Leibniz Institute for Baltic Sea Research Warnemünde

Long-term alkalinity increase in the Baltic Sea buffers CO_2-induced acidification

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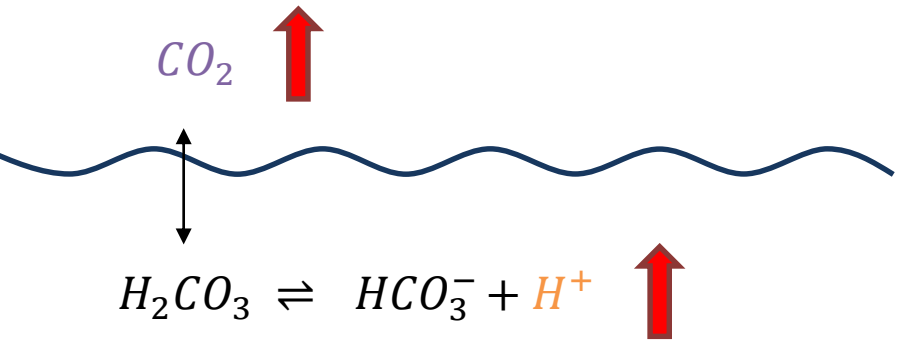
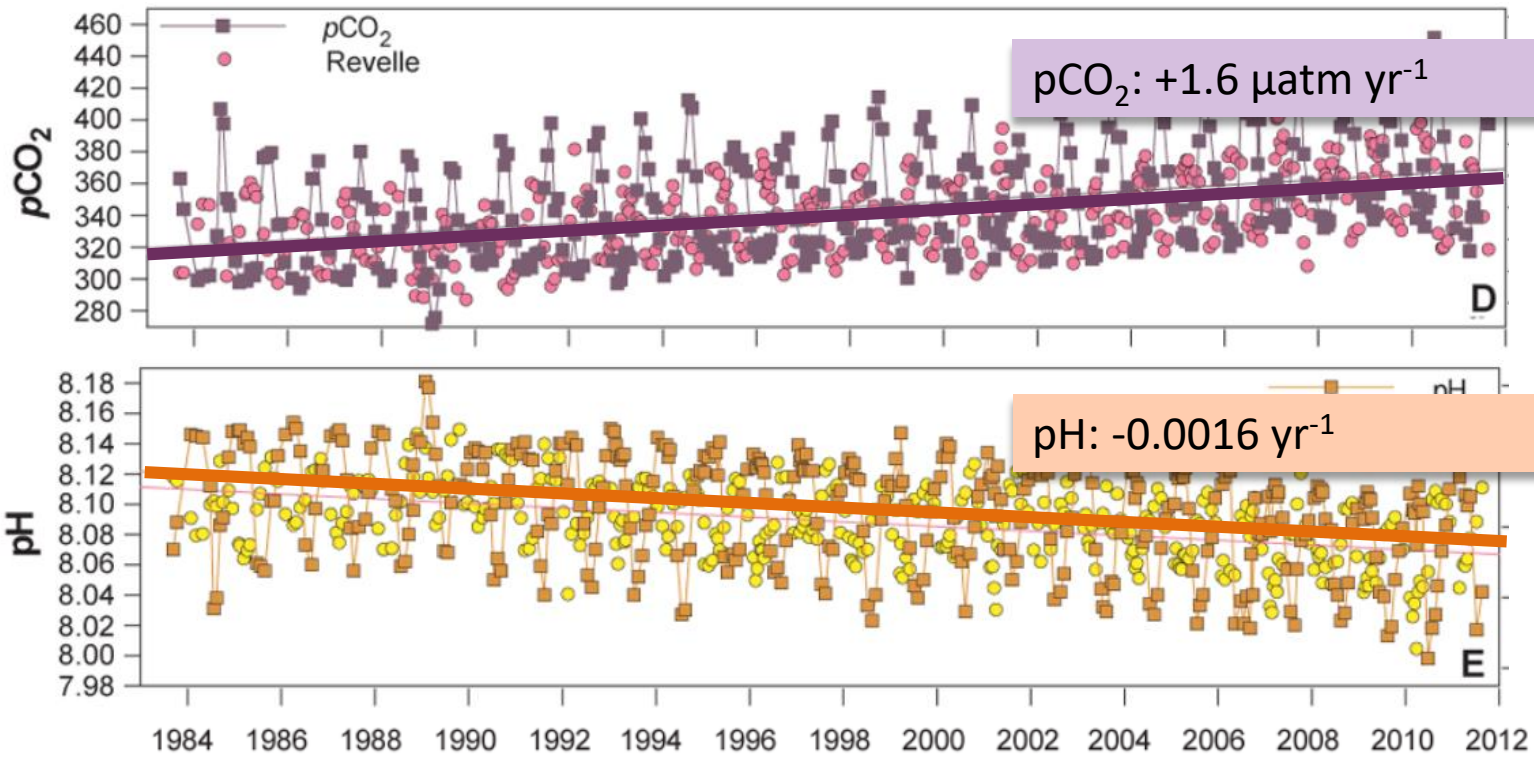
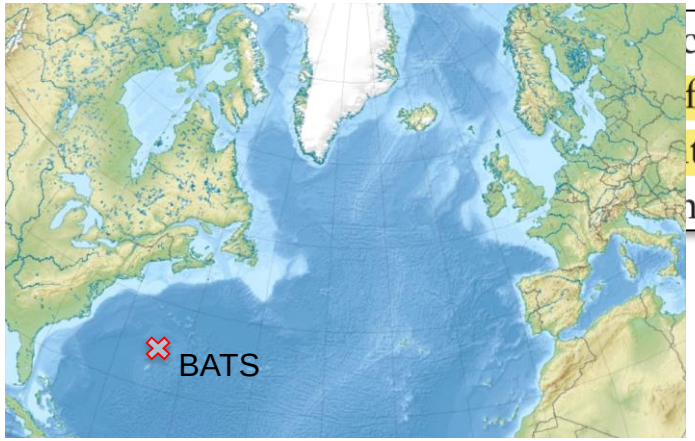




