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New insight into the spatiotemporal variability and source apportionments of C₁–C₄ alkyl nitrates in Hong Kong

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Table S1 The statistics of the major NMHCs, together with O₃, O_x, NO_x and CO at TMS and TW*

Groups	species	TMS (ppbv)			TW (ppbv)		
		Mean	10 th #	90 th #	Mean	10 th	90 th
Alkanes	ethane	1.91 ± 0.08	1.15	2.47	2.22 ± 0.09	1.36	2.91
	propane	1.10 ± 0.07	5.69	1.75	3.55 ± 0.26	1.84	5.15
	<i>n</i> -butane	0.83 ± 0.09	3.49	1.52	4.49 ± 0.36	2.17	7.63
	<i>i</i> -butane	0.85 ± 0.34	0.29	1.21	2.87 ± 0.36	1.37	4.81
	<i>n</i> -pentane	0.43 ± 0.14	0.09	0.66	0.76 ± 0.44	0.21	0.94
	<i>i</i> -pentane	0.48 ± 0.09	0.16	0.76	1.04 ± 0.32	0.35	1.43
	<i>n</i> -hexane	0.26 ± 0.04	0.06	0.49	0.36 ± 0.05	0.09	0.87
	2-methylpentane	0.17 ± 0.02	0.04	0.35	0.26 ± 0.04	0.11	0.45
	3-methylpentane	0.12 ± 0.01	0.03	0.27	0.16 ± 0.02	0.06	0.32
	<i>n</i> -heptane	0.11 ± 0.02	0.02	0.25	0.17 ± 0.02	0.07	0.35
	<i>n</i> -octane	0.03 ± 0.01	0.01	0.06	0.05 ± 0.02	0.03	0.10
	<i>n</i> -nonane	0.03 ± 0.01	0.01	0.06	0.07 ± 0.01	0.03	0.15
	<i>n</i> -decane	0.04 ± 0.01	0.02	0.06	0.11 ± 0.06	0.04	0.14
Alkenes	ethene	0.73 ± 0.04	0.37	1.18	1.85 ± 0.11	1.13	3.11
	propene	0.13 ± 0.11	0.05	0.23	0.52 ± 0.05	0.24	0.96
	1-butene	0.04 ± 0.01	0.01	0.08	0.09 ± 0.01	0.04	0.15
	<i>i</i> -butene	0.19 ± 0.05	0.03	0.46	0.38 ± 0.08	0.11	0.71
	<i>cis</i> -2-butene	0.01 ± 0.01	--	0.01	0.04 ± 0.01	0.01	0.05
	<i>trans</i> -2-butene	0.01 ± 0.01	--	0.02	0.03 ± 0.01	0.02	0.07
	1-pentene	0.01 ± 0.01	--	0.03	0.03 ± 0.01	0.01	0.08
	1,3-butadiene	0.01 ± 0.01	--	0.04	0.06 ± 0.01	0.02	0.11
	ethyne	1.56 ± 0.07	0.88	2.05	2.62 ± 0.10	1.81	3.47
Aromatics	benzene	0.63 ± 0.03	0.39	0.91	0.73 ± 0.03	0.49	1.04
	toluene	2.17 ± 0.73	0.40	3.69	2.74 ± 0.35	1.06	5.65
	ethylbenzene	0.56 ± 0.10	0.05	1.27	0.78 ± 0.14	0.17	1.99
	<i>m</i> -xylene	0.28 ± 0.07	0.01	0.72	0.63 ± 0.19	0.11	1.36
	<i>o</i> -xylene	0.14 ± 0.02	0.01	0.32	0.28 ± 0.07	0.06	0.60
	<i>p</i> -xylene	0.15 ± 0.02	0.01	0.39	0.29 ± 0.07	0.06	0.77
	1,2,3-trimethylbenzene	0.01 ± 0.01	--	0.03	0.03 ± 0.01	0.01	0.07
	1,2,4-trimethylbenzene	0.03 ± 0.01	--	0.08	0.11 ± 0.02	0.03	0.25
	1,3,5-trimethylbenzene	0.02 ± 0.01	--	0.04	0.04 ± 0.01	0.01	0.07
	Isoprene	0.11 ± 0.02	0.01	0.30	0.24 ± 0.03	0.07	0.61
CO	436 ± 7	243	627	517 ± 8	299	753	
NO _x	10.7 ± 0.3	5.5	16.9	55 ± 1	17	96	
O ₃	55 ± 1	25	82	22 ± 1	5	42	
O _x (O ₃ +NO ₂)	58 ± 1	23	89	47 ± 1	26	70	

* Mean ±95% confidence intervals

10th and 90th percentiles

Table S2 Summary of synoptic weather conditions and the corresponding variations of air pollutants on the sampling O₃ and non-O₃ episode days

