Supplementary information

Net community metabolism of a *Posidonia oceanica* meadow.

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Supplemental Table 1: Gross primary production (GPP) based on O_2 change (GPP_{O2} in mmolO_2 m^{-2} d^{-1}), community respiration (CR) based on O_2 change (CR_{O2} in mmol O_2 m^{-2} d^{-1}), net community production (NCP) based on O_2 change (NCP_{O2} in mmol O_2 m^{-2} d^{-1}), GPP based on change of dissolved inorganic carbon corrected for $CaCO_3$ precipitation/dissolution (DIC*) (GPP_{DIC*} in mmolC m^{-2} d^{-1}), CR based on DIC* change (CR_{DIC*} in mmolC m^{-2} d^{-1}), NCP based on DIC* change (NCP_{DIC*} in mmolC m^{-2} d^{-1}), $CaCO_3$ precipitation (CAL) and dissolution (DIS) based on total alkalinity (mmol $CaCO_3$ m^{-2} d^{-1}) derived from benthic incubations at 10 m depth in a *Posidonia oceanica* meadow in the Bay of Revellata. A positive value of metabolic rates based on O_2 indicates a release of O_2 to the water column, and a negative value of metabolic rates based on DIC* indicates an uptake of CO_2 to the water column.

Date	GPP_{O2}	CR_{O2}	NCP_{O2}	GPP_{DIC*}	CR_{DIC*}	NCP_{DIC*}	CAL	DIS
dd-mm-yyyy	mmolO_2 m^2 d^{-1}			mmolC m^2 d^{-1}			mmol$CaCO_3$ m^2 d^{-1}	
06-08-2006	392 ± 77	-243 ± 41	150 ± 87	-416 ± 87	218 ± 43	-198 ± 75	60 ± 28	120 ± 88
02-10-2006	56 ± 9	-39 ± 2	17 ± 9	-63 ± 45	33 ± 44	-30 ± 12	24 ± 24	19 ± 53
05-12-2006	28 ± 7	-68 ±18	-40 ±19	-32 ± 37	25 ± 34	-7 ± 16	21 ± 13	94 ± 55
20-02-2007	45±17	-107 ± 40	-62 ± 43	-55 ± 92	95 ± 70	39 ± 59	21 ± 8	76 ± 25
04-04-2007	139 ± 64	-239 ± 109	-100 ± 126	-180 ± 102	169 ± 100	-11 ± 19	13 ± 38	39 ± 109
28-05-2007	158 ± 114	-95 ± 73	63 ± 136	-95 ± 66	39 ± 20	-55 ± 63	2 ± 13	20 ± 14
24-08-2007	76 ± 10	-130 ± 17	-54 ± 19	-71 ± 99	127 ± 65	55 ± 75	17 ± 30	129 ± 133
29-10-2007	23 ± 3	-49 ± 8	-27 ± 8	-25 ± 19	50 ± 3	25 ± 18	20 ± 5	82 ± 4
05-02-2008	76 ± 30	-69 ± 27	7 ± 41	-56 ± 46	44 ± 39	-12 ± 23	12 ± 12	33 ± 40
29-04-2008	254 ± 67	-219 ± 69	35 ± 96	-95 ± 65	63 ± 51	-32 ± 40	39 ± 29	176 ± 118
15-08-2008	273 ± 100	-297 ± 104	-24 ± 144	-200 ± 188	312 ± 133	112 ± 133	81 ± 39	461 ± 168
03-12-2008	46 ± 24	-54 ± 38	-8 ± 45	-1 ± 70	37 ± 49	38 ± 50	12 ± 12	41 ± 39
25-02-2009	99 ± 31	-74 ± 21	26 ± 37	-44 ± 86	47 ± 74	4 ± 44	9 ± 5	18 ± 18
08-06-2009	390 ± 143	-301 ± 73	89 ± 160	- 355 ± 84	287 ± 51	-179 ± 66	62 ± 27	126 ± 124
12-08-2009	229 ± 68	-192 ± 51	37 ± 85	-34 ± 105	118 ± 42	44 ± 96	41 ± 23	137 ± 113

