

1 **Supplementary Material for “The impact of aged wildfire smoke on**
2 **atmospheric composition and ozone in the Colorado Front Range in**
3 **summer 2015”**

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5 Roscioli⁴, Scott Herndon⁴, and Emily V. Fischer¹

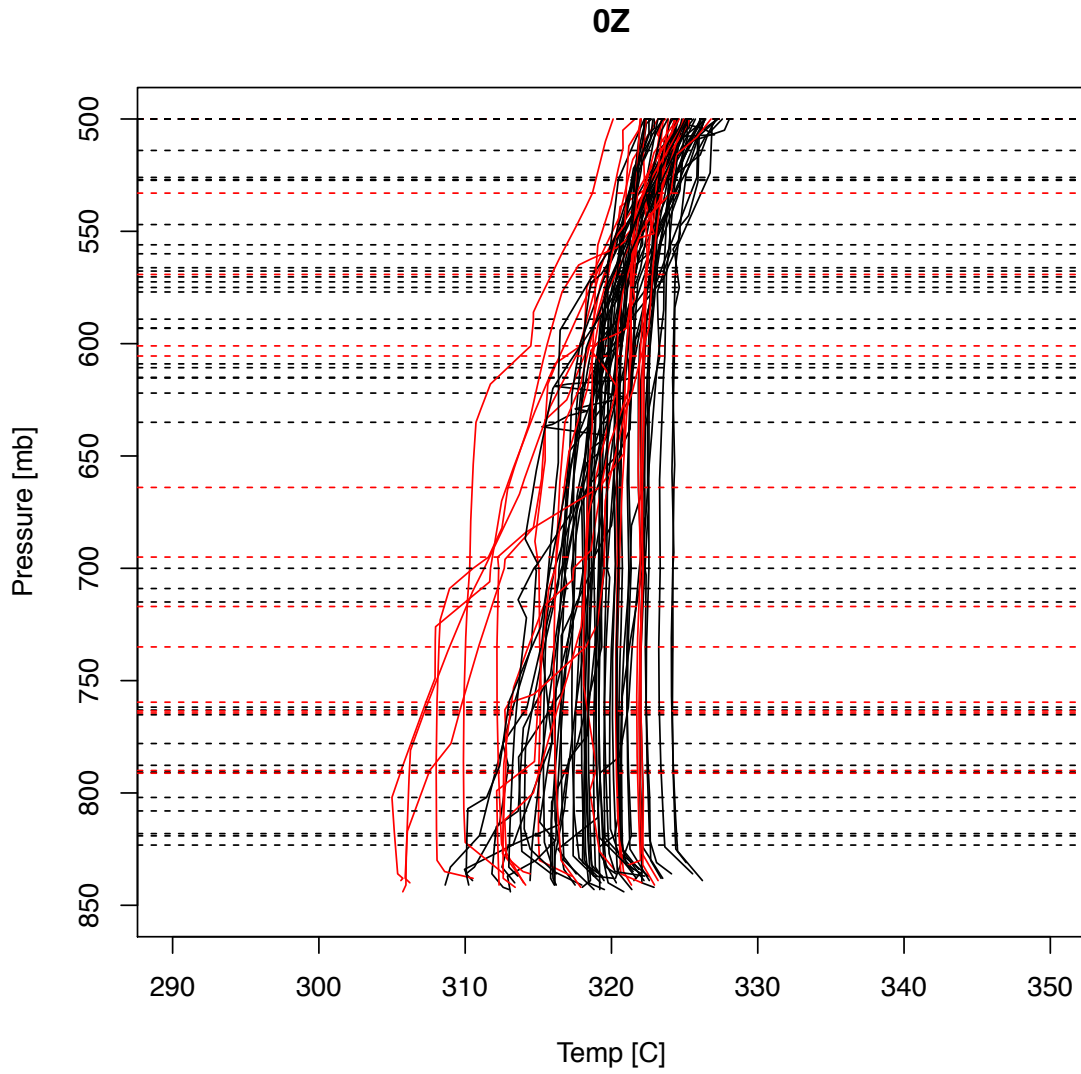
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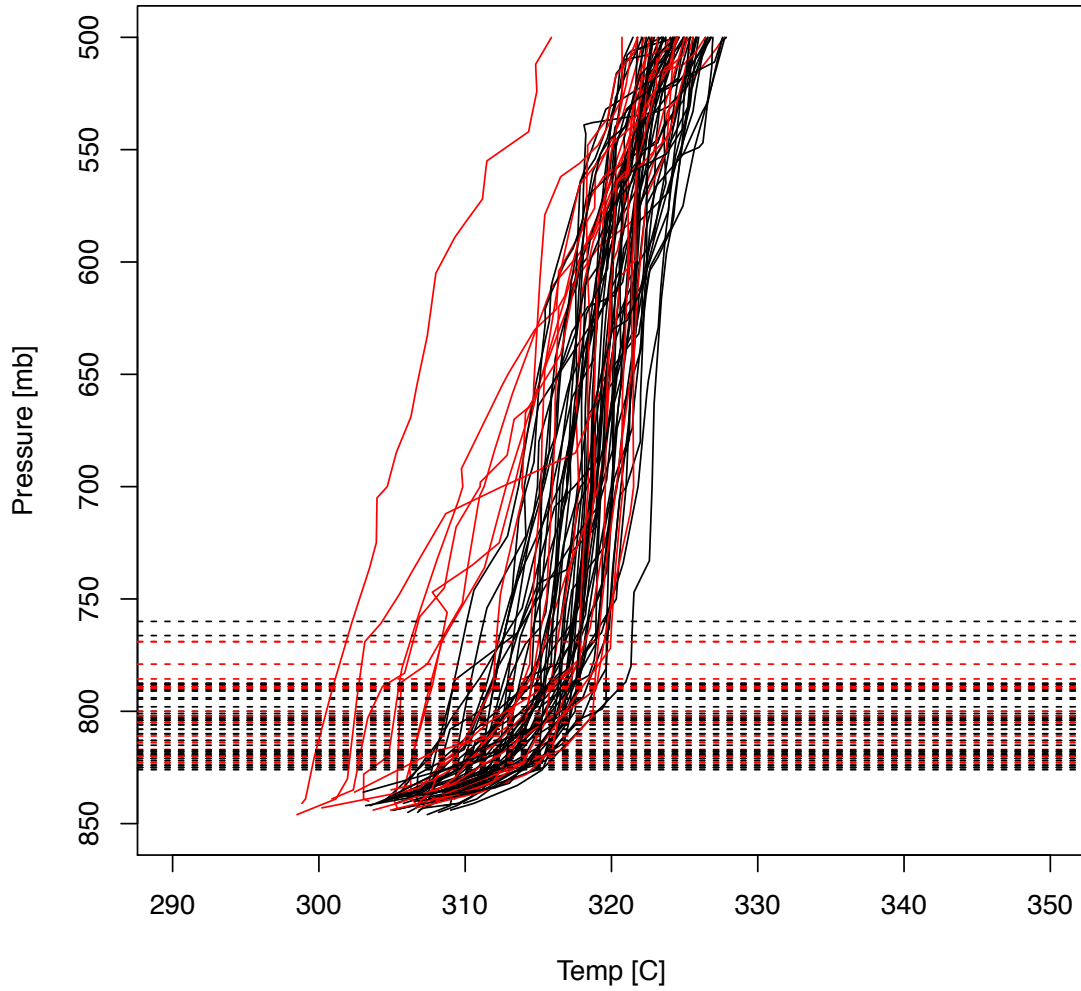


