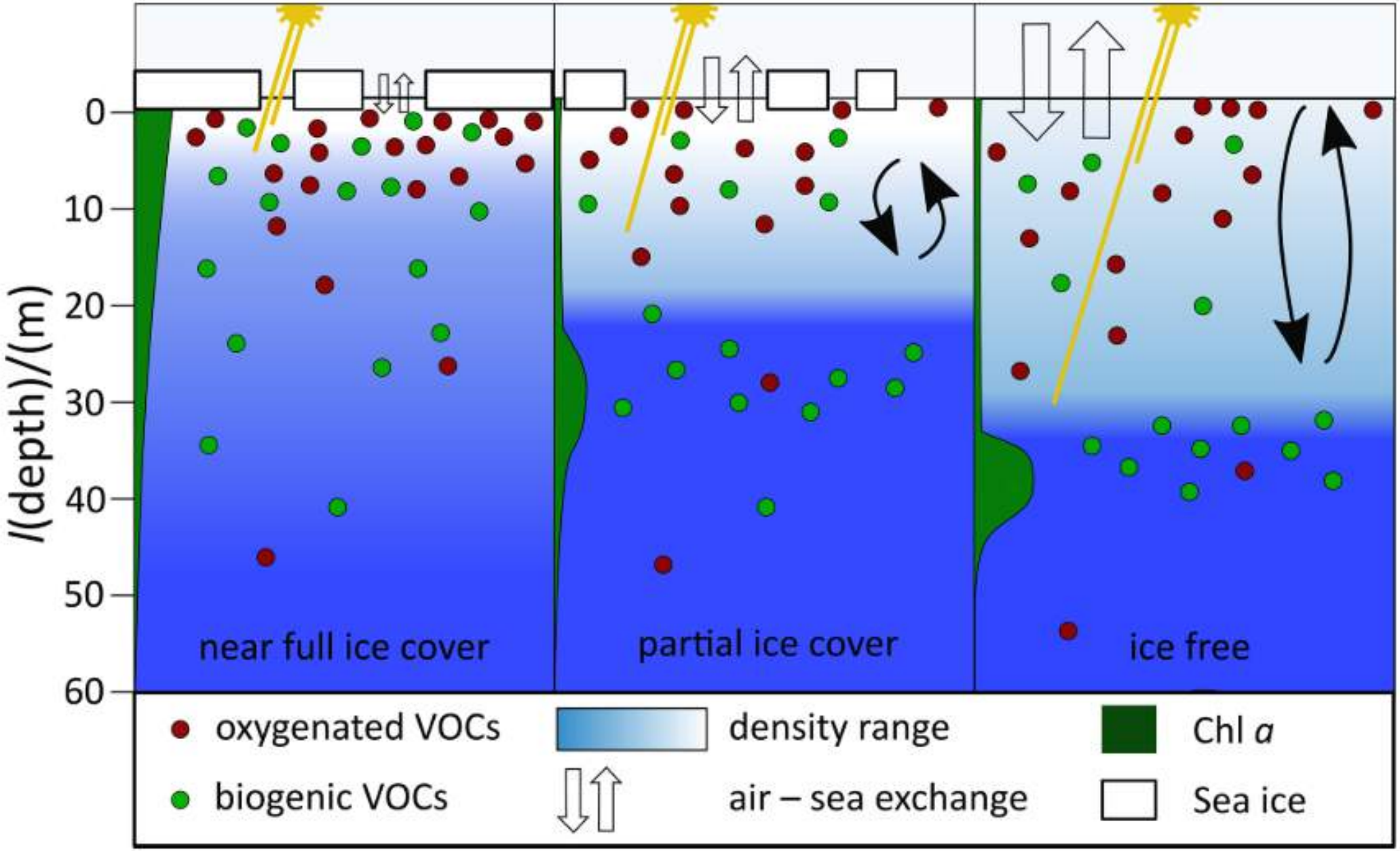
Mean acetone **8.9 nM**

In ice mean: 10.9 nM > ice-free mean 8.3 nM

Calculated Air-Sea Fluxes



*Acetone calculated to be taken up by the ocean


0
10
20
30
40
50
60
/(depth)/(m)
near full ice cover
partial ice cover
ice free
oxygenated VOCs
biogenic VOCs
density range
air – sea exchange
Chl a
Sea ice

