

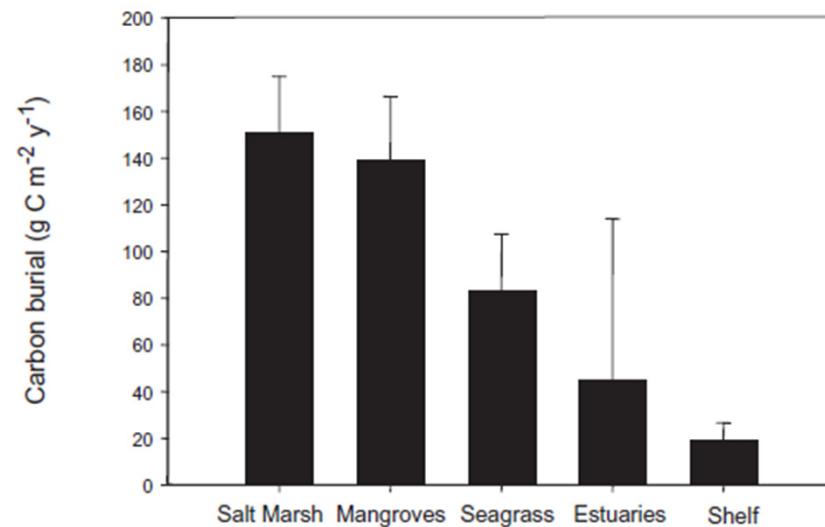
Seasonal and inter-annual variations of gross primary production, community respiration, and net community production of a seagrass meadow

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Université de Liège, Belgium

Seagrasses are:

1. Hot spots of carbon production and burial



Carbon burial (TgC yr ⁻¹)	
Vegetated coastal systems	
Mangroves	24
Salt marshes	60
Seagrasses	27
Continental shelf	99
Deep ocean sediments	6

Seagrasses are:

- 1. Hot spots of carbon production and burial**
- 2. Hot spots of biodiversity**



Seagrasses are:

- 1. Hot spots of carbon production and burial**
- 2. Hot spots of biodiversity**
- 3. Providers of diverse ecosystems functions, services, and goods**

Seagrasses are:

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How productive are *Posidonia oceanica* meadows ?

How variable is production of *P. oceanica* at short-time scales ?

How variable is production of *P. oceanica* at inter-annual scales ?

Is it possible to monitor long-term trends of production of *P. oceanica* ?

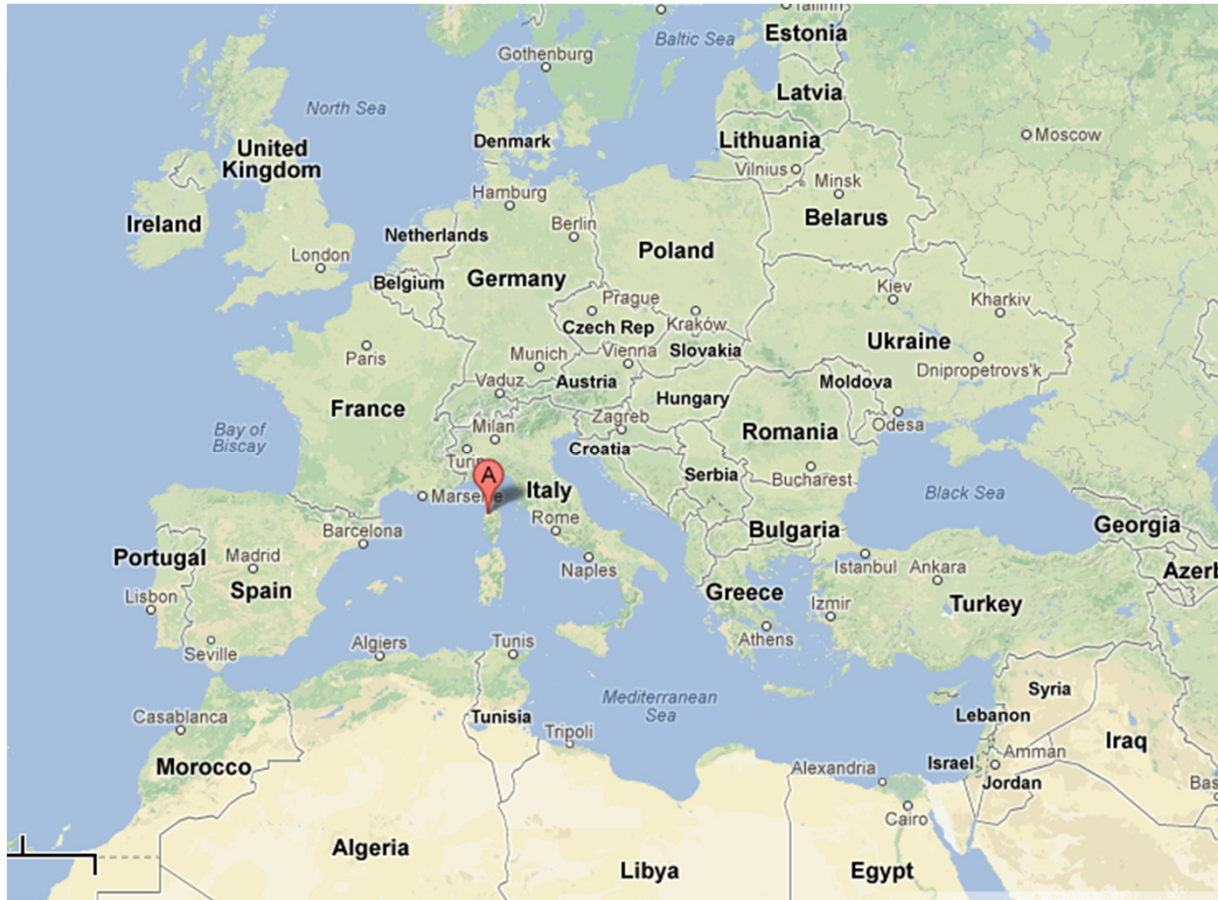
Posidonia oceanica (Linnaeus) Delile 1813

- Angiospermae (terrestrial origin)
- endemic to the Mediterranean
- most abundant seagrass in the Mediterranean
- Present from shore to ~40 m depth
- habitat for a large biodiversity
- long-living but very slow-growing
- vulnerable
- threatened (mechanical damage, light limitation from eutrophication)
- meadows declining

