Supplement for

Extending ozone and particulate matter pollution control from New York City to Beijing

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This file includes:

Figure S1 to S10

Table S1

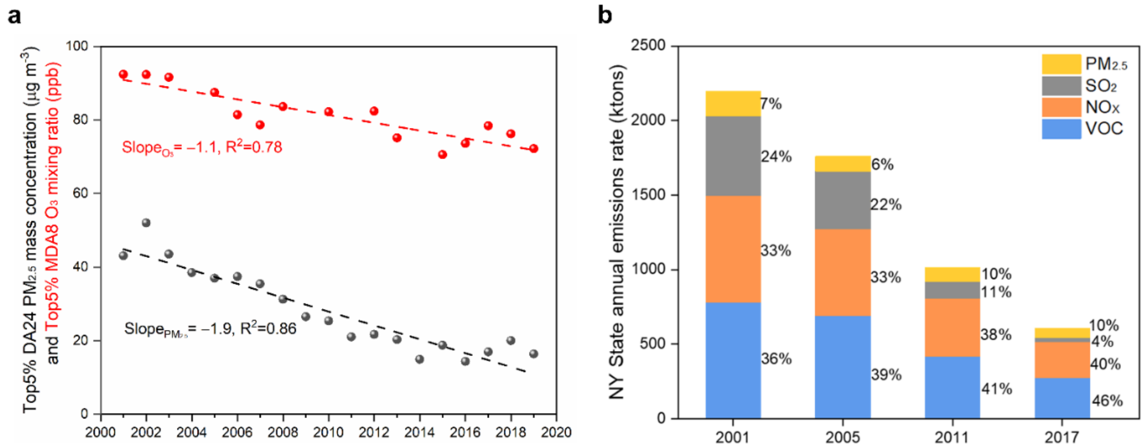

Figure S1. a, Time series of annual averages of the top5% of DA24 $PM_{2.5}$ and MDA8 O_3 concentrations of NYC and their best-fit lines; **b,** The VOC, NOx, SO_2, and primary $PM_{2.5}$ emissions of NY state in 2001, 2005, 2011, 2017.

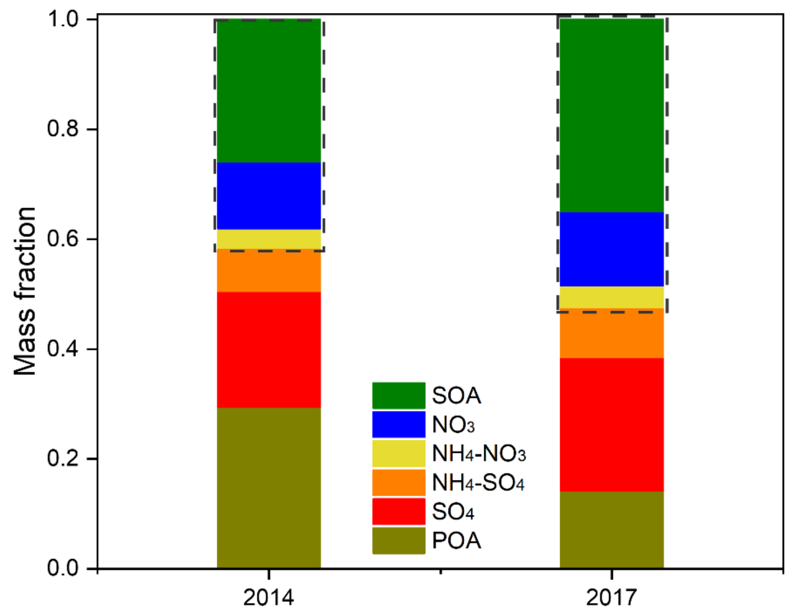

Figure S2. The averaged aerosol mass fraction for each subperiod in Beijing.

