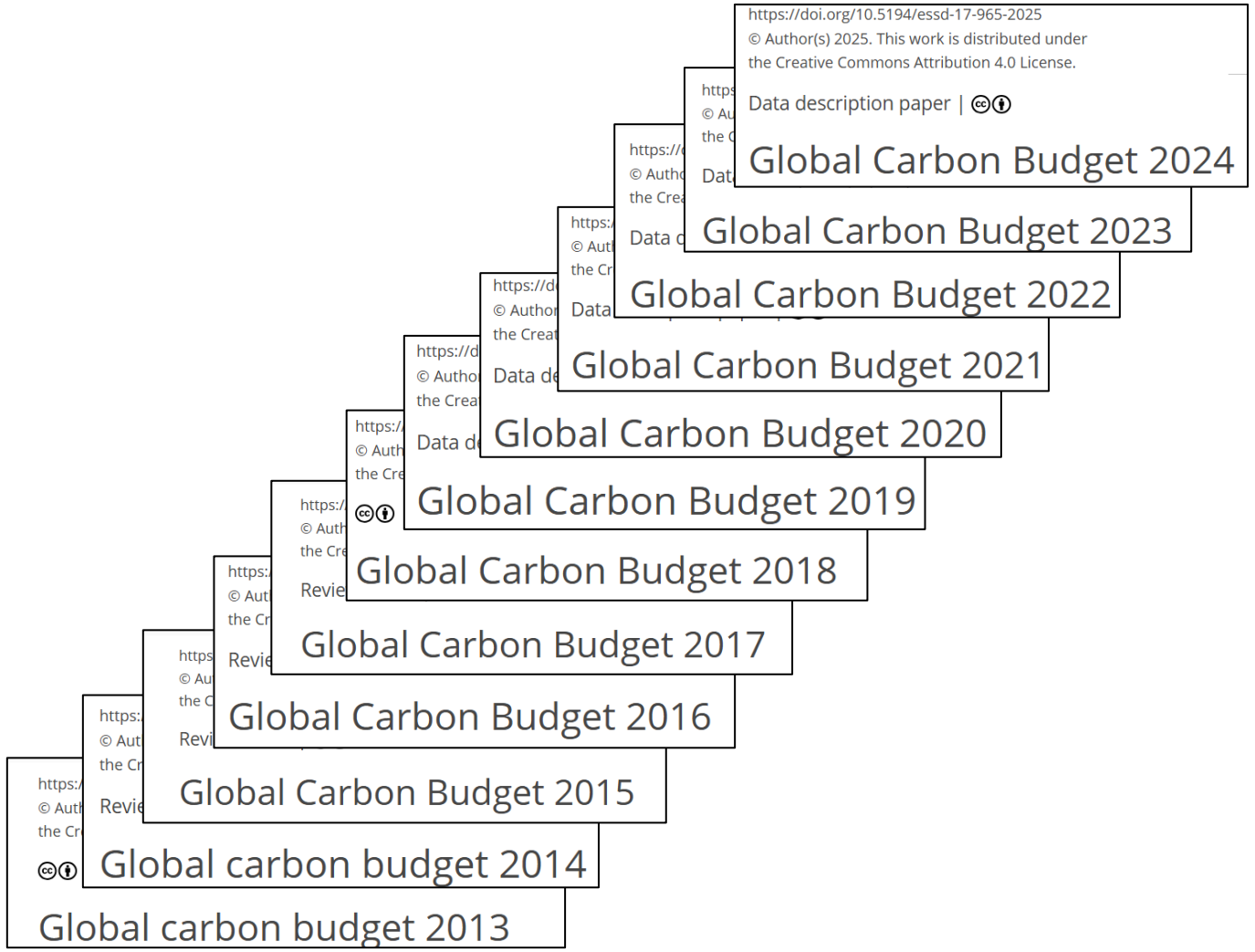
Linking ICOS and SOCAT pCO_2 Observations with Machine Learning to Assess Marine Heatwave Impacts on Coastal Carbon Cycling

Maurie Keppens [1,2], Alizée Roobaert [1], Arianna Olivelli [1], Griet Neukermans [2] & Peter Landschützer[1]

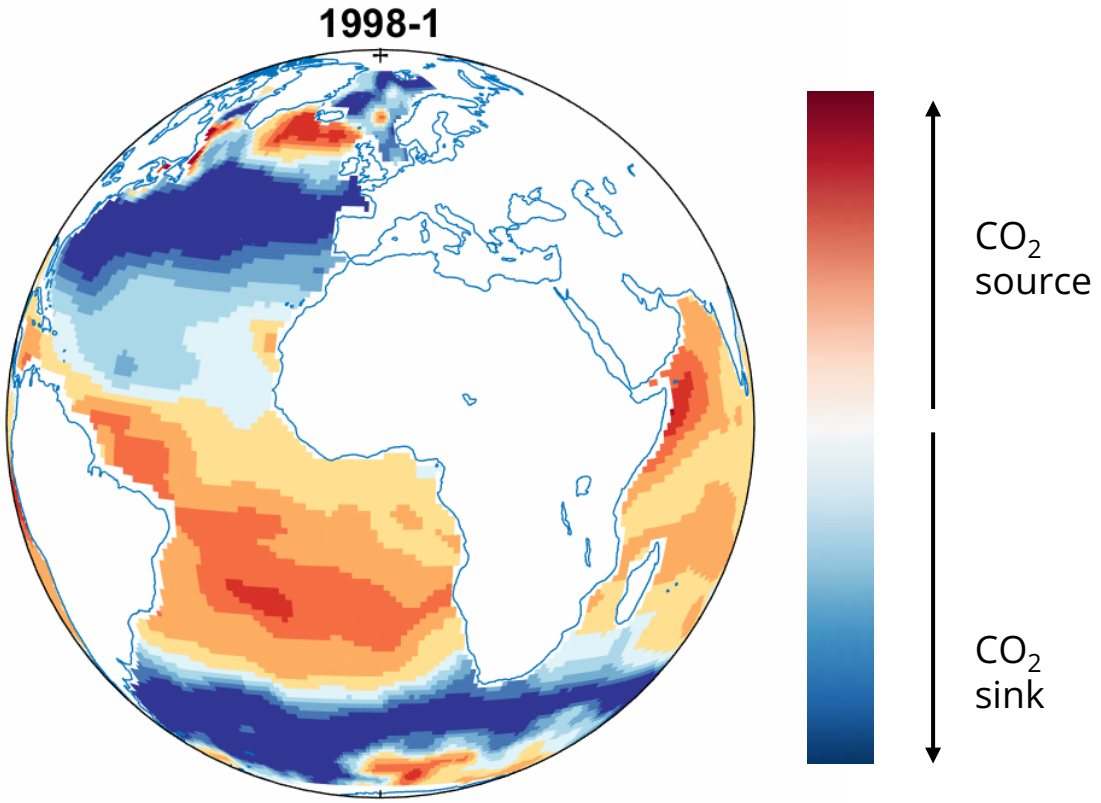
[1] *Flanders Marine Institute, VLIZ, Oostende, Belgium*
[2] *Faculty of Sciences, University of Ghent, Ghent, Belgium*
maurie.keppens@vliz.be

Introduction



Introduction

Continuous maps of CO_2 estimates



Landschützer et al. (2014)

