Supplementary Information

Space-based inversion tracks and attributes Shanxi's under-estimated carbon monoxide emissions

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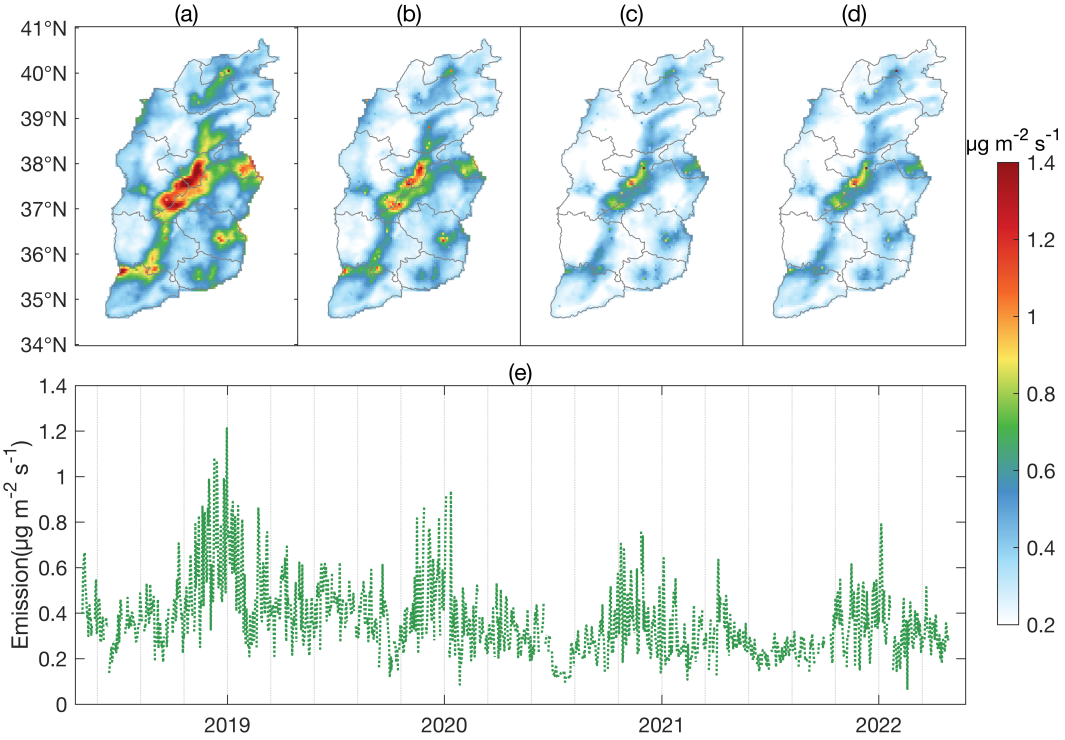
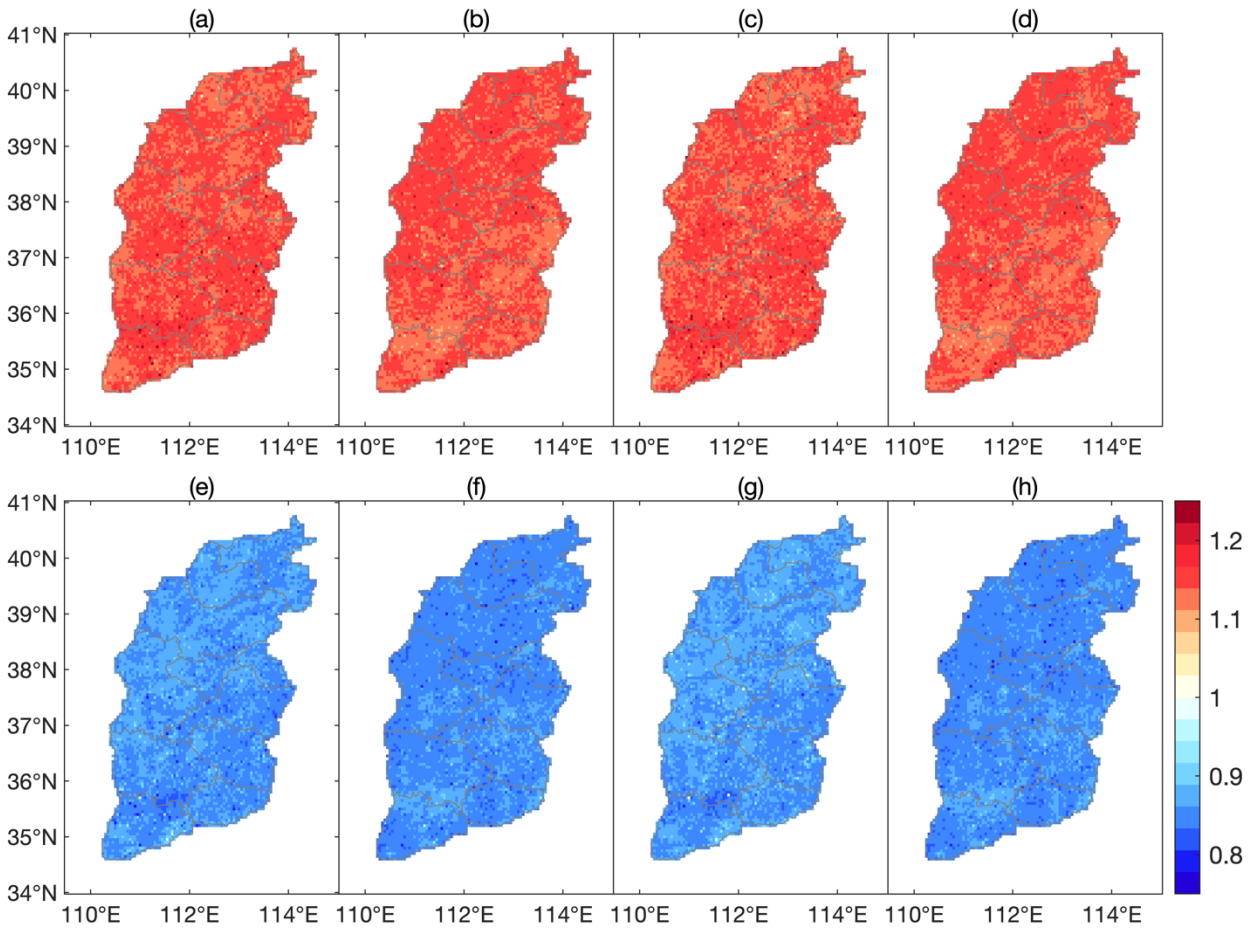
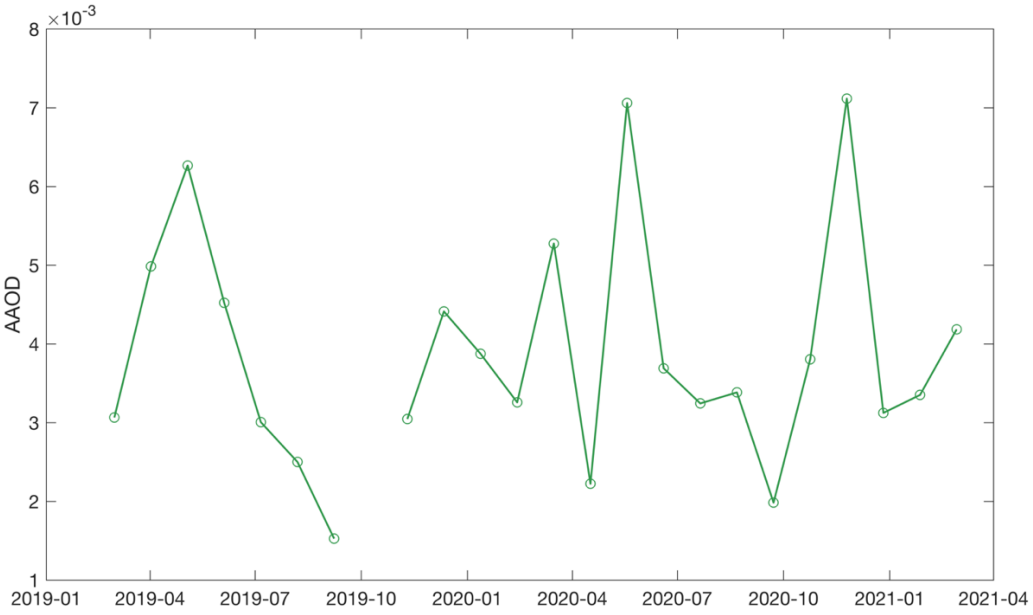


