Role of phosphorus in the seasonal deoxygenation of the East China Sea shelf

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SUPPORTING MATERIAL

TABLES

Table S1. Vertically integrated primary production, water column respiration, POM flux and SOC in zones 2, 4 and 5 along the CE-JI transect in July and August (15-31). The corresponding spatially resolved transects are available in Figure 6 and Figure S2.

		July 15-31			August 15-31		
		Zone 2	Zone 4	Zone 5	Zone 2	Zone 4	Zone 5
P. Production	Average	166.9	120.6	57.8	152.3	99.5	57.5
(mmol O_2 m^{-2} d^{-1})	ΔPP	-19.7	-45.1	+15.7	-25.0	-3.1	+17.0
W. Respiration	Average	31.9	54.8	39.3	42.0	54.0	44.9
(mmol O_2 m^{-2} d^{-1})	ΔWR	-0.2	-0.2	+5.2	-0.2	+4.9	+9.9
POM flux	Average	8.8	8.6	3.0	8.8	5.7	3.2
(mmol N m^{-2} d^{-1})	ΔFPOM	-1.4	-4.6	+0.6	-2.4	-1.9	+1.1
SOC	Average	69.0	63.7	18.9	69.4	44.2	23.9
(mmol O_2 m^{-2} d^{-1})	ΔSOC	-10.1	-32.9	+3.1	-18.2	-13.5	+7.9

Table S2. Area integrated annual change in O2 sources and sinks.

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Total
PP (10^8 mol O_2)	2.6	-545.9	-103.6	-197.1	683.5	126.4	-34.0
WR (10^8 mol O_2)	3.0	-20.8	-8.9	188.2	329.4	67.2	558.0
SOC (10^8 mol O_2)	-18.2	-270.7	-61.2	-552.6	202.3	-21.2	-721.6
denitrification (10^9 mol N)	-1.9	-28.2	-6.4	-57.7	21.1	-2.2	-75.3
Denitrification (%)	-1.9	-12.6	-5.2	-14.0	17.7	-0.9	-6.2

Table S3. Summary of time-integrated hypoxic area ($\times 10^3$ km^2 yr) in zone 2 for the baseline and nutrient reduction experiments.

		Time-integrated hypoxic area in zone 2 ($\times 10^3$ km^2 yr)					
		Baseline	80%	60%	40%	20%	0%
N+P	2008	197	135	60	8	0	0
	2009	301	169	77	5	0	0
	2010	714	474	227	69	0	0
	2011	43	12	1	0	0	0
	2012	242	111	22	0	0	0
	2013	26	6	1	0	0	0
	$\Delta\overline{H}$ (%)	**100**	**60**	**25**	**5**	**0**	**0**
N-only	2008	197	160	122	65	1	0
	2009	301	214	148	74	0	0
	2010	714	576	399	136	0	0
	2011	43	16	4	0	0	0
	2012	242	150	68	6	0	0
	2013	26	10	3	1	0	0
	$\Delta\overline{H}$ (%)	**100**	**74**	**49**	**19**	**0**	**0**
P-only	2008	197	168	136	88	32	3
	2009	301	234	172	114	49	3
	2010	714	585	454	307	188	87
	2011	43	31	20	10	4	0
	2012	242	182	120	62	16	1
	2013	26	16	9	5	2	1
	$\Delta\overline{H}$ (%)	**100**	**80**	**60**	**38**	**19**	**6**

Table S4. Summary of time-integrated hypoxic area ($\times 10^3$ km^2 yr) in zone 3 for the baseline and nutrient reduction experiments.

