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Modulation of the vertical particle transfer efficiency in the oxygen minimum zone off Peru

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Tables captions

Tab. S1: ***Particles fluxes and their transfer efficiencies (T) according to the sampling dates for both AMOP1 AMOP$_{summer}$ (denoted AMOP1) and AMOP$_{winter\text{-}spring}$ (denoted AMOP2) datasets.***
T is determined from %Flux$_{149m}$/Flux$_{34m}$ and its uncertainty from logarithmic expansion calculation, and b coefficient from the Martin's curves theory (Suess, 1980; Martin et al., 1987). Italic and non-italic values correspond to the fluxes at 34 m and 149 m, respectively. On the last lines of the table, bold colored values in red, yellow and blue correspond to particles fluxes averaged values for low, intermediate and high T_{eff} ranges, respectively, with the relative standard deviation between samples (±SD%). Analysis accuracy on the particles total mass fluxes is ±3%, inducing an absolute uncertainty on their vertical transfer efficiency estimated from a logarithmic expansion of ±6% (cf. Methods).

Tab. S2: ***Organic elemental fluxes and their transfer efficiencies according to the sampling dates for both AMOP1 AMOP$_{summer}$ (denoted AMOP1) and AMOP$_{winter\text{-}spring}$ (denoted AMOP2) datasets.***
a), b), c) and d) POC, PON, POP and BSi fluxes in $mg.m^{-2}.d^{-1}$, $mmol.m^{-2}.d^{-1}$and mol% (on POC+PON+POP+BSi), and their transfer efficiency in % (T_{eff}, T_{effPON}; cf. Table 1 caption for calculation) in terms of Particulate Organic Carbon (POC), Nitrogen (PON), Phosphorus (POP) and Biogenic Silica (BSi) according to the sampling dates for both AMOP$_{summer}$ (denoted AMOP) and AMOP$_{winter\text{-}spring}$ (denoted AMOP2) datasets.
For a), b), c) and d), italic and non-italic values correspond to the fluxes at 34 m and 149 m, respectively. On the last lines of the table, bold values correspond to particles fluxes averaged values for low, intermediate and high T_{eff} ranges, with the relative standard deviation between samples (±SD%). Analysis accuracies on the elementary fluxes are ±0.2% for both POC and PON, ±3% for POP, and ±5% for BSi, inducing an absolute uncertainty of ±0.2% (T_{eff}), ±0.2% (T_{effPON}), ±3% (T_{effPOP}) and ±5% (T_{effBSi}) on the transfer efficiency (cf. Methods).

Tab. S3: ***Molar ratios and their transfer efficiencies according to the sampling dates for both AMOP1 AMOP$_{summer}$ (denoted AMOP1) and AMOP$_{winter\text{-}spring}$ (denoted AMOP2) datasets.***
a) Values of elementary ratios (C:N, C:P and N:P) and transfer efficiency of these ratios in % ($T_{effC:N}$, $T_{effC:P}$, and $T_{effN:P}$; cf. Table 1 caption for calculation) according to the sampling dates for both AMOP$_{summer}$ (denoted AMOP1) and AMOP$_{winter\text{-}spring}$ (denoted AMOP2) datasets.
b) Values of elementary ratios (Si:C, Si:N and Si:P) and transfer efficiency of these ratios in % ($T_{effSi:N}$, $T_{effSi:N}$ and $T_{effSi:P}$; cf. Table 1 caption for calculation) according to the sampling dates for both AMOP$_{summer}$ (denoted AMOP1) and AMOP$_{winter\text{-}spring}$ (denoted AMOP2) datasets.
For a) and b), italic and non-italic values correspond to the fluxes at 34 m and 149 m, respectively. On the last lines of the table, bold values correspond to particles fluxes averaged values for low, intermediate and high T_{eff} ranges, with the relative standard deviation between samples (±SD%). Analysis accuracies on the elementary ratios are ± 0.4, 3.2, 3.2% and ± 5.2, 5.2, 8% for C:N, C:P and N:P and for Si:C, Si:N and Si:P, respectively, inducing an absolute uncertainty of ±0.9% ($T_{effC:N}$), ±6.3% ($T_{effC:P}$), ±6% ($T_{effN:P}$), and of ±12% ($T_{effSi:C}$), ±13.4% ($T_{effSi:N}$) and ±19% ($T_{effSi:P}$) on the transfer efficiency cf. Methods. Classical (reference) molar ratios have been reported on the second lines from Redfield et al. (1963) and Brezinski (1985).

Tab. S4: ***Isotopic fluxes and their transfer efficiencies according to the sampling dates for both AMOP1 AMOP$_{summer}$ (denoted AMOP1) and AMOP$_{winter\text{-}spring}$ (denoted AMOP2) datasets.***
Carbon isotopic ratio ($\delta^{13}C$) and nitrogen isotopic ratio ($\delta^{15}N$) fluxes in ‰ and their transfer efficiencies in % (T_{eff13C} and T_{eff15N}; cf. Table 1 caption for calculation) according to the sampling dates for both AMOP$_{summer}$ (denoted AMOP1) and AMOP$_{winter\text{-}spring}$ (denoted AMOP2) datasets. Italic and non-italic values correspond to the fluxes at 34 m and 149 m, respectively. On the last lines of the table, bold values correspond to particles fluxes averaged values for low, intermediate and high T_{eff} ranges, with the relative standard deviation between samples (±SD%). Analysis accuracies on the isotopic values are ±0.006‰ for $\delta^{13}C$ and ±0.007‰ for $\delta^{15}N$, inducing an absolute uncertainty of ±0.06% (T_{eff13C}) and ±0.26% (T_{eff15N}) on the transfer efficiency (cf. Methods).

Tab. S5: ***Inorganic calcium carbonate flux and its transfer efficiencies according to the sampling dates for both AMOP1 AMOP$_{summer}$ (denoted AMOP1) and AMOP$_{winter\text{-}spring}$ (denoted AMOP2) datasets.***

Inorganic calcium carbonate ($CaCO_3$) fluxes in mgCa.m^{-2}.d^{-1} and in % of the total mass flux, and its transfer efficiency in % ($T_{effCaCO3}$; cf. Table 1 caption for calculation) according to the sampling dates for both AMOP$_{summer}$ (denoted AMOP1) and AMOP$_{winter\text{-}spring}$ (denoted AMOP2) datasets. Italic and non-italic values correspond to the fluxes at 34 m and 149 m, respectively. On the last lines of the table, bold values correspond to particles fluxes averaged values for low, intermediate and high T_{eff} ranges, with the relative standard deviation between samples (±SD%). Analysis accuracies on the elementary fluxes are ±3% for $CaCO_3$, inducing an absolute uncertainty of ±3% on the transfer efficiency ($T_{effCaCO3}$; cf. Methods).