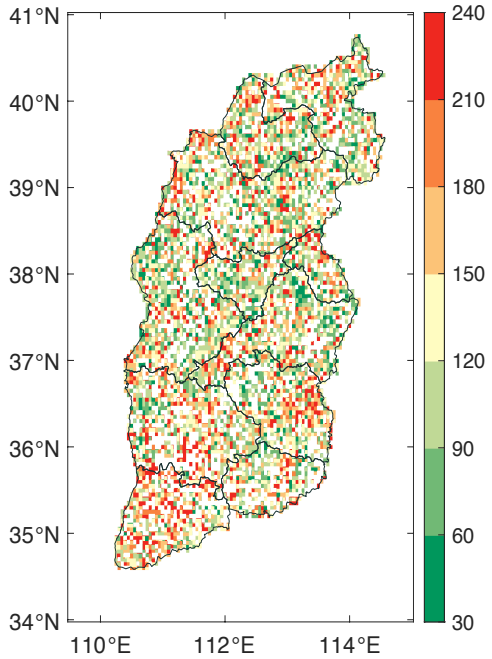
Supplementary Figure 1. NO_x calculated emissions by MFIEF from May 2018 to April 2022 over Shanxi at 0.05° × 0.05° scale: (a-d) year-to-year spatial distribution of daily average emissions of NO_x; (e) day-to-day variation of the Shanxi-average NO_x emissions.



