Supplementary Material

Effects of meteorological factors and anthropogenic precursors on PM$_{2.5}$ concentrations in cities in China

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Table S1. Effect of various factors on PM$_{2.5}$ in China in 2016, value with *** is significant at the 0.01 level; value with ** is significant at the 0.05 level; value with * is significant at the 0.1 level.

| Time  | PRE  | RHU  | SSD  | WIN  | PRS  | TEM  | VOC  | NOx  | NH3  | SO2  |
|-------|------|------|------|------|------|------|------|------|------|------|
| Year  | 0.22*** | 0.08*** | 0.08*** | 0.01*** | 0.17*** | 0.27*** | 0.07*** | 0.07*** | 0.07*** | 0.03*** |
| Spring| 0.12*** | 0.04*** | 0.04*** | 0.04*** | 0.1*** | 0.07*** | 0.06*** | 0.05*** | 0.06*** | 0.05*** |
| Summer| 0.06**  | 0.09*** | 0.01  | 0.06*** | 0.07*** | 0.09*** | 0.1***  | 0.11*** | 0.11*** | 0.08*** |
| Autumn| 0.13*** | 0.1***  | 0.07*** | 0.01  | 0.11*** | 0.18*** | 0.09*** | 0.11*** | 0.11*** | 0.1***  |
| Winter| 0.07*** | 0.11*** | 0.17*** | 0.07*** | 0.16*** | 0.21*** | 0.13*** | 0.12*** | 0.18*** | 0.08*** |

Table S2. Effect of various factors on PM$_{2.5}$ throughout the whole year at the regional scale, value with *** is significant at the 0.01 level; value with ** is significant at the 0.05 level; value with * is significant at the 0.1 level.

| Region | Year | PRE   | PRS   | RHU   | SSD   | TEM   | WIN   | VOC   | NOx   | SO2   | NH3   |
|--------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| EC     | 2016 | 0.12*** | 0.14*** | 0.04*** | 0.08*** | 0.19*** | 0.12*** | 0.01*** | 0.01*** | 0.02*** | 0.03*** |
| MUPR   | 2016 | 0.14*** | 0.09*** | 0.01*** | 0.00*** | 0.04*** | 0.01*** | 0.05*** | 0.03*** | 0.02*** | 0.03*** |
| MUYR   | 2016 | 0.13*** | 0.11*** | 0.01*** | 0.02*** | 0.12*** | 0.04*** | 0.04*** | 0.03*** | 0.04*** | 0.00*** |
| MYR    | 2016 | 0.05*** | 0.08*** | 0.02*** | 0.08*** | 0.2***  | 0.03*** | 0.04*** | 0.04*** | 0.03*** | 0.00*** |
| NC     | 2016 | 0.04*** | 0.04*** | 0.01*** | 0.07*** | 0.12*** | 0.09*** | 0.04*** | 0.09*** | 0.05*** |       |
| NE     | 2016 | 0.05*** | 0.08*** | 0.02*** | 0.05*** | 0.13*** | 0.02*** | 0.04*** | 0.04*** | 0.06*** | 0.02*** |
| QTP    | 2016 | 0.07*** | 0.21*** | 0.04*** | 0.02*** | 0.11*** | 0.01*** | 0.13*** | 0.15*** | 0.06*** | 0.14*** |
| SC     | 2016 | 0.16*** | 0.09*** | 0.07*** | 0.02*** | 0.11*** | 0.03*** | 0.02*** | 0.03*** | 0.03*** | 0.01*** |
| UYR    | 2016 | 0.04*** | 0.02*** | 0.00*** | 0.05*** | 0.12*** | 0.03*** | 0.03*** | 0.04*** | 0.01*** | 0.04*** |
Table S3. Effect of various factors on PM$_{2.5}$ in spring at the regional scale, value with *** is significant at the 0.01 level; value with ** is significant at the 0.05 level; value with * is significant at the 0.1 level.