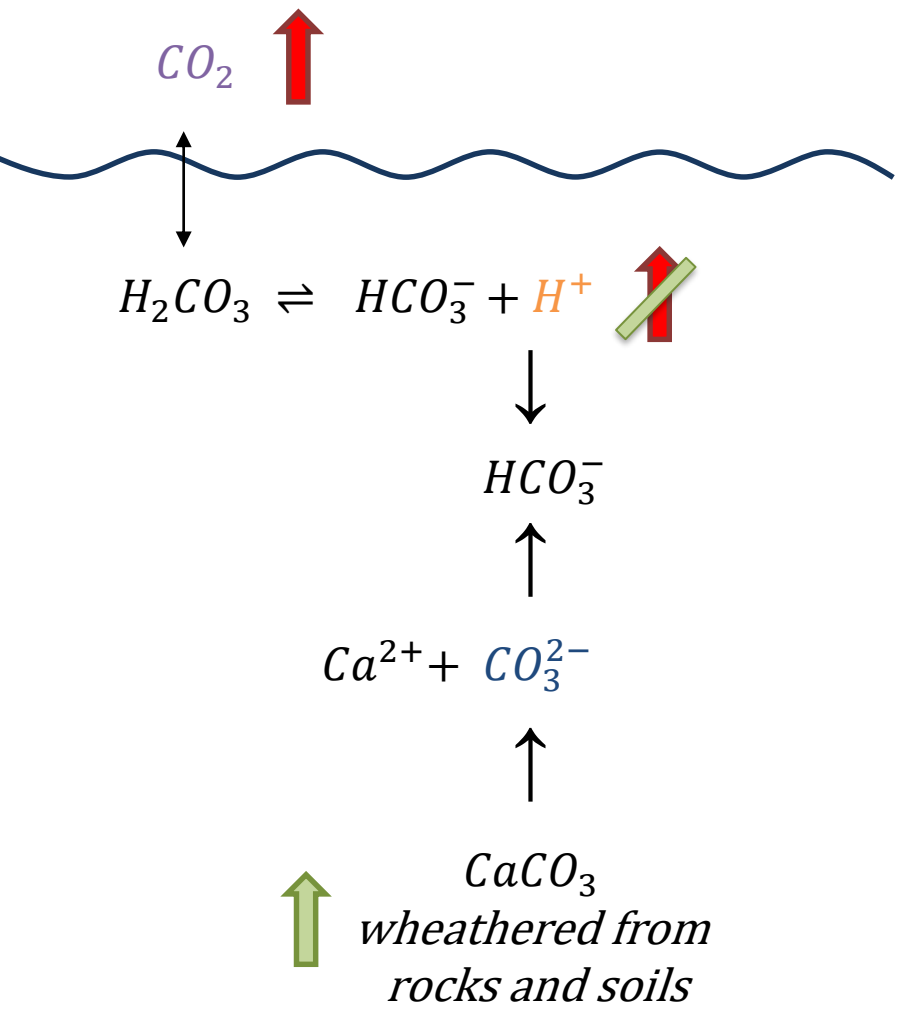
pCO_2: +1.6 µatm yr^{-1}

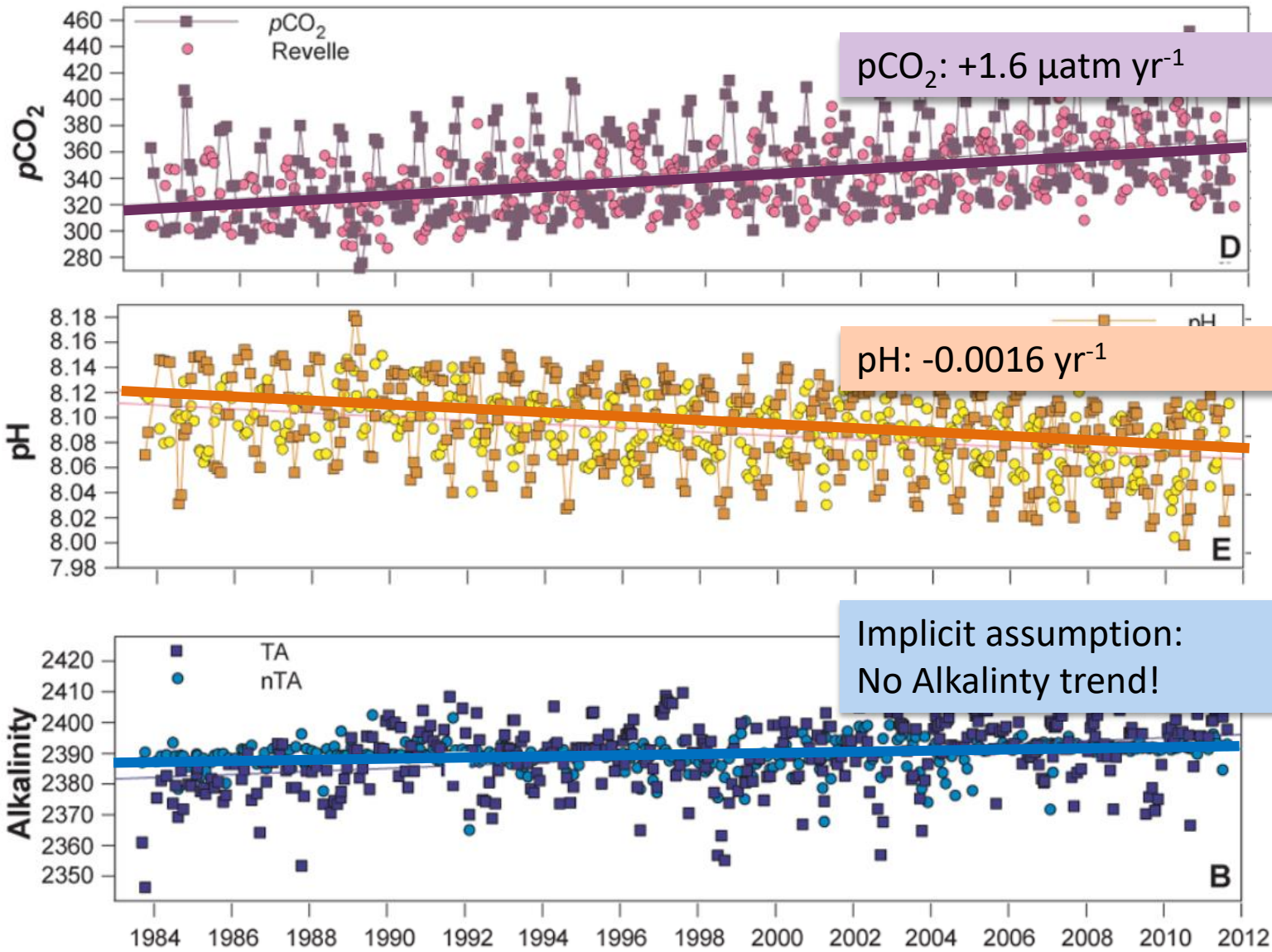
pH: -0.0016 yr^{-1}



commonly referred to as the "other CO_2 problem" (Henderson 2006, Turley 2005). fication is a predictable consequence of rising atmospheric CO_2 and does not suffer ties associated with climate change forecasts. Absorption