Supplementary Information for

HONO Formation Mechanisms and Impacts on Ambient Oxidants in Coastal Regions of Fujian, China

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Table S1. List of the configurations in different modeling cases for sensitivity experiments.

CASE	Meteorology	Continental Emission	Shipping emission	HONO sources	Comments
BASE	FNL input and FDDA nudging	MEIC (Anth.) and MEGAN (Bio.)	SEIM shipping emissions	Only considering NO+OH	REV minus BASE to reveal the impacts of HONO on oxidants
REV	FNL input and FDDA nudging	MEIC (Anth.) and MEGAN (Bio.)	SEIM shipping emissions	NO+OH and HONO source updates	
Noship	FNL input and FDDA nudging	MEIC (Anth.) and MEGAN (Bio.)	No shipping emissions	NO+OH and HONO source updates	REV minus Noship to reveal the contribution of shipping emissions to coastal HONO formation

Table S2. List of the observed HONO concentrations from previous literature.

Location	Site type	Time	HONO (ppbv)	References
Xinken, PRD	Suburban	13 Oct to 2 Nov 2004	1.20	(Su et al., 2008)
Beijing, NCP	Urban	13 to 25 Aug 2007	1.02	(Li et al., 2011)
Back Garden, PRD	Rural	3 to 26 Jul 2006	0.60	(Li et al., 2012)
Beijing, NCP	Urban	23 Jan to 14 Feb 2007	1.04	(Spataro et al., 2013)
Beijing, NCP	Urban	2 to 31 Aug 2007	1.45	(Spataro et al., 2013)
Nanjing, YRD	Suburban	18 Apr to 25 Jun 2012	0.76	(Nie et al., 2015)
Hong Kong	Suburban	3 Aug to 7 Sep 2011	0.66	(Xu et al., 2015)
Hong Kong	Suburban	1 Nov to 3 Dec 2011	0.93	(Xu et al., 2015)
Hong Kong	Suburban	3 Feb to 9 Mar 2012	0.91	(Xu et al., 2015)
Hong Kong	Suburban	1 to 31 May 2012	0.35	(Xu et al., 2015)
Hong Kong	Urban	1 to 31 May 2012	3.30	(Yun et al., 2017)
Jinan, NCP	Urban	1 Dec 2015 to 29 Feb 2016	1.71	(Li et al., 2018)
Jinan, NCP	Urban	1 Apr to 31 May 2016	1.16	(Li et al., 2018)
Jinan, NCP	Urban	1 Jun to 31 Aug 2016	1.12	(Li et al., 2018)
Jinan, NCP	Urban	1 Sep to 30 Nov 2015	0.78	(Li et al., 2018)
Heshan, PRD	Suburban	4 to 8 Jan 2017	2.65	(Fu et al., 2019)
Nanjing, YRD	Suburban	1 Dec 2017 to 28 Feb 2018	1.04	(Liu et al., 2019)
Nanjing, YRD	Suburban	1 Apr to 31 May 2018	0.68	(Liu et al., 2019)
Nanjing, YRD	Suburban	1 Jun to 31 Aug 2018	0.45	(Liu et al., 2019)
Nanjing, YRD	Suburban	1 Sep to 30 Nov 2018	0.66	(Liu et al., 2019)
Beijing, NCP	Urban	15 to 31 Aug 2006	1.64	(Zhang et al., 2019a)
Beijing, NCP	Suburban	15 to 31 Aug 2006	0.76	(Zhang et al., 2019a)
Wangdu, NCP	Rural	29 Nov to 3 Dec 2017	1.87	(Zhang et al., 2019b)
YelRD, NCP	Rural	8 Feb to 24 Mar 2017	0.26	(Gu et al., 2020)
YelRD, NCP	Rural	1 Jun to 10 Jul 2017	0.17	(Gu et al., 2020)
Beijing, NCP	Urban	22 to 31 Jul 2016	0.87	(Guo et al., 2020)
Shanghai, YRD	Urban	7 to 13 Jul 2013	0.69	(Guo et al., 2020)
Guangzhou, PRD	Urban	18 Oct to 1 Nov 2015	1.09	(Guo et al., 2020)
Mt. Tai, NCP	Remote	Nov–Dec 2017	0.15	(Jiang et al., 2020)
Mt. Tai, NCP	Remote	Mar–Apr 2018	0.13	(Jiang et al., 2020)
Beijing, NCP	Urban	1 Feb to 30 Jun 2018	1.26	(Liu et al., 2020)
Nanjing, YRD	Suburban	1 to 31 Dec 2015	1.32	(Zheng et al., 2020)
Guangzhou, PRD	Urban	14 to 19 Oct 2019	5.80	(Li et al., 2021)
Beijing, NCP	Urban	25 May to 15 Jul 2018	1.27	(Liu et al., 2021)
Beijing, NCP	Urban	26 Nov 2018 to 15 Jan 2019	1.13	(Liu et al., 2021)
Xinjin, Sichuan	Suburban	13 Aug to 12 Sep 2019	1.18	(Yang et al., 2021)
Beijing, NCP	Urban	7 to 22 Dec 2015	3.20	(Zhang et al., 2021)
Beijing, NCP	Urban	7 to 30 May 2017	1.25	(Gu et al., 2022)
Beijing, NCP	Urban	15 to 30 Jan 2018	1.04	(Gu et al., 2022)