		Time-integrated hypoxic area in zone 3 ($\times 10^3$ km^2 yr)					
		Baseline	80%	60%	40%	20%	0%
N+P	2008	323	228	127	50	1	0
	2009	351	236	154	71	1	0
	2010	461	332	174	48	0	0
	2011	25	12	4	0	0	0
	2012	116	68	32	6	0	0
	2013	34	20	9	1	0	0
	$\Delta\overline{H}$ (%)	**100**	**68**	**38**	**14**	**0**	**0**
N-only	2008	323	256	160	64	0	0
	2009	351	270	185	87	0	0
	2010	461	363	228	67	0	0
	2011	25	13	4	0	0	0
	2012	116	75	39	10	0	0
	2013	34	23	13	4	0	0
	$\Delta\overline{H}$ (%)	**100**	**76**	**48**	**18**	**0**	**0**
P-only	2008	323	293	250	198	143	82
	2009	351	300	248	203	157	111
	2010	461	425	383	331	268	200
	2011	25	22	18	14	10	7
	2012	116	100	85	69	54	36
	2013	34	29	24	19	13	6
	$\Delta\overline{H}$ (%)	**100**	**89**	**77**	**64**	**49**	**34**

Table S5. Area-specific annual change in O_2 sources and sinks (mmol O_2 m^{-2}).

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
PP	+10	-3010	-810	-330	+1310	+170
WR	+10	-110	-70	+310	+630	+90
SOC	-80	-1490	-480	-920	+390	-30

FIGURES

Figure S1. Comparison of simulated surface NO_3 (colored maps) with the 2010-2012 observations of Gao et al. (2015) and the 2013 observations of Ge et al. (2020) (2013) for the dates indicated in each panel (colored dots). Simulated NO_3 corresponds to the mid cruise date.

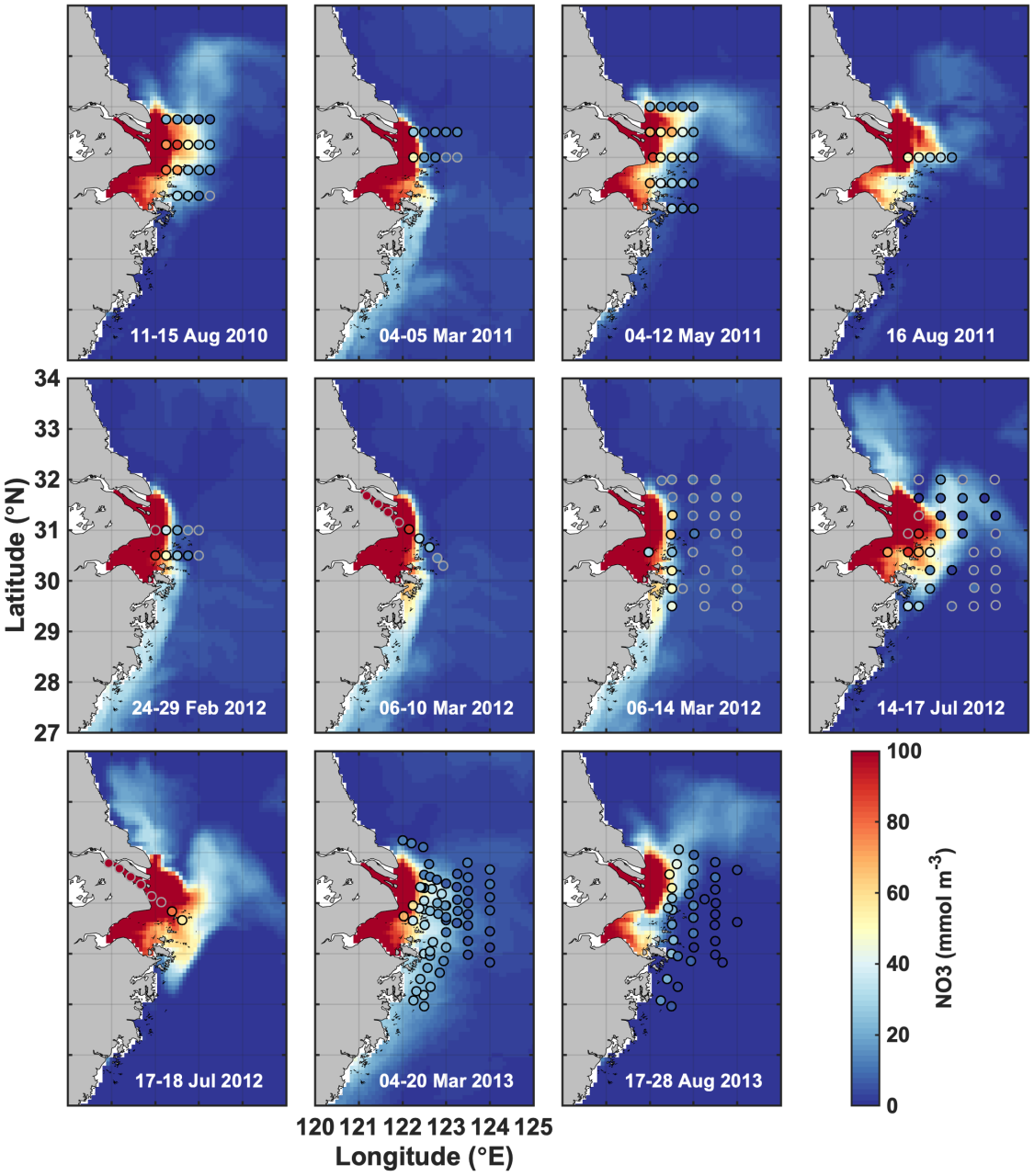
Figure S2. Mean change in POM flux and SOC due to P limitation (baseline – NoPlim) along the CE-JI transect line (see Figure 1) for July 15-31 (left) and August 15-31 (right).