of anthropogenic CO_2, nd lower calcium carbonate ($CaCO_3$) saturation in surface waters, where the bulk [2]

1: Bates et al., 2012, 2: Doney et. al. (2009)





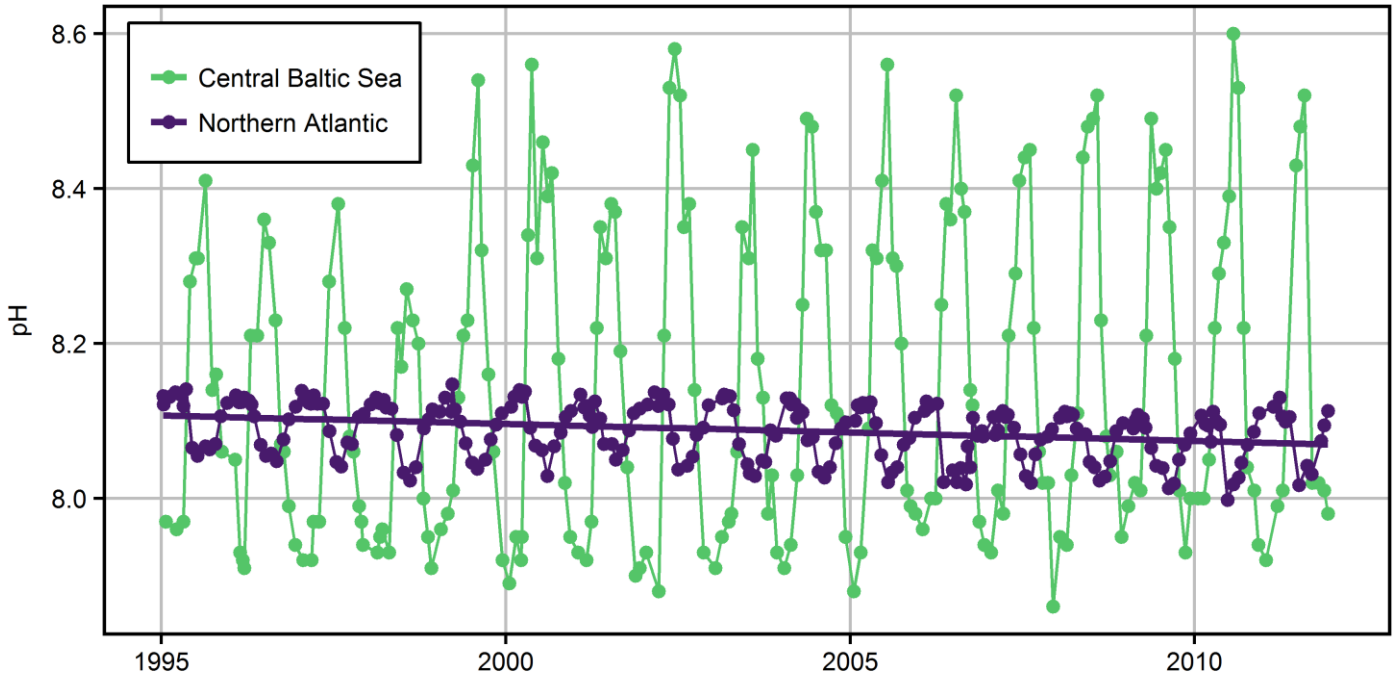
pCO_2: +1.6 µatm yr^{-1}

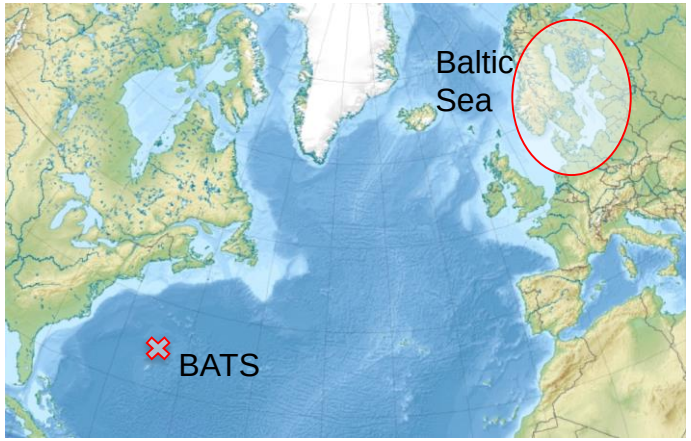
pH: -0.0016 yr^{-1}

Implicit assumption:
No Alkalinty trend!

