

*Supplement of*

# **Linking marine phytoplankton emissions, meteorological processes and downwind particle properties with FLEXPART**

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**Table S1. Abbreviations and descriptions of biochemical and subsurface optical satellite measurements obtained from the GlobColour Archive (<http://hermes.acri.fr/index.php>), modeled net primary production obtained from satellite, model data obtained from the Oregon State Ocean Productivity archive (<http://sites.science.oregonstate.edu/ocean.productivity/index.php>) and meteorological variables from the NOAA's Global Data Assimilation archive (<https://www.ncdc.noaa.gov/data-access/model-data/model-datasets/global-data-assimilation-system-gdas>). Bold rows are the variables used in the main text.**

Abbreviation	Units	Description
Satellite (8-day average)		
<b>CHL<sub>GSM</sub></b>	<b>mg m<sup>3</sup></b>	<b>Chlorophyll-a product derived from Garver-Siegel-Maritonena ocean color model</b>
CHL <sub>NN</sub>	mg m <sup>3</sup>	Chlorophyll-a product derived from a Neural Network Algorithm
CHL <sub>OC5</sub>	mg m <sup>3</sup>	Chlorophyll-a product derived from the Gohin algorithm
<b>POC</b>	<b>mg m<sup>3</sup></b>	<b>Marine particulate organic carbon</b>
PIC	mol m <sup>3</sup>	Marine particulate inorganic carbon
<b>CDM</b>	<b>m<sup>-1</sup></b>	<b>Colored dissolved and detrital organic materials absorption coefficient</b>
<b>ZEU</b>	<b>m</b>	<b>Depth of the euphotic zone</b>
ZHL	m	Depth of the Heated Layer
NPP Models (8-day average)		
CbPM	mg C m <sup>-2</sup> day <sup>-1</sup>	Carbon based model of Westberry et al. (2008)
VGPM	mg C m <sup>-2</sup> day <sup>-1</sup>	Vertically Generalized Production model of Behrenfeld and Falkowski (1997)
VGPM <sub>Eppley</sub>	mg C m <sup>-2</sup> day <sup>-1</sup>	VGPM Eppley variation (Behrenfeld and Falkowski, 1997; Eppley, 1972)
<b>CAFE</b>	<b>mg C m<sup>-2</sup> day<sup>-1</sup></b>	<b>Carbon, Absorption, and Fluorescence Euphotic-resolving model of Silsbe et al. (2016)</b>
GDAS		
CF <sub>Total</sub>	%	Total cloud cover (3-hour average)
<b>CF<sub>Low</sub></b>	<b>%</b>	<b>Low-level cloud cover (3-hour average)</b>
<b>DSWF</b>	<b>W m<sup>-2</sup></b>	<b>Downward shortwave forcing (3-hour average)</b>
PBLH	m	Planetary boundary layer height
<b>Precip.</b>	<b>m</b>	<b>Precipitation (6-hour accumulation)</b>
SST	K	Sea surface temperature
<b>U</b>	<b>m s<sup>-1</sup></b>	<b>Sea surface wind speed</b>

**Table S2. Ship measurements used for comparison with FLEXPART-residence-time-weighted trajectories.**

Ship Measurements	Units	Full name	Instrument
CN	cm <sup>-3</sup>	Total condensation nuclei	CPC
N <sub>&gt;100nm</sub>	cm <sup>-3</sup>	Condensation nuclei (D <sub>p</sub> > 100nm)	SEMS
N <sub>&lt;100nm</sub>	cm <sup>-3</sup>	Condensation nuclei (D <sub>p</sub> < 100nm)	SEMS
Org	µg m <sup>-3</sup>	Organic mass	AMS
SO <sub>4</sub>	µg m <sup>-3</sup>	Sulfate mass	AMS
NO <sub>3</sub>	µg m <sup>-3</sup>	Nitrate mass	AMS
DMS	ppt	Dimethyl sulfide	CIMS
N <sub>PMA</sub>	cm <sup>-3</sup>	Sea spray aerosol number	SEMS and APS
BC <sub>m</sub>	ng m <sup>-3</sup>	Black Carbon mass	SP2
Rn	mBq m <sup>-3</sup>	Radon	Dual-flow-loop two-filter 103 radon detector

**Table S3. Correlation of 5-day FLEXPART-residence-time-weighted GlobColour satellite products with all 5-day FLEXPART-residence-time-weighted explanatory variables during clean marine conditions shown as the Pearson's coefficient (r). Weak correlations ( $0.25 \leq |r| < 0.50$ ) are highlighted in red, moderate correlations ( $0.50 \leq |r| < 0.80$ ) are highlighted in yellow, and strong correlations ( $|r| \geq 0.80$ ) are highlighted in green.**

	CHL <sub>GSM</sub>	CHL <sub>NN</sub>	CHL <sub>OC5t</sub>	POC	PIC	CDM	ZEU	ZHL
Satellite Measurements								
CHL <sub>GSM</sub>	1.00	0.94	0.87	0.78	0.48	0.90	-0.74	-0.72
CHL <sub>NN</sub>	0.94	1.00	0.92	0.67	0.36	0.87	-0.73	-0.71
CHL <sub>OC5</sub>	0.87	0.92	1.00	0.69	0.15	0.86	-0.74	-0.73
POC	0.78	0.67	0.69	1.00	0.40	0.89	-0.77	-0.76
PIC	0.48	0.36	0.15	0.40	1.00	0.51	-0.39	-0.38
CDM	0.90	0.87	0.86	0.89	0.51	1.00	-0.88	-0.87
ZEU	-0.74	-0.73	-0.74	-0.77	-0.39	-0.88	1.00	1.00
ZHL	-0.72	-0.71	-0.73	-0.76	-0.38	-0.87	1.00	1.00
NPP Model								
CbPM	0.21	0.14	0.14	0.26	0.12	0.16	0.07	0.07
VGPM <sub>EPPLEY</sub>	0.74	0.78	0.78	0.52	0.04	0.61	-0.48	-0.47
VGPM	0.79	0.82	0.83	0.59	0.07	0.68	-0.58	-0.57
CAFE	0.76	0.83	0.76	0.46	0.06	0.58	-0.40	-0.38
GDAS								
CF <sub>Total</sub>	0.45	0.41	0.41	0.50	0.37	0.60	-0.72	-0.72
CF <sub>Low</sub>	0.51	0.46	0.40	0.52	0.52	0.63	-0.69	-0.68
DSWF	0.13	0.17	0.14	-0.14	-0.26	-0.13	0.36	0.37
PBLH	-0.15	-0.18	-0.26	-0.13	0.11	-0.16	0.09	0.09
Precip.	-0.06	-0.04	-0.02	-0.12	-0.23	-0.06	-0.03	-0.04
SST	-0.69	-0.62	-0.58	-0.73	-0.64	-0.83	0.85	0.84
U	0.22	0.23	0.23	0.29	0.18	0.36	-0.50	-0.50

