

Supplementary

Table S1. Data sets used in this study.

Dataset	Type	Unit	Spatial resolution	Temporal resolution	Source
Surface PM _{2.5}	Surface	$\mu\text{g m}^{-3}$	1km×1km	Daily	Bai et al. (2022)
Surface ozone	Surface	$\mu\text{g m}^{-3}$	0.1°×0.1°	Daily	Ma et al.(2023)
Surface SO ₂	Surface	$\mu\text{g m}^{-3}$	0.1°×0.1°	Daily	Ma et al.(2023)
Surface NO ₂	Surface	$\mu\text{g m}^{-3}$	0.1°×0.1°	Daily	Ma et al.(2023)
HCHO	total column formaldehyde	kg m^{-2}	0.75°×0.75°	3-hour	CAMS
hydrogen peroxide	total column peroxyacetyl nitrate	kg m^{-2}	0.75°×0.75°	3-hour	CAMS
isoprene	total column isoprene	kg m^{-2}	0.75°×0.75°	3-hour	CAMS
Peroxyacetyl nitrate	total column peroxyacetyl nitrate	kg m^{-2}	0.75°×0.75°	3-hour	CAMS
hydroxyl radicals	total column hydroxyl radicals	kg m^{-2}	0.75°×0.75°	3-hour	CAMS
methane	total column methane	kg m^{-2}	0.75°×0.75°	3-hour	CAMS
propane	total column propane	kg m^{-2}	0.75°×0.75°	3-hour	CAMS
CAMS NO _x anthropogenic emissions	/	$\text{kg m}^{-2} \text{s}^{-1}$	0.1°×0.1°	Monthly	CAMS
CAMS SO _x anthropogenic emissions	/	$\text{kg m}^{-2} \text{s}^{-1}$	0.1°×0.1°	Monthly	CAMS
Surface temperature	Surface 2m	K	0.1°×0.1°	1-hour	ERA5
Surface UV radiation	Integrated	J m^{-2}	0.1°×0.1°	1-hour	ERA5
Relative humidity	1000 hpa	%	0.1°×0.1°	1-hour	ERA5
Surface pressure	Surface	Pa	0.1°×0.1°	1-hour	ERA5
Boundary layer height	Integrated	m	0.1°×0.1°	1-hour	ERA5
Wind speed	Surface 10m	m s^{-1}	0.1°×0.1°	1-hour	ERA5
Wind direction	Surface 10m	°	0.1°×0.1°	1-hour	ERA5
Total cloud cover	Integrated	%	0.1°×0.1°	1-hour	ERA5
Land cover	Surface	/	1km×1km	Yearly	Yang and Huang (2021)
Population	/	/	1km×1km	Yearly	CRESDC
NDVI	Surface	/	0.05°×0.05°	16-day	MODIS
AOD	/	/	1km×1km	Daily	Bai et al. (2022)
Aerosol component	Integrated	kg m^{-3}	0.5°×0.625°	1-hour	MERRA-2

Figures: S1–S21

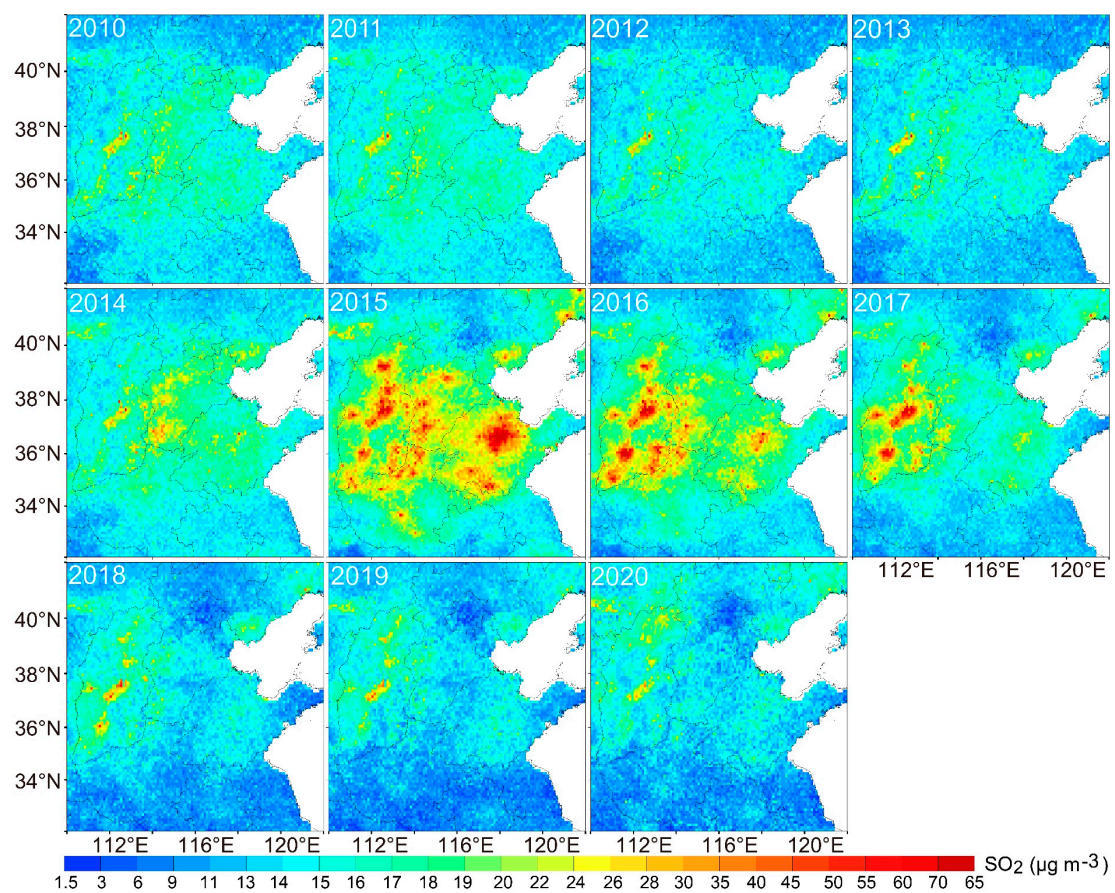


Figure S1. The spatial distribution of annual SO₂ concentration in the NCP during 2010–2020.

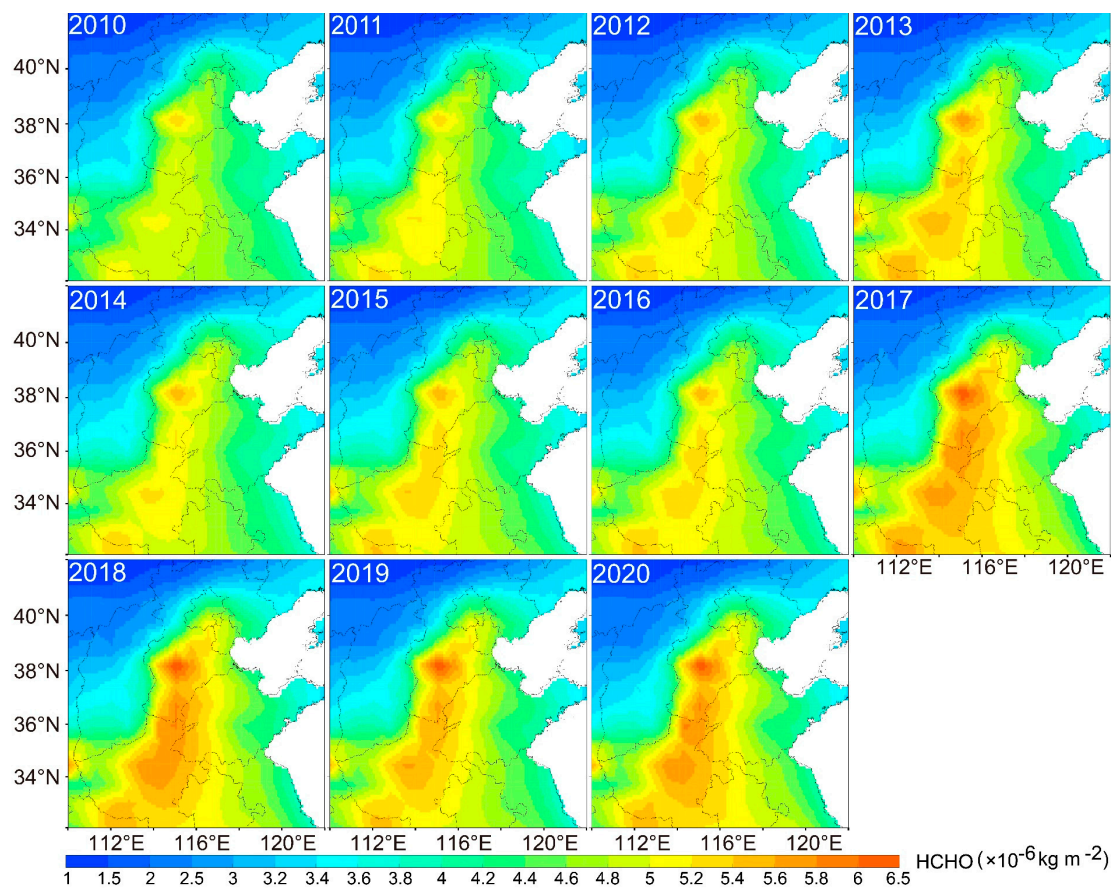


Figure S2. The spatial distribution of annual HCHO concentration in the NCP during 2010-2020.

