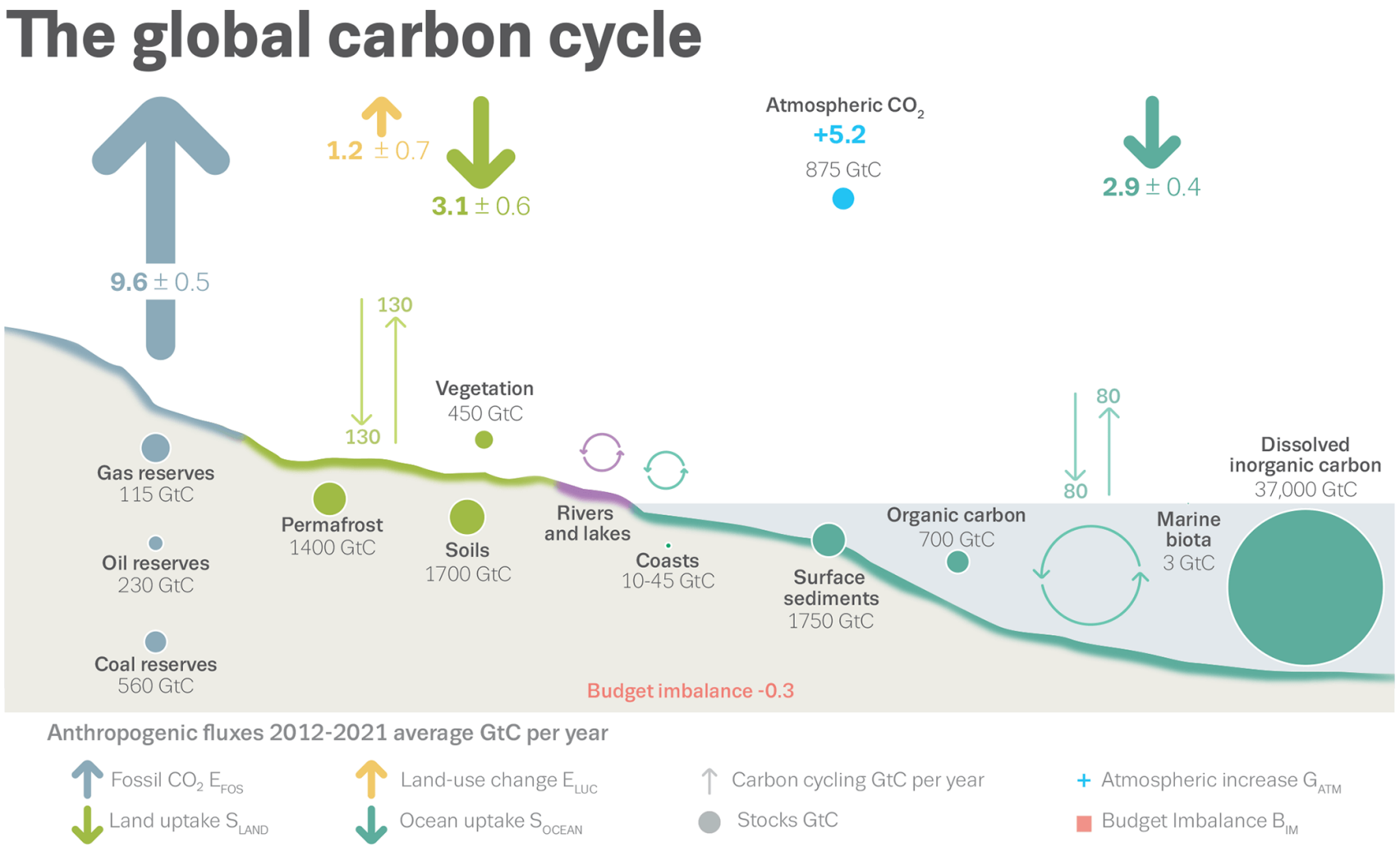
Carbonate chemistry trends from ICOS observations and connection with carbon neutrality. Case study: The Belgian part of the North Sea

Hannelore Theetaert, Silke Veerbrugge, Michiel T'Jampens, Andre Cattrijsse, Thanos Gkritzalis

