Supplement of Atmos. Chem. Phys., 25, 2649–2666, 2025
https://doi.org/10.5194/acp-25-2649-2025-supplement

Supplement of

Investigating the response of China's surface ozone concentration to the future changes of multiple factors

Jinya Yang et al.

Correspondence to: Yu Zhao (yuzhao@nju.edu.cn)

Number of tables: 3 Number of figures: 7

Table list

Figure list

Tables

Table S1 Statistical metrics for comparison between the observed and simulated monthly average meteorological variables and MDA8 O_3 in 2020. OBS is mean of observation, SIM is mean of simulation, and Bias is mean bias between SIM and OBS. R, NMB, NME and IOA refers to the correlation coefficient, normalized mean bias, normalized mean error and index of agreement between SIM and OBS, respectively.

Variables		OBS	SIM	Bias	R	NMB	NME	IOA
T2 (°C)		13.21	12.53	−0.69	0.96	−5.20 %	17.65 %	0.98
WS (m s^{-1})		2.60	4.02	1.41	0.51	54.21 %	60.04 %	0.57
WD (°)		175.75	174.78	−0.97	0.51	−0.55 %	18.40 %	0.72
RH (%)		65.25	66.17	0.92	0.78	1.41 %	12.78 %	0.88
MDA8 O_3 (ppb)	Warm season	57.45	65.56	8.11	0.71	14.12 %	16.33 %	0.74
	Non-warm season	38.67	42.88	4.21	0.32	10.90 %	25.48 %	0.49

Table S2 Comparison of BVOCs estimates between this study and previous estimations.

Species	Period	Annual emission (Tg)	Reference
Total BVOCs	2020s	33.55	This study
	2015–2019	29.28±0.91	Ma et al. (2021)
	2015–2019	31.42±0.95	Ma et al. (2021)
	2008–2018	54.60	Li et al. (2020)
	2001–2016	34.27	Wang et al. (2021)
	2017	23.54	Wu et al. (2020)
Isoprene	2020s	21.08	This study
	2015–2019	13.88±0.57	Ma et al. (2021)
	2015–2019	14.29±0.54	Ma et al. (2021)
	2008–2018	29.30	Li et al. (2020)
	2001–2016	15.94	Wang et al. (2021)
	2017	13.30	Wu et al. (2020)
Terpenes	2020s	3.30	This study
	2015–2019	5.28±0.12	Ma et al. (2021)
	2015–2019	4.77±0.11	Ma et al. (2021)
	2017	3.09	Wu et al. (2020)

Table S3 Coefficients of variation (CVs) for simulated O_3 concentrations within five-year simulations for the whole country (CHN) and selected developed regions (BTH, YRD, and PRD).

Simulation	Warm Season				Non-warm Season			
	CHN	BTH	YRD	PRD	CHN	BTH	YRD	PRD
2020s	2.6 %	5.7 %	1.8 %	4.0 %	1.4 %	0.9 %	2.7 %	3.8 %
2060s	1.5 %	4.0 %	2.2 %	5.6 %	0.8 %	1.3 %	2.1 %	3.4 %
CLIM	1.9 %	5.9 %	2.5 %	6.5 %	1.1 %	1.6 %	4.1 %	3.8 %
EMIS	2.2 %	3.3 %	2.2 %	3.7 %	1.4 %	1.4 %	1.5 %	2.5 %
BVOC	2.6 %	5.0 %	2.0 %	4.3 %	1.4 %	1.0 %	2.3 %	3.4 %
SURR	2.7 %	5.8 %	1.7 %	4.1 %	1.5 %	0.9 %	2.7 %	3.9 %

