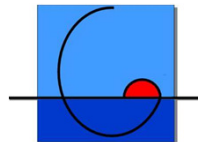


pCO₂ dynamic and air-sea fluxes in the Scheldt plume (Southern North Sea) from 2001 to 2003

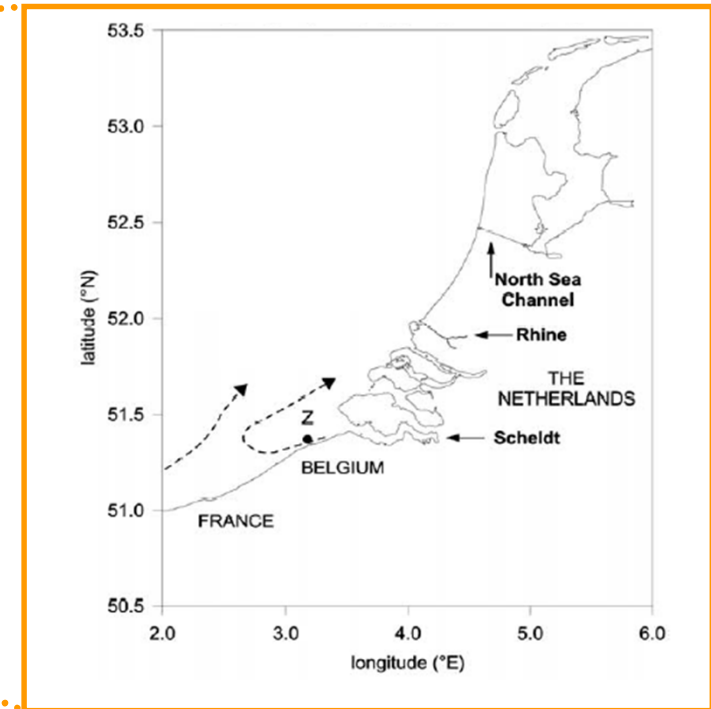
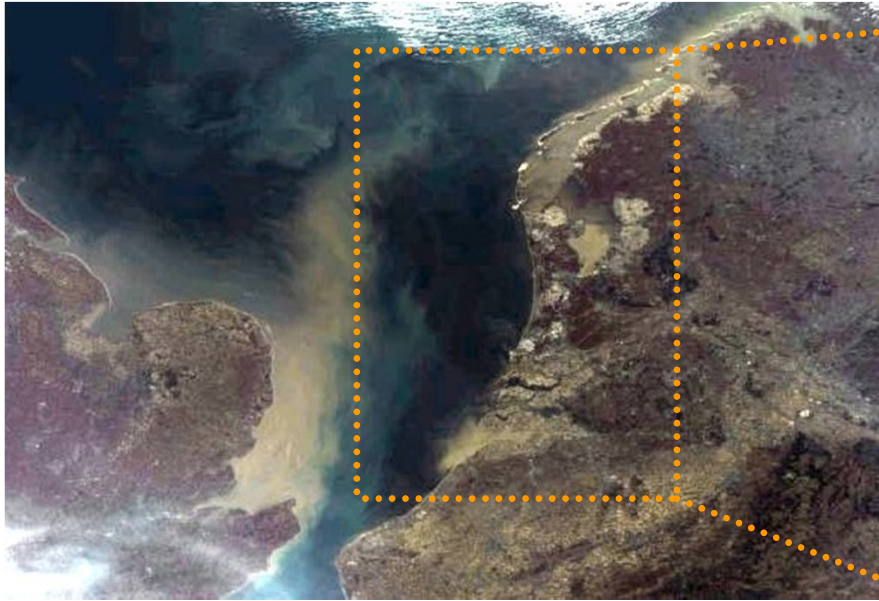
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Studied area: The Scheldt plume (Belgian coastal water)



Inner Scheldt estuary:

Heterotrophic and a source of CO_2 : 300 to 700 $\text{mmol C m}^{-2} \text{ day}^{-1}$ (Frankignoulle et al. 1998).

