# UK air quality showed clear improvement from 2015 to 2024 but breaching of targets remains very common: Supplementary Information

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Figures S1-S29

## 1. SUPPLEMENTARY FIGURES

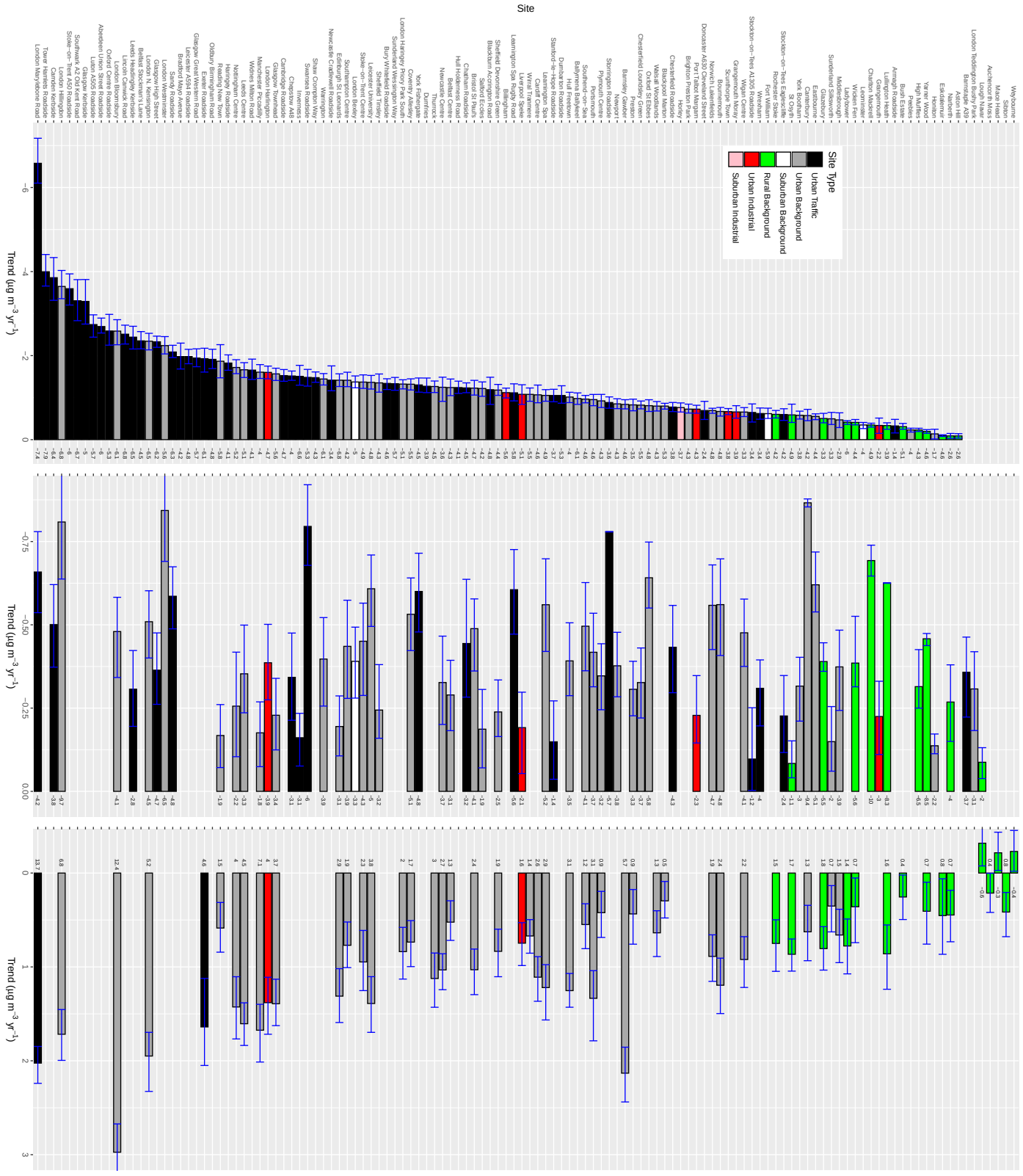


**Fig. S1.** Deseasonalised trend over 2015-2024 from AURN sites of (a) $NO_2$, (b) $PM_{2.5}$ and (c) $O_3$. Error bars show 95% confidence bounds and only sites with at least 75% coverage of the time period starting in 2015, running to at least 2023, and where trends are significant at the 95% level are included. Small text shows the fractional trend (% yr$^{-1}$).

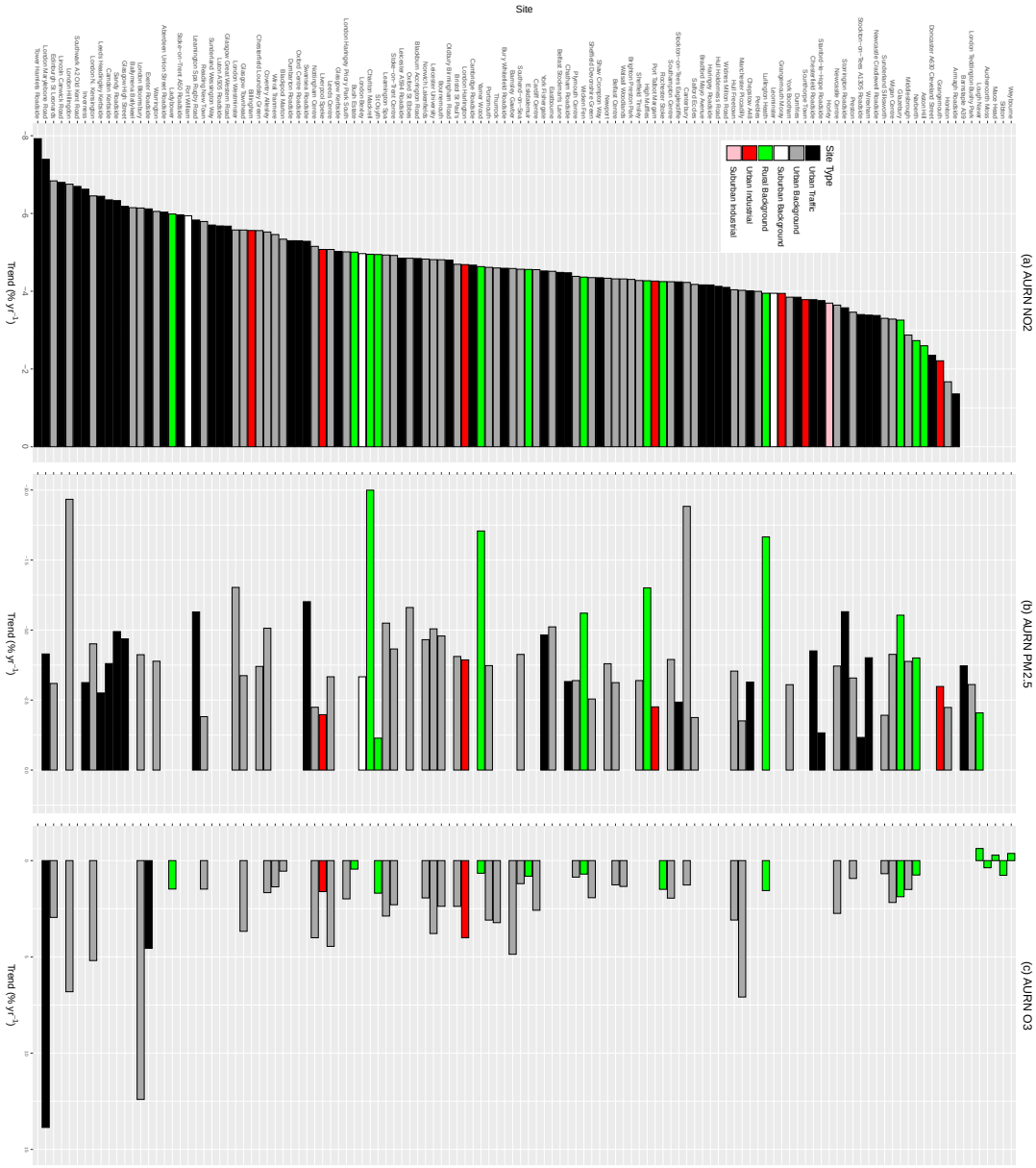


**Fig. S2.** Deseasonalised percentage trend over 2015-2024 from AURN sites of (a) $NO_2$, (b) $PM_{2.5}$ and (c) $O_3$. Only sites with at least 75% coverage of the time period starting at 2015 and where trends are significant at 95% level are included.

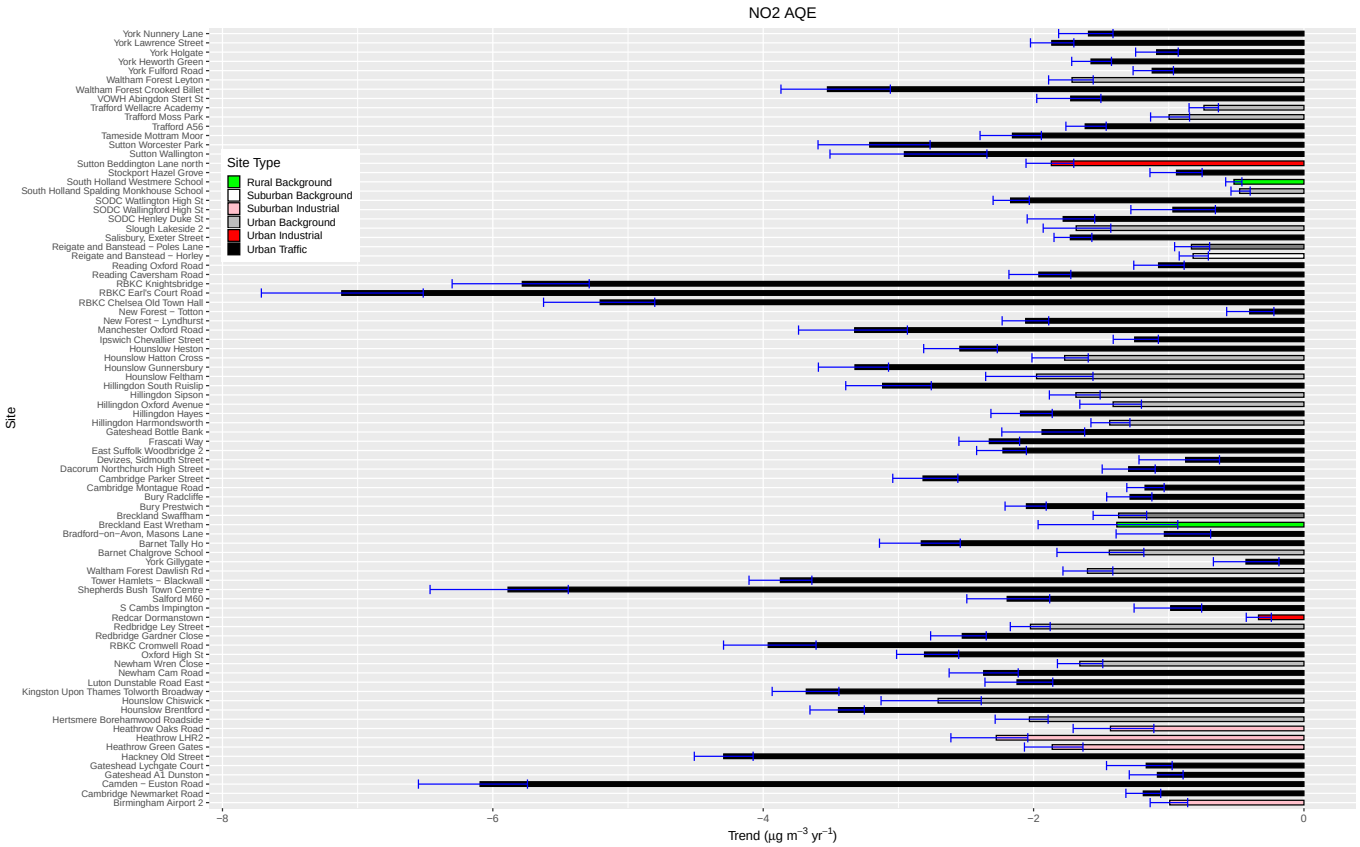


**Fig. S3.** Deseasonalised trend over 2015-2024 from AQE sites for $NO_2$. Error bars show 95% confidence bound. Criteria for inclusion same as in Figure S2.