| Region | Season | PRE  | PRS  | RHU  | SSD  | TEM  | WIN  | VOC  | NOx  | SO2  | NH3 |
|--------|--------|------|------|------|------|------|------|------|------|------|-----|
| EC     | spring | 0.13*** | 0.06*** | 0.02*** | 0.07*** | 0.04*** | 0.08*** | 0.03*** | 0.02*** | 0.02*** | 0.03*** |
| MUPR   | spring | 0.11*** | 0.07*** | 0.01**  | 0.01**  | 0.02*** | 0.02*** | 0.03*** | 0.02*** | 0.02*** | 0.04*** |
| MUYR   | spring | 0.12*** | 0.09*** | 0.01*** | 0.03*** | 0.05*** | 0.02*** | 0.06*** | 0.07*** | 0.03*** | 0.05*** |
| MYR    | spring | 0.02*** | 0.07*** | 0.01*** | 0.09*** | 0.06*** | 0.02*** | 0.02*** | 0.05*** | 0.04*** | 0.01*** |
| NC     | spring | 0.03*** | 0.02*** | 0.00*** | 0.07*** | 0.03*** | 0.04*** | 0.04*** | 0.03*** | 0.02*** | 0.02*** |
| NE     | spring | 0.03*** | 0.06*** | 0.01**  | 0.03*** | 0.06*** | 0.04*** | 0.04*** | 0.05*** | 0.06*** | 0.04*** |
| QTP    | spring | 0.02*** | 0.2***  | 0.03*** | 0.01**  | 0.06*** | 0.03*** | 0.12*** | 0.22*** | 0.13*** | 0.23*** |
| SC     | spring | 0.12*** | 0.09*** | 0.07*** | 0.02*** | 0.12*** | 0.02*** | 0.03*** | 0.03*** | 0.07*** | 0.06*** |
| UYR    | spring | 0.01**  | 0.06*** | 0.03*** | 0.05*** | 0.03*** | 0.01*** | 0.03*** | 0.04*** | 0.05*** | 0.04*** |
| XJ     | spring | 0.01*   | 0.19*** | 0.03*** | 0.13*** | 0.01**  | 0.1***  | 0.11*** | 0.09*** | 0.12*** | 0.08*** |
Table S4. Effect of various factors on PM$_{2.5}$ in summer at the regional scale, value with *** is significant at the 0.01 level; value with ** is significant at the 0.05 level; value with * is significant at the 0.1 level.

| Region | Season | PRE  | PRS  | RHU  | SSD  | TEM  | WIN  | VOC  | NOx  | SO2  | NH3  |
|--------|--------|------|------|------|------|------|------|------|------|------|------|
| EC     | Summer | 0.04*** | 0.00** | 0.03*** | 0.02*** | 0.01*** | 0.08*** | 0.04*** | 0.02*** | 0.05*** | 0.04*** |
| MUPR   | Summer | 0.06*** | 0.07*** | 0.03*** | 0.04*** | 0.05*** | 0.05*** | 0.1*** | 0.07*** | 0.12*** | 0.06*** |
| MUYR   | Summer | 0.09*** | 0.09*** | 0.01*** | 0.05*** | 0.07*** | 0.03*** | 0.05*** | 0.07*** | 0.07*** | 0.05*** |
| MYR    | Summer | 0.02*** | 0.04*** | 0.03*** | 0.04*** | 0.01*** | 0.01*** | 0.04*** | 0.05*** | 0.08*** | 0.05*** |
| NC     | Summer | 0.03*** | 0.01*** | 0.04*** | 0.08*** | 0.04*** | 0.07*** | 0.04*** | 0.08*** | 0.07*** | 0.04*** |
| NE     | Summer | 0.03*** | 0.09*** | 0.03*** | 0.01*** | 0.2*** | 0.02*** | 0.06*** | 0.09*** | 0.15*** | 0.08*** |
| QTP    | Summer | 0.04*** | 0.4*** | 0.02*** | 0.04*** | 0.07*** | 0.01 | 0.25*** | 0.38*** | 0.18*** | 0.34*** |
| SC     | Summer | 0.06*** | 0.05*** | 0.06*** | 0.02*** | 0.03*** | 0.02*** | 0.04*** | 0.05*** | 0.05*** | 0.07*** |
| UYR    | Summer | 0.01*  | 0.02*** | 0.01**  | 0.01*** | 0.02*** | 0.02*** | 0.02*** | 0.03*** | 0.02*** | 0.01*** |
| XJ     | Summer | 0.02*** | 0.27*** | 0.02*** | 0.02*** | 0.06*** | 0.04*** | 0.3*** | 0.25*** | 0.19*** | 0.28*** |
Table S5. Effect of various factors on PM$_{2.5}$ in autumn at the regional scale, value with *** is significant at the 0.01 level; value with ** is significant at the 0.05 level; value with * is significant at the 0.1 level.