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13 **Figure S1. Temperature profiles from the 0Z (6PM MDT) atmospheric sounding at Denver, CO. Dashed lines show the estimated**
 14 **planetary boundary layer height following Coniglio et al. (2016). Red lines denote soundings during the smoke-impacted periods**
 15 **and black lines denote the smoke-free period.**

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18 **Figure S2. Temperature profiles from the 12Z (6AM MDT) atmospheric sounding at Denver, CO. Dashed lines show the estimated**
19 **planetary boundary layer height following Coniglio et al. (2016). Red lines denote soundings during the smoke-impacted periods**
20 **and black lines denote the smoke-free period.**

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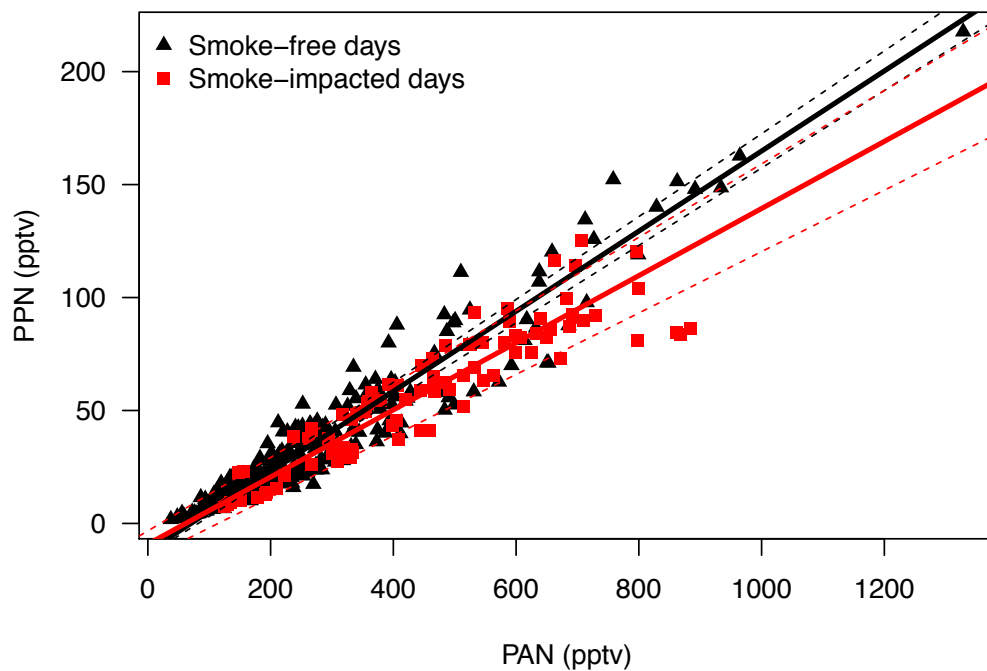
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36 Section S4.2