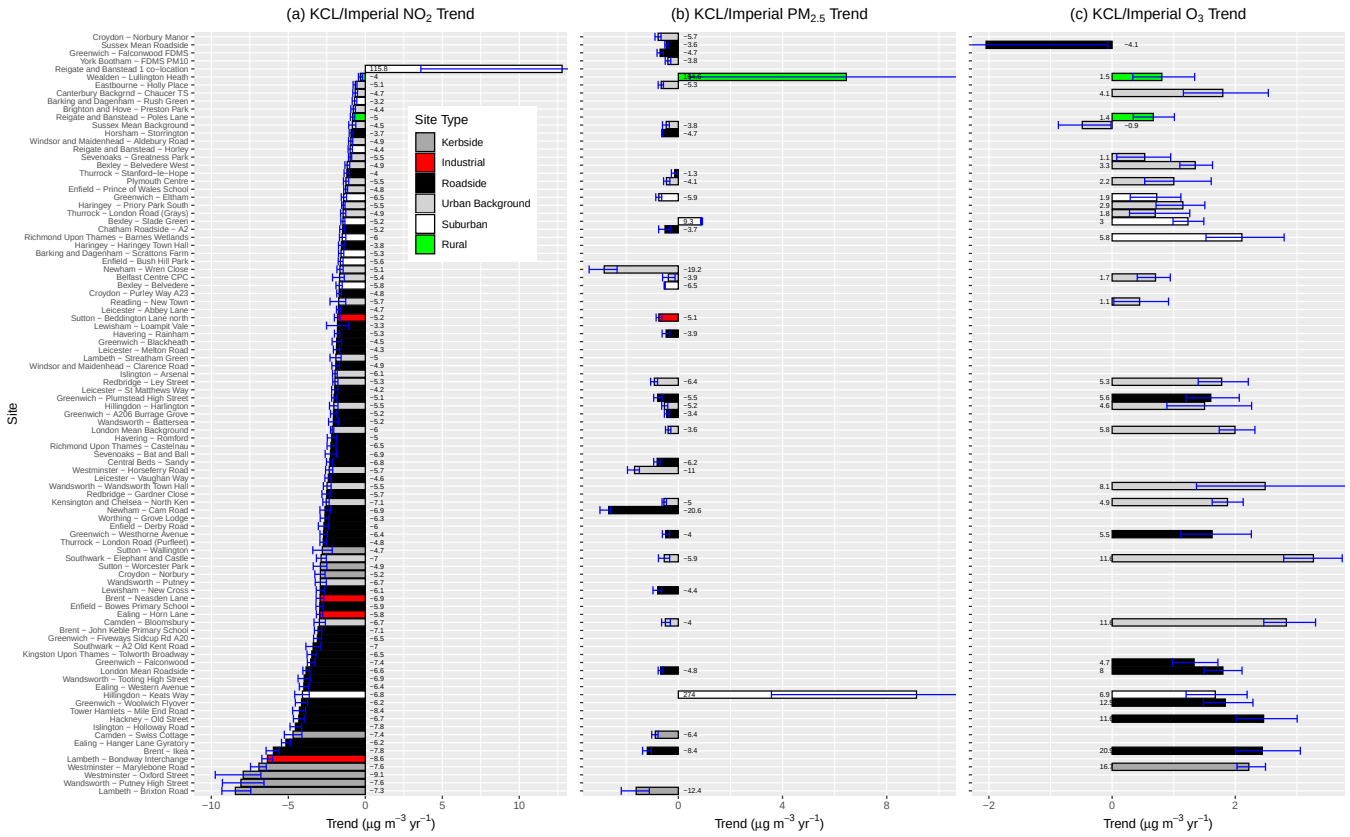


**Fig. S4.** Deseasonalised trend over 2015-2024 from SAQN sites for $NO_2$. Error bars show 95% confidence bound. Criteria for inclusion same as in Figure S2.

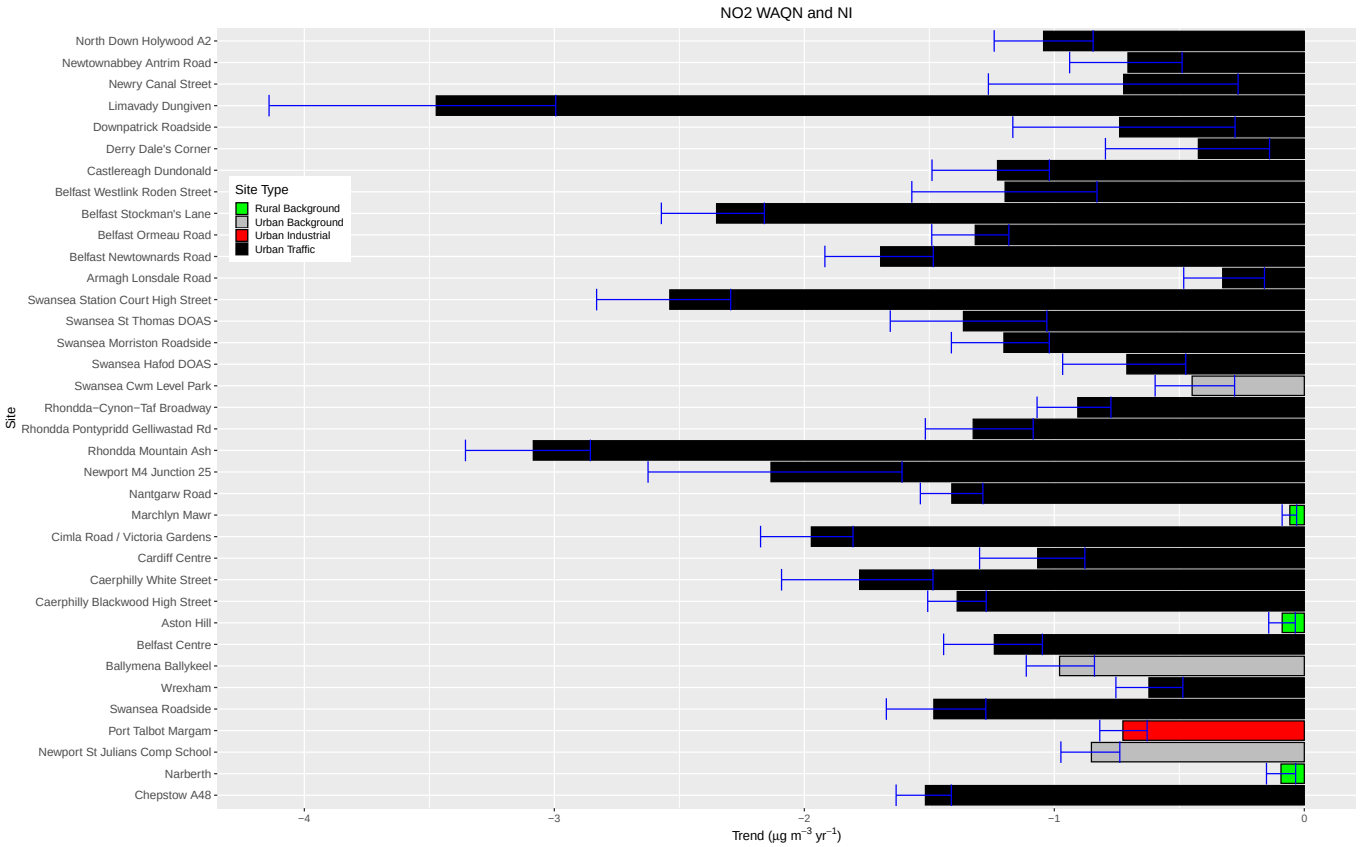


**Fig. S5.** Deseasonalised trend over 2015-2024 from WAQN and NI sites for $NO_2$. Error bars show 95% confidence bound. Criteria for inclusion same as in Figure S2.

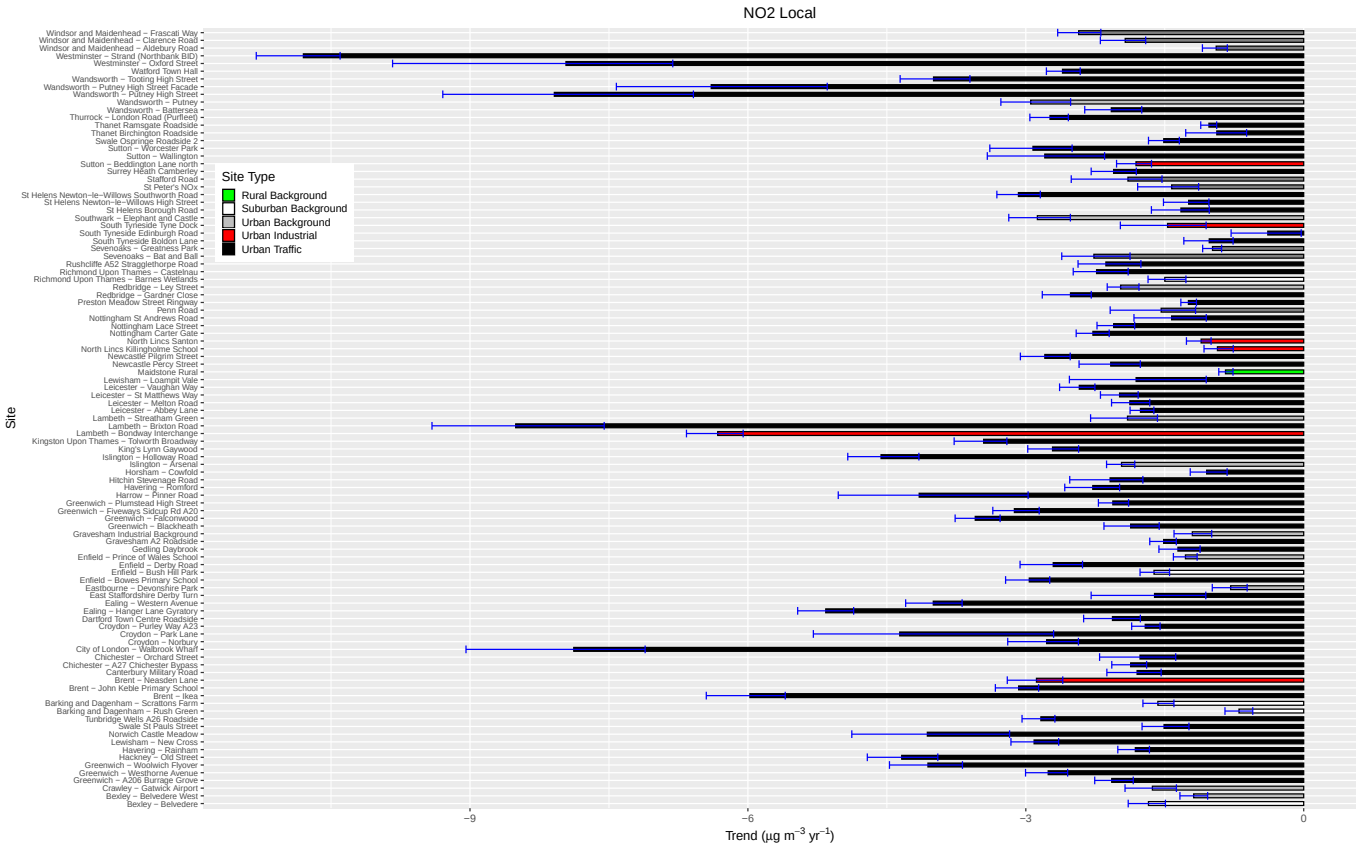


**Fig. S6.** Deseasonalised trend over 2015-2024 from Local network sites for $NO_2$. Error bars show 95% confidence bound. Criteria for inclusion same as in Figure S2.