**Table S4. Correlation of 5-day FLEXPART-residence-time-weighted modeled net primary production with all 5-day FLEXPART-residence-time-weighted explanatory variables during clean marine conditions shown as the Pearson's coefficient (r). Weak correlations ( $0.25 \leq |r| < 0.50$ ) are highlighted in red, moderate correlations ( $0.50 \leq |r| < 0.80$ ) are highlighted in yellow, and strong correlations ( $|r| \geq 0.80$ ) are highlighted in green.**

	CbPM	VGPM <sub>EPPLEY</sub>	VGPM	CAFE
<b>Satellite Measurements</b>				
CHL <sub>GSM</sub>	0.21	0.74	0.79	0.76
CHL <sub>NN</sub>	0.14	0.78	0.82	0.83
CHL <sub>OC5</sub>	0.14	0.78	0.83	0.76
POC	0.26	0.52	0.59	0.46
PIC	0.12	0.04	0.07	0.06
CDM	0.16	0.61	0.68	0.58
ZEU	0.07	-0.48	-0.58	-0.40
ZHL	0.07	-0.47	-0.57	-0.38
<b>NPP Model</b>				
CbPM	1.00	0.54	0.46	0.44
VGPM <sub>EPPLEY</sub>	0.54	1.00	0.99	0.93
VGPM	0.46	0.99	1.00	0.91
CAFE	0.44	0.93	0.91	1.00
<b>GDAS</b>				
CF <sub>Total</sub>	-0.32	0.10	0.21	0.05
CF <sub>Low</sub>	-0.34	0.06	0.15	0.08
DSWF	0.60	0.59	0.49	0.64
PBLH	-0.51	-0.50	-0.44	-0.44
Precip.	-0.36	-0.20	-0.18	-0.15
SST	0.22	-0.20	-0.30	-0.19
U	-0.61	-0.19	-0.07	-0.15

Table S5. Correlation of 5-day FLEXPART-residence-time-weighted model reanalysis meteorological variables with all 5-day FLEXPART-residence-time-weighted explanatory variables during clean marine conditions shown as the Pearson's coefficient (r). Weak correlations ( $0.25 \leq |r| < 0.50$ ) are highlighted in red, moderate correlations ( $0.50 \leq |r| < 0.80$ ) are highlighted in yellow, and strong correlations ( $|r| \geq 0.80$ ) are highlighted in green.

	CF <sub>Total</sub>	CF <sub>Low</sub>	DSWF	PBLH	Precip	SST	U
Satellite Measurements							
CHL <sub>GSM</sub>	0.45	0.51	0.13	-0.15	-0.06	-0.69	0.22
CHL <sub>NN</sub>	0.41	0.46	0.17	-0.18	-0.04	-0.62	0.23
CHL <sub>OC5</sub>	0.41	0.40	0.14	-0.26	-0.02	-0.58	0.23
POC	0.50	0.52	-0.14	-0.13	-0.12	-0.73	0.29
PIC	0.37	0.52	-0.26	0.11	-0.23	-0.64	0.18
CDM	0.60	0.63	-0.13	-0.16	-0.06	-0.83	0.36
ZEU	-0.72	-0.69	0.36	0.09	-0.03	0.85	-0.50
ZHL	-0.72	-0.68	0.37	0.09	-0.04	0.84	-0.50
NPP Model							
CbPM	-0.32	-0.34	0.60	-0.51	-0.36	0.22	-0.61
VGPM <sub>EPPLEY</sub>	0.10	0.06	0.59	-0.50	-0.20	-0.20	-0.19
VGPM	0.21	0.15	0.49	-0.44	-0.18	-0.30	-0.07
CAFE	0.05	0.08	0.64	-0.44	-0.15	-0.19	-0.15
GDAS							
CF <sub>Total</sub>	1.00	0.90	-0.59	0.17	0.39	-0.71	0.70
CF <sub>Low</sub>	0.90	1.00	-0.57	0.30	0.26	-0.81	0.71
DSWF	-0.59	-0.57	1.00	-0.49	-0.32	0.49	-0.65
PBLH	0.17	0.30	-0.49	1.00	0.16	-0.13	0.53
Precip.	0.39	0.26	-0.32	0.16	1.00	-0.02	0.38
SST	-0.71	-0.81	0.49	-0.13	-0.02	1.00	-0.60
U	0.70	0.71	-0.65	0.53	0.38	-0.60	1.00

**Table S6. Correlation between ship measurements shown as the Pearson's coefficient (r). Weak correlations ( $0.25 \leq |r| < 0.50$ ) are highlighted in red, moderate correlations ( $0.50 \leq |r| < 0.80$ ) are highlighted in yellow, and strong correlations ( $|r| \geq 0.80$ ) are highlighted in green.**

	N	N <sub>&gt;100nm</sub>	N <sub>&lt;100nm</sub>	Org	SO <sub>4</sub>	NO <sub>3</sub>	DMS	N <sub>PMA</sub>	BC <sub>m</sub>	Rn
N	1.00	0.54	0.90	0.29	0.45	0.34	0.17	0.06	0.20	0.14
N <sub>&gt;100nm</sub>	0.54	1.00	0.40	0.65	0.83	0.61	0.45	0.36	0.64	0.16
N <sub>&lt;100nm</sub>	0.90	0.40	1.00	0.21	0.39	0.38	0.05	-0.03	0.08	0.18
Org	0.29	0.65	0.21	1.00	0.39	0.35	0.46	0.52	0.53	0.29
SO <sub>4</sub>	0.45	0.83	0.39	0.39	1.00	0.56	0.34	0.02	0.39	0.24
NO <sub>3</sub>	0.34	0.61	0.38	0.35	0.56	1.00	0.34	0.20	0.35	0.24
DMS	0.17	0.45	0.05	0.46	0.34	0.34	1.00	0.64	0.07	0.23
N <sub>PMA</sub>	0.06	0.36	-0.03	0.52	0.02	0.20	0.64	1.00	0.38	0.19
BC <sub>m</sub>	0.20	0.64	0.08	0.53	0.39	0.35	0.07	0.38	1.00	0.04
Rn	0.14	0.16	0.18	0.29	0.24	0.24	0.23	0.19	0.04	1.00

**Table S7. Pearson coefficient values for log of in-situ sea water particulate organic carbon ( $POC_{in-line}$ ) and chlorophyll-a ( $CHL_{in-line}$ ) measurements compared to log of satellite  $CHL_{GSM}$  and POC products at the R/V Atlantic location. Weak correlations ( $0.25 \leq |r| < 0.50$ ) are highlighted in red, moderate correlations ( $0.50 \leq |r| < 0.80$ ) are highlighted in yellow, and strong correlations ( $|r| \geq 0.80$ ) are highlighted in green.**