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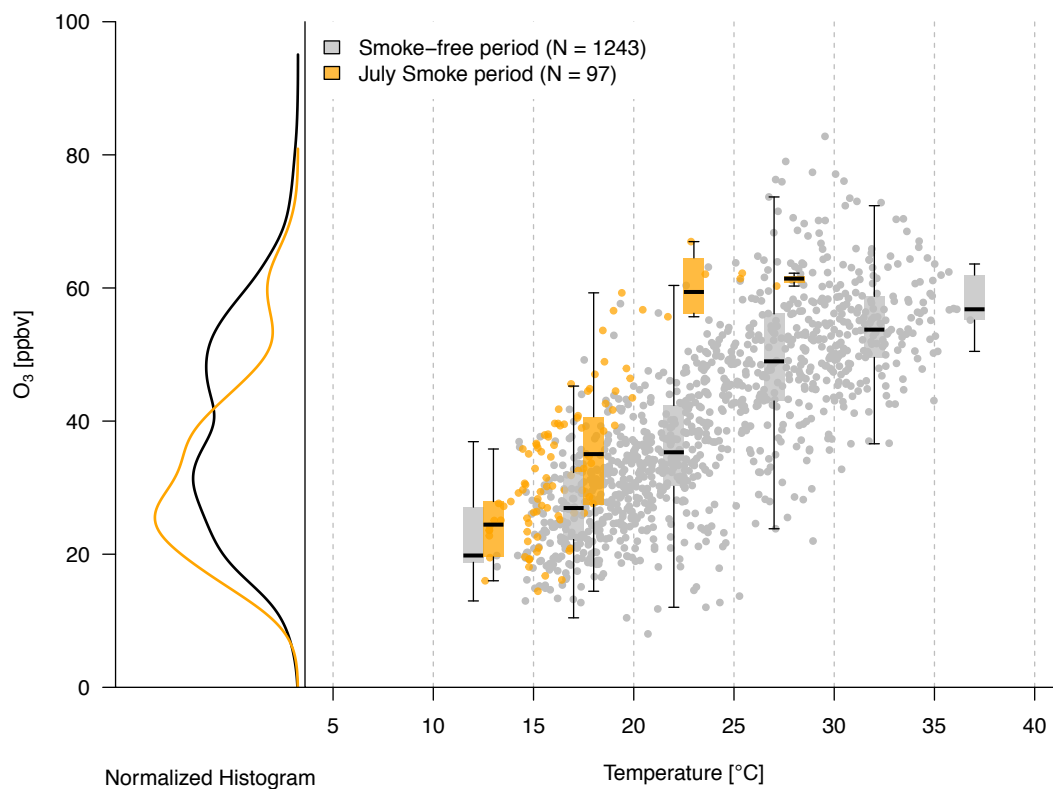
39 Figure S3. Mixing ratios of hourly average (or 5 min point) PPN plotted against PAN in pptv. Reduced major axis regression (R
40 package “lmodel2”) fits are plotted as solid lines with dashed lines showing the 95% confidence interval for the slope and the
41 intercept. Slopes of PPN/PAN ratio are 0.17 ± 0.006 for smoke-free days (black) and 0.14 ± 0.012 for smoke-impacted days (red).

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65 **Section S4.3**

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71 **Figure S4. Hourly O₃ data from BAO plotted against hourly temperature data show a positive correlation between temperature**
 72 **and O₃ abundances for both smoke-free time periods in grey and the July smoke-impacted time period in orange. Overlaid are**
 73 **boxplots (5th, 25th, 50th, 75th, and 95th percentiles) for each 5 °C bin. On the left normalized histograms of the hourly O₃ data are**
 74 **plotted, with all smoke-free measurements in black, and all hourly measurements made during the July smoke-impacted period in**
 75 **orange.**