Sampling days	Synoptic weather conditions	Variation of pollutants
O₃ episode day		
October 23~24 2010	After the tropical cyclone Megi, the weather was sunny. The temperature (max: 23 and 31 °C at TMS and TW, respectively) and solar radiation levels (max: 843 and 851 W/m ² , respectively) increased and remained at high levels. The wind speed decreased and the prevailing wind direction was from the north at TMS. The prevailing winds at TW changed from southeast on October 23 to north on October 24.	O ₃ , NO and SO ₂ increased clearly and CO increased moderately. O ₃ reached peaks of 137 ppbv at TMS and 85 ppbv at TW. SO ₂ reached 10 ppbv at TMS and 14 ppbv at TW. The mixing ratios of alkyl nitrates increased clearly and the diurnal patterns of alkyl nitrates were more significant with peak values observed in the afternoon. The diurnal patterns tracked each other well for C ₃ -C ₄ alkyl nitrates at TMS and TW.
October 29 ~ November 3, 2010	With a continental anticyclone over mainland China, the temperature started to increase and the weather was sunny. A northerly dry monsoon was enhanced at both sites. The solar radiation levels were higher at TMS than that at TW, where their peaks reached 811 and 800 W/m ² , respectively. The winds were mostly from the north at TMS, and those at TW were from the southeast, east and northeast.	O ₃ increased and stayed at high levels at TMS. SO ₂ and CO at the two sites exhibited an increasing trend and a broad peak. The levels of alkyl nitrates were slightly lower than those on October 23 and 24 at both sites. The diurnal patterns of C ₁ -C ₂ alkyl nitrates with troughs and peaks during daytime hours were observed on October 29 - November 3 at both sites.
November 9, 2010	A continental anticyclone controlled northwestern China. After rainy days on November 4 ~ 6, the weather was sunny and stable. The temperatures and solar radiation levels increased and the wind speeds decreased.	O ₃ stayed at a level above 100 ppbv at TMS. NO remained stable and the levels CO and SO ₂ fluctuated. The levels of alkyl nitrates increased significantly at TMS and TW, with peaks observed in the afternoon.
November 19, 2010	The anticyclone moved over northeastern China and the East China Sea. Although the prevailing direction was from the north at both sites, the wind speeds decreased. The solar radiation levels were higher at TMS than those at TW, with maximum values of 673 and 555 W/m ² , respectively.	O ₃ increased sharply and reached peaks higher than 110 ppb at TMS. CO had a broad peak at both sites. The peak values of alkyl nitrates increased significantly. C ₃ and C ₄ alkyl nitrates peaked in the afternoon at the two sites. The maximum MeONO ₂ and EtONO ₂ levels were observed at midnight at TW and in the afternoon at TMS on some sampling days.
Non-O₃ episode days		

September 28, October 2, 8 and 14, 2010	<p>Low-pressure systems were located in the PRD region and Hainan province on September 28 and October 8. The weather was cloudy in the afternoon on these two days. On October 2 and 14, low-pressure systems (trough) were observed in northern and southern China. The temperatures and solar radiation levels were high on these two days, reaching daily maximum values of 24~27 °C and 775~886 W/m², respectively. The winds were mostly from the southeast at TW, those at TMS were from the east and northeast at low speeds. Rainfall was observed on the days of September 20-25, October 7, and 9-12.</p>	<p>The levels of O₃ and alkyl nitrates were low at TMS and TW on September 28 and October 2. Over the 4 sampling days, the maximum levels of O₃ and alkyl nitrates were observed on October 8, with O₃ (total alkyl nitrates) reaching peaks of 97 ppbv (125 pptv) at TMS and 65 ppbv (129 pptv) at TW.</p>
October 18~19, 2010	<p>The tropical cyclones Megi was formed in the South China Sea. The temperature and solar radiation started to decrease from October 18 to 19. The prevailing winds were from the north at TMS and changed from southeast to north from October 18 to 19 at TW.</p>	<p>The daily maximum levels of O₃ decreased from 95 ppbv on October 18 to 85 ppbv on October 19 at TMS. Diurnal patterns with maximum values in the afternoon were observed for alkyl nitrates at TMS and TW.</p>
October 27~28, 2010	<p>The tropical cyclone S.T.Chaba was located about 600 km east of Taiwan in the Philippine Sea and moving north. The winds at the two sites were mostly from the north. The temperature started to decrease, with daily maximum values reaching 16 and 25 °C at TMS and TW, respectively.</p>	<p>Air pollutants started to accumulate. The maximum levels of O₃ reached 80 and 50 ppbv at TMS and TW, respectively. The levels of alkyl nitrates on these two days were lower than those on October 23 and 24, reaching maximum total levels of 95 and 94 pptv at TMS and TW, respectively.</p>
November 20~21, 2010	<p>On the south edge of the high-pressure system located in North China, the weather was sunny. Prevailing southeast winds were observed at TW. The prevailing winds at TMS were from the east. The solar radiation levels were low on November 20, reaching maximum values of 428 and 507 W/m² at TMS and TW, respectively.</p>	<p>O₃ concentrations decreased to low levels at TMS and TW, with maximum hourly average values of 67 and 33 ppbv, respectively. The levels of alkyl nitrates decreased at the two sites on November 19. High alkyl nitrates mixing ratios were observed at midnight at TW.</p>