Figure S3. Duration of P limitation in the surface waters of zones 1-6 (upper left) and change in primary production (upper right) water column respiration (lower left) and sediment O_2 consumption (lower right). Data are averages for 2008-2013.

Figure S4. Effect of nutrient reduction on the size of the hypoxic area (time integrated) for zones 1-6 combined (left), zone 2 (middle) and zone 3 (right). The results presented are an average for 2011-2013.

Figure S5. Change in the relative importance of water column versus total respiration (2008-2013 monthly mean) due to P limitation (baseline - NoPlim).

Figure S6. Spatial distribution of stratification in summer (July-August, 2008-2013 averaged) in the ECS. The Potential Energy Anomaly (a proxy for stratification) is divided by water column depth to enable the comparison of areas with various depths (see Große et al. (2020) for details).



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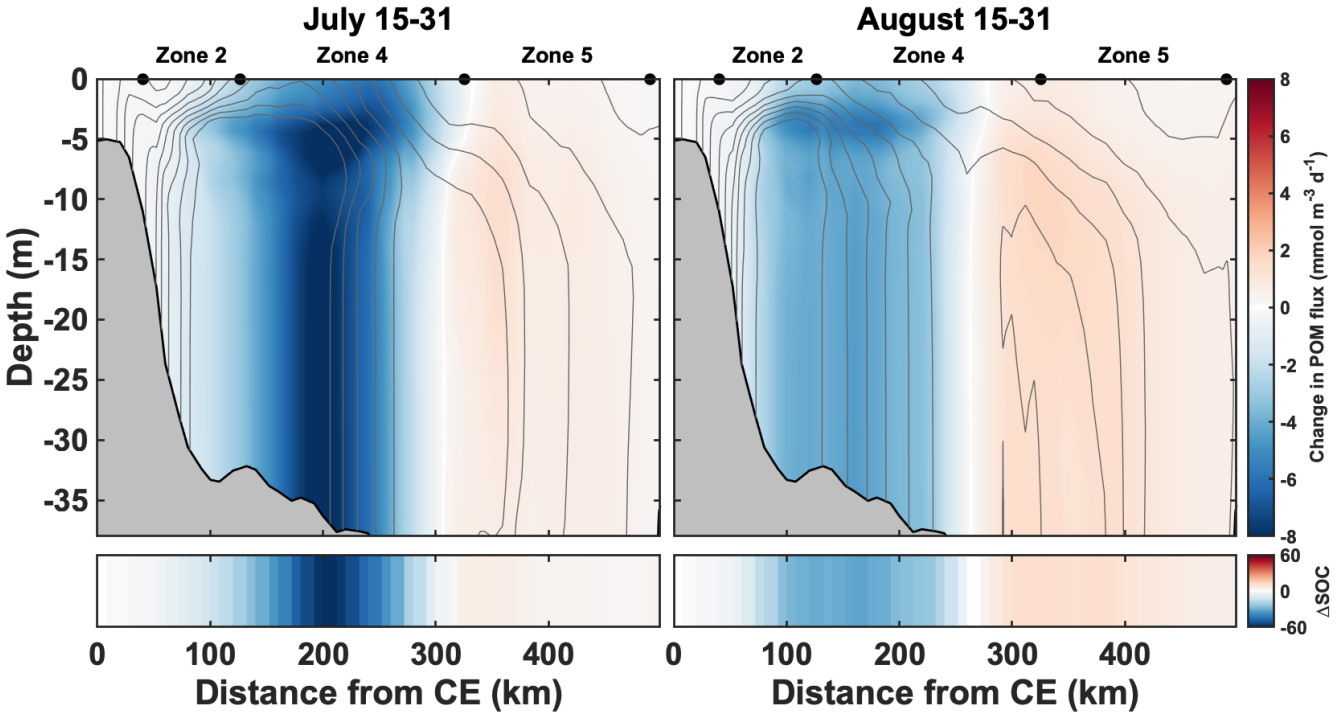

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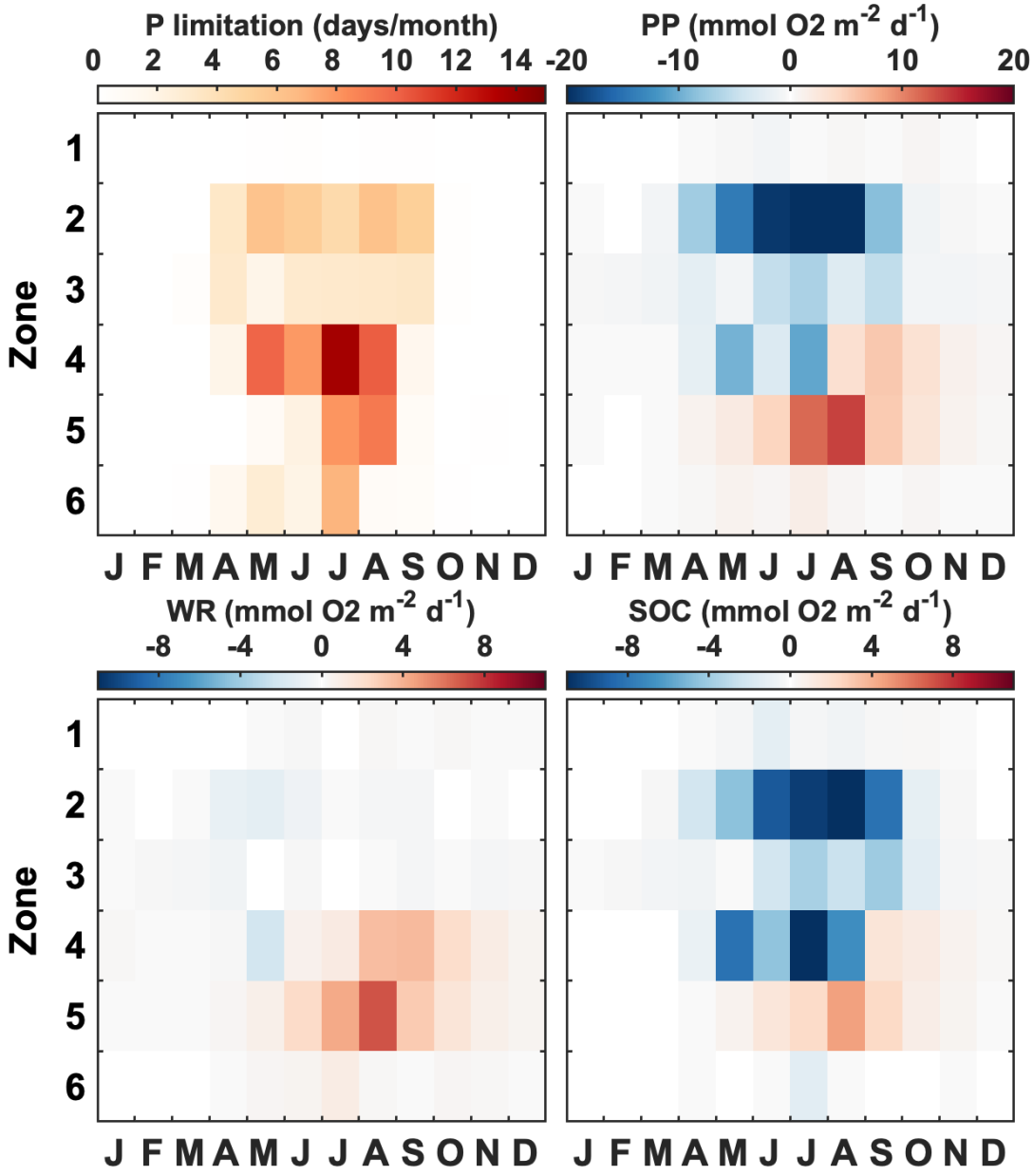