Too coarse to capture coastal variability for regional carbon budgets

Close this gap using the Belgian Part of the North Sea as a test case

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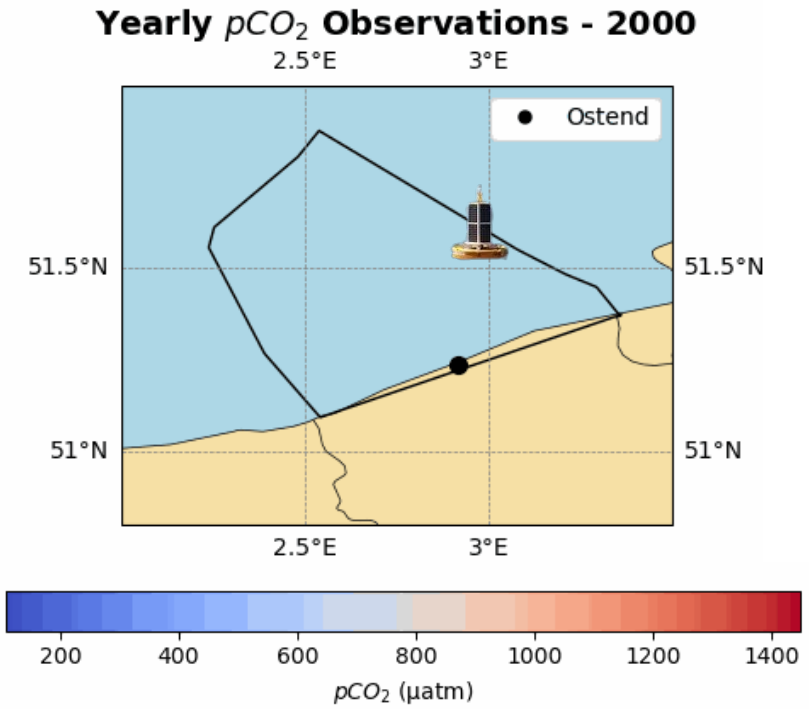
High-Resolution Coastal Carbon Dynamics: pCO_2 - **Study Area**



- ~80,000 pCO_2 data points over 2000-2024
- A buoy giving us continuous data since 2017

