

**Near-Automated Estimate of City Nitrogen Oxides Emissions Applied to
South and Southeast Asia**

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Table S1: Annual top-down NO_x emissions and effective lifetimes, sampling area mean wind speeds, and bottom-up NO_x emissions for cities in South and Southeast Asia

City (Country) ^a	Top-down NO _x emissions [mol s ⁻¹] ^b	NO _x lifetimes [h] ^{b,c}	Wind speeds [m s ⁻¹] ^d	Bottom-up NO _x emissions [mol s ⁻¹] ^e
1. Karachi (Pakistan)	52.9 ± 18.7	3.1 ± 0.6	5.6 ± 0.1	24.7
2. Kabul (Afghanistan)	18.8 ± 6.1	1.5 ± 0.3	2.8 ± 0	1.8
3. Ahmedabad (India)	21.7 ± 9.2	3.8 ± 0.8	4.3 ± 0.1	19.5
4. Mumbai (India)	45.6 ± 16.5	2.9 ± 0.6	4.2 ± 0.1	45.3
5. Islamabad (Pakistan)	21.7 ± 8.4	2.2 ± 0.5	3.0 ± 0	10.6
6. Lahore (Pakistan)	33.4 ± 11.9	3.0 ± 0.5	3.4 ± 0	14.0
7. Delhi (India)	89.0 ± 31.9	2.5 ± 0.5	4.3 ± 0	54.4
8. Bangalore (India)	15.5 ± 5.0	3.5 ± 0.5	3.7 ± 0	22.9
9. Colombo (Sri Lanka)	20.7 ± 7.6	1.2 ± 0.3	5.7 ± 0.2	10.9
10. Chennai (India)	25.3 ± 13.6	4.9 ± 2.0	5.2 ± 0	27.9
11. Kolkata (India)	42.5 ± 15.8	2.7 ± 0.5	4.1 ± 0	35.1
12. Dhaka (Bangladesh)	124.8 ± 41.1	2.6 ± 0.4	3.8 ± 0	18.2
13. Yangon (Myanmar)	16.1 ± 5.2	2.1 ± 0.3	3.6 ± 0	4.9
14. Bangkok (Thailand)	102.3 ± 55.9	2.5 ± 0.7	4.4 ± 0	104.4
15. Kuala Lumpur (Malaysia)	41.4 ± 22.0	6.3 ± 1.9	3.7 ± 0.1	76.3
16. Singapore	112.1 ± 37.7	2.4 ± 0.4	5.1 ± 0.1	141.1
17. Ho Chi Minh City (Vietnam)	25.2 ± 11.3	4.9 ± 1.4	4.9 ± 0.3	16.4
18. Jakarta (Indonesia)	65.8 ± 32.5	3.3 ± 1.1	4.2 ± 0.2	144.2
19. Manila (Philippines)	40.5 ± 17.4	3.3 ± 0.7	6.1 ± 0.2	62.5

^aNumbered according to labels in Figure 1.

^bErrors in emissions and lifetimes calculated by adding individual errors in quadrature (see Section 2.2 for details).

^cEffective lifetime, as loss is dominated by dispersion.

^dCalculated using ERA5 reanalysis midday hourly wind fields (see Section 2.2 for details).

^eHTAP version 3 anthropogenic emissions inventory 24-h emission rates (see Section 2.3 for details).

