Table S1. Comparison of three DDA-based chemical lifetime fitting parameters for WN.

Test1: fixed_*f* and single_τ;

Test2: variable_*f* and single_τ;

Control: variable_*f* and nonlinear_τ, i.e., this study.

Each value represents the monthly mean; the bottom row shows the mean over the study period.

parameters		**R^2**			**RMSE (μmol m^{-2} s^{-1})**			**τ (h)**	
month	Test1	Test2	Control	Test1	Test2	Control	Test1	Test2	Control
1	0.71	0.77	0.66	0.97	1.19	0.83	14.51	11.86	6.19
2	0.68	0.65	0.57	0.72	0.86	0.53	12.13	11.90	5.10
3	0.59	0.57	0.29	0.72	0.81	0.61	15.93	15.87	8.38
4	0.53	0.56	0.45	0.70	0.73	0.44	12.48	11.88	5.94
5	0.53	0.53	0.42	0.57	0.57	0.37	12.70	12.15	6.41
6	0.50	0.49	0.45	0.52	0.51	0.25	20.71	21.45	6.52
7	0.66	0.74	0.42	0.46	0.42	0.26	9.88	7.99	6.41
8	0.33	0.36	0.39	0.51	0.48	0.25	32.60	31.14	6.60
9	0.28	0.30	0.45	0.62	0.61	0.31	25.74	22.84	5.25
10	0.57	0.60	0.52	0.70	0.76	0.40	19.60	18.31	7.13
11	0.32	0.43	0.49	1.14	1.29	0.80	27.48	21.40	6.36
12	0.89	0.93	0.68	0.69	0.85	0.75	11.91	9.96	7.73
mean	0.55	0.58	0.49	0.69	0.76	0.51	17.97	16.40	6.49

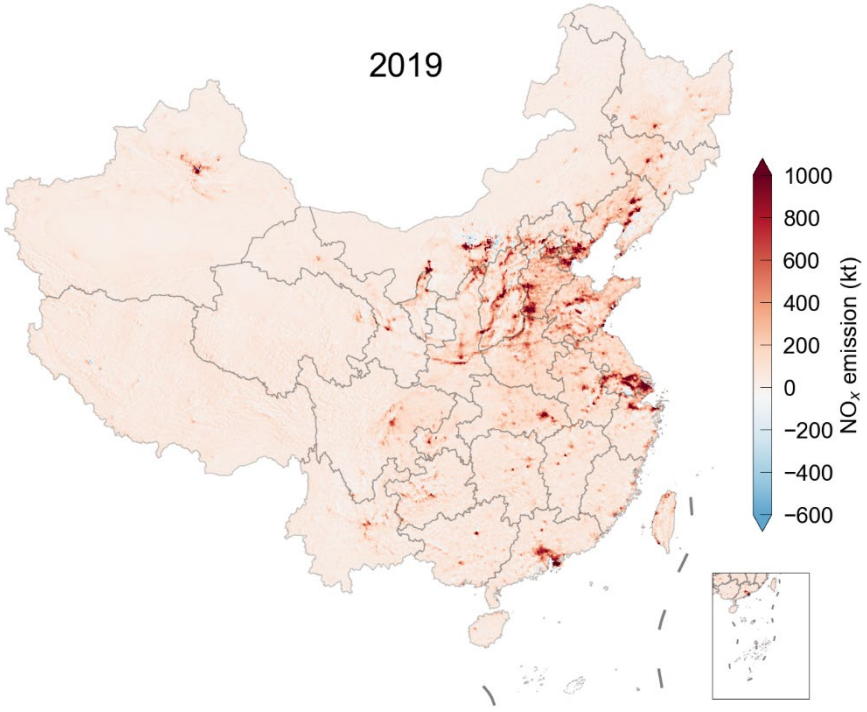

Figure S1: Spatial distribution of total NO_x emissions in China for 2019.