Research Infrastructure group, VLIZ – Flanders Marine Institute, Oostende, BE

Big Picture #1



Source: Friedlingstein et al 2022; Global Carbon Project 2022

Big Picture #2

Sources = **Sinks**

9.6 GtC/yr

89%

11%

1.2 GtC/yr

5.2 GtC/yr

48%

29%

3.1 GtC/yr

26%

2.9 GtC/yr

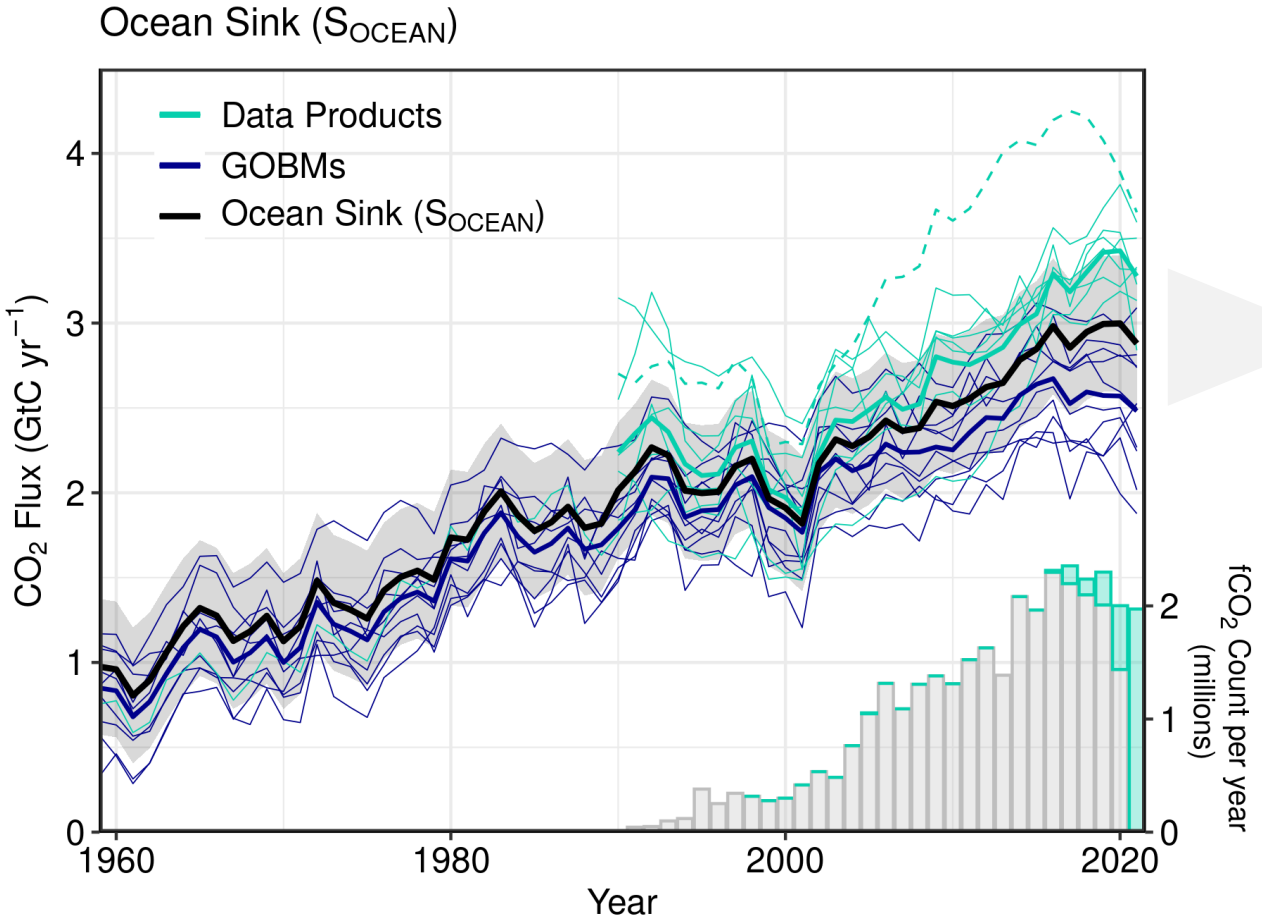
Budget Imbalance:
(the difference between estimated sources & sinks)