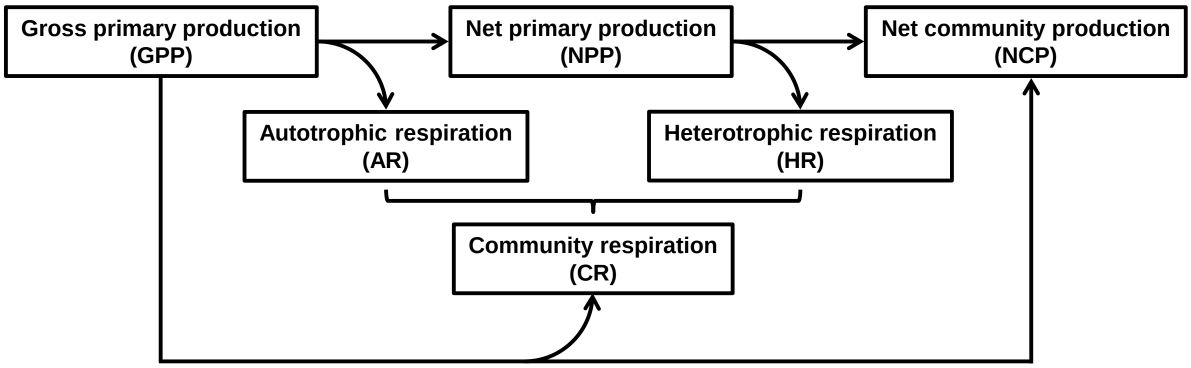
Supplemental Table 2: Pore water H_2S concentration in vegetated (*Posidonia oceanica*) and bare sediments at three depths in the sediment (0.5 cm, 10 cm and 20 cm) in the in the Bay of Revellata at 8 m bottom depth from 9 June 2009 to 20 February 2012. At all depths and all samplings, O_2 was below detection limit.

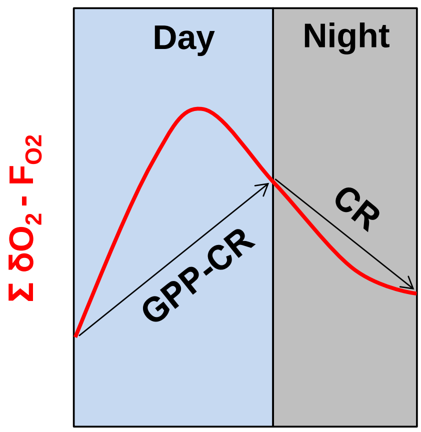
date DD/MM/YY	Depth (cm)	H_2S (Vegetated sediment) (µmol L^{-1})	H_2S (Bare sediment) (µmol L^{-1})
09-06-2009	0.5	3.3	4.6
09-06-2009	10	15.4	57.5
09-06-2009	20	9.1	60.8
13-08-2009	0.5	3.0	10.0
13-08-2009	10	18.3	157.7
13-08-2009	20	26.4	62.4
04-11-2009	0.5	6.8	9.7
04-11-2009	10	8.3	23.5
04-11-2009	20	7.0	20.3
06-06-2010	0.5	0.0	0.0
06-06-2010	10	8.1	14.5
06-06-2010	20	15.6	65.6
08-11-2010	0.5	0.0	2.0
08-11-2010	10	2.1	122.7
08-11-2010	20	69.9	58.8
18-02-2011	0.5	9.8	4.2
18-02-2011	10	9.7	12.4
18-02-2011	20	1.7	10.7
13-08-2011	0.5	8.9	12.3
13-08-2011	10	106.1	121.8
13-08-2011	20	2.4	61.1
20-02-2012	0.5	31.3	2.7
20-02-2012	10	176.5	32.2
20-02-2012	20	12.8	57.4

Supplemental Table 3: CH_4 concentration (nmol L^{-1}) in surface water (depth ~1m), sea surface temperature (SST in °C), wind speed (m s^{-1}) and air-sea CH_4 flux (µmol m^{-2} d^{-1}) along a bathymetry gradient over a *Posidonia oceanica* meadow in the Bay of Revellata. CH_4 concentration was higher and more variable in winter (13.0±10.0 nmol L^{-1}) than in spring/summer (5.1±1.8 nmol L^{-1}). This was probably related to stormier conditions and more wave action in winter, leading to sediment resuspension or advective pore-water exchange due to gravity waves, in particular in the sandy patches associated to the vegetated sediments. This might also explain the higher CH_4 concentrations at shallower depths in November 2016 under windy conditions.