Sample name	Date in 2013 Start	End	TOTAL MASS FLUX mg.m^{-2}.d^{-1} *34 m*	149 m	Transfer efficiency % T	Error bar on T %
AMOP1-S1	**06/01**	**13/01**	486.9	474.6	97	±1.2
AMOP1-S2	**13/01**	**20/01**	630.8	336.9	53	± 0.7
AMOP1-S3	**20/01**	**27/01**	748.3	419.3	56	± 0.6
AMOP1-S4	**27/01**	**03/02**	667.1	70.4	11	± 0.5
AMOP1-S5	**03/02**	**10/02**	431.9	165.4	38	± 1.0
AMOP1-S6	**10/02**	**17/02**	655.2	164.2	25	± 0.6
AMOP1-S7	**17/02**	**24/02**	256.9	118.4	46	± 1.7
AMOP1-S8	**24/02**	**03/03**	383.7	76.5	20	± 0.9
AMOP1-S9	**03/03**	**10/03**	386.8	127.5	33	± 1.0
AMOP1-S10	**10/03**	**17/03**	181.8	65.8	36	± 2.2
AMOP1-S11	**17/03**	**24/03**	65.6	38.2	58	± 7.2
AMOP1-S12	**24/03**	**31/03**	227.0	73.8	33	± 1.8
AMOP2-S1	**28/06**	**09/07**	260.5	488.0	187	± 3.3
AMOP2-S2	**09/07**	**20/07**	235.4	154.3	66	± 2.1
AMOP2-S3	**20/07**	**31/07**	81.9	123.8	151	± 9.2
AMOP2-S4	**31/07**	**11/08**	83.0	25.3	30	± 4.7
AMOP2-S5	**11/08**	**22/08**	82.2	82.2	100	± 7.3
AMOP2-S6	**22/08**	**02/09**	39.0	78.0	200	± 23.1
AMOP2-S7	**02/09**	**13/09**	4647.1	48.6	1	± 0.1
AMOP2-S8	**13/09**	**24/09**	2998.3	18.9	1	± 0.1
AMOP2-S9	**24/09**	**05/10**	1228.5	33.9	3	± 0.3
AMOP2-S10	**05/10**	**16/10**	814.9	47.0	6	± 0.4
AMOP2-S11	**16/10**	**27/10**	877.2	30.8	4	± 0.4
AMOP2-S12	**27/10**	**07/11**	484.5	12.1	3	± 0.6
	High Teff		**328.6** (±69%)	**278.1** (±79%)	**81** (±80%)	
	Intermediate Teff		**408.6** (±61%)	**144.9** (±77%)	**49** (±85%)	
	Low Teff		**1767.5** (±97%)	**42.9** (±48%)	**36** (±226%)	

Table S1

a) Sample name	Date in 2013 Start	End	POC flux mgC.m^{-2}.d^{-1}	mmolC.m^{-2}.d^{-1}	%molC	mgC.m^{-2}.d^{-1}	mmolC.m^{-2}.d^{-1}	%molC	Transfer efficiency %
				34 m			149 m		T_{eff}
AMOP1-S1	**06/01**	**13/01**	*139.4*	*11.6*	*71*	98.6	8.2	62	71
AMOP1-S2	**13/01**	**20/01**	*127.9*	*10.7*	*66*	70.7	5.9	60	55
AMOP1-S3	**20/01**	**27/01**	*149.5*	*12.5*	*64*	85.9	7.2	62	57
AMOP1-S4	**27/01**	**03/02**	*92.2*	*7.7*	*69*	22.1	1.8	65	24
AMOP1-S5	**03/02**	**10/02**	*107.4*	*9.0*	*68*	45.5	3.8	65	42
AMOP1-S6	**10/02**	**17/02**	*132.7*	*11.1*	*64*	41.5	3.5	61	31
AMOP1-S7	**17/02**	**24/02**	*41.2*	*3.4*	*49*	18.0	1.5	46	44
AMOP1-S8	**24/02**	**03/03**	*86.3*	*7.2*	*63*	20.4	1.7	63	24
AMOP1-S9	**03/03**	**10/03**	*109.7*	*9.1*	*72*	37.9	3.2	70	35
AMOP1-S10	**10/03**	**17/03**	*51.3*	*4.3*	*73*	19.2	1.6	72	38
AMOP1-S11	**17/03**	**24/03**	*20.3*	*1.7*	*74*	11.6	1.0	76	57
AMOP1-S12	**24/03**	**31/03**	*54.1*	*4.5*	*65*	20.1	1.7	65	37
AMOP2-S1	**28/06**	**09/07**	*41.2*	*3.4*	*49*	55.5	4.6	42	135
AMOP2-S2	**09/07**	**20/07**	*37.1*	*3.1*	*48*	21.1	1.8	46	57
AMOP2-S3	**20/07**	**31/07**	*17.2*	*1.4*	*53*	18.2	1.5	48	106
AMOP2-S4	**31/07**	**11/08**	*19.4*	*1.6*	*65*	6.2	0.5	69	32
AMOP2-S5	**11/08**	**22/08**	*17.9*	*1.5*	*56*	12.2	1.0	47	68
AMOP2-S6	**22/08**	**02/09**	*6.4*	*0.5*	*51*	9.6	0.8	47	149
AMOP2-S7	**02/09**	**13/09**	*470.5*	*39.2*	*41*	8.3	0.7	59	2
AMOP2-S8	**13/09**	**24/09**	*395.1*	*32.9*	*48*	4.9	0.4	63	1
AMOP2-S9	**24/09**	**05/10**	*172.9*	*14.4*	*56*	7.2	0.6	51	4
AMOP2-S10	**05/10**	**16/10**	*135.0*	*11.3*	*58*	7.0	0.6	40	5
AMOP2-S11	**16/10**	**27/10**	*180.9*	*15.1*	*60*	4.8	0.4	62	3
AMOP2-S12	**27/10**	**07/11**	*83.0*	*6.9*	*63*	3.0	0.3	71	4
	High Teff		***70.5*** (±89%)	***5.9*** (±89%)	***61*** (±16%)	**40.3** (±88%)	**3.4** (±88%)	**58** (±21%)	**59** (±9%)
	Intermediate Teff		***77.1*** *(±49%)*	***6.4*** *(±49%)*	***65*** *(±11%)*	**25.7** (±50%)	**2.1** (±50%)	**64** (±12%)	**34** (±21%)
	Low Teff		***239.6*** *(±65%)*	***20,0*** *(±65%)*	***54*** *(±15%)*	**5.9** (±33%)	**0.5** (±33%)	**57** (±18%)	**3** (±48%)