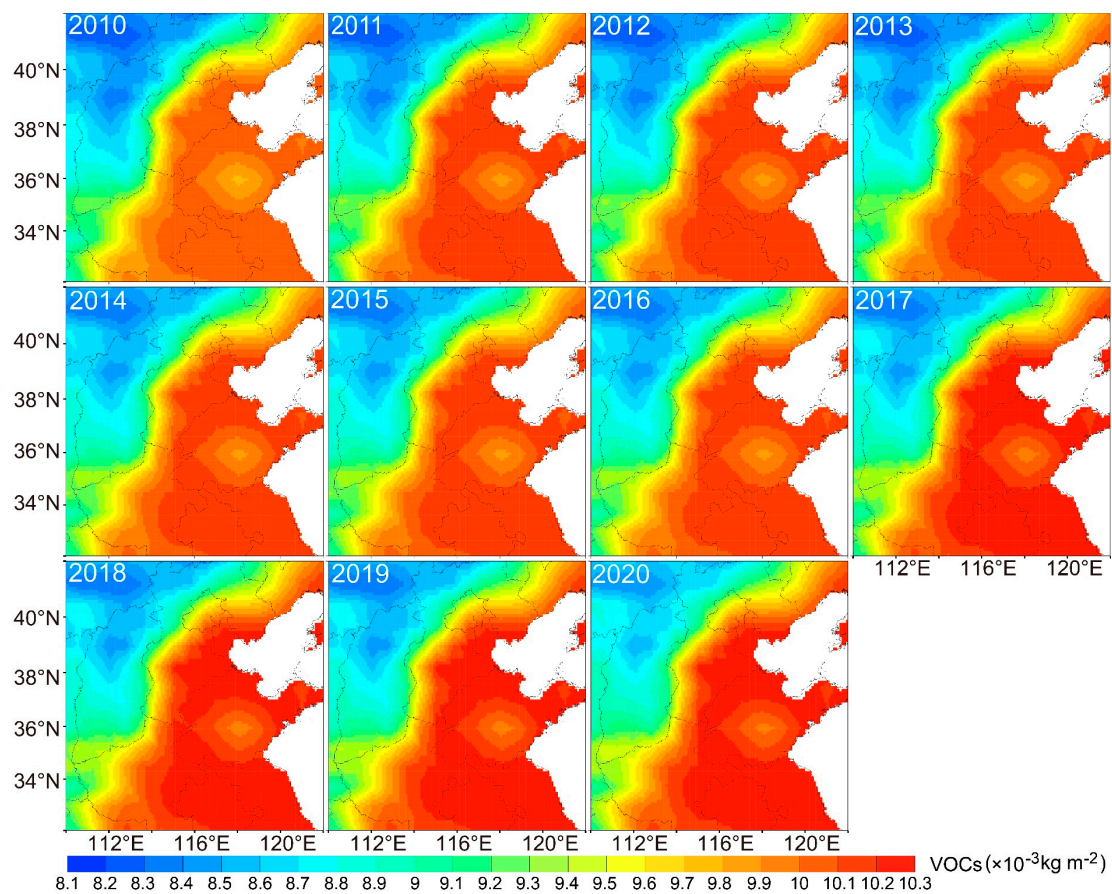


Figure S3. The spatial distribution of annual VOCs concentration in the NCP during 2010-2020.

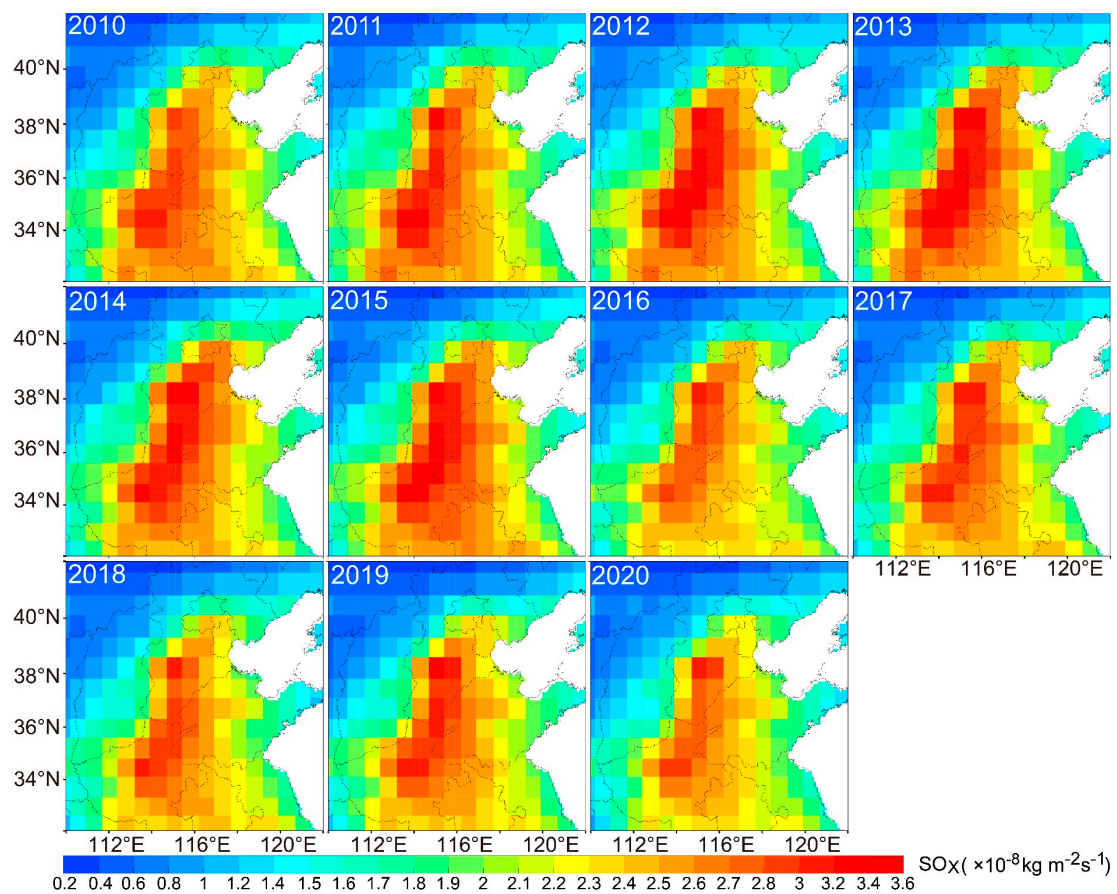


Figure S4. The spatial distribution of annual SO_x concentration in the NCP during 2010-2020.

