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Environmental Chemistry

Supplementary Material

Occurrence and emission of non-methane hydrocarbons in the East China Sea: roles of phytoplankton assemblages

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1. Parameter calculation of sea-to-air flux

The Schmidt number Sc (dimensionless) was taken as Sc = (μ/D), where μ is the kinematic viscosity of seawater and D is the diffusion coefficient of the considered species in water, depending on temperature (Wilke and Chang, 1955). Kinematic viscosity μ of seawater was obtained by multiplying the viscosity of distilled water by a factor determined from a third-order polynomial (Wanninkhof, 1992)：

$$\mu = 1.052 + 1.300 \times 10^{-3}t + 5.000 \times 10^{-6}t^2 - 5.000 \times 10^{-7}t^3$$

where t is water temperature (°C).

D for gas was calculated as described by Wilke and Chang (1955):

$$D = 7.4 \times 10^{-8} (2.6 \times M_b)^{0.5} T/(n_B V_a^{0.6})$$

where M_b is the molar weight of water (g mol^{-1}), T the temperature of seawater (K), n_B is the dynamic viscosity of water, and V_a is the molar volume of considered species.

Table S1 Variations of cell number of dominant phytoplankton (cells mL^{-1}).

Station DH	3000-2	3000-5	3-1	3-3	4-1	4-2	4-4	5-1	5-5	6-1	6-2	6-5	7-1	7-4	8-1	8-3	9-1	9-2	9-4	9-6	11-1	11-5
Diatom																						
Bacteriastrum			1.8		5.0	0.1	0.2	0.5	0.3	1.1				0.2	0.4	2.3		0.1			0.5	0.4
Cerataulina							0.7			2.5			10.9		13.3	1.0	0.4	6.5	0.2			0.9
Chaetoceros	0.2		5.3		6.2	0.4	4.7	2.0	2.8	14.8	1.8	2.0	50.9	5.4	57.0	7.2	3.5	51.4	8.9	0.2	182.0	43.8
Corethron		0.6		0.5		0.0		0.4	0.3	0.4			0.8	0.6	0.1	0.2		0.1	0.6			0.1
Coscinodiscus	0.1	0.1			2.0			0.1						0.3	1.1			0.7			0.4	
Detonula			1.8			0.38																
Ditylum		0.05			1.0		0.2	0.2	0.1	2.5			4.7	0.2	4.0	0.7	1.2	3.3	4.8		0.2	8.8
Eucampia					0.5					2.16			7.0	1.2	19.0	6.8	1.3	8.5	1.7		0.3	
Guinardia									0.3					0.9		2.3	0.1		0.8			2.3
Helicotheca																	0.3		2.9			
Hemiaulus							0.5		1.3		0.5	0.1				2.3	0.1		0.2			
Lauderia		0.4		0.1	0.3	0.0		0.2	0.3	1.1			2.3			2.3	0.2					
Leptocylindrus			8.8		4.0	0.3		0.2		2.5			32.8	0.6			0.2		2.7			
Nitzschia	0.1	1.2	45.1		18.0	1.5	2.6	1.5	1.5	13.0	4.0	0.5	12.5	0.7	28.5	27.5	5.8	3.3	4.2		4.1	116.6
Odontella								0.1							0.8	0.6	0.1	0.9	0.2		0.1	0.2
Pinnularia					1.0									0.3								