Wangdu, NCP	Rural	3 to 23 Dec 2017	1.79	(Song et al., 2022)
Wangdu, NCP	Rural	16 Jun to 10 Aug 2020	0.67	(Song et al., 2022)
Wangdu, NCP	Rural	21 Aug to 20 Sep 2020	0.83	(Song et al., 2022)
Mt. Tai, NCP	Remote	9 to 31 Jul 2018	0.13	(Xue et al., 2022)
Guangzhou, PRD	Urban	27 Sep to 8 Nov 2018	0.74	(Yu et al., 2022)
Beijing, NCP	Urban	11 to 31 October 2018	1.67	(J. Zhang et al., 2022a)
Wangdu, NCP	Rural	6 Jul to 11 Aug 2016	0.43	(J. Zhang et al., 2022b)
Beijing, NCP	Urban	1 to 31 Jul 2016	0.63	(J. Zhang et al., 2022b)
Dongbaituo, NCP	Rural	15 Dec 2017 to 4 Jan 2018	2.51	(W. Zhang et al., 2022)
Xianghe, NCP	Suburban	15 Dec 2017 to 4 Jan 2018	2.18	(W. Zhang et al., 2022)
Beijing, NCP	Urban	15 Dec 2017 to 4 Jan 2018	1.17	(W. Zhang et al., 2022)
Beijing, NCP	Urban	22 Dec 2018 to 23 Jan 2019	0.98	(X. Zhang et al., 2022)
Sanmenxia, NCP	Urban	22 Dec 2018 to 23 Jan 2019	1.12	(X. Zhang et al., 2022)
Xiamen, Fujian	Coastal	Aug 2018 to Mar 2019	0.55	(Hu et al., 2022)
Chengdu, Sichuan	Urban	22 Mar to 28 Jun 2022	1.00	(Chen et al., 2023)
Shanghai, YRD	Urban	1 Jan to 31 Dec 2019	1.10	(Feng et al., 2023)
Shanghai, YRD	Urban	1 Jan to 31 Dec 2019	0.90	(Feng et al., 2023)
Beijing, NCP	Urban	10 to 19 Jun 2017	1.60	(Song et al., 2023)
Wangdu, NCP	Rural	8 to 16 Jun 2017	1.10	(Song et al., 2023)
Beijing, NCP	Suburban	18 Aug to 16 Sep 2018	0.38	(Xuan et al., 2023)
Taizhou, YRD	Suburban	23 May to 18 Jun 2018	0.62	(Ye et al., 2023)
Baoding, NCP	Rural	17 Nov to 8 Dec 2018	2.76	(S. Zhang et al., 2023)
Beijing, NCP	Urban	1 to 30 Mar 2021	1.48	(W. Zhang et al., 2023)
Qingdao, NCP	Coastal	27 Apr to 19 May 2021	0.46	(Zhong et al., 2023)
Beijing, NCP	Urban	25 Oct to 7 Dec 2018	2.52	(X. Zhang et al., 2023)
Beijing, NCP	Urban	1 Jan to 15 Mar and 15 Nov to 31 Dec 2018	1.02	(W. Zhang et al., 2024)
Beijing, NCP	Urban	1 Apr to 31 Oct 2018	1.54	(W. Zhang et al., 2024)
Beijing, NCP	Urban	1 to 24 Jan 2020	0.97	(Y. Zhang et al., 2024)
Beijing, NCP	Urban	25 Jan to 6 Mar 2020	0.53	(Y. Zhang et al., 2024)
Nanjing, YRD	Suburban	24 to 27 Mar 2019	1.17	(H. Zhang et al., 2024)
Beijing, NCP	Urban	18 Jun to 25 Oct 2021	1.10	(Li et al., 2025)