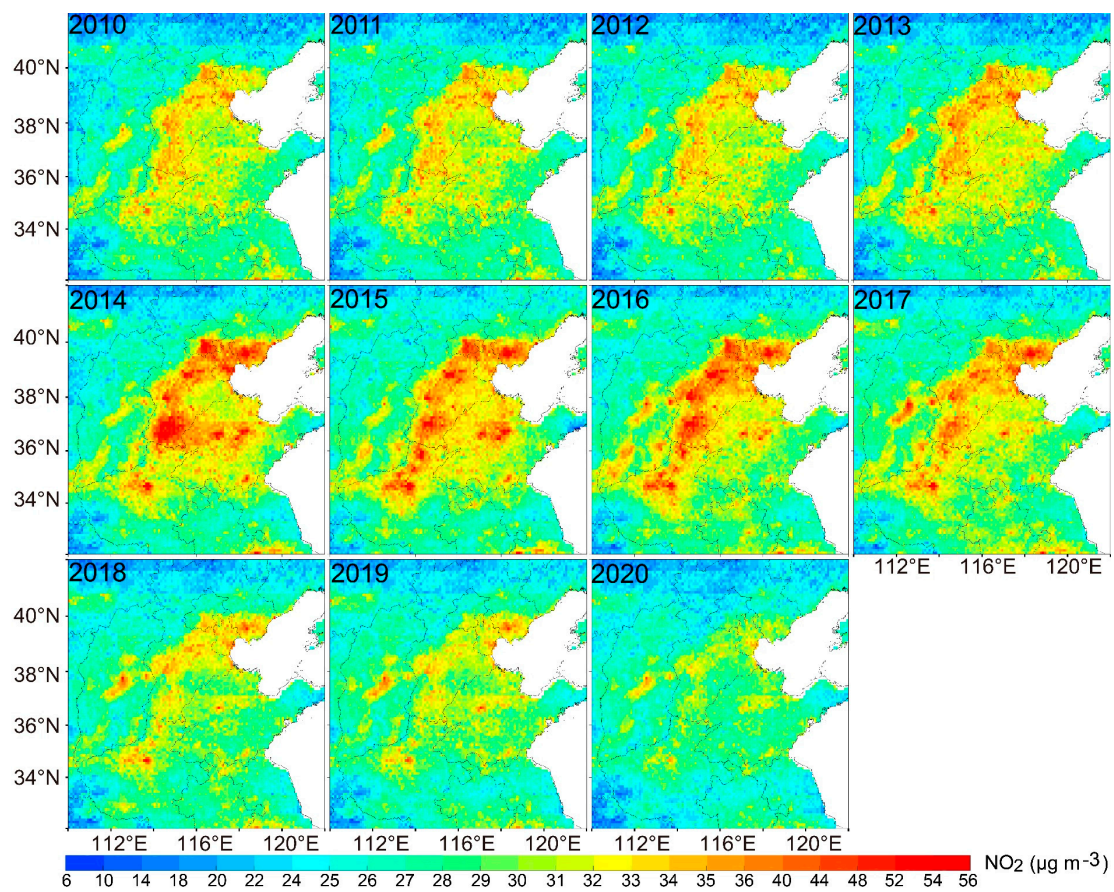


Figure S5. The spatial distribution of annual NO_2 concentration in the NCP during 2010-2020.

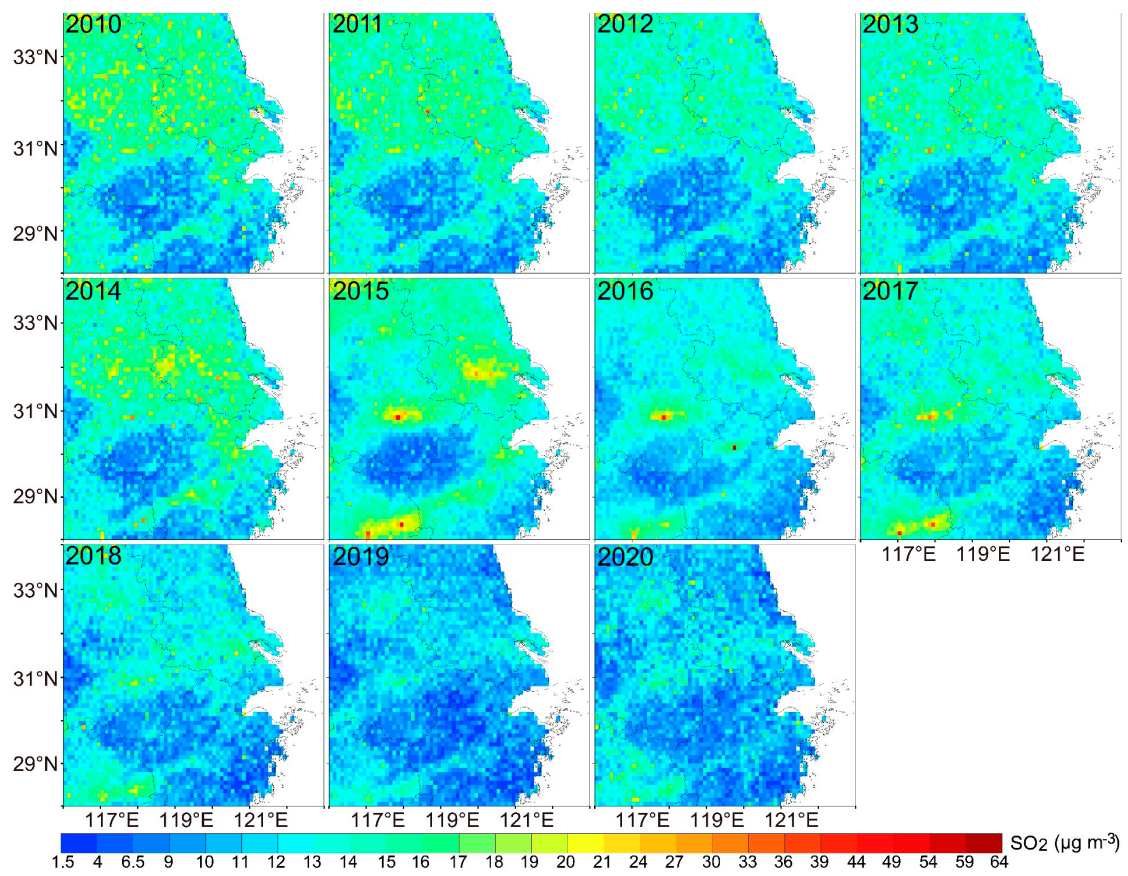


Figure S6. The spatial distribution of annual SO_2 concentration in the YRD during 2010-2020.

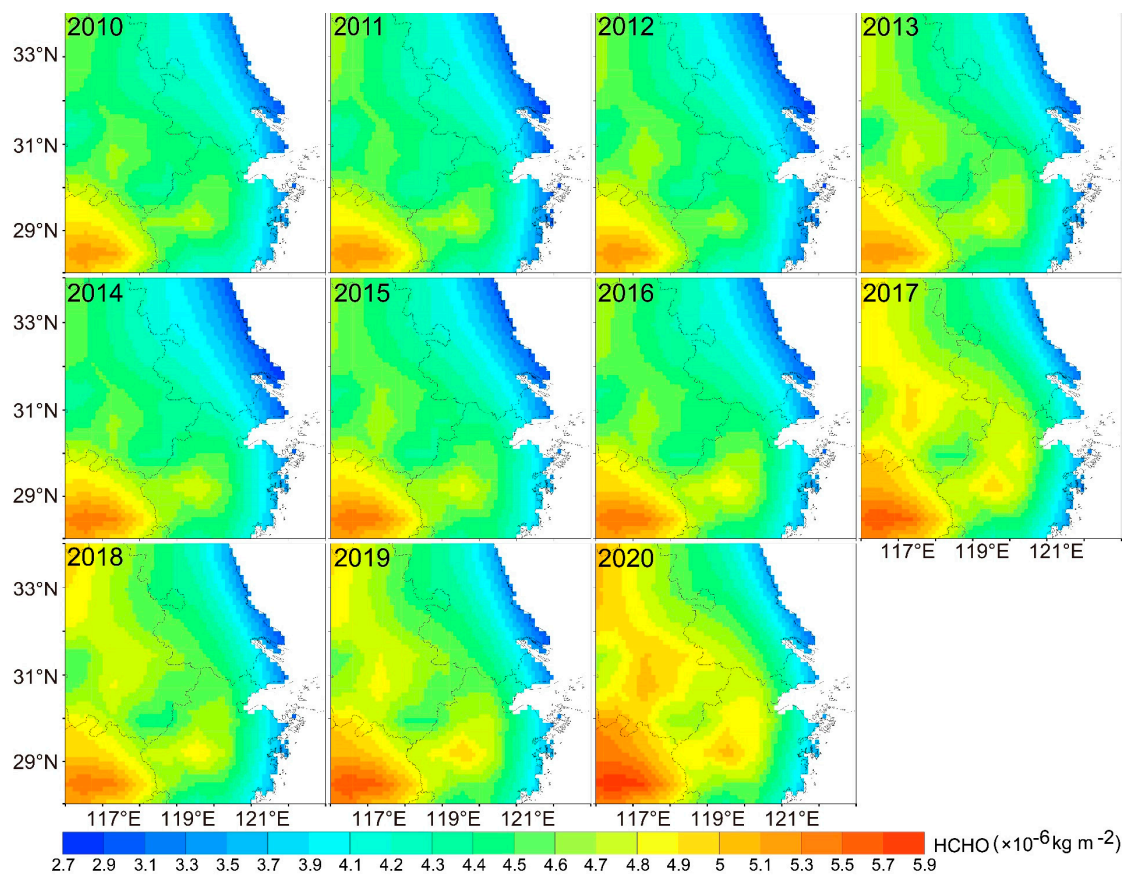


Figure S7. The spatial distribution of annual HCHO concentration in the YRD during 2010-2020.