Rhizosolenia			0.5			0.1	0.5		0.2		1.5	0.4		2.5		1.6		0.3	0.2		0.1	0.4
Schroederella		2.4	2.6		0.2	0.3		0.3	2.1	3.2	0.1	1.0	14.8	19.5	5.7	4.6	0.9	12.4	15.2		2.1	4.4
Skeletonema					8.0			0.7		4.0			22.6						1.9		1.7	1.3
Thalassionema	0.1	10.1	10.6	0.1	13.3	0.7	3.0	0.8	1.8	8.6	5.5	2.8	4.9	0.6	11.4	6.3	1.7	6.6	1.5	0.5	1.1	1.5
Thalassiosira	1.3	4.6	3.0	0.2	19.1	0.3	0.5	1.8	0.3	1.8		0.1	8.7	1.2	7.1	11.4	3.5	7.8	23.0	0.1	1.5	11.0
Dinoflagellate																						
Alexandrium			6.2			0.1									0.4			0.3			0.5	
Ceratium	0.1				1.0			0.1	0.1						0.2			0.7			0.7	4.4
Heterocapsa					1.0																	
Gymnodinium	0.16		0.88		2	0.1								0.3		1.1		2.0			0.1	
Prorocentum	0.2		2.6		8.0	0.4	0.4		0.1	0.7	0.3		0.1	1.1	1.1		0.1	1.3		0.1	0.3	2.2
Protoperidinium			0.5		1.0	0.1				0.4			0.1			1.1	0.1	0.7			0.1	0.1
Chrysophyceae																						
Dictyocha	0.1	0.1	1.8	0.3	1.0	0.1	0.5			0.4			0.1	0.3	1.1	0.1	0.1				0.1	0.1

Table S2. Correlation coefficients between alkanes or alkenes in the ECS during summer.

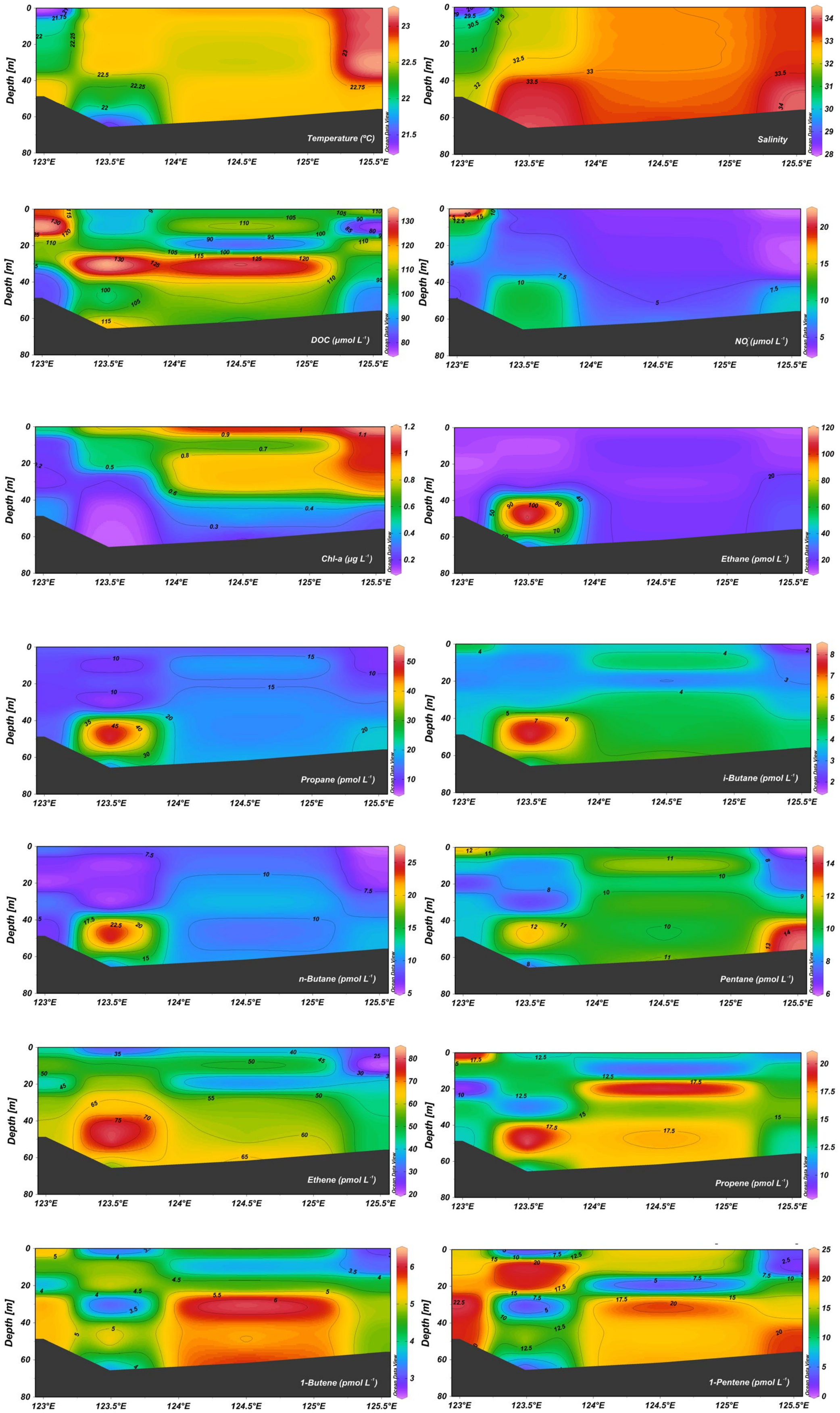
Variables	Ethane	Propane	i-Butane	n-Butane	Pentane
Ethane	1				
Propane	0.367*	1			

