Supplementary for

Elucidating ozone and PM$_{2.5}$ pollution in Fenwei Plain reveals the co-benefits of controlling precursor gas emissions in winter haze

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This document contains:

Figure S1-S12.

Table S1.
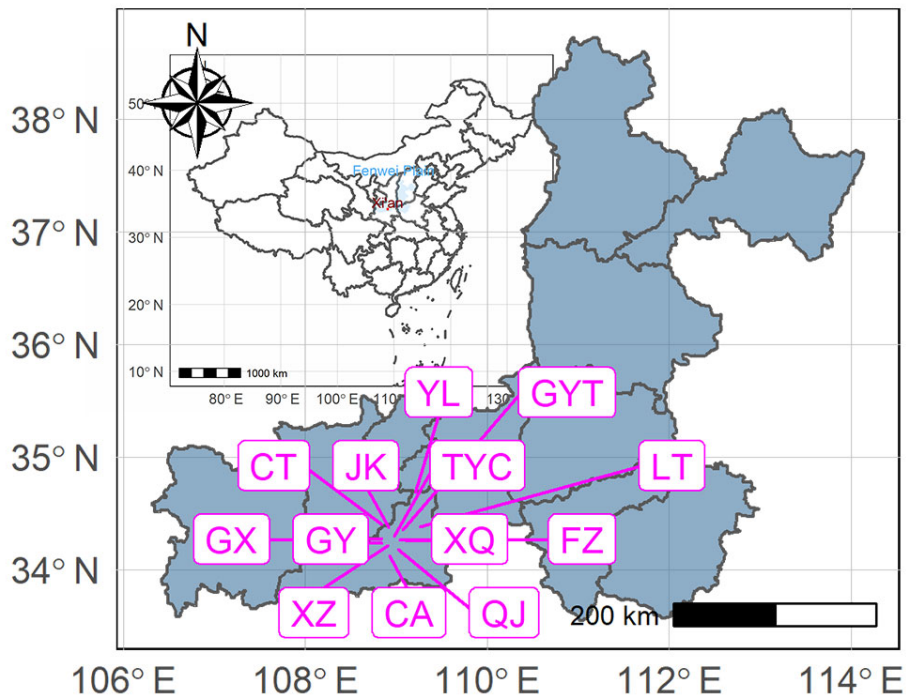
Figure S1. The 13 monitoring sites in urban Xi'an, the largest city in the Fenwei Plain. All 13 sampling sites are classified as urban sites within Xi'an city. GY: GaoYa kaiguanchang; XQ: XingQing community; FZ: FanZhi city; XZ: XiaoZhai; TYC: shirenmin TiYuChang; GX: GaoXin new district; JK: JingKai district; CA: ChangAn district; YL: