Supplement of
Atmospheric oxidation capacity and ozone pollution mechanism in a coastal city of southeastern China: analysis of a typical photochemical episode by an observation-based model

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Captions:

**Figure S1.** The concentrations of monthly and annual MDA8h O\textsubscript{3} in Xiamen from 2016 to 2020.

**Figure S2.** 72h back trajectories were calculated at 100 m altitude during 20-29 Sep. 2019.

**Figure S3.** Daytime (06:00-18:00 LT) variations of the simulated concentration, production, and loss rate of (a)OH, (b)HO\textsubscript{2}, and (c)RO\textsubscript{2} in Xiamen.

**Figure S4.** Synoptic situations of surface wind field from 20 to 29 Sep. 2019. Arrows in the figure represent the surface wind speed and direction. The blue square is the study site.

**Table S1.** Comparison of NO, NO\textsubscript{2} and total VOCs levels in cities between China and other countries.

**Table S2.** Dry deposition velocity (cm s\textsuperscript{-1}) for chemical species.

**Table S3.** Estimated degree of freedom (Edf), degree of reference (Ref. df), P-value, F-value, deviance explained (%), adjusted R\textsuperscript{2} for the smoothed variables (including UV, T, RH, P, and WS) in the GAM model.
Figure S1. The concentrations of monthly and annual MDA8h O₃ in Xiamen from 2016 to 2020.

Figure S2. 72h back trajectories were calculated at 100 m altitude during 20-29 Sep. 2019.
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Figure S4. Synoptic situations of surface wind field from 20 to 29 Sep. 2019. Arrows in the figure represent the surface wind speed and direction. The blue square is the study site.

Table S1. Comparison of NO, NO\textsubscript{2} and total VOCs levels in cities between China and other countries (Units: ppbv).

| Location      | NO\textsubscript{2} | NO  | VOCs | Site category | Observation periods       | Reference                  |
|---------------|---------------------|-----|------|---------------|---------------------------|----------------------------|
| Xiamen        | 15.4                | 1.4 | 17.2 | Urban         | Sep. 2019 (episode)       | This study                 |
| Beijing       | 16.8                | 2.1 | 44.2 | Urban         |                           | Liu et al., 2021b          |
| Wuhan         | 17.5                | 3.2 | 30.2 | Urban         | Summer 2018 (episode)     | Liu et al., 2021b          |
| Lanzhou       | 15.8                | 2.9 | 45.3 | Urban         |                           | Liu et al., 2021b          |
| Shanghai      | 14.2                | 3.38| 25.3 | Urban         | Jun. 2019 (episode)       | Zhu et al., 2020           |
| Chengdu       | 39.0                | 3.6 | 36.0 | Urban         | Jul. 2017 (episode)       | Yang et al., 2020          |
| Los Angeles   | -                   | -   | 41.3 | Urban         | May–Jun. 2010             | Warneke et al., 2012       |
| London        | -                   | -   | 22.1 | Urban         | 1998–2008                 | Von Schneidemesser et al., 2010 |
| Tokyo         | -                   | -   | 43.4 | Urban         | 2003–2005                 | Hoshi et al., 2008         |
| Location                | O3   | NO2  | HONO | HNO3 | HNO4 | NH3  | SO2  | H2SO4 | H2O2 | PAN | PPN | APAN | MPAN | HCHO | MCHO | PALD | C4A | C7A | ACHO | MVK | MACR | MGLY | MOH | ETOH | POH | CRES | FORM | ACAC | ROOH | ONIT | INIT |
|-------------------------|------|------|------|------|------|------|------|-------|------|-----|-----|------|------|------|------|------|-----|-----|------|-----|------|------|------|------|------|------|------|------|
| Beijing                 | 11.5 | 4.8  | 28.1 |      |      |      |      |       |      |     |     |      |      |      |      |      |     |    |      |     |     |      |     |      |      |     |      |     |     |      |
| Hong Kong               | 25.0 | 14.0 | 26.9 |      |      |      |      |       |      |     |     |      |      |      |      |      |     |    |    |      |     |     |      |     |      |      |     |      |     |     |      |
| Chengdu                 | 11.4 | 8.0  | 28.0 |      |      |      |      |       |      |     |     |      |      |      |      |      |     |    |    |      |     |     |      |     |      |      |     |      |     |     |      |
| Qingdao                 | 16.7 | 1.6  | 7.6  | Suburban |      |      |      |       |      |     |     |      |      |      |      |      |     |    |    |      |     |     |      |     |      |      |     |      |     |     |      |
| The Pearl River Delta   | 39.9 | 4.2  | 38.0 | Rural |      |      |      |       |      |     |     |      |      |      |      |      |     |    |    |      |     |     |      |     |      |      |     |      |     |     |      |
| Hong Kong               | 12.2 | 1.9  | 10.9 | Regional background | Aug.-Dec. 2012 |      |      |       |      |     |     |      |      |      |      |      |     |    |    |      |     |     |      |     |      |      |     |      |     |     |      |
| Mt. Wuyi                | 4.7  |      |      | Background | Dec. 2016 |      |      |       |      |     |     |      |      |      |      |      |     |    |    |      |     |     |      |     |      |      |     |      |     |     |      |
| Mt. Tai                 | 8.8  |      |      | Background | Jun. 2006 |      |      |       |      |     |     |      |      |      |      |      |     |    |    |      |     |     |      |     |      |      |     |      |     |     |      |
| Mt. Waliguan            | 2.6  |      |      | Remote region | Jul.-Aug. 2003 |      |      |       |      |     |     |      |      |      |      |      |     |    |    |      |     |     |      |     |      |      |     |      |     |     |      |