Figures

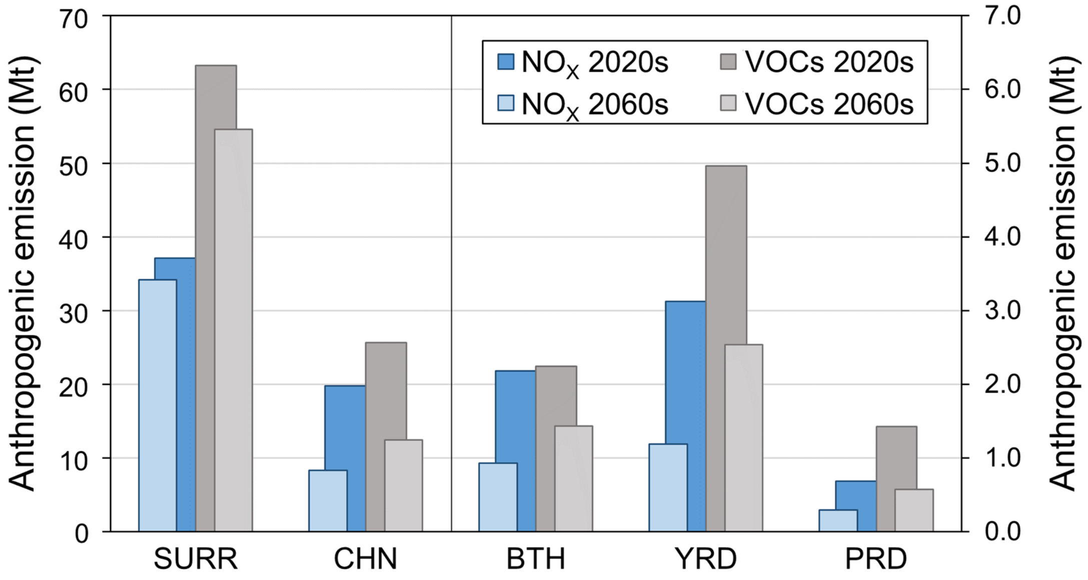

Figure S1 The NO_x and NMVOCs emissions in 2020 and 2060 for the surrounding areas within the modelling domain but excluding Chinese mainland (SURR), Chinese mainland (CHN), as well as the three regions. Data illustrated are obtained from MEIC for 2020 and DPEC for 2060 within Chinese mainland, and SSP dataset for the rest.

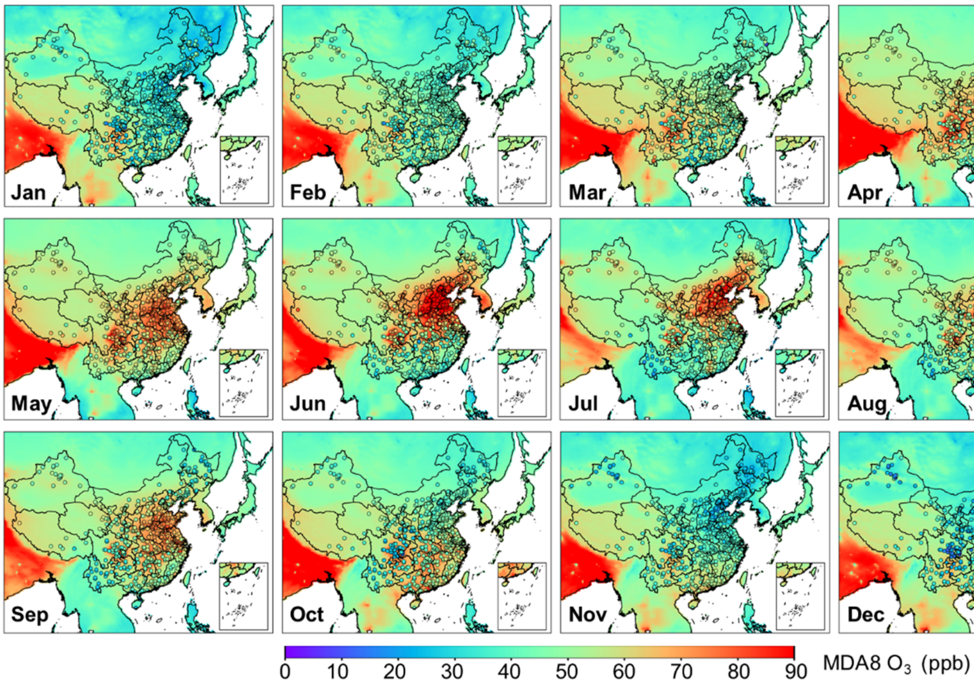

Figure S2 Spatial distribution of the observation (circles) and simulation (shaded) of monthly average MDA8 O_3 in 2020 across China.