ICOS INTEGRATED CARBON OBSERVATION SYSTEM

SOCAT SURFACE OCEAN CO_2 ATLAS

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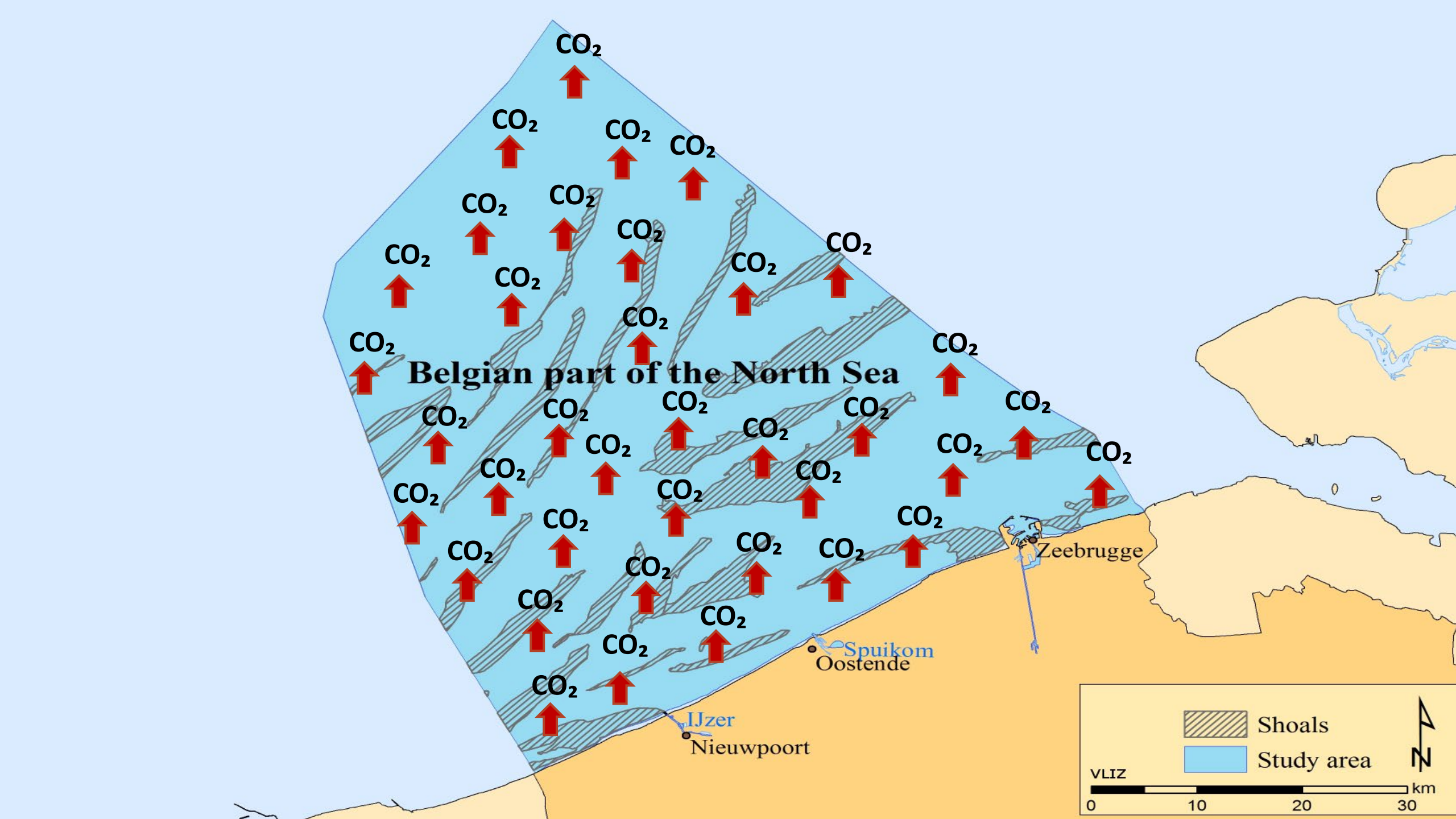
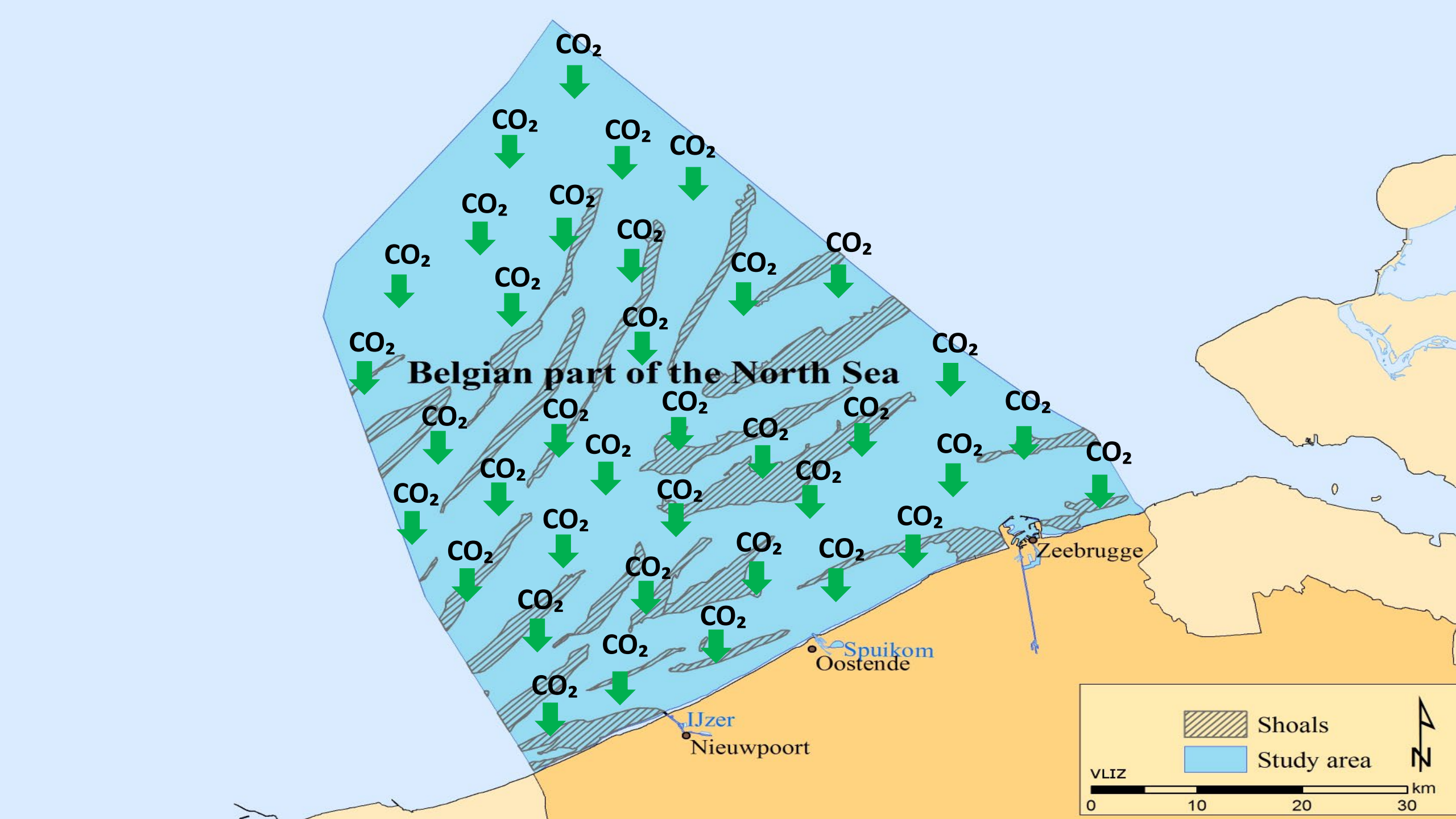
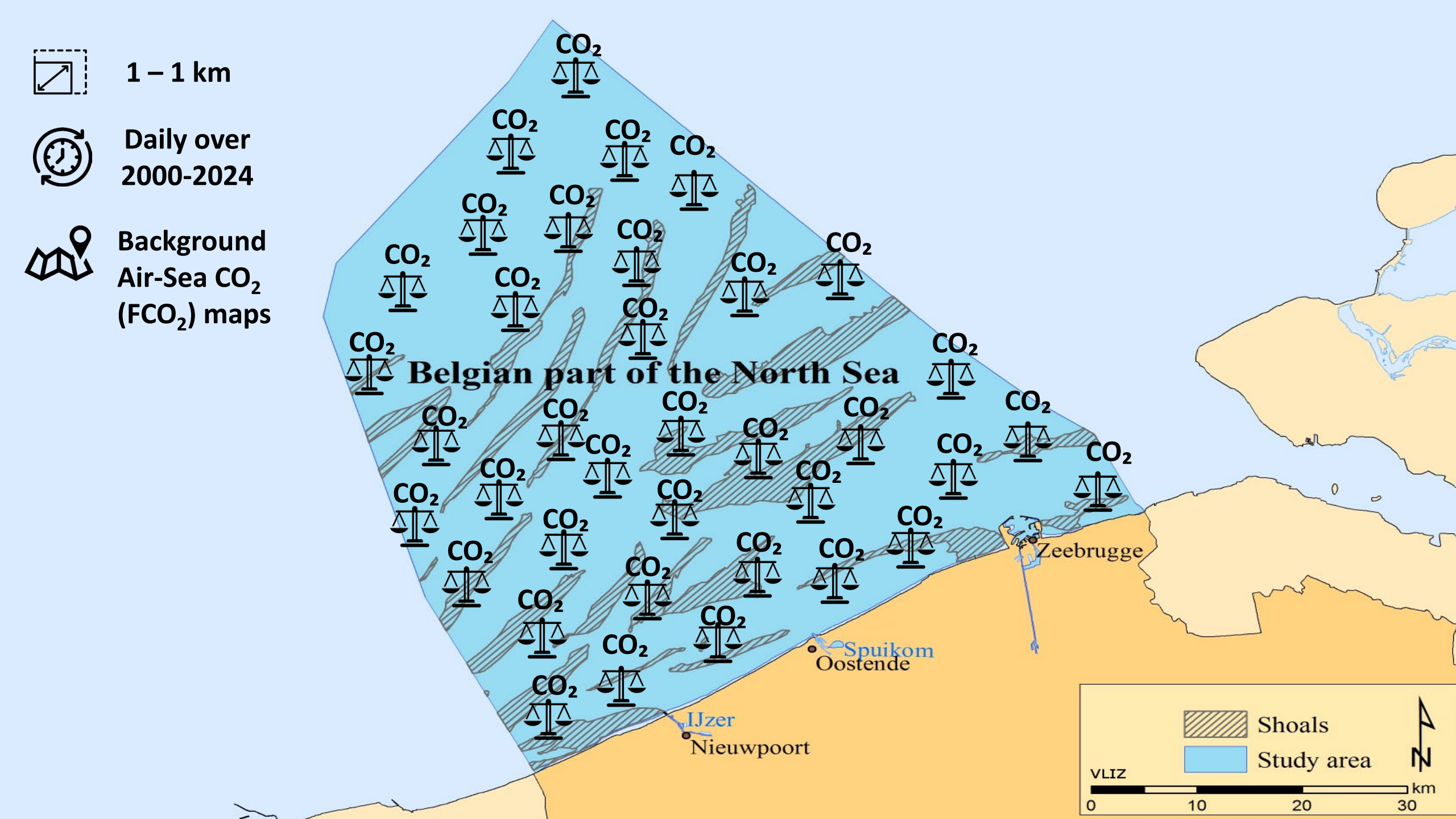
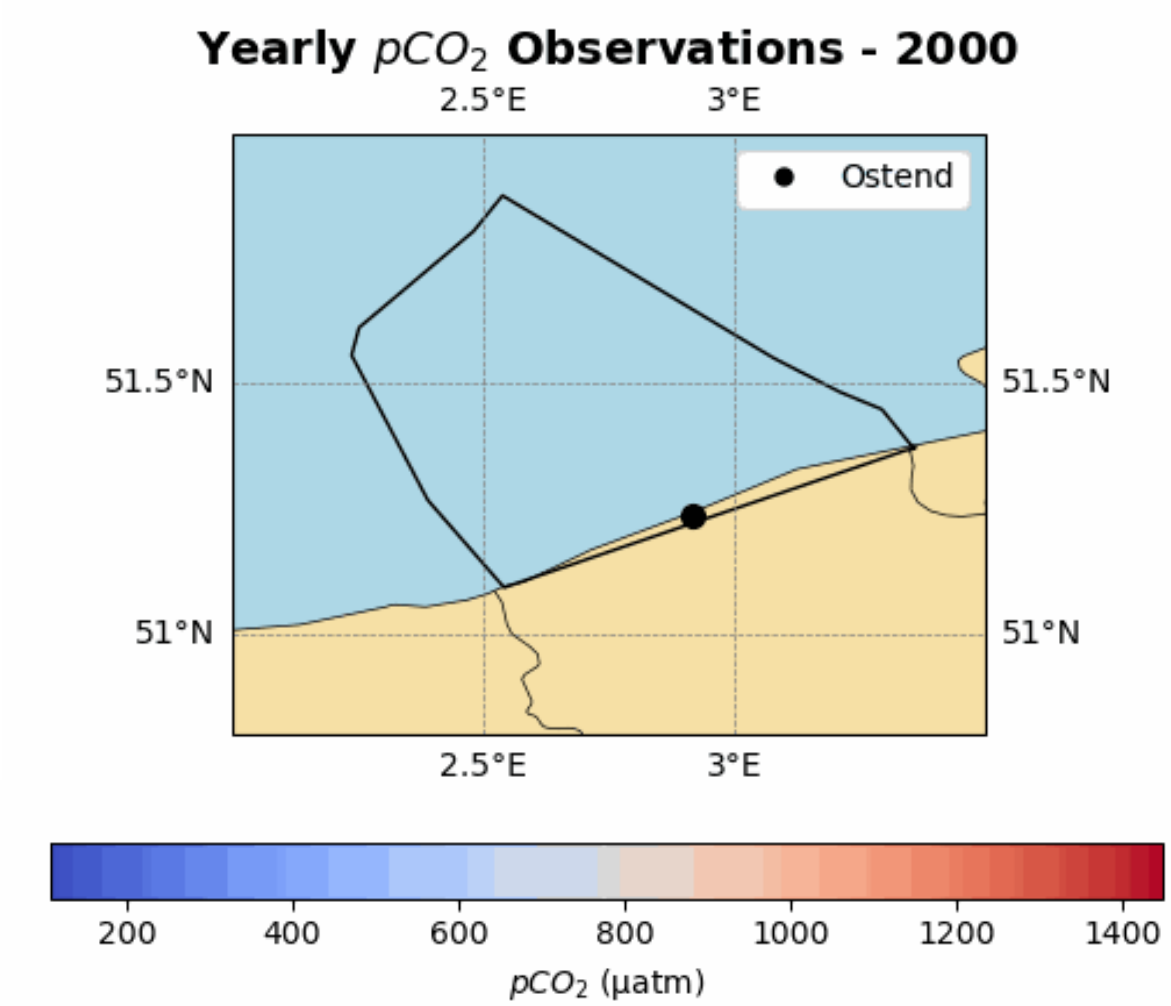