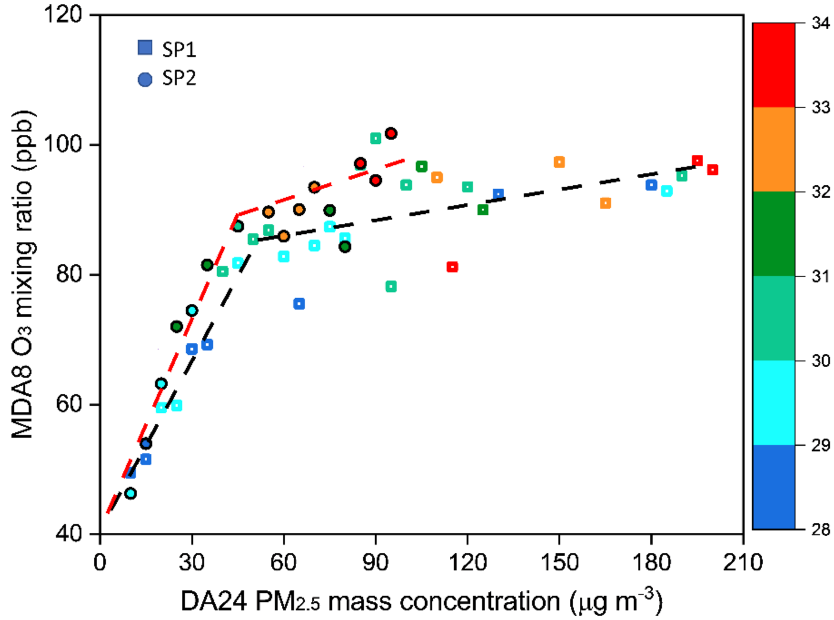

Figure S3. The O_3-$PM_{2.5}$ relationship of BJ for SP1 (2014-2016) and SP2 (2017-2019) (colored by the average temperature of each $PM_{2.5}$ level). The temperature of SP2 was about 2-3 °C higher than SP1 after $PM_{2.5}$ over IFP, which would related be about an increase of 2-3 ppb of O_3 for SP2[1]. This enhancement would be relative lower than the difference of O_3 of SP2 vs. SP1, with the estimated 10 ppb O_3 enhancement at the top5% DA24 $PM_{2.5}$ level of SP2 (90 μg m^{-3}), which implying the enhancement of O_3 caused by the increased temperature of SP2 would not be the dominate reason.

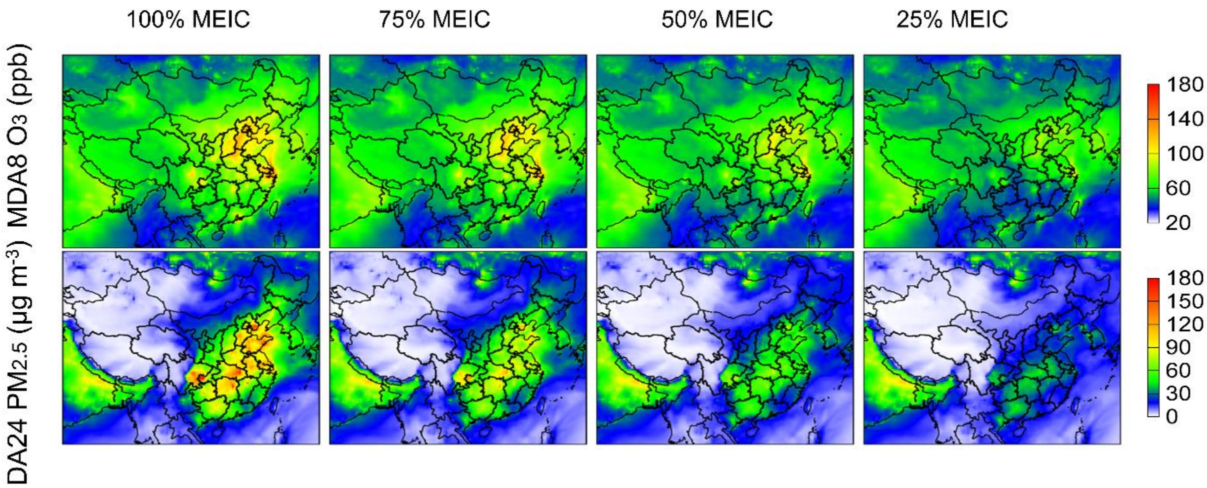

Figure S4. The average of the top5% MDA8 O_3 and DA24 $PM_{2.5}$ during June-August, 2017 in the base case and cases with proportional abatements of all the anthropogenic emissions by 25%, 50%, and 75%.