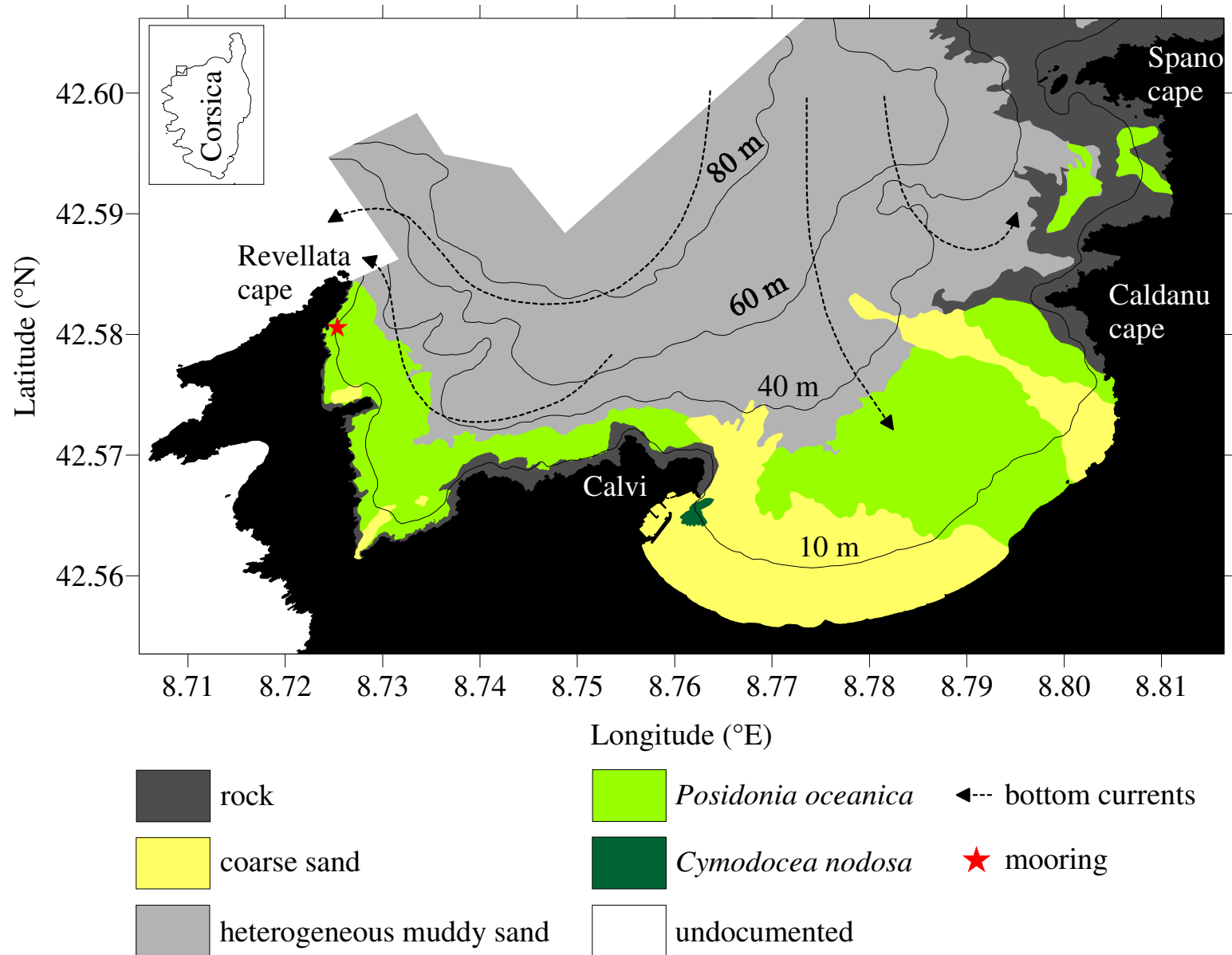




Methods

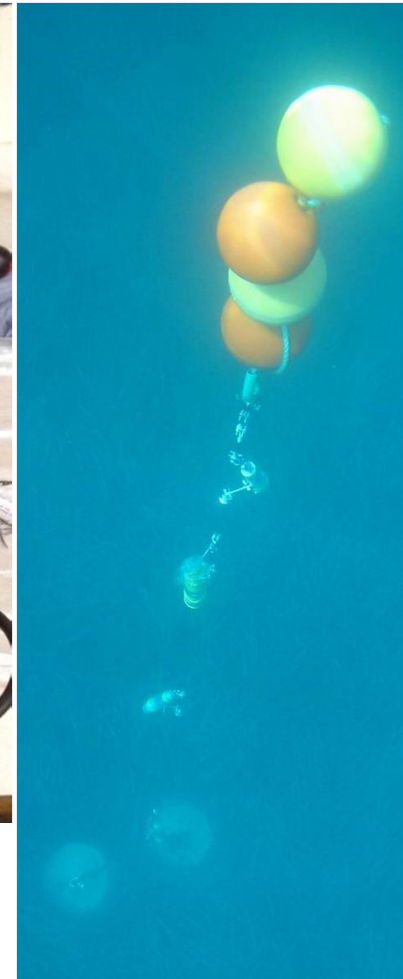


Methods





Aanderaa optodes 3835
Wetlabs Eco fluorometer
Salinometer

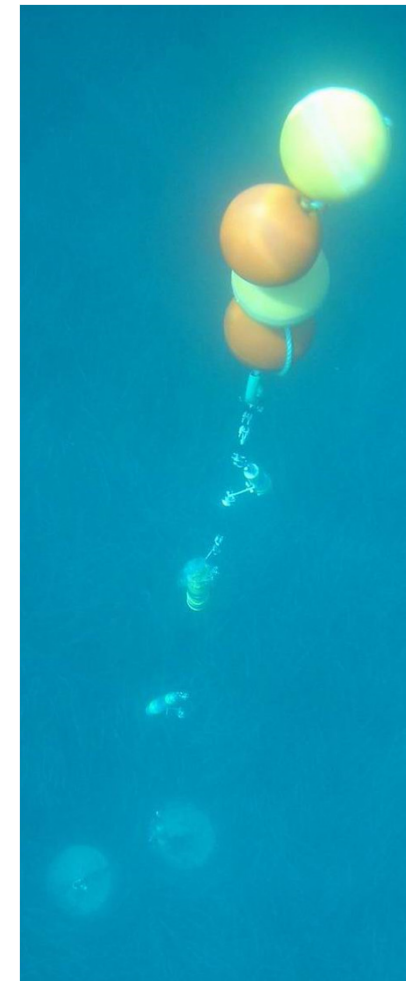


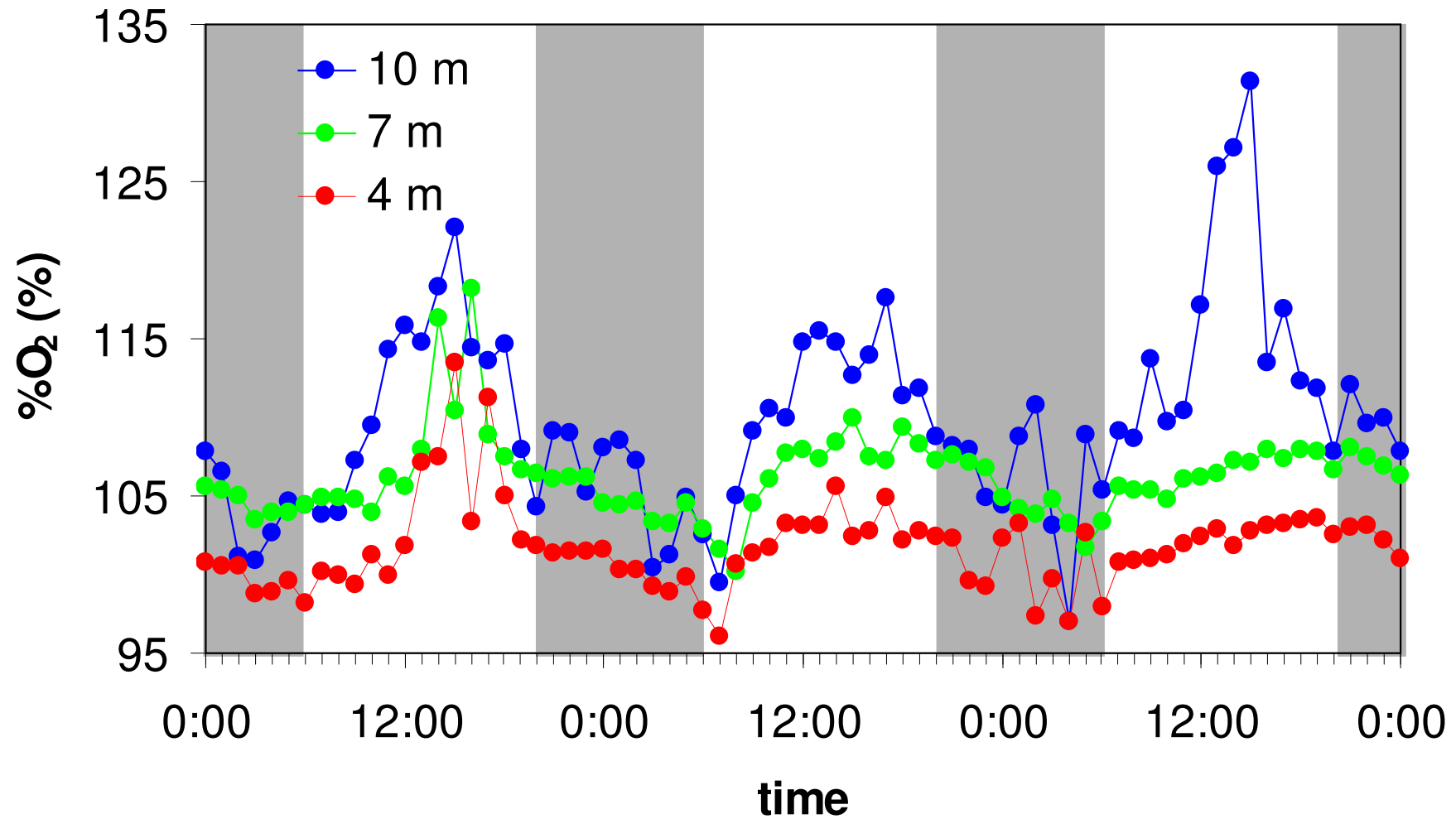
Moored instruments (10m depth) :