i-Butane	0.576**	0.236	1		
n-Butane	0.578**	0.089	0.793**	1	
Pentane	0.583**	0.067	0.620**	0.757**	1

Variables	Ethene	Propene	1-Butene	1-Pentene	Isoprene
Ethene	1				
Propene	0.608**	1			
1-Butene	0.350*	0.749**	1		
1-Pentene	0.282	0.633**	0.418*	1	
Isoprene	0.343*	0.750**	0.294	0.620**	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed); n = 36.


Temperature (°C)
Salinity
DOC (μmol L⁻¹)
NO3⁻ (μmol L⁻¹)
Chl-a (μg L⁻¹)
Ethane (pmol L⁻¹)
Propane (pmol L⁻¹)
i-Butane (pmol L⁻¹)
n-Butane (pmol L⁻¹)
Pentane (pmol L⁻¹)
Ethene (pmol L⁻¹)
Propene (pmol L⁻¹)
1-Butene (pmol L⁻¹)
1-Pentene (pmol L⁻¹)
Depth [m]
123°E
123.5°E
124°E
124.5°E
125°E
125.5°E
Ocean Data View

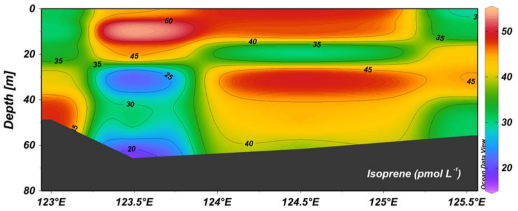


Figure S1. Vertical profiles of temperature, salinity, Chl-a, and C_2~C_5 NMHCs in transect DH3000 of the ECS in autumn.