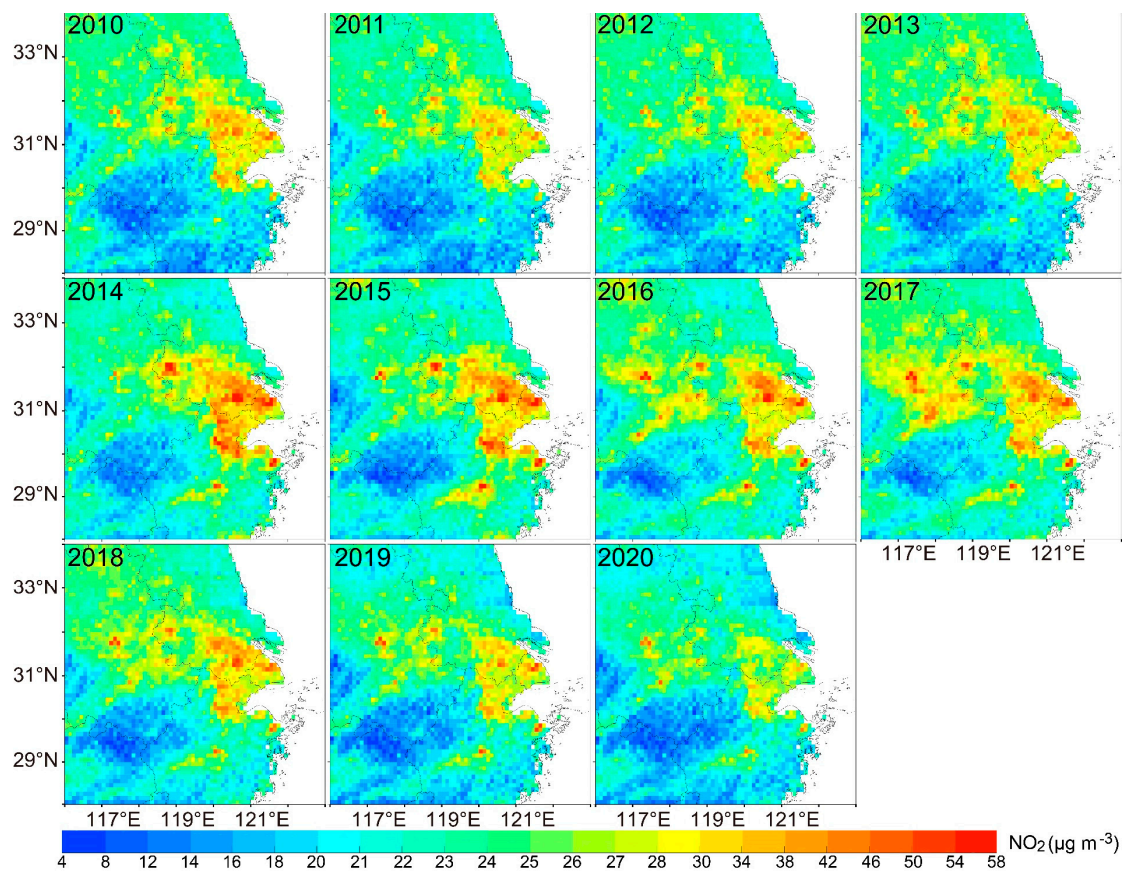


Figure S8. The spatial distribution of annual NO_2 concentration in the YRD during 2010-2020.

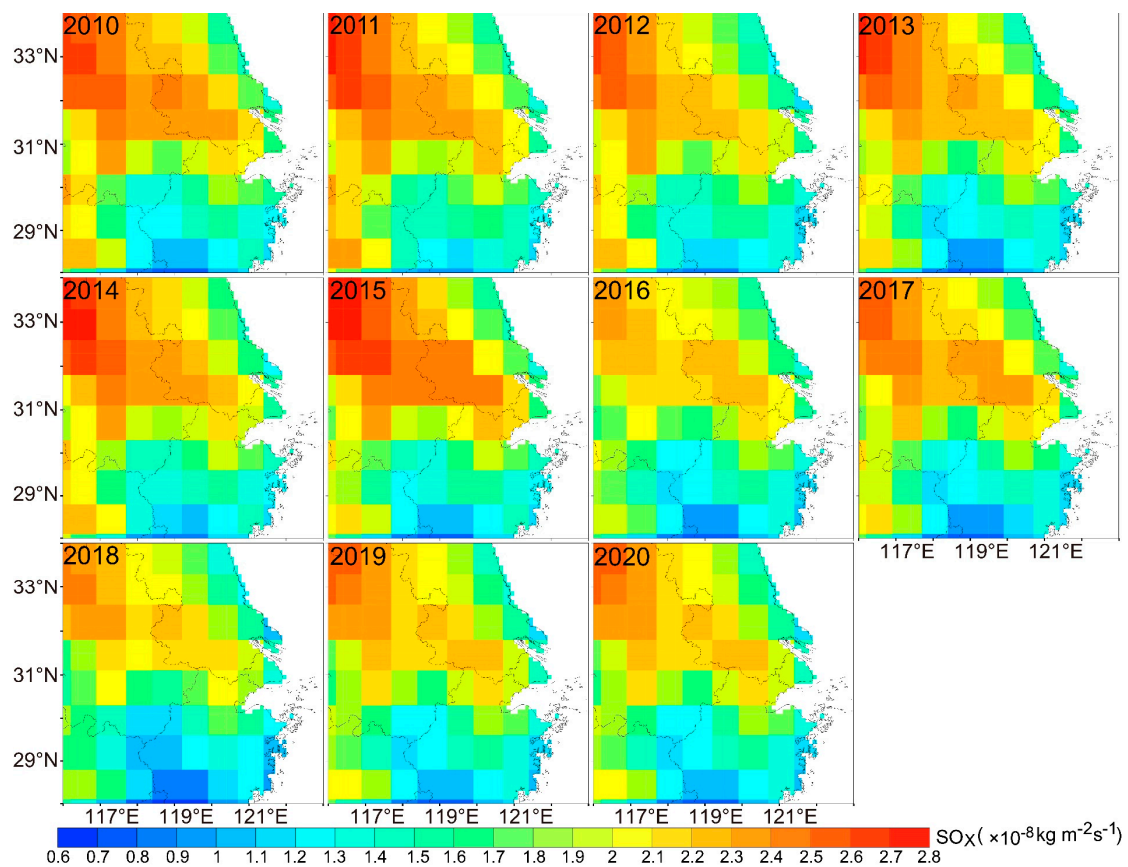


Figure S9. The spatial distribution of annual SO_x concentration in the YRD during 2010-2020.