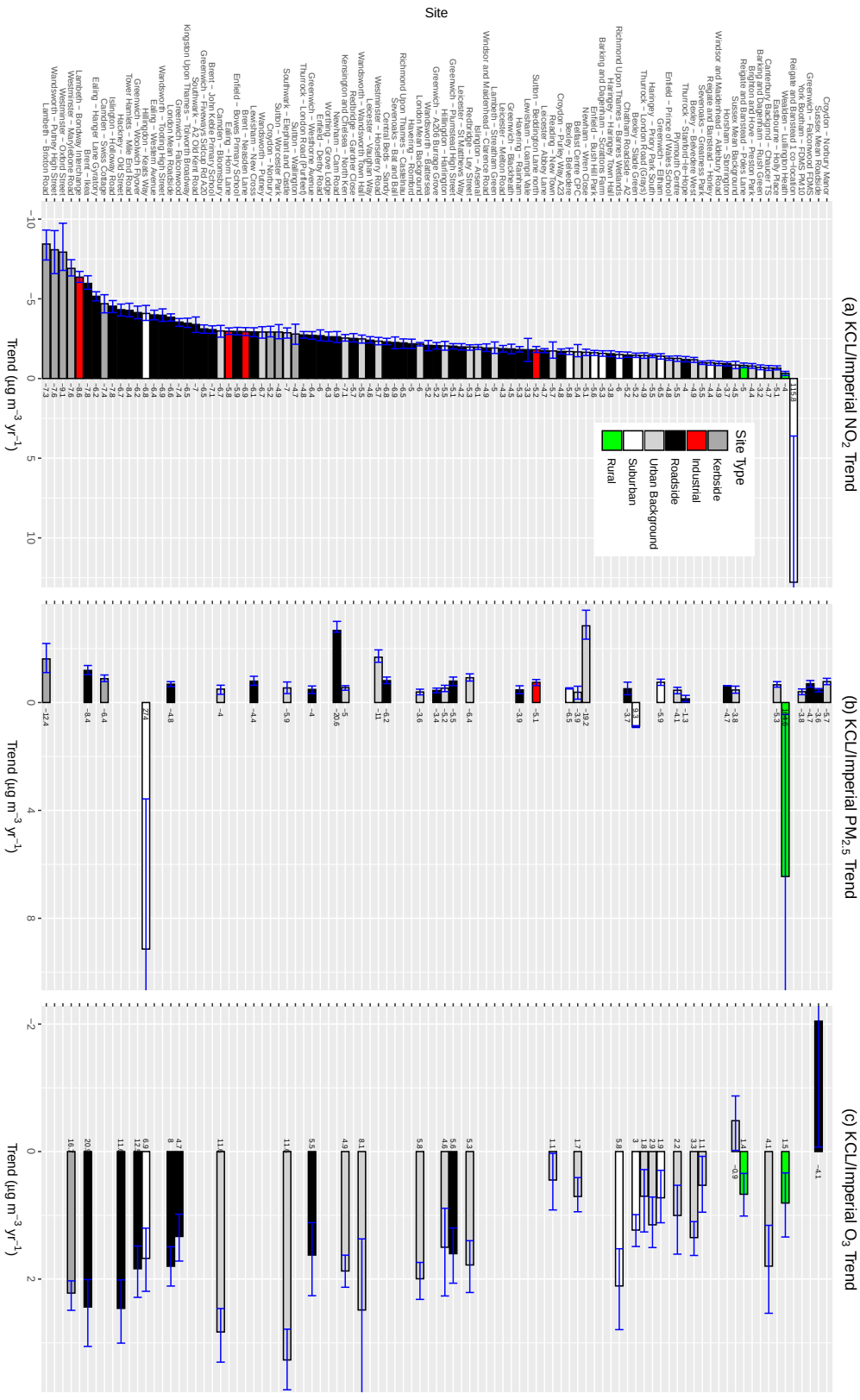


**Fig. S7.** Deseasonalised trend over 2015-2024 for all qualifying KCL/Imperials sites. Error bars show 95% confidence bound. Criteria for inclusion same as in Figure S2.

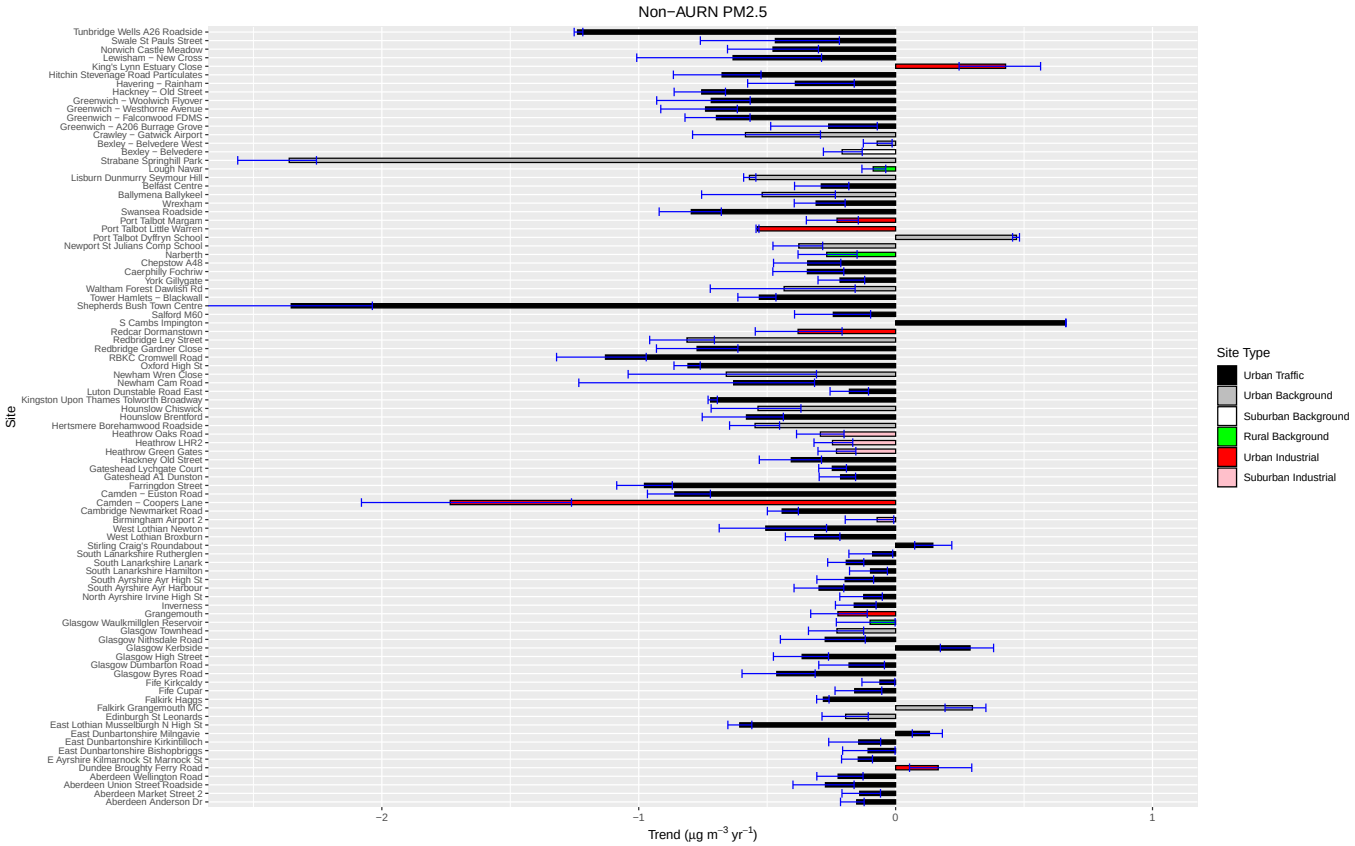


**Fig. S8.** Deseasonalised trend over 2015-2024 for AQE, SAQN, WQAN. NI and local sites for $PM_{2.5}$. Error bars show 95% confidence bound. Criteria for inclusion same as in Figure S2.

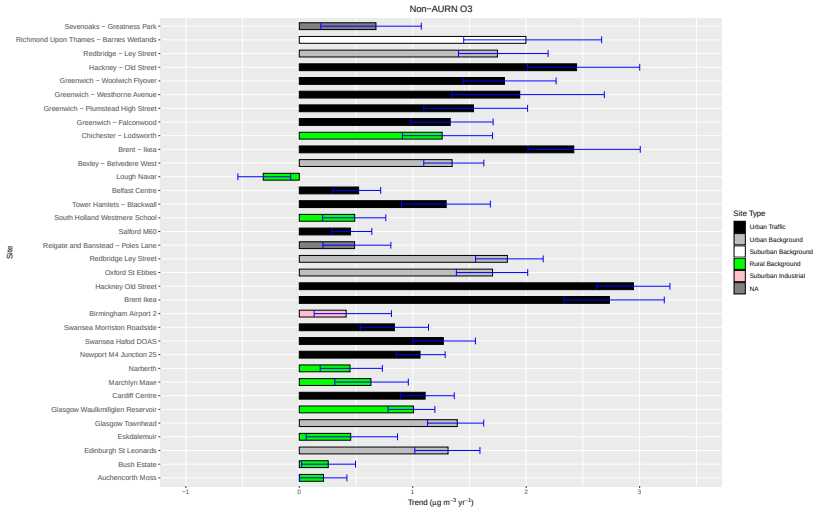


**Fig. S9.** Deseasonalised trend over 2015-2024 for AQE, SAQN, WQAN. NI and local sites sites for $O_3$. Error bars show 95% confidence bound. Criteria for inclusion same as in Figure S2.