10

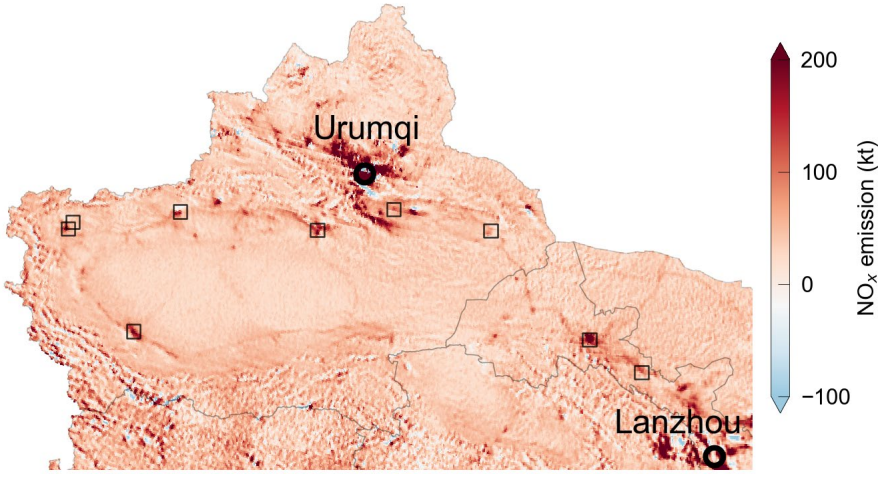

Figure S2: As Fig. S1 but for Northwest China. Urumqi and Lanzhou are major cities in Northwest China, with other cities mark by hollow square symbols. The linear trajectories reflect the transportation routes that connect them.

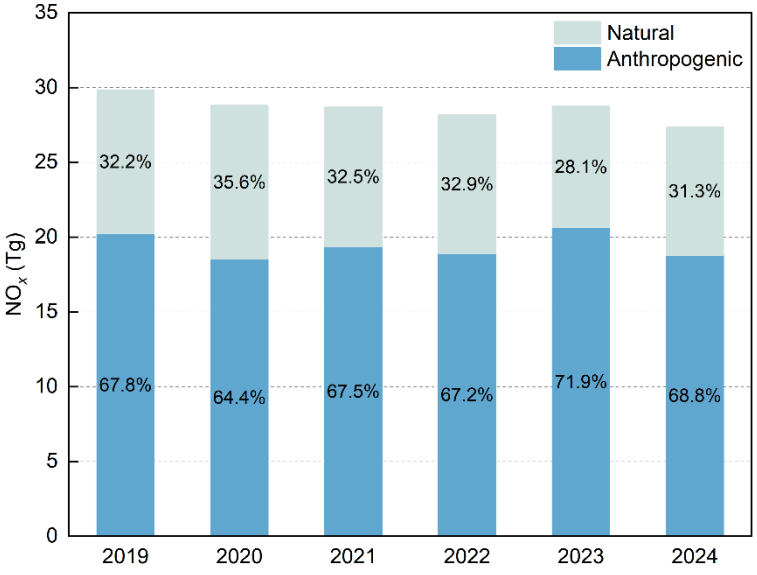

Figure S3: The proportion of anthropogenic and natural NO_x relative to total NO_x emissions in China for 2019–2024.