Fluorescence	4m	12 h
%O ₂	4, 7, 10m	1 h
Temperature	4, 7, 10m	1 h
Wind speed	-	1 h

Benthic incubations :

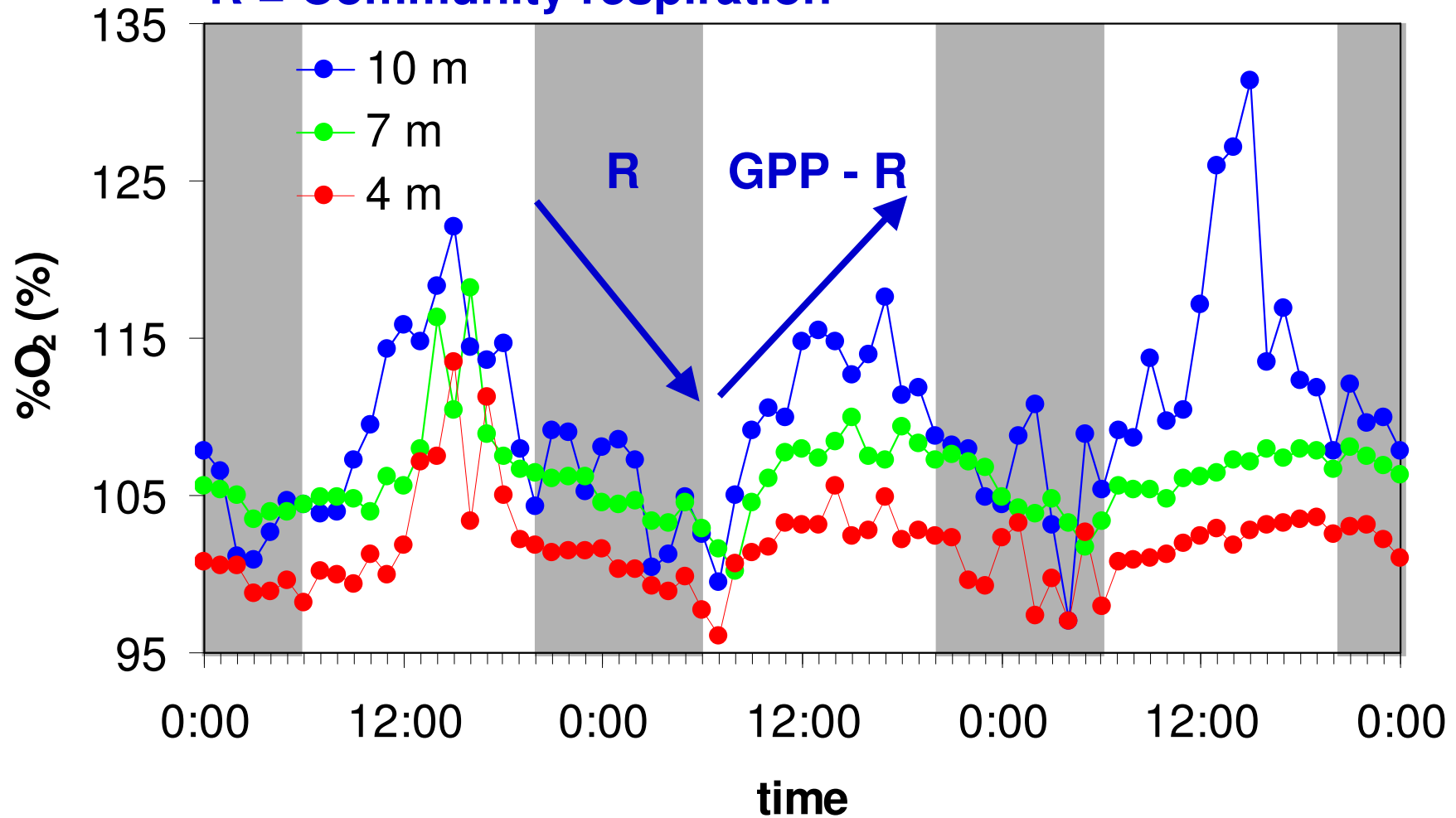
CO ₂ , O ₂ , nutrient fluxes	10m	2-4 months
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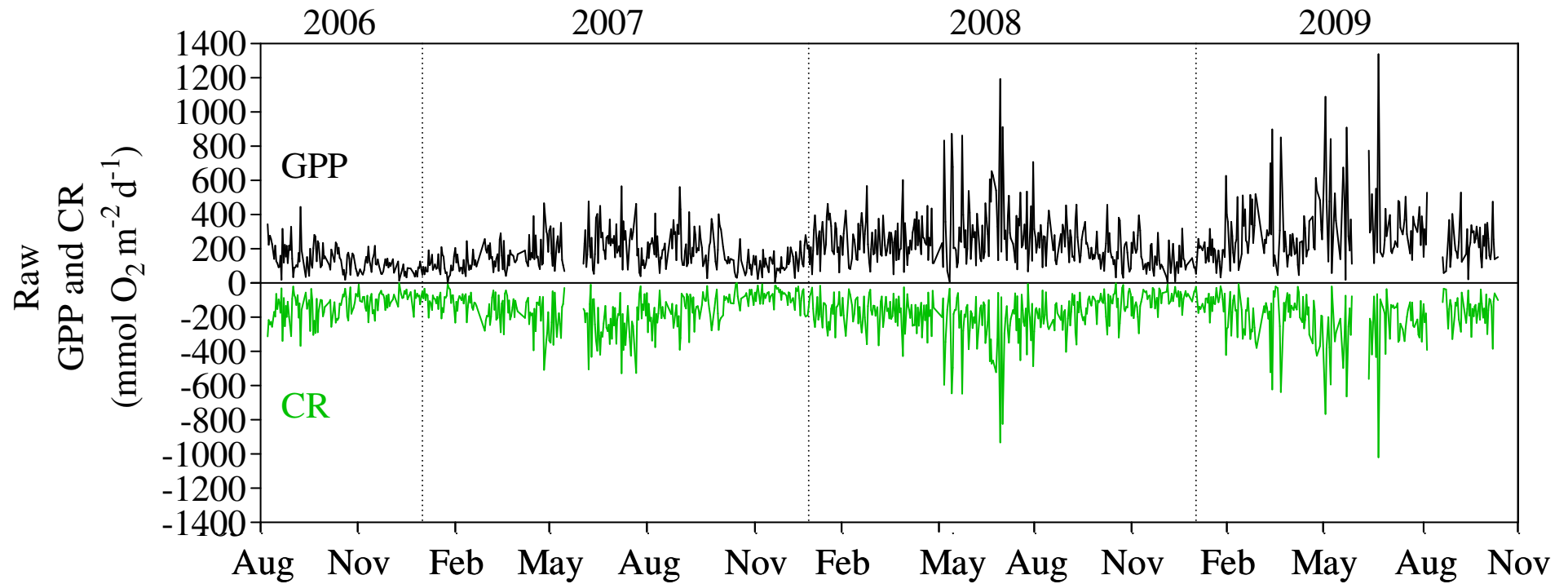


Higher O₂ at 10m
Higher daily amplitude of O₂ 10m } Effluence of Posidonia biology