Table S2a

b) Sample name	Date in 2013 Start	End	PON flux mgN.m^{-2}.d^{-1}	mmolN.m^{-2}.d^{-1}	%molN	mgN.m^{-2}.d^{-1}	mmolN.m^{-2}.d^{-1}	%molN	Transfer efficiency %
				34 m			149 m		T_{effPON}
AMOP1-S1	**06/01**	**13/01**	*23.6*	*1.7*	*10*	15.7	1.1	8	67
AMOP1-S2	**13/01**	**20/01**	*19.8*	*1.4*	*9*	10.5	0.8	8	53
AMOP1-S3	**20/01**	**27/01**	*20.8*	*1.5*	*8*	11.5	0.8	7	55
AMOP1-S4	**27/01**	**03/02**	*14.3*	*1.0*	*9*	3.6	0.3	9	25
AMOP1-S5	**03/02**	**10/02**	*14.3*	*1.0*	*8*	6.3	0.5	8	44
AMOP1-S6	**10/02**	**17/02**	*17.3*	*1.2*	*7*	7.1	0.5	9	41
AMOP1-S7	**17/02**	**24/02**	*5.7*	*0.4*	*6*	2.2	0.2	5	39
AMOP1-S8	**24/02**	**03/03**	*12.0*	*0.9*	*7*	2.4	0.2	6	20
AMOP1-S9	**03/03**	**10/03**	*15.5*	*1.1*	*9*	5.0	0.4	8	32
AMOP1-S10	**10/03**	**17/03**	*7.4*	*0.5*	*9*	2.4	0.2	8	32
AMOP1-S11	**17/03**	**24/03**	*2.7*	*0.2*	*8*	1.8	0.1	10	65
AMOP1-S12	**24/03**	**31/03**	*6.2*	*0.4*	*6*	2.9	0.2	8	47
AMOP2-S1	**28/06**	**09/07**	*6.4*	*0.5*	*7*	7.1	0.5	5	110
AMOP2-S2	**09/07**	**20/07**	*6.0*	*0.4*	*7*	2.8	0.2	5	46
AMOP2-S3	**20/07**	**31/07**	*2.9*	*0.2*	*8*	2.5	0.2	6	84
AMOP2-S4	**31/07**	**11/08**	*3.8*	*0.3*	*11*	1.0	0.1	10	26
AMOP2-S5	**11/08**	**22/08**	*3.4*	*0.2*	*9*	1.7	0.1	6	51
AMOP2-S6	**22/08**	**02/09**	*1.1*	*0.1*	*8*	1.4	0.1	6	123
AMOP2-S7	**02/09**	**13/09**	*77.3*	*5.5*	*6*	1.1	0.1	7	1
AMOP2-S8	**13/09**	**24/09**	*67.3*	*4.8*	*7*	0.8	0.1	8	1
AMOP2-S9	**24/09**	**05/10**	*26.0*	*1.9*	*7*	1.0	0.1	6	4
AMOP2-S10	**05/10**	**16/10**	*23.6*	*1.7*	*9*	0.9	0.1	4	4
AMOP2-S11	**16/10**	**27/10**	*36.7*	*2.6*	*10*	0.9	0.1	10	3
AMOP2-S12	**27/10**	**07/11**	*16.5*	*1.2*	*11*	0.7	0.0	14	4
	High Teff		***10.6*** *(±85%)*	***0.8*** *(±85%)*	***8*** *(±11%)*	**5.7** (±87%)	**0.4** (±87%)	**7** (±26%)	**54** (±13%)
	Intermediate Teff		***10.7*** *(±46%)*	***0.8*** *(±46%)*	***8*** *(±20%)*	**3.7** (±56%)	**0.3** (±56%)	**8** (±19%)	**34** (±27%)
	Low Teff		***41.2*** *(±61%)*	***2.9*** *(±61%)*	***8*** *(±24%)*	**0.9** (±18%)	**0.1** (±18%)	**8** (±41%)	**3** (±47%)

Table S2b

c) Sample name	Date in 2013 Start	End	POP flux mgP.m^{-2}.d^{-1}	mmolP.m^{-2}.d^{-1}	%molP	mgP.m^{-2}.d^{-1}	mmolP.m^{-2}.d^{-1}	%molP	Transfer efficiency %
				34 m			149 m		T_{effPOP}
AMOP1-S1	**06/01**	**13/01**	*17.3*	*0.6*	*4*	5.6	0.2	1	32
AMOP1-S2	**13/01**	**20/01**	*7.1*	*0.2*	*1*	2.4	0.1	1	34
AMOP1-S3	**20/01**	**27/01**	*5.9*	*0.2*	*1*	2.1	0.1	1	35
AMOP1-S4	**27/01**	**03/02**	*3.5*	*0.1*	*1*	0.9	0.0	1	26
AMOP1-S5	**03/02**	**10/02**	*4.7*	*0.2*	*1*	1.3	0.0	1	27
AMOP1-S6	**10/02**	**17/02**	*3.9*	*0.1*	*1*	2.6	0.1	2	66
AMOP1-S7	**17/02**	**24/02**	*2.2*	*0.1*	*1*	0.9	0.0	1	40
AMOP1-S8	**24/02**	**03/03**	*3.4*	*0.1*	*1*	0.9	0.0	1	27
AMOP1-S9	**03/03**	**10/03**	*6.4*	*0.2*	*2*	1.6	0.1	1	25
AMOP1-S10	**10/03**	**17/03**	*2.7*	*0.1*	*2*	1.4	0.0	2	53
AMOP1-S11	**17/03**	**24/03**	*1.0*	*0.0*	*1*	0.5	0.0	1	45
AMOP1-S12	**24/03**	**31/03**	*3.0*	*0.1*	*1*	0.9	0.0	1	31
AMOP2-S1	**28/06**	**09/07**	*1.8*	*0.1*	*1*	2.7	0.1	1	152
AMOP2-S2	**09/07**	**20/07**	*2.0*	*0.1*	*1*	1.6	0.1	1	80
AMOP2-S3	**20/07**	**31/07**	*0.8*	*0.0*	*1*	0.8	0.0	1	104
AMOP2-S4	**31/07**	**11/08**	*3.7*	*0.1*	*5*	0.4	0.0	2	12
AMOP2-S5	**11/08**	**22/08**	*0.5*	*0.0*	*1*	0.5	0.0	1	107
AMOP2-S6	**22/08**	**02/09**	*0.2*	*0.0*	*1*	0.5	0.0	1	267
AMOP2-S7	**02/09**	**13/09**	*9.2*	*0.3*	*0*	0.2	0.0	1	3
AMOP2-S8	**13/09**	**24/09**	*8.3*	*0.3*	*0*	0.1	0.0	1	2
AMOP2-S9	**24/09**	**05/10**	*2.8*	*0.1*	*0*	0.5	0.0	2	19
AMOP2-S10	**05/10**	**16/10**	*2.2*	*0.1*	*0*	0.6	0.0	1	25
AMOP2-S11	**16/10**	**27/10**	*5.1*	*0.2*	*1*	1.5	0.1	8	30
AMOP2-S12	**27/10**	**07/11**	*2.0*	*0.1*	*1*	0.2	0.0	2	9
	High Teff		***3.3*** (±91%)	***0.1*** (±91%)	***1*** (±32%)	**1.4** (±63%)	**0.0** (±63%)	**1** (±32%)	**60** (±53%)
	Intermediate Teff		***3.7*** (±33%)	***0.1*** (±33%)	***2*** (±79%)	**1.2** (±50%)	**0.0** (±50%)	**1** (±36%)	**34** (±48%)
	Low Teff		***4.9*** (±64%)	***0.2*** (±64%)	***0*** (±33%)	**0.5** (±98%)	**0.0** (±98%)	**2** (±120%)	**15** (±81%)