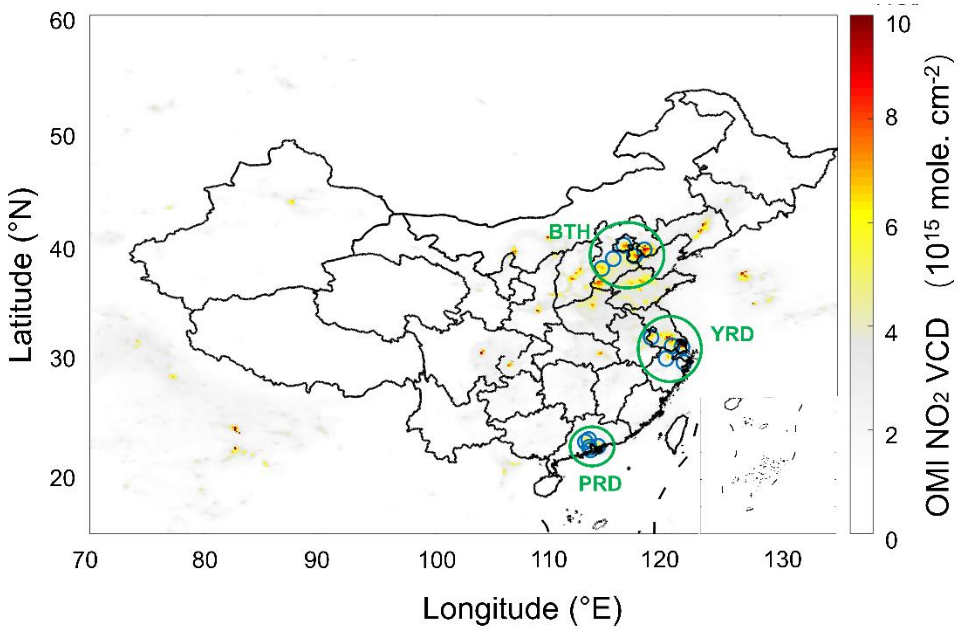

Figure S5. The location of main urban cities in three megacity clusters with a background map of 2019 summer TROPOMI NO_2 column concentration (BTH: Beijing-Tianjin-Hebei region, including Beijing, Tianjin, Shijiazhuang, Tangshan and Baoding. YRD: Yangtze River Delta, including Shanghai, Nanjing, Suzhou, Hangzhou and Ningbo. PRD: Pearl River Delta, including Guangzhou, Shenzhen, Zhuhai, Foshan and Zhongshan).