3%

-0.3 GtC/yr

Source: Friedlingstein et al 2022; Global Carbon Project 2022

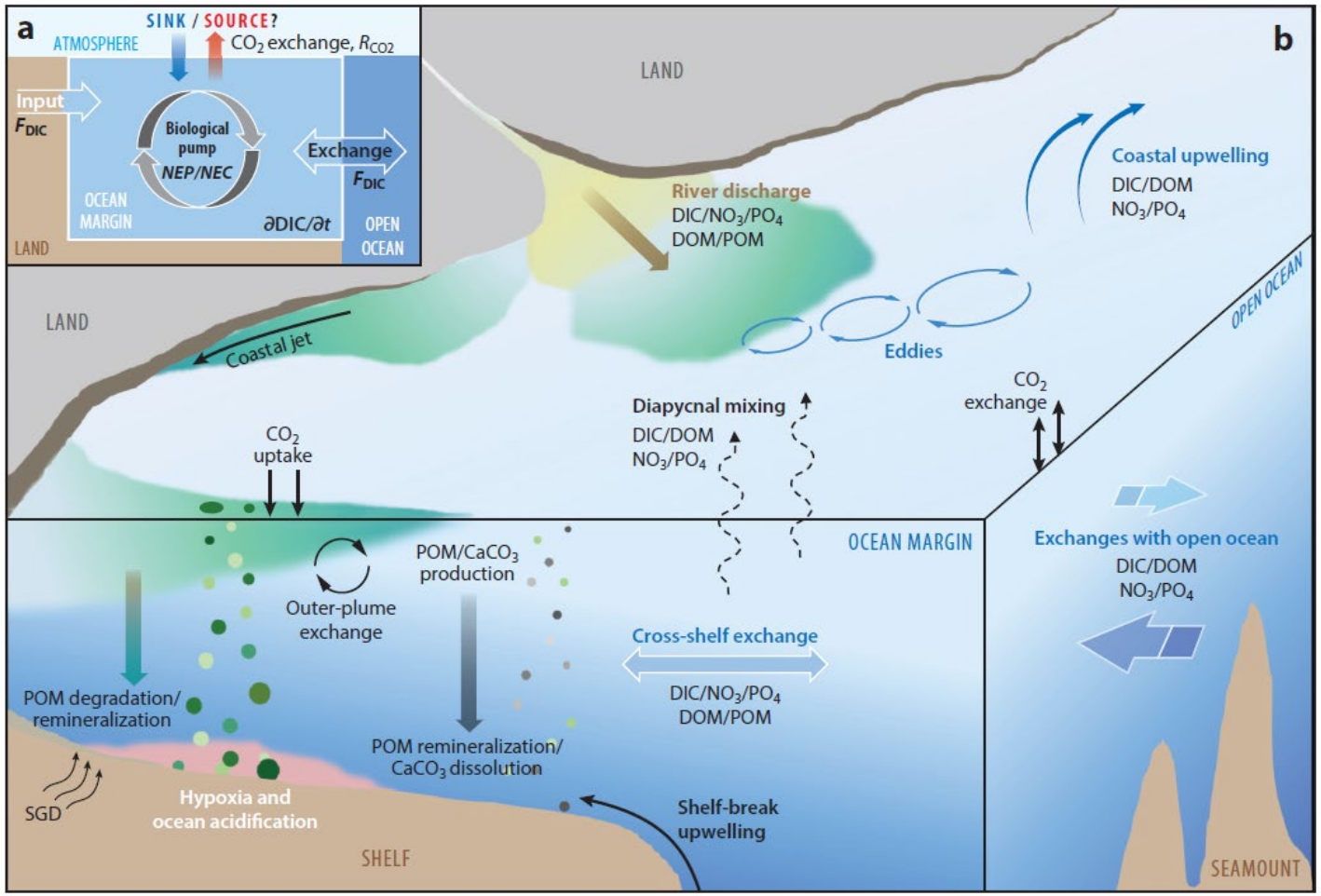
Big Picture #3



EU27 emissions (2022): 0.8 GtC

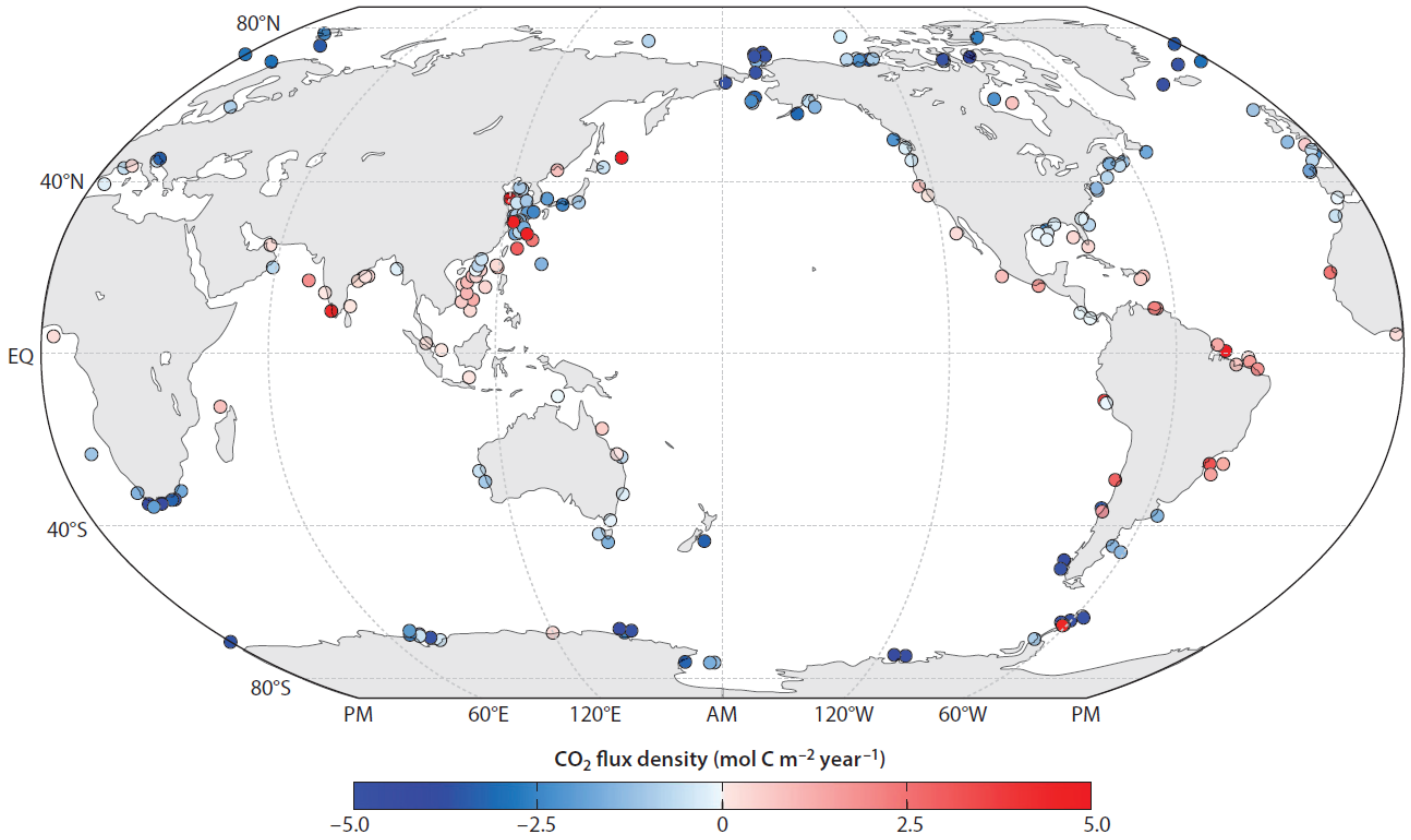
Source: Friedlingstein et al 2022; Global Carbon Project 2022