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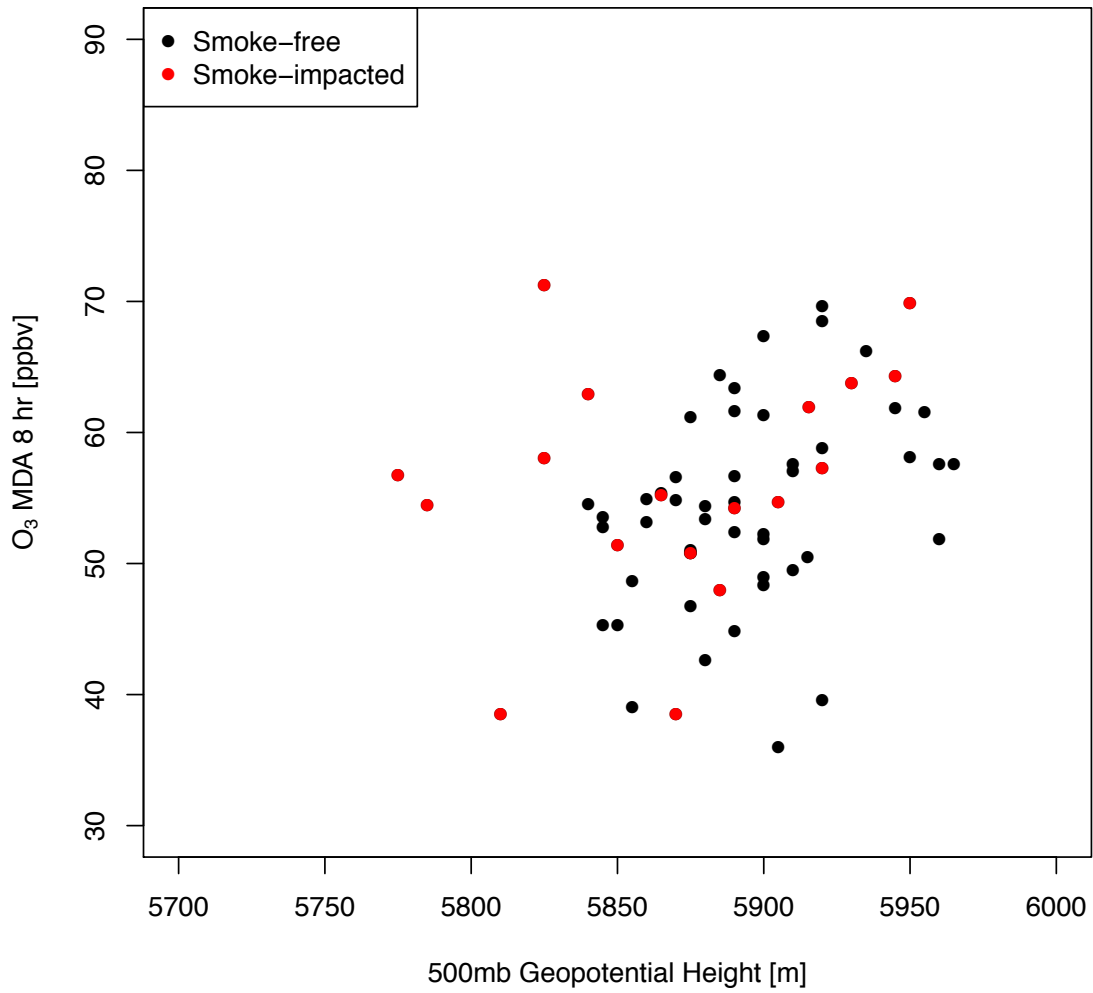
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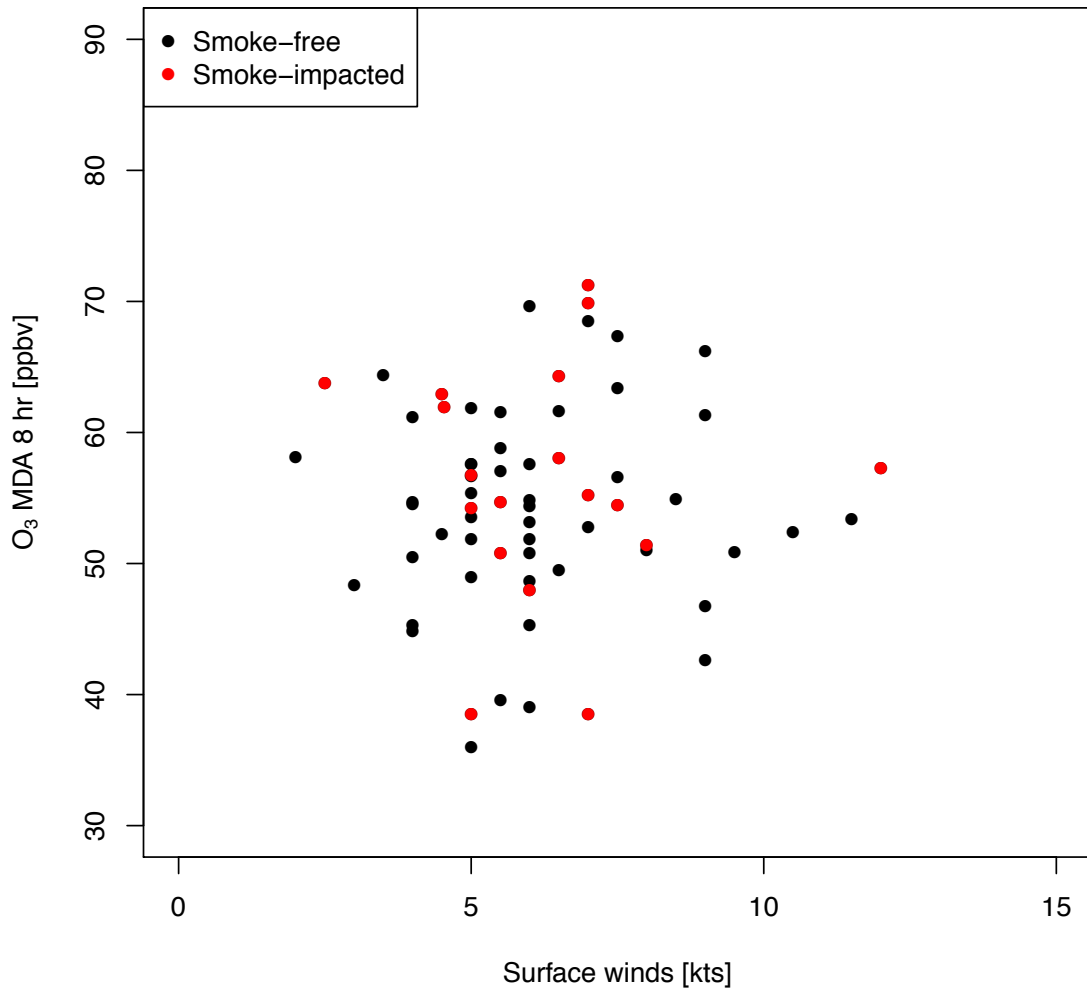
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