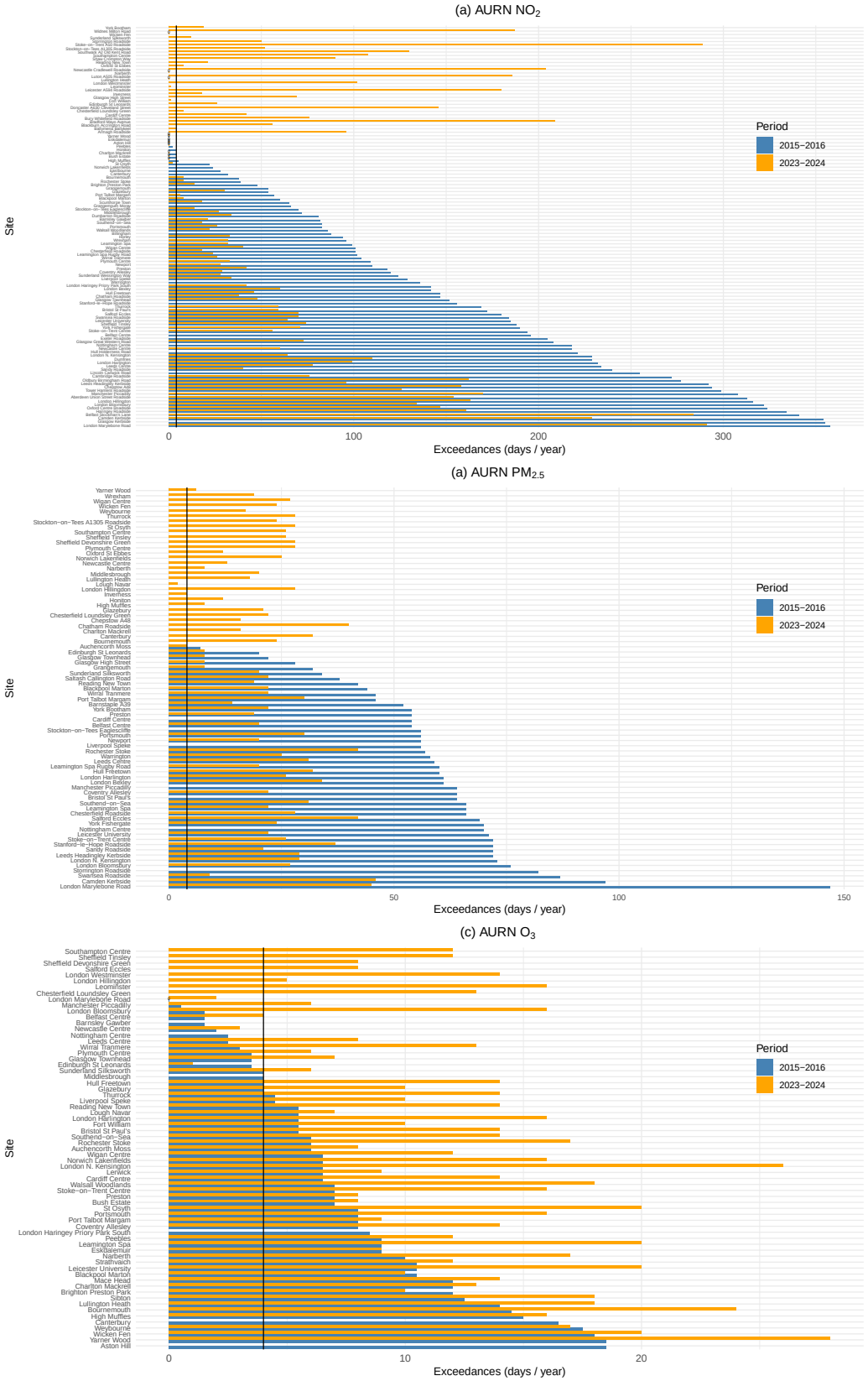


**Fig. S10.** Mean number of exceedances of WHO 2021 air quality targets for 2015-2016 and 2023-2024 for AURN measurements of (a) $NO_2$, (b) $PM_{2.5}$ and (c) MDA8 $O_3$. For each site, exceedances are only given if there are data for at least 300 days in both years of the period. "0" on the vertical axis indicates zero exceedances while a blank space indicates insufficient data. Exceedances should occur on no more than 3-4 days/year (vertical black line).

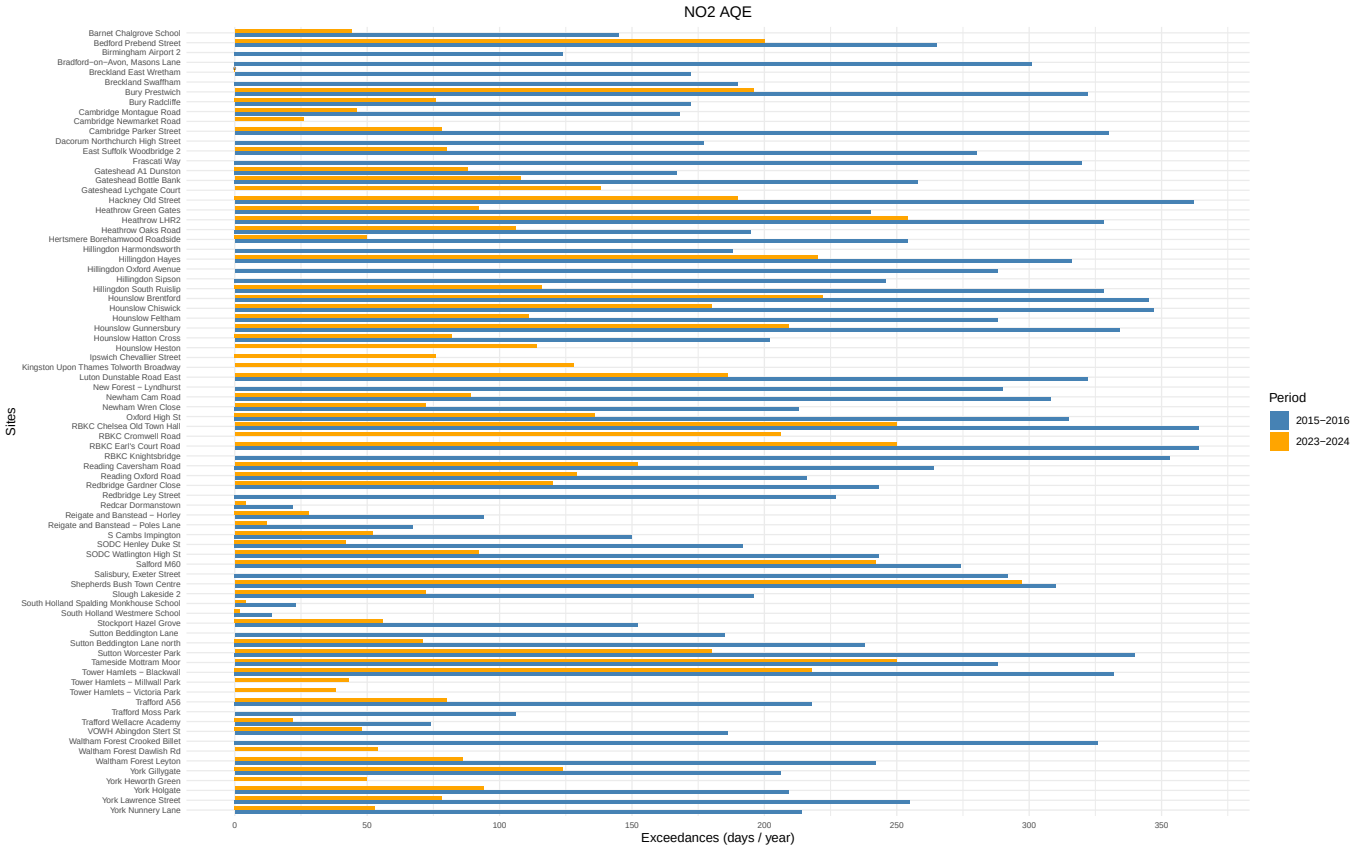


**Fig. S11.** Mean number of exceedances of WHO 2021 air quality targets for 2015-2016 and 2023-2024 for AQE site measurements of $NO_2$. For each site, exceedances are only given if there are data for at least 300 days in both years of the period. "0" on the vertical axis indicates zero exceedances while blank space indicates insufficient data. Exceedances should occur on no more than 3-4 days/year.

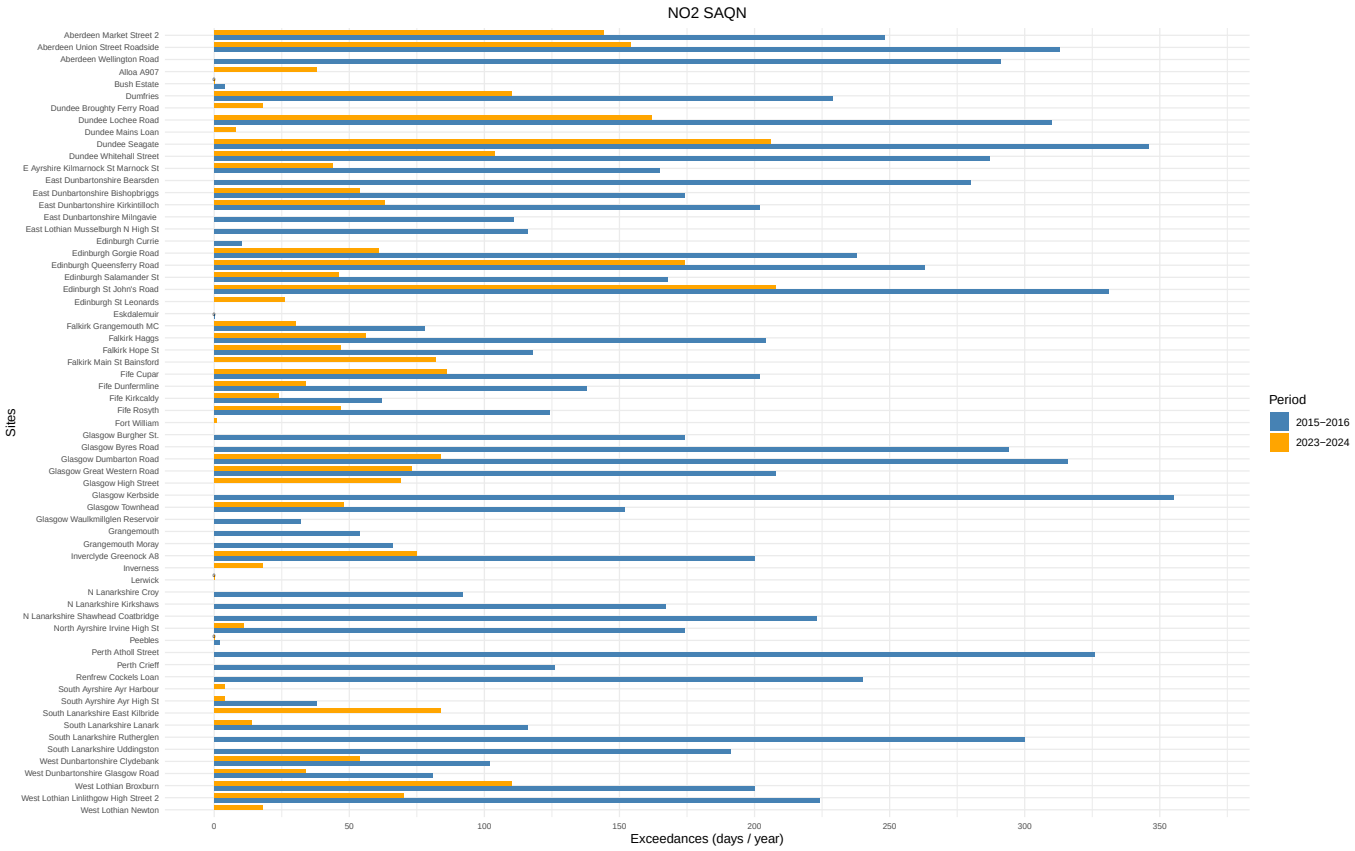


**Fig. S12.** Mean number of exceedances of WHO 2021 air quality targets for 2015-2016 and 2023-2024 for SAQN site measurements of $NO_2$. Criteria for inclusion same as is in Figure S11.

