## **Supplemental Information**

1. Investigation of collinearity among predictor variables through Pearson's correlation of meteorological variables

Table 1. Pearson's correlation coefficient  $\mathbf{r}$  between raw data, baseline and short-term components of meteorological factors

| Factor 1 | Factor 2 | Raw data | Baseline | Short-term |
|----------|----------|----------|----------|------------|
| TMAX     | DASR     | 0.615    | 0.895    | 0.200      |
|          | DARH     | -0.010   | -0.160   | 0.126      |
|          | DMWS     | -0.253   | -0.591   | -0.011     |
| DASR     | DARH     | -0.571   | -0.324   | -0.711     |
|          | DMWS     | -0.244   | -0.360   | -0.200     |
| DARH     | DMWS     | 0.042    | -0.080   | 0.093      |

## 2. Investigation of linear trends in yearly statistics of MDA8 ozone at Aldine

Table 2. Linear regression models for yearly statistics (mean, median and max) of MDA8 ozone

| Yearly Statistics   | Slope                 | $\mathbb{R}^2$ | p-value                  |
|---------------------|-----------------------|----------------|--------------------------|
| Mean (1990-2016)    | -0.311 <u>+</u> 0.132 | 0.485          | 5.058 x 10 <sup>-5</sup> |
| Mean (1990-1999)    | $0.088 \pm 0.848$     | 0.007          | 0.816                    |
| Mean (2000-2016)    | -0.350 <u>+</u> 0.220 | 0.435          | 0.004                    |
| Median (1990-2016)  | -0.243 <u>+</u> 0.137 | 0.243          | 0.009                    |
| Median (1990-1999)  | 0.190 <u>+</u> 0.828  | 0.033          | 0.649                    |
| Median (2000-2016)  | -0.163 <u>+</u> 0.247 | 0.117          | 0.179                    |
| Maximum (1990-2016) | -2.560 <u>+</u> 0.575 | 0.771          | 1.820 x 10 <sup>-9</sup> |

3. Investigation of the effectiveness of  $KZ_{15,5}$  filter in effectively removing short-term component W(t) from the original MDA8 ozone timeseries, through demonstration of W(t) to follow gaussian distribution



Figure 1. (a) histogram of frequency distribution of short term MDA8 ozone component W(t), (b) Normal Q-Q plot of short term MDA8 ozone component W(t)

4. Regression Plots of raw data and short-term components of ozone and meteorological control variables



Figure 2. Regression plots of raw values of MDA8 ozone and (a) TMAX, (b) DASR, (c) DARH, (d) DAWS



Figure 3. Regression plots of short term component, W(t) values of MDA8 ozone and (a) TMAX, (b) DASR, (c) DARH, (d) DAWS



5. Investigating the independence of regression residuals from meteorological factors

Figure 4. Scatter plots of regression residuals ( $\epsilon_i(t)$ ) and meteorological variables indicating insignificant correlations

| Models Statistics  |                            | Correlation coefficient |  |
|--------------------|----------------------------|-------------------------|--|
| Model 1            | $\epsilon_1(t)$ vs TMAX    | -0.0257                 |  |
| Model 2            | $\epsilon_2(t)$ vs DASR    | -0.0021                 |  |
| Model 3            | $\epsilon_3(t)$ vs DARH    | -0.0172                 |  |
| Model 4            | $\epsilon_4(t)$ vs DAWS    | -0.0058                 |  |
| Model 5            | ε <sub>5</sub> (t) vs TMAX | -0.0136                 |  |
|                    | ε <sub>5</sub> (t) vs DARH | -0.0201                 |  |
| Model 6<br>Model 7 | $\epsilon_6(t)$ vs DASR    | -0.0016                 |  |
|                    | $\varepsilon_6(t)$ vs DAWS | -0.0137                 |  |
|                    | ε <sub>7</sub> (t) vs TMAX | -0.0024                 |  |
|                    | ε <sub>7</sub> (t) vs TMAX | 0.0088                  |  |
|                    | ε <sub>7</sub> (t) vs TMAX | -0.0143                 |  |
|                    | ε <sub>7</sub> (t) vs TMAX | -0.0114                 |  |

Table 3. Pearson's correlation coefficient **r** between residuals of regressions ( $\epsilon_i(t)$ ) and meteorological factors





Figure 5. Meteorologically adjusted MDA8 ozone residuals (gray) with effects of the following control variables removed from baseline data of ozone: (a) temperature, (b) solar radiation, (c) relative humidity, (d) resultant wind speed. The secondary Y-axis on the right side of each graph is for the long-term component (dark lines) of meteorologically independent MDA8 ozone residuals



Figure 6. Meteorologically adjusted MDA8 ozone residuals (gray) with effects of the following control variables removed from baseline data of ozone: (a) temperature/relative humidity, (b) solar radiation/wind speed resultant, (c) temperature/relative humidity/solar radiation/wind speed resultant. The secondary Y-axis on the right side of each graph is for the long-term component (dark lines) of meteorologically independent MDA8 ozone residuals



Figure 7. Box plot with yearly statistics for MDA8 values of ozone at Aldine, during 1990-2016. Hollow squares represent means, dots represent maximum values, line dividing the boxes represents median, upper and lower limits of boxes represent third and first quartile, and whisker length represents 1.5 times interquartile distance

## 7. 1-hr daily maximum ozone analysis (MDA1) at Aldine from 1990-2016



Figure 8. Decomposed time-series of ln(MDA1) ozone at Aldine, during 1990-2016. (a) natural log of MDA8 ozone, (b) long-term trend component e(t), (c) seasonal component S(t), (d) short-term component W(t)