PhD Supervisors

Mingxi Yang, Bill Sturges, Anna Jones, Phil Nightingale

Collaborators:

Brent Else, Brian Butterworth, Dave Capelle

CCGS Amundsen Crew

Mohamed Ahmed

Tonya Burgers

Jonathan Abbott

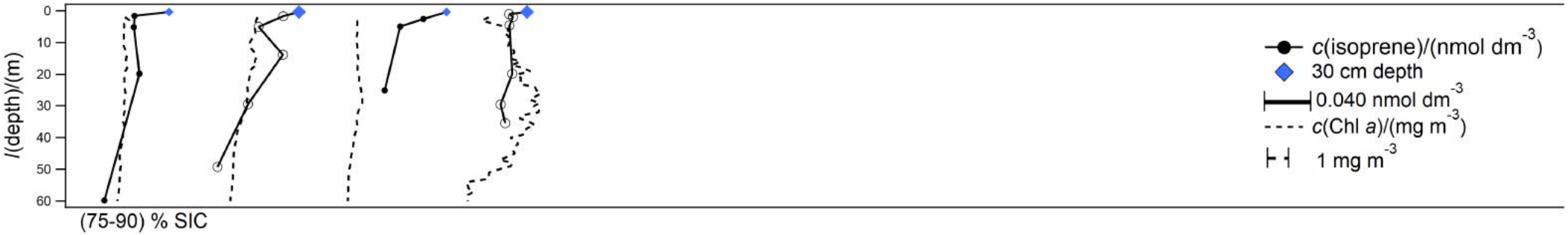
Douglas Collins

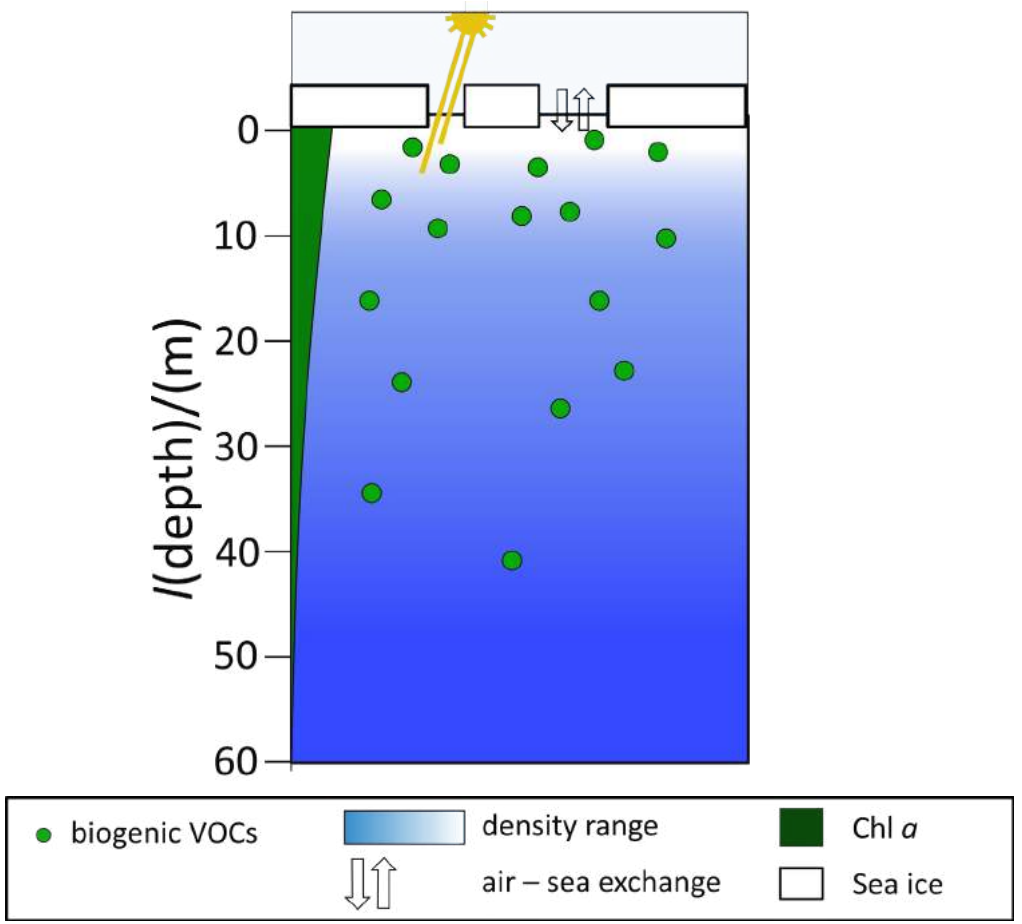
Participation at GTWS 2022, contributions by SOLAS/SCOR ECR travel support grant – Thank you!