24

Table S3. Statistics of the simulated NO_2 concentrations, HONO concentrations and formation rates on different underlying surfaces in the coastal regions of Fujian.

Underlying surface		**Forest**	**Grassland**	**Cropland**	**Urban**	**Total region**
Grid number		358 (66.7%)	24 (4.5%)	129 (24.0%)	26 (4.8%)	537
Concentration (ppbv)	NO_2	3.07	3.33	4.69	6.10	3.45
	HONO	0.182	0.190	0.250	0.305	0.196
HONO production rate (ppbv h^{-1})	NO+OH	0.056 (11.5%)	0.066 (14.4%)	0.141 (19.5%)	0.244 (21.1%)	0.080 (14.7%)
	NO_x photo-oxidation	0.116 (24.0%)	0.135 (29.4%)	0.257 (35.6%)	0.417 (36.1%)	0.156 (28.6%)
	NO_x dark-oxidation	0.002 (0.4%)	0.002 (0.5%)	0.004 (0.6%)	0.007 (0.6%)	0.003 (0.5%)
	Primary emissions	0.041 (8.4%)	0.044 (9.5%)	0.096 (13.2%)	0.262 (22.6%)	0.058 (10.6%)
	Hetero-aerosol	0.006 (1.3%)	0.006 (1.4%)	0.012 (1.6%)	0.021 (1.8%)	0.008 (1.4%)
	Hetero-land	0.219 (45.3%)	0.162 (35.3%)	0.173 (23.9%)	0.171 (14.8%)	0.200 (36.7%)
	Nitrate-photolysis	0.044 (9.0%)	0.044 (9.6%)	0.040 (5.5%)	0.033 (2.9%)	0.041 (7.5%)
	Total rate	0.48	0.46	0.72	1.16	0.54