Belgian part of the North Sea
CO2
Zeebrugge
Spuikom
Oostende
IJzer
Nieuwpoort
Shoals
Study area
VLIZ
km
0
10
20
30


CO2
Belgian part of the North Sea
Zeebrugge
Spuikom
Oostende
IJzer
Nieuwpoort
Shoals
Study area
VLIZ
km
0
10
20
30


1 – 1 km
Daily over 2000-2024
Background Air-Sea CO_2 (FCO_2) maps
Belgian part of the North Sea
Zeebrugge
Spuikom
Oostende
IJzer
Nieuwpoort
Shoals
Study area
VLIZ
0
10
20
30
km

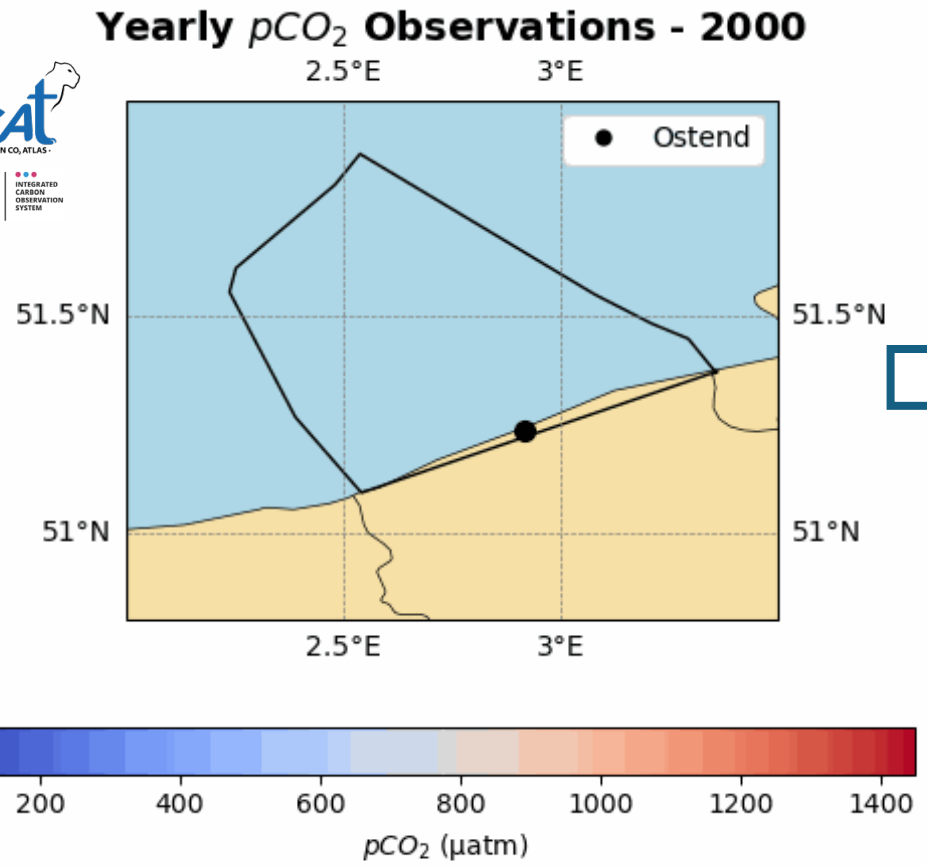
High-Resolution Coastal Carbon Dynamics: pCO_2 - **Methodology**

Discontinuous Maps



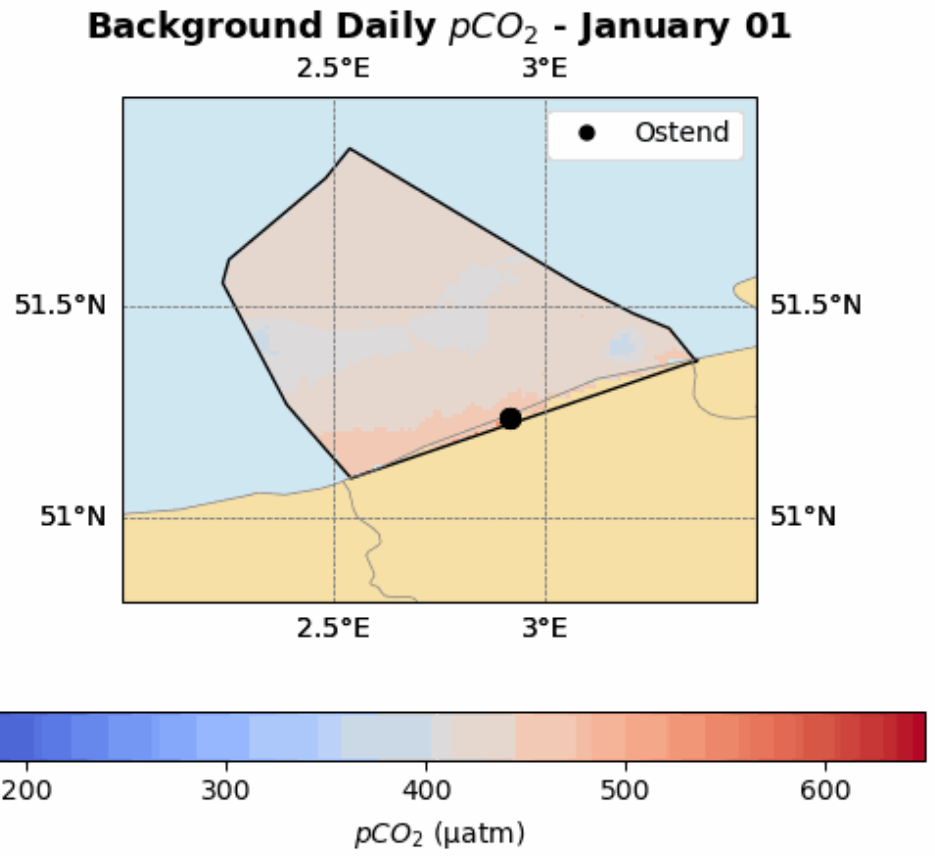
High-Resolution Coastal Carbon Dynamics: pCO_2 - **Methodology**

Discontinuous Maps



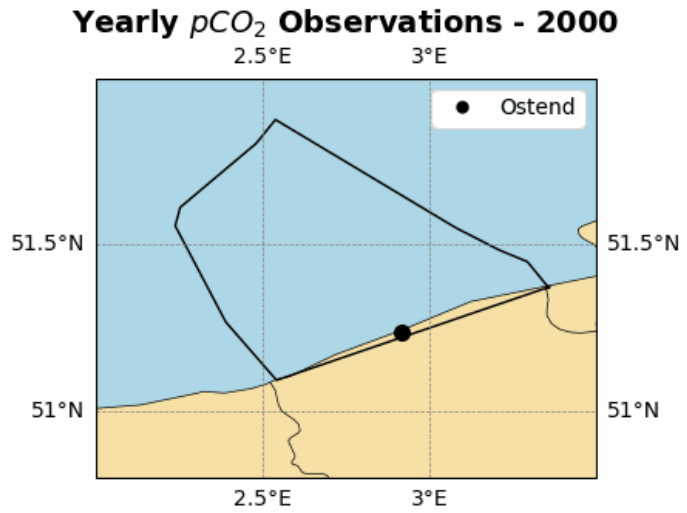
Feedforward Neural Network (FFN)