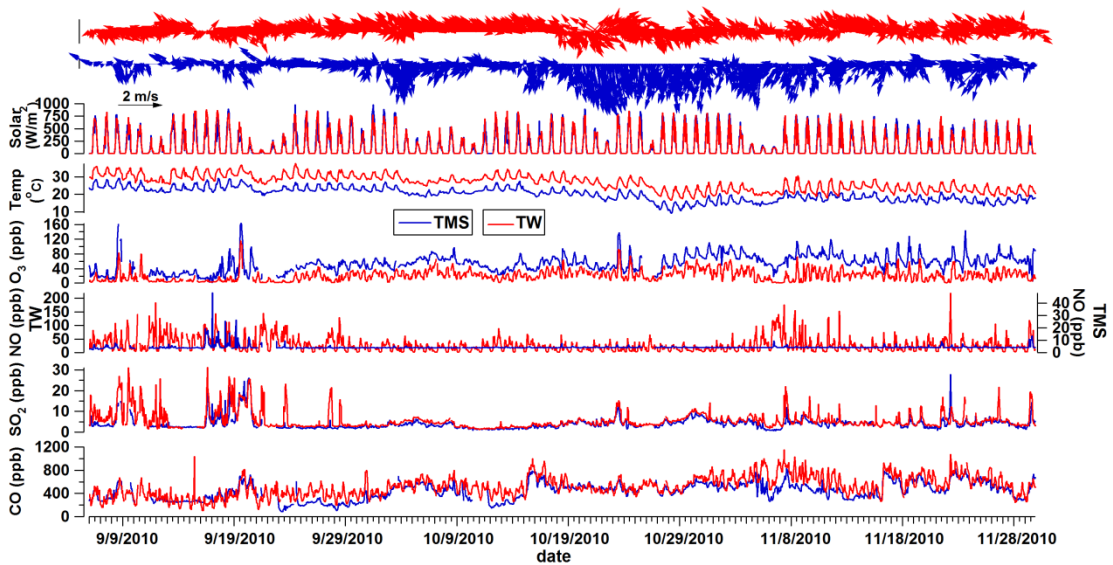


Figure S1. Time series of trace gases and meteorological conditions between 06 September and 29 November at TMS (blue) and TW (red).

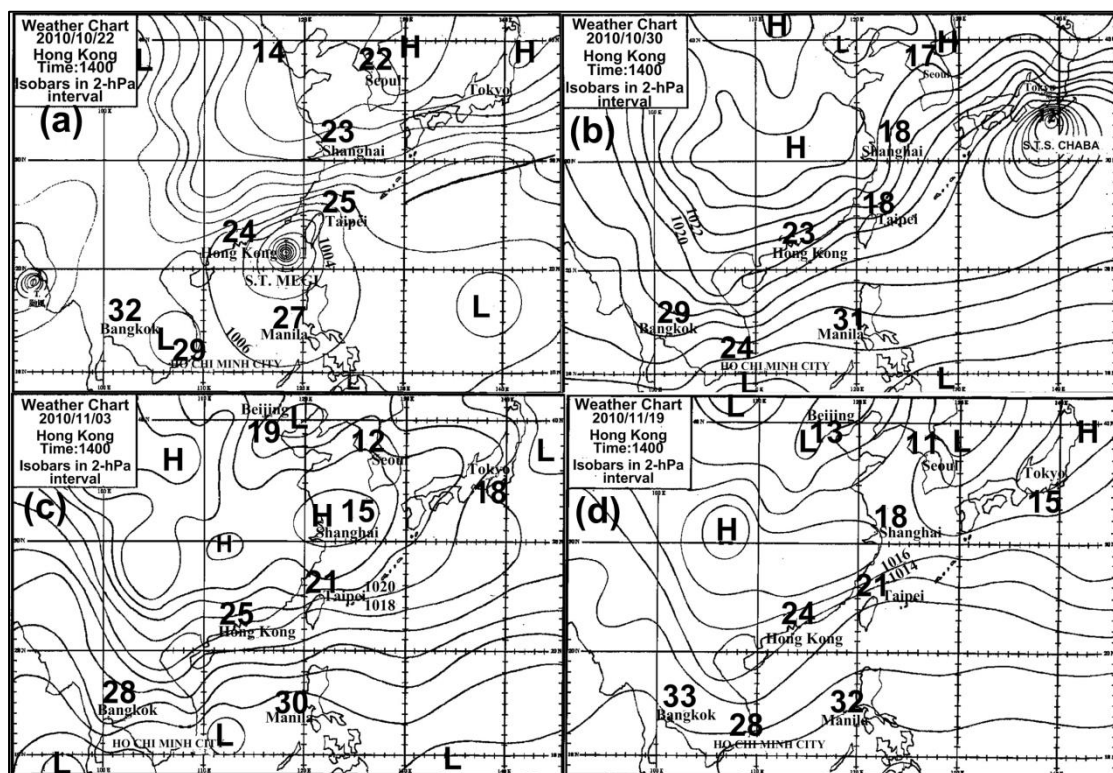


Figure S2 Synoptic charts for the sampling days influenced by tropical cyclone (a) and anticyclones (b-d)