

Figure S1. Model simulated annual and seasonal mean near surface sea salt concentrations (unit:  $\mu\text{g m}^{-3}$ ) (a~e) and cloud fractions (unit: %) (f~j).

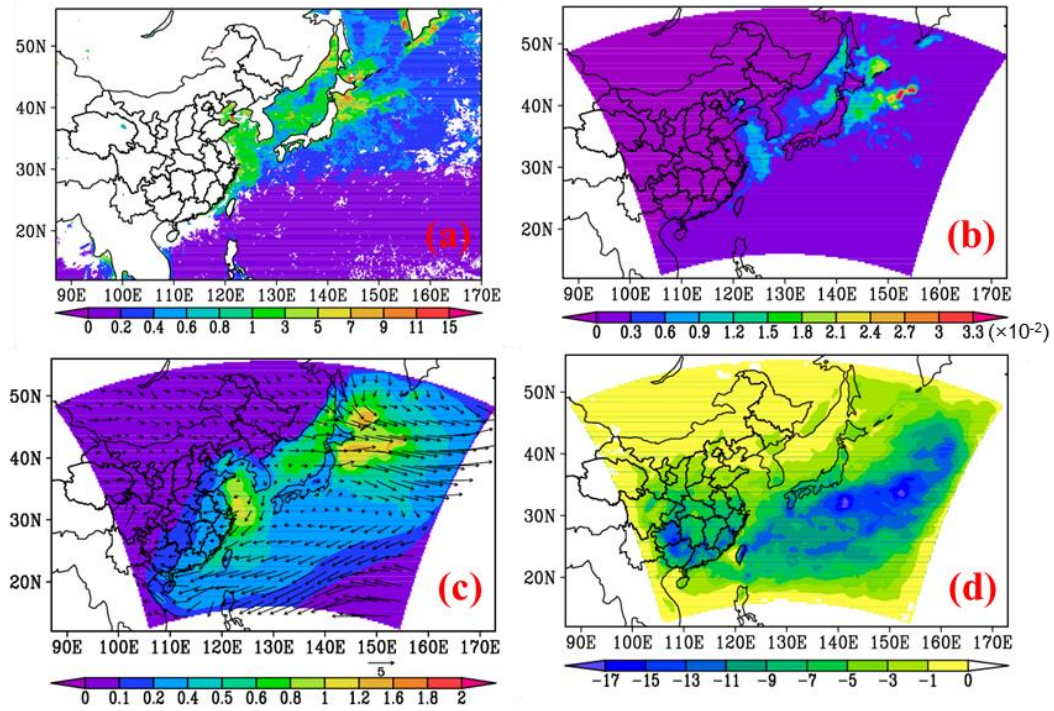


Figure S2. VIIRS retrieved April mean Chl-a concentration (unit:  $\text{mg m}^{-3}$ ) (a), model simulated April mean MPOA emission flux (unit:  $\mu\text{g m}^{-2} \text{s}^{-1}$ ) (b), MOA concentration (unit:  $\mu\text{g m}^{-3}$ ) overlaid with wind vector (unit:  $\text{m s}^{-1}$ ) (c), and IREMOA (unit:  $\text{W m}^{-2}$ ) (d).

Table S1. Performance statistics for hourly gas precursor concentrations (unit: pptv) at EANET sites for the year 2014. Mean observation (Obs), mean simulation (Sim), correlation coefficient (R), and normalized mean bias (NMB in %) are listed.

Sites	SO <sub>2</sub>				NO <sub>x</sub> /NO <sub>2</sub> <sup>a</sup>				O <sub>3</sub>						
	Samples	Obs	Sim	R	NMB	Samples	Obs	Sim	R	NMB	Samples	Obs	Sim	R	NMB
Rishiri	8493	0.22	0.21	0.62	-5	7606	0.70	0.96	0.27	38	8583	38.6	45.4	0.57	18
Tappi	8570	0.48	0.40	0.35	-15	8517	1.47	1.95	0.40	33	8569	39.3	48.0	0.52	22
Sado	8233	0.38	0.52	0.41	39	8200	0.75	2.91	0.39	286	8400	46.5	49.6	0.55	7
Okii	7837	0.54	0.45	0.54	-17	7919	1.32	1.66	0.39	26	8507	46.8	50.8	0.52	9
Hedo	7546	0.26	0.26	0.55	-2	7910	0.74	1.10	0.47	48	8260	39.6	41.5	0.84	5
Ogasawara	7635	0.10	0.11	0.09	5	7226	0.37	0.37	0.21	1	8506	33.4	35.8	0.84	7
Jeju	8282	0.54	0.76	0.41	42	8300	3.29	3.53	0.29	7	8419	44.7	52.5	0.56	17
Kanghwa	8517	2.77	4.09	0.25	48	8539	5.90	12.97	0.45	120	8526	50.3	29.4	0.55	-42
Imsil	8337	2.32	1.50	0.16	-35	8200	3.99	1.81	0.18	-55	8385	31.4	39.9	0.54	27
Average	73450	0.86	0.95	0.51	10	72417	2.12	2.87	0.48	36	76155	41.2	43.6	0.54	6