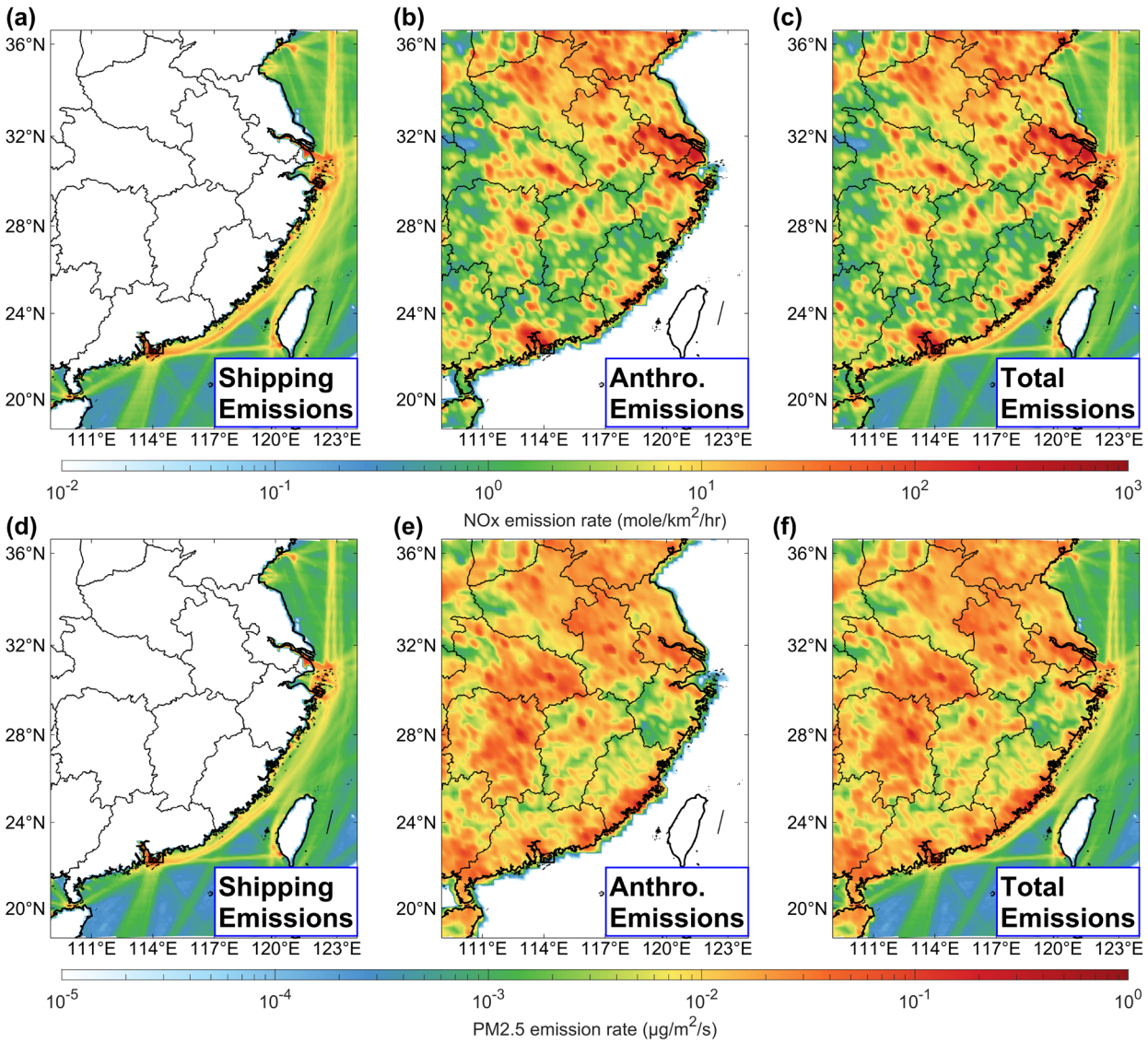

Figure S1. Spatial distribution pattern of emission rates of NO_x and $PM_{2.5}$ from oceanic shipping and continental anthropogenic sources in this study.