Table S2c

d) Sample name	Date in 2013 Start	End	BSi flux mgSi.m^{-2}.d^{-1}	mmolSi.m^{-2}.d^{-1}	%molSi	mgSi.m^{-2}.d^{-1}	mmolSi.m^{-2}.d^{-1}	%molSi	Transfer efficiency %
				34 m			149 m		T_{effBSi}
AMOP1-S1	**06/01**	**13/01**	*69.3*	*2.5*	*15*	105.6	3.8	28	152
AMOP1-S2	**13/01**	**20/01**	*110.6*	*3.9*	*24*	85.5	3.1	31	77
AMOP1-S3	**20/01**	**27/01**	*151.8*	*5.4*	*28*	97.4	3.5	30	64
AMOP1-S4	**27/01**	**03/02**	*66.3*	*2.4*	*21*	19.6	0.7	25	30
AMOP1-S5	**03/02**	**10/02**	*84.5*	*3.0*	*23*	43.1	1.5	26	51
AMOP1-S6	**10/02**	**17/02**	*138.5*	*4.9*	*28*	46.4	1.7	29	33
AMOP1-S7	**17/02**	**24/02**	*84.9*	*3.0*	*44*	44.1	1.6	48	52
AMOP1-S8	**24/02**	**03/03**	*93.0*	*3.3*	*29*	22.2	0.8	29	24
AMOP1-S9	**03/03**	**10/03**	*61.8*	*2.2*	*17*	26.2	0.9	21	42
AMOP1-S10	**10/03**	**17/03**	*27.1*	*1.0*	*17*	11.4	0.4	18	42
AMOP1-S11	**17/03**	**24/03**	*10.3*	*0.4*	*16*	4.8	0.2	13	47
AMOP1-S12	**24/03**	**31/03**	*51.7*	*1.8*	*27*	18.2	0.7	25	35
AMOP2-S1	**28/06**	**09/07**	*84.1*	*3.0*	*43*	158.5	5.7	52	188
AMOP2-S2	**09/07**	**20/07**	*78.1*	*2.8*	*44*	50.6	1.8	47	65
AMOP2-S3	**20/07**	**31/07**	*28.7*	*1.0*	*38*	39.9	1.4	45	139
AMOP2-S4	**31/07**	**11/08**	*13.5*	*0.5*	*19*	4.1	0.1	20	30
AMOP2-S5	**11/08**	**22/08**	*26.0*	*0.9*	*35*	28.4	1.0	47	109
AMOP2-S6	**22/08**	**02/09**	*12.1*	*0.4*	*41*	21.6	0.8	46	178
AMOP2-S7	**02/09**	**13/09**	*1394.8*	*49.8*	*53*	11.2	0.4	34	1
AMOP2-S8	**13/09**	**24/09**	*863.8*	*30.8*	*45*	5.2	0.2	28	1
AMOP2-S9	**24/09**	**05/10**	*256.4*	*9.2*	*36*	13.5	0.5	41	5
AMOP2-S10	**05/10**	**16/10**	*179.8*	*6.4*	*33*	21.9	0.8	54	12
AMOP2-S11	**16/10**	**27/10**	*199.4*	*7.1*	*28*	3.7	0.1	20	2
AMOP2-S12	**27/10**	**07/11**	*78.9*	*2.8*	*26*	1.3	0.0	13	2
	High Teff		***75.4*** (±78%)	***2.7*** (±78%)	***29*** (±36%)	**53.3** (±72%)	**1.9** (±72%)	**34** (±41%)	**72** (±32%)
	Intermediate Teff		***69.0*** (±54%)	***2.5*** (±54%)	***25*** (±33%)	**26.2** (±58%)	**0.9** (±58%)	**27** (±33%)	**38** (±26%)
	Low Teff		***495.5*** (±105%)	***17.7*** (±105%)	***37*** (±28%)	**9.5** (±81%)	**0.3** (±81%)	**32** (±46%)	**4** (±120%)

Table S2d

a) Sample name	Date in 2013 Start	End	C:N 6.625 34 m	149 m	$T_{effC:N}$ %	C:P 34 m	149 m	$T_{effC:P}$ %	N:P 16 34 m	149 m	$T_{effN:P}$ %
AMOP1-S1	**06/01**	**13/01**	*6.89*	7.31	106	*20.83*	45.75	220	*3.02*	6.26	207
AMOP1-S2	**13/01**	**20/01**	*7.52*	7.83	104	*46.48*	75.02	161	*6.18*	9.58	155
AMOP1-S3	**20/01**	**27/01**	*8.37*	8.72	104	*65.64*	106.59	162	*7.84*	12.23	156
AMOP1-S4	**27/01**	**03/02**	*7.53*	7.13	95	*67.8*	62.03	91	*9.00*	8.7	97
AMOP1-S5	**03/02**	**10/02**	*8.78*	8.36	95	*58.99*	92.12	156	*6.72*	11.02	164
AMOP1-S6	**10/02**	**17/02**	*8.94*	6.83	76	*88.38*	41.67	47	*9.89*	6.1	62
AMOP1-S7	**17/02**	**24/02**	*8.48*	9.55	113	*48.6*	52.87	109	*5.73*	5.53	97
AMOP1-S8	**24/02**	**03/03**	*8.39*	10.03	120	*66.48*	58.57	88	*7.93*	5.84	74
AMOP1-S9	**03/03**	**10/03**	*8.25*	8.81	107	*44.4*	60.43	136	*5.38*	6.86	127
AMOP1-S10	**10/03**	**17/03**	*8.09*	9.39	116	*49.11*	34.94	71	*6.07*	3.72	61
AMOP1-S11	**17/03**	**24/03**	*8.7*	7.67	88	*51.68*	65.93	128	*5.94*	8.6	145
AMOP1-S12	**24/03**	**31/03**	*10.11*	8.01	79	*46.78*	55.48	119	*4.63*	6.93	150
AMOP2-S1	**28/06**	**09/07**	*7.47*	9.14	122	*59.29*	52.59	89	*7.93*	5.75	72
AMOP2-S2	**09/07**	**20/07**	*7.17*	8.81	123	*48.7*	34.62	71	*6.79*	3.93	58
AMOP2-S3	**20/07**	**31/07**	*6.8*	8.62	127	*55.06*	56.17	102	*8.1*	6.52	80
AMOP2-S4	**31/07**	**11/08**	*5.91*	7.13	121	*13.49*	36.27	269	*2.28*	5.09	223
AMOP2-S5	**11/08**	**22/08**	*6.18*	8.30	134	*91.12*	57.91	64	*14.75*	6.98	47
AMOP2-S6	**22/08**	**02/09**	*6.62*	7.99	121	*96.15*	53.67	56	*14.52*	6.72	46
AMOP2-S7	**02/09**	**13/09**	*7.1*	8.55	120	*132.48*	88.43	67	*18.66*	10.35	55
AMOP2-S8	**13/09**	**24/09**	*6.85*	7.53	110	*123.45*	88.11	71	*18.02*	11.7	65
AMOP2-S9	**24/09**	**05/10**	*7.75*	8.05	104	*159.21*	34.67	22	*20.53*	4.31	21
AMOP2-S10	**05/10**	**16/10**	*6.69*	9.21	138	*160.16*	32.63	20	*23.95*	3.54	15
AMOP2-S11	**16/10**	**27/10**	*5.75*	5.95	103	*90.7*	8.1	9	*15.78*	1.36	9
AMOP2-S12	**27/10**	**07/11**	*5.86*	5.00	85	*105.16*	42.17	40	*17.94*	8.43	47
	High Teff		***7.59*** ***(±13%)***	**8.26** **(±6%)**	**111** **(±16%)**	***60.72*** ***(±31%)***	**68.01** **(±39%)**	**117** **(±41%)**	***8.3*** ***(±44%)***	**8.26** **(±37%)**	**112** **(±49%)**
	Intermediate Teff		***8.27*** ***(±14%)***	**8.36** **(±14%)**	**102** **(±16%)**	***53.78*** ***(±38%)***	**54.93** **(±32%)**	**121** **(±54%)**	***6.4*** ***(±36%)***	**6.64** **(±32%)**	**117** **(±46%)**
	Low Teff		***6.67*** ***(±11%)***	**7.38** **(±22%)**	**110** **(±16%)**	***128.53*** ***(±22%)***	**49.02** **(±66%)**	**38** **(±68%)**	***19.15*** ***(±15%)***	**6.61** **(±62%)**	**35** **(±67%)**