YanLiang district; LT: LinTong district; CT: CaoTan district; QJ: QuJiang wehuachanyejituan; GYT: GuangYunTan.
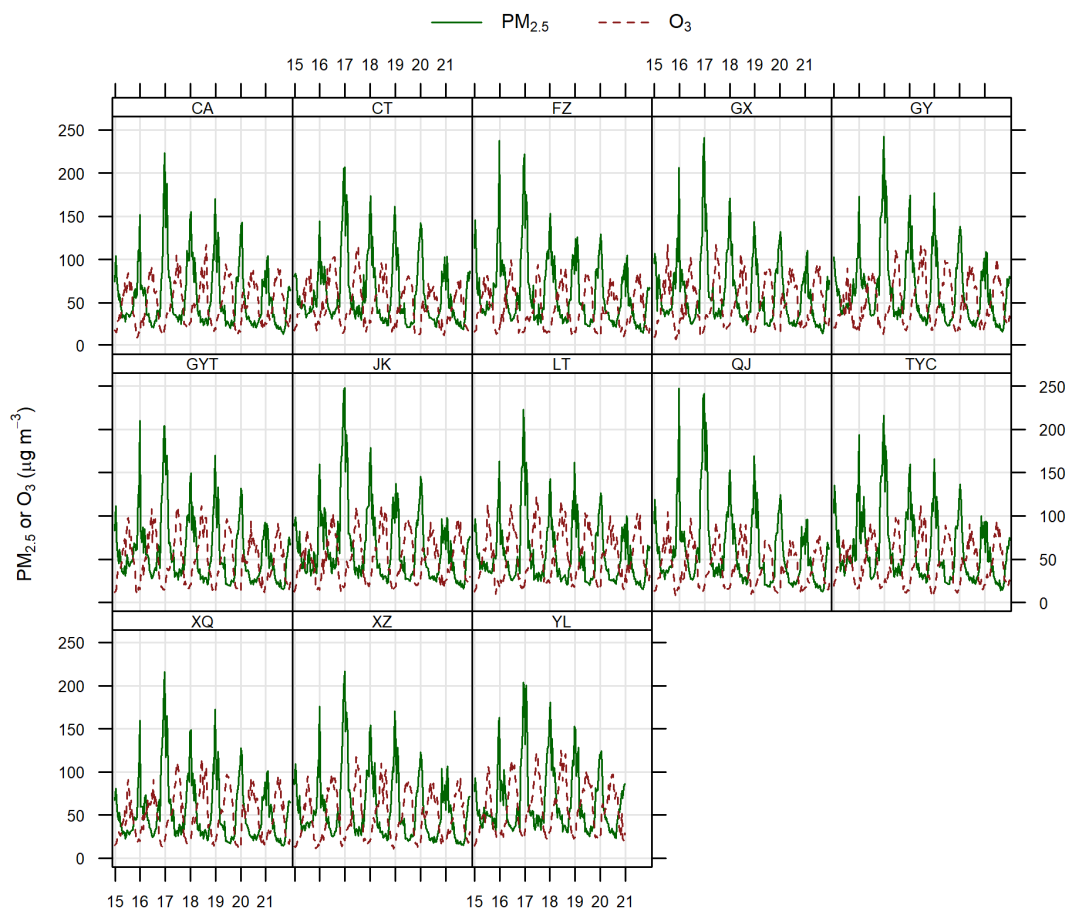
Figure S2. Time series of PM$_{2.5}$ and O$_3$ at the 13 sampling sites. The abbreviation for the sampling site is the same as in Figure S1. Data were averaged at 2 weeks for clarity reasons.
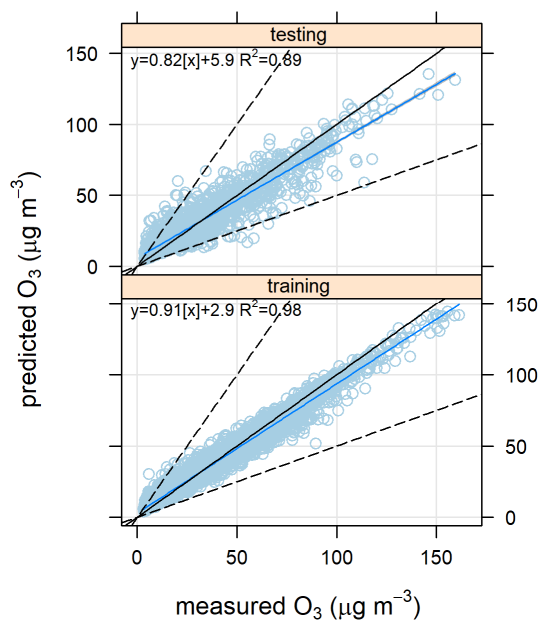
Figure S3. Time series correlation between the predicted and measured O₃ using the random forest model.
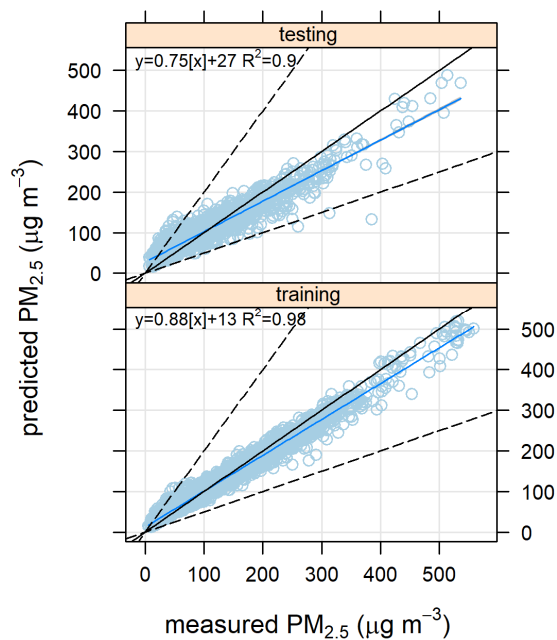
Figure S4. Time series correlation between the predicted and measured PM₂.₅ using the random forest model.