Thank you!

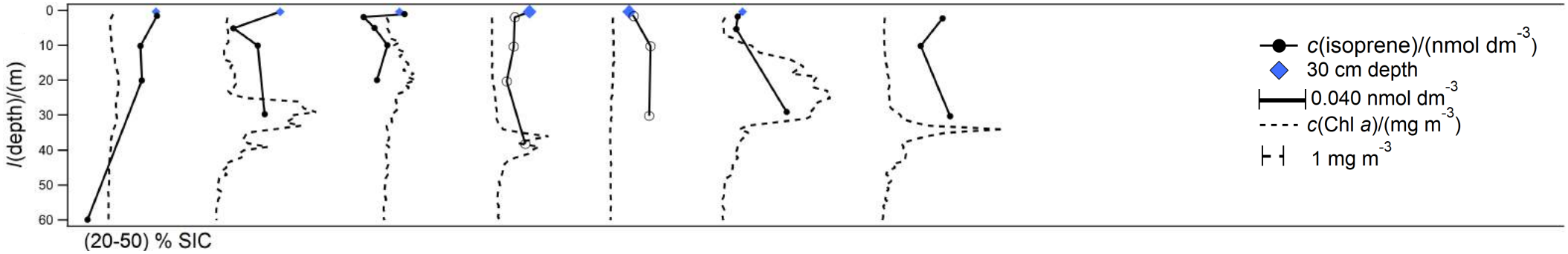
Currently Post-Doc in Rafel Simó Group
Coupling SFCE to VOCUS PTR-ToF