GPP = Gross primary production
R = Community respiration



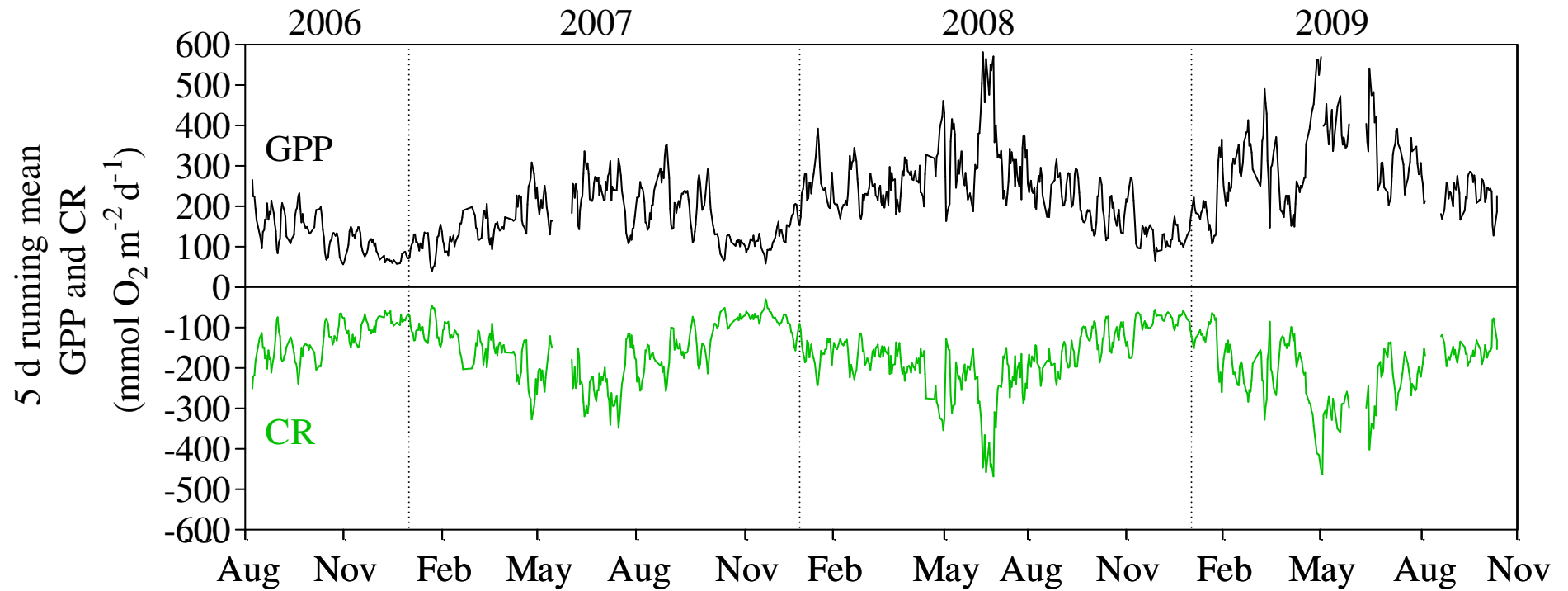
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Strong sub-weekly variability of GPP

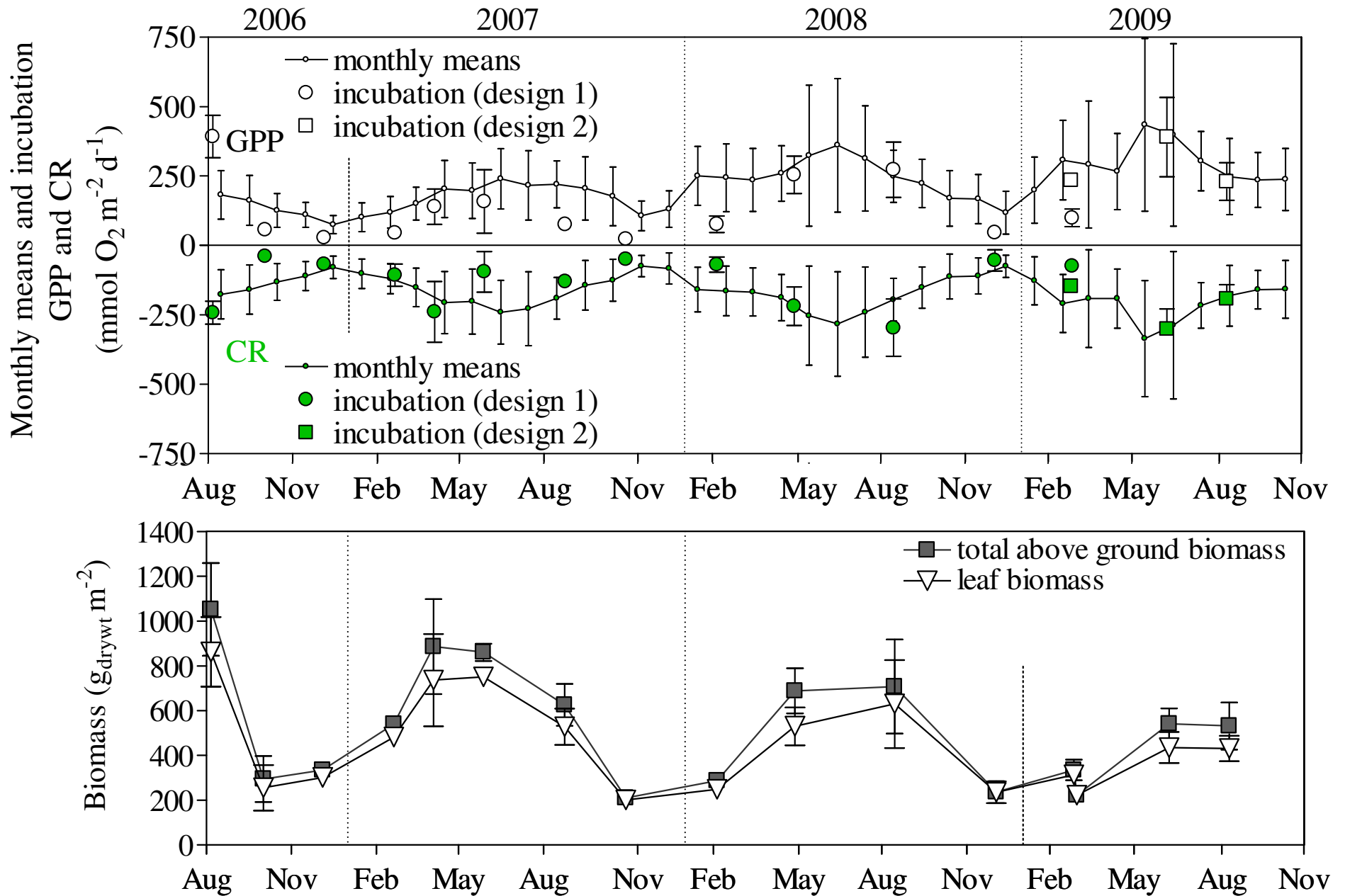
Probably related to daily variations in incoming solar radiation (cloudiness)