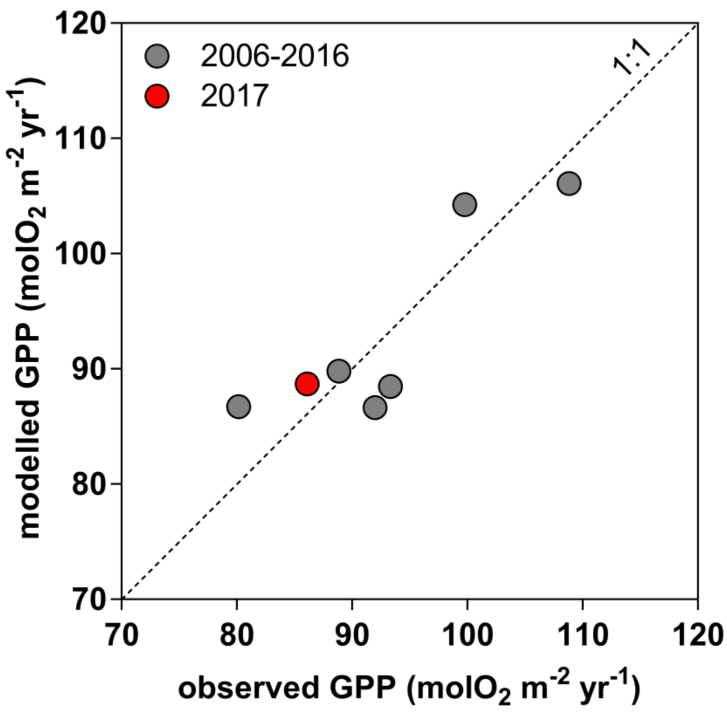
Date dd-mm-yyyy	Bottom depth (m)	CH_4 (nmol L^{-1})	SST (°C)	Wind speed (m s^{-1})	Air-sea CH_4 flux (µmol m^{-2} d^{-1})
02-11-2016	10	39.7	20.3	7.0	110.7
	15	32.6			89.7
	20	26.9			73.2
	30	5.5			10.2
27-02-2017	10	5.9	14.3	4.8	4.5
	15	7.0			5.8
	20	20.3			22.0
	25	13.7			14.0
	30	11.4			11.2
08-05-2017	10	10.6	16.6	2.5	3.0
22-08-2017	10	4.4	24.9	2.0	0.7
	15	4.3			0.7
	20	4.0			0.6
	25	4.1			0.6
	30	5.5			1.0
01-11-2017	10	6.5	20.3	1.5	0.6
	15	7.7			0.8
	20	5.6			0.5
	25	6.2			0.6
	30	6.0			0.6
14-02-2018	10	13.3	13.6	3.1	5.3
	15	9.1			3.3
	20	4.2			0.9
	25	10.8			4.1
	30	13.8			5.5
15-05-2018	10	5.5	17.5	3.7	2.6
25-08-2018	10	4.4	26.7	7.2	9.7
	15	4.2			8.9
	20	4.8			11.1
	25	5.0			11.6
	30	5.0			11.5

Supplemental Figure 1: Definition of metabolic rates and schematic representation of derivation of metabolic rates based on the O_2 mass balance during a 24h cycle of O_2 measurements. Mass balance is based on the change of the total water column O_2 inventory ($\Sigma\delta O_2$) corrected for air-sea O_2 exchange (F_{O2}).