	1-Day satellite average		8-Day satellite average	
	$CHL_{in-line}$	$POC_{in-line}$	$CHL_{in-line}$	$POC_{in-line}$
$CHL_{GSM}$	0.87	0.78	0.62	0.62
$CHL_{NN}$	0.72	0.66	0.63	0.60
$CHL_{OC5}$	0.72	0.75	0.68	0.73
POC	0.69	0.70	0.46	0.47
PIC	0.41	0.62	0.33	0.48
CDM	0.64	0.62	0.57	0.58
ZEU	-0.82	-0.76	-0.62	-0.63
ZHL	-0.83	-0.76	-0.62	-0.62



**Table S8. Pearson's Coefficients (r) of satellite measurements, modeled NPP and reanalysis meteorological variables weighted by FLEXPART back trajectories from 0-5 days compared to organic aerosol mass (Figure 4a) measured on the R/V Atlantis. Bold explanatory variables are included in main text. Descriptions of explanatory variables are in Table S1. Values are excluded when  $p > 0.05$ . Weak correlations ( $0.25 \leq |r| < 0.50$ ) are highlighted in red, moderate correlations ( $0.50 \leq |r| < 0.80$ ) are highlighted in yellow, and strong correlations ( $|r| \geq 0.80$ ) are highlighted in green.**

	0-Hours	6-Hours	12-Hours	1-Day	2-Days	3-Days	5-Days
<b>Satellite Measurements</b>							
<b>CHL<sub>GSM</sub></b>	0.34	0.33	0.37	0.39	0.39	0.37	0.36
CHL <sub>NN</sub>	0.36	0.33	0.35	0.38	0.40	0.40	0.35
CHL <sub>OC5</sub>	0.38	0.31	0.37	0.38	0.39	0.36	0.28
<b>POC</b>	0.23	0.17	0.22	0.22	0.14	0.09	0.13
PIC	0.31	0.24	0.32	0.36	0.19	0.12	-
<b>CDM</b>	0.34	0.31	0.33	0.35	0.32	0.25	0.15
<b>ZEU</b>	-0.09	-0.09	-0.09	-0.10	-0.10	-	-
ZHL	-	-	-	-	-	-	-
<b>NPP Model</b>							
CbPM	0.29	0.38	0.39	0.39	0.41	0.45	0.50
VGPM <sub>EPPLEY</sub>	0.49	0.47	0.49	0.52	0.56	0.58	0.60
VGPM	0.46	0.44	0.46	0.49	0.52	0.53	0.53
<b>CAFE</b>	0.45	0.47	0.50	0.54	0.59	0.62	0.62
<b>GDAS</b>							
CF <sub>Total</sub>	0.10	0.11	0.11	-	-	-	-0.14
CF <sub>Low</sub>	0.13	0.12	0.11	-	-	-	-0.14
<b>DSWF</b>	0.11	0.15	0.26	0.45	0.52	0.55	0.58
PBLH	-0.19	-0.16	-0.21	-0.27	-0.34	-0.32	-0.38
<b>Precip.</b>	-	-	-	-	-	-	-
SST	-	-	-	-	-	-	0.10
<b>U</b>	-	-	-0.15	-0.26	-0.32	-0.30	-0.34

Table S9. Pearson's Coefficients ( $r$ ) of satellite measurements, modeled NPP and reanalysis meteorological variables weighted by FLEXPART back trajectories from 0-5 days compared to sulfate aerosol mass (Figure 4b) measured on the R/V Atlantis. Bold explanatory variables are included in main text. Descriptions of explanatory variables are in Table S1. Values are excluded when  $p > 0.05$ . Weak correlations ( $0.25 \leq |r| < 0.50$ ) are highlighted in red, moderate correlations ( $0.50 \leq |r| < 0.80$ ) are highlighted in yellow, and strong correlations ( $|r| \geq 0.80$ ) are highlighted in green.

	0-Hours	6-Hours	12-Hours	1-Day	2-Days	3-Days	5-Days
<b>Satellite Measurements</b>							
<b>CHL<sub>GSM</sub></b>	-	-	-	-	-	-0.09	-0.16
CHL <sub>NN</sub>	-	-	-	-	-	-	-0.12
CHL <sub>LOC5</sub>	-	-	-	-	-	-0.11	-0.20
<b>POC</b>	-	-	-	-0.15	-0.22	-0.26	-0.33
PIC	-	-	-	-	-	-0.13	-0.18
<b>CDM</b>	-	-	-	-	-0.15	-0.23	-0.35
<b>ZEU</b>	0.39	0.40	0.41	0.42	0.42	0.46	0.53
<b>ZHL</b>	0.40	0.42	0.42	0.43	0.44	0.48	0.54
<b>NPP Model</b>							
<b>CbPM</b>	0.22	0.26	0.28	0.34	0.39	0.40	0.40
VGPM <sub>EPPLEY</sub>	0.14	0.12	0.13	0.15	0.20	0.21	0.18
VGPM	-	-	-	-	0.12	0.12	-
<b>CAFE</b>	0.14	0.12	0.13	0.16	0.23	0.24	0.28
<b>GDAS</b>							
<b>CF<sub>Total</sub></b>	-0.13	-0.14	-0.19	-0.27	-0.43	-0.48	-0.51
<b>CF<sub>Low</sub></b>	-0.18	-0.19	-0.23	-0.30	-0.43	-0.48	-0.47
<b>DSWF</b>	0.25	0.25	0.41	0.66	0.69	0.71	0.69
<b>PBLH</b>	-0.28	-0.29	-0.30	-0.32	-0.37	-0.39	-0.35
<b>Precip.</b>	-	-	-	-	-	-0.17	-0.26
<b>SST</b>	0.26	0.29	0.30	0.34	0.42	0.46	0.49
<b>U</b>	-0.25	-0.28	-0.34	-0.41	-0.50	-0.53	-0.56

**Table S10. Pearson's Coefficients (r) of satellite measurements, modeled NPP and reanalysis meteorological variables weighted by FLEXPART back trajectories from 0-5 days compared to DMS (Figure 4c) measured on the R/V Atlantis. Bold explanatory variables are included in main text. Descriptions of explanatory variables are in Table S1. Values are excluded when  $p > 0.05$ . Weak correlations ( $0.25 \leq |r| < 0.50$ ) are highlighted in red, moderate correlations ( $0.50 \leq |r| < 0.80$ ) are highlighted in yellow, and strong correlations ( $|r| \geq 0.80$ ) are highlighted in green.**