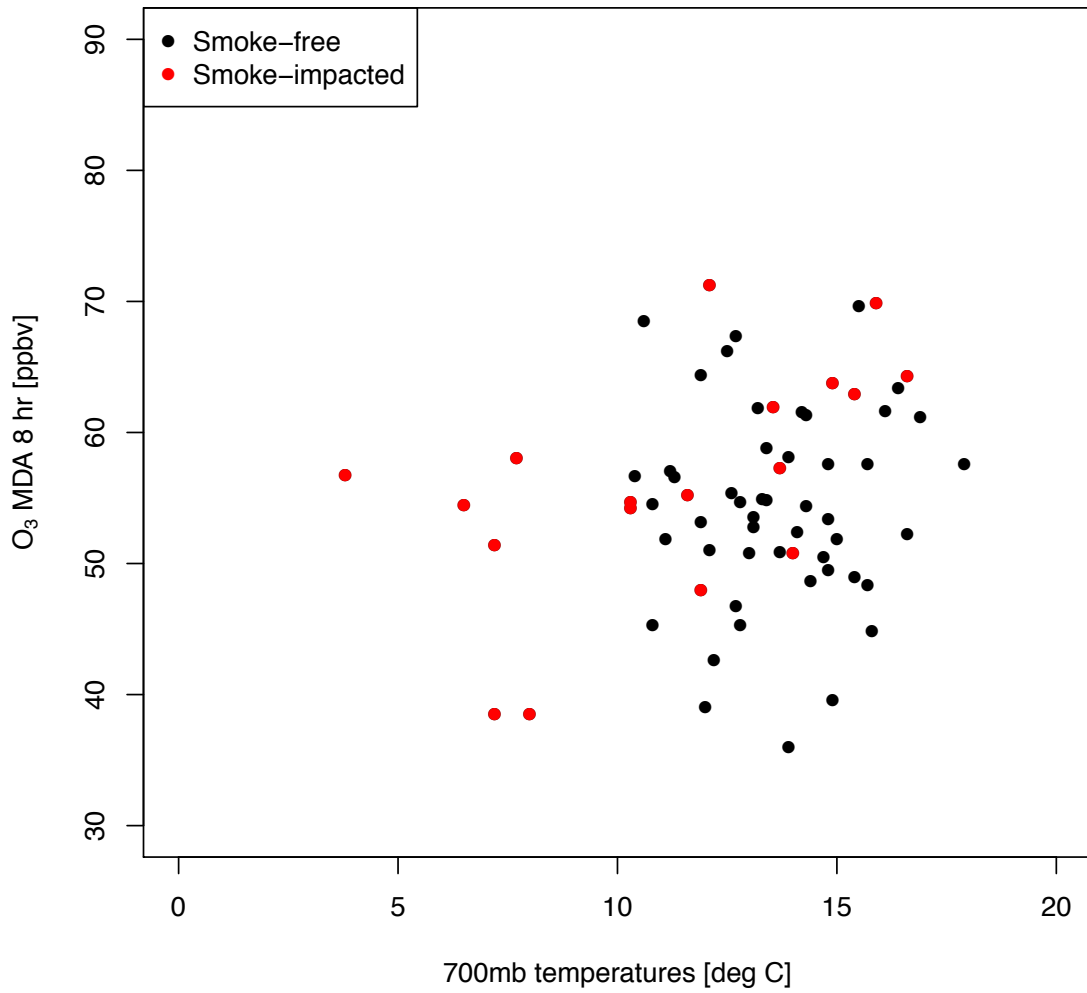
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83 **Figure S5. Ozone MDA8 plotted against 500mb geopotential height from the 12Z atmospheric soundings over Denver.**