Coastal Story #1



Source: Dai, M., et al., 2022

Coastal Story #2

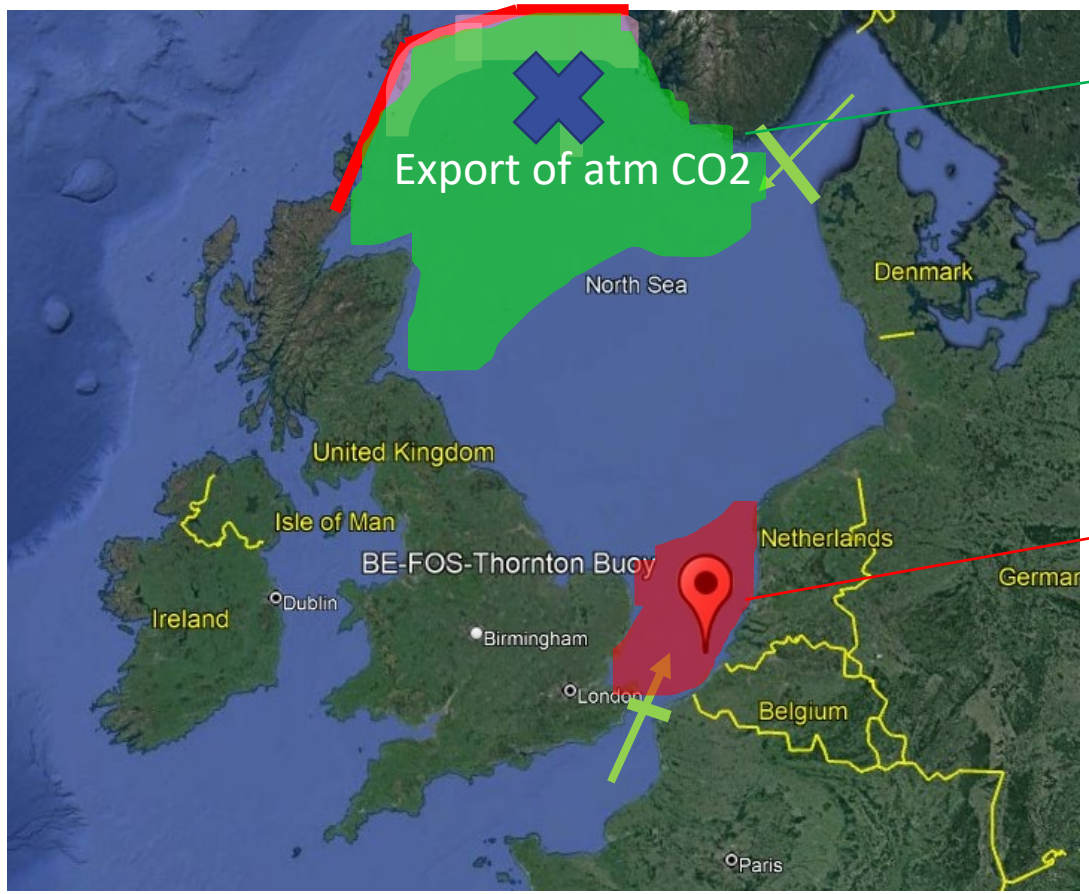


- 0.25 GtC/y

(0.19 – 0.45)

Source: Dai, M., et al., 2022

North Sea



Mid - North NS & Norwegian Trench: Strong Sink

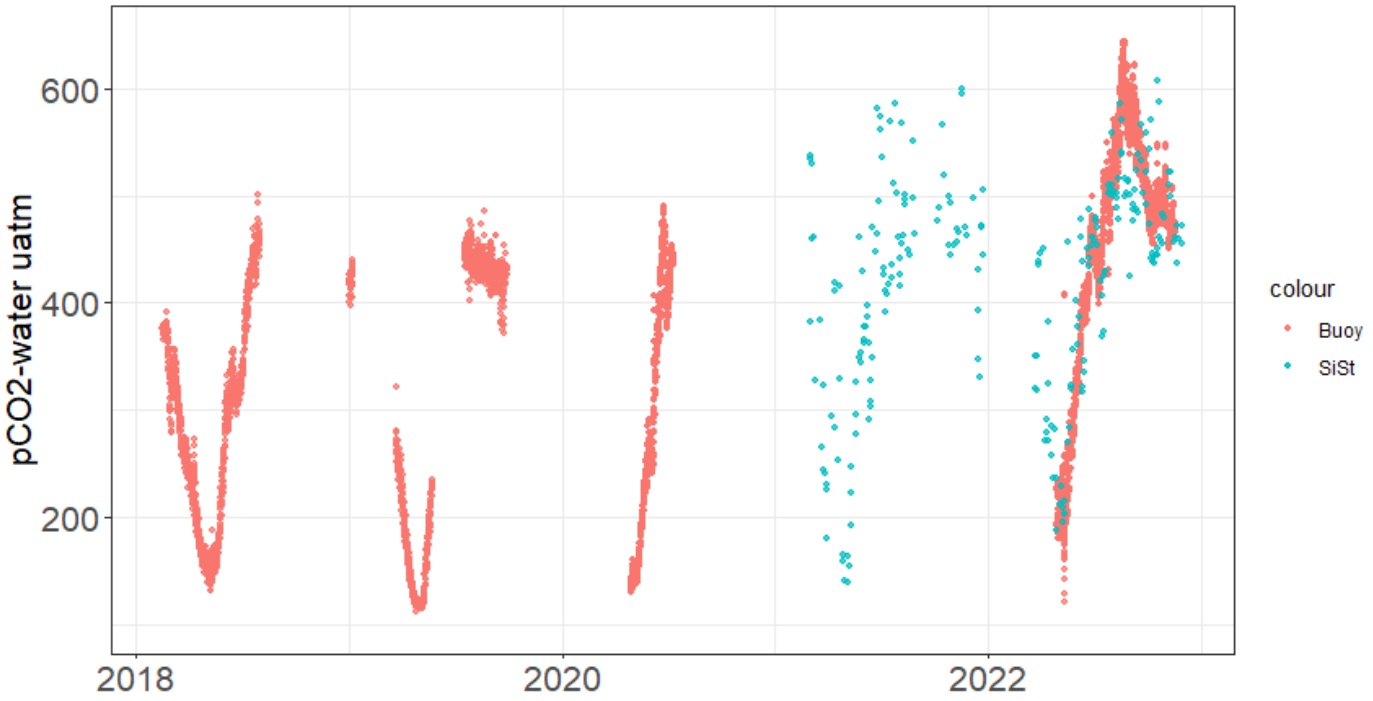
SBNS – BPNS

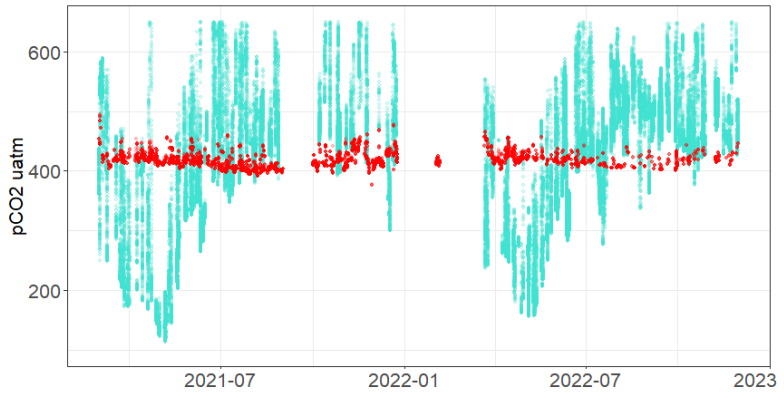
Contrasting findings: Small source to small sink