Table S3a

b) Sample name	Date in 2013 Start	End	Si:C 0.14 34 m	149 m	$T_{effSi:C}$ %	Si:N 0.94 34 m	149 m	$T_{effSi:N}$ %	Si:P 15 34 m	149 m	$T_{effSi:P}$ %
AMOP1-S1	**06/01**	**13/01**	*0.21*	0.46	215	*1.46*	3.34	228	*4.42*	20.92	473
AMOP1-S2	**13/01**	**20/01**	*0.37*	0.52	140	*2.78*	4.05	146	*17.17*	38.77	226
AMOP1-S3	**20/01**	**27/01**	*0.43*	0.48	112	*3.63*	4.22	116	*28.49*	51.65	181
AMOP1-S4	**27/01**	**03/02**	*0.31*	0.38	123	*2.31*	2.7	117	*20.83*	23.52	113
AMOP1-S5	**03/02**	**10/02**	*0.34*	0.41	121	*2.95*	3.39	115	*19.84*	37.33	188
AMOP1-S6	**10/02**	**17/02**	*0.45*	0.48	107	*3.99*	3.26	82	*39.42*	19.89	50
AMOP1-S7	**17/02**	**24/02**	*0.88*	1.05	119	*7.47*	10.00	134	*42.83*	55.34	129
AMOP1-S8	**24/02**	**03/03**	*0.46*	0.46	101	*3.86*	4.66	121	*30.62*	27.21	89
AMOP1-S9	**03/03**	**10/03**	*0.24*	0.3	123	*1.99*	2.61	131	*10.68*	17.87	167
AMOP1-S10	**10/03**	**17/03**	*0.23*	0.25	112	*1.83*	2.38	130	*11.08*	8.85	80
AMOP1-S11	**17/03**	**24/03**	*0.22*	0.18	82	*1.89*	1.36	72	*11.23*	11.73	104
AMOP1-S12	**24/03**	**31/03**	*0.41*	0.39	95	*4.13*	3.1	75	*19.10*	21.44	112
AMOP2-S1	**28/06**	**09/07**	*0.87*	1.22	140	*6.52*	11.16	171	*51.71*	64.17	124
AMOP2-S2	**09/07**	**20/07**	*0.9*	1.02	114	*6.46*	9.01	139	*43.88*	35.41	81
AMOP2-S3	**20/07**	**31/07**	*0.72*	0.94	131	*4.86*	8.08	166	*39.37*	52.63	134
AMOP2-S4	**31/07**	**11/08**	*0.3*	0.28	95	*1.75*	2.02	115	*4.01*	10.26	256
AMOP2-S5	**11/08**	**22/08**	*0.62*	0.99	160	*3.83*	8.24	215	*56.5*	57.5	102
AMOP2-S6	**22/08**	**02/09**	*0.8*	0.96	120	*5.32*	7.69	145	*77.26*	51.67	67
AMOP2-S7	**02/09**	**13/09**	*1.27*	0.58	46	*8.99*	4.94	55	*167.81*	51.11	30
AMOP2-S8	**13/09**	**24/09**	*0.93*	0.45	49	*6.4*	3.42	53	*115.31*	39.96	35
AMOP2-S9	**24/09**	**05/10**	*0.63*	0.8	127	*4.91*	6.46	132	*100.85*	27.84	28
AMOP2-S10	**05/10**	**16/10**	*0.57*	1.34	236	*3.81*	12.36	325	*91.14*	43.79	48
AMOP2-S11	**16/10**	**27/10**	*0.47*	0.33	70	*2.71*	1.95	72	*42.71*	2.66	6
AMOP2-S12	**27/10**	**07/11**	*0.41*	0.19	46	*2.38*	0.93	39	*42.70*	7.87	18
	High Teff		***0.51*** (±52%)	**0.64** (±57%)	**121** (±25%)	***3.72*** (±46%)	**5.38** (±59%)	**138** (±38%)	***31.45*** (±60%)	**39.01** (±45%)	**139** (±45%)
	Intermediate Teff		***0.4*** (±50%)	**0.44** (±54%)	**111** (±11%)	***3.36*** (±54%)	**3.79** (±65%)	**113** (±19%)	***22.04*** (±60%)	**24.63** (±58%)	**132** (±48%)
	Low Teff		***0.71*** (±46%)	**0.62** (±67%)	**95** (±79%)	***4.87*** (±51%)	**5.01** (±82%)	**113** (±97%)	***93.42*** (±51%)	**28.87** (±69%)	**28** (±52%)