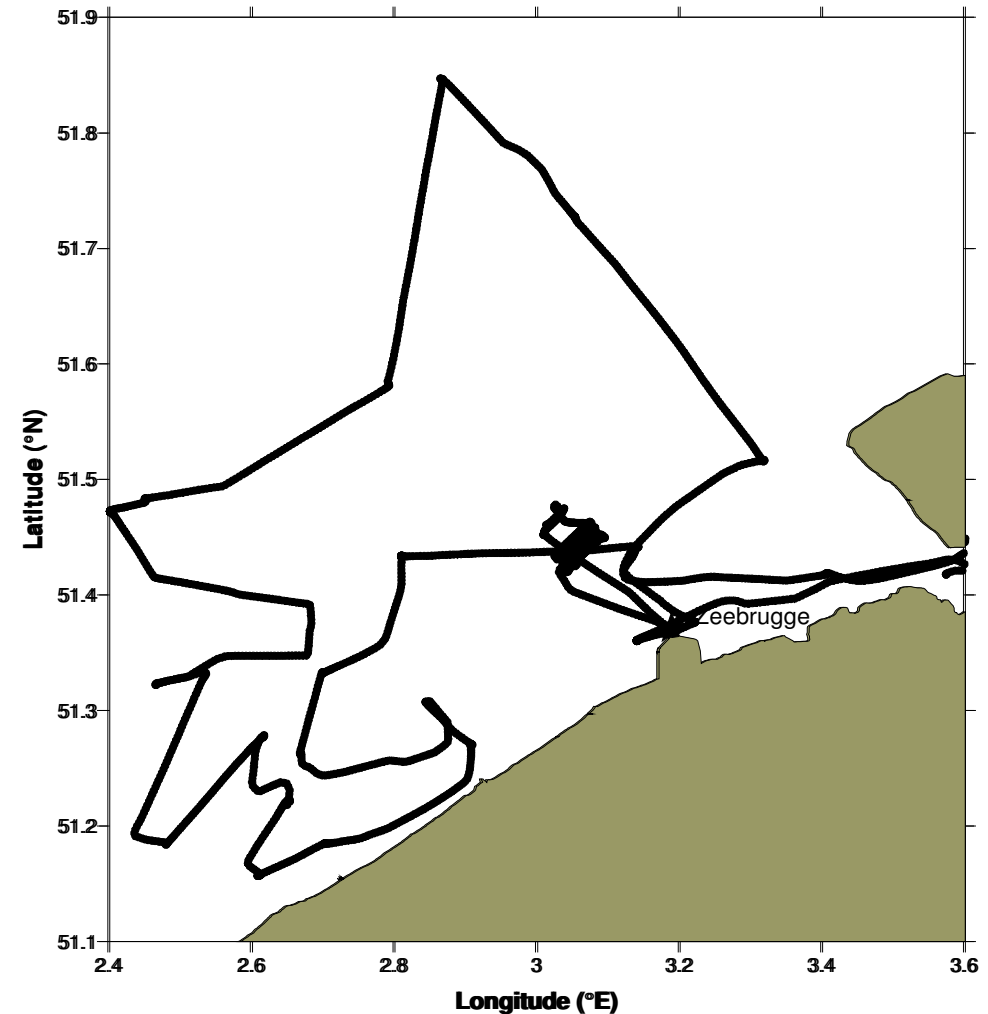
Scheldt plume:

- Well-mixed through the year
- Phytoplanktonic bloom during spring (dominated by *Phaeocystis* sp.)

Objectives: Temporal v Spatial high resolution

Two approaches:

- **One** sampling station (2 times a week)
- Whole Plume Surface area = **6000 to 7000** data records (only 1-3 times a month)
 - Krigging interpolation
 - Data treatment ($S < 34$)
 - Determination of the plume surface area