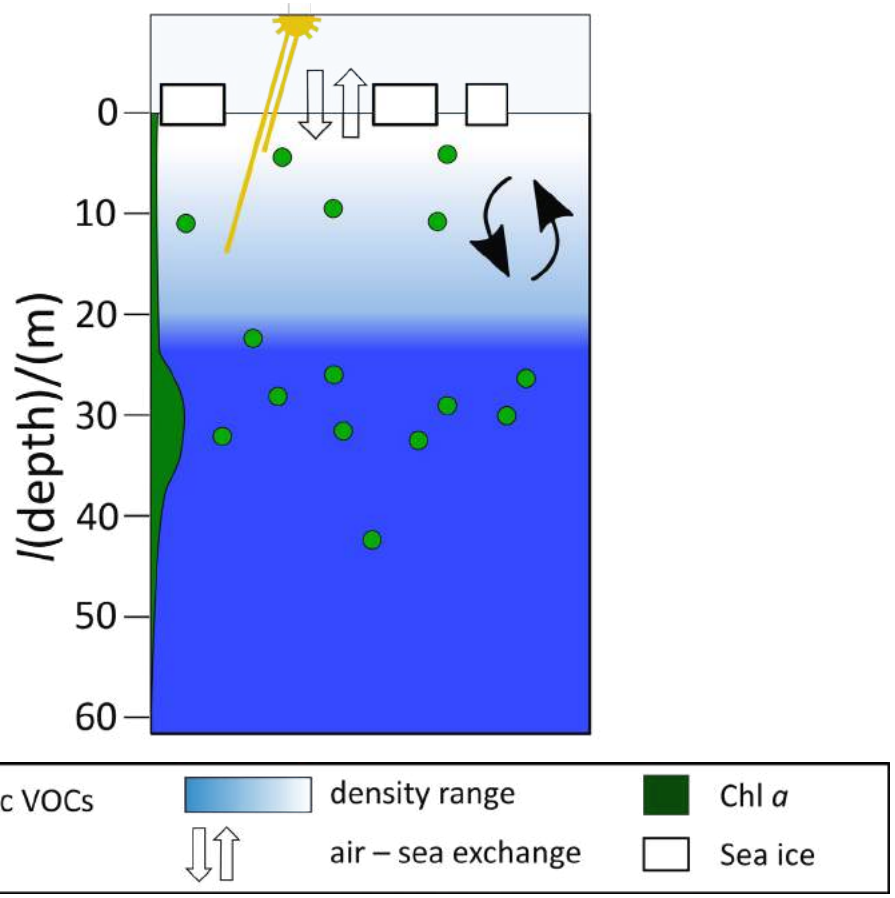
Isoprene: Near-full ice cover



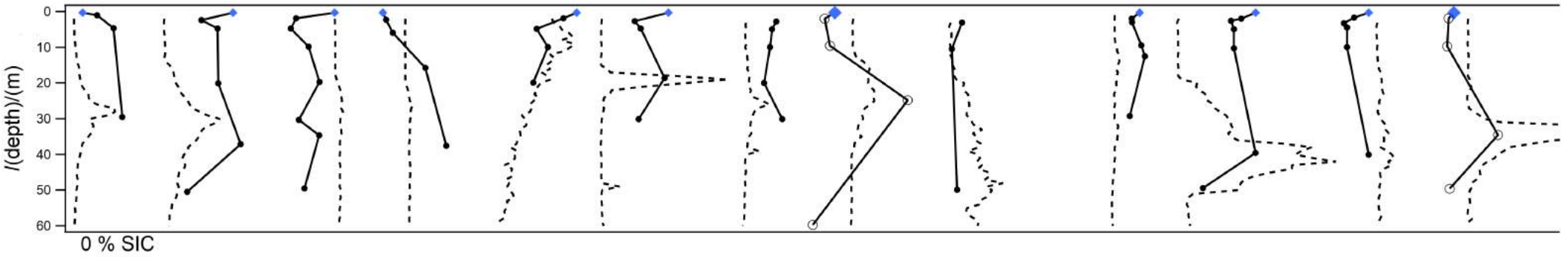


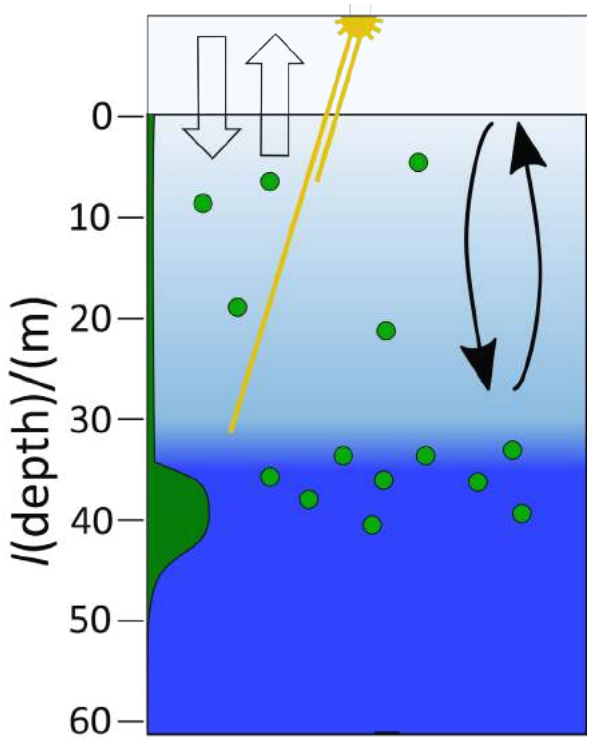
Isoprene: Partial ice cover

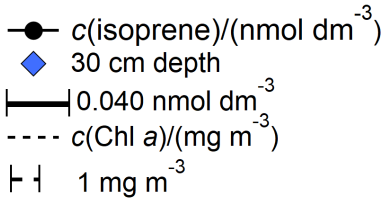


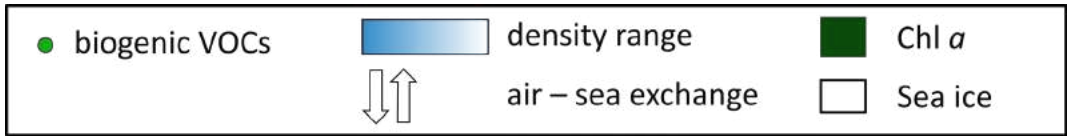


