Supplement of

Source-resolved variability of fine particulate matter and human exposure in an urban area

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Table S1. Outer (CONUS) boundary condition concentrations of major aerosol species.

| Component                | Concentration (µg m⁻³) |
|--------------------------|------------------------|
|                          | West | East | South | North |
| Nitrate                  | 0.01 | 0.01 | 0.03  | 0.03  |
| Ammonium                 | 0.14 | 0.25 | 0.24  | 0.16  |
| Sulfate                  | 0.64 | 1.12 | 0.81  | 0.68  |
| Elemental carbon         | 0.04 | 0.05 | 0.09  | 0.03  |
| Organic aerosol (Winter) | 0.20 | 0.16 | 0.58  | 0.80  |
| Organic aerosol (Summer) | 0.80 | 0.80 | 0.80  | 0.80  |
Table S2. Comparison of total PM$_{2.5}$ performance with the use of old surrogates and new surrogates for onroad traffic and commercial cooking. Measurements from EPA-CSN and low-cost sensors (RAMPs) withing the inner 1 x 1 km modeling domain were used.

|                     | February 2017 | New Surrogates |
|---------------------|--------------|----------------|
|                     | Old Surrogates | EPA-CSN | RAMPs | EPA-CSN | RAMPs |
| Observed Average ($\mu g \text{ m}^{-3}$) | 10.38 | 11.65 | 10.38 | 11.65 |
| Predicted Average ($\mu g \text{ m}^{-3}$) | 10.36 | 11.32 | 10.52 | 13.50 |
| Error ($\mu g \text{ m}^{-3}$) | 2.87 | 4.12 | 3.02 | 5.12 |
| Fractional Error | 0.29 | 0.31 | 0.30 | 0.38 |
| Bias ($\mu g \text{ m}^{-3}$) | -0.02 | -0.33 | 0.18 | 1.85 |
| Fractional Bias | 0.06 | 0.08 | 0.07 | 0.24 |

|                     | July 2017 | New Surrogates |
|---------------------|-----------|----------------|
|                     | Old Surrogates | EPA-CSN | RAMPs | EPA-CSN | RAMPs |
| Observed Average ($\mu g \text{ m}^{-3}$) | 11.24 | 12.58 | 11.24 | 12.58 |
| Predicted Average ($\mu g \text{ m}^{-3}$) | 7.13 | 7.98 | 7.23 | 8.83 |
| Error ($\mu g \text{ m}^{-3}$) | 4.70 | 5.32 | 4.67 | 4.89 |
| Fractional Error | 0.49 | 0.47 | 0.48 | 0.42 |
| Bias ($\mu g \text{ m}^{-3}$) | -4.11 | -4.61 | -4.01 | -3.76 |
| Fractional Bias | -0.41 | -0.37 | -0.39 | -0.27 |
Figure S1 Average upper air concentration (13 simulated vertical layers above the ground layer) of local PM$_{2.5}$ from (A) power generation and (B) biomass burning in February 2017.
Figure S2 Population exposure histograms of the contribution to PM$_{2.5}$ concentrations from (A) commercial cooking, (B) industrial, (C) on-road traffic and (D) power generation sources during February 2017. A different scale for population is used for the distribution from power generation.
Figure S3 Population exposure histograms of the contribution to PM$_{2.5}$ concentrations from (A) biomass burning, (B) miscellaneous area sources and (C) all other sources during February 2017. Contributions from long-range transport (D) are shown with a different concentration scale.
**Figure S4** Population exposure histograms of the contribution to PM$_{2.5}$ concentrations from (A) commercial cooking, (B) industrial, (C) on-road traffic and (D) power generation sources during July 2017.
Figure S5 Population exposure histograms of the contribution to PM$_{2.5}$ concentrations from (A) biomass burning, (B) miscellaneous area sources and (C) all other sources during July 2017. Contributions from long-range transport (D) are shown with a different concentration scale.
Figure S6 Absolute contributions from local sources to population weighted total PM$_{2.5}$ concentration for February and July 2017