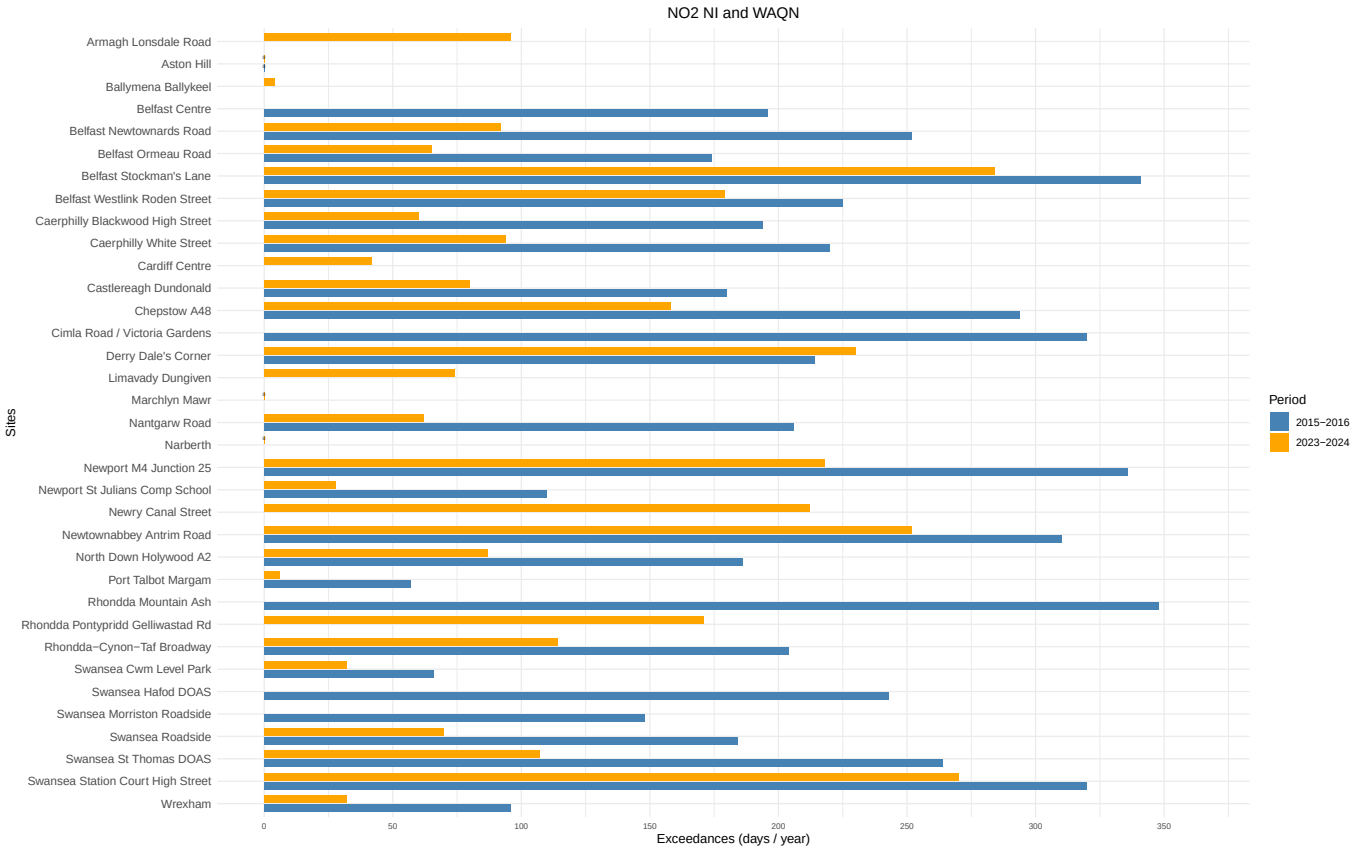


**Fig. S13.** Mean number of exceedances of WHO 2021 air quality targets for 2015-2016 and 2023-2024 for WAQN and NI site measurements of $NO_2$. Criteria for inclusion same as is in Figure S11.

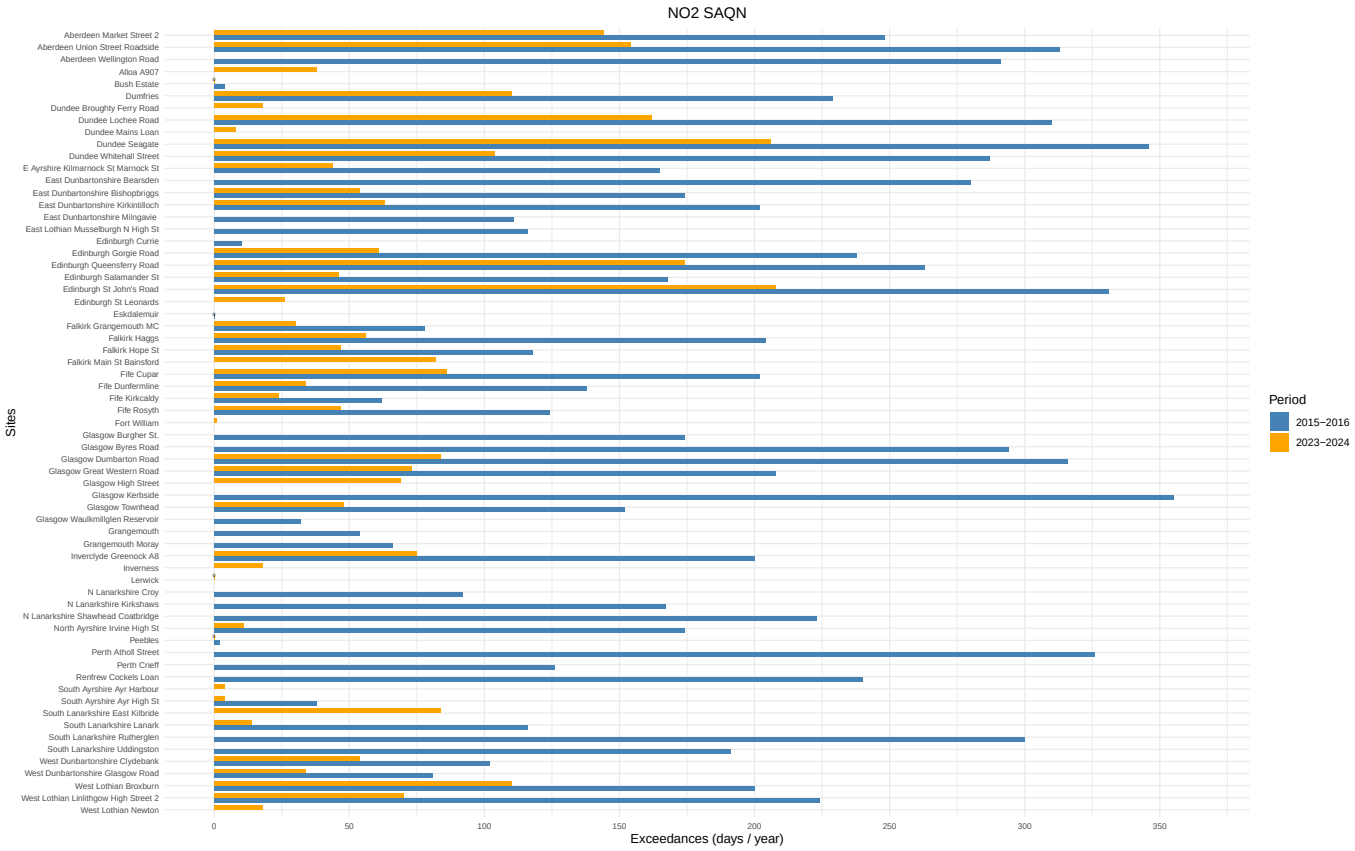


**Fig. S14.** Mean number of exceedances of WHO 2021 air quality targets for 2015-2016 and 2023-2024 for Local network site measurements of $NO_2$. Criteria for inclusion same as is in Figure S11.

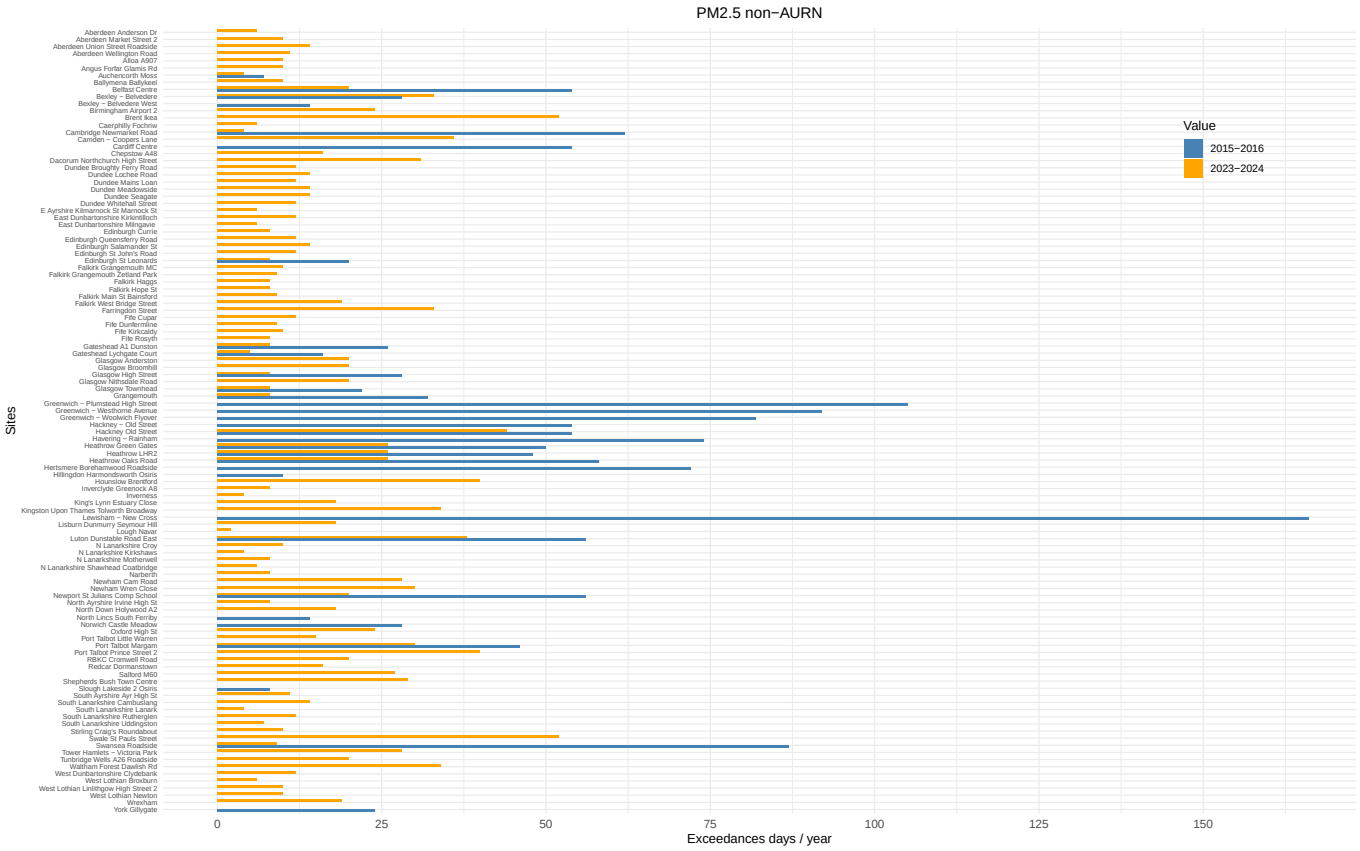


**Fig. S15.** Mean number of exceedances of WHO 2021 air quality targets for 2015-2016 and 2023-2024 for all non-AURN site measurements of $PM_{2.5}$. Criteria for inclusion same as is in Figure S11.