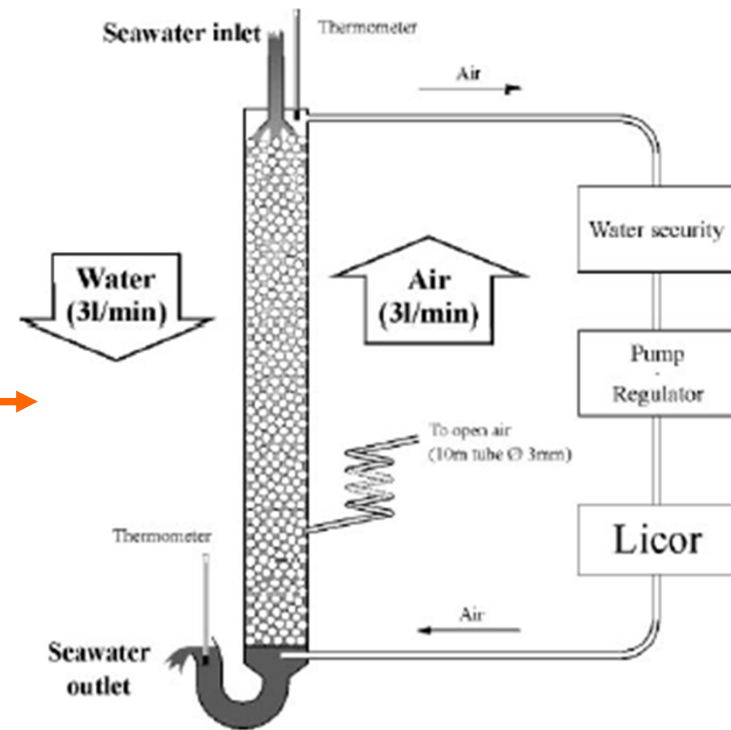


Materials and Methods



Surface $p\text{CO}_2$ measured from the equilibrator technique (Frankignoulle et al. 2001).

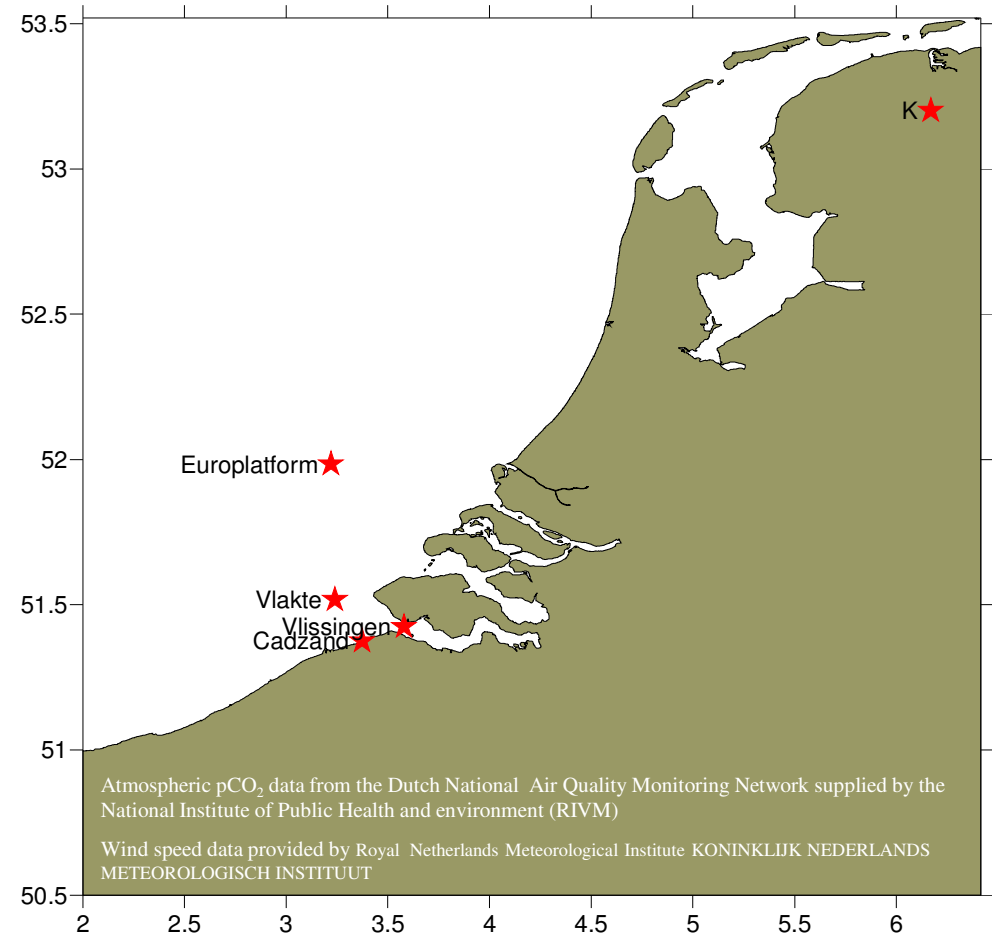
Equilibrator deployed on the *R.V. Belgica* since September 2000 (over 50 campaigns). Data acquisition every minutes. Calibration every weeks.