1: Bates et al., 2012, 2: Doney et. al. (2009)

Ocean Acidification in the Baltic Sea?





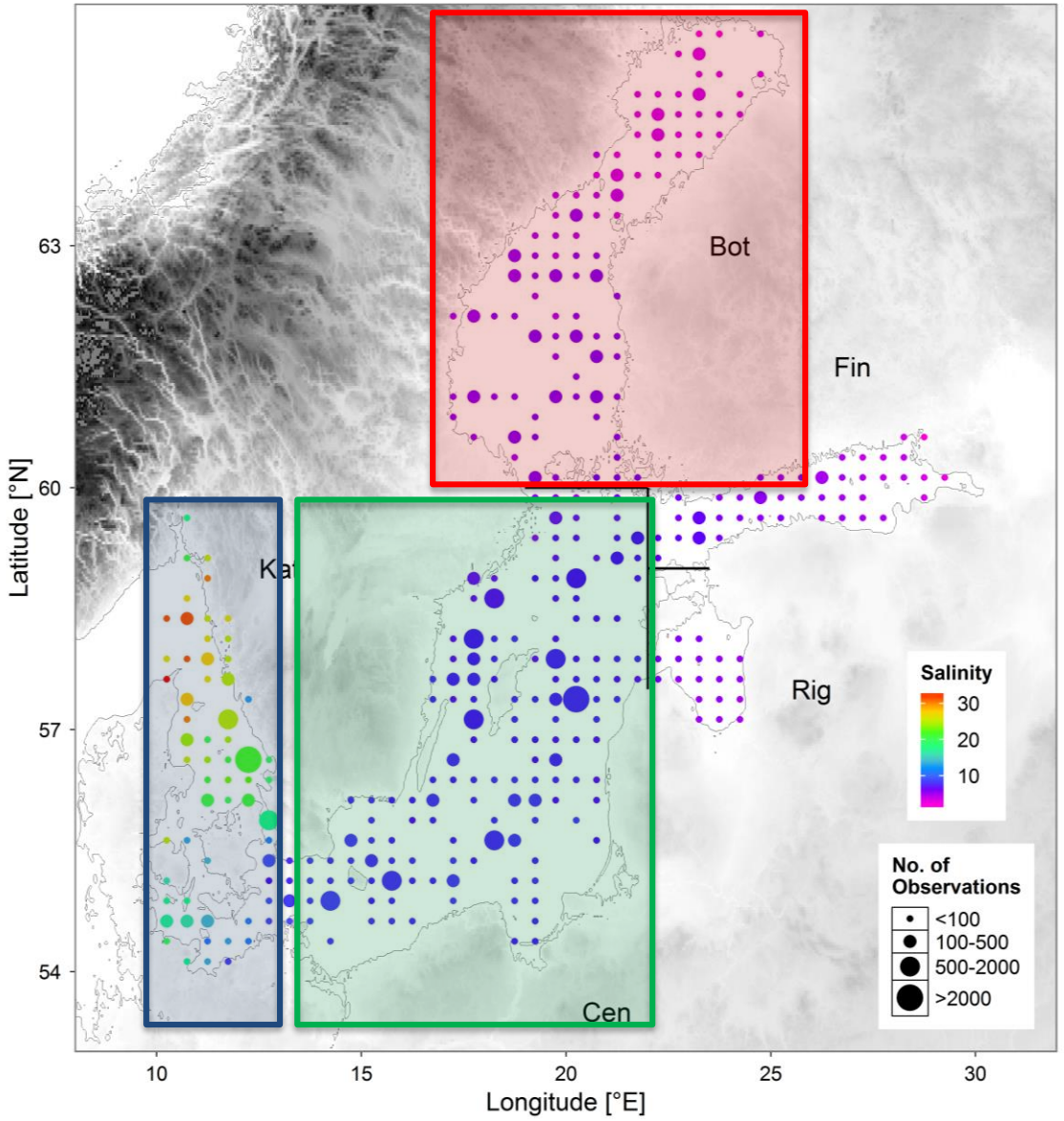
Option 1:
Measure pH!
EU BONUS project PINBAL
Development of a spectrophotometric pH measurement system for monitoring in the Baltic Sea

BONUS
Science for a better future of the Baltic Sea region

Option 2:
Check what you know about Alkalinity!

1: Bates et al., 2012, 2: SMHI monitoring data

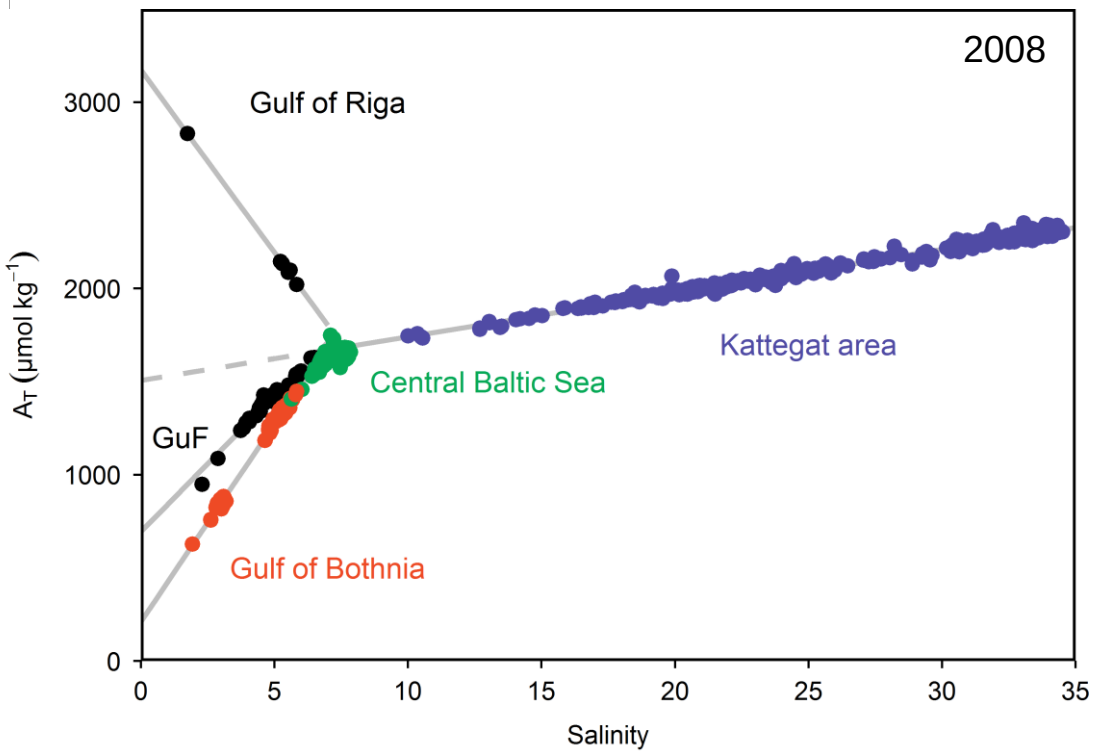
Alkalinity observations in the Baltic Sea