Results

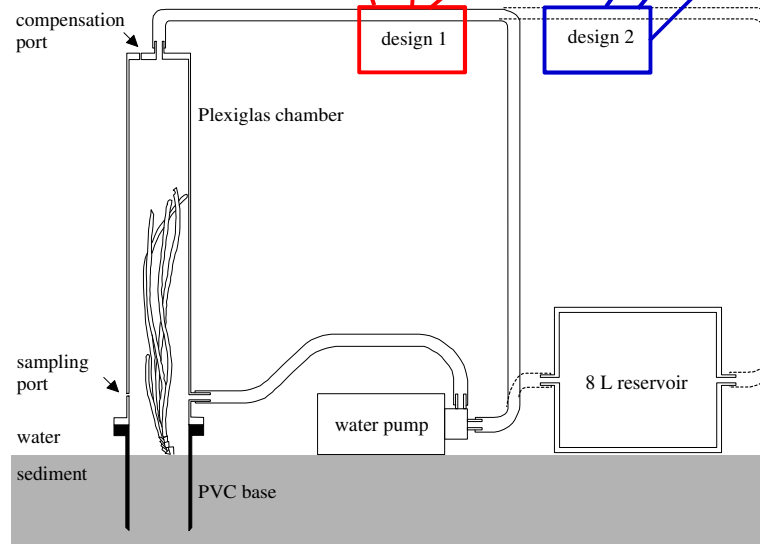
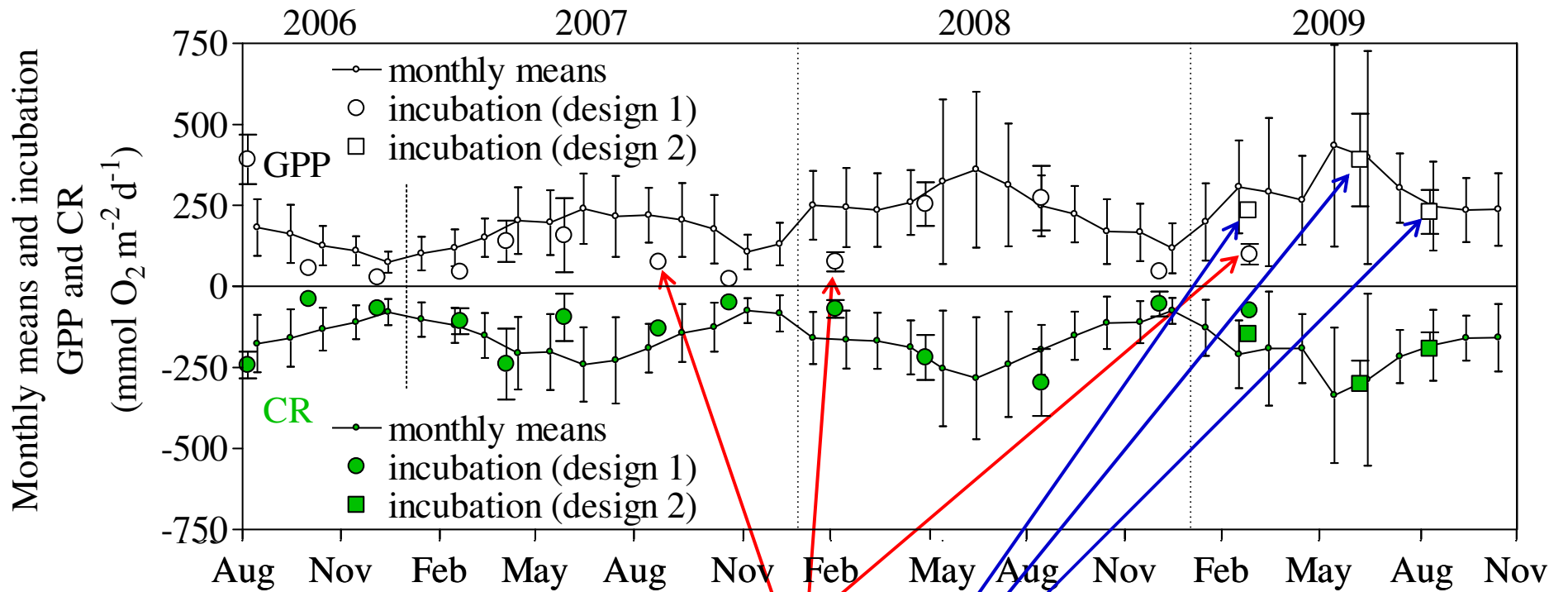


Summer time maximum of GPP
Related to optimal light availability

Results

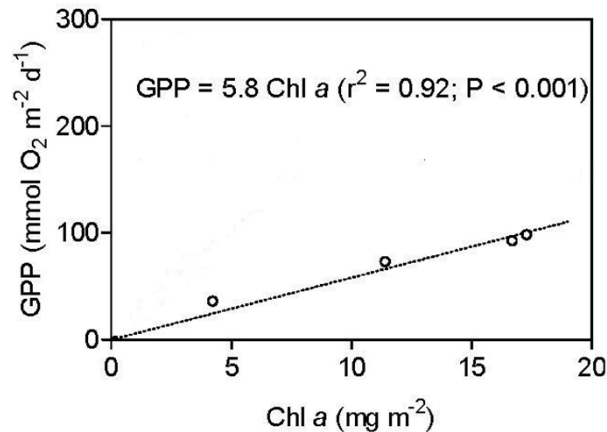


Results



Increase of O_2 inside the incubation bell
⇒ photo-respiration
⇒ GPP under-estimated

Planktonic versus benthic GPP ?



→ Chl a from our fluorometer → (very) rough estimate of planktonic GPP

GPP = f (Chl a)
Bay of Palma (Mallorca)
Gazeau et al. (2005)

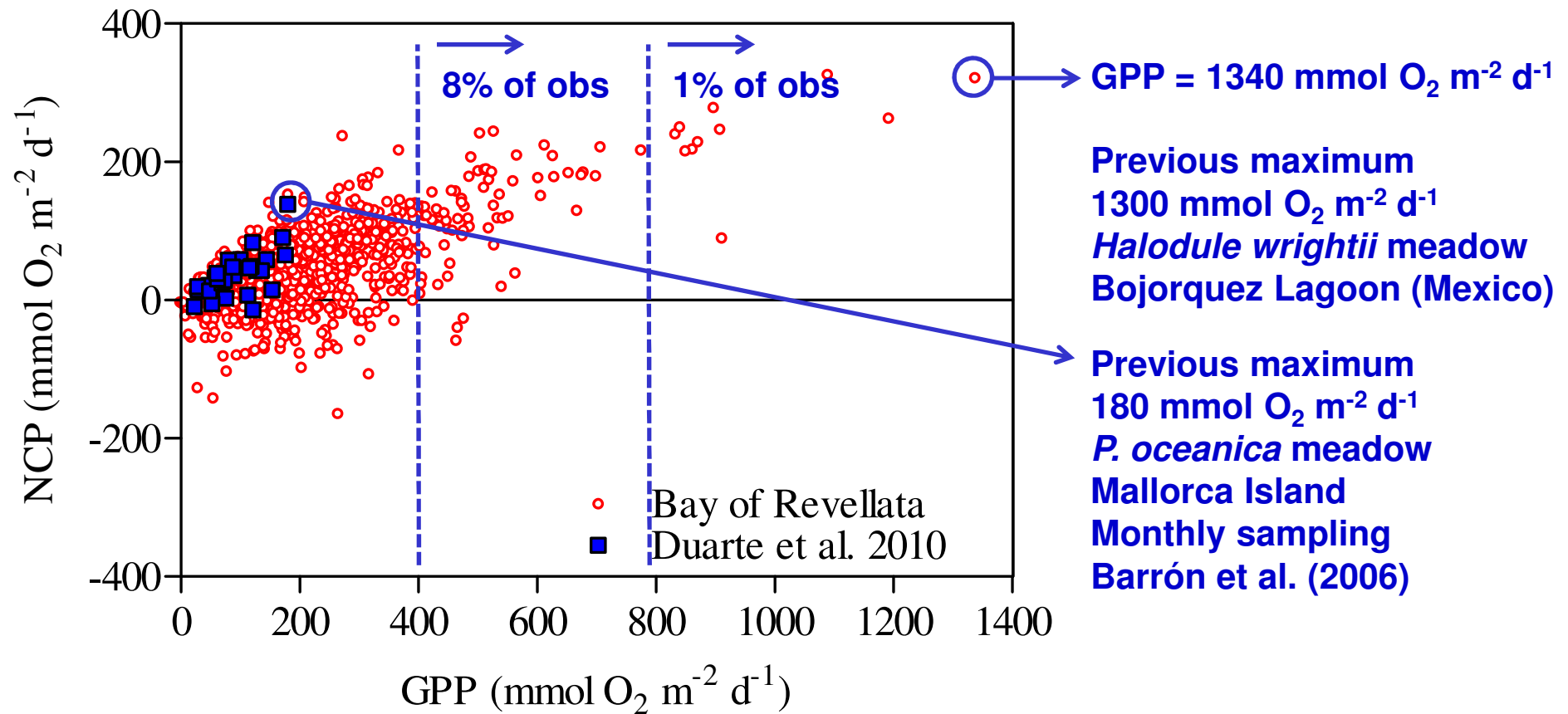
01 August 2006 - 01 August 2007:

calculated planktonic GPP
range ~0.0 to 92.6 mmol O₂ m⁻² d⁻¹,
average 4.5 mol O₂ m⁻² yr⁻¹.