Continuous Maps



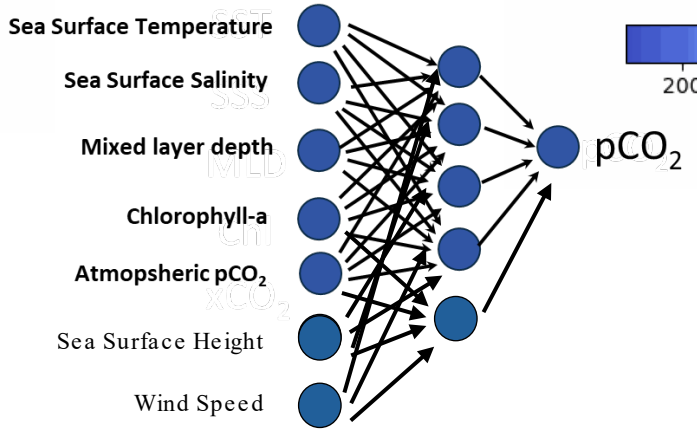
High-Resolution Coastal Carbon Dynamics: pCO_2 - **Methodology**

Discontinuous Maps

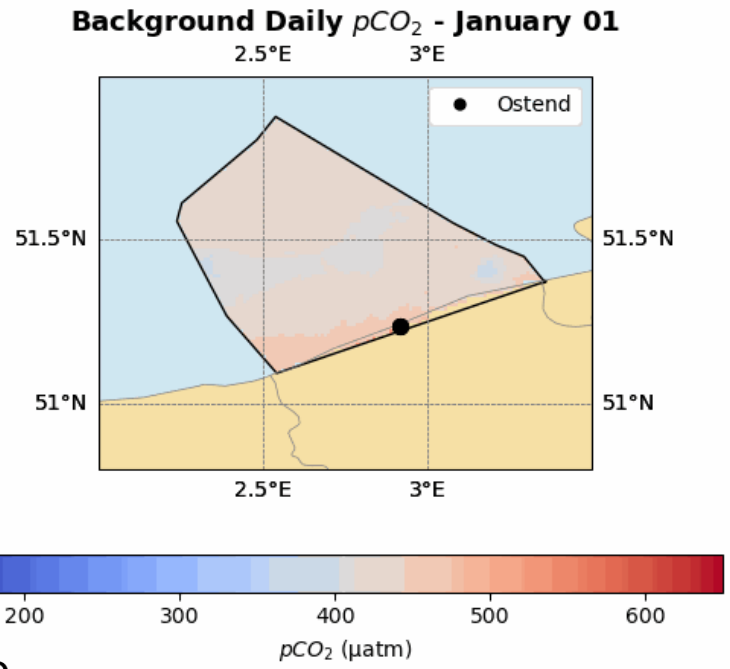


79966 pCO_2 Data (0.2% of total grid prediction points)

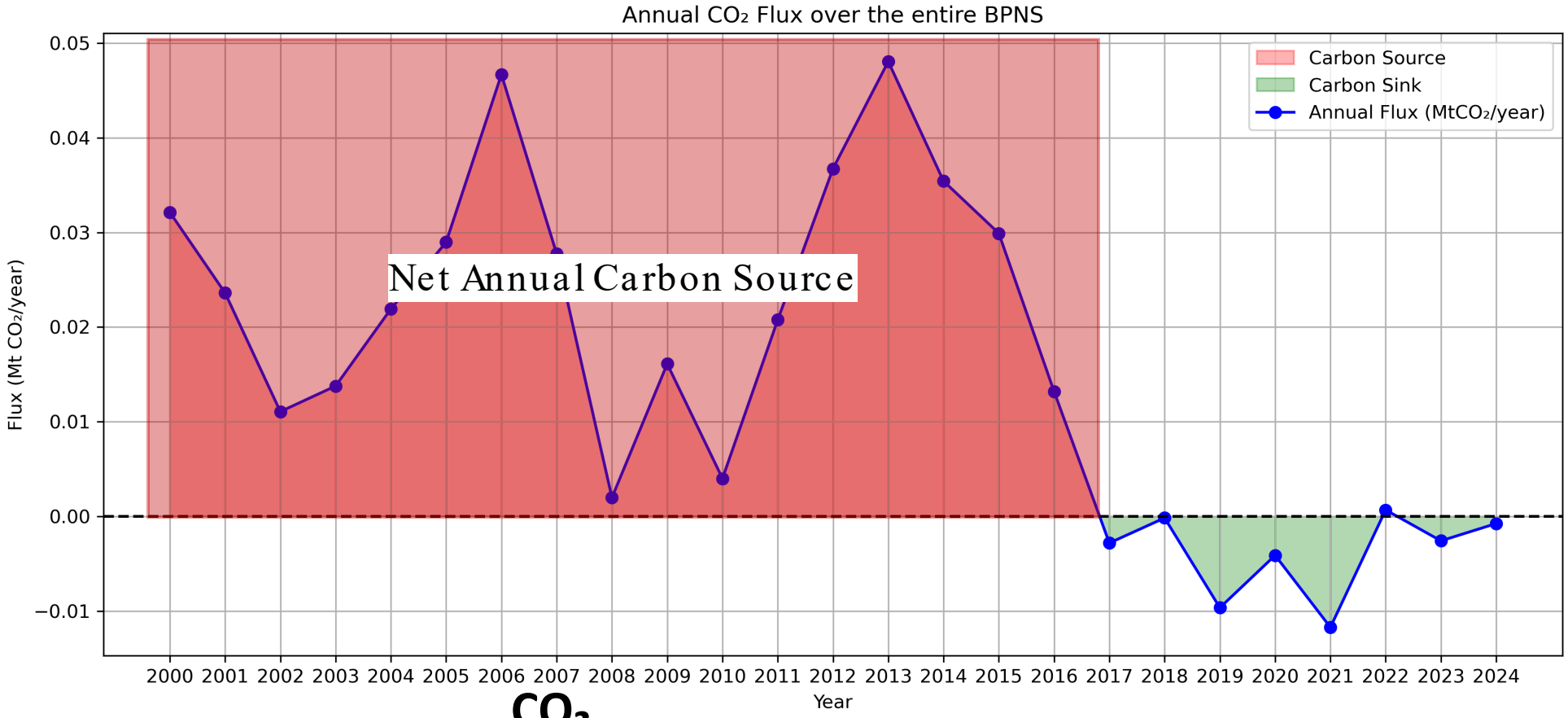
Feedforward Neural Network (FFN)