	0-Hours	6-Hours	12-Hours	1-Day	2-Days	3-Days	5-Days
<b>Satellite Measurements</b>							
<b>CHL<sub>GSM</sub></b>	0.59	0.56	0.60	0.60	0.60	0.58	0.48
CHL <sub>NN</sub>	0.67	0.65	0.66	0.64	0.66	0.67	0.64
CHL <sub>OC5</sub>	0.58	0.60	0.65	0.65	0.65	0.63	0.59
<b>POC</b>	0.55	0.46	0.57	0.53	0.26	0.17	0.17
PIC	0.60	0.52	0.53	0.48	0.23	0.13	-
<b>CDM</b>	0.50	0.49	0.57	0.55	0.46	0.41	0.34
<b>ZEU</b>	-0.35	-0.35	-0.37	-0.34	-0.33	-0.32	-0.29
<b>ZHL</b>	-0.34	-0.34	-0.35	-0.32	-0.31	-0.30	-0.28
<b>NPP Model</b>							
CbPM	0.37	0.31	0.28	0.22	-	-	-
VGPM <sub>EPPLEY</sub>	0.38	0.51	0.51	0.50	0.57	0.60	0.60
VGPM	0.37	0.50	0.49	0.47	0.54	0.59	0.60
<b>CAFE</b>	0.64	0.66	0.66	0.64	0.66	0.68	0.71
<b>GDAS</b>							
CF <sub>Total</sub>	0.13	0.17	0.14	0.13	0.13	0.15	0.14
CF <sub>Low</sub>	0.19	0.26	0.24	0.28	0.26	0.24	0.17
<b>DSWF</b>	0.16	0.14	0.23	0.42	0.40	0.40	0.45
PBLH	-0.19	-0.18	-0.25	-0.31	-0.32	-0.29	-0.41
<b>Precip.</b>	-	0.37	-	-	-0.17	-0.16	-
SST	-0.57	-0.52	-0.52	-0.48	-0.36	-0.27	-0.15
<b>U</b>	-	-	-	-	-	0.15	-

**Table S11. Pearson's Coefficients (r) of satellite measurements, modeled NPP and reanalysis meteorological variables weighted by FLEXPART back trajectories from 0-5 days compared to  $N_{<100nm}$  (Figure 4d) measured on the R/V Atlantis. Bold explanatory variables are included in main text. Descriptions of explanatory variables are in Table S1. Values are excluded when  $p > 0.05$ . Weak correlations ( $0.25 \leq |r| < 0.50$ ) are highlighted in red, moderate correlations ( $0.50 \leq |r| < 0.80$ ) are highlighted in yellow, and strong correlations ( $|r| \geq 0.80$ ) are highlighted in green.**

	0-Hours	6-Hours	12-Hours	1-Day	2-Days	3-Days	5-Days
<b>Satellite Measurements</b>							
<b>CHL<sub>GSM</sub></b>	0.15	0.17	0.20	0.22	0.24	0.25	0.27
<b>CHL<sub>NN</sub></b>	0.28	0.29	0.29	0.25	0.26	0.25	0.22
<b>CHL<sub>OC5</sub></b>	0.28	0.25	0.26	0.24	0.26	0.27	0.27
<b>POC</b>	-	-	-	0.11	0.10	0.11	0.12
<b>PIC</b>	-	-	-	-	-	-0.10	-0.17
<b>CDM</b>	0.24	0.22	0.23	0.23	0.23	0.21	0.14
<b>ZEU</b>	-0.19	-0.17	-0.17	-0.15	-0.13	-0.11	-
<b>ZHL</b>	-0.17	-0.16	-0.16	-0.14	-0.13	-0.10	-
<b>NPP Model</b>							
<b>CbPM</b>	0.11	0.14	0.14	0.21	0.26	0.30	0.30
<b>VGPM<sub>EPPLEY</sub></b>	0.44	0.39	0.44	0.46	0.46	0.45	0.45
<b>VGPM</b>	0.43	0.39	0.44	0.45	0.45	0.44	0.42
<b>CAFE</b>	0.41	0.38	0.40	0.41	0.42	0.39	0.37
<b>GDAS</b>							
<b>CF<sub>Total</sub></b>	-	-	-	-	-	-	-
<b>CF<sub>Low</sub></b>	-	-	-0.11	-0.10	-	-	-0.11
<b>DSWF</b>	-	0.10	0.24	0.31	0.32	0.34	0.39
<b>PBLH</b>	-0.22	-0.21	-0.24	-0.29	-0.32	-0.34	-0.32
<b>Precip.</b>	-	-	-0.23	-0.24	-	-	-
<b>SST</b>	-	-	-	-	-	-	0.12
<b>U</b>	-0.11	-0.13	-0.20	-0.29	-0.24	-0.22	-0.19

**Table S12. Pearson's Coefficients (r) of satellite measurements, modeled NPP and reanalysis meteorological variables weighted by FLEXPART back trajectories from 0-5 days compared to  $N_{>100nm}$  (Figure 4e) measured on the R/V Atlantis. Bold explanatory variables are included in main text. Descriptions of explanatory variables are in Table S1. Values are excluded when  $p > 0.05$ . Weak correlations ( $0.25 \leq |r| < 0.50$ ) are highlighted in red, moderate correlations ( $0.50 \leq |r| < 0.80$ ) are highlighted in yellow, and strong correlations ( $|r| \geq 0.80$ ) are highlighted in green.**

	0-Hours	6-Hours	12-Hours	1-Day	2-Days	3-Days	5-Days
<b>Satellite Measurements</b>							
<b>CHL<sub>GSM</sub></b>	0.16	0.22	0.24	0.24	0.23	0.19	0.13
<b>CHL<sub>NN</sub></b>	0.23	0.22	0.22	0.21	0.22	0.20	0.15
<b>CHL<sub>OC5</sub></b>	0.27	0.26	0.28	0.25	0.22	0.18	0.11
<b>POC</b>	0.13	0.14	0.17	-	-	-	-
<b>PIC</b>	0.22	0.19	0.19	0.15	-	-	-
<b>CDM</b>	0.19	0.22	0.24	0.21	0.14	-	-
<b>ZEU</b>	0.18	0.17	0.18	0.22	0.22	0.25	0.31
<b>ZHL</b>	0.20	0.19	0.20	0.24	0.24	0.27	0.32
<b>NPP Model</b>							
<b>CbPM</b>	0.29	0.36	0.38	0.40	0.44	0.46	0.48
<b>VGPM<sub>EPPLEY</sub></b>	0.33	0.36	0.37	0.39	0.42	0.42	0.42
<b>VGPM</b>	0.29	0.31	0.32	0.33	0.36	0.35	0.34
<b>CAFE</b>	0.31	0.32	0.34	0.37	0.43	0.44	0.46
<b>GDAS</b>							
<b>CF<sub>Total</sub></b>	-	-	-	-0.11	-0.29	-0.29	-0.35
<b>CF<sub>Low</sub></b>	-	-0.10	-0.14	-0.19	-0.27	-0.26	-0.28
<b>DSWF</b>	0.27	0.30	0.46	0.67	0.71	0.71	0.70
<b>PBLH</b>	-0.24	-0.22	-0.25	-0.28	-0.31	-0.33	-0.34
<b>Precip.</b>	-	-	-	-	-	-	-0.17
<b>SST</b>	-	0.10	0.10	0.16	0.25	0.29	0.32
<b>U</b>	-	-	-0.15	-0.26	-0.34	-0.37	-0.42