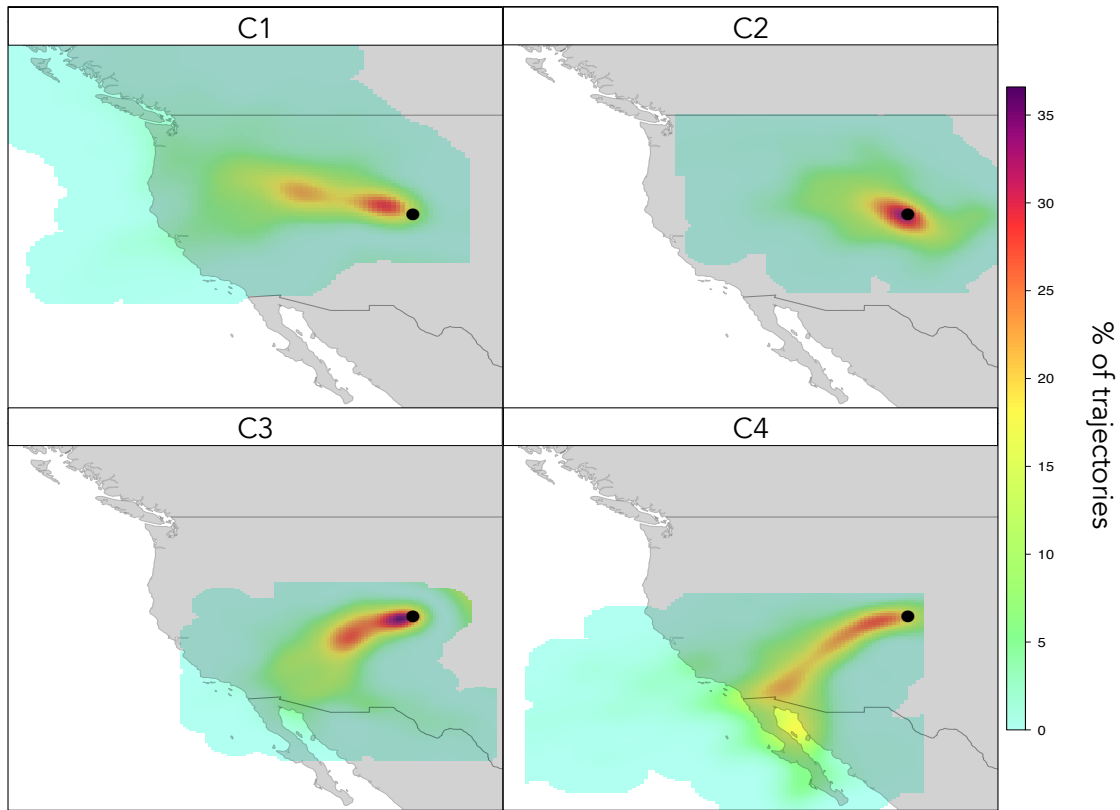
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86 **Figure S6. Ozone MDA8 plotted against surface winds from the 12Z atmospheric soundings over Denver.**
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90 **Figure S7. Ozone MDA8 plotted against 700mb temperatures from the 12Z atmospheric soundings over Denver.**
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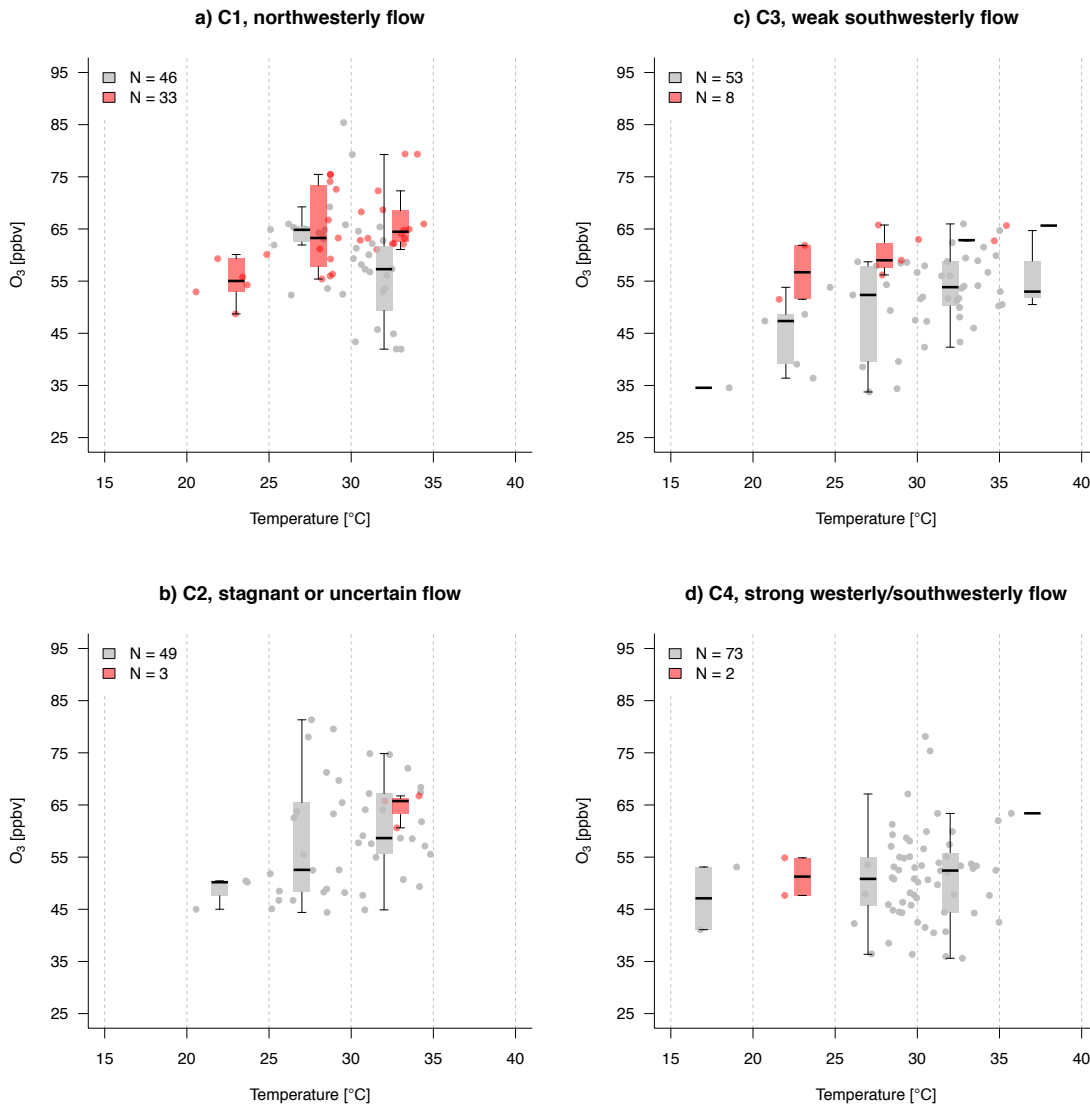