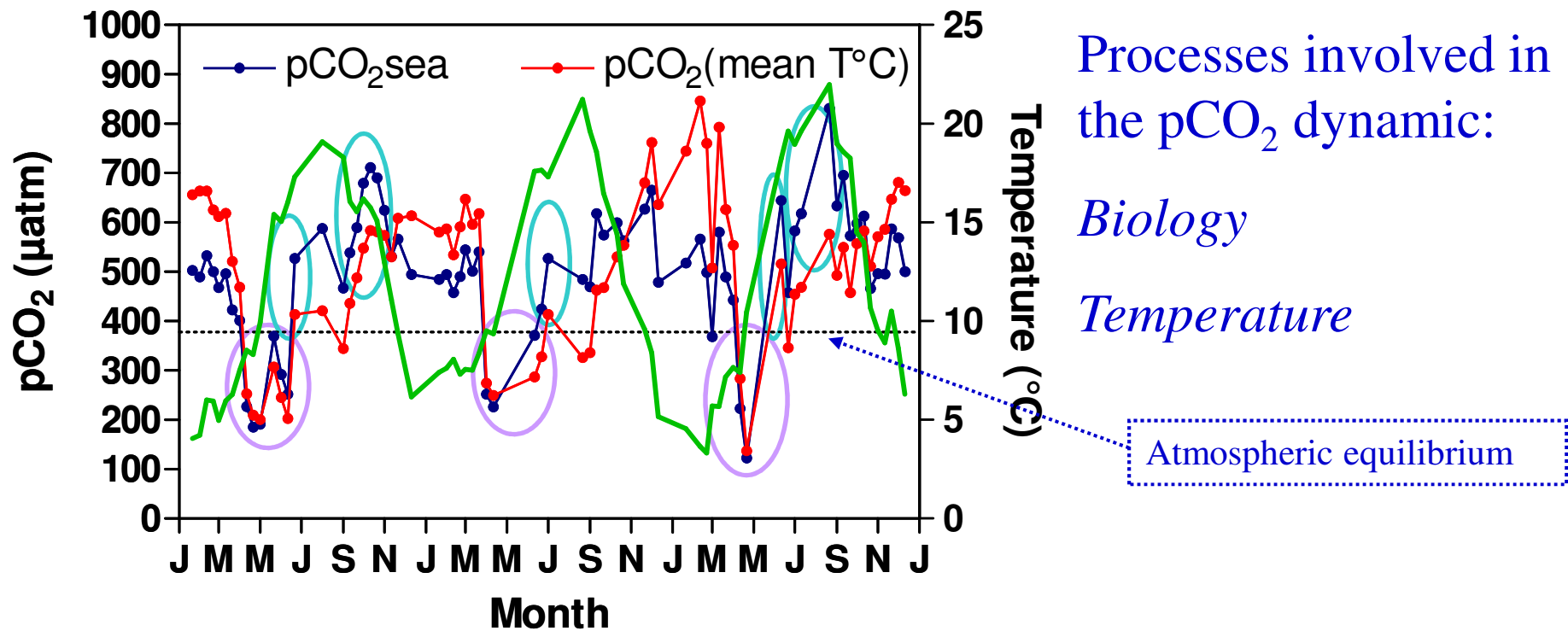
Materials and Methods: CO₂ air-sea fluxes

Fluxes ($F = \alpha \cdot K \cdot \Delta p\text{CO}_2$)
computed from:

- Atmospheric $p\text{CO}_2$ (Kollumerwaard)
- 4 Wind speed stations (every hours)
- K-wind relations from L&M, W, W&McG and N&al.