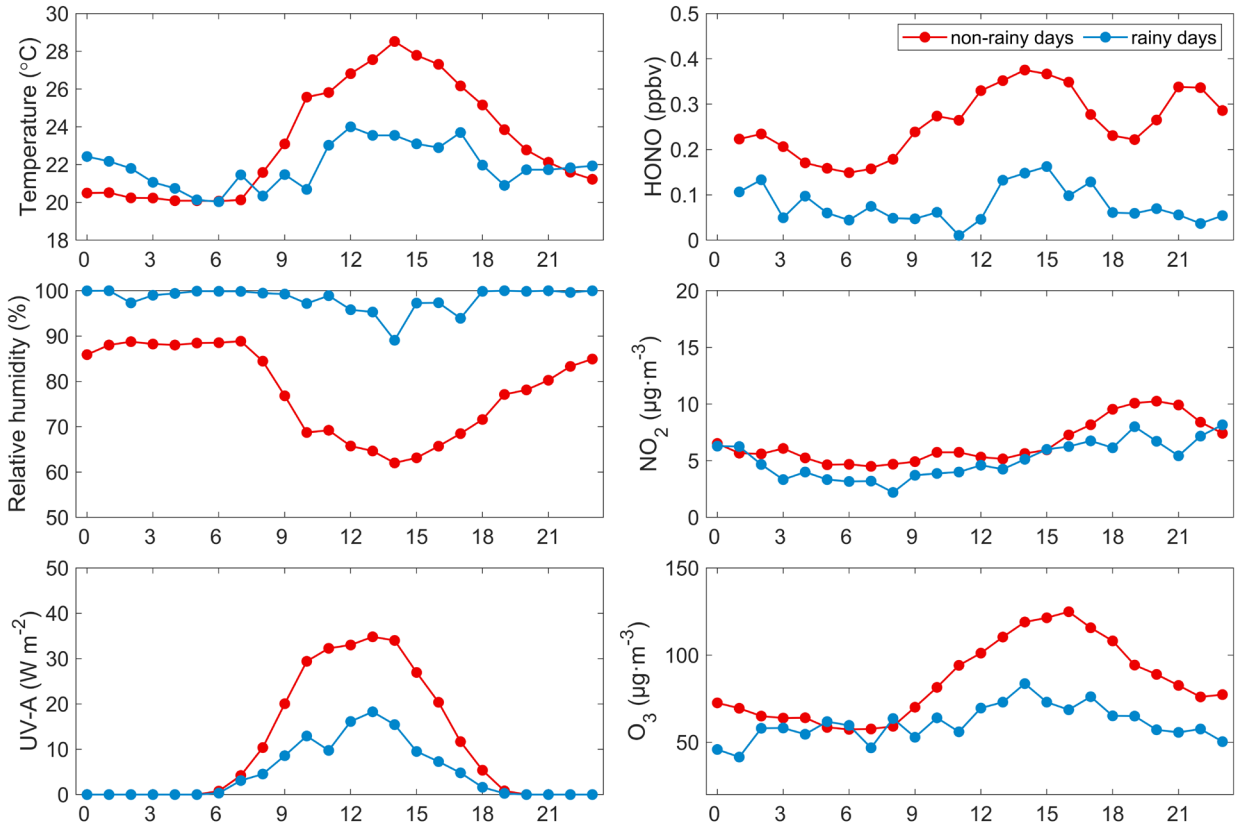

Figure S2. Diurnal variations of the observed meteorological parameters (air temperature, relative humidity, UV-A radiation) and air pollutants (HONO, NO_2, O_3) on rainy and non-rainy days during the study period.