**Table S13. Pearson's Coefficients (r) of satellite measurements, modeled NPP and reanalysis meteorological variables weighted by FLEXPART back trajectories from 0-5 days compared to  $N_{PMA}$  (Figure 4f) measured on the R/V Atlantis. Bold explanatory variables are included in main text. Descriptions of explanatory variables are in Table S1. Values are excluded when  $p > 0.05$ . Weak correlations ( $0.25 \leq |r| < 0.50$ ) are highlighted in red, moderate correlations ( $0.50 \leq |r| < 0.80$ ) are highlighted in yellow, and strong correlations ( $|r| \geq 0.80$ ) are highlighted in green.**

	0-Hours	6-Hours	12-Hours	1-Day	2-Days	3-Days	5-Days
<b>Satellite Measurements</b>							
<b>CHL<sub>GSM</sub></b>	0.20	0.25	0.29	0.40	0.46	0.46	0.48
<b>CHL<sub>NN</sub></b>	0.28	0.27	0.32	0.43	0.48	0.49	0.50
<b>CHL<sub>OC5</sub></b>	0.30	0.32	0.40	0.49	0.49	0.49	0.50
<b>POC</b>	0.18	0.20	0.24	0.30	0.30	0.26	0.35
<b>PIC</b>	0.40	0.34	0.42	0.37	0.26	0.19	-
<b>CDM</b>	0.23	0.25	0.31	0.43	0.42	0.40	0.40
<b>ZEU</b>	-0.25	-0.25	-0.26	-0.26	-0.27	-0.30	-0.35
<b>ZHL</b>	-0.24	-0.24	-0.25	-0.25	-0.26	-0.29	-0.35
<b>NPP Model</b>							
<b>CbPM</b>	0.28	0.45	0.40	0.26	0.23	0.20	0.19
<b>VGPM<sub>EPPLEY</sub></b>	0.31	0.33	0.32	0.37	0.37	0.40	0.47
<b>VGPM</b>	0.33	0.34	0.32	0.36	0.36	0.40	0.48
<b>CAFE</b>	0.37	0.36	0.35	0.39	0.42	0.46	0.47
<b>GDAS</b>							
<b>CF<sub>Total</sub></b>	-	-	-	0.15	0.14	0.19	0.19
<b>CF<sub>Low</sub></b>	0.18	-	0.16	0.19	0.19	0.26	0.24
<b>DSWF</b>	-	-	-	-	0.15	0.14	0.16
<b>PBLH</b>	0.25	0.23	0.19	-	-	-	-
<b>Precip.</b>	-	-	-	-	-	-	-
<b>SST</b>	-0.29	-0.30	-0.31	-0.34	-0.33	-0.32	-0.30
<b>U</b>	0.59	0.55	0.54	0.44	0.27	0.24	0.23

**Table S14. Pearson's Coefficients (r) of satellite measurements, modeled NPP and reanalysis meteorological variables weighted by FLEXPART back trajectories from 0-5 days compared to black carbon mass (Figure S3a) measured on the R/V Atlantis. Bold explanatory variables are included in main text. Descriptions of explanatory variables are in Table S1. Values are excluded when  $p > 0.05$ . Weak correlations ( $0.25 \leq |r| < 0.50$ ) are highlighted in red, moderate correlations ( $0.50 \leq |r| < 0.80$ ) are highlighted in yellow, and strong correlations ( $|r| \geq 0.80$ ) are highlighted in green.**

	0-Hours	6-Hours	12-Hours	1-Day	2-Days	3-Days	5-Days
<b>Satellite Measurements</b>							
<b>CHL<sub>GSM</sub></b>	-	-	-	-	-	-	-
CHL <sub>NN</sub>	-	-	-	-	-	-	-
CHL <sub>LOC5</sub>	-	-	-	-	-	-	-0.10
<b>POC</b>	-	-	-0.09	-0.14	-0.14	-0.16	-0.18
PIC	-	-	-	-	0.09	0.10	0.11
<b>CDM</b>	-	-	-	-	-	-	-0.13
<b>ZEU</b>	0.11	0.12	0.12	0.12	0.12	0.16	0.22
<b>ZHL</b>	0.13	0.14	0.14	0.13	0.13	0.16	0.22
<b>NPP Model</b>							
CbPM	-	0.17	0.20	0.26	0.34	0.34	0.39
VGPM <sub>EPPLEY</sub>	0.17	0.12	0.15	0.22	0.26	0.24	0.23
VGPM	0.14	0.10	0.13	0.19	0.21	0.17	0.14
<b>CAFE</b>	0.11	0.10	0.12	0.17	0.23	0.23	0.23
<b>GDAS</b>							
CF <sub>Total</sub>	-	-	-	-0.12	-0.21	-0.23	-0.31
CF <sub>Low</sub>	-	-	-	-0.11	-0.19	-0.21	-0.25
<b>DSWF</b>	-	0.09	0.17	0.39	0.44	0.46	0.47
PBLH	-	-	-	-	-0.12	-0.15	-0.20
<b>Precip.</b>	-	-	-	-	-	-0.11	-0.22
SST	0.18	0.19	0.19	0.22	0.25	0.25	0.22
<b>U</b>	-0.17	-0.15	-0.19	-0.28	-0.34	-0.40	-0.48

**Table S15. Pearson's Coefficients (r) of satellite measurements, modeled NPP and reanalysis meteorological variables weighted by FLEXPART back trajectories from 0-5 days compared to nitrate mass (Figure S3b) measured on the R/V Atlantis. Bold explanatory variables are included in main text. Descriptions of explanatory variables are in Table S1. Values are excluded when  $p > 0.05$ . Weak correlations ( $0.25 \leq |r| < 0.50$ ) are highlighted in red, moderate correlations ( $0.50 \leq |r| < 0.80$ ) are highlighted in yellow, and strong correlations ( $|r| \geq 0.80$ ) are highlighted in green.**