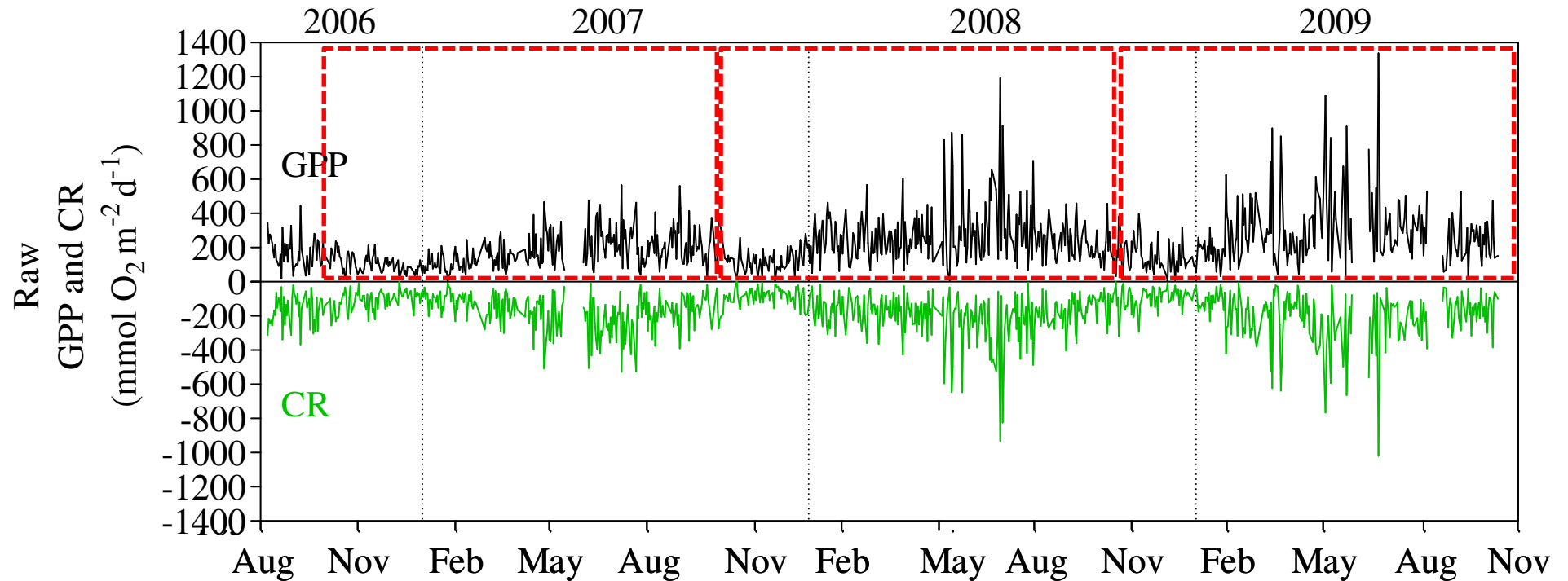
community GPP
range 0.4 to 564.6 mmol O₂ m⁻² d⁻¹
average 56.9 mol O₂ m⁻² yr⁻¹

Planktonic compartment contributes
<10% of community GPP on an annual
scale in this specific community at this
depth.

Comparison with previous estimates of GPP for *P. oceanica*?

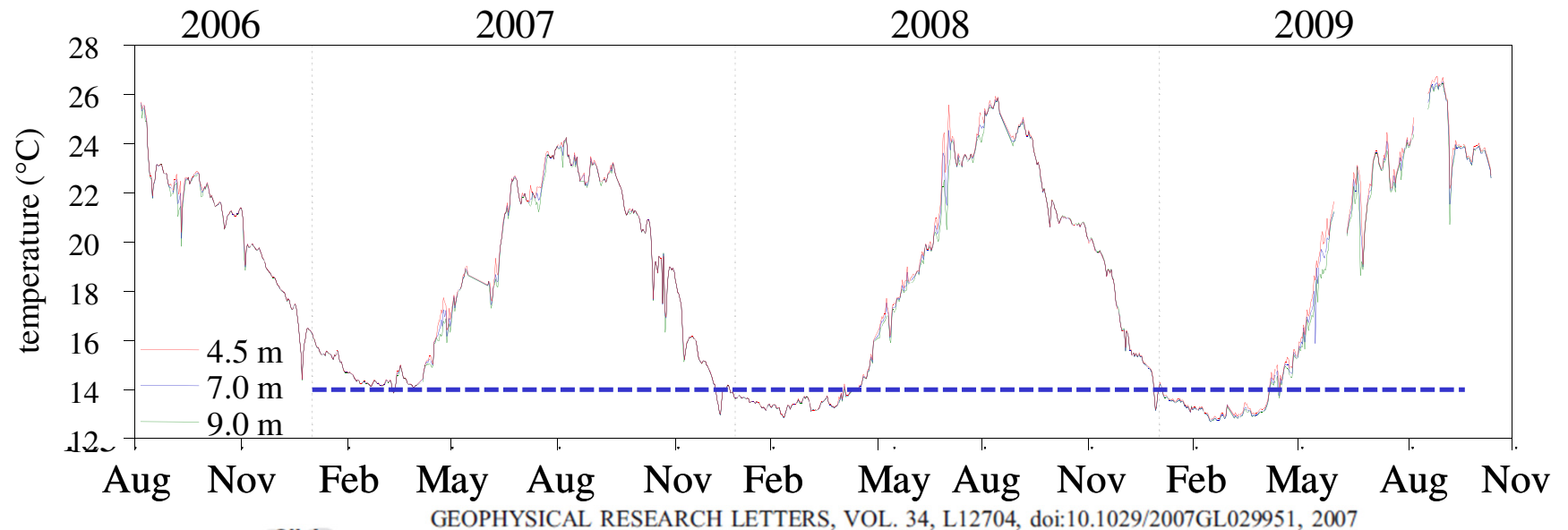


Inter-annual variability of GPP for *P. oceanica*?



mol O₂ m⁻² yr⁻¹	CR	GPP	NCP	P:R
2006-2007 cycle	-58	61	4	1.1
2007-2008 cycle	-64	89	25	1.4
2008-2009 cycle	-67	96	29	1.4

Inter-annual variability of GPP for *P. oceanica*?