Table S3b

Sample name	Date in 2013 Start	End	δ¹³C ‰ 34 m	149 m	Teff13C %	δ¹⁵N ‰ 34 m	149 m	T_{eff15N} %
AMOP1-S1	**06/01**	**13/01**	*-20.8*	-18.4	88	*9,0*	8.9	99
AMOP1-S2	**13/01**	**20/01**	*-20.3*	-18.8	93	*6.6*	8.4	127
AMOP1-S3	**20/01**	**27/01**	*-20.3*	-19.1	94	*5.9*	8.6	146
AMOP1-S4	**27/01**	**03/02**	*-20.3*	-19.3	95	*3.5*	9.3	267
AMOP1-S5	**03/02**	**10/02**	*-21.0*	-19.8	94	*5.5*	10.1	185
AMOP1-S6	**10/02**	**17/02**	*-21.0*	-19.8	94	*5.9*	13.1	224
AMOP1-S7	**17/02**	**24/02**	*-21.0*	-20.8	99	*9.2*	8.0	86
AMOP1-S8	**24/02**	**03/03**	*-21.2*	-19.7	93	*6.3*	8.2	130
AMOP1-S9	**03/03**	**10/03**	*-21.5*	-20.2	94	*5.9*	8.0	135
AMOP1-S10	**10/03**	**17/03**	*-21.6*	-20.2	94	*4.5*	7.9	177
AMOP1-S11	**17/03**	**24/03**	*-21.1*	-19.3	91	*7.9*	9.1	116
AMOP1-S12	**24/03**	**31/03**	*-20.7*	-19.1	92	*7.5*	8.6	115
AMOP2-S1	**28/06**	**09/07**	*-22.0*	*-21.0*	95	*4.3*	4.3	100
AMOP2-S2	**09/07**	**20/07**	*-22.1*	-21.9	99	*5.9*	4.9	83
AMOP2-S3	**20/07**	**31/07**	*-22.7*	-21.9	96	*7.7*	6.9	89
AMOP2-S4	**31/07**	**11/08**	*-22.3*	-20.5	92	*9.3*	8.0	86
AMOP2-S5	**11/08**	**22/08**	*-22.4*	-20.2	90	*7.3*	6.7	92
AMOP2-S6	**22/08**	**02/09**	*-19.4*	-17.6	91	*5.6*	6.5	115
AMOP2-S7	**02/09**	**13/09**	*-19.4*	-17.4	90	*4.9*	7.4	152
AMOP2-S8	**13/09**	**24/09**	*-19.8*	-17.6	89	*7.7*	8.3	108
AMOP2-S9	**24/09**	**05/10**	*-18.4*	-17.8	97	*6.9*	6.8	98
AMOP2-S10	**05/10**	**16/10**	*-19.1*	*-19.0*	100	*7.8*	8.0	90
AMOP2-S11	**16/10**	**27/10**	*-19.7*	-19.9	101	*9.3*	8.4	90
AMOP2-S12	**27/10**	**07/11**	*-20.4*	-21.4	105	*7.9*	8.1	103
	High Teff		***-21.2*** (±5%)	**-19.8** (±6%)	**93** (±4%)	***6.7*** (±13%)	**7.5** (±23%)	**113** (±23%)
	Intermediate Teff		***-21.2*** (±3%)	**-19.9** (±3%)	**94** (±2%)	***6.4*** (±31%)	**9.0** (±19%)	**156** (±40%)
	Low Teff		***-19.5*** (±3%)	**-18.9** (±8%)	**97** (±6%)	***7.4*** (±20%)	**7.7** (±9%)	**107** (±22%)

Table S4

Sample name	Date in 2013 Start	End	$CaCO_3$ mg$Ca.m^{-2}.d^{-1}$ *34 m*	149 m	$T_{effCaCO3}$ %
AMOP1-S1	**06/01**	**13/01**	*10.61*	19.48	184
AMOP1-S2	**13/01**	**20/01**	*9.92*	13.22	133
AMOP1-S3	**20/01**	**27/01**	*33.57*	11.93	36
AMOP1-S4	**27/01**	**03/02**	*24.27*	4.54	19
AMOP1-S5	**03/02**	**10/02**	*16.16*	4.64	29
AMOP1-S6	**10/02**	**17/02**	*19.25*	3.73	19
AMOP1-S7	**17/02**	**24/02**	*4.43*	2.16	49
AMOP1-S8	**24/02**	**03/03**	*10.16*	2.11	21
AMOP1-S9	**03/03**	**10/03**	*23.29*	5.00	21
AMOP1-S10	**10/03**	**17/03**	*9.82*	7.04	72
AMOP1-S11	**17/03**	**24/03**	*2.45*	1.64	67
AMOP1-S12	**24/03**	**31/03**	*6.29*	2.06	33
AMOP2-S1	**28/06**	**09/07**	*2.46*	14.54	591
AMOP2-S2	**09/07**	**20/07**	*4.39*	5.82	133
AMOP2-S3	**20/07**	**31/07**	*0.63*	6.14	969
AMOP2-S4	**31/07**	**11/08**	*17.00*	1.28	8
AMOP2-S5	**11/08**	**22/08**	*0.70*	1.87	267
AMOP2-S6	**22/08**	**02/09**	*2.84*	2.59	91
AMOP2-S7	**02/09**	**13/09**	*373.38*	2.02	1
AMOP2-S8	**13/09**	**24/09**	*157.72*	0.73	0
AMOP2-S9	**24/09**	**05/10**	*49.12*	1.05	2
AMOP2-S10	**05/10**	**16/10**	*22.77*	0.99	4
AMOP2-S11	**16/10**	**27/10**	*14.95*	4.78	32
AMOP2-S12	**27/10**	**07/11**	*25.32*	0.96	4
	High Teff		***10.21*** ***(±132%)***	**6.9** **(±79%)**	**127** **(±70%)**
	Intermediate Teff		***14.52*** ***(±50%)***	**3.62** **(±52%)**	**30** **(±65%)**
	Low Teff		***107.21*** ***(±131%)***	**1.76** **(±88%)**	**7** **(±170%)**

Table S5

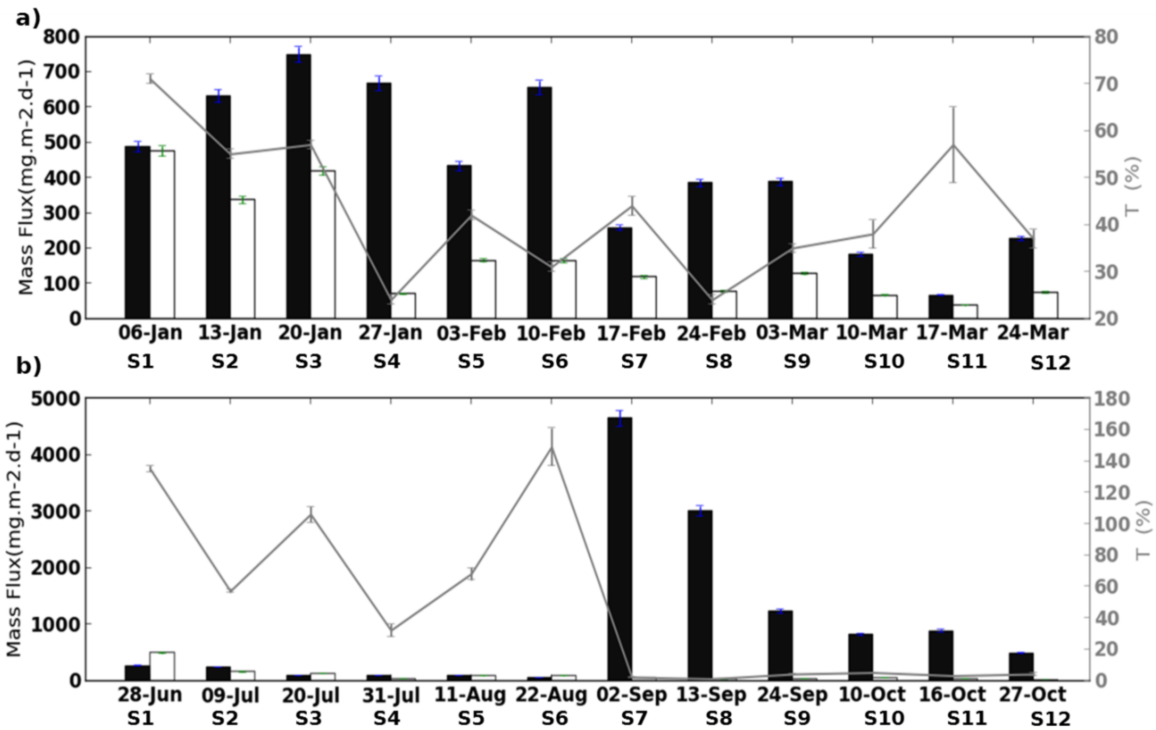
Figures

Figure S1: ***Time series in 2013 for particle fluxes*** *(left handed scale)* ***at 34 m*** *(black bar)* ***and 149 m*** *(white bar)* ***and the corresponding transfer efficiency*** *(T; similarly to T_{eff} defined from Eq.1, gray line, right-handed scale), covering $AMOP_{summer}$ (denoted AMOP1, a) and $AMOP_{winter\text{-}spring}$ (denoted AMOP2, b) periods. Error bars correspond to the accuracy of analytical determination for the particle flux and is estimated through a logarithmic expansion of Eq. 1 for T as for T_{eff}. (cf. Methods, and Tab. S1 for details).*