	0-Hours	6-Hours	12-Hours	1-Day	2-Days	3-Days	5-Days
<b>Satellite Measurements</b>							
<b>CHL<sub>GSM</sub></b>	0.20	0.21	0.20	0.21	0.26	0.25	0.19
<b>CHL<sub>NN</sub></b>	0.29	0.26	0.23	0.22	0.26	0.25	0.22
<b>CHL<sub>LOC5</sub></b>	0.29	0.26	0.28	0.29	0.30	0.28	0.23
<b>POC</b>	0.21	0.19	0.22	0.20	0.16	0.13	0.09
PIC	0.18	-	-	0.13	0.09	-	-
<b>CDM</b>	0.30	0.28	0.29	0.30	0.27	0.23	0.13
<b>ZEU</b>	-0.18	-0.18	-0.17	-0.17	-0.16	-0.13	-
<b>ZHL</b>	-0.17	-0.16	-0.16	-0.16	-0.15	-0.12	-
<b>NPP Model</b>							
<b>CbPM</b>	0.25	0.32	0.34	0.40	0.43	0.41	0.38
<b>VGPM<sub>EPPLEY</sub></b>	0.34	0.33	0.33	0.39	0.47	0.48	0.46
<b>VGPM</b>	0.33	0.31	0.32	0.38	0.44	0.45	0.41
<b>CAFE</b>	0.29	0.31	0.31	0.34	0.42	0.43	0.43
<b>GDAS</b>							
<b>CF<sub>Total</sub></b>	0.18	0.19	0.17	0.13	-	-	-
<b>CF<sub>Low</sub></b>	0.22	0.19	0.16	0.13	-	-	-
<b>DSWF</b>	-	-	0.14	0.27	0.34	0.38	0.43
<b>PBLH</b>	-0.30	-0.28	-0.30	-0.33	-0.36	-0.36	-0.41
<b>Precip.</b>	-	-	-	-0.22	-	-	-0.14
<b>SST</b>	-0.16	-0.14	-0.14	-0.10	-	-	-
<b>U</b>	-0.13	-0.12	-0.16	-0.21	-0.18	-0.16	-0.23



**Table S16. Pearson's Coefficients (r) of satellite measurements, modeled NPP and reanalysis meteorological variables weighted by FLEXPART back trajectories from 0-5 days compared to Radon (Figure S3c) measured on the R/V Atlantis. Bold explanatory variables are included in main text. Descriptions of explanatory variables are in Table S1. Values are excluded when  $p > 0.05$ . Weak correlations ( $0.25 \leq |r| < 0.50$ ) are highlighted in red, moderate correlations ( $0.50 \leq |r| < 0.80$ ) are highlighted in yellow, and strong correlations ( $|r| \geq 0.80$ ) are highlighted in green.**

	0-Hours	6-Hours	12-Hours	1-Day	2-Days	3-Days	5-Days
<b>Satellite Measurements</b>							
<b>CHL<sub>GSM</sub></b>	0.09	0.13	0.14	0.15	0.20	0.23	0.22
CHL <sub>NN</sub>	0.18	<b>0.26</b>	0.23	0.20	0.21	0.24	0.23
CHL <sub>OC5</sub>	0.15	0.19	0.19	0.19	0.23	<b>0.26</b>	0.22
<b>POC</b>	-	0.10	0.11	0.13	0.19	0.22	0.21
PIC	0.15	0.11	0.09	-	-	-	-
<b>CDM</b>	0.17	0.21	0.21	0.23	<b>0.25</b>	<b>0.26</b>	0.20
<b>ZEU</b>	-	-0.11	-0.10	-0.11	-0.13	-0.13	-0.08
ZHL	-	-0.09	-0.09	-0.10	-0.11	-0.11	-
<b>NPP Model</b>							
<b>CbPM</b>	<b>0.31</b>	<b>0.37</b>	<b>0.39</b>	<b>0.39</b>	<b>0.34</b>	<b>0.31</b>	<b>0.29</b>
VGPM <sub>EPPLEY</sub>	0.19	0.21	0.21	0.22	0.27	0.30	0.32
VGPM	0.18	0.20	0.20	0.21	0.25	0.27	0.28
<b>CAFE</b>	<b>0.27</b>	<b>0.32</b>	<b>0.31</b>	<b>0.29</b>	<b>0.30</b>	<b>0.33</b>	<b>0.35</b>
<b>GDAS</b>							
CF <sub>Total</sub>	0.17	0.16	0.13	-	-	-	-0.11
CF <sub>Low</sub>	0.09	0.17	0.16	0.13	-	-	-
<b>DSWF</b>	0.18	0.16	0.19	<b>0.25</b>	<b>0.26</b>	<b>0.27</b>	<b>0.31</b>
PBLH	-	-	-0.10	-0.18	-0.24	<b>-0.29</b>	<b>-0.38</b>
<b>Precip.</b>	-	-	-	-	-	-	-
SST	-0.10	-0.09	-0.10	-0.11	-0.09	-	-
U	-	-	-	-0.11	-0.10	-0.11	-0.17