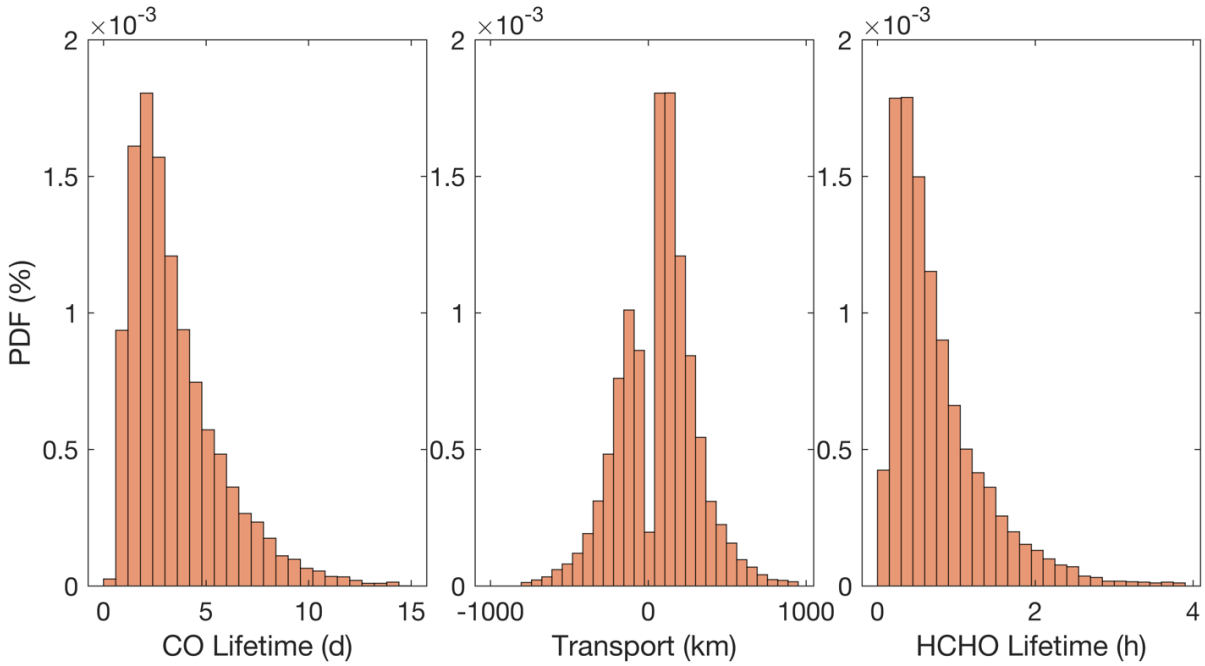
Supplementary Fig. 2. Sensitivity of CO emissions due to adjustment of input observations to account for uncertainty. Calculated CO emissions when (a) TROPOMI CO plus 30% and HCHO plus 40% divided by the original EI_{CO}; (b) a priori emission of CO plus 30% and HCHO plus 40% divided by the original EI_{CO}; (c) TROPOMI CO plus 30% and HCHO minus 40% divided by the original EI_{CO}; (d) a priori emission of CO plus 30% and HCHO minus 40% divided by the original EI_{CO}; (e) TROPOMI CO minus 30% and HCHO plus 40% divided by the original EI_{CO}; (f) a priori emission of CO minus 30% and HCHO plus 40% divided by the original EI_{CO}; (g) TROPOMI CO minus 30% and HCHO minus 40% divided by the original EI_{CO}; (h) a priori emission of CO minus 30% and HCHO minus 40% divided by the original EI_{CO}.



Supplementary Fig. 3. Monthly average AAOD from MISR over Shanxi during March 2019 to February 2021.



Supplementary Fig.4**.** Space distribution of average CO lifetime divided by HCHO lifetime.



Supplementary Fig. 5. The month-to-month PDFs of the inverse values of (a) α_2, (b) α_3 and (c) α_4.