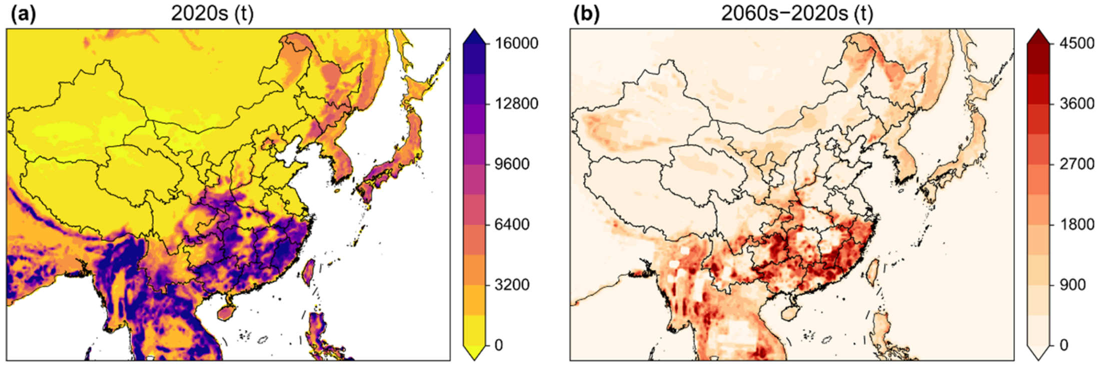

Figure S3 The spatial distribution of BVOCs emissions of the 2020s and the difference between the 2060s and 2020s.

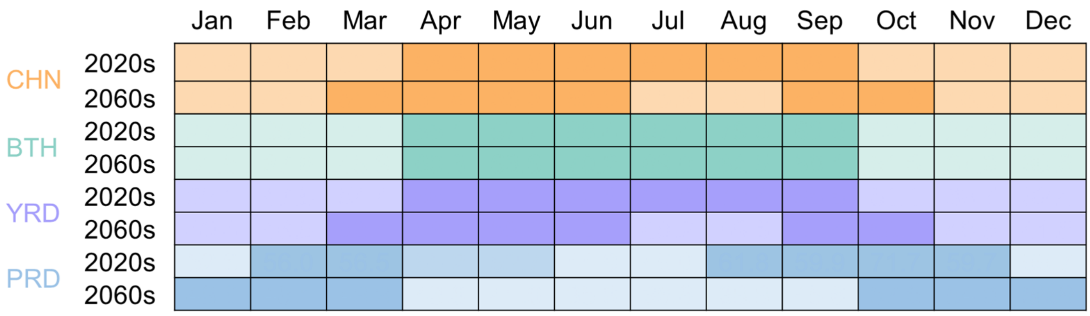

Figure S4 The distribution of O_3 seasons across China and the three regions, and the top six months with the highest levels of O_3 pollution are covered by darker color. Note that there is discrepancy between simulation and observation in PRD for 2020s. February and March are simulated as two of the six most polluted months, while the observation indicates April and May.