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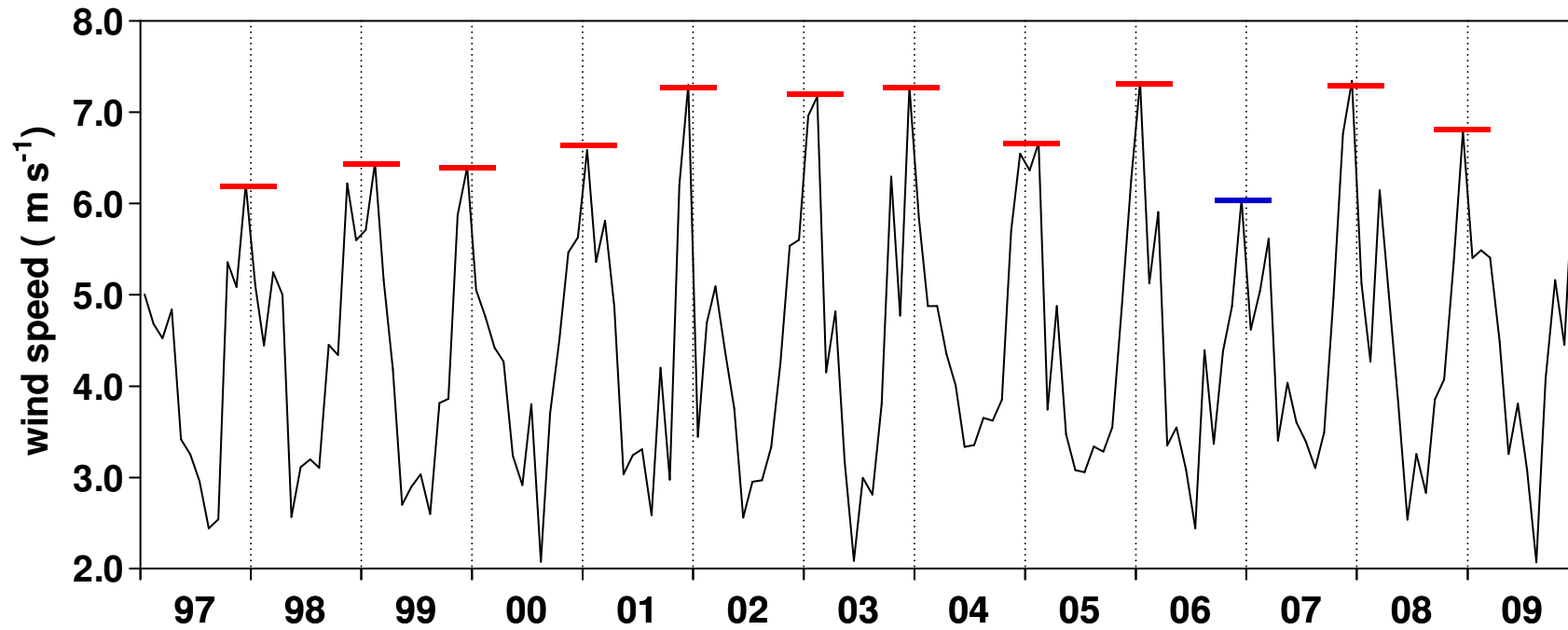
Exceptional European warmth of autumn 2006 and winter 2007: Historical context, the underlying dynamics, and its phenological impacts

Jürg Luterbacher,¹ Mark A. Liniger,² Annette Menzel,³ Nicole Estrella,³ Paul M. Della-Marta,² Christian Pfister,⁴ This Rutishauser,¹ and Elena Xoplaki¹

Received 9 March 2007; revised 27 April 2007; accepted 15 May 2007; published 19 June 2007.

[1] Updated European averaged autumn and winter surface air temperature (SAT) timeseries indicate that the autumn 2006 and winter 2007 were extremely likely (>95%) **the warmest for more than 500 years.**

Inter-annual variability of GPP for *P. oceanica*?

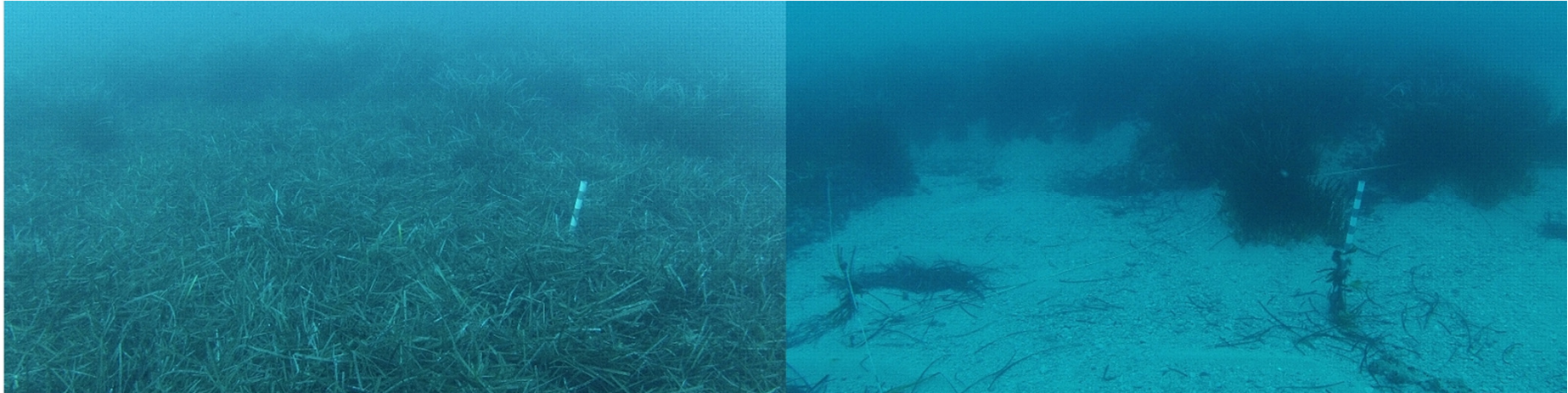


Inter-annual variability of GPP for *P. oceanica*?



**meadow + *Posidonia* litter
(end of summer)**

Inter-annual variability of GPP for *P. oceanica*?



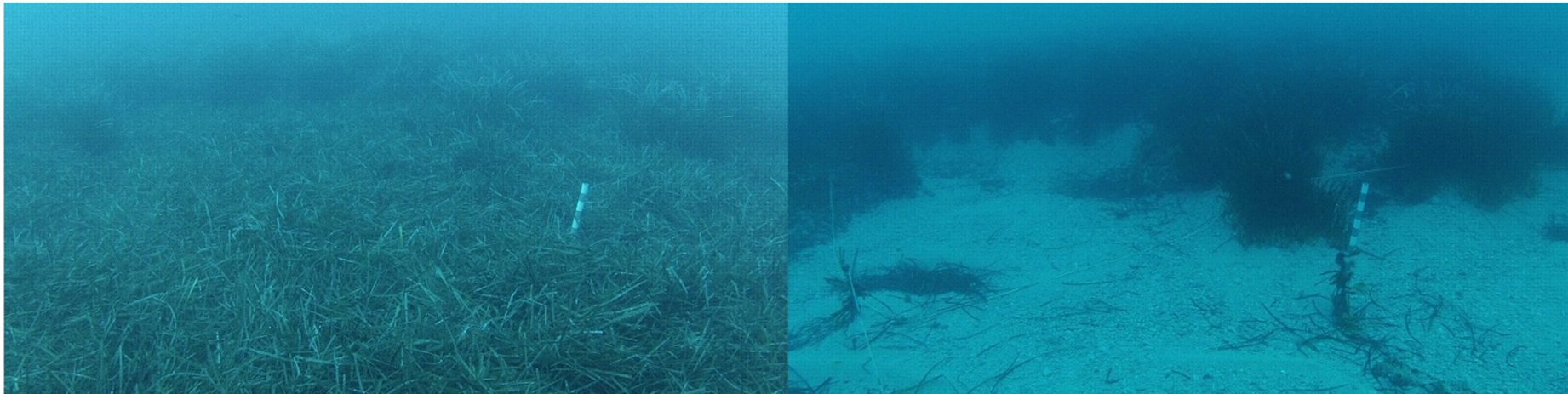
**meadow + *Posidonia* litter
(end of summer)**

**Meadow clear of litter
(winter and start of next cycle)**



Fall & winter storms

Inter-annual variability of GPP for *P. oceanica*?



Meadow + litter
(winter and start of next cycle)

Meadow clear of litter
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mol O₂ m⁻² yr⁻¹	CR	GPP	NCP	P:R
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How variable is production of *P. oceanica* at short-time scales ?

Very

How variable is production of *P. oceanica* at inter-annual scales ?

Very

Is it possible to monitor long-term trends of production of *P. oceanica* ?