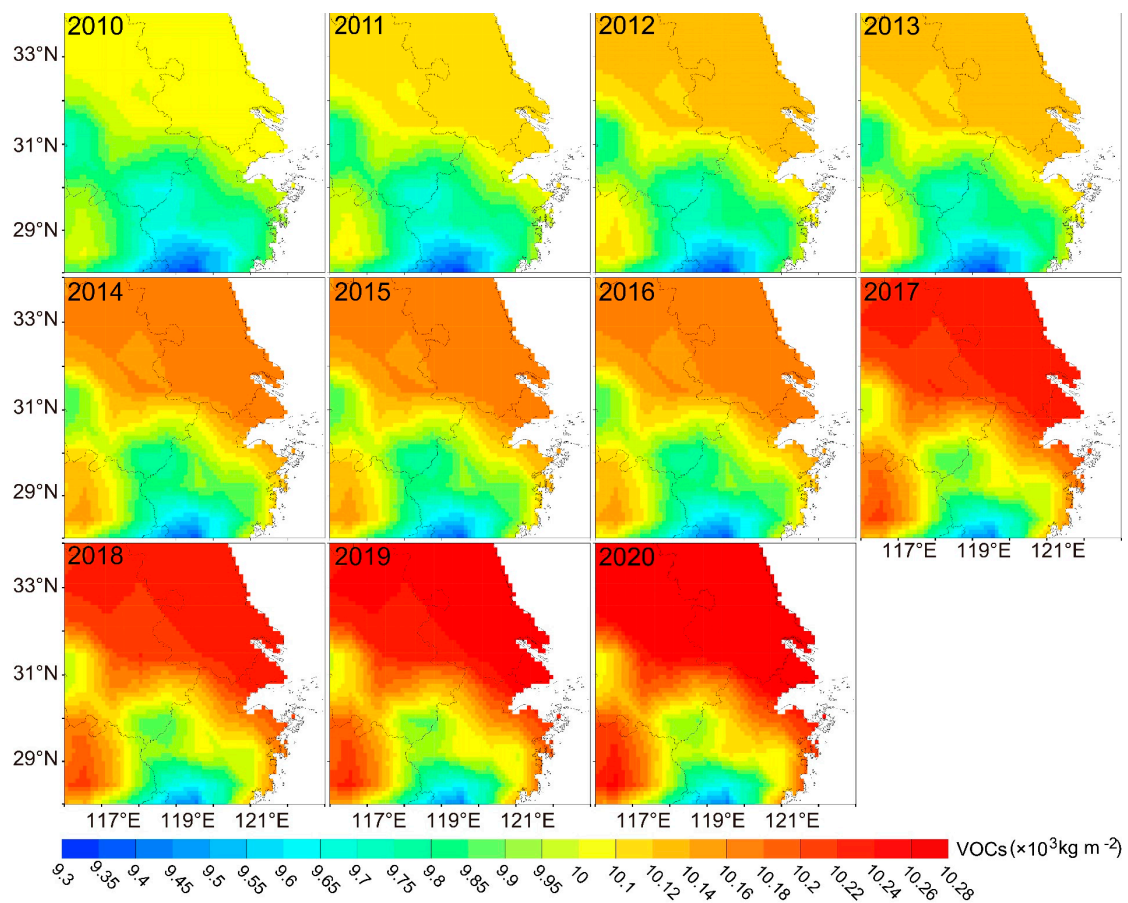


Figure S10. The spatial distribution of annual VOCs concentration in the YRD during 2010-2020.

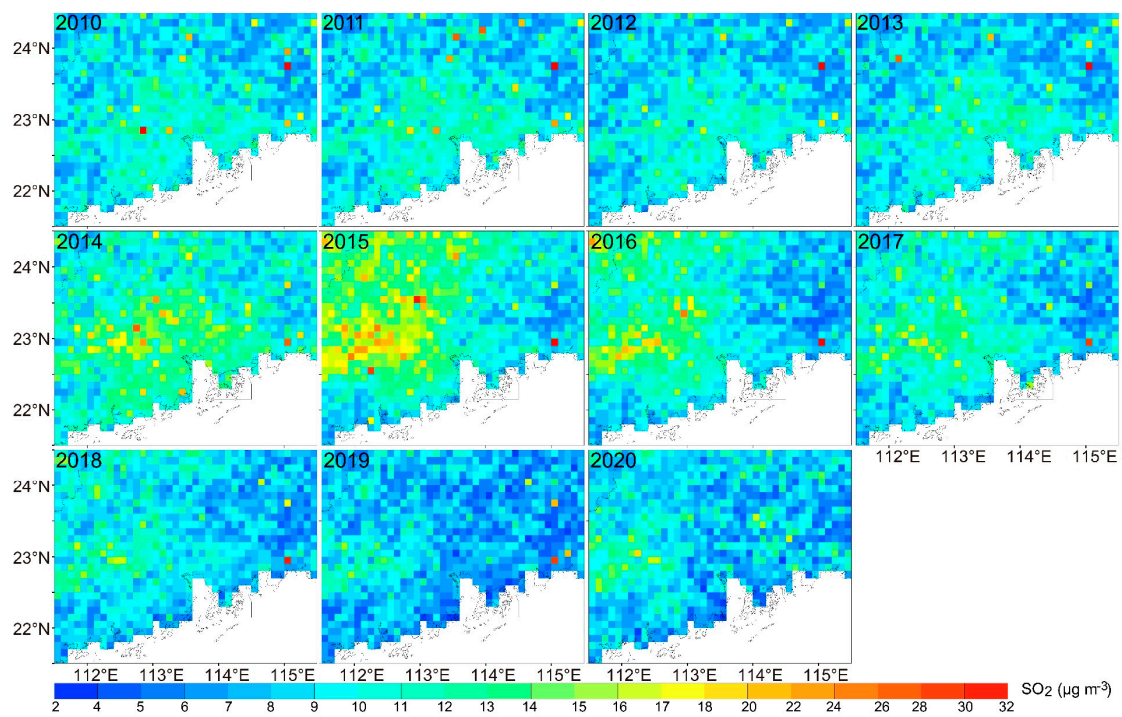


Figure S11. The spatial distribution of annual SO_2 concentration in the PRD during 2010-2020.

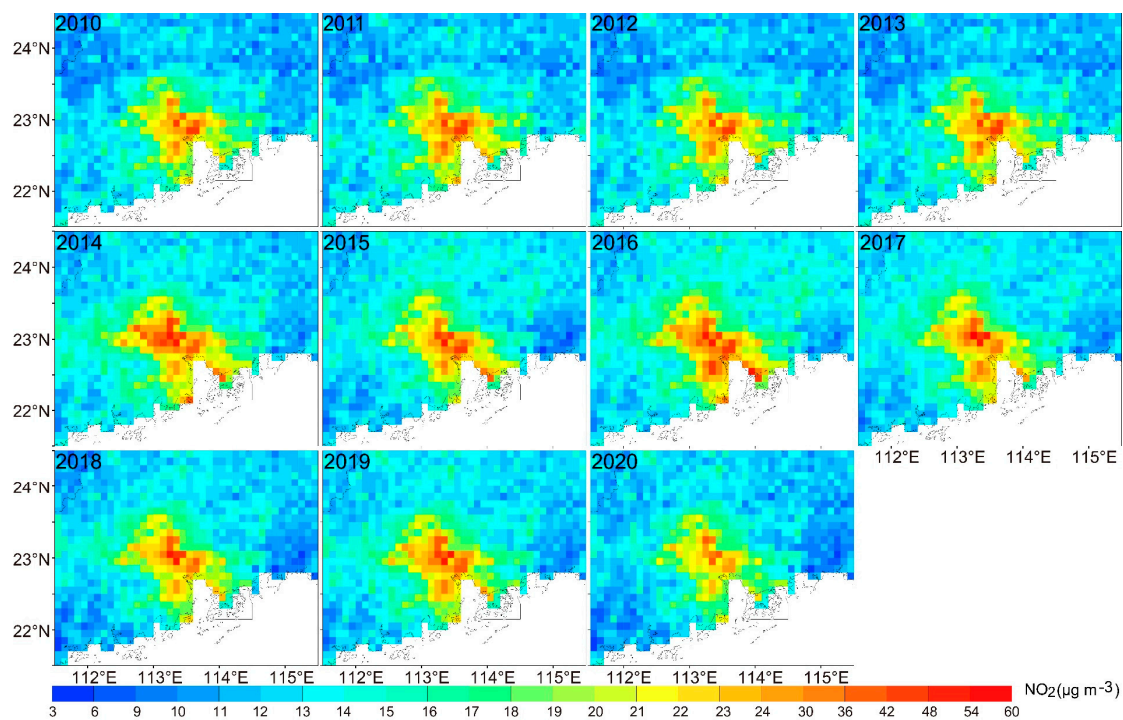


Figure S12. The spatial distribution of annual NO_2 concentration in the PRD during 2010-2020.