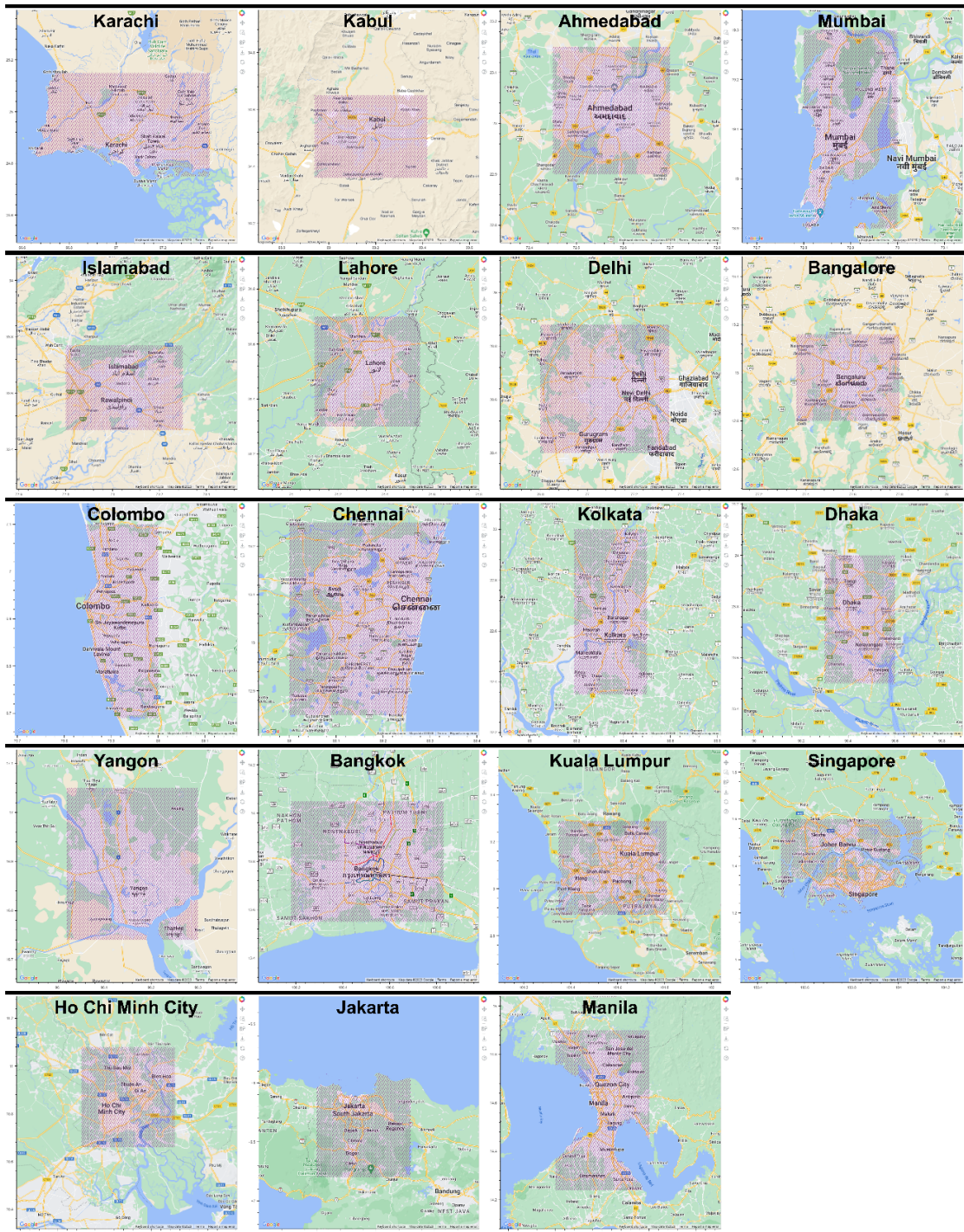


Figure S1. Sampling areas of bottom-up emissions for target cities in South and Southeast Asia. Hatching identifies the sampling extent for each city. City and sampling boundaries are determined using the Database of Global Administrative Areas (GADM) (<https://gadm.org/>; last accessed 17 March 2023) and Google Maps for all cities and the Humanitarian Data Exchange (<https://data.humdata.org/>; last accessed 17 March 2023) to map Laguna de Bay bordering Manila. Background maps are from © Google Maps, 2023.