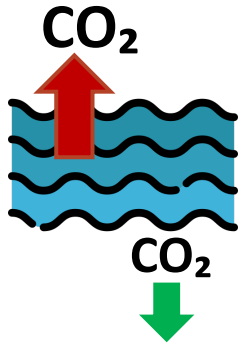


Continuous Maps



High-Resolution Coastal Carbon Dynamics: pCO_2/FCO_2 - **Results**





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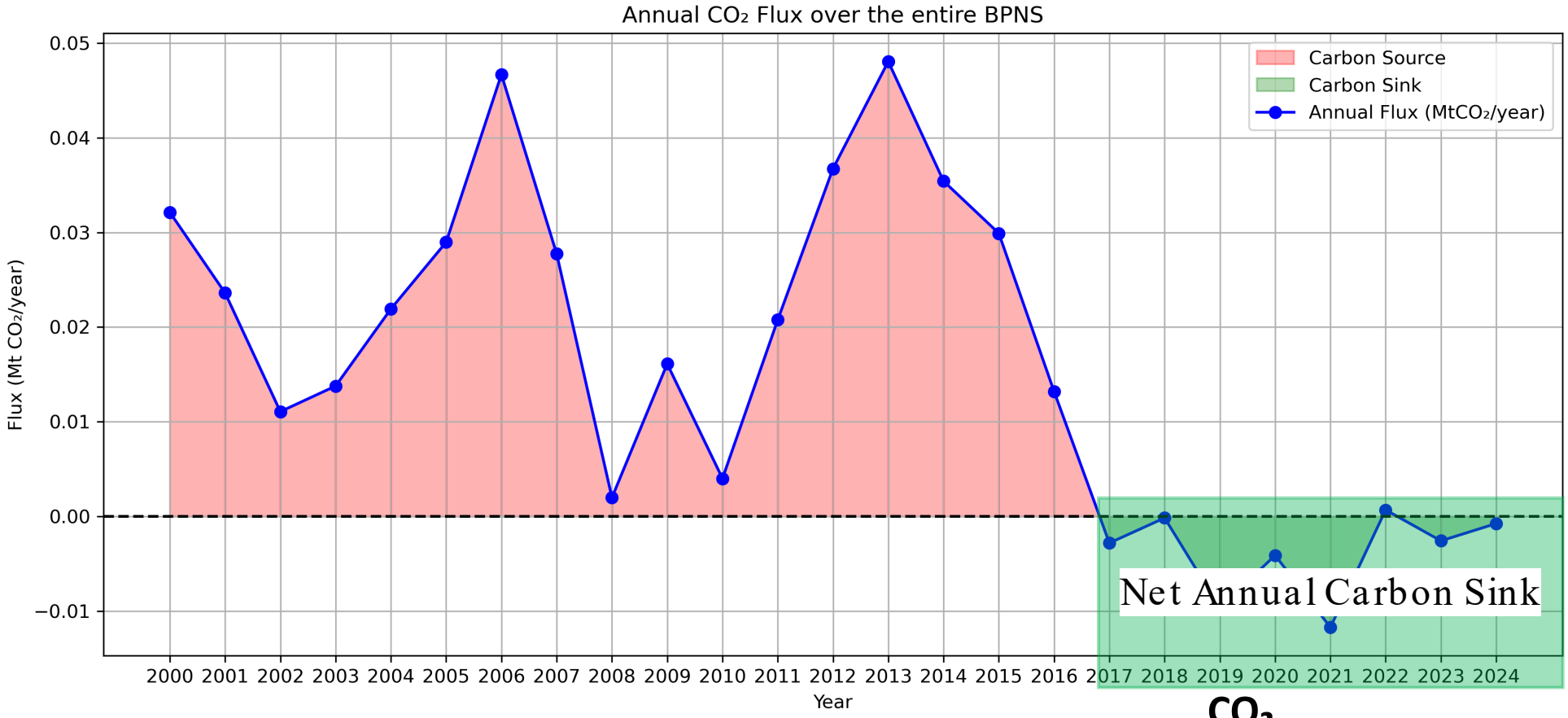
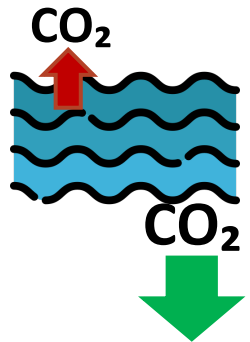
High-Resolution Coastal Carbon Dynamics: pCO_2/FCO_2 - **Results**





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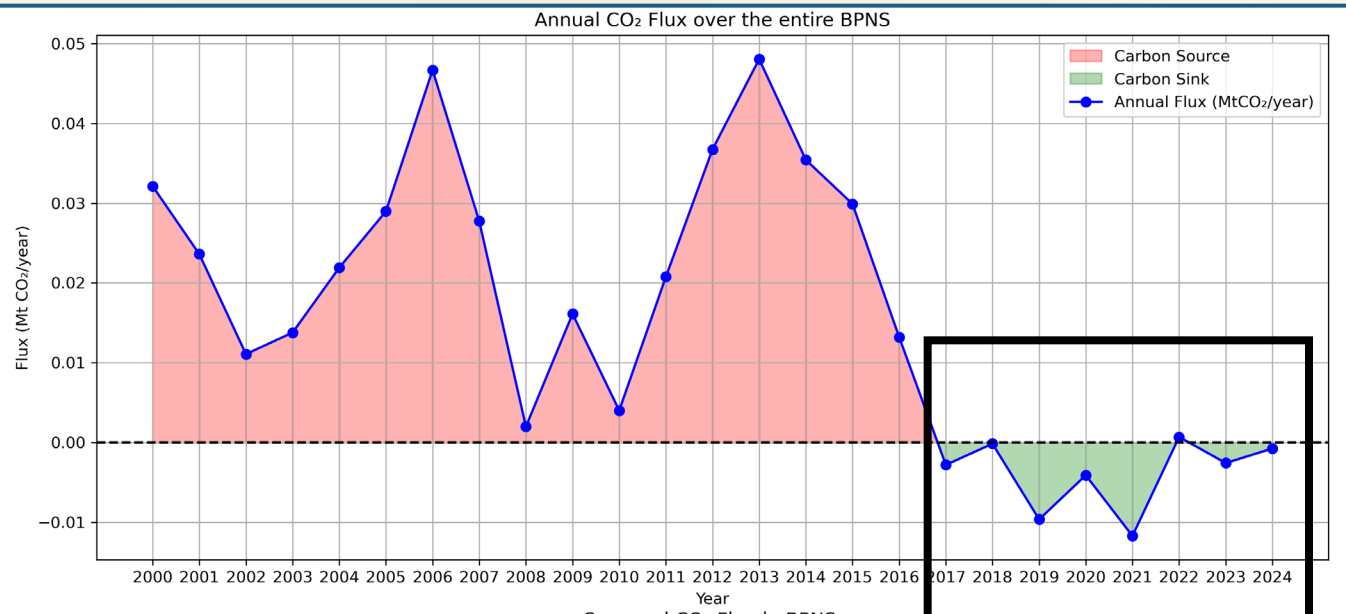
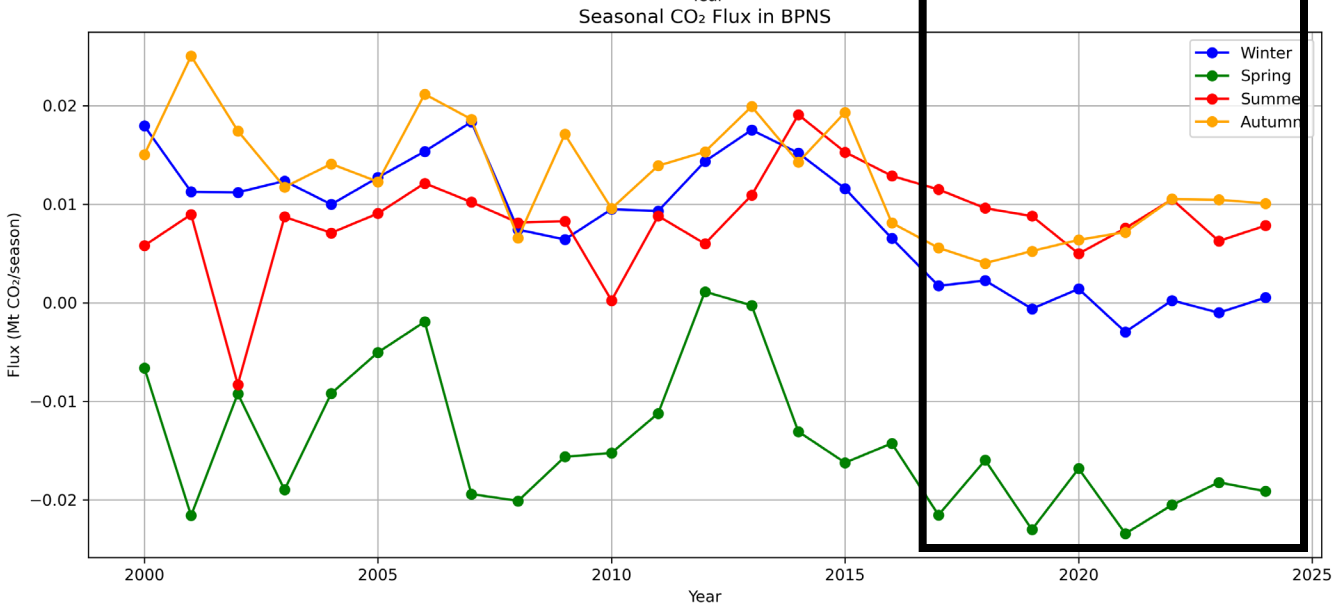
High-Resolution Coastal Carbon Dynamics: pCO_2/FCO_2 - **Results**