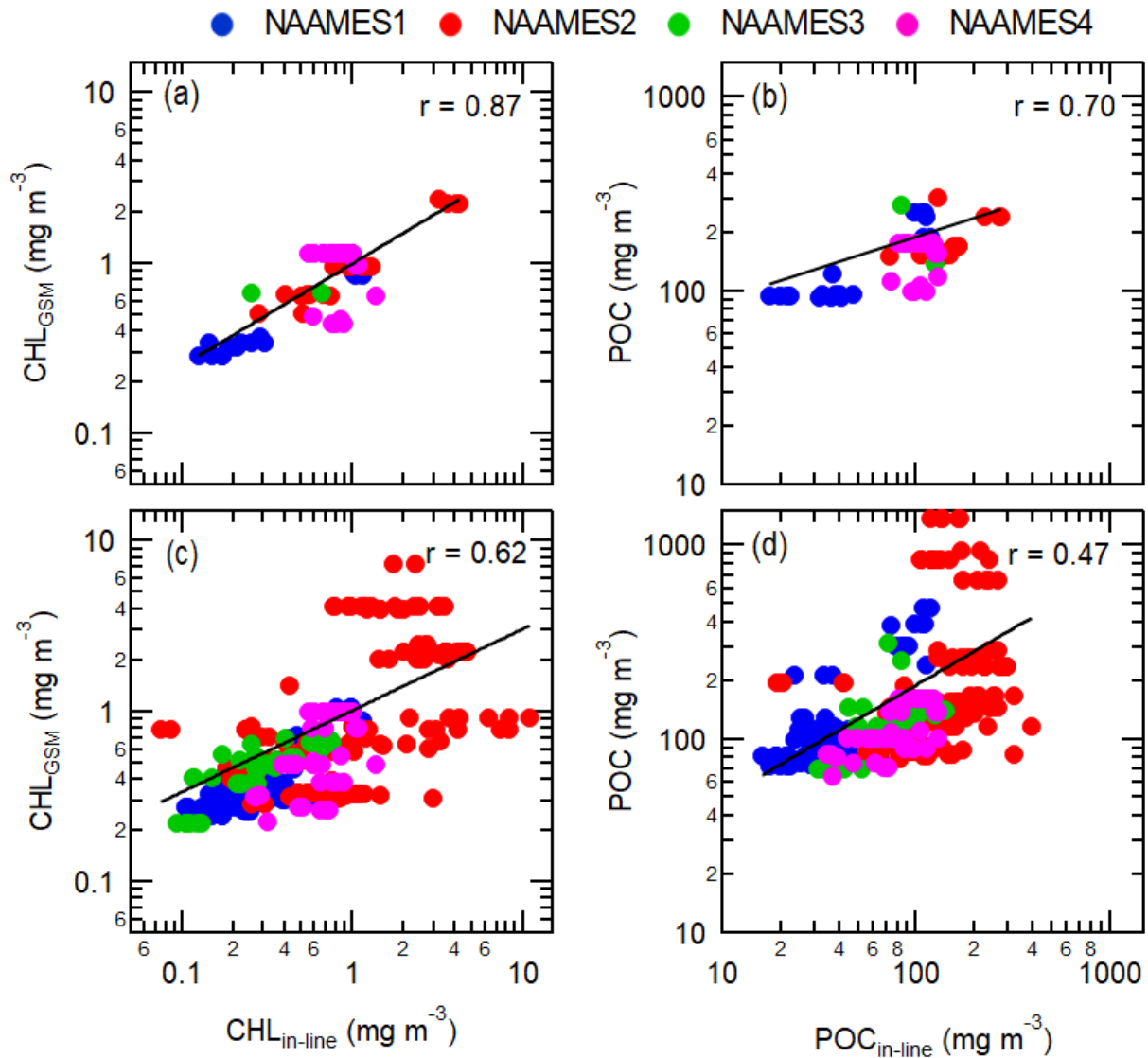
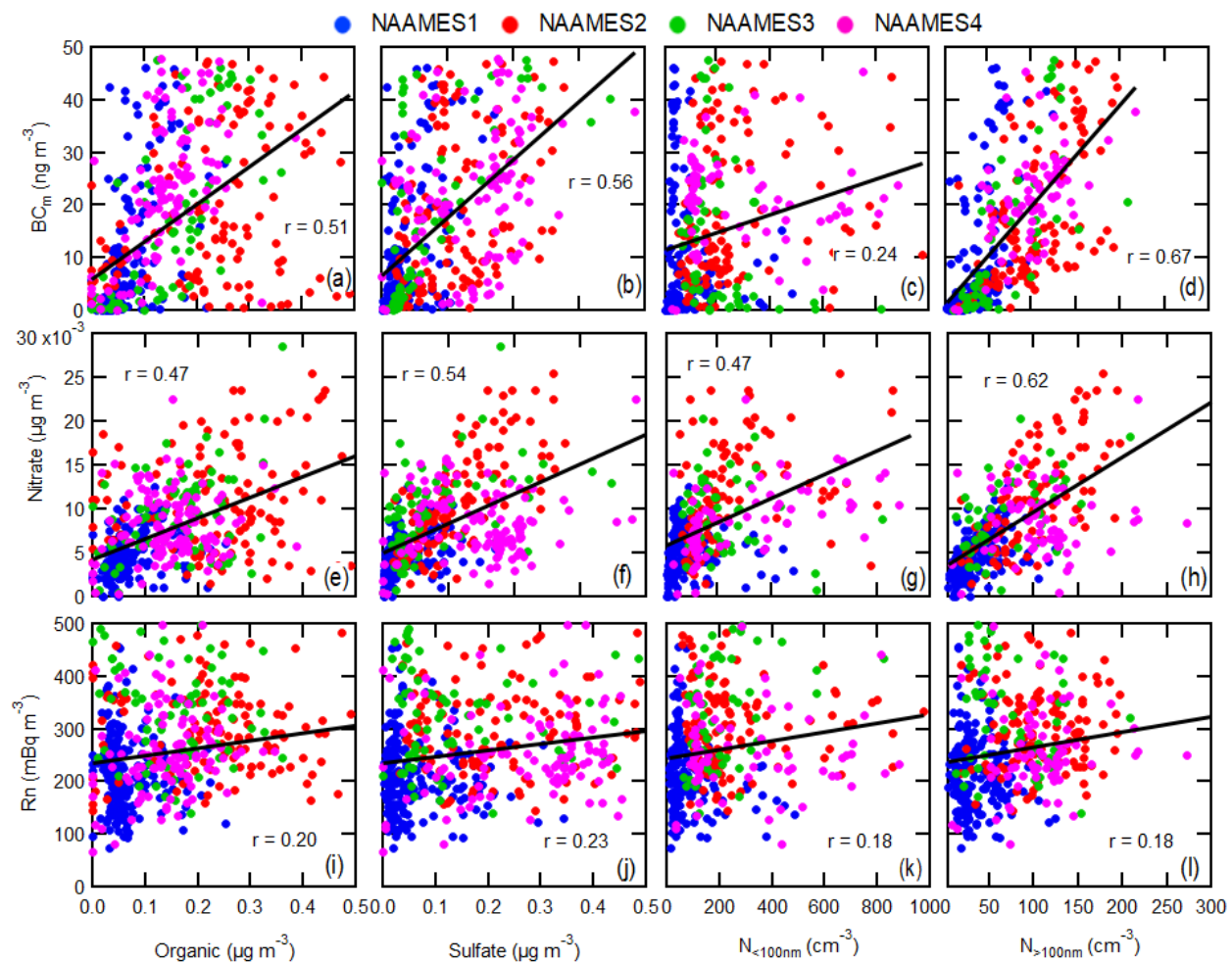
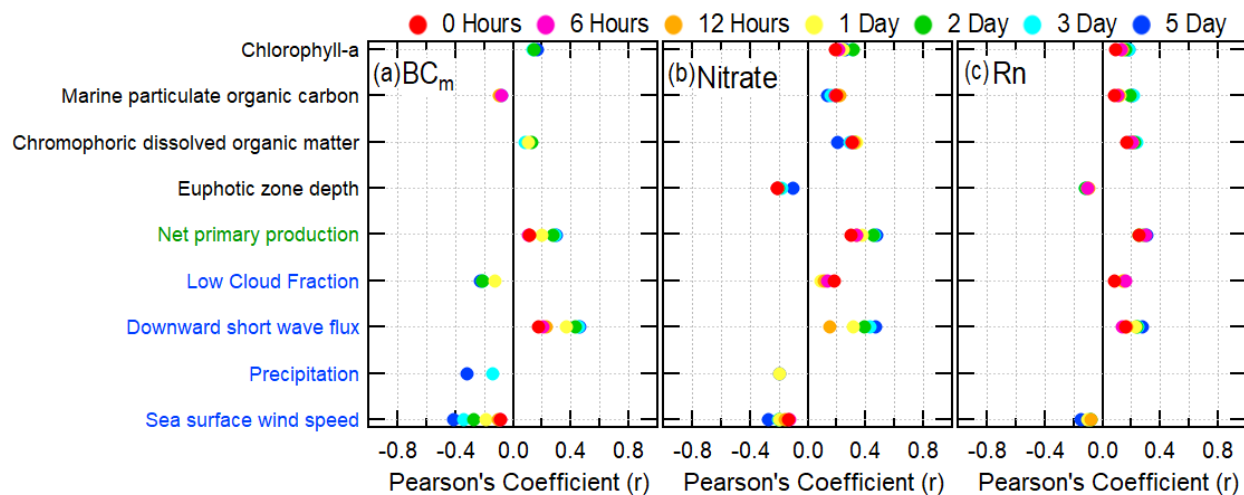