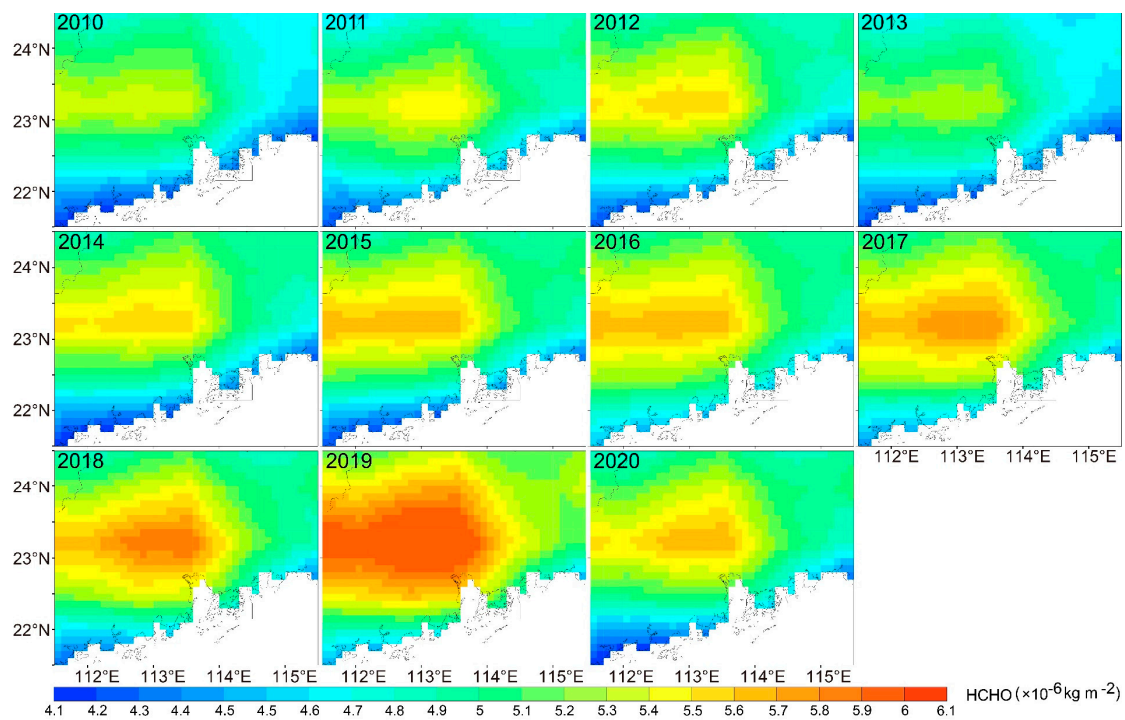


Figure S13. The spatial distribution of annual HCHO concentration in the PRD during 2010-2020.

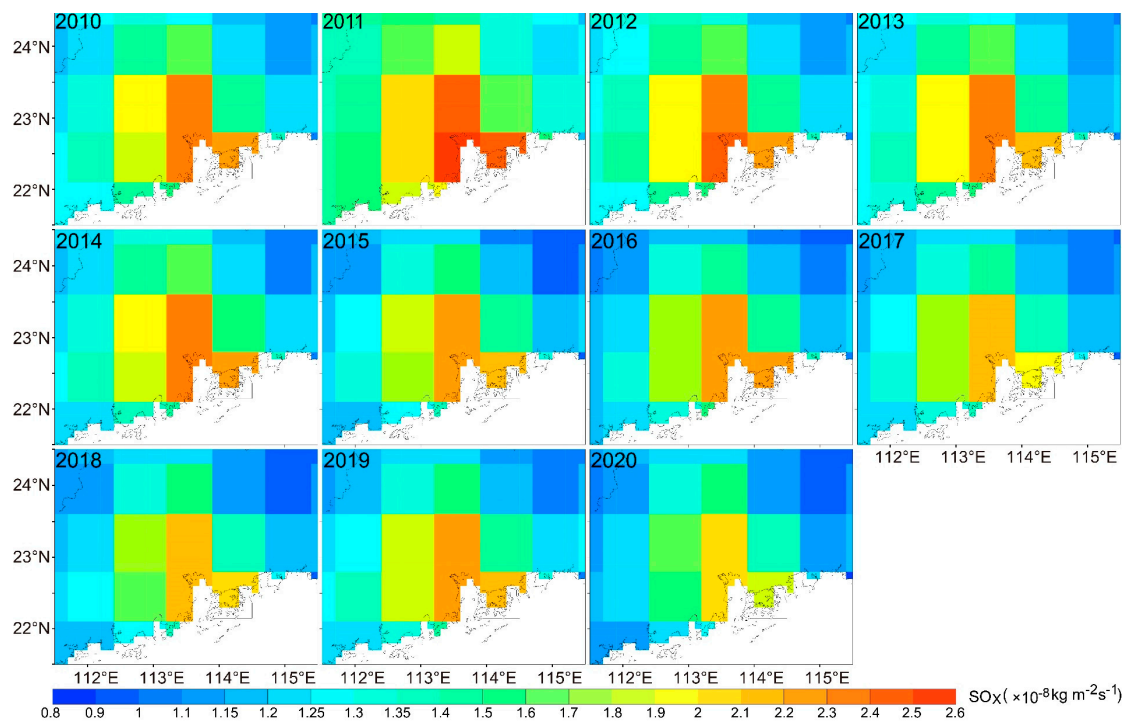


Figure S14. The spatial distribution of annual SO_x concentration in the PRD during 2010-2020.

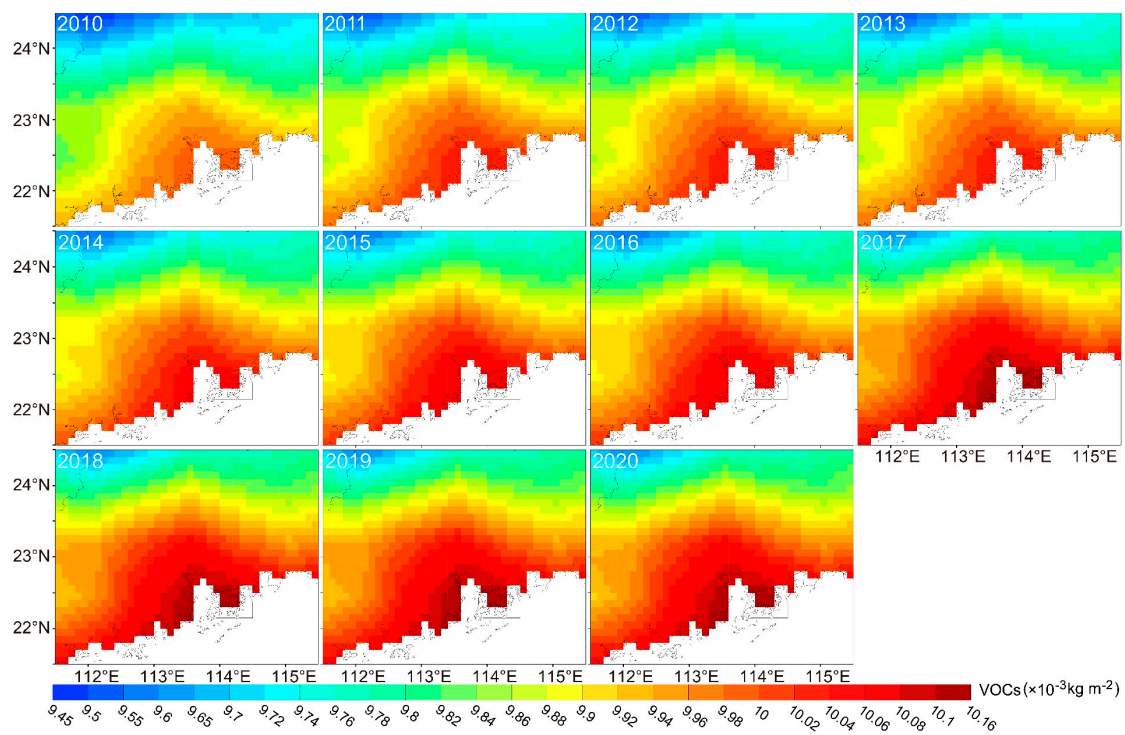


Figure S15. The spatial distribution of annual VOCs concentration in the PRD during 2010-2020.