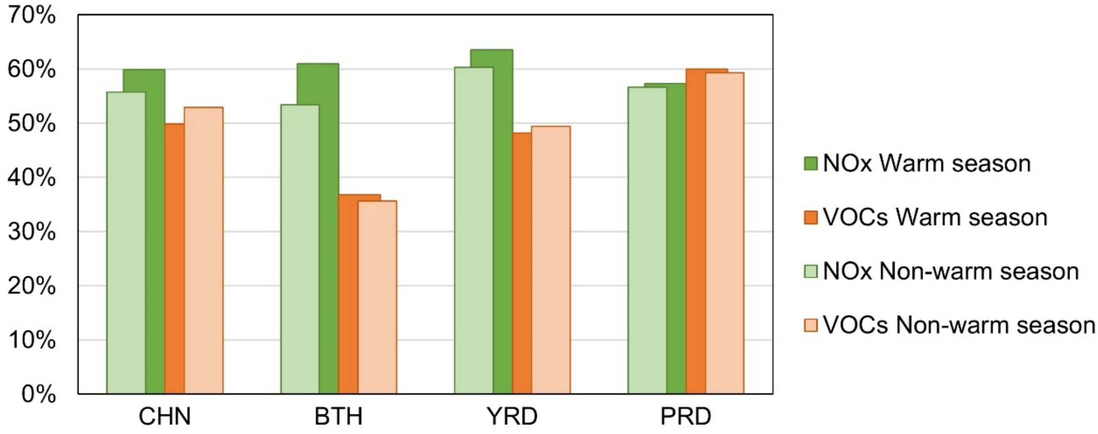

Figure S5 The emission reduction rates for the two precursors during 2020 and 2060 over China and the three regions.

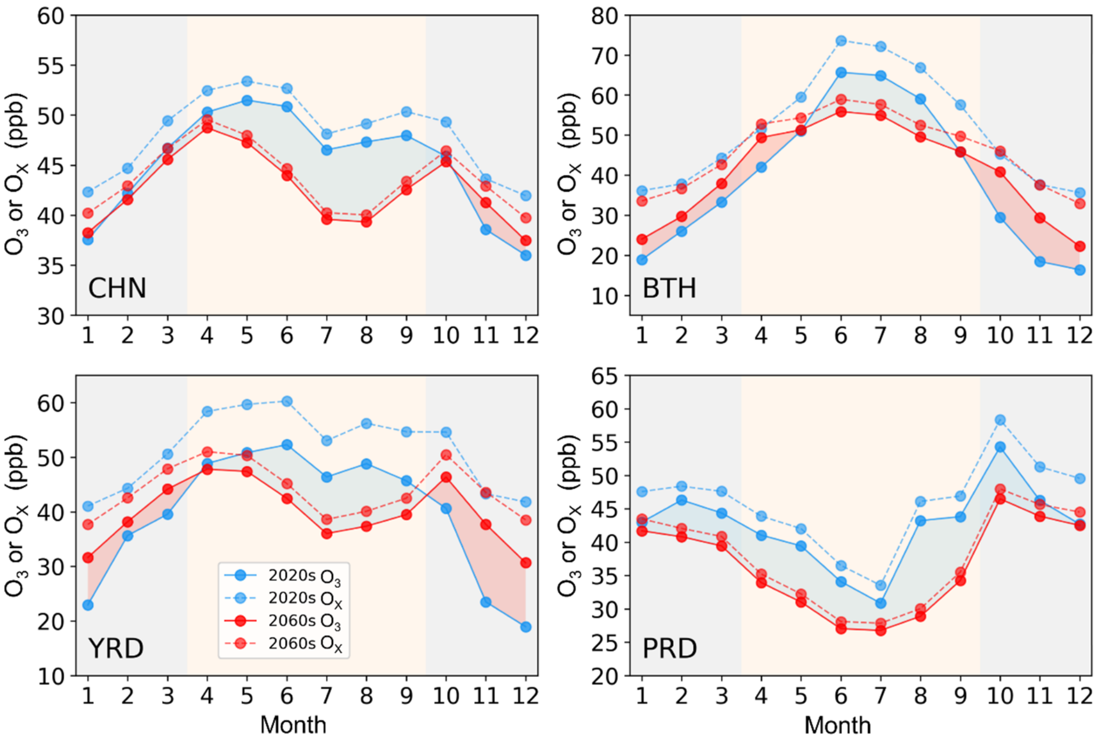

Figure S6 Simulation and projection of hourly O_3 and O_x in the 2020s and 2060s over China and the three regions.