Winter **<u>Carbon Source Decreases</u>**
Spring **<u>Carbon Sink Increases</u>**

<u>Higher Chl-a</u> concentrations in recent years

BPNS becomes a net **<u>annual carbon sink</u>**

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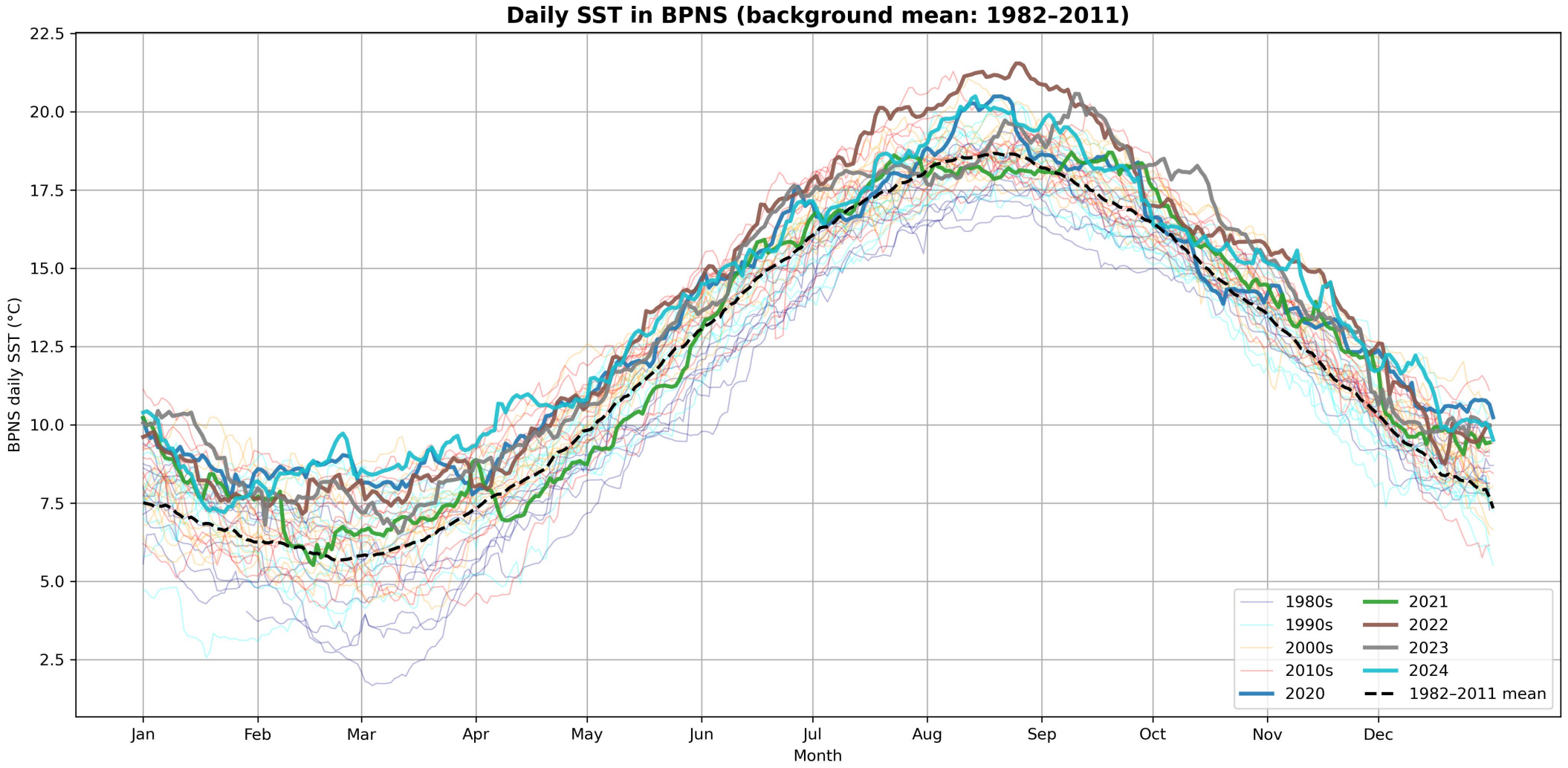
High-Resolution Coastal Carbon Dynamics: **Implications for MHWs**



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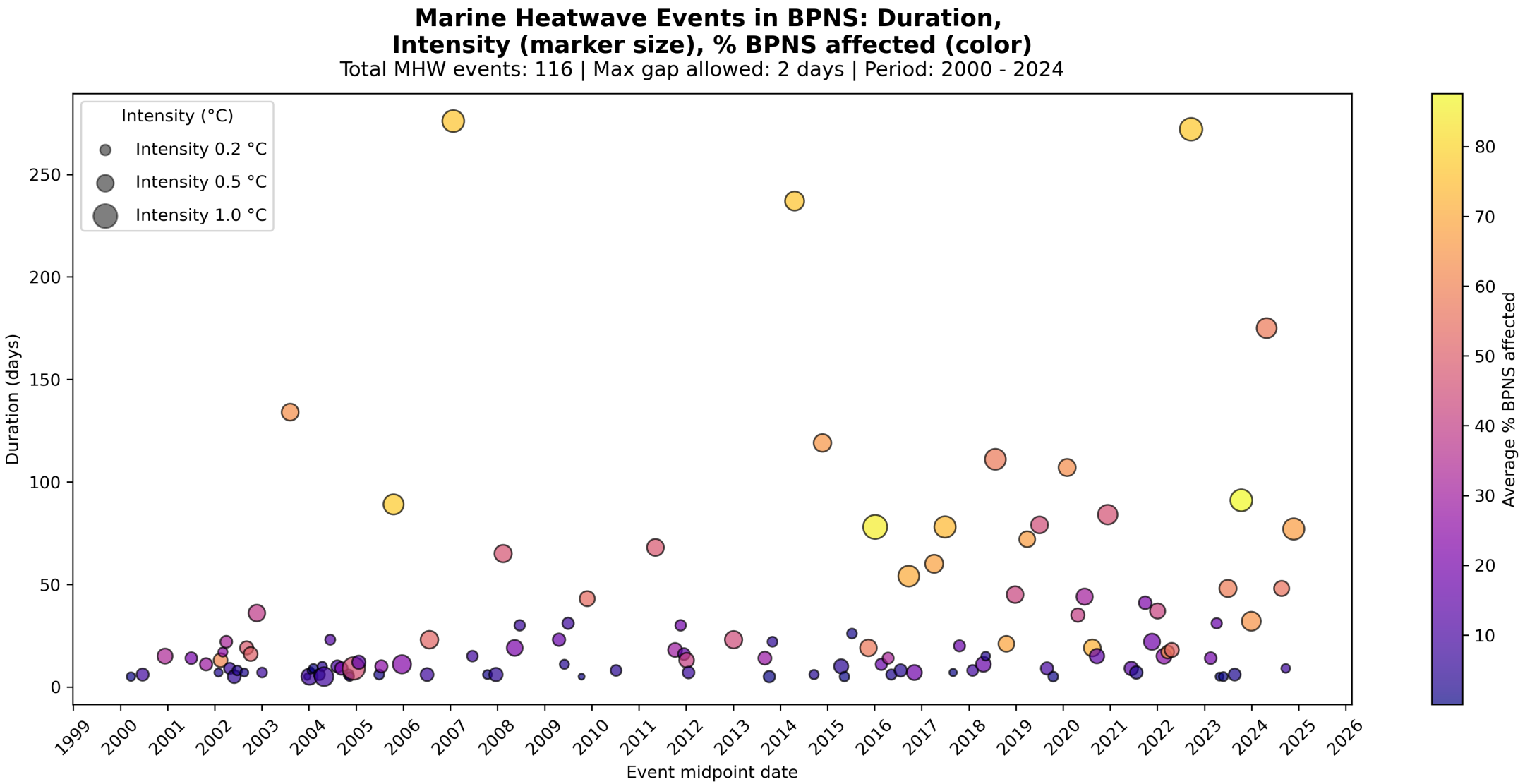
High-Resolution Coastal Carbon Dynamics: **Implications for MHWs**