Data compilation:

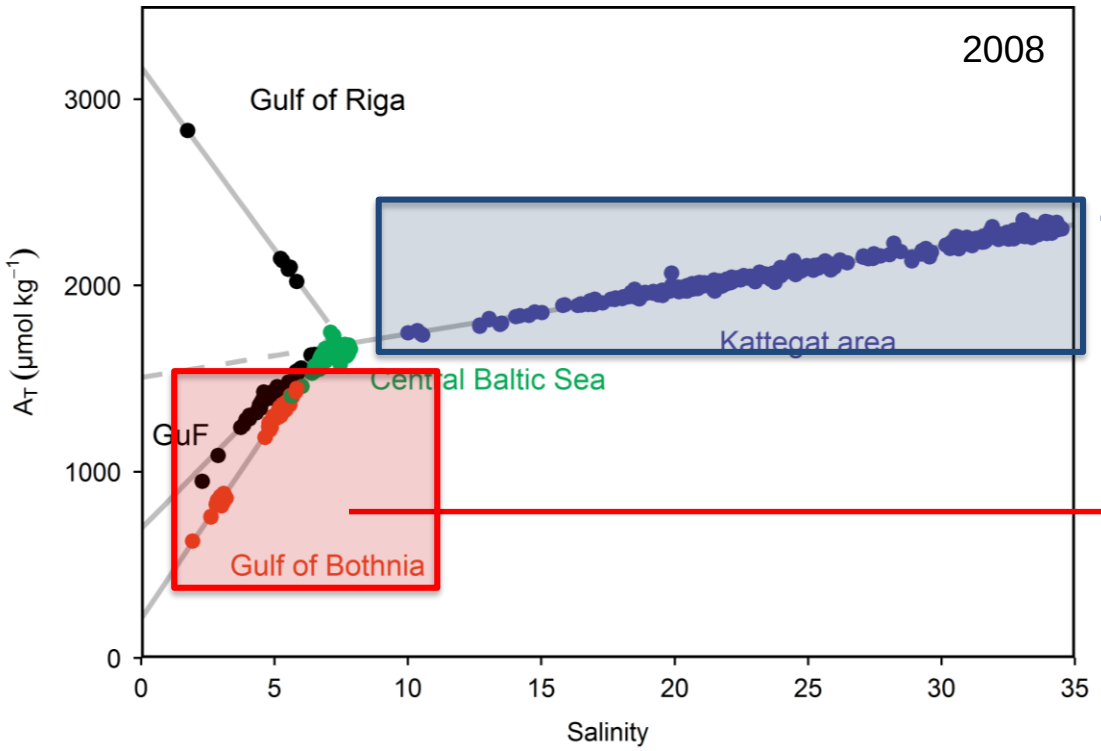
- CANIBAL data set[1] → most of the historic observations dating back to 1906
- SMHI monitoring data[2]
- Baltic-C (BALTEX Phase II (BONUS+))[3]
- FMI monitoring data[4]