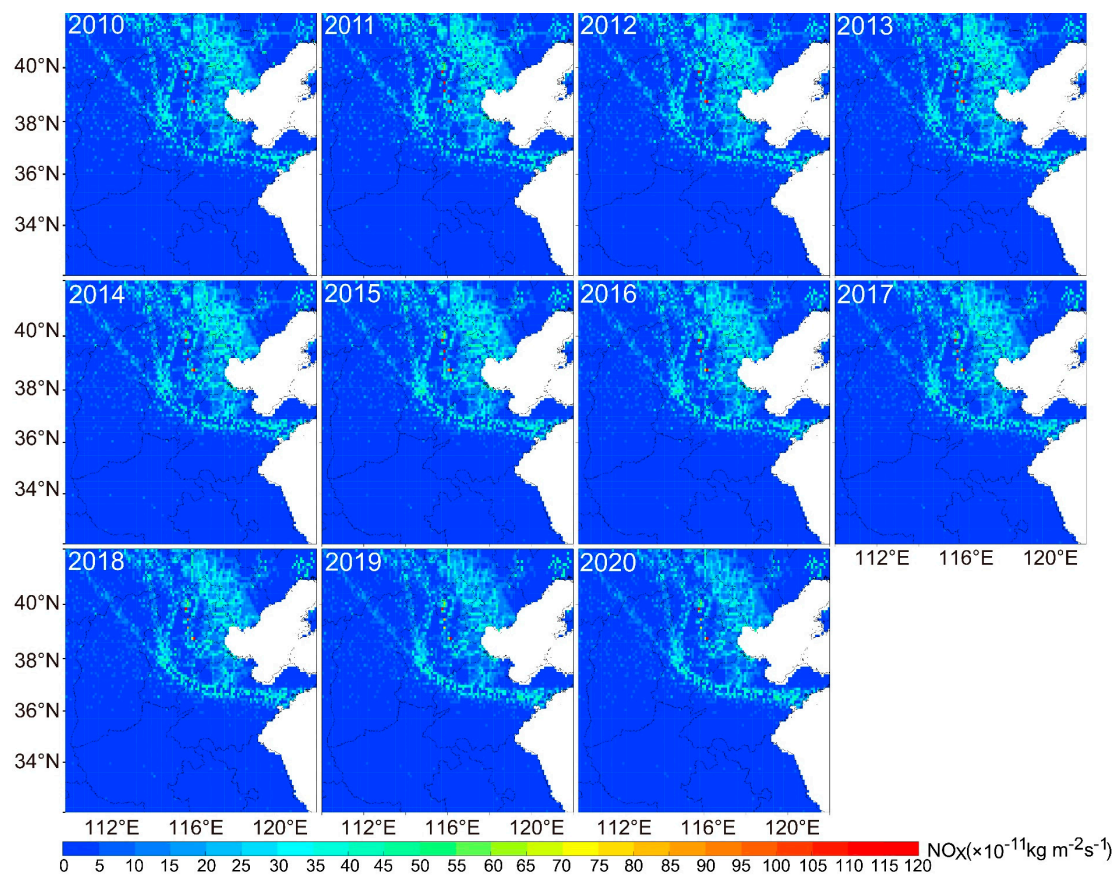


Figure S16. The spatial distribution of annual NO_x concentration in the NCP during 2010-2020.

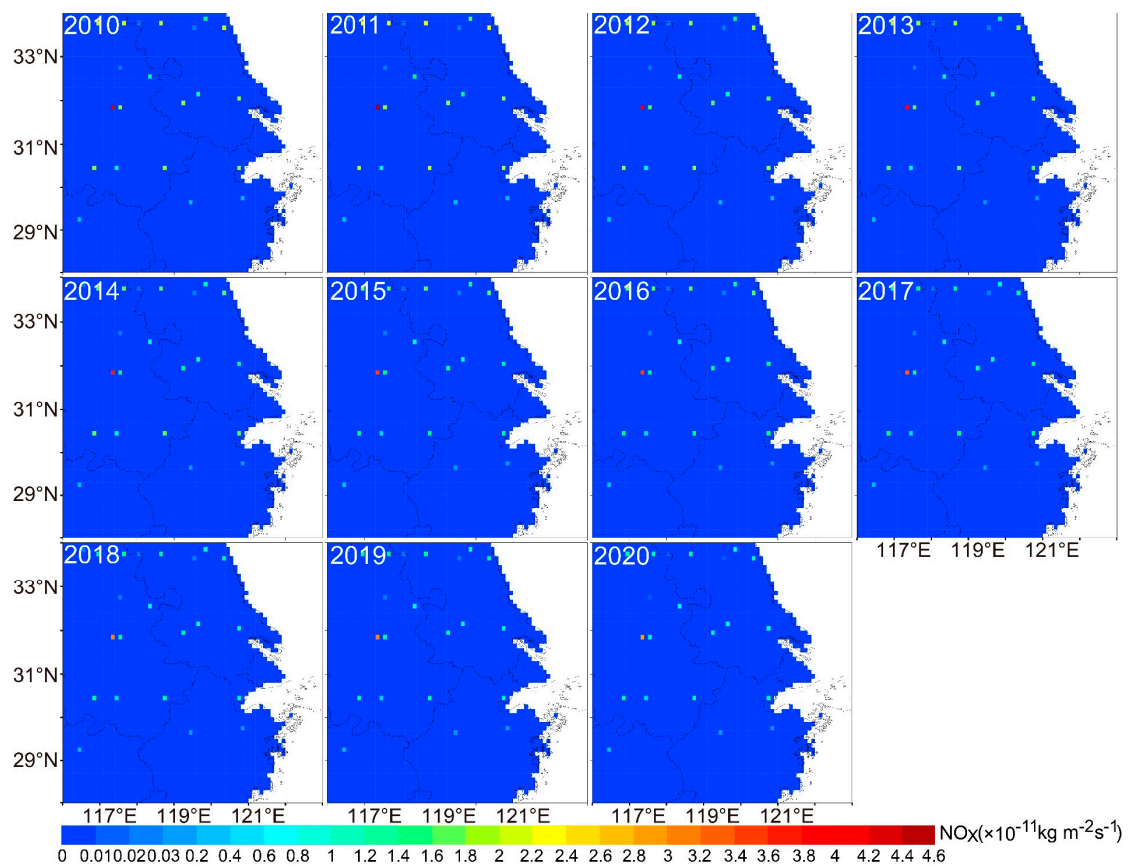


Figure S17. The spatial distribution of annual NO_x concentration in the YRD during 2010-2020.

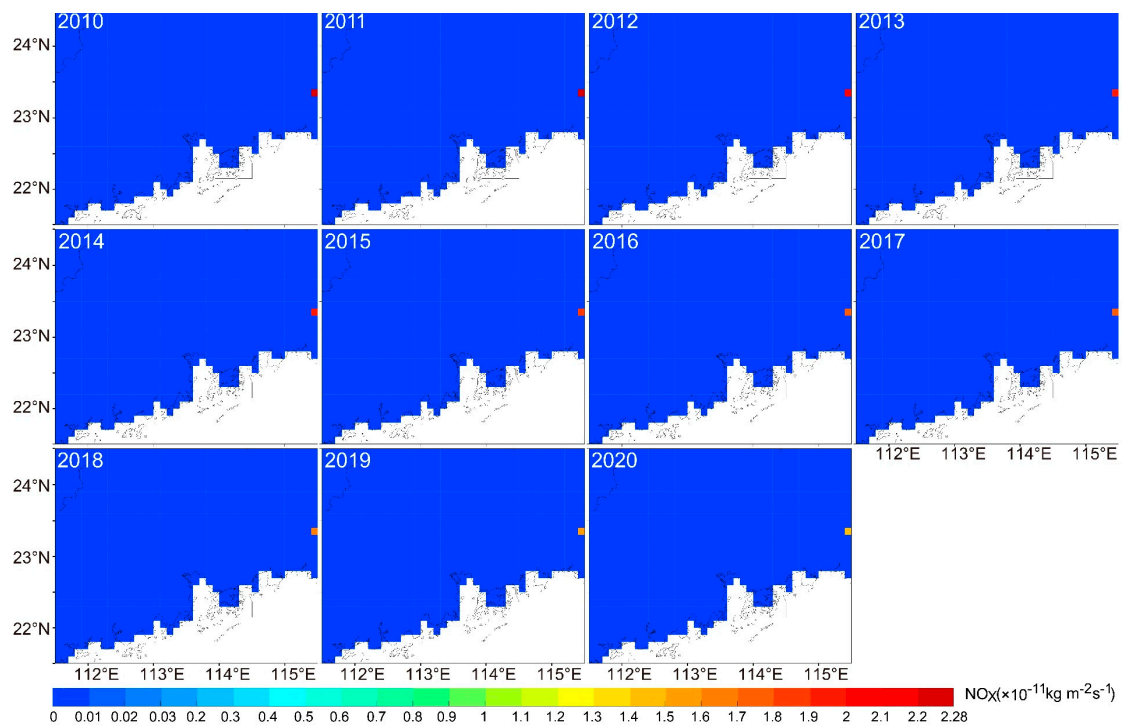


Figure S18. The spatial distribution of annual NO_x concentration in the PRD during 2010–2020.