a: NO<sub>x</sub> in Japan and NO<sub>2</sub> in Korea.

Table S2. Comparison of observational based estimated marine isoprene emission fluxes over different oceanic areas from previously published studies and model simulations (Units:  $\text{nmol m}^{-2} \text{day}^{-1}$ ).

Locations <sup>a</sup>	Simulations from this study		Observations from previous studies		References
	periods	mean (max/min)	periods	mean (max/min)	
Western North Pacific (30.75~35.78°N, 146.42°E)	May 2014	85 (100/40)	18–26 May 2001	140 (300/32)	Matsunaga et al. (2002)
Northwest Pacific (34~43°N, 138~150°E)	Jan 2014 May 2014 Aug 2014	26.2 88.6 63.1	Jan 2008–2012 May 2008–2012 Aug 2008–2012	21.4 143.8 55.6	Ooki et al. (2015)
East China Sea (25.69~30°N, 121~126°E)	Oct–Nov 2013 May–Jun 2014	48 (120/0) 35 (180/0)	Oct–Nov 2013 May–Jun 2014	48.34 (169.15/4.19) 36.12 (137.75/2.46)	Li et al. (2018)
South Yellow Sea and East China Sea (30~38°N, 121.6~127°E)	Jul 2014	130 (240/0)	14 July – 1 Aug 2013	161.5 (537.2/22.17)	Li et al. (2017)
Southern Ocean <sup>b</sup>	Jul–Aug 2014	(400/0)	Dec 2010–Jan 2011	(313/181)	Kameyama et al. (2014)
Arctic Ocean <sup>b</sup>	Jul 2014	(400/0)	Jun–Jul 2010	(148/8.8)	Tran et al. (2013)

a: All the observations were conducted on research cruises and ranges of longitudes and latitudes indicate the coverages of each cruise.

b: Simulation results were restricted within the study domain of western North Pacific.

Reference:

- Kameyama, S., Yoshida, S., Tanimoto, H., Inomata, S., Suzuki, K., and Yoshikawa-Inoue, H.: High-resolution observations of dissolved isoprene in surface seawater in the Southern Ocean during austral summer 2010–2011, *J. Oceanogr.*, 70, 225–239, <https://doi.org/10.1007/s10872-014-0226-8>, 2014.
- Li, J.-L., Zhang, H.-H., and Yang, G.-P.: Distribution and sea-to-air flux of isoprene in the East China Sea and the South Yellow Sea during summer, *Chemosphere*, 178, 291–300, 2017.
- Li, J.-L., Zhai, X., Zhang, H.-H., and Yang, G.-P.: Temporal variations in the distribution and sea-to-air flux of marine isoprene in the East China Sea, *Atmos. Environ.*, 187, 131–143, 2018.
- Matsunaga, S., Mochida, M., Saito, T., and Kawamura, K.: In situ measurement of isoprene in the marine air and surface seawater from the western North Pacific, *Atmos. Environ.*, 36, 6051–6057, doi:10.1016/s1352-2310(02)00657-x, 2002.
- Ooki, A., Nomura, D., Nishino, S., Kikuchi, T., and Yokouchi, Y.: A global-scale map of isoprene and volatile organic iodine in surface seawater of the Arctic, Northwest Pacific, Indian, and Southern Oceans, *J. Geophys. Res.: Oceans* 120, 4108–4128, doi:10.1002/2014JC010519, 2015.
- Tran, S., Bonsang, B., Gros, V., Peeken, I., Sarda-Esteve, R., Bernhardt, A., and Belviso, S.: A survey of carbon monoxide and nonmethane hydrocarbons in the Arctic Ocean during summer 2010, *Biogeosciences*, 10, 1909–1935, <https://doi.org/10.5194/bg-10-1909-2013>, 2013.