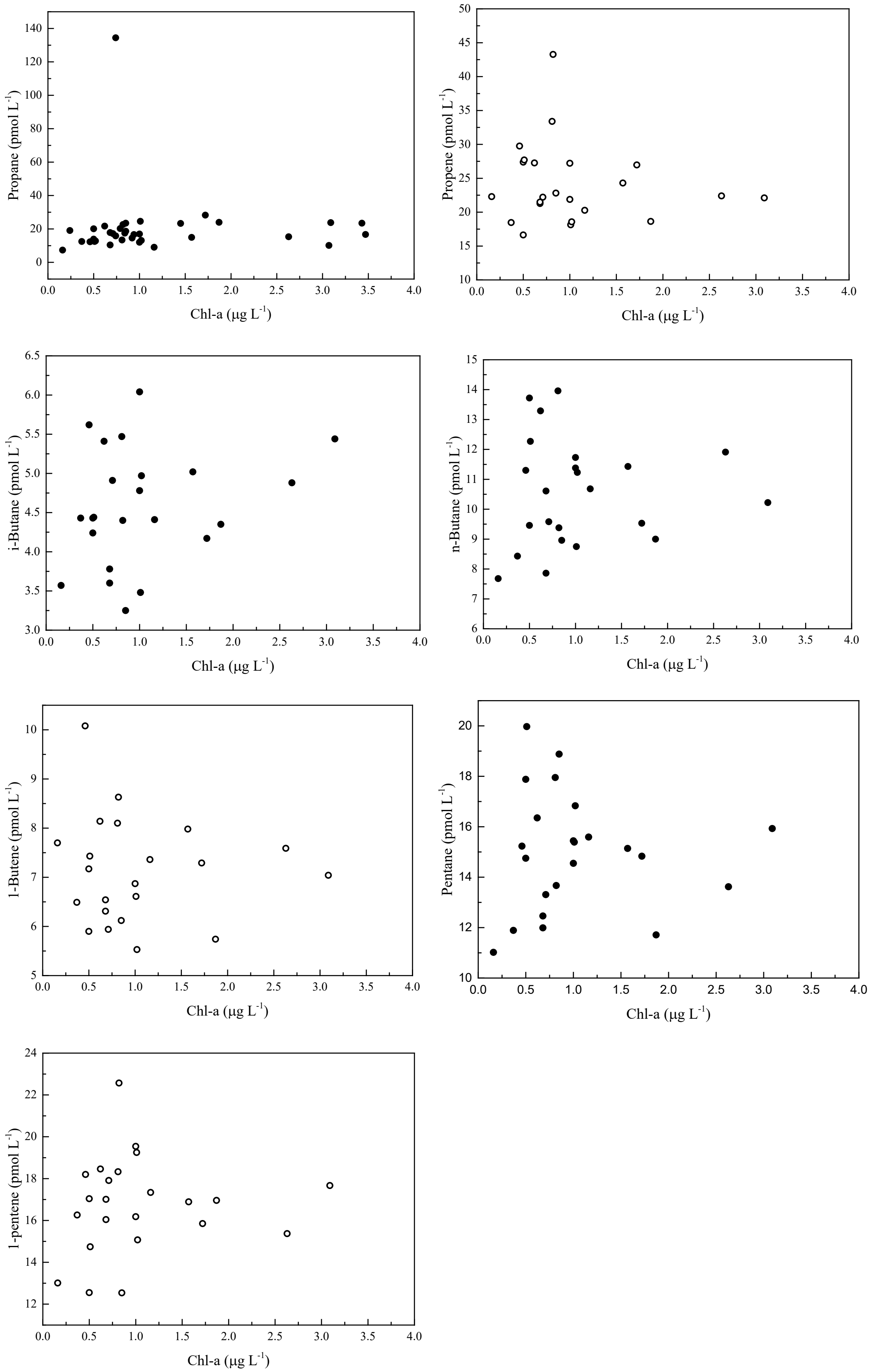

Propane (pmol L-1)
Chl-a (μg L-1)
Propene (pmol L-1)
Chl-a (μg L-1)
i-Butane (pmol L-1)
Chl-a (μg L-1)
n-Butane (pmol L-1)
Chl-a (μg L-1)
1-Butene (pmol L-1)
Chl-a (μg L-1)
Pentane (pmol L-1)
Chl-a (μg L-1)
1-pentene (pmol L-1)
Chl-a (μg L-1)

Figure S2. Correlation between Chl-a and propane, propene, i-butane, n-butane, 1-butene, pentane, and1-pentene concentrations in the surface seawater of ECS.

References

Wanninkhof, R., 1992. Relationship between wind speed and gas exchange over the ocean. Journal of Geophysical Research: Oceans *97*, 7373-7382.

Wilke, C.R., and Chang, P., 1955. Correlation of diffusion coefficients in dilute solutions. Aiche J *1*, 264-270.