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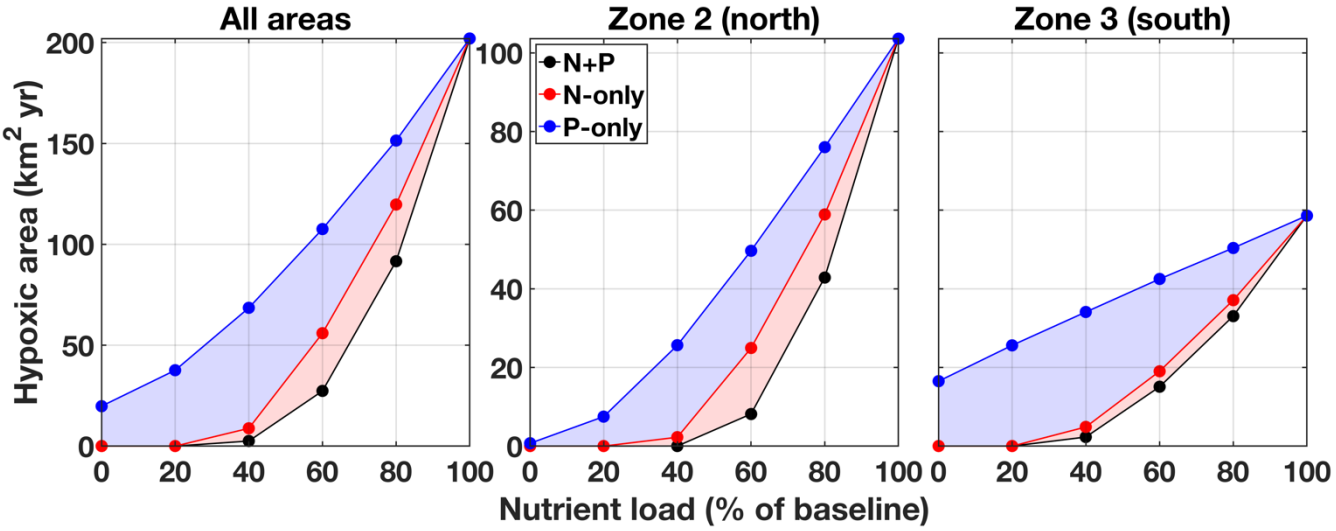