North Sea is a continental shelf C pump

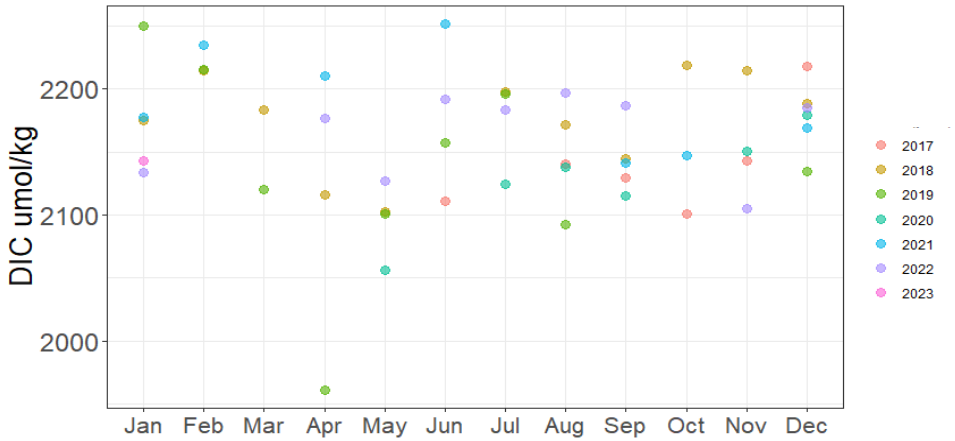
ICOS Capacity in the BPNS – SBNS & Greater North Sea