**Fig. S16.** Equivalent exceedance days per year for (a) $NO_2$, (b) $PM_{2.5}$ and (c) $O_3$ (relative to WHO 2021 AQ target) for AURN sites. Equivalent exceedance days is defined as number of days where AQ target was exceeded scaled by 365/n where n is the number of days with data. Solid line is median of all sites and shaded regions shows IQR. Only sites with data for every year in time period are considered.

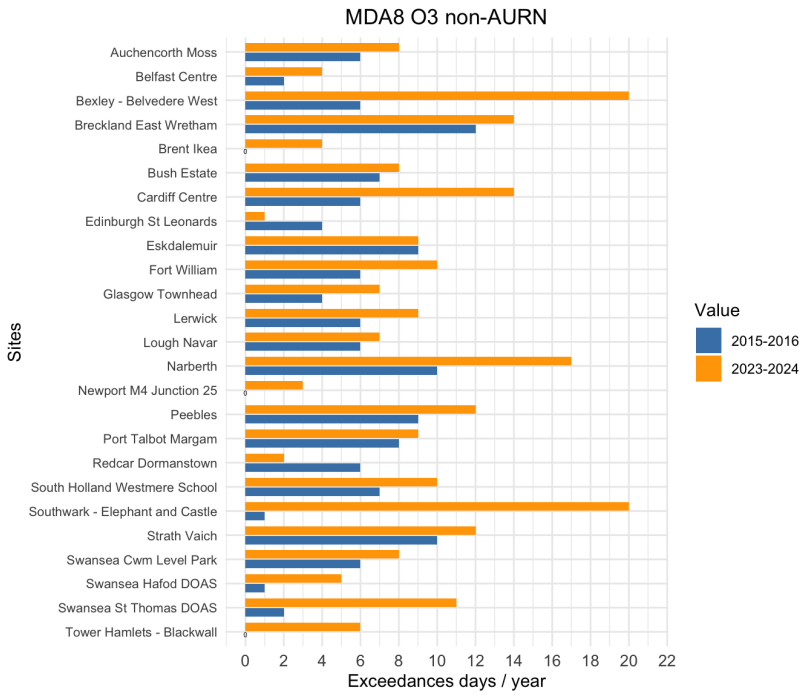


**Fig. S17.** Mean number of exceedances of WHO 2021 air quality targets for 2015-2016 and 2023-2024 for all non-AURN site measurements of MDA8 $O_3$. Criteria for inclusion same as is in Figure S11.

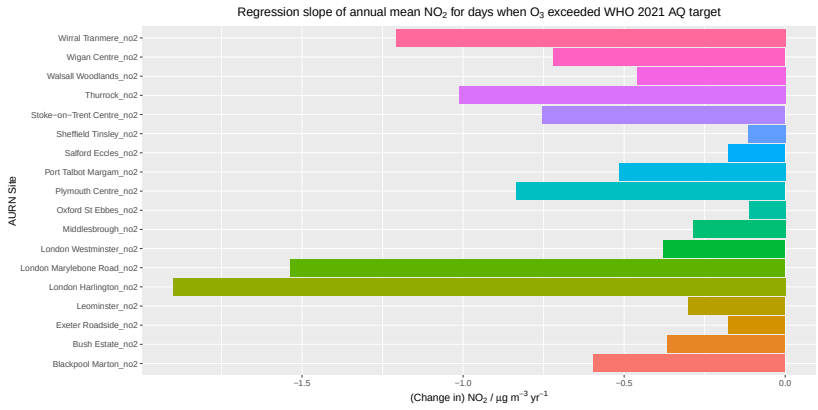


**Fig. S18.** Regression slope of annual mean NO2 for days when O3 exceeded the WHO 2021 AQ target across 2015-2024.

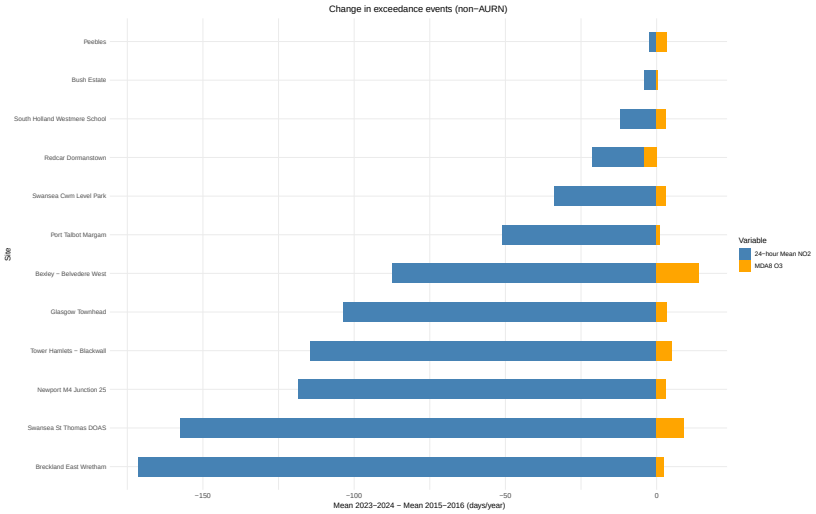


**Fig. S19.** Change in mean number of exceedances between 2015-2016 and 2023-2024 for non-AURN sites with measurements of both $NO_2$ and MDA8 $O_3$. Criteria for inclusion same as is in Figure 4.

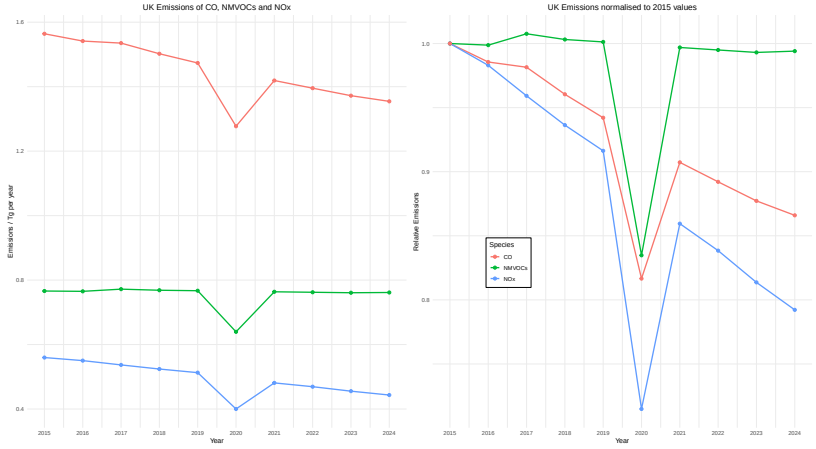


**Fig. S20.** UK-wide emissions for non-methyl volatile organic compounds (NMVOCs), CO and $NO_x$ from the Copernicus Atmospheric Monitoring Service (CAMS) inventory (v6.2). Absolute emissions (left) and emissions normalised to 2015 values (right).

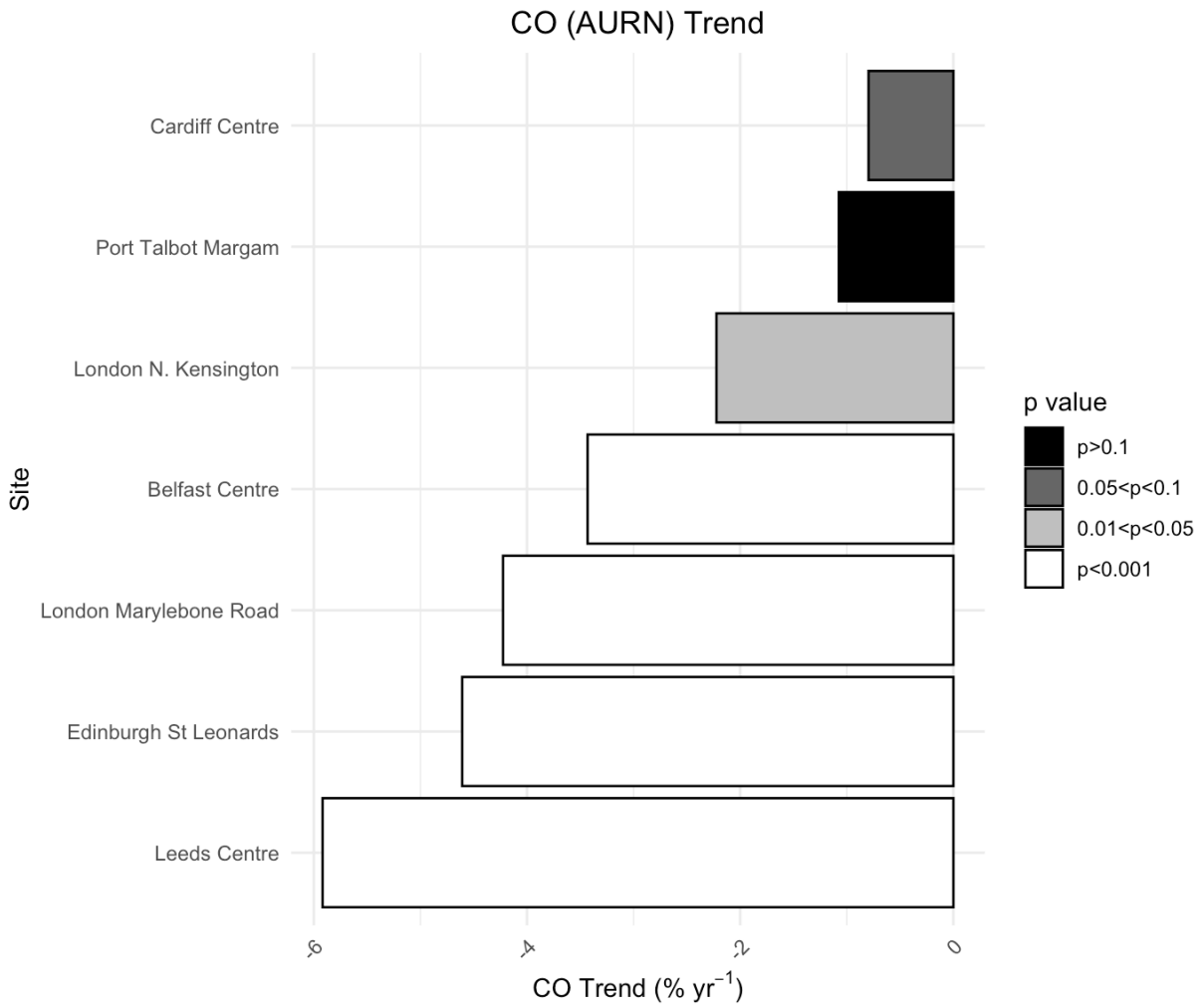


**Fig. S21.** Deseasonalised percentage trend over 2015-2024 from AURN sites of carbon monoxide (CO).


**Fig. S22.** Monthly mean emissions of anthropogenic CO and NMVOCs and total anthropogenic (CO + NMVOCs) and monthly mean emissions of biogenic CO and isoprene and total biogenic (CO + isoprene + other) (top). Ratio of monthly total anthropogenic emissions to monthly total biogenic emissions (bottom). Both plots have a logarithmic vertical axis.