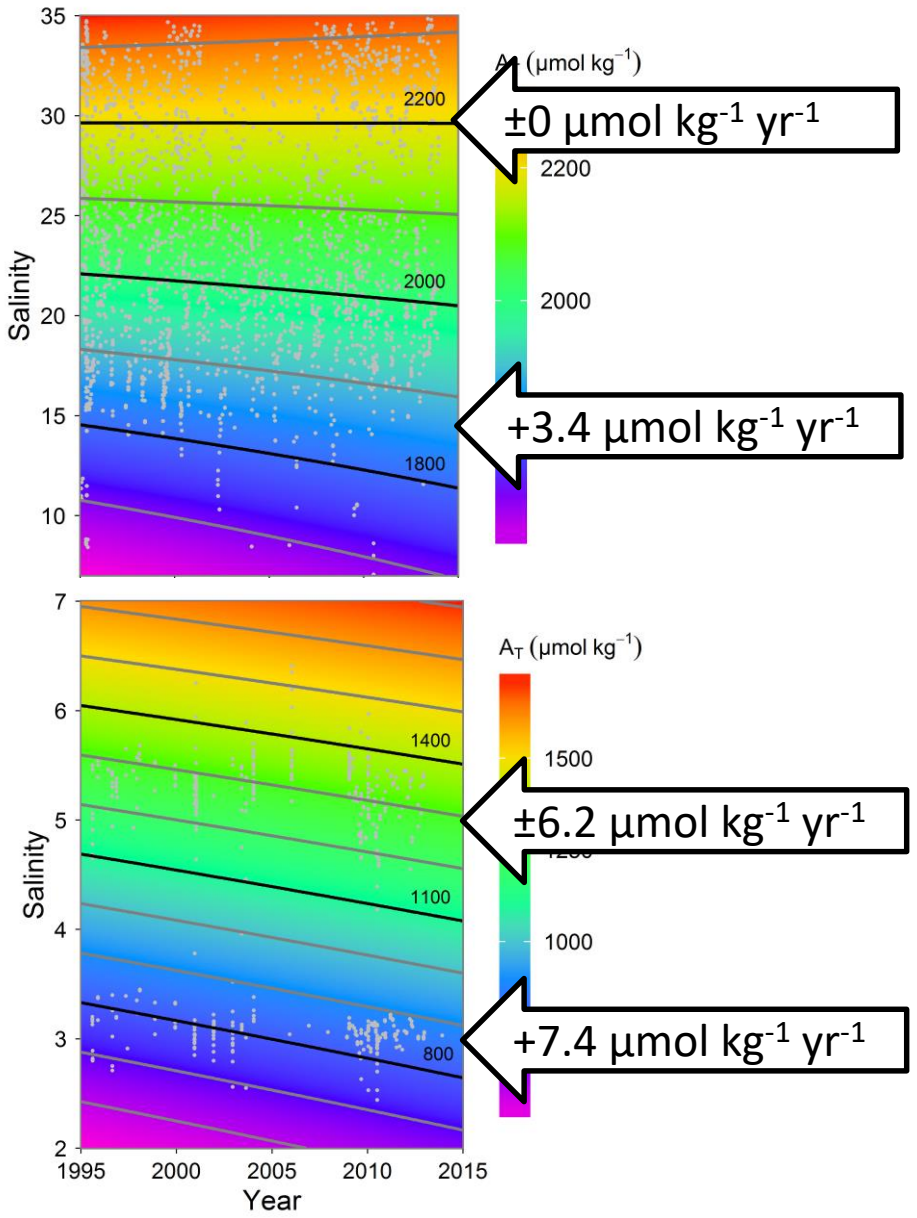
- 31436 observations
- First measurements in the early 20th century
- Surface water <20m