Figure S1. Hourly in-situ sea water particulate organic carbon (POC<sub>in-line</sub>) and chlorophyll-a (CHL<sub>in-line</sub>) compared to (a, b) day averaged and (c, d) 8-day averaged 100 km resolution OceanColour merged satellite CHL<sub>GSM</sub> and POC. Pearson's coefficients (r) are included for each plot along with best fit lines shown as black lines.



**Figure S2.** Measured black carbon mass, nitrate mass and radon concentration are compared to measured organic and sulfate aerosol mass and  $N_{<100nm}$  and  $N_{>100nm}$ . Pearson's coefficients ( $r$ ) are included for each plot along with best fit lines shown as black lines.



**Figure S3. Pearson's correlation coefficients between FLEXPART-residence-time-weighted explanatory variables and the following atmospheric measurement variables: (a) black carbon mass, (b) nitrate aerosol mass and (c) radon concentrations. The explanatory variables listed on the ordinate axis are colored to denote satellite-derived parameters (black text), CAFE ocean biology model parameters (green text), and atmospheric model reanalysis products (blue text). Pearson's correlation coefficients are only included for statistically significant cases where  $p < 0.05$ .**

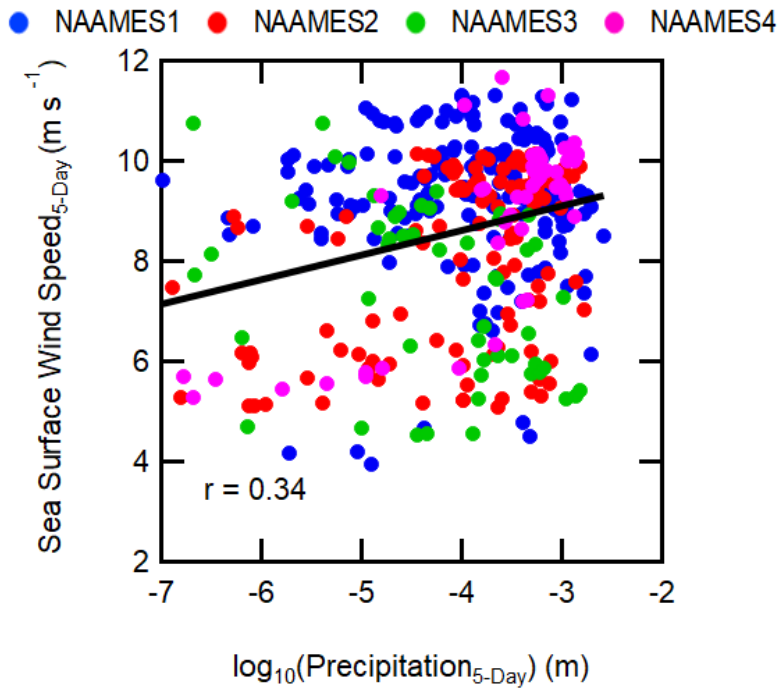


Figure S4. 5-day FLEXPART-residence-time-weighted wind speed is compared to the base 10 logarithm of the 5-day FLEXPART-residence-time-weighted 6-hour total precipitation. Pearson's coefficients ( $r$ ) are included for each plot along with best fit lines shown as black lines.

● 0 Hours ● 6 Hours ● 12 Hours ● 1 Day ● 2 Day ● 3 Day ● 5 Day

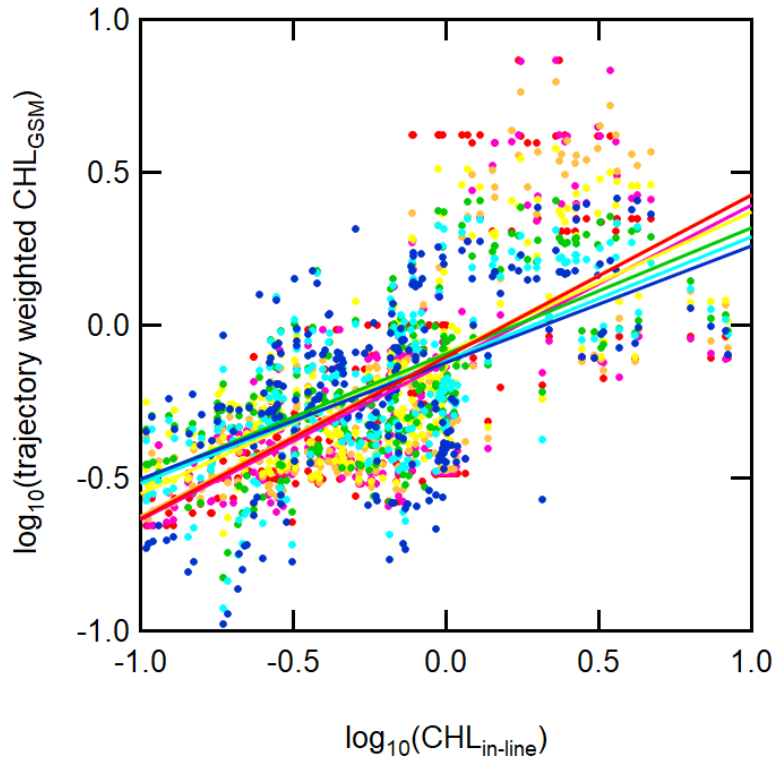


Figure S5. In-line chlorophyll-a measured from the R/V Atlantis are compared to 0-5 day FLEXPART-residence-time-weighted values obtained from GDAS satellite measurements. Lines show corresponding base 10 logarithm fits for each trajectory length.