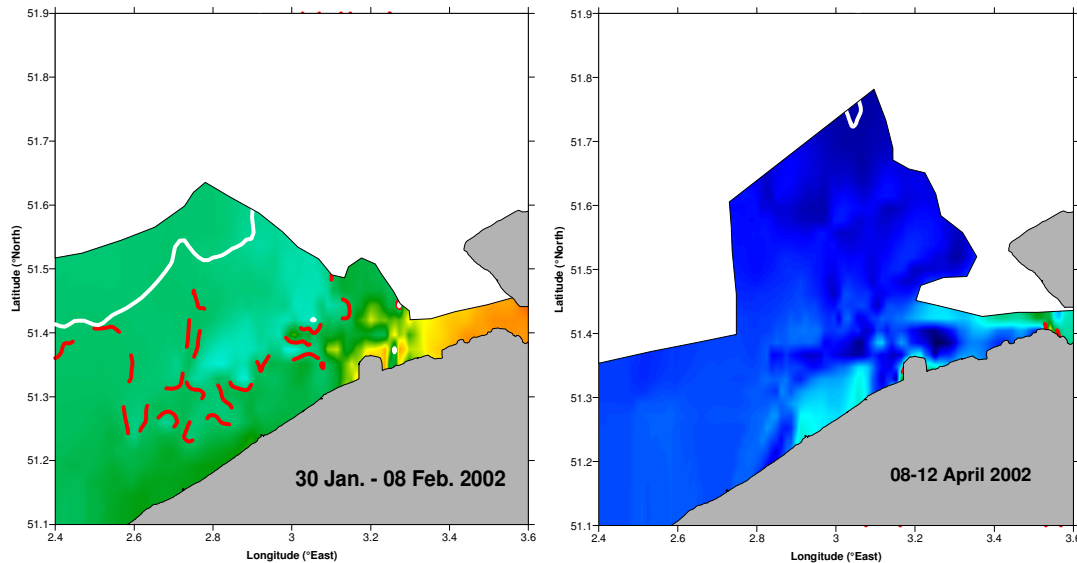


Fixed station approach: Zeebrugge

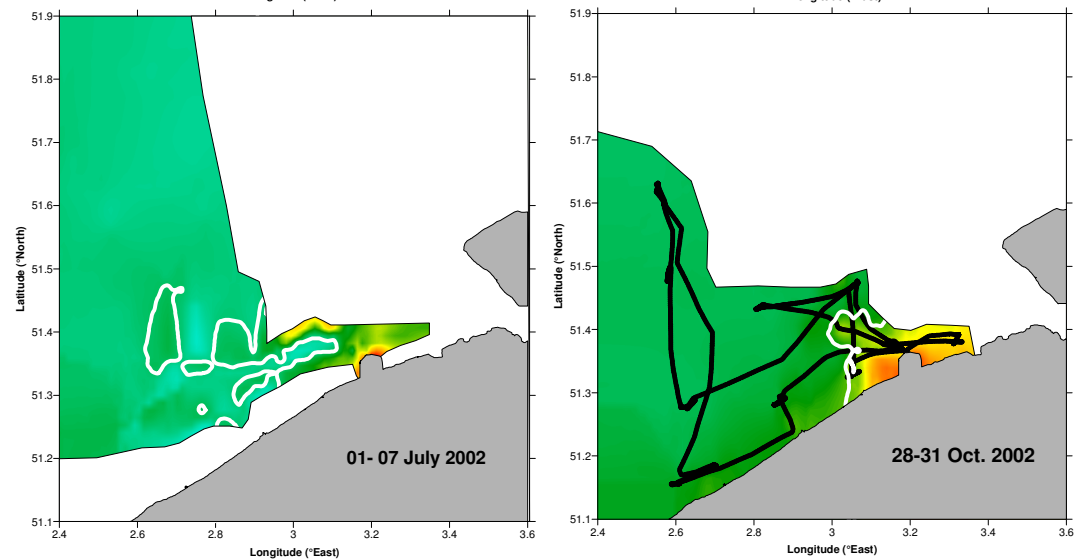


	T/B
2001	0.76
2002	0.72
2003	0.70

Whole surface area approach: $p\text{CO}_2$ seasonal distribution

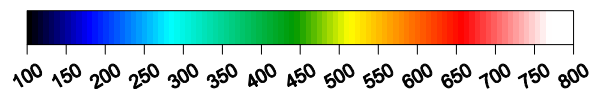


Oversaturated most of the year (except during spring).