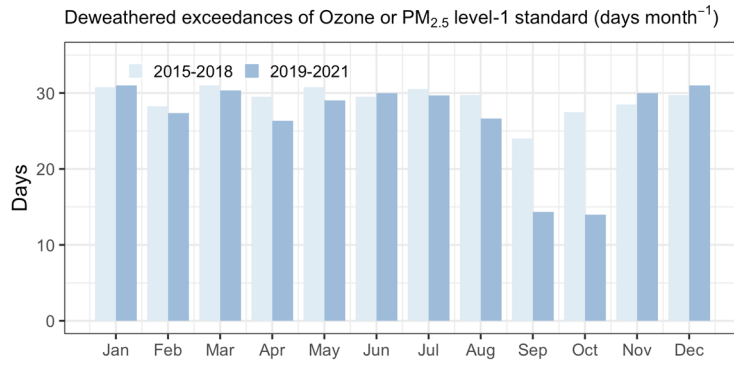
Figure S5. Deweathered exceedances of ozone or PM$_{2.5}$ level-1 standard for 2015-2018 and 2019-2021. Ozone and PM$_{2.5}$ were averaged from 13 monitoring sites in Xi'an with full 2015 to 2021 records.
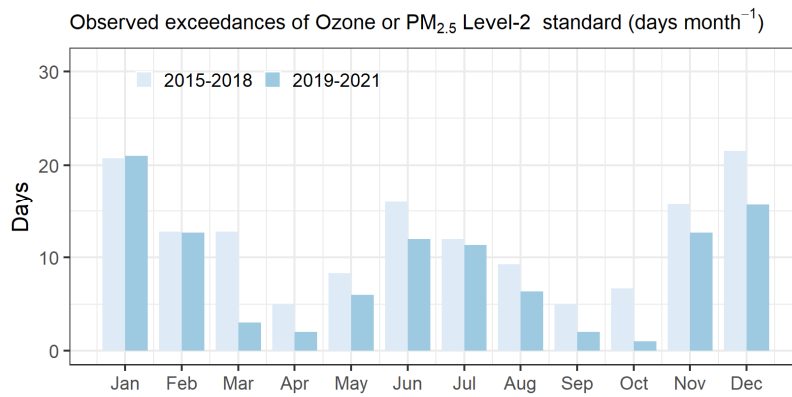
Figure S6. Observed exceedances of ozone or PM$_{2.5}$ level-2 standard for 2015-2018 and 2019-2021. Ozone and PM$_{2.5}$ were averaged from 13 monitoring sites in Xi'an with full 2015 to 2021 records.
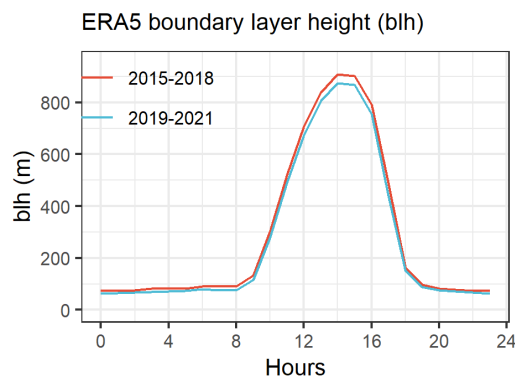
Figure S7. Mean boundary layer height (blh) for 2015-2018 and 2019-2021.
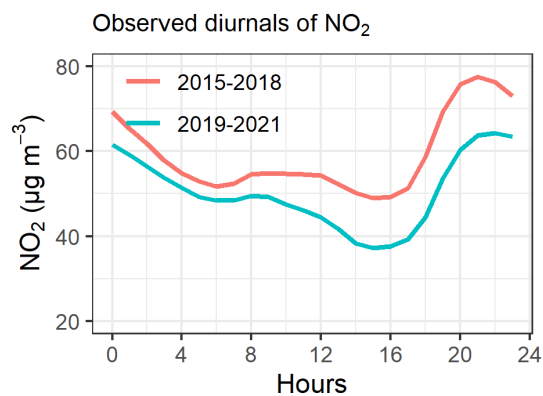
Figure S8. Observed diurnal of NO_2 in January-February for 2015-2018 and 2019-2021.
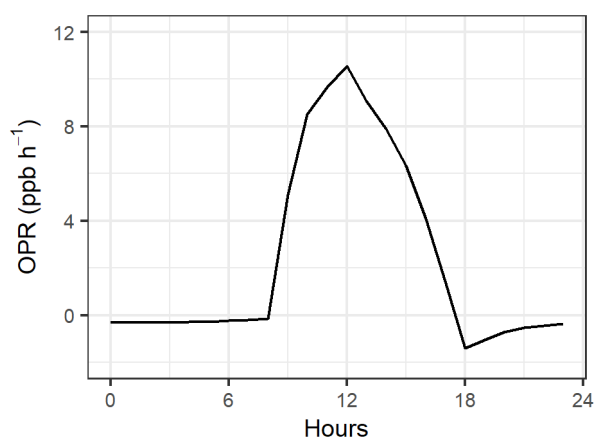
Figure S9. Simulated ozone production rate (OPR at ppb h^{-1}) from 0-D box model.