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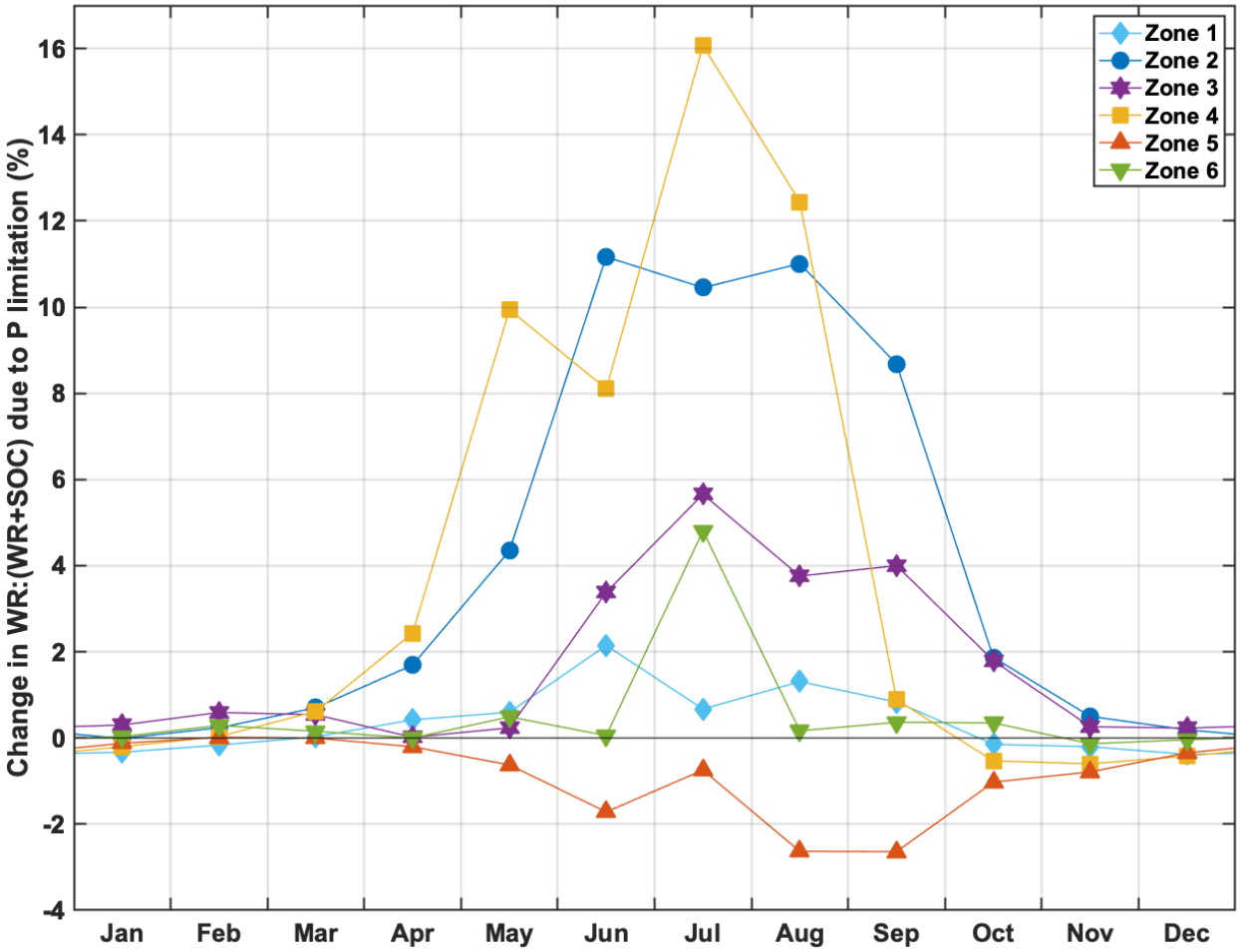