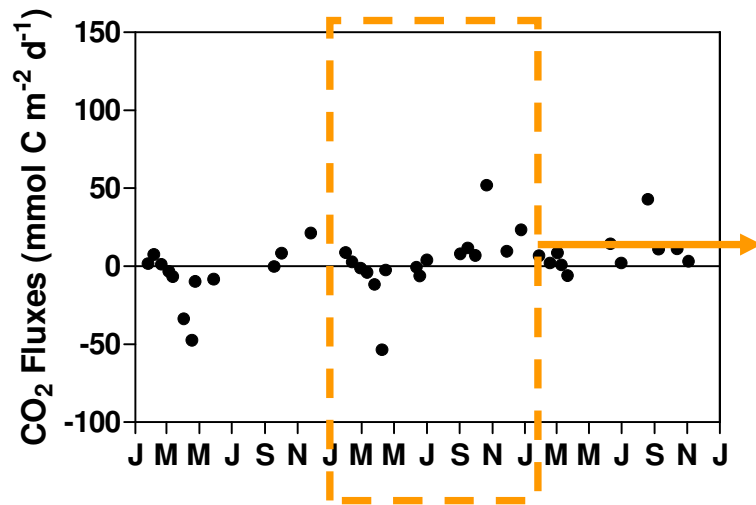
Highest $p\text{CO}_2$ values close to the Scheldt mouth and near Zeebrugge.

Large variations of the surface plume (800 to 4600km²).

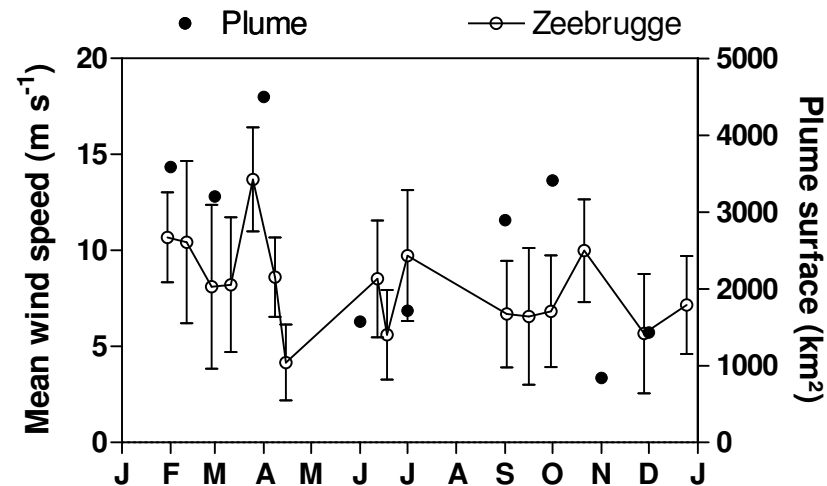
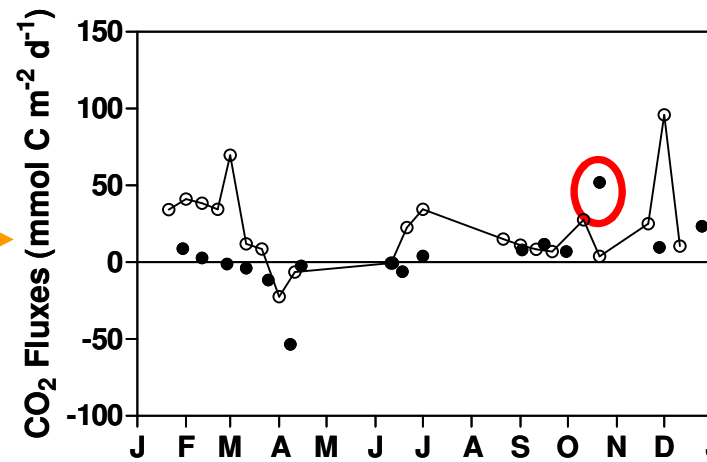