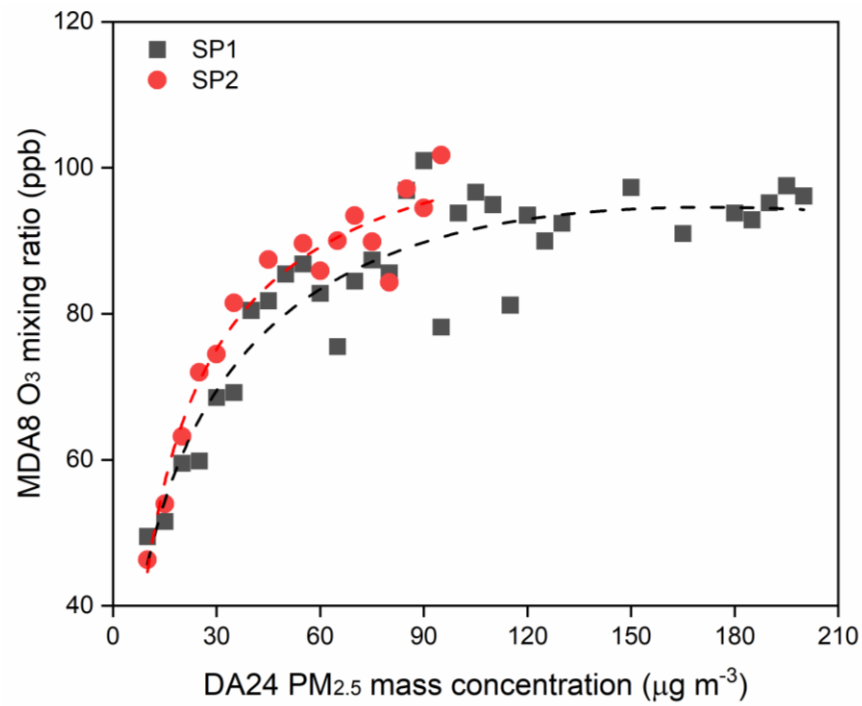

Figure S6. Diagram non-linear fitting of the BJ O_3-$PM_{2.5}$ relationship of SP1 and SP2.

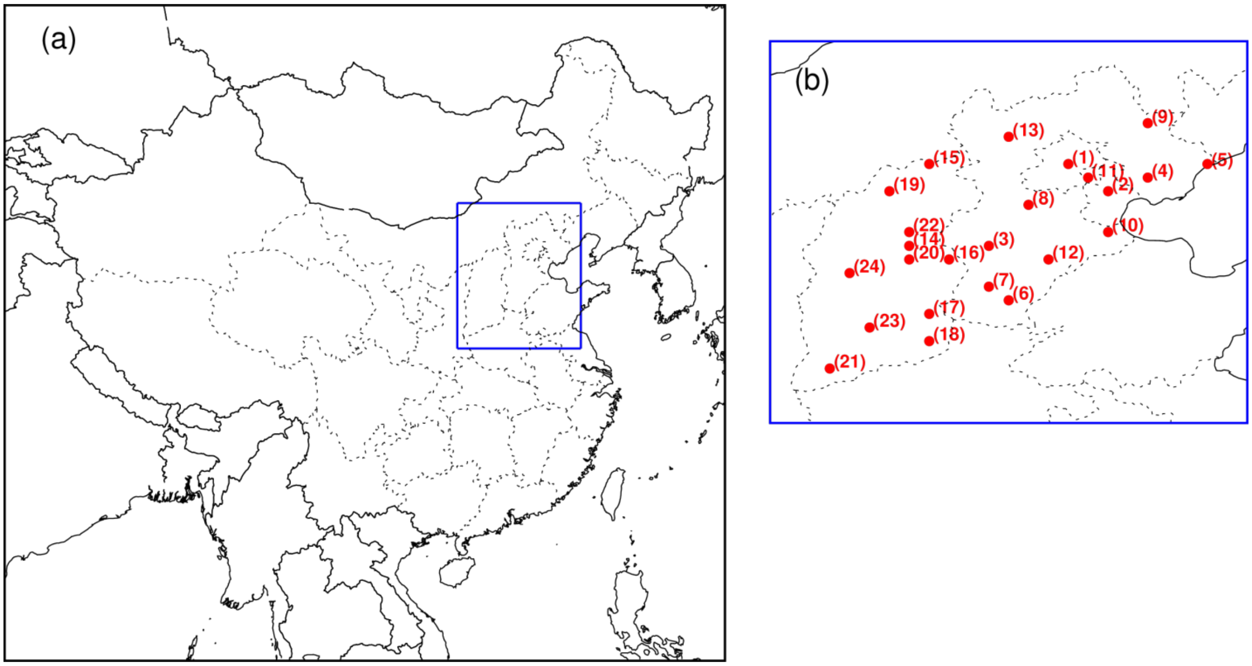

Figure S7. a, Domain of the CMAQ model simulation including BTH and its nearby region (Beijing-Tianjin-Hebei-Shanxi (BTHS)); **b**, locations of 24 cities for model evaluations of O_3 and $PM_{2.5}$.