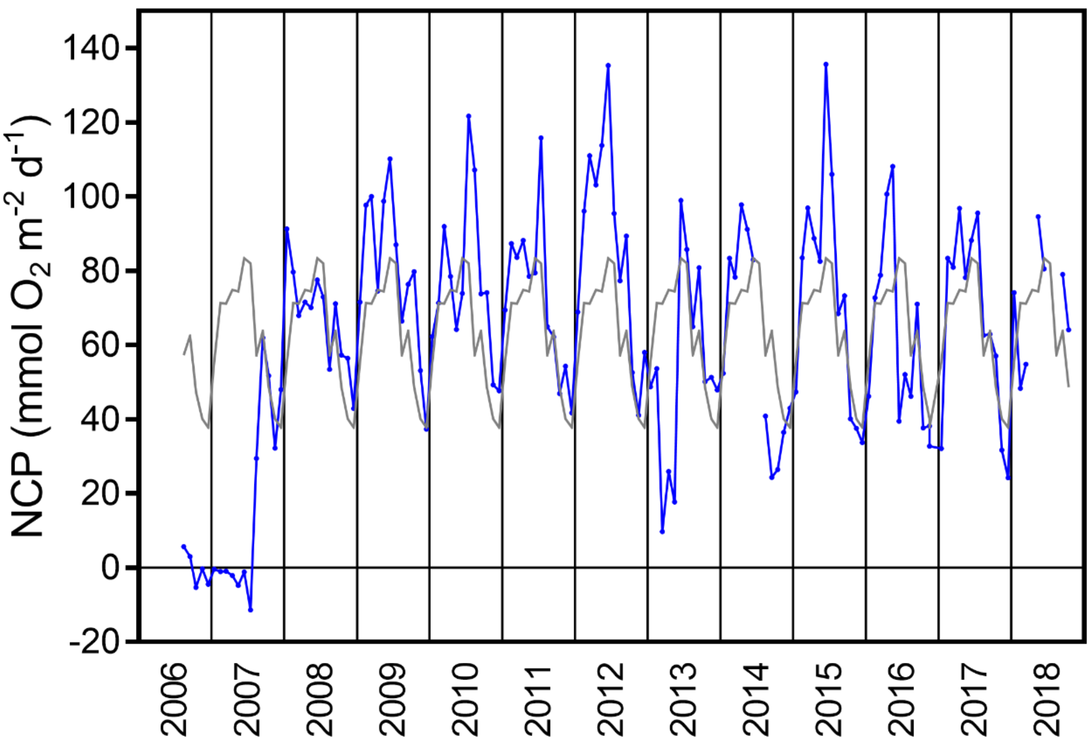




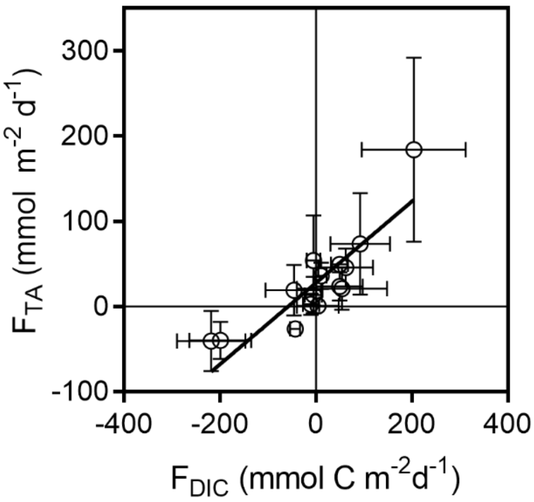
Supplemental Figure 2: Comparison of the observed and modelled annual GPP reported by Champenois and Borges (2019) and an additional independent data point acquired in 2017 (this study). The statistical model was developed from a data-set of GPP from 2006 to 2016 and uses as input variables solar radiation, sea water temperature, remote sensed Chlorophyll-a in surface waters.