Whole surface area approach: CO₂ air-sea fluxes

CO₂ air-sea fluxes computed for 2001-2003 with wind speed at Vlakte



2002



• Surface —○— Wind speed

Whole surface area approach: CO₂ air-sea fluxes

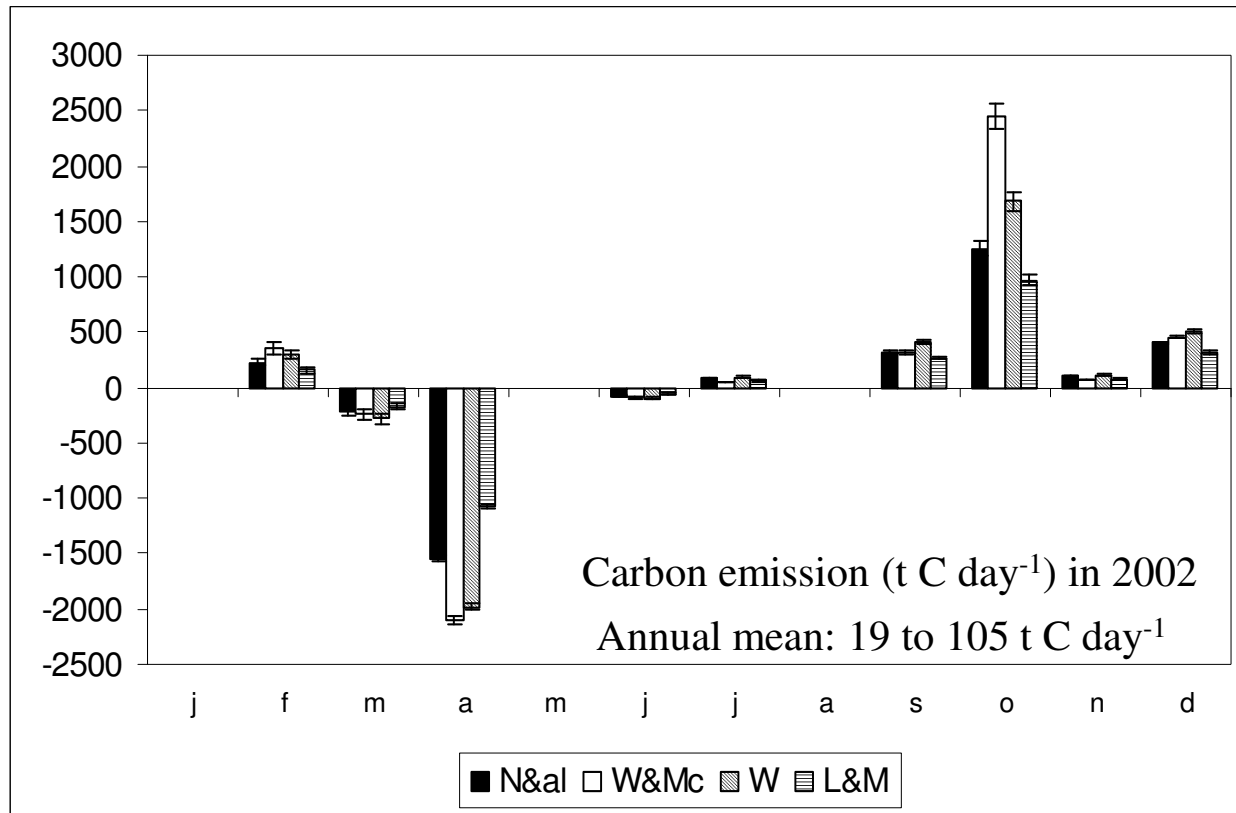
Annual mean air-sea CO₂ flux (mol C m² yr⁻¹) from spatially integrated pCO₂

		L&M	W	W&McG	N&aI
This study	2001	-1.51	-2.61	-2.32	-2.08
	2002	0.95	1.43	1.90	1.10
	2003	2.60	4.06	3.36	3.24
Borges and Frankignoulle (2002)	1996-1999	1.08	2.00	2.81	1.47

No data during
summer

No data during spring
phytoplanktonic bloom

Whole surface area approach: CO₂ emissions



Emission of carbon from the inner estuary: 456 t C day⁻¹ (Frankignoulle et al. 1998)

%/ Inner Scheldt estuary

L&M	W	W&McG	N&al.
6	7	23	4

Outer Scheldt:

This study: + **0.9 to 1.9** mol C m² yr⁻¹ (2002)

Borges & Frankignoulle (2002): + **1.1 to 2.8** (1996-1999)



Southern North Sea:

-**0.2** (Thomas et al. 2004)

Whole North Sea:

-**1.8** (Thomas et al. 2004)

Inner Scheldt:

+ **141** (Frankignoulle et al. 1998) data from 1993-1996

Conclusions

- Dominance of biological processes over temperature in the $p\text{CO}_2$ dynamics in the present case.
- $p\text{CO}_2$ dynamics at one station can be representative of the whole system, but not in terms of CO_2 air-sea fluxes.
- In such heterogeneous and dynamics systems, we need **both** high temporal and spatial resolutions.

Acknowledgments:

- Thank to the crew of the *R.V. Belgica* and Joan Backers from the BMM for their help.
- This presentation is dedicated to Michel Frankignoulle, who left us much too soon.