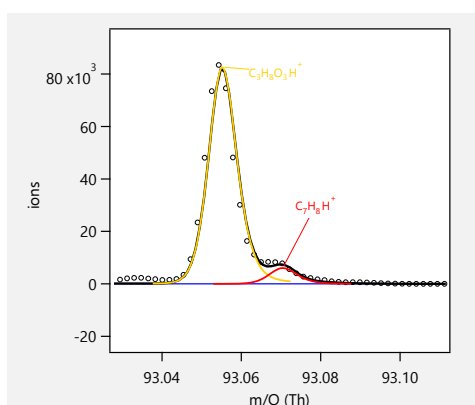
Figure S10. The organic ions at m/z 93. Toluene ion ($C_7H_8H^+$) had a strong neighbor ion, which can be hardly separated by a low-mass resolution mass analyzer.
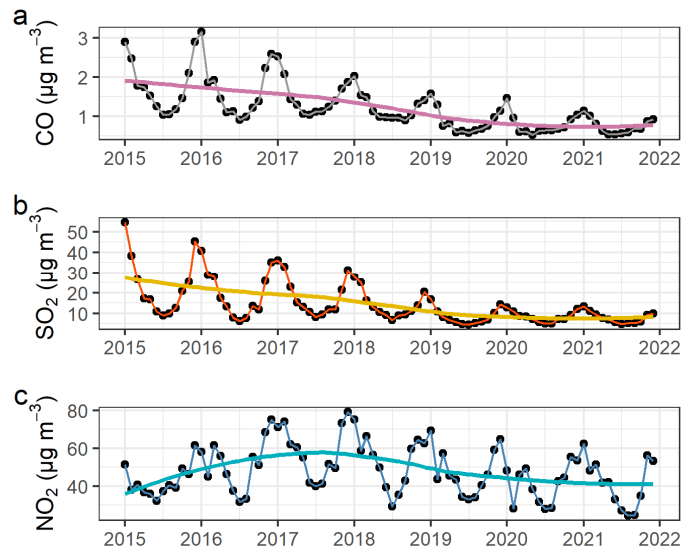
Figure S11. Month means of CO, SO$_2$, and NO$_2$ from 2015 to 2022. The smooth line is fitted using a Locally Weighted Least Squares Regression.
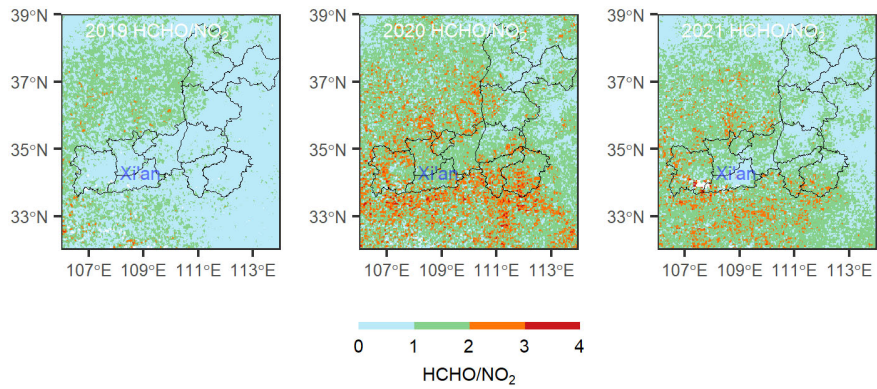
Figure S12. HCHO to NO$_2$ ratios (HCHO/NO$_2$) measured by the TROPOMI satellite instrument in January-February in 2019, 2020, and 2021.

Table S1. Mean and one standard deviation (sd) chemical composition of non-refractory particulate matter (NR-PM$_{2.5}$) and the OA factor for the winter in 2013-2014 and 2019-2021. All in µg m^{-3}.

Species	2013-2014	sd	2019-2021	sd
OA	125.4	78.5	48.1	6.1
Sulfate	52.6	57.7	20.3	9.9
Nitrate	34.9	30.9	17.6	3.0
Ammonium	21.0	9.6	10.2	2.8
Chloride	27.4	30.2	4.5	1.8
OA factors				
Fossil	37.7	16.4	8.8	4.7
Biomass	33.5	29.4	9.3	2.7
Cooking	19.6	12.0	3.1	0.7
OOA	26.3	20.8	23.3	3.2