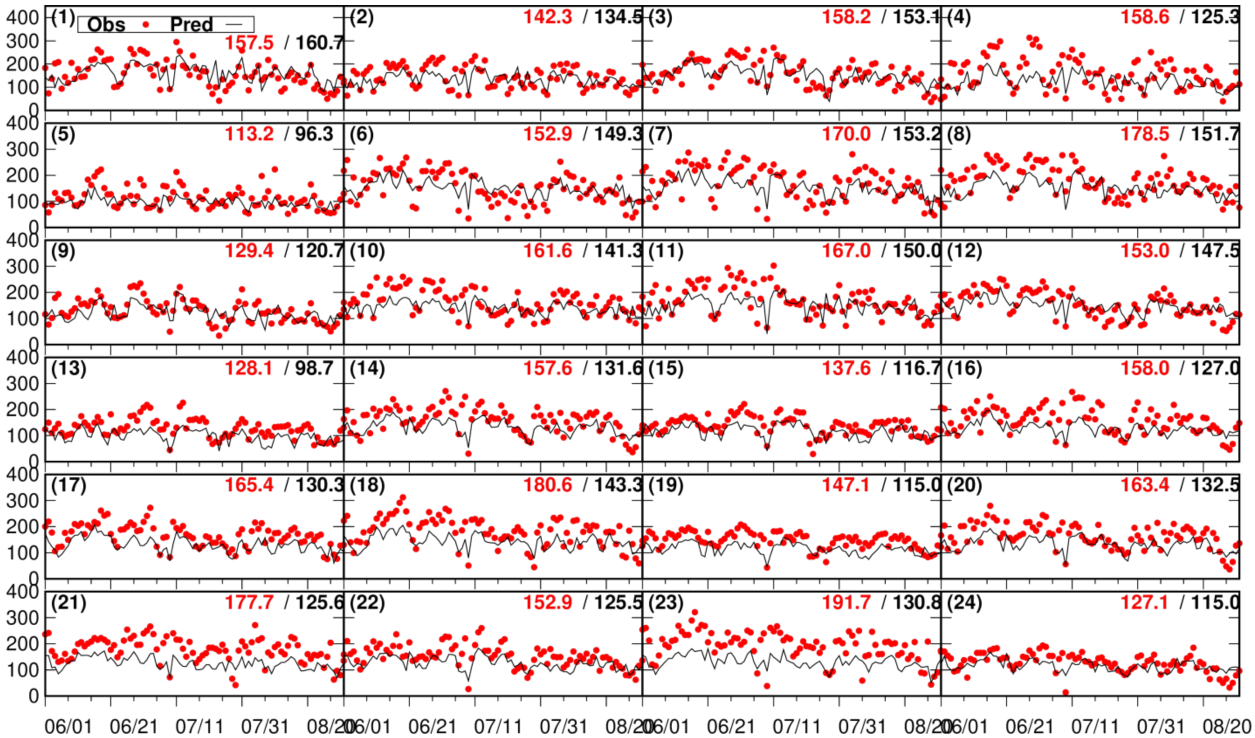

Figure S8. Comparison of observed (red dot) and modeled (black line) MDA8 O_3 in 24 cities shown in Fig. S5. The episode-averaged MDA8 O_3 by observations (red) and predictions (black) at each city are also included in each panel (units are μg m^{-3}).