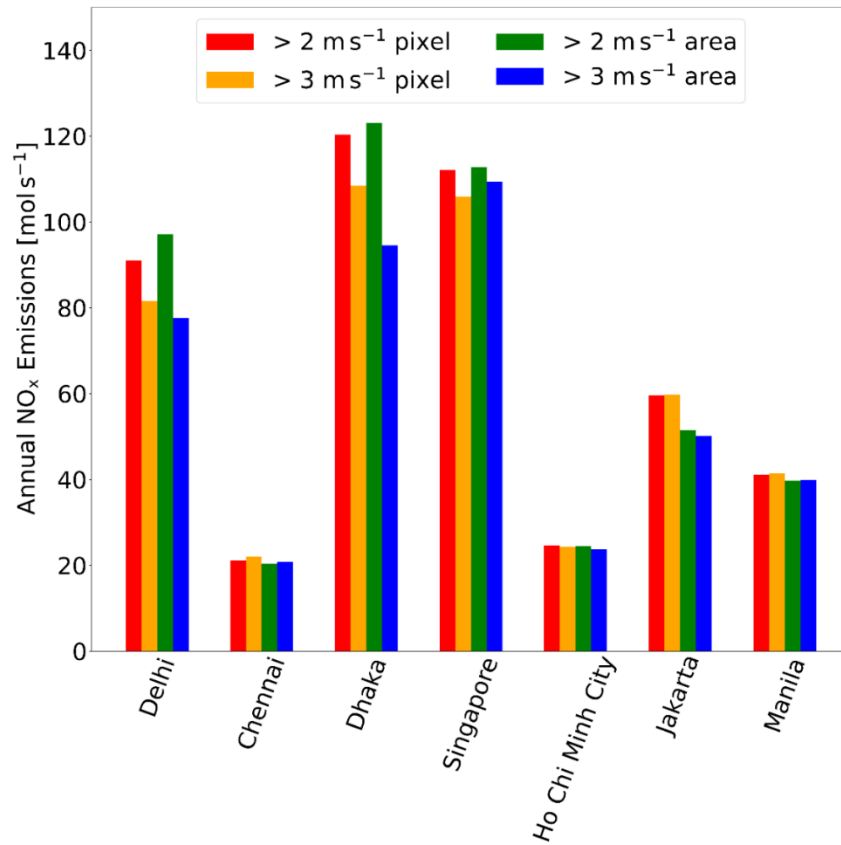
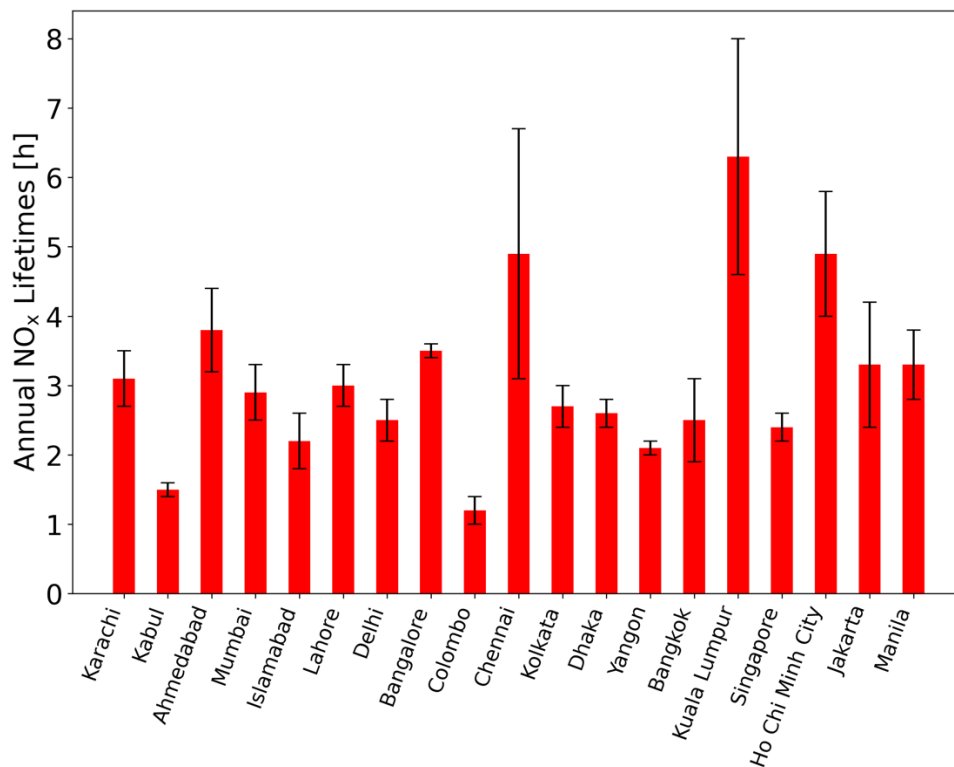
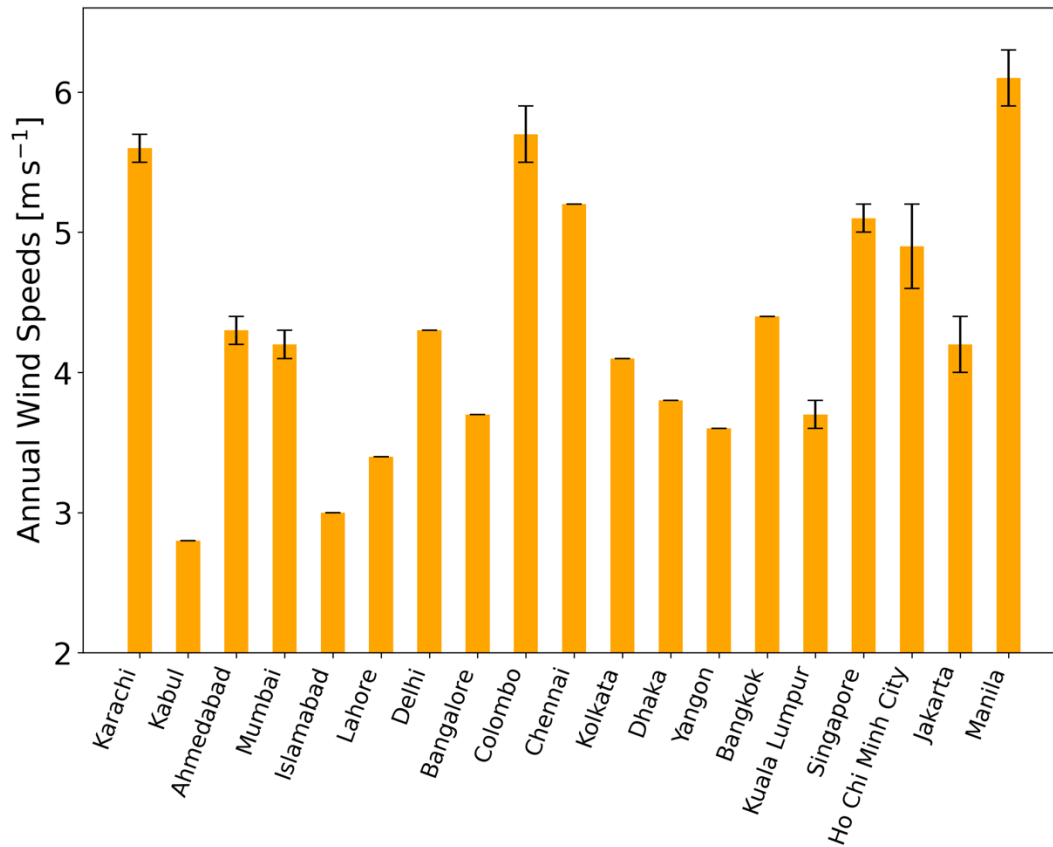


Figure S2. Sensitivity of annual top-down NO_x emissions to wind speed selection. Wind speeds tested are individual pixels with speeds > 2 m s⁻¹ (red) and > 3 m s⁻¹ (yellow), and sampling area (1.5° downwind, 0.75° upwind, ±0.75° across-wind) mean speeds > 2 m s⁻¹ (green) and > 3 m s⁻¹ (blue). Only cities with successful EMG fits for all wind speed selections are shown.



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41 **Figure S3.** Annual effective NO_x lifetimes from all successful EMG fits for target cities in South
 42 and Southeast Asia. Red bars are the means of NO₂ lifetimes and black error lines are the standard
 43 deviations from all successful EMG fits.



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45 **Figure S4.** Annual mean wind speeds for target cities in South and Southeast Asia. Yellow bars
 46 are the sampling area mean wind speeds and black error lines are the standard deviations from all
 47 successful annual EMG fits.