| Region | Season | PRE   | PRS   | RHU   | SSD   | TEM   | WIN   | VOC   | NOx   | SO2   | NH3   |
|--------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| EC     | Autumn | 0.17*** | 0.03*** | 0.02*** | 0.12*** | 0.1*** | 0.25*** | 0.02*** | 0.01*** | 0.03*** | 0.02*** |
| MUPR   | Autumn | 0.12*** | 0.13*** | 0.06*** | 0.03*** | 0.11*** | 0.02*** | 0.1***  | 0.09*** | 0.08*** | 0.08*** |
| MUYR   | Autumn | 0.14*** | 0.07*** | 0.06*** | 0.06*** | 0.03*** | 0.05*** | 0.05*** | 0.06*** | 0.07*** | 0.05*** |
| MYR    | Autumn | 0.08*** | 0.04*** | 0.07*** | 0.07*** | 0.09*** | 0.01*** | 0.07*** | 0.07*** | 0.05*** | 0.06*** |
| NC     | Autumn | 0.04*** | 0.01*** | 0.06*** | 0.09*** | 0.05*** | 0.11*** | 0.06*** | 0.09*** | 0.07*** | 0.06*** |
| NE     | Autumn | 0.04*** | 0.03*** | 0.05*** | 0.05*** | 0.08*** | 0.01*** | 0.05*** | 0.04*** | 0.03*** | 0.06*** |
| QTP    | Autumn | 0.12*** | 0.29*** | 0.06*** | 0.04*** | 0.17*** | 0.02*  | 0.21*** | 0.3***  | 0.26*** | 0.17*** |
| SC     | Autumn | 0.22*** | 0.05*** | 0.1***  | 0.13*** | 0.08*** | 0.02*** | 0.05*** | 0.06*** | 0.05*** | 0.03*** |
| UYR    | Autumn | 0.08*** | 0.03*** | 0.02*** | 0.05*** | 0.13*** | 0.02*** | 0.06*** | 0.06*** | 0.03*** | 0.08*** |
| XJ     | Autumn | 0.04*** | 0.18*** | 0.01**  | 0.08*** | 0.08*** | 0.15*** | 0.22*** | 0.23*** | 0.14*** | 0.14*** |
Table S6. Effect of various factors on PM$_{2.5}$ in winter at the regional scale, value with *** is significant at the 0.01 level; value with ** is significant at the 0.05 level; value with * is significant at the 0.1 level.

| Region | Season | PRE  |PRS  | RHU  | SSD  | TEM  | WIN  | VOC  | NOx  | SO2  | NH3  |
|--------|--------|------|-----|------|------|------|------|------|------|------|------|
| EC     | Winter | 0.11***| 0.04***| 0.06***| 0.13***| 0.02***| 0.2***| 0.01***| 0.01***| 0.01***| 0.02***|
| MUPR   | Winter | 0.04***| 0.12***| 0.02***| 0.05***| 0.06***| 0.08***| 0.07***| 0.06***| 0.06***| 0.02***|
| MUYR   | Winter | 0.05***| 0.08***| 0.00 | 0.02***| 0.03***| 0.04***| 0.06***| 0.06***| 0.07***| 0.05***|
| MYR    | Winter | 0.01 | 0.08***| 0.02***| 0.23***| 0.06***| 0.15***| 0.04***| 0.04***| 0.09***| 0.05***|
| NC     | Winter | 0.02***| 0.07***| 0.01***| 0.15***| 0.04***| 0.25***| 0.06***| 0.05***| 0.09***| 0.03***|
| NE     | Winter | 0.02***| 0.02***| 0.01***| 0.12***| 0.06***| 0.18***| 0.05***| 0.02***| 0.06***| 0.03***|
| QTP    | Winter | 0.01 | 0.2***| 0.02** | 0.01**| 0.05***| 0.01| 0.23***| 0.28***| 0.09***| 0.18***|
| SC     | Winter | 0.13***| 0.05***| 0.05***| 0.1***| 0.08***| 0.06***| 0.04***| 0.03***| 0.1***| 0.03***|
| UYR    | Winter | 0.02***| 0.1***| 0.02***| 0.05***| 0.11***| 0.14***| 0.09***| 0.06***| 0.04***| 0.06***|
| XJ     | Winter | 0.03***| 0.12***| 0.03***| 0.03***| 0.02***| 0.03***| 0.34***| 0.33***| 0.21***| 0.31***|

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