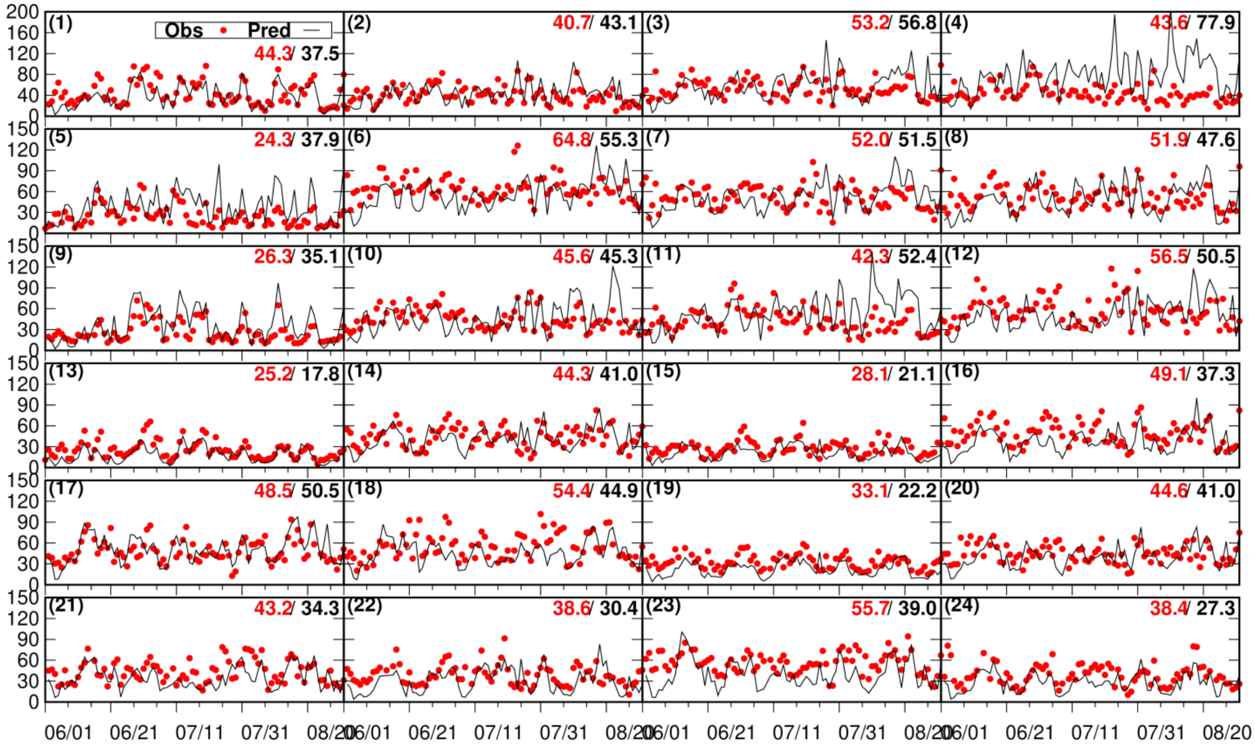

Figure S9. Comparison of observed (red dot) and modeled (black line) DA24 $PM_{2.5}$ in 24 cities shown in Fig. S5. The episode-averaged DA24 $PM_{2.5}$ by observations (red) and predictions (black) at each city are also included in each panel (units are μg m^{-3}).

