

## **Supporting Information for** **Anthropogenic and Natural Causes for the Interannual Variation of** **PM<sub>2.5</sub> in East Asia During Summer Monsoon Periods From 2008 to** **2018.**

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Tables S1 to S4

**Table S1.** Changes in near-surface PM<sub>2.5</sub> concentrations (µg/m<sup>3</sup>) during the EASM period from 2009 to 2018 relative to 2008 in the North China Plain (NCP), Fen-Wei Plain (FWP), Yangtze River Delta (YRD), Pearl River Delta (PRD), and Sichuan Basin (SCB)

| Year  | NCP    | FWP    | YRD    | PRD   | SCB    |
|-------|--------|--------|--------|-------|--------|
| 2009  | -11.24 | -1.29  | -11.37 | 1.41  | -3.16  |
| 2010  | -3.87  | 1.9    | -15.2  | -3.57 | -4.79  |
| 2011  | -6.27  | 0.22   | -14.76 | 0.13  | -8.65  |
| 2012  | -7.42  | 1.69   | -17.61 | 2.35  | -15.99 |
| 2013  | -14.67 | -15.49 | -14.9  | -6.34 | -20.37 |
| 2014  | -24.26 | -15.36 | -19.95 | -6.72 | -22.87 |
| 2015  | -31.41 | -16.9  | -27.76 | -9.91 | -31.75 |
| 2016  | -38.5  | -25.23 | -32.43 | -8.18 | -35.58 |
| 2017  | -40.69 | -25.49 | -26.21 | -5.82 | -37.43 |
| 2018  | -48.96 | -27.83 | -33.08 | -9.53 | -42.19 |
| PreG  | -8.69  | -2.59  | -14.77 | -1.20 | -10.59 |
| PostG | -36.76 | -22.16 | -27.89 | -8.03 | -33.96 |

**Table S2.** Impact of meteorological condition changes on PM<sub>2.5</sub> (μg/m<sup>3</sup>), Precipitation (mm/day), Wind Speed (m/s), Near-Surface Temperature (K), and Planetary Boundary Layer (PBL) Height (m)

| Region | Period | PM <sub>2.5</sub><br>(μg/m <sup>3</sup> ) | Precipitation<br>(mm/day) | Wind<br>Speed<br>(m/s) | Near-Surface<br>Temperature<br>(K) | PBL<br>(m) |
|--------|--------|-------------------------------------------|---------------------------|------------------------|------------------------------------|------------|
| NCP    | PreG   | -4.01                                     | 0.58                      | 0.17                   | 0.32                               | -46.8      |
|        | PostG  | -1.6                                      | 0.6                       | 0.26                   | 0.6                                | -14.5      |
| FWP    | PreG   | 2.32                                      | 1.68                      | -0.06                  | 0.1                                | -108.5     |
|        | PostG  | 1                                         | 0.81                      | 0.05                   | 0.46                               | -15.3      |
| YRD    | PreG   | -6.31                                     | 1.02                      | 0.18                   | -0.29                              | -33.9      |
|        | PostG  | -0.43                                     | 0.48                      | -0.08                  | 0.45                               | 21.9       |
| PRD    | PreG   | 1.49                                      | -2.39                     | -0.02                  | 0.36                               | 29.6       |
|        | PostG  | 0.11                                      | -3.24                     | 0.18                   | 1.00                               | 52.2       |
| SCB    | PreG   | 0.29                                      | 1.81                      | 0.13                   | -0.58                              | -136.5     |
|        | PostG  | -1.14                                     | 0.37                      | -0.03                  | -0.14                              | -76        |

**Table S3.** The effect of CO<sub>2</sub> concentration changes on PM<sub>2.5</sub> (μg/m<sup>3</sup>), CO<sub>2</sub> (ppm), precipitation (mm/day), and isoprene (μg/m<sup>3</sup>) across different regions of East Asia

| Region | Period | PM <sub>2.5</sub><br>(μg/m <sup>3</sup> ) | CO <sub>2</sub><br>(ppm) | Precipitation<br>(mm/day) | Isoprene<br>(μg/m <sup>3</sup> ) |
|--------|--------|-------------------------------------------|--------------------------|---------------------------|----------------------------------|
| NCP    | PreG   | 0.6                                       | 3.19                     | 0.27                      | -0.1                             |
|        | PostG  | -1.3                                      | 4.24                     | 0.13                      | 0.26                             |
| FWP    | PreG   | 0.84                                      | 1.70                     | 0.21                      | -0.16                            |
|        | PostG  | -0.98                                     | 2.05                     | 0.06                      | 0.33                             |
| YRD    | PreG   | -0.02                                     | 4.1                      | 0.13                      | -0.32                            |
|        | PostG  | -0.05                                     | 6.2                      | 0.09                      | -0.58                            |
| PRD    | PreG   | 1.13                                      | 1.97                     | -1.02                     | 0.31                             |
|        | PostG  | 0.31                                      | 3.20                     | -0.33                     | 0.92                             |
| SCB    | PreG   | -0.49                                     | 2.80                     | 0.64                      | -0.78                            |
|        | PostG  | -0.73                                     | 2.78                     | 0.21                      | 0.69                             |

**Table S4.** Changes in PM<sub>2.5</sub> concentrations (ALL) and the impacts of anthropogenic pollutant emissions (Emis), meteorological conditions (Met), and CO<sub>2</sub> concentration (CO<sub>2</sub>) variations on PM<sub>2.5</sub> concentrations across different regions of East Asia (µg/m<sup>3</sup>)

| Region | Period | ALL    | Emis   | Met   | CO <sub>2</sub> |
|--------|--------|--------|--------|-------|-----------------|
| NCP    | PreG   | -8.69  | -5.28  | -4.01 | 0.6             |
|        | PostG  | -36.76 | -33.86 | -1.6  | -1.3            |
| FWP    | PreG   | -2.59  | -5.75  | 2.32  | 0.84            |
|        | PostG  | -22.16 | -22.18 | 1     | -0.98           |
| YRD    | PreG   | -14.77 | -8.44  | -6.31 | -0.02           |
|        | PostG  | -27.89 | -27.41 | -0.43 | -0.05           |
| PRD    | PreG   | -1.2   | -3.82  | 1.49  | 1.13            |
|        | PostG  | -8.03  | -8.45  | 0.11  | 0.31            |
| SCB    | PreG   | -10.59 | -10.39 | 0.29  | -0.49           |
|        | PostG  | -33.96 | -32.09 | -1.14 | -0.73           |