Note: “-” means that the data was not mentioned in the relevant studies.

**Table S2. Dry deposition velocity (cm s\(^{-1}\)) for chemical species (Zhang et al., 2003).**

| Symbol | Name                               | dry deposition velocity |
|--------|------------------------------------|-------------------------|
| O3     | Ozone                              | 0.6                     |
| NO2    | Nitrogen dioxide                   | 0.6                     |
| HONO   | Nitrous acid                       | 1.9                     |
| HNO3   | Nitric acid                        | 4.7                     |
| HNO4   | Pernitric acid                     | 3.3                     |
| NH3    | Ammonia                            | 1                       |
| SO2    | Sulphur dioxide                    | 0.8                     |
| H2SO4  | Sulphuric acid                     | 1.1                     |
| H2O2   | Hydrogen peroxide                  | 1.2                     |
| PAN    | Peroxyacetyl nitrate               | 0.4                     |
| PPN    | Peroxypropynitrate                 | 0.4                     |
| APAN   | Aromatic acylnitrate               | 0.5                     |
| MPAN   | Peroxymethacrylic nitric anhydride | 0.3                     |
| HCHO   | Formaldehyde                       | 0.9                     |
| MCHO   | Acetaldehyde                       | 0.2                     |
| PALD   | C3 Carbonyls                       | 0.2                     |
| C4A    | C4-C5 Carbonyls                    | 0.2                     |
| C7A    | C6-C8 Carbonyls                    | 0.2                     |
| ACHO   | Aromatic carbonyls                 | 0.2                     |
| MVK    | Methyl-vinyl-ketone                | 0.2                     |
| MACR   | Methacrolein                       | 0.2                     |
| MGLY   | Methylgloxal                       | 0.2                     |
| MOH    | Methyl alcohol                     | 0.7                     |
| ETOH   | Ethyl alcohol                      | 0.6                     |
| POH    | C3 alcohol                         | 0.5                     |
| CRES   | Cresol                             | 0.2                     |
| FORM   | Formic acid                        | 1.4                     |
| ACAC   | Acetic acid                        | 1.1                     |
| ROOH   | Organic peroxides                  | 0.6                     |
| ONIT   | Organic nitrates                   | 0.4                     |
| INIT   | Isoprene nitrates                  | 0.3                     |
Table S3. Estimated degree of freedom (Edf), degree of reference (Ref. df), P-value, F-value, deviance explained (%), adjusted $R^2$ for the smoothed variables (including UV, T, RH, P, and WS) in the GAM model.

| Smoothed variables | $^a$Edf | $^a$Ref.df | $^b$F | $^c$P-value | $^d$Adjust $R^2$ | $^e$Deviance explained (%) |
|--------------------|-------|---------|------|-----------|----------------|-------------------------|
| UV (W·m$^{-2}$)    | 3.1   | 3.8     | 3.0  | 0.0       | 0.0            | 5.4                     |
| T (℃)              | 5.3   | 6.5     | 10.9 | 0.0       | 0.2            | 24.1                    |
| RH (%)             | 2.9   | 3.6     | 40.1 | 0.0       | 0.4            | 38.9                    |
| WS (m·s$^{-1}$)    | 2.9   | 3.6     | 26.9 | 0.0       | 0.3            | 29.3                    |
| P (hPa)            | 6.9   | 8.0     | 3.9  | 0.0       | 0.1            | 13.4                    |

Note: $^a$ The degree of freedom (edf, ref.df) of the explanatory variable is 1, indicating the linear relationships between the explanatory variable and the response variable, and a non-linear relationship is shown when the degree>1; $^b$ a high F-value indicates the great importance of the influencing factor; $^c$ the P-value is used to judge the significance of the model result; $^d$ the adjusted $R^2$ is the value of the regression square ranging from 0 to 1; $^e$ the deviance explained represents the fitting effect.

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