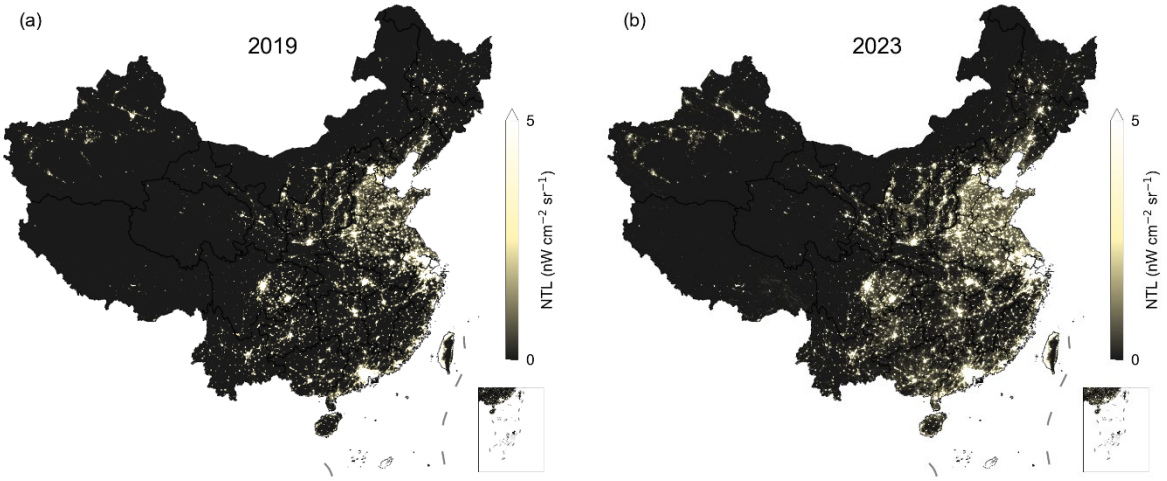

Figure S4: Nighttime Light (NTL) from SNPP/VIIRS in China for (a) 2019 and (b) 2023.