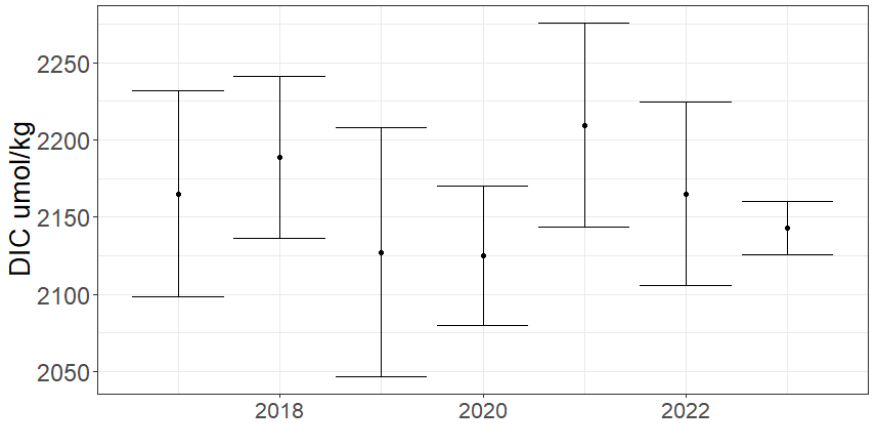
pCO_2 story

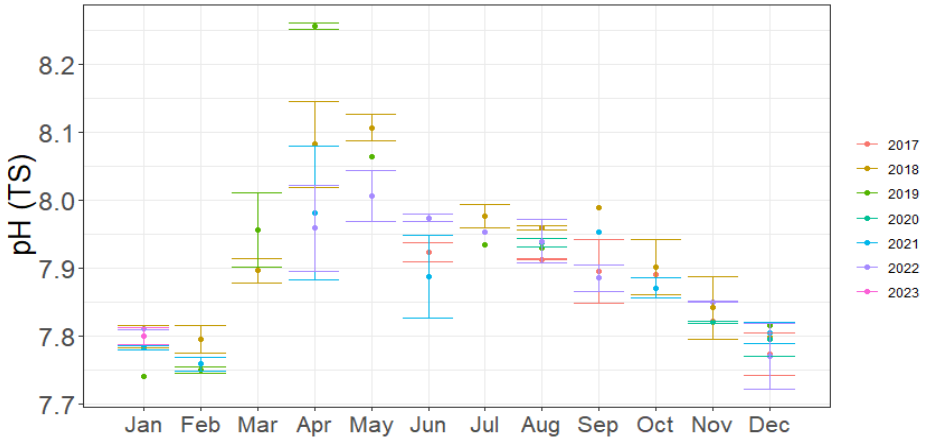

pCO2-water uatm
600
400
200
2018
2020
2022
colour
Buoy
SiSt

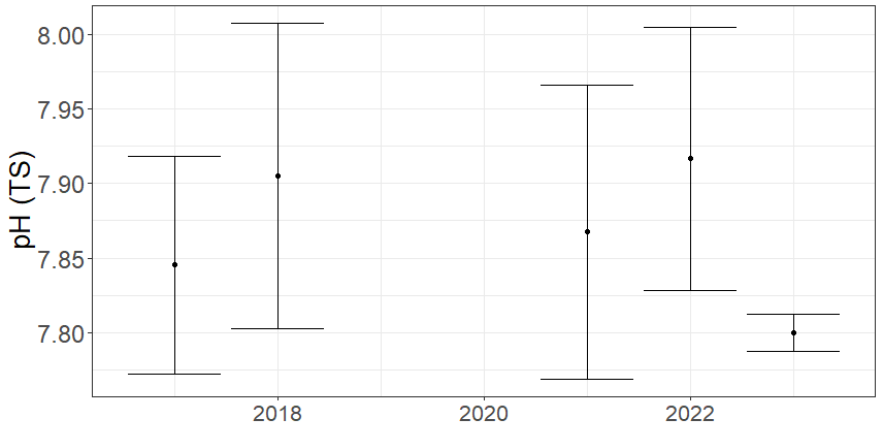

pCO2 uatm
600
400
200
2021-07
2022-01
2022-07
2023

Carbonate chemistry story



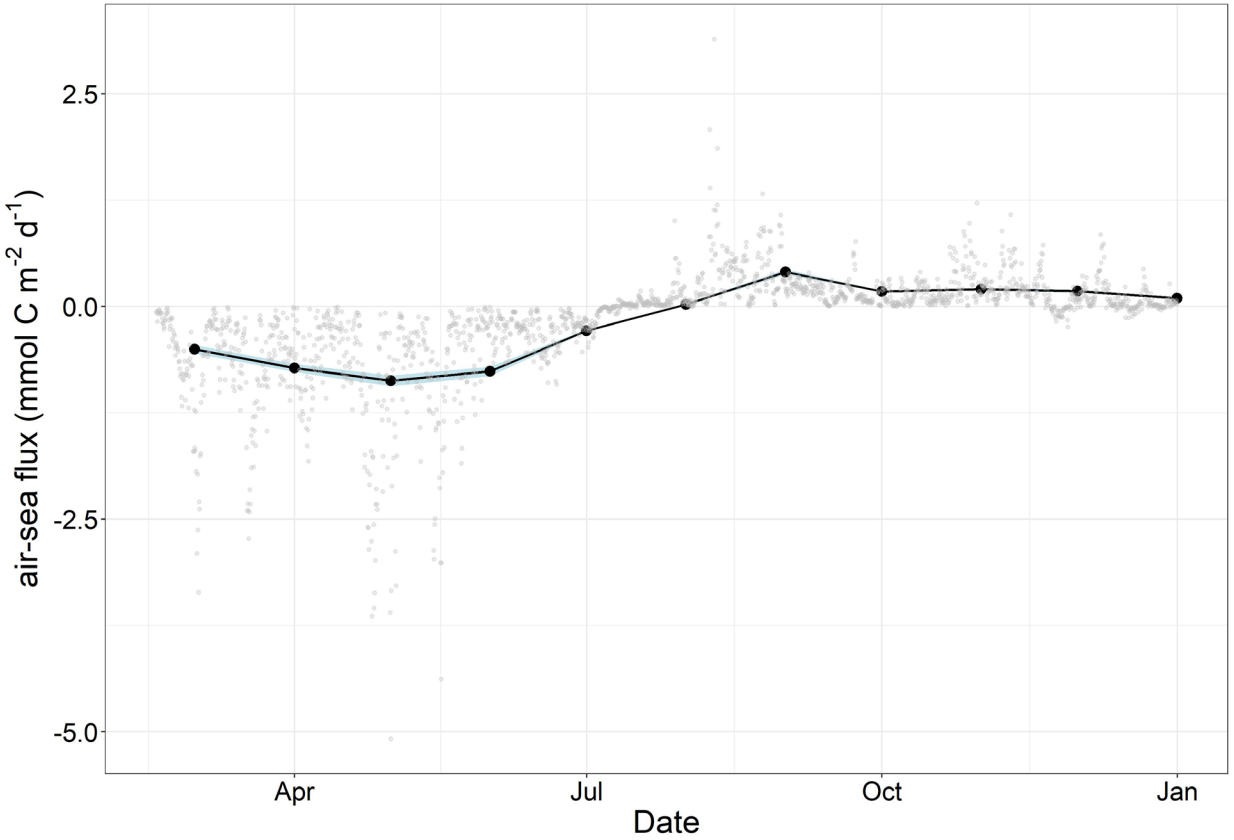




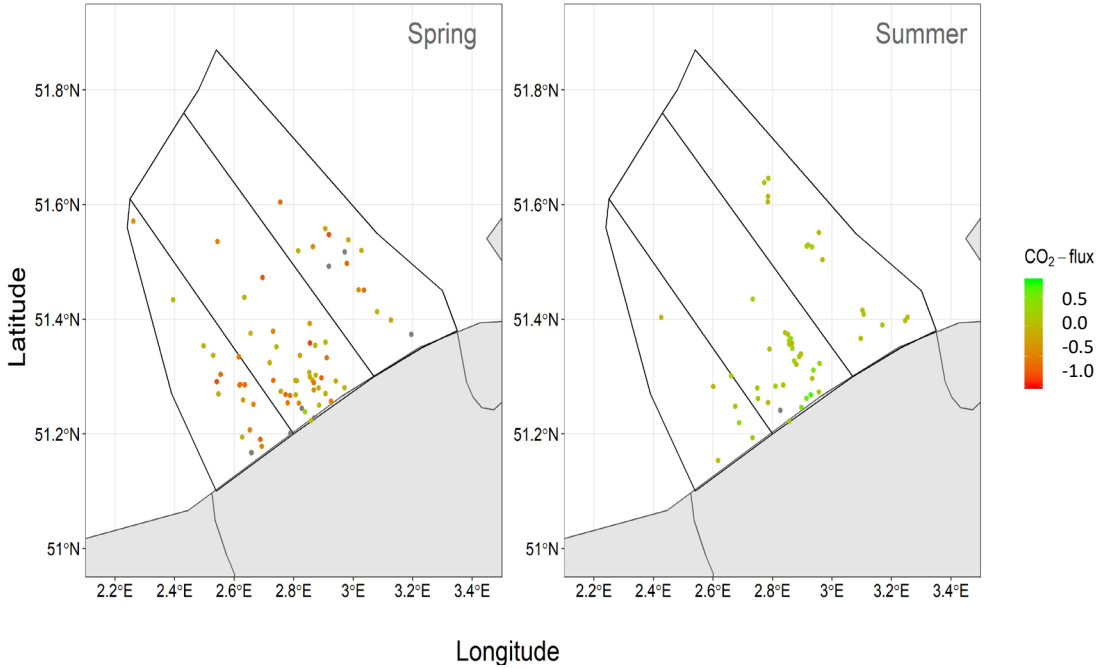


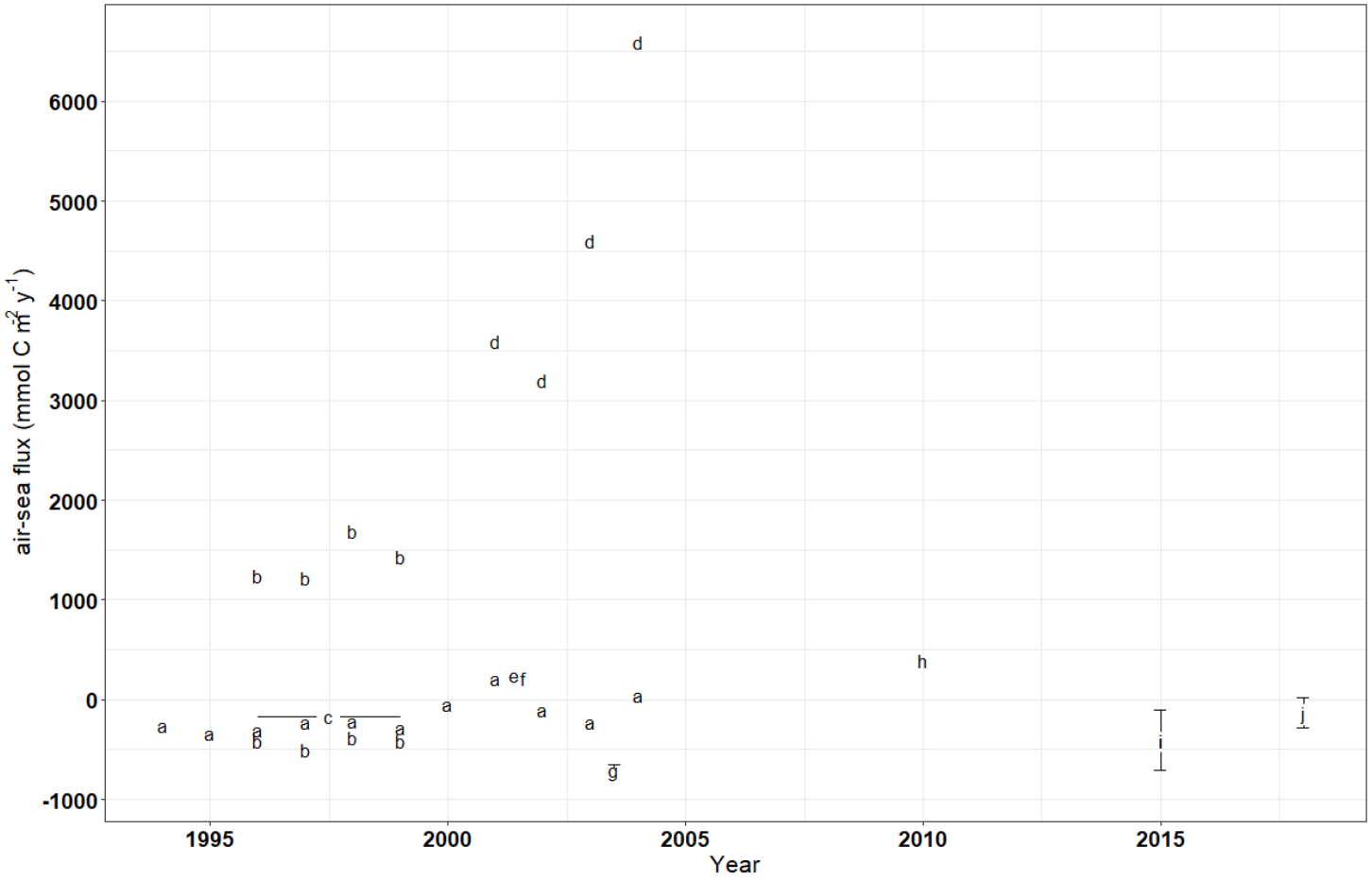
Fluxes story

BE-FOS-Thornton 2018

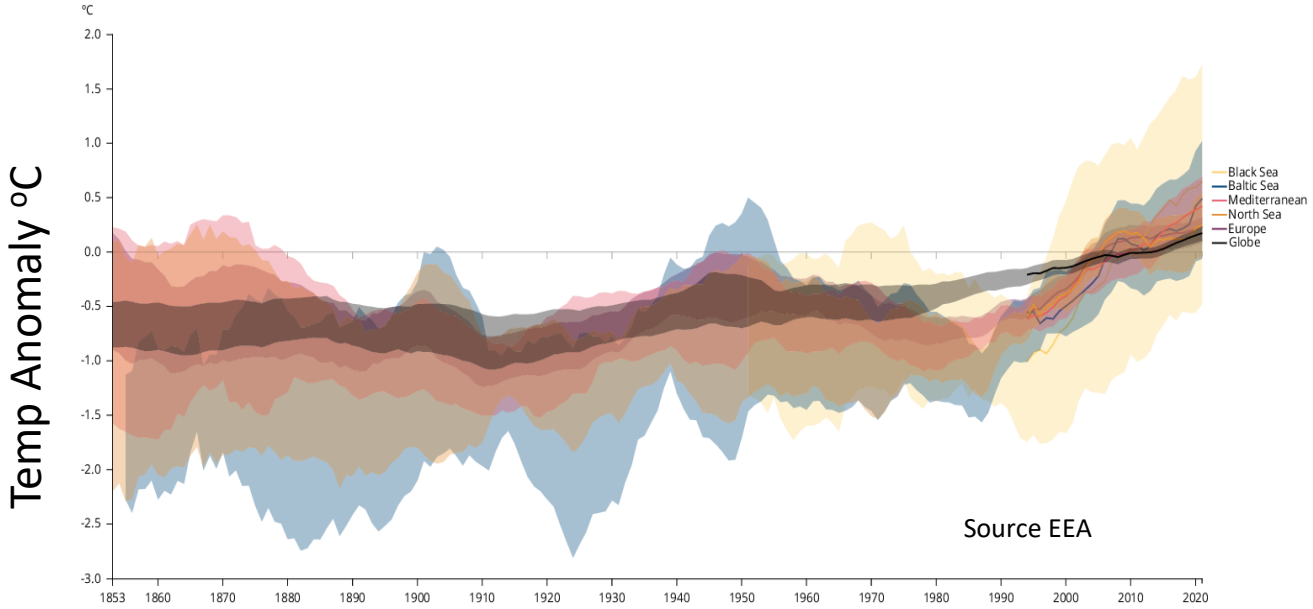


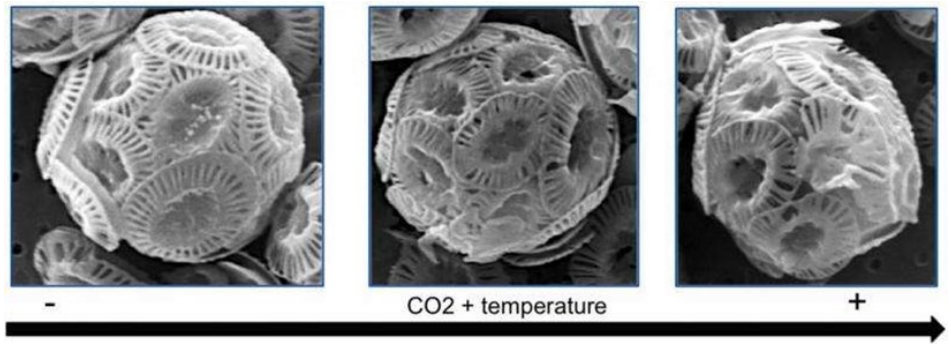
BE-SOOP-SiSt 2019

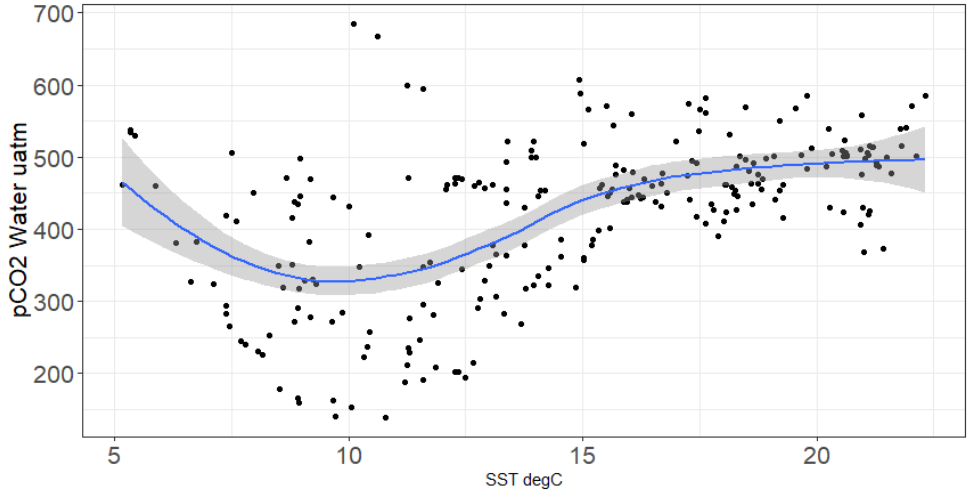