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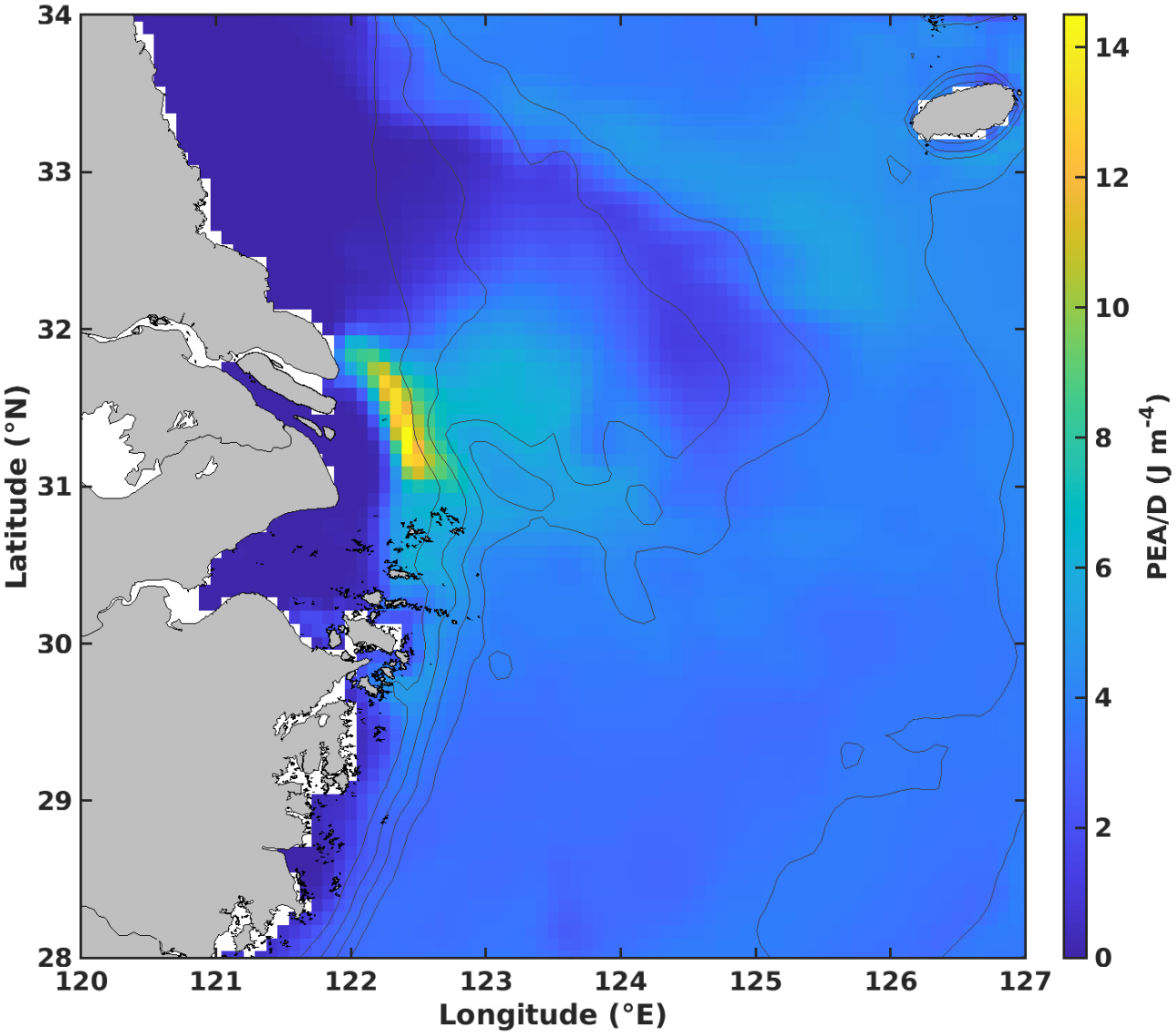

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