Figure S2: ***Relationship between the mass flux and the flux of carbon and nitrogen, and between their Transfer Ratios****. a) Total mass fluxes versus the POC fluxes and b) total mass fluxes versus the PON fluxes, at 34 m (filled dots) and at 149 m (empty dots). c) Transfer efficiency of the total mass (T) versus the transfer efficiency of the POC fluxes (T_{eff}) and d) the transfer efficiency of the the total mass (T) versus the transfer efficiency of the PON fluxes (T_{effPON}). The color of the dots symbolizes the three different main T_{eff} ranges (red, yellow and blue for low, intermediate and high T_{eff}, respectively).*

Figure S3: ***Vertical cross-shore section at 12°S at the latitude of the AMOP fixed mooring for the oxygen concentration and pH value****. Data were acquired in the framework of R/V L'Atalante AMOP cruise from January 27 to February 3, 2014. AMOP mooring location is indicated by the vertical white line near the coast on the right. The upper panel (a) represents the oxygen concentration (µmol.kg^{-1}) and the lower panel (b) represents the pH values. On both graphs the white dashed isopleth corresponds to the averaged oxygen concentration at the depth where the oxygen gradient is the strongest over all the available AMOP cruise casts (lower oxycline boundary at O_2=87 µmol.kg^{-1}) in a-b. The black isopleth corresponds to pH=7.6 (average in the oxycline in b).*

Figure S3: ***Transfer efficiency for the total mass fluxes and for Organic Matter.*** *The black line represents the mass flux transfer efficiency (T). The green line represents the transfer efficiency of the OM, where the OM is estimated as twice the POC fluxes according to Klaas and Archer (2002). Error bars are estimated from a logarithmic expansion of Eq. 1 and the analysis accuracies (cf. Methods), for both $AMOP_{summer}$ (denoted AMOP1) and $AMOP_{winter\text{-}spring}$ (denoted AMOP2) periods in 2013.*



a)
Mass Flux(mg.m-2.d-1)
T (%)
06-Jan 13-Jan 20-Jan 27-Jan 03-Feb 10-Feb 17-Feb 24-Feb 03-Mar 10-Mar 17-Mar 24-Mar
S1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S12
b)
Mass Flux(mg.m-2.d-1)
T (%)
28-Jun 09-Jul 20-Jul 31-Jul 11-Aug 22-Aug 02-Sep 13-Sep 24-Sep 10-Oct 16-Oct 27-Oct
S1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S12