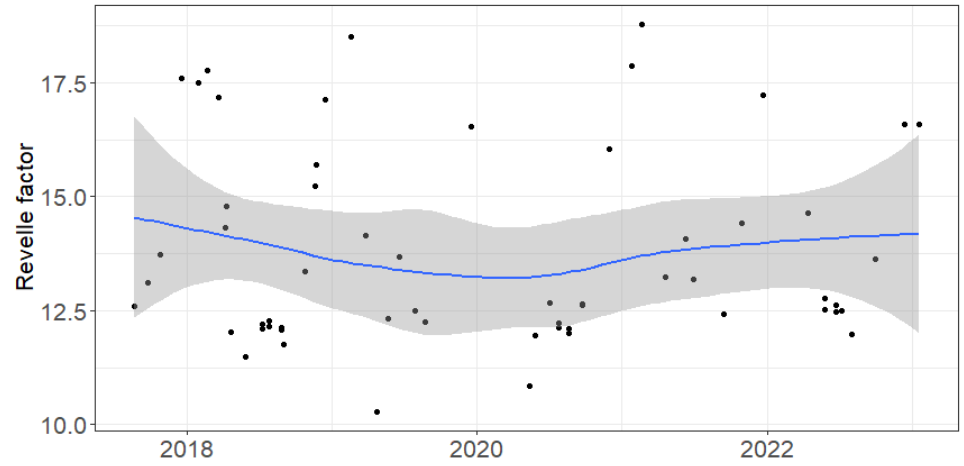

air-sea flux (mmol C m-2 y-1)
6000
5000
4000
3000
2000
1000
0
-1000
1995
2000
2005
2010
2015
Year
reference
a Gypens et al. (2011)
b Borges and Frankignoulle (2002)
c Gypens et al. (2004)
d Borges et al. (2008)
e Thomas et al. (2004)
f Thomas et al. (2005)
g Schiettecatte et al. (2007)
h Woolf et al. (2019)
i Kitidis et al. (2019)
j This study

Context

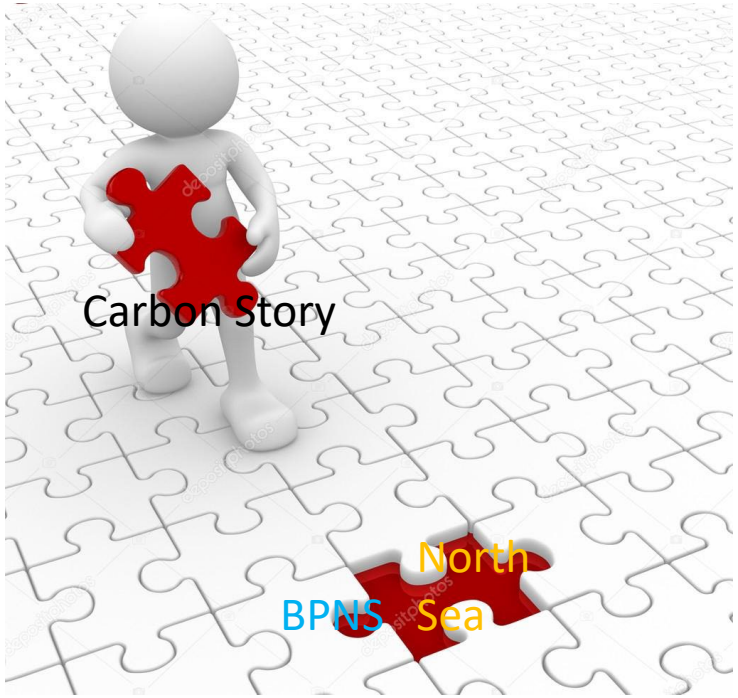

Temp Anomaly °C
°C
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
1853
1860
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
Black Sea
Baltic Sea
Mediterranean
North Sea
Europe
Globe
Source EEA


-
CO2 + temperature
+


pCO2 Water uatm
700
600
500
400
300
200
5
10
15
20
SST degC


Revelle factor
17.5
15.0
12.5
10.0
2018
2020
2022

Food for thought…



- Coastal areas will become more and more relevant for national climate policy
- ICOS Capacity is adequate for comprehensive understanding of carbon story in SBNS
- No state of emergence or panic button, BUT
- Delicate thermodynamics and increasing stress….

Disclaimer: More than one pieces of the puzzle are missing!!

Thank you!