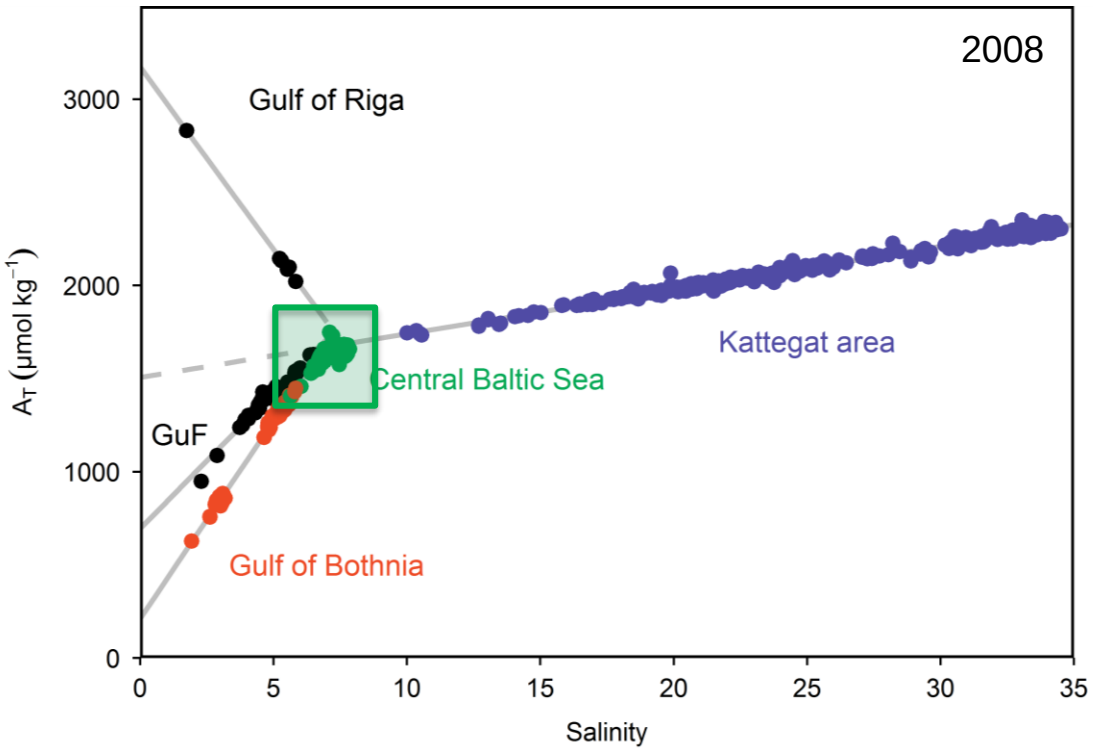


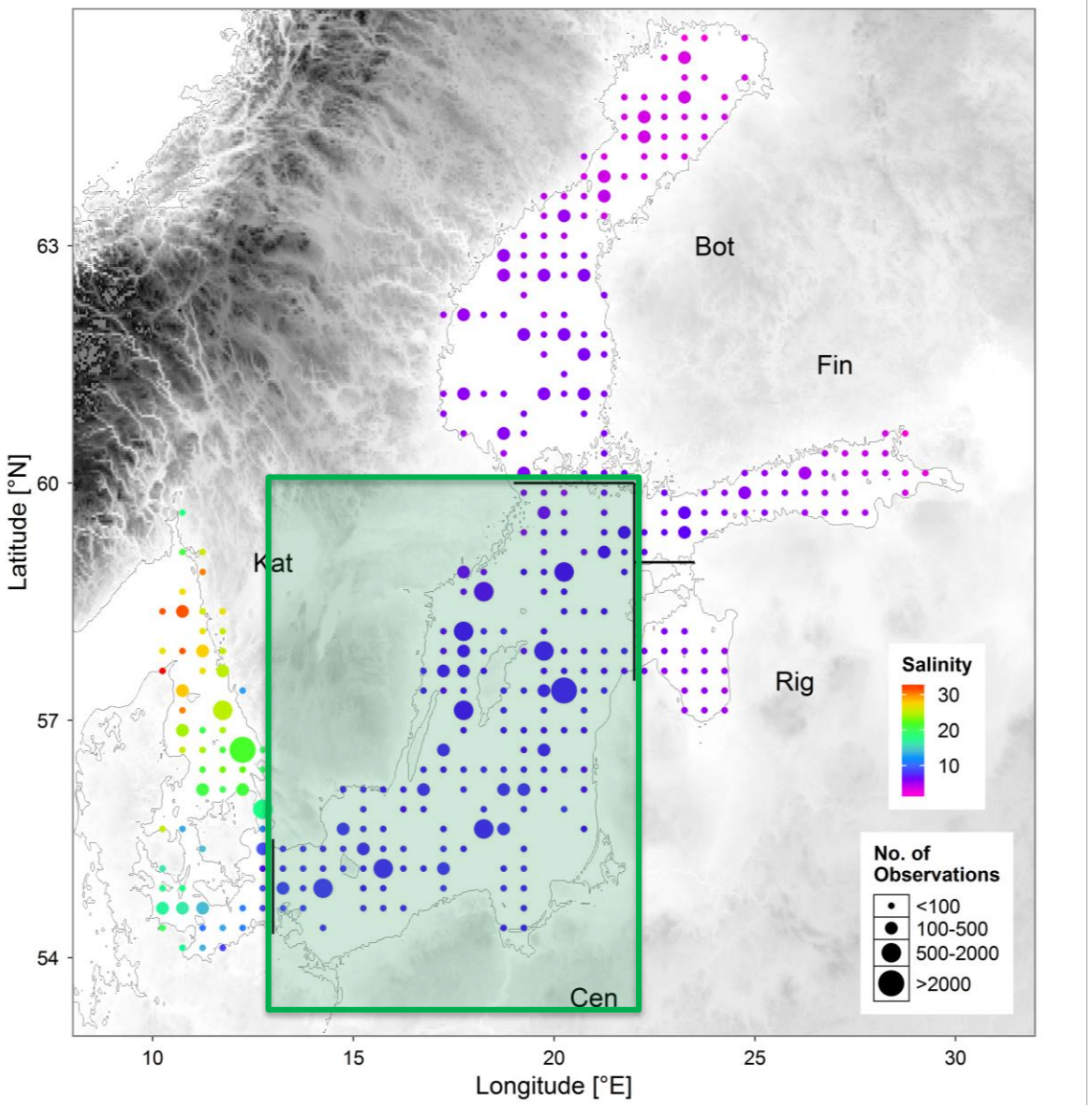
1: Hjalmarsson et al. (2008) 2: extracted from SHARK in June 2015 3: http://www.smhi.se/ecds/search-data 4: provided by M. Pertilla