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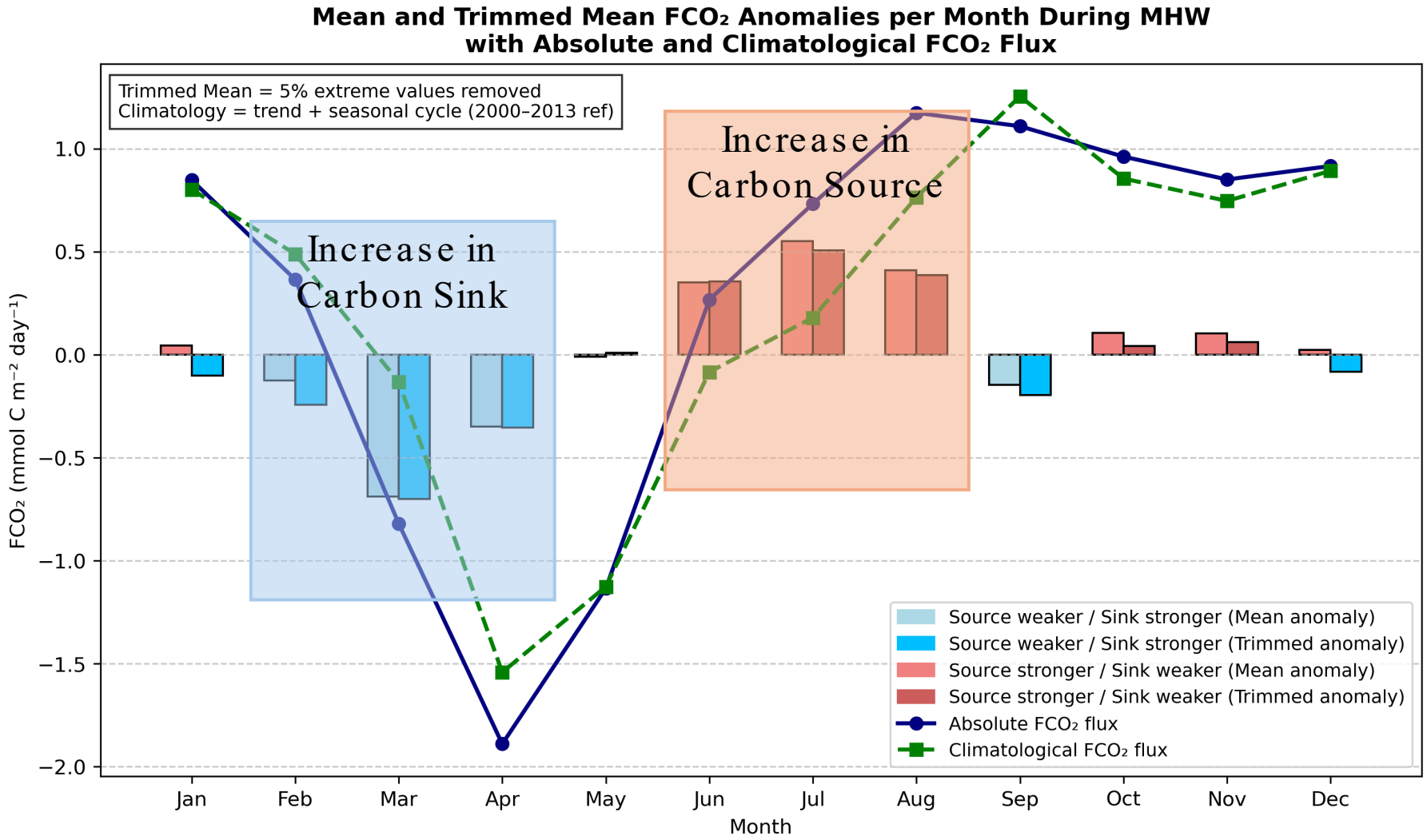
High-Resolution Coastal Carbon Dynamics: **Implications for MHWs**



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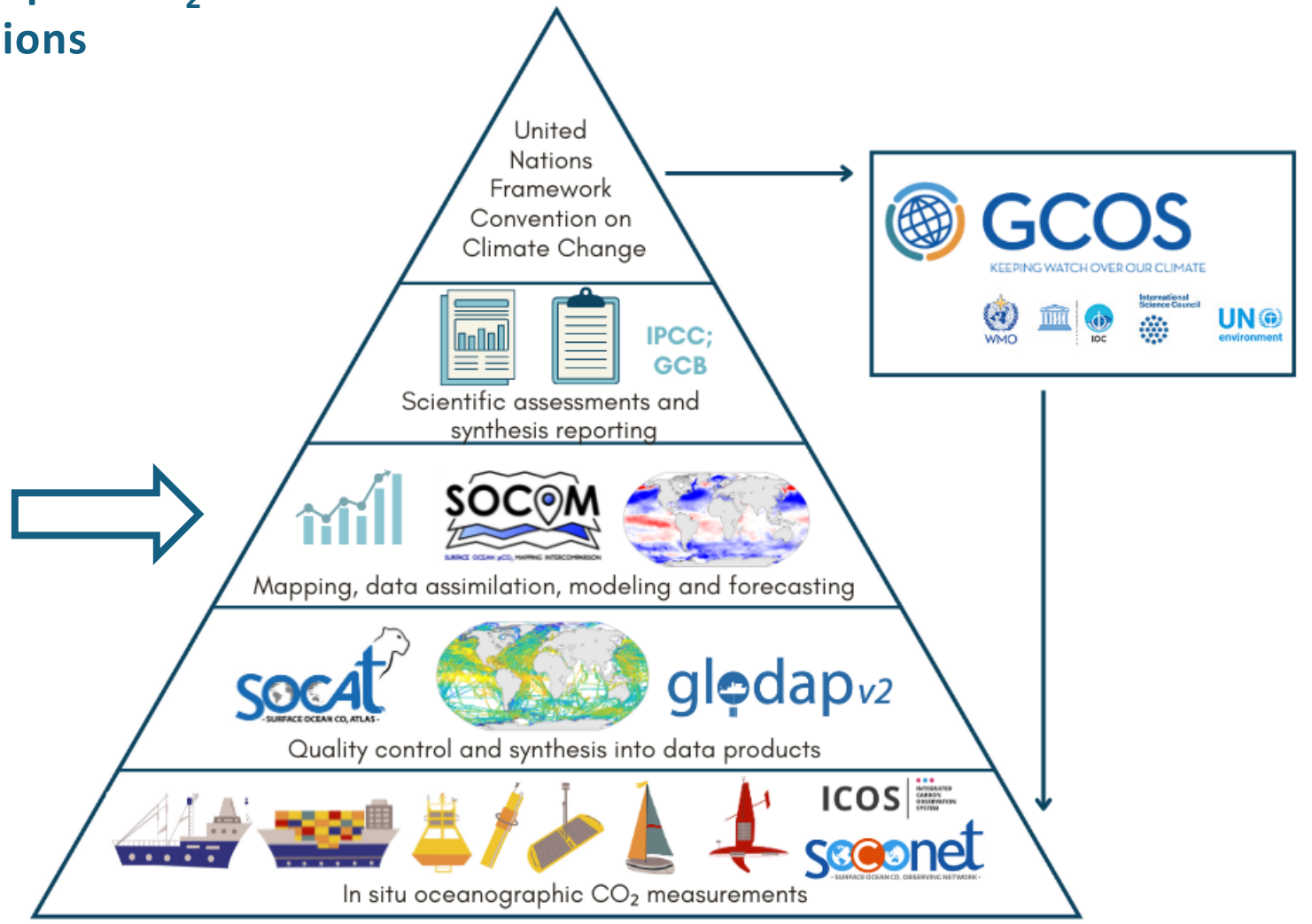
The Bigger Picture: **Value Chain**

Connects oceanographic CO_2 measurements to climate negotiations



Modified after Guidi et al. (2020)

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VLIZ pioneer in marine science

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MarSens MARINE OPTICS & REMOTE SENSING

ICOS INTEGRATED CARBON OBSERVATION SYSTEM

Thank you for listening! Questions?

Maurie Keppens – maurie.keppens@vliz.be