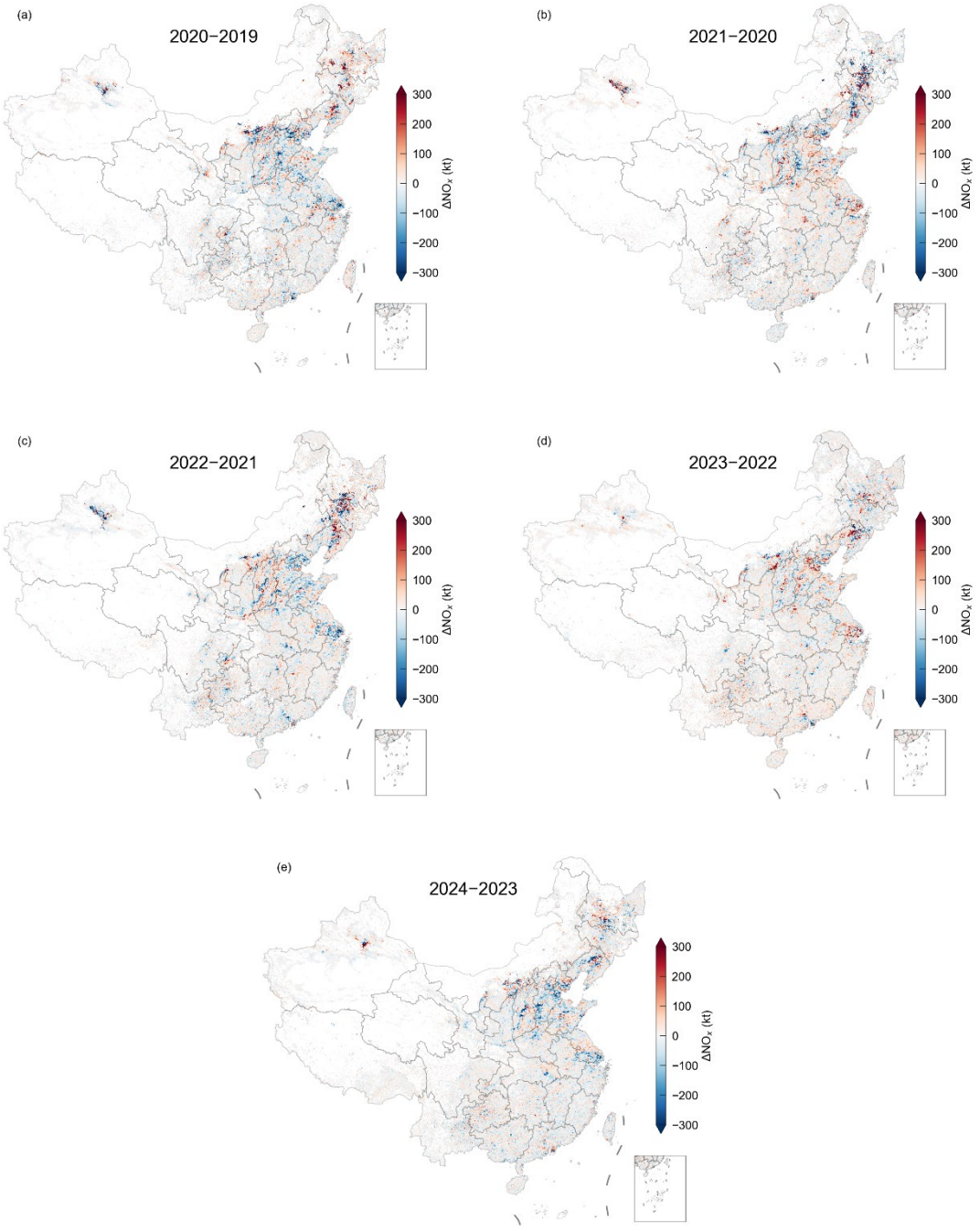

Figure S5: Spatial distribution of year-on-year changes in anthropogenic NO_x emissions in China for (a) 2020−2019, (b) 2021−2020, (c) 2022−2021, (d) 2023−2022, and (e) 2024−2023.

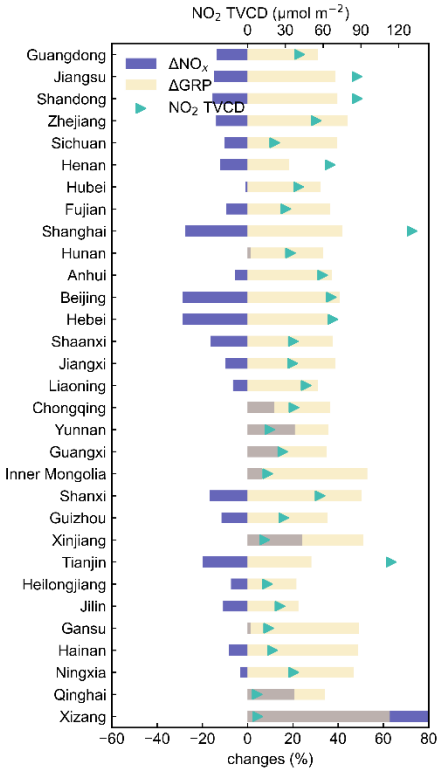

Figure S6: Changes in provincial NO_x emissions, Gross Regional Product (GRP) and NO_2 TVCDs in China from 2019 to 2024.

30

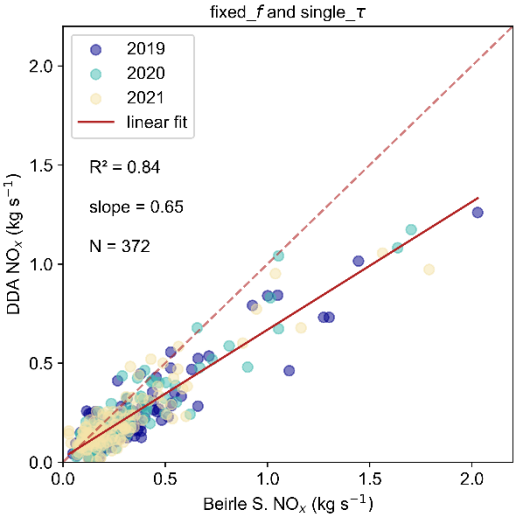

Figure S7: Comparisons of NO_x point source emission rates between the DDA test without ratio correction and fitting scheme improvement (fixed_*f* and single_τ) and Beirle et al. (2023) data.