Figure S1

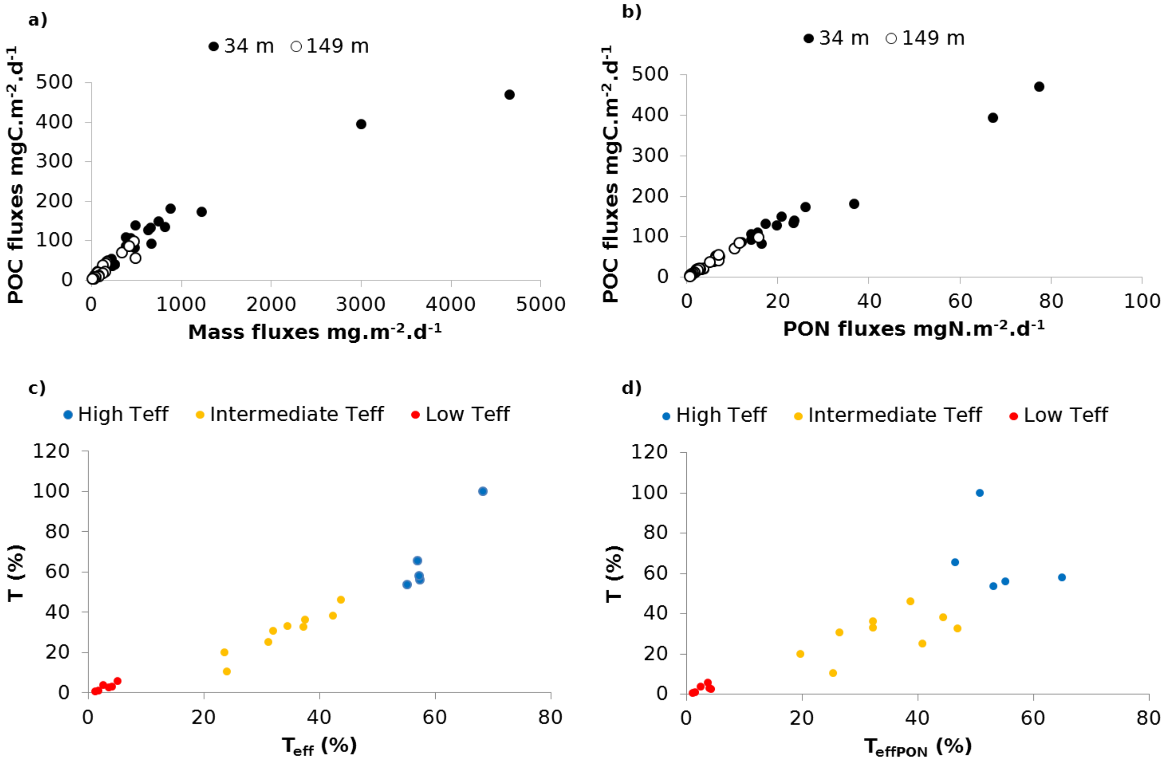
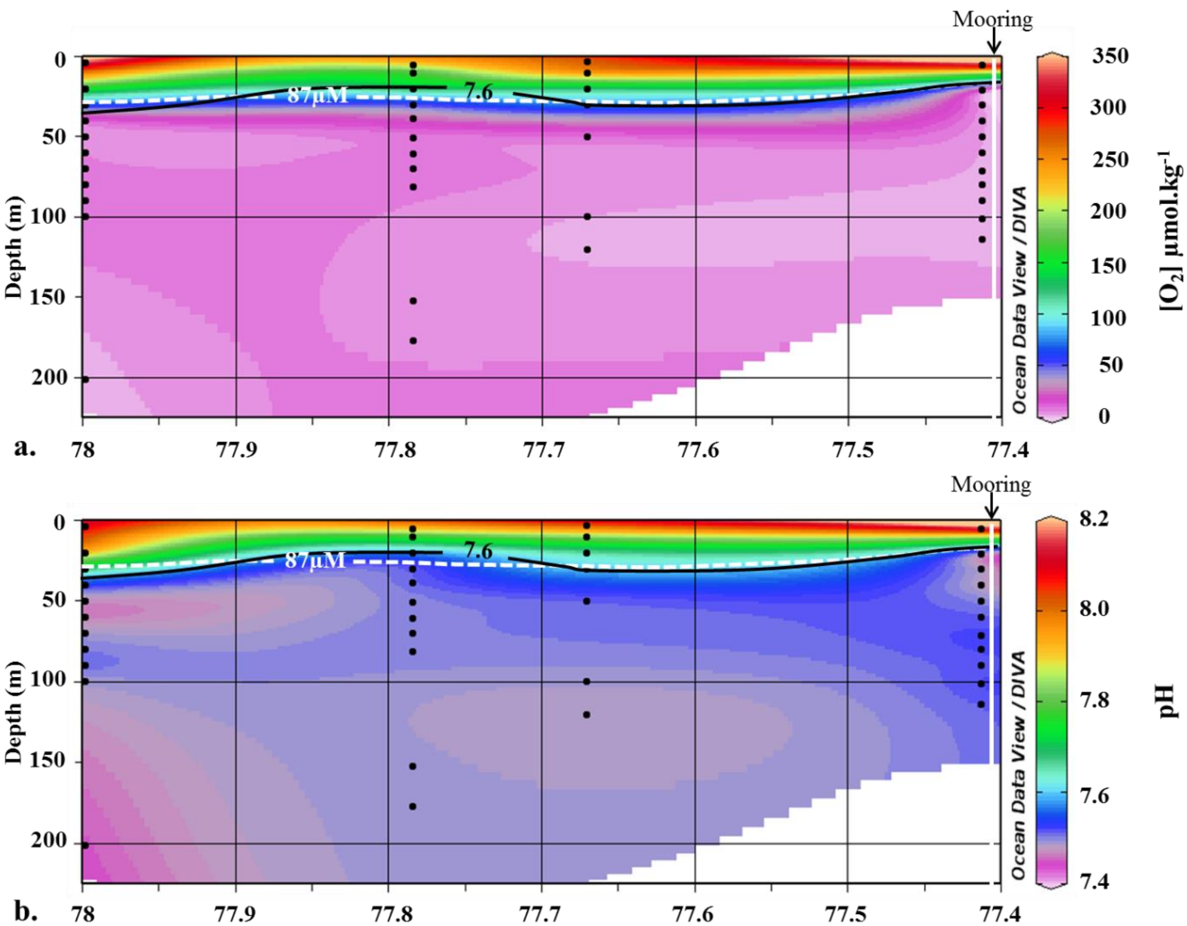
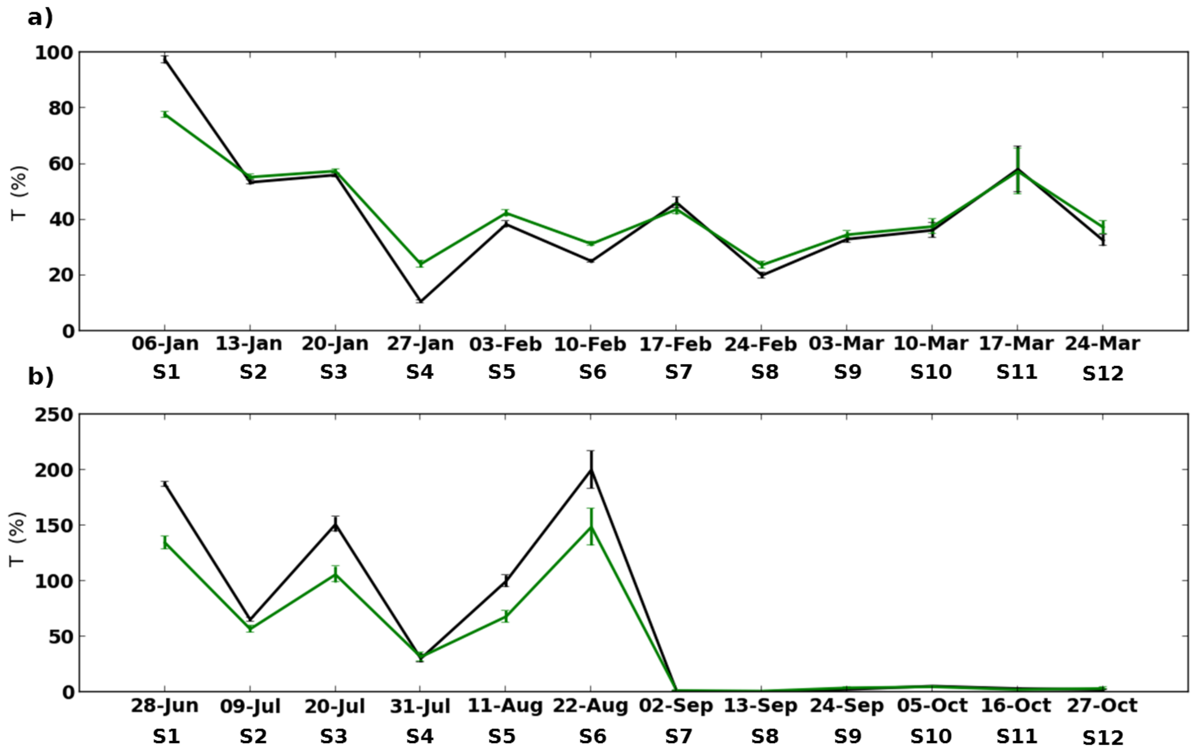

a)
34 m
149 m
POC fluxes mgC.m-2.d-1
0
100
200
300
400
500
0
1000
2000
3000
4000
5000
Mass fluxes mg.m-2.d-1
b)
34 m
149 m
POC fluxes mgC.m-2.d-1
0
100
200
300
400
500
0
20
40
60
80
100
PON fluxes mgN.m-2.d-1
c)
High Teff
Intermediate Teff
Low Teff
T (%)
0
20
40
60
80
100
120
0
20
40
60
80
Teff (%)
d)
High Teff
Intermediate Teff
Low Teff
T (%)
0
20
40
60
80
100
120
0
20
40
60
80
TeffPON (%)

Figure S2



Mooring
0
50
100
150
200
Depth (m)
87µM
7.6
Ocean Data View / DIVA
350
300
250
200
150
100
50
0
[O2] µmol.kg-1
a.
78
77.9
77.8
77.7
77.6
77.5
77.4
Mooring
0
50
100
150
200
Depth (m)
87µM
7.6
Ocean Data View / DIVA
8.2
8.0
7.8
7.6
7.4
pH
b.
78
77.9
77.8
77.7
77.6
77.5
77.4

Figure S3



a)
T (%)
100
80
60
40
20
0
06-Jan
13-Jan
20-Jan
27-Jan
03-Feb
10-Feb
17-Feb
24-Feb
03-Mar
10-Mar
17-Mar
24-Mar
S1
S2
S3
S4
S5
S6
S7
S8
S9
S10
S11
S12
b)
T (%)
250
200
150
100
50
0
28-Jun
09-Jul
20-Jul
31-Jul
11-Aug
22-Aug
02-Sep
13-Sep
24-Sep
05-Oct
16-Oct
27-Oct
S1
S2
S3
S4
S5
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S11
S12

Figure S4