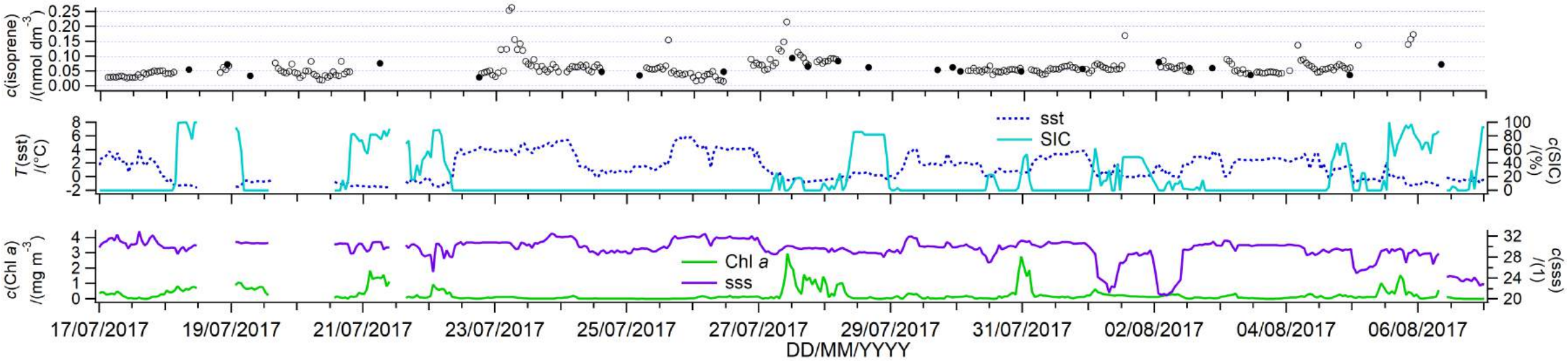
Isoprene: ice-free





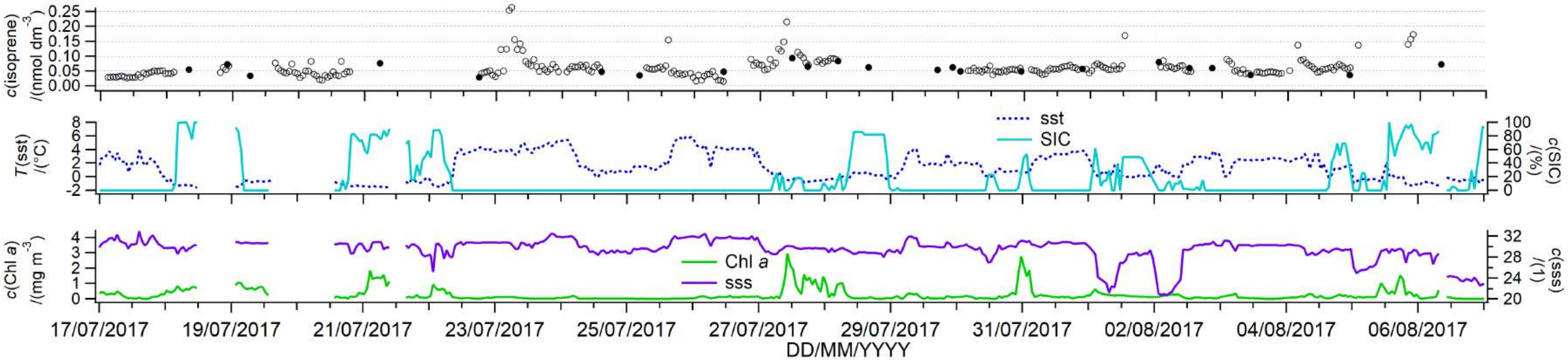






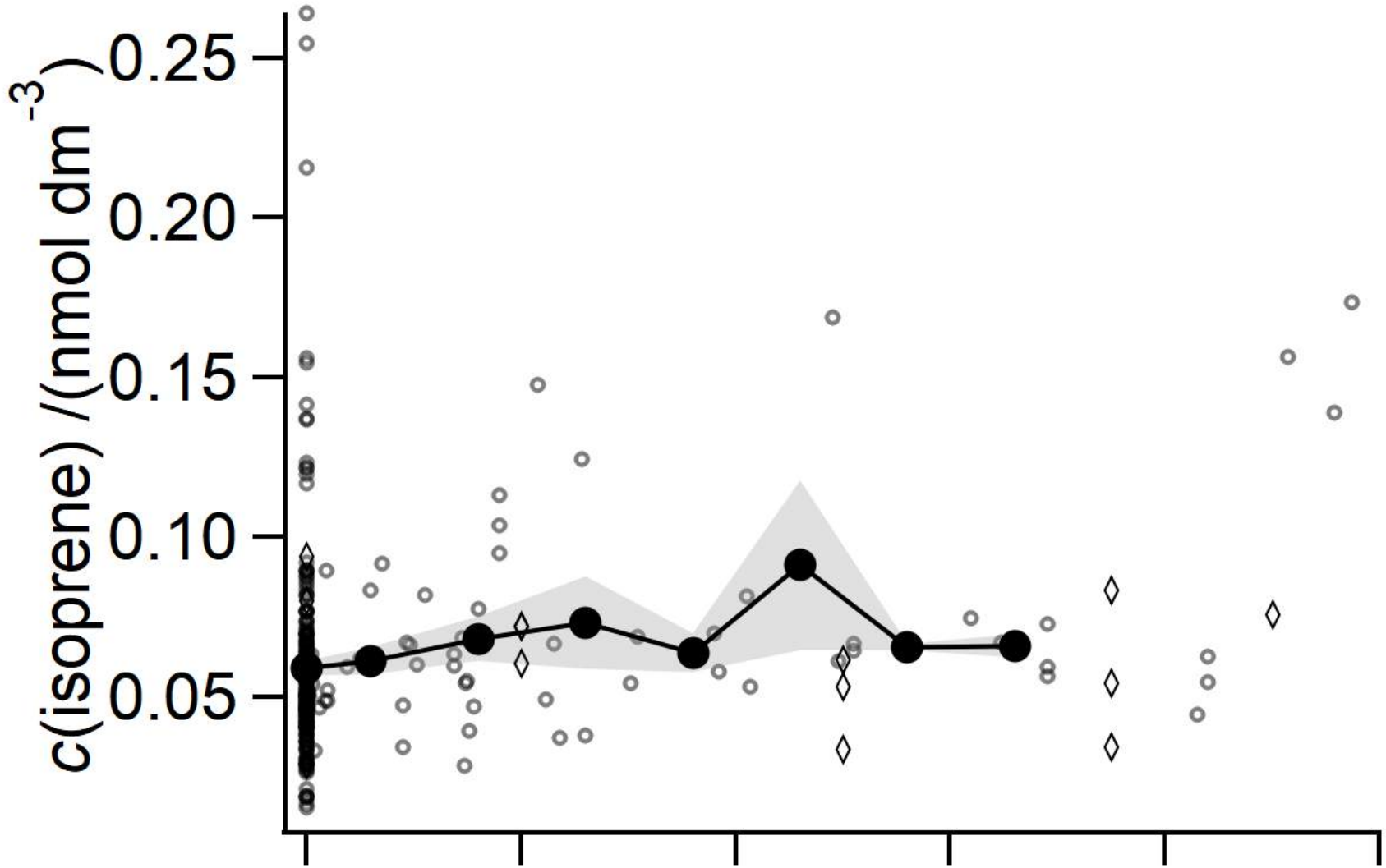
Mean isoprene surface seawater concentration: **63 pM**

-> possibly due to longer air-sea exchange lifetime (24 days): sea ice acting as a barrier



Isoprene correlates better with sea ice concentration than Chl *a* and displays a negative correlation with sst

-> different controls in sea ice compared to open ocean


c(isoprene) /(nmol dm-3)
0.25
0.20
0.15
0.10
0.05