Yes

Instrumentation is available and easy to deploy

All we need is motivation, funding and patience

Limnol. Oceanogr., 57(1), 2012, 347–361
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doi:10.4319/lo.2012.57.1.0347

Seasonal and interannual variations of community metabolism rates of a *Posidonia oceanica* seagrass meadow

W. Champenois and A. V. Borges*

Available at :

<http://orbi.ulg.ac.be/>

<http://www.co2.ulg.ac.be/>

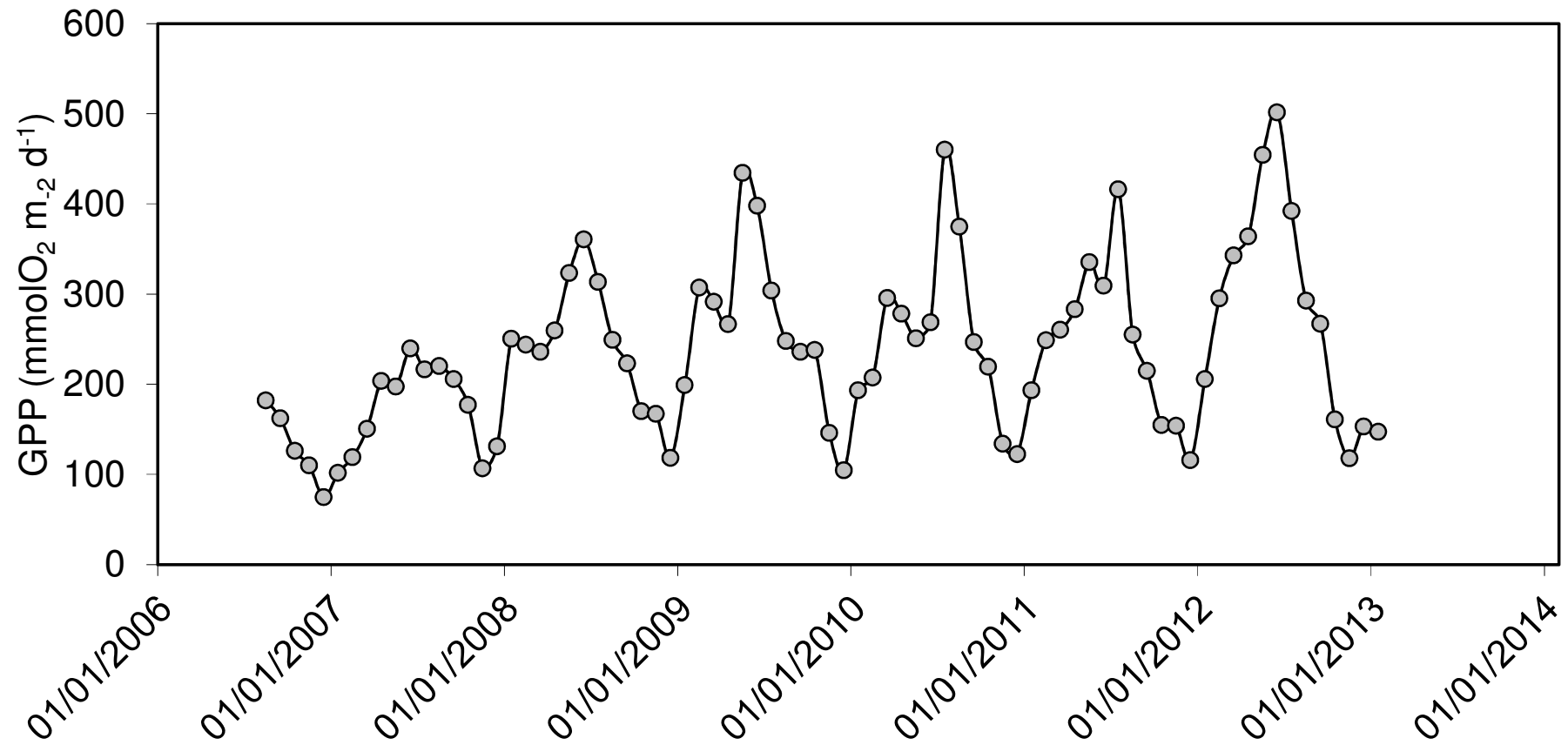
<http://www.aslo.org/lo/> (free download)

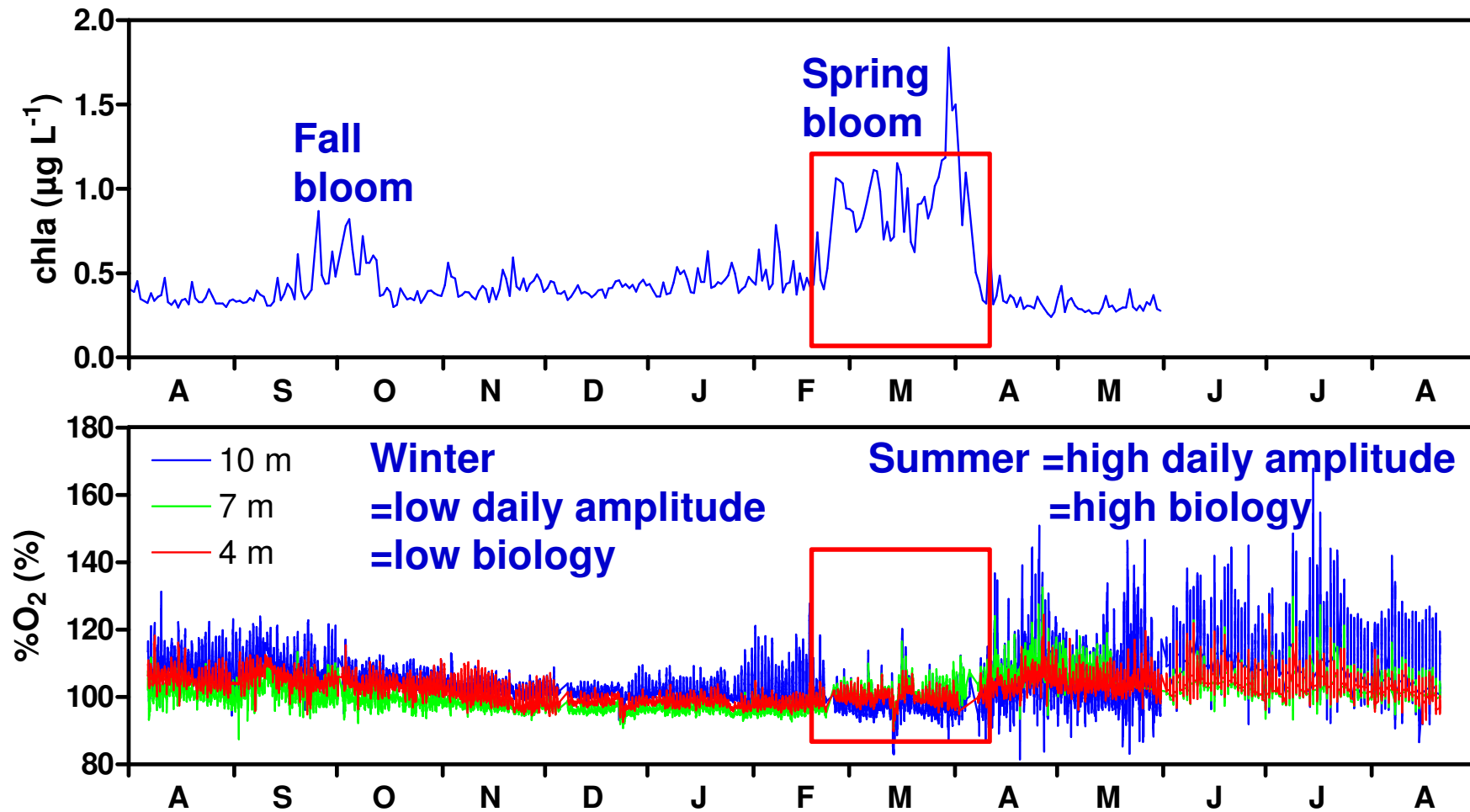
Acknowledgements :

J.-M. Beckers, R. Biondo, A. Alvera, M.-V. Commarieu, B. Delille, S. Gobert, M. Grégoire, J. Jacquemart, G. Lepoint, P. Lejeune, L.-S. Schiettecatte, Stareso team



**Funded by
Fonds National de la Recherche Scientifique (FNRS)**





- Largest daily amplitude observed from mid-April to September**
- = after the spring phytoplankton bloom**
- = production of Posidonia much larger than pelagic production**
- = production of Posidonia related to light availability (internal nutrient recycling)**
- = phytoplankton bloom => shading effect on Posidonia**