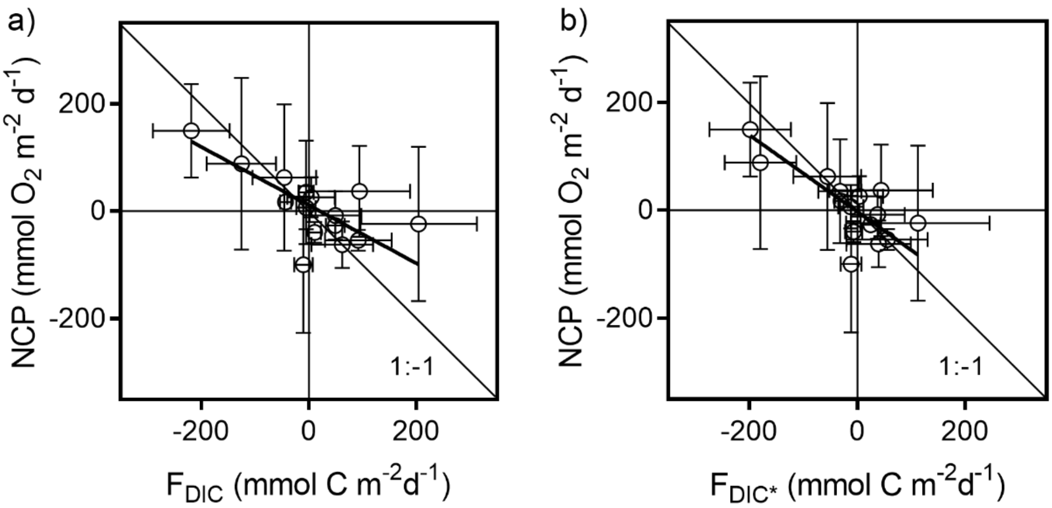
Supplemental Figure 3: Monthly average of net community production (NCP) in mmol O_2 m^{-2} d^{-1} (blue line) over a *Posidonia oceanica* meadow in the Bay of Revellata at 10 m bottom depth from 7 August 2006 to 29 October 2018. The grey line represents the climatological annual cycle of GPP for the 2006-2018 period, that was constructed from the average for each month computed from the values for that month from all of the years.



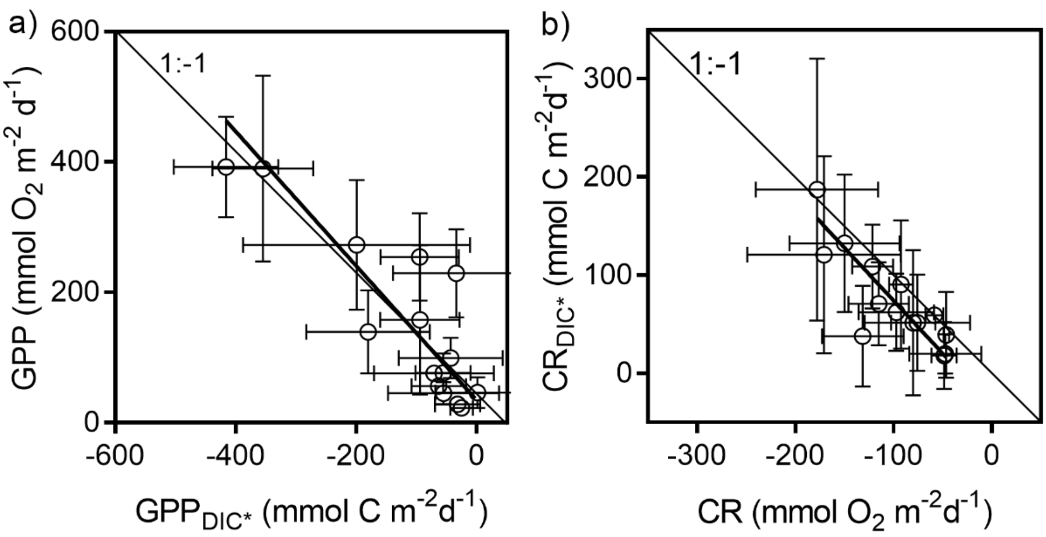
Supplemental Figure 4: Net daily total alkanity (TA) fluxes (F_{TA}) versus dissolved inorganic carbon (DIC) fluxes (F_{DIC}) from benthic chamber incubations during 24h over a *Posidonia oceanica* meadow in the Bay of Revellata at 10 m depth from 6 August 2006 to 12 August 2009 (n=15). Error bars correspond to standard deviation of fluxes computed from triplicate benthic chamber incubations. Solid thick line is the linear regression: F_{TA} = 0.48 (±0.17) x FDIC + 27.7 (±9.1) (r^2 = 0.74 p<0.0001, n=15).