Kattegat and the gulfs – Linear A_T-S-relationship



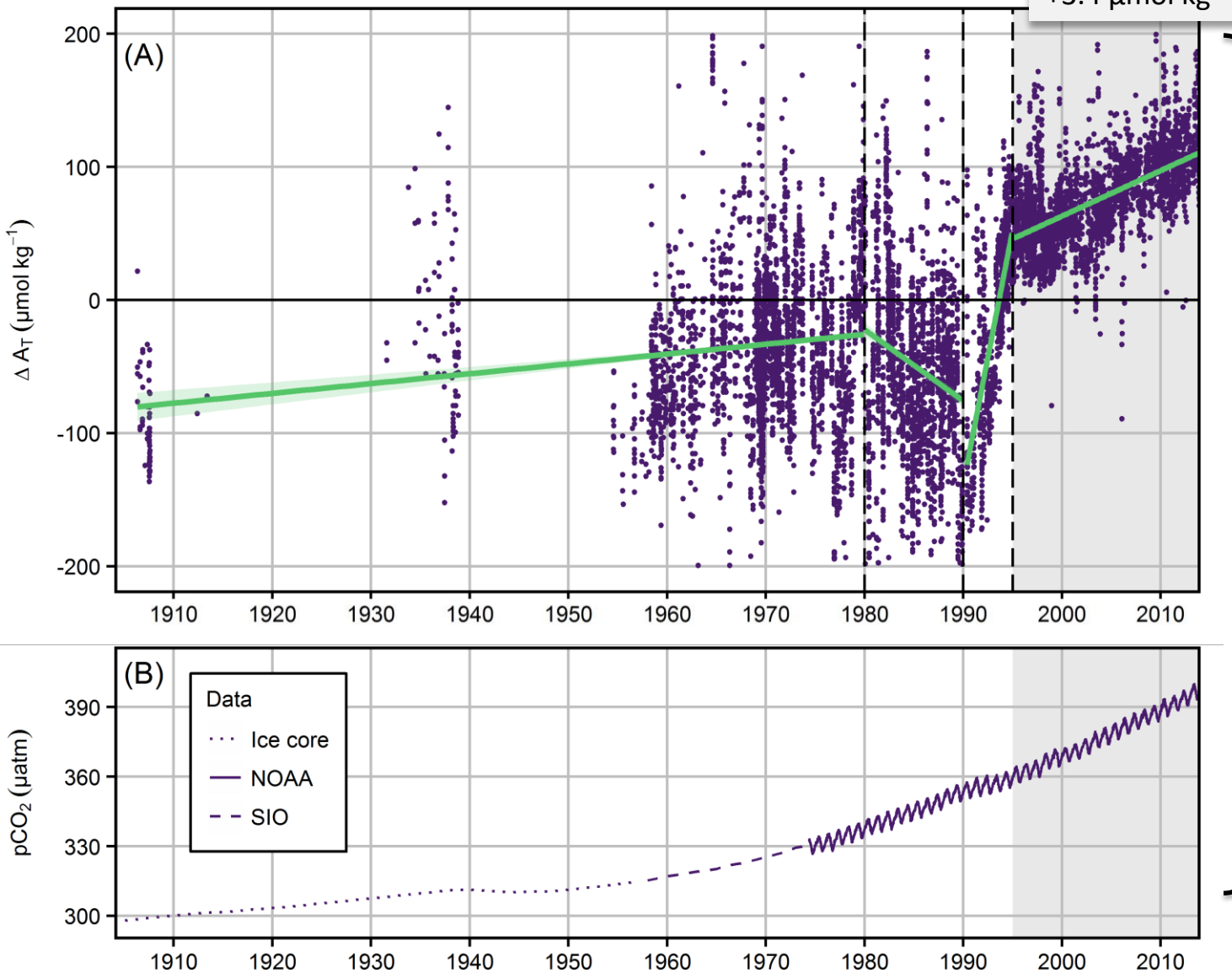


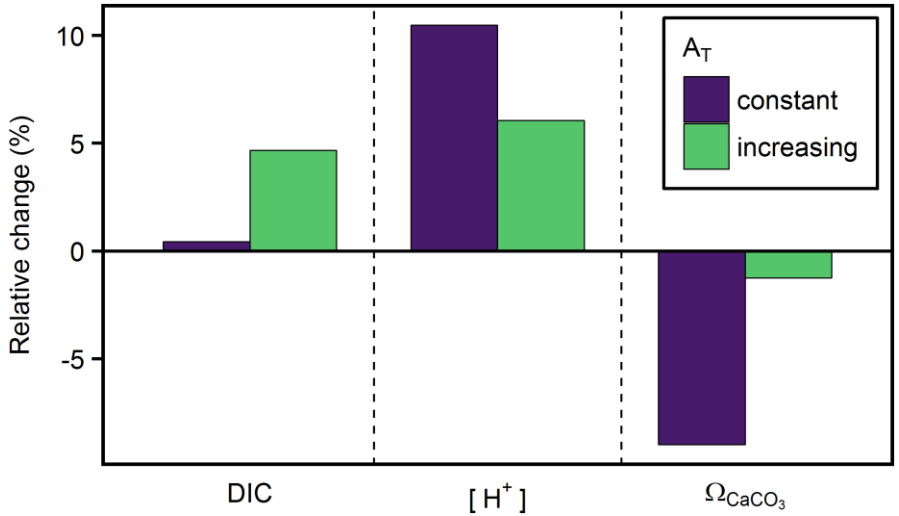

2008
Gulf of Riga
Kattegat area
Central Baltic Sea
GuF
Gulf of Bothnia
A_T (µmol kg^{-1})
Salinity
0
1000
2000
3000
0
5
10
15
20
25
30
35


Bot
Fin
Kat
Rig
Cen
Salinity
30
20
10
No. of Observations
<100
100-500
500-2000
>2000
Latitude [°N]
Longitude [°E]
54
57
60
63
10
15
20
25
30

Central Baltic Sea – No defined A_T-S-relationship

1995-2014:
+3.4 µmol kg^{-1} yr^{-1}





Thanks for your attention!

LIMNOLOGY and OCEANOGRAPHY

ASLO

Limnol. Oceanogr. 61, 2016, 1984–2002

doi: 10.1002/lno.10349

Long-term alkalinity trends in the Baltic Sea and their implications for CO_2-induced acidification

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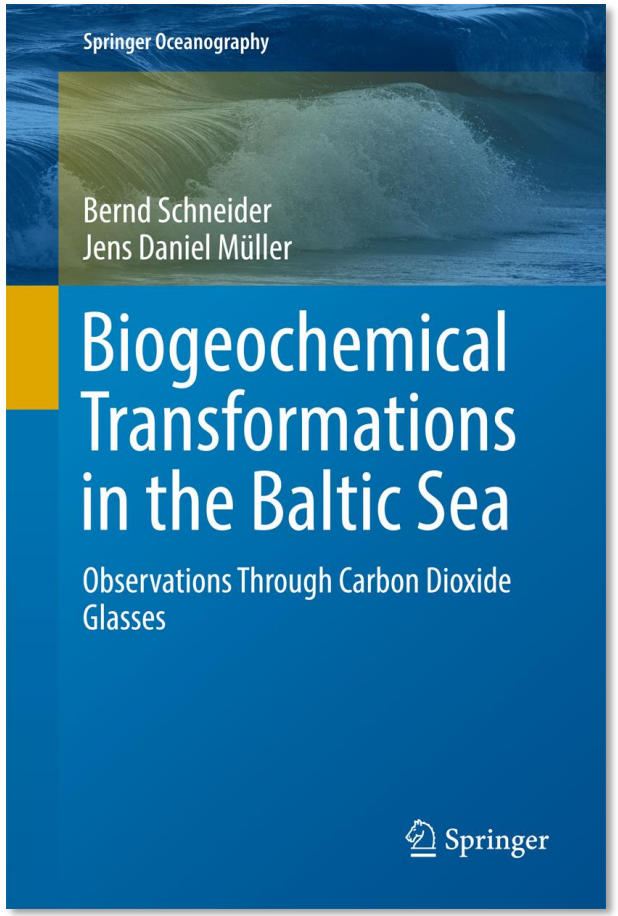
Abstract

Anthropogenic CO_2 emissions currently decrease open ocean pH, but on multi-millennial time scales intensified continental weathering is expected to contribute to increasing oceanic alkalinity (A_T) and thus mitigate the acidification signal. The Baltic Sea is an ideal study site for such A_T dynamics, due to its direct link to terrestrial processes, short water residence time and long history of A_T measurements dating back to

Müller et al. (2016)
Long-term alkalinity trends in the Baltic Sea and their implications for CO_2-induced acidification.
Limnol. Oceanogr. 61, 1984–2002.
doi:10.1002/lno.10349.



Schneider and Müller (2018)
Biogeochemical Transformations in the Baltic Sea: Observations Through Carbon Dioxide Glasses
doi:10.1007/978-3-319-61699-5.