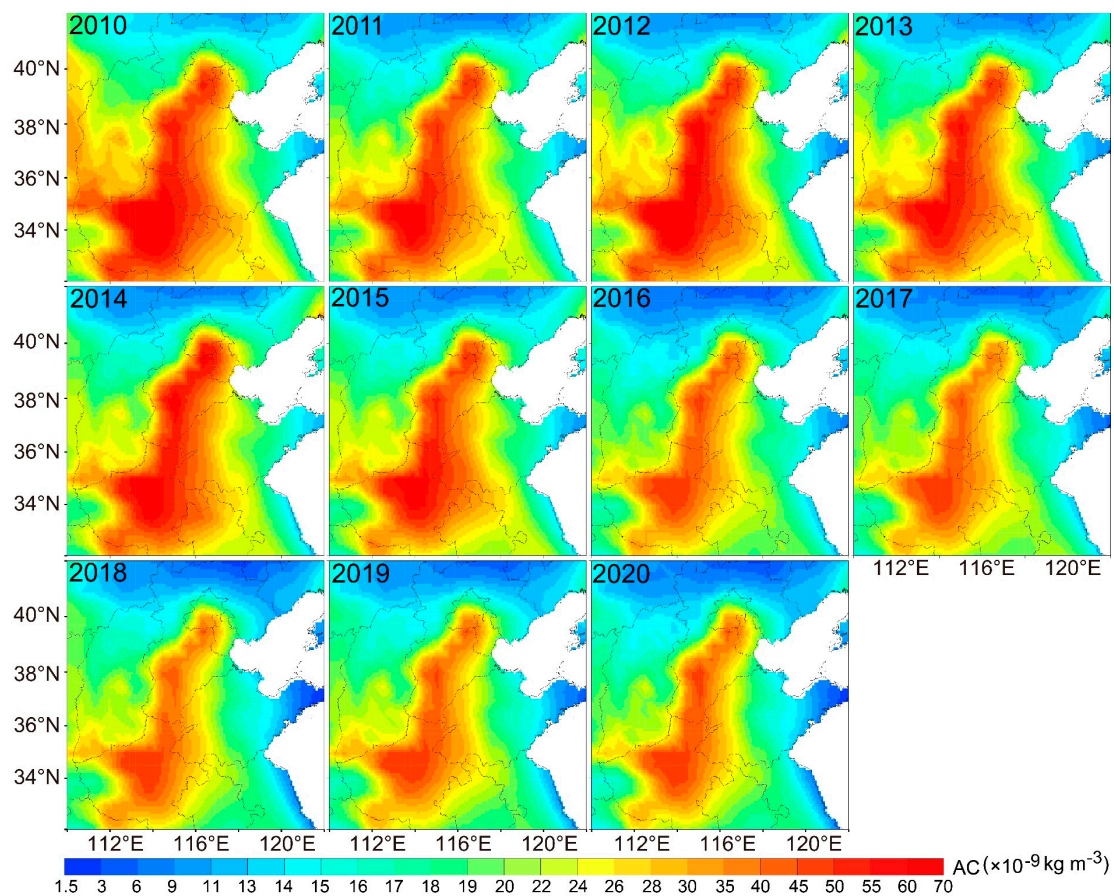


Figure S19. The spatial distribution of annual aerosol component concentration in the NCP during 2010-2020.

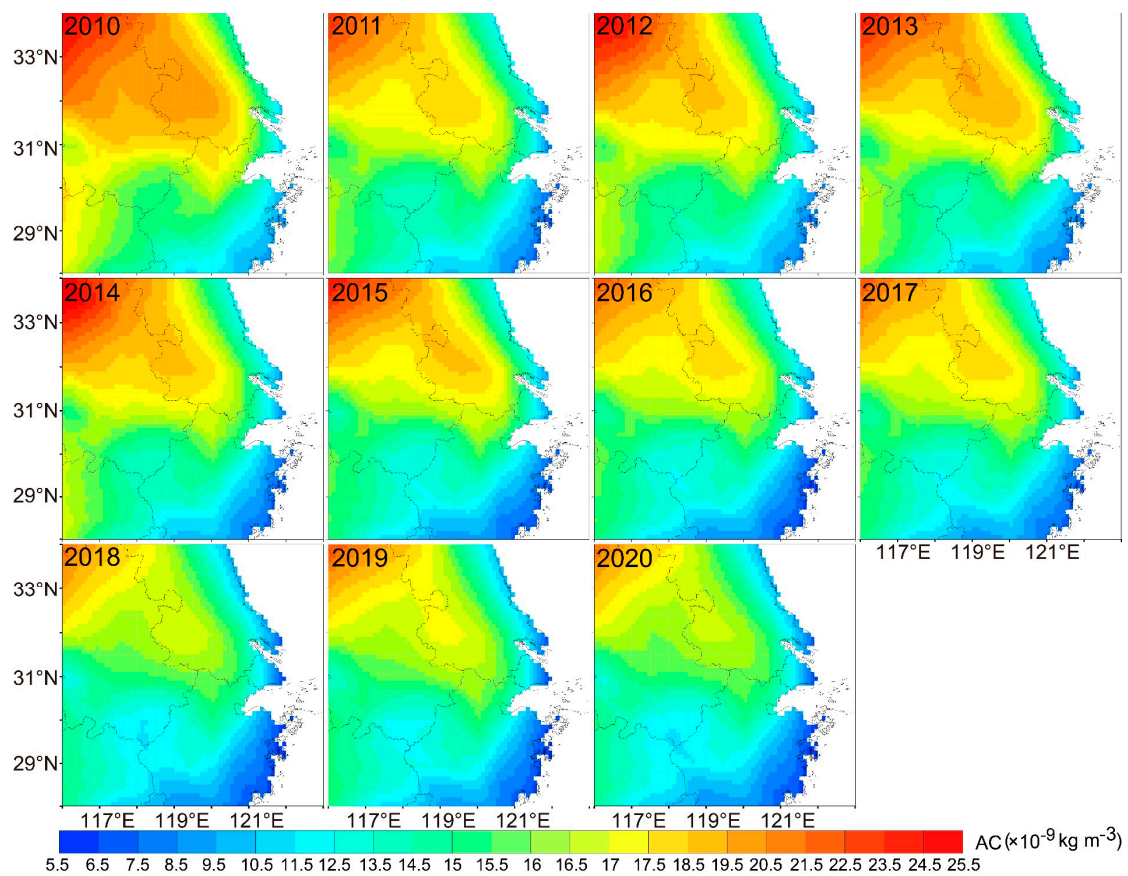


Figure S20. The spatial distribution of annual aerosol component concentration in the YRD during 2010-2020.

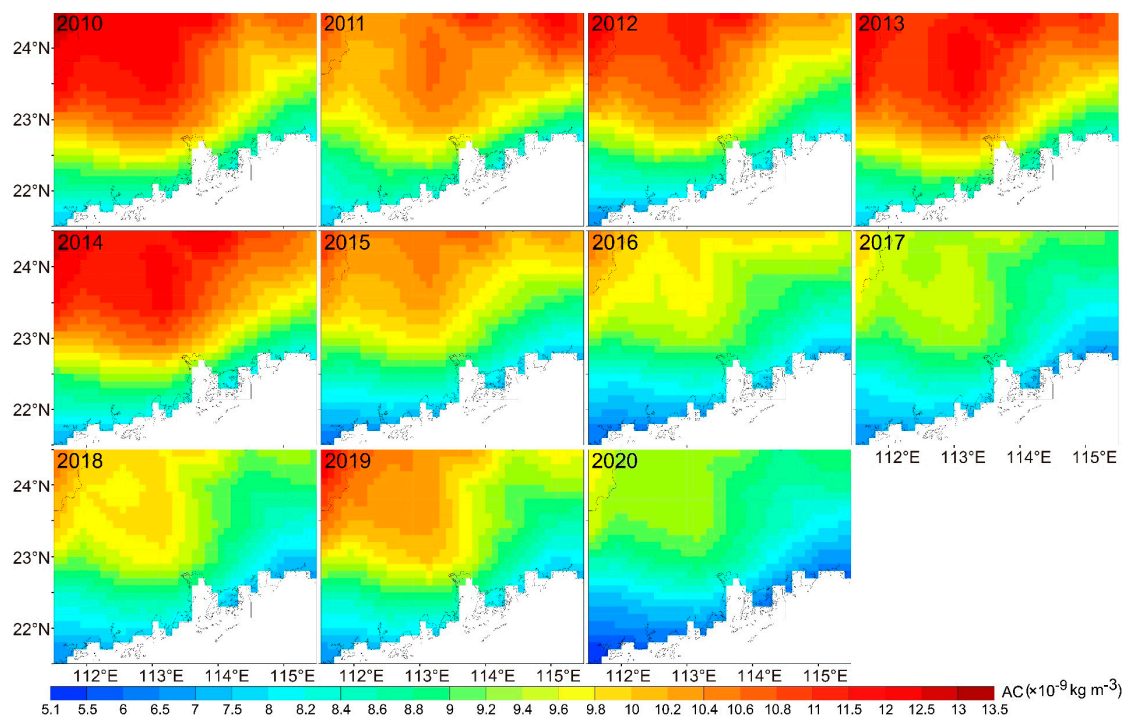


Figure S21. The spatial distribution of annual aerosol component concentration in the PRD during 2010-2020.