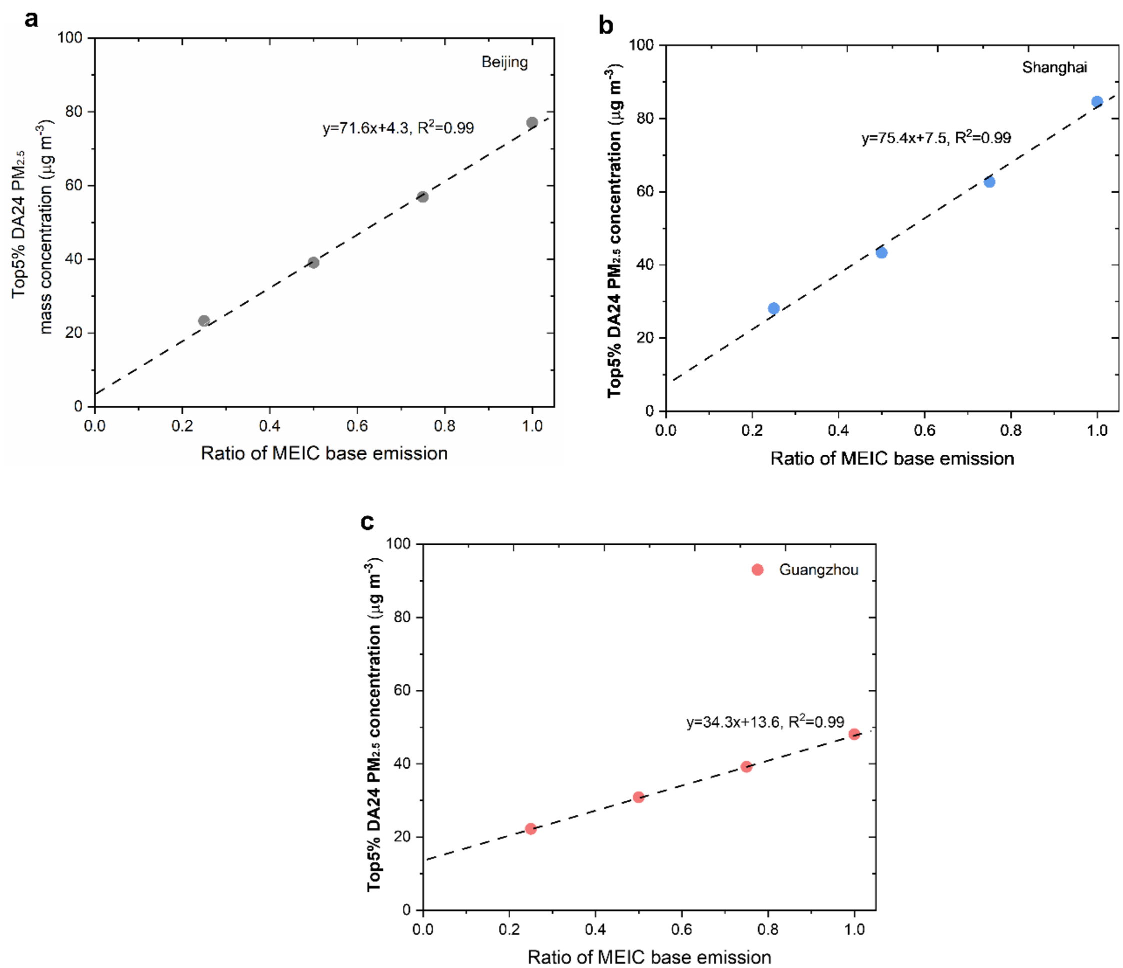

Figure S10. The relationship of the top5% DA24 $PM_{2.5}$ concentration with the ratio of MEIC base emissions for, **a,** Beijing city; **b,** Shanghai city; **c,** Guangzhou city.

Table S1. Statistical analysis of MDA8 O_3 and DA24 $PM_{2.5}$ in 24 cities of the BTHS region (Fig. S5) in June, July, and August 2017 (NMB: normalized mean bias; NME: normalized mean error[2])

	MDA8 O_3		DA24 $PM_{2.5}$	
	NMB	NME	NMB	NME
Jun	-0.19	0.23	-0.17	0.33
July	-0.13	0.24	-0.07	0.36
August	-0.12	0.24	0.11	0.41
Benchmark*	<±0.15	<0.25	<±0.30	<0.50

References

1. Shi, Z. et al. Sensitivity analysis of the surface ozone and fine particulate matter to meteorological parameters in China. *Atmos. Chem. Phys.* 20, 13455–13466 (2020).
2. Emery, C. et al. Recommendations on statistics and benchmarks to assess photochemical model performance. *J. Air Waste Manag. Assoc.* 67, (5), 582-598 (2017).