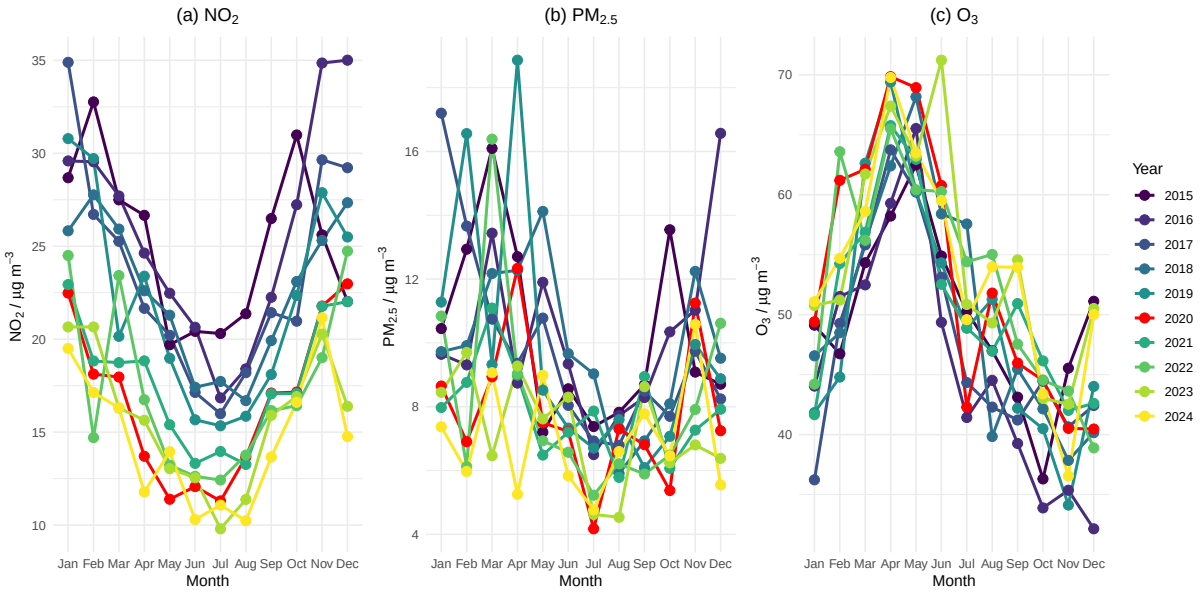


**Fig. S23.** Median of monthly mean concentration of (a) $NO_2$, (b) $PM_{2.5}$ and (c) $O_3$ across all qualifying AURN sites (at least 80% data for given month).

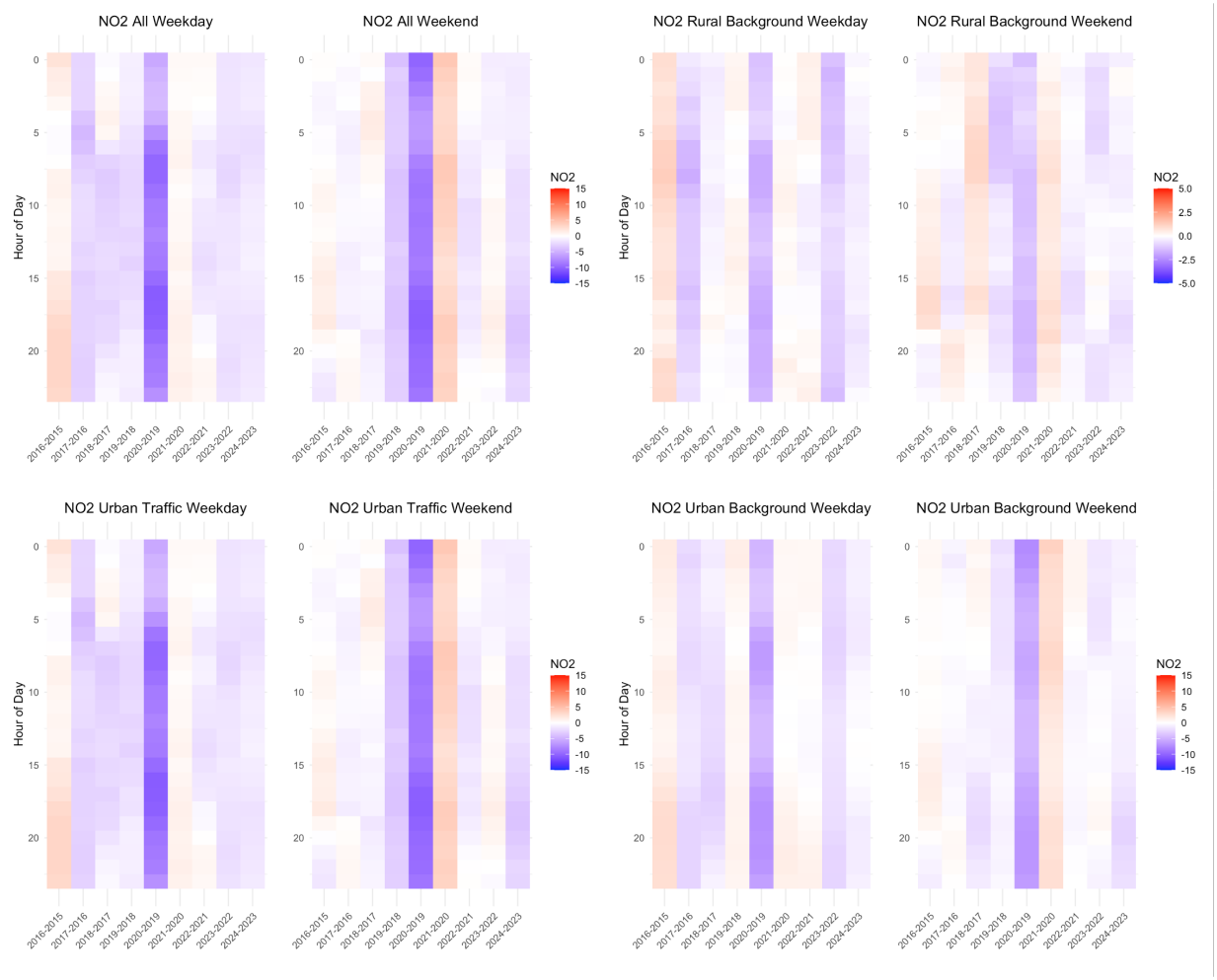


**Fig. S24.** Year-on-year change in $NO_2$ decomposed into hour of day and site type. Qulaifying criteria as in Figure 5.

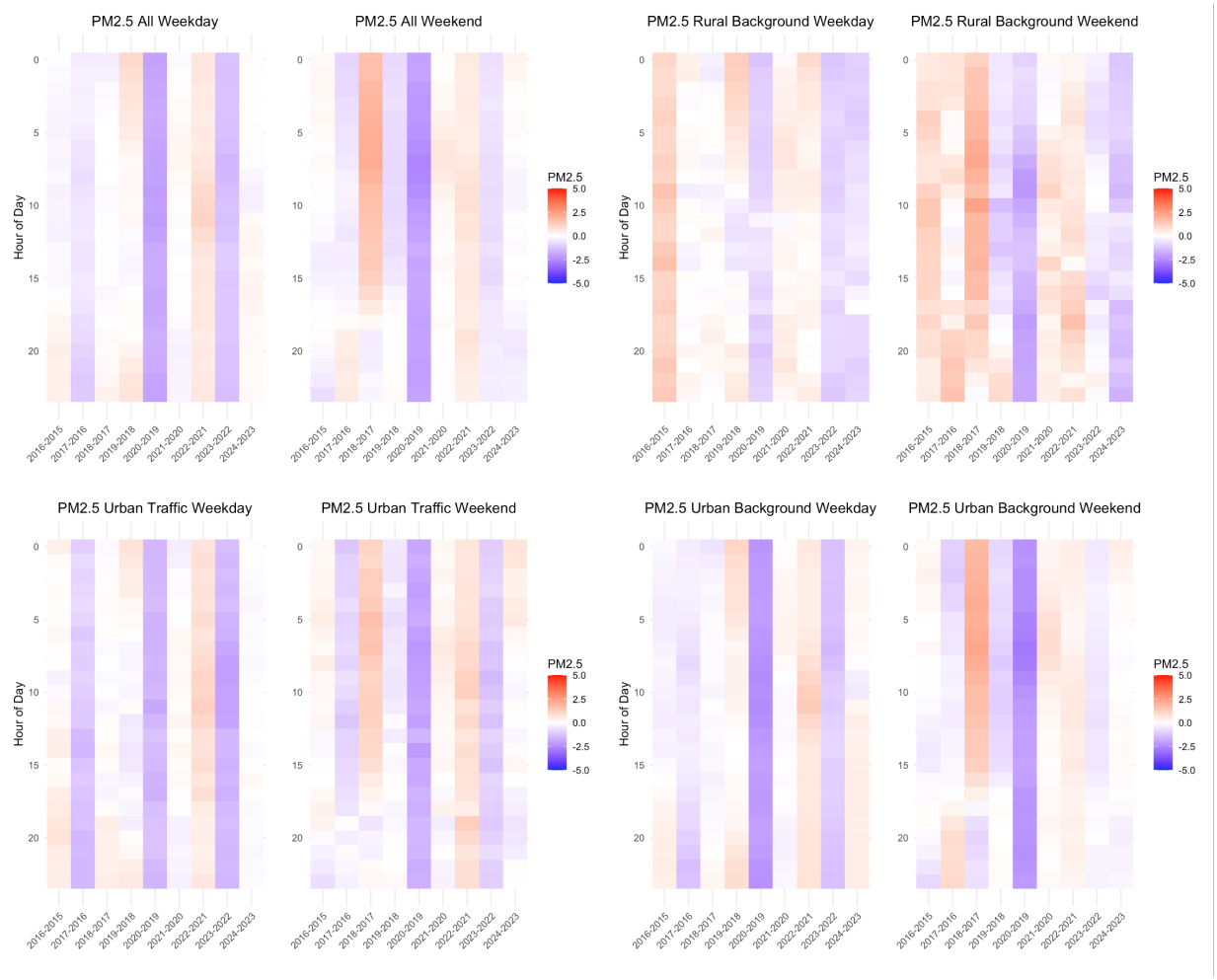


**Fig. S25.** Year-on-year change in $PM_{2.5}$ decomposed into hour of day and site type. Qulaifying criteria as in Figure 5.