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93 **Figure S8. Trajectory clusters calculated for hourly HYSPLIT back trajectories initiated from BAO. Clusters are calculated using**
 94 **k-means cluster analysis. 66% of all hours during the campaign were able to be clustered. C1 shows northwesterly flow, and**
 95 **contains the majority of the smoke-impacted hours. C2 shows stagnant or uncertain flow. C3 shows weak southwesterly flow, and**
 96 **C4 shows strong westerly/southwesterly flow.**

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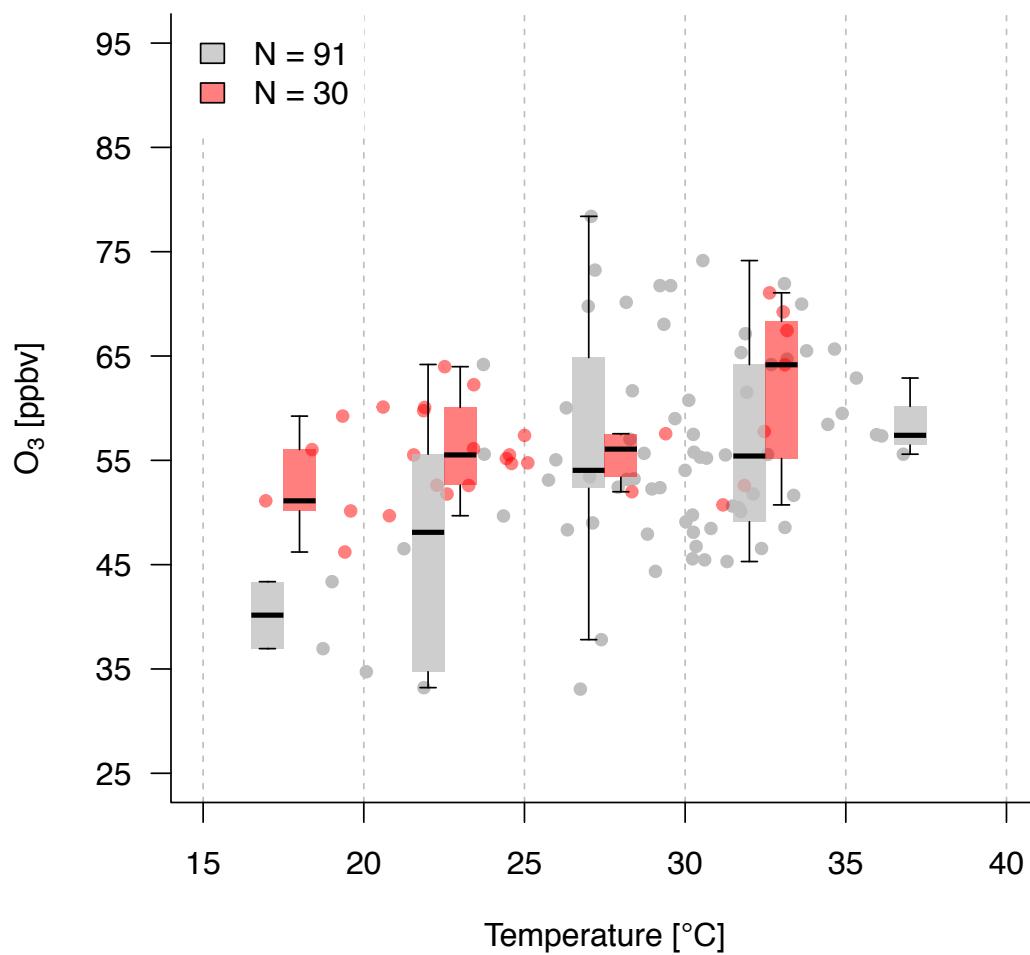
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100 **Figure S9. Hourly O₃ versus temperature for the four k-means trajectory clusters: a) C1, b) C2, c) C3, and d) C4. Plotted here are**
 101 **hourly data, with boxplots showing standard percentiles of 5 °C binned O₃ data. Smoke-free days are shown in black and August**
 102 **smoke-impacted days are shown in red as in Figure 6 and Figure 8.**