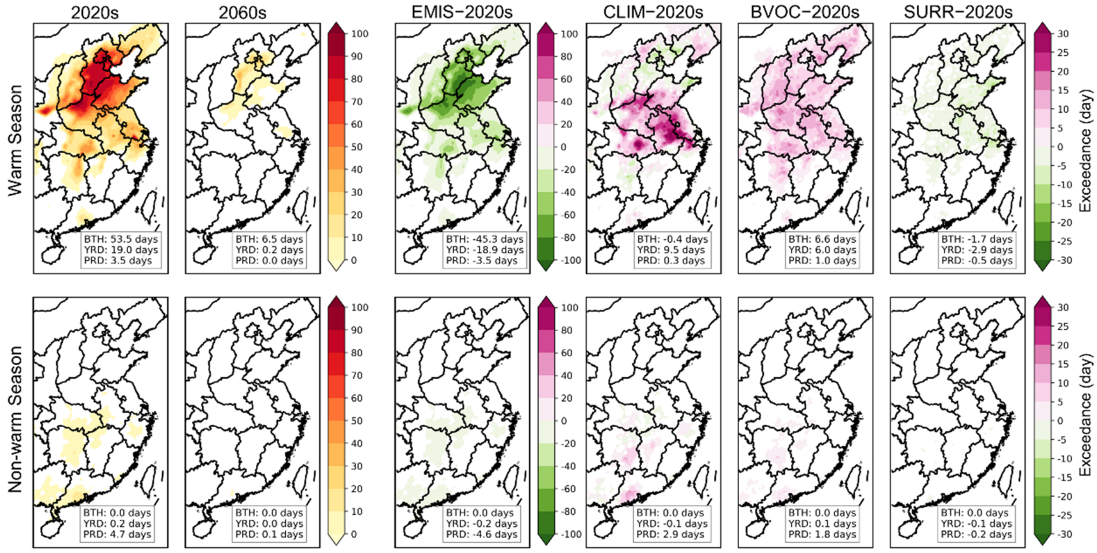

Figure S7 Projected seasonal O_3 exceedance over the east of China in the 2020s and 2060s, and the exceedance changes when the four factors at 2060s level.

References

Li, L., Yang, W., Xie, S., and Wu, Y.: Estimations and uncertainty of biogenic volatile organic compound emission inventory in China for 2008-2018, Science of the Total Environment, 733, 139301, 10.1016/j.scitotenv.2020.139301, 2020.

Ma, M., Gao, Y., Ding, A., Su, H., Liao, H., Wang, S., Wang, X., Zhao, B., Zhang, S., Fu, P., Guenther, A. B., Wang, M., Li, S., Chu, B., Yao, X., and Gao, H.: Development and Assessment of a High-Resolution Biogenic Emission Inventory from Urban Green Spaces in China, Environmental Science & Technology, 10.1021/acs.est.1c06170, 2021.

Wang, H., Wu, Q., Guenther, A. B., Yang, X., Wang, L., Xiao, T., Li, J., Feng, J., Xu, Q., and Cheng, H.: A long-term estimation of biogenic volatile organic compound (BVOC) emission in China from 2001–2016: the roles of land cover change and climate variability, Atmospheric Chemistry and Physics, 21, 4825-4848, 10.5194/acp-21-4825-2021, 2021.

Wu, K., Yang, X., Chen, D., Gu, S., Lu, Y., Jiang, Q., Wang, K., Ou, Y., Qian, Y., Shao, P., and Lu, S.: Estimation of biogenic VOC emissions and their corresponding impact on ozone and secondary organic aerosol formation in China, Atmospheric Research, 231, 10.1016/j.atmosres.2019.104656, 2020.