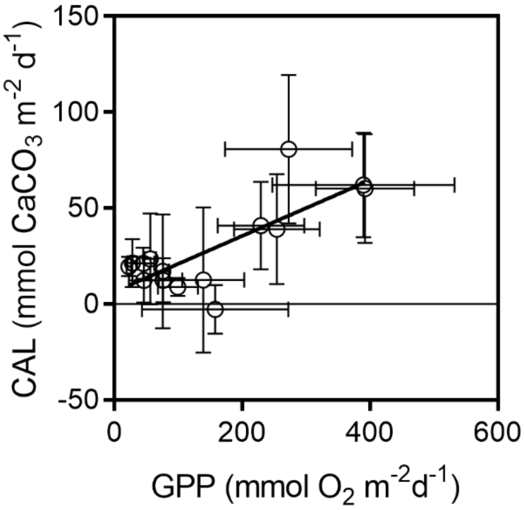
Supplemental Fig. 5: Net community production computed from O_2 change (NCP in mmol O_2 m^{-2} d^{-1}) versus the net flux of dissolved inorganic carbon (DIC) (F_{DIC} in mmol C m^{-2} d^{-1}) a) and versus DIC corrected for $CaCO_3$ dynamics (DIC*) (F_{DIC*} in mmol C m^{-2} d^{-1}) over a *Posidonia oceanica* meadow in the Bay of Revellata at 10 m depth from 6 August 2006 to 12 August 2009 (n=15). Error bars correspond to standard deviation of fluxes computed from triplicate benthic chamber incubations. Solid thick lines correspond to linear regressions: NCP = -0.51 (±0.18) x F_{DIC} + 7.3 (±13.0) (r^2=0.51, p=0.0026, n=15), NCP = 0.71 (±0.17) x F_{DIC*} -2.5 (±13.0) (r^2=0.57, p=0.0012, n=15).



Supplemental Figure 6: Gross primary production computed from O_2 change (GPP in mmol O_2 m^{-2} d^{-1}) *versus* GPP computed from DIC corrected for $CaCO_3$ dynamics (DIC*) (GPP_{DIC*} in mmol C m^{-2} d^{-1}) a) and community respiration computed from O_2 change (CR in mmol O_2 m^{-2} d^{-1}) versus CR computed from DIC* (CR_{DIC*} in mmol C m^{-2} d^{-1}) b) over a *Posidonia oceanica* meadow in the Bay of Revellata at 10 m bottom depth from 6 August 2006 to 12 August 2009 (n=15). Error bars correspond to standard deviation of fluxes computed from triplicate benthic chamber incubations. Solid thick lines correspond to linear regressions: GPP = -1.03(±0.21) x GPP_{DIC*} - 34.0 (± 22.4) (r^2=0.74, p<0.0001, n=15), CR_{DIC*} = -1.08 (±0.22) CR – 33.8 (±20.8) (r^2=0.75, p<0.0001, n=15).



Supplemental Figure 7: Community calcification derived from changes in total alkalinity (CAL in mmol C m^{-2} d^{-1}) versus gross primary production computed from O_2 change (GPP in mmol O_2 m^{-2} d^{-1}) over a *Posidonia oceanica* meadow in the Bay of Revellata at 10 m bottom depth from 6 August 2006 to 12 August 2009 (n=15). Error bars correspond to standard deviation of fluxes computed from triplicate benthic chamber incubations. Solid line corresponds to linear regression: CAL = 0.15 (±0.03) xGPP + 6.5 (± 4.3) (r^2=0.61, p<0.0006, n=15).



Supplemental Figure 8: Computed air-sea CO_2 flux (in mmol m^{-2} d^{-1}) and wind speed (in m s^{-1}) over a *Posidonia oceanica* meadow in the Bay of Revellata at 10 m bottom depth from 9 August 2006 to 20 August 2007.