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a) Unclustered

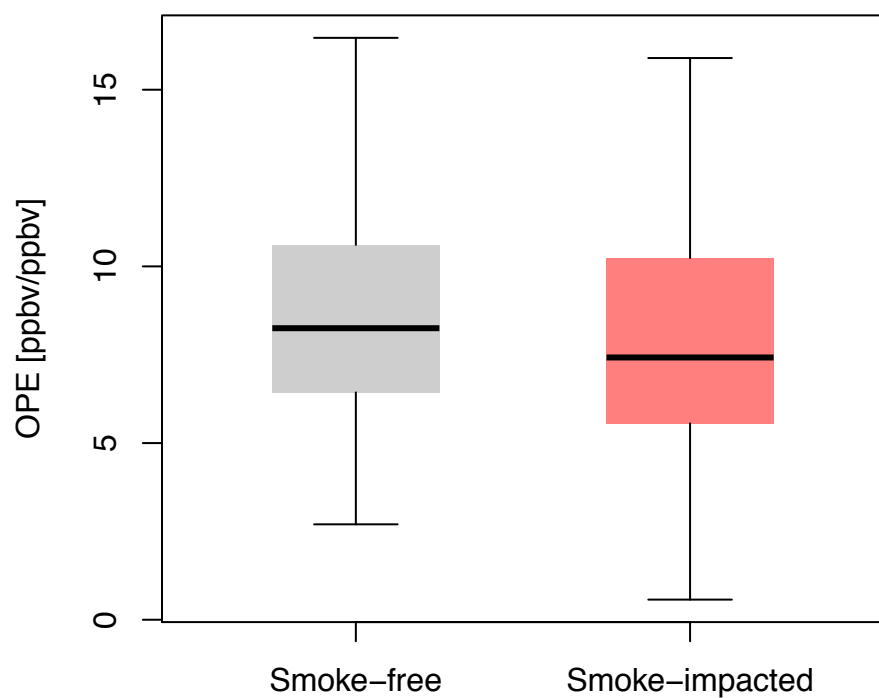


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106 **Figure S10. Hourly O₃ versus temperature for the unclustered HYSPLIT trajectory hours. Plotted here are hourly data, with**
107 **boxplots showing standard percentiles of 5 °C binned O₃ data the same as is shown in Figure 6 and Figure 8.**

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111 **Figure S11. Boxplots showing median, 5th, 25th, 75th, and 95th percentile ozone production efficiency (OPE) for the smoke-free**
112 **period in grey and the smoke-impacted periods in red. OPE was calculated as the slope of the relationship between O₃ and NO_z**
113 **(NO_z = NO_y - NO_x) during 30 minute periods from 12PM - 5PM MDT. Reduced major axis regression was used (package lmodel2**
114 **in R software) and only OPE values corresponding to an R² > 0.3 were retained in this plot.**

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