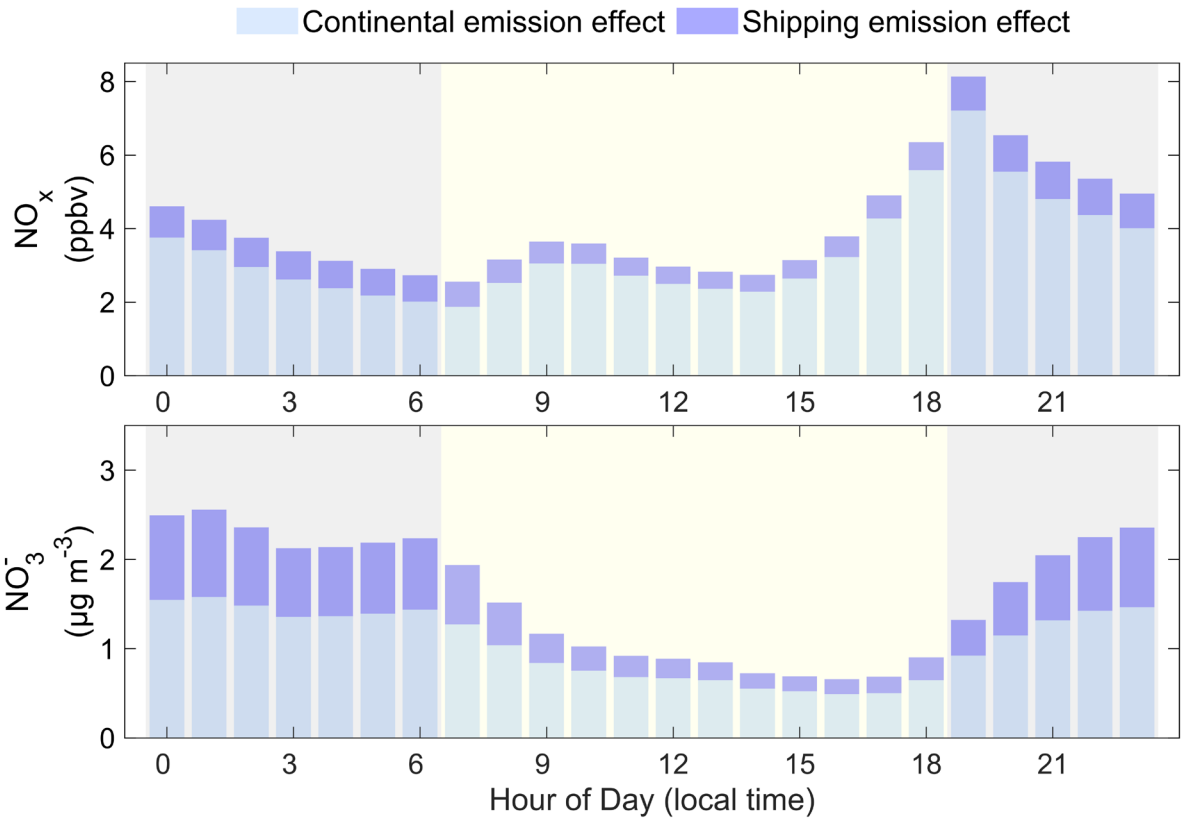

Figure S3. Diurnal variations of contributions of continental and shipping emissions to NO_x and nitrate aerosol concentrations in the coastal regions of Fujian.

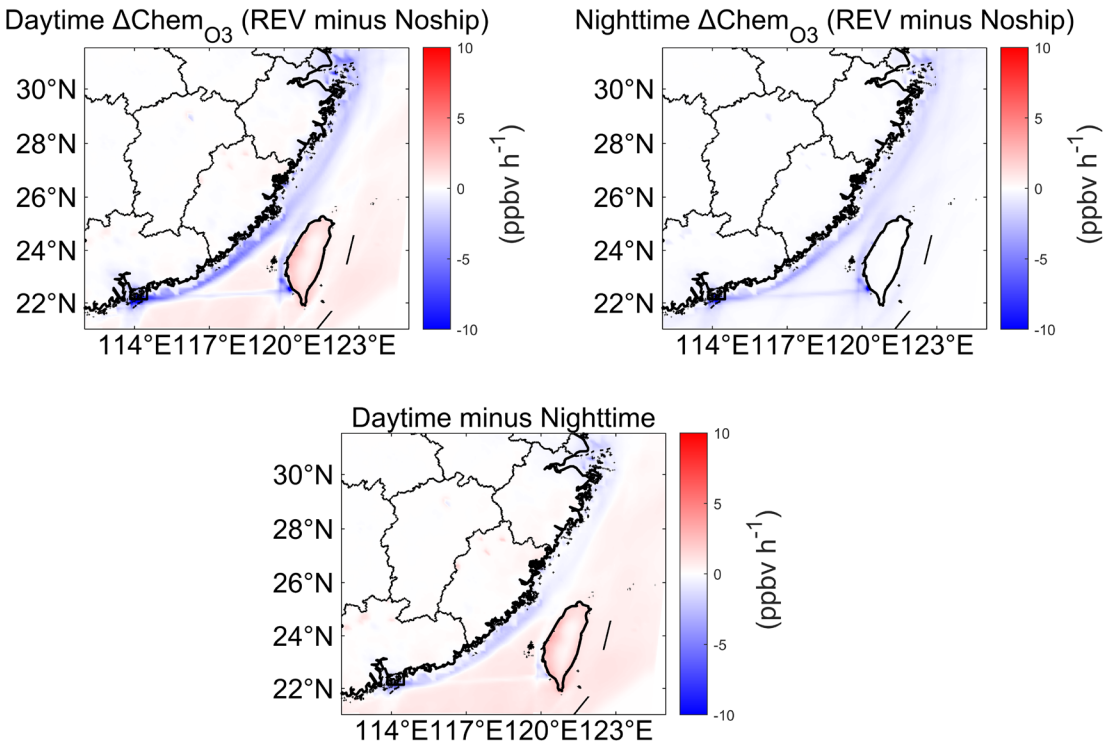

Figure S4. Spatial distribution of impacts of shipping emissions on chemical production rates of O_3 ($\Delta Chem_{o3}$) during the daytime and nighttime (upper panels). The difference between the daytime and nighttime is also presented in the bottom panel.

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223