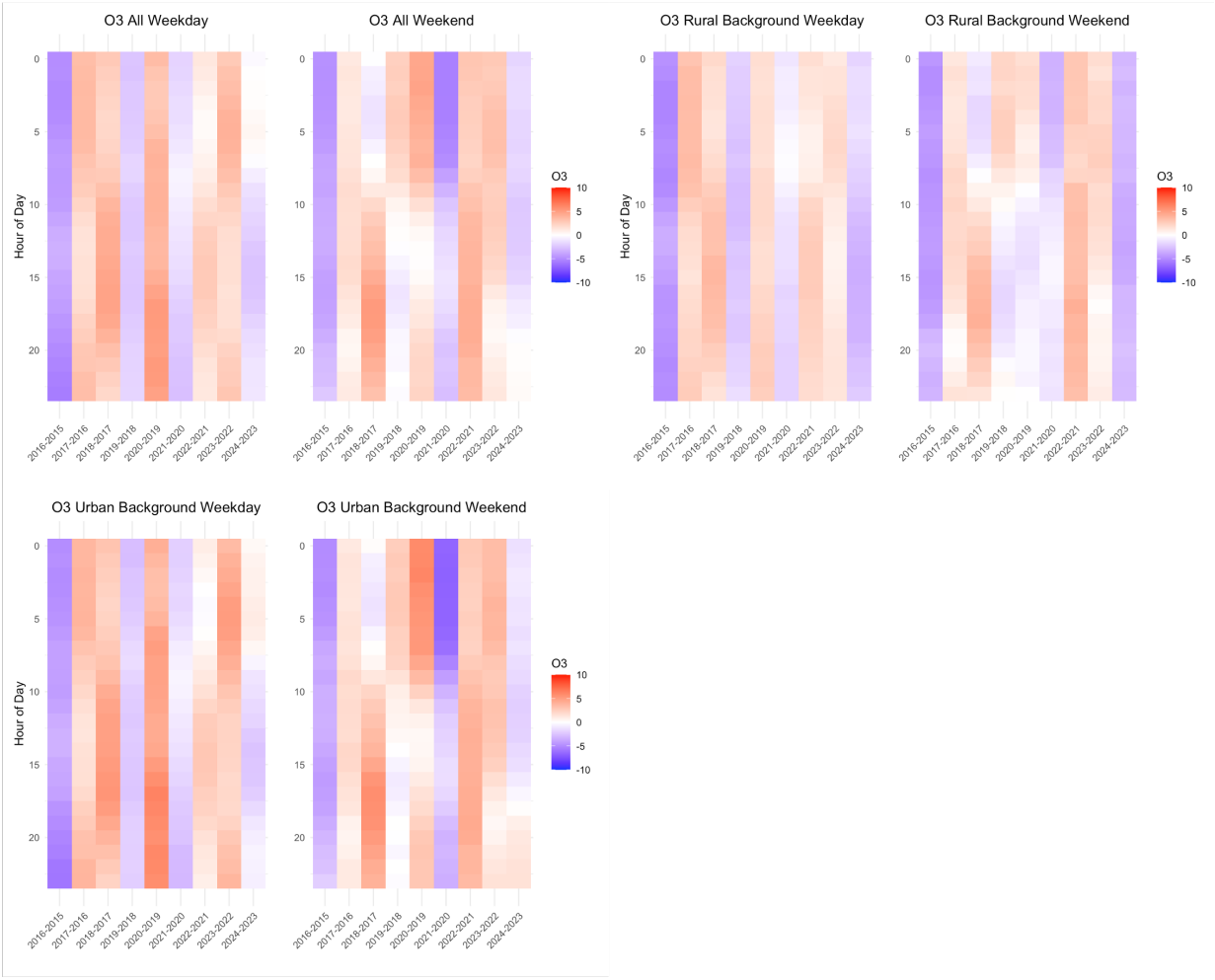


**Fig. S26.** Year-on-year change in $O_3$ decomposed into hour of day and site type. Qulaifying criteria as in Figure 5.

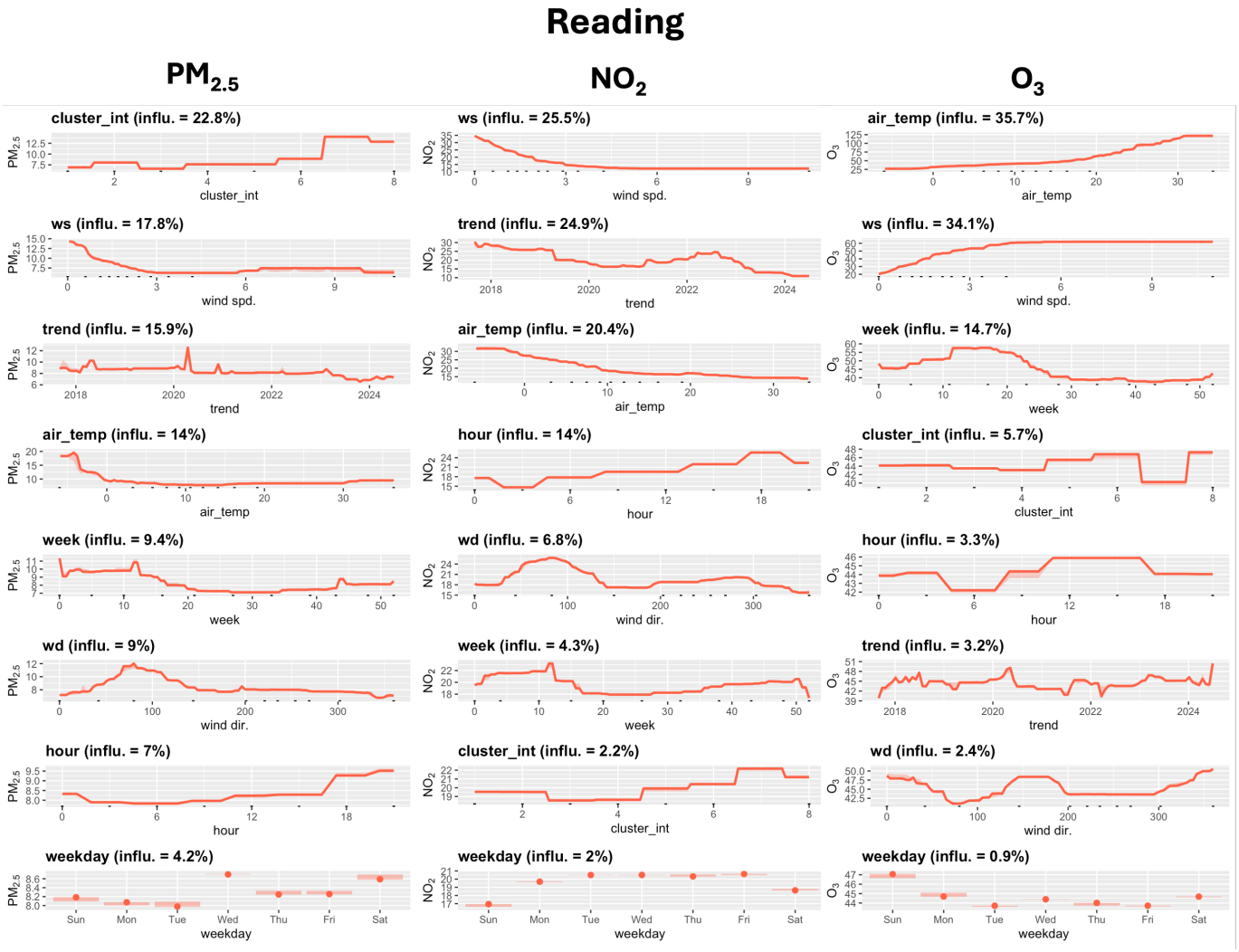


**Fig. S27.** Partial dependencies produced by the deweather module for Reading (2017-2014).

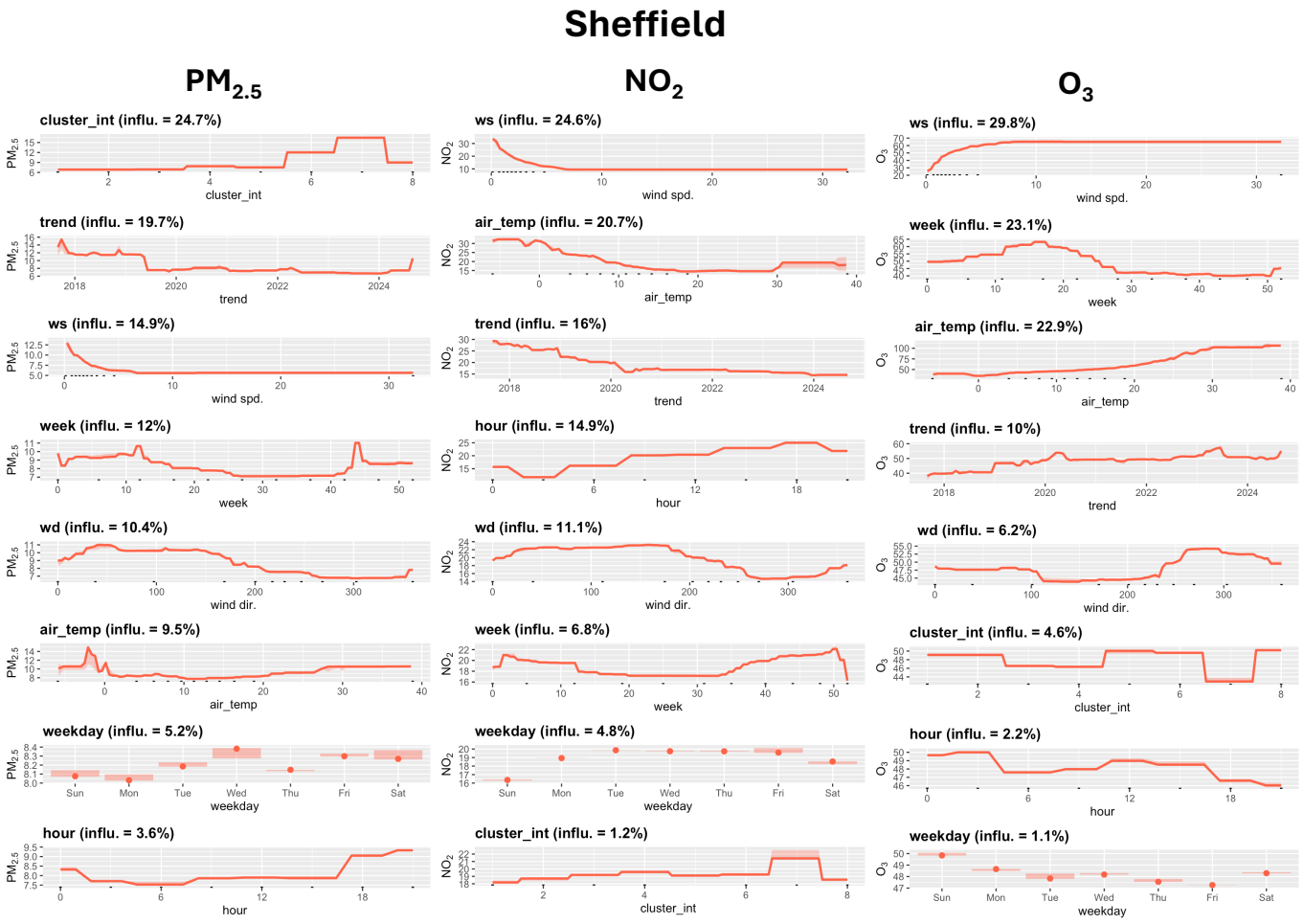


**Fig. S28.** Partial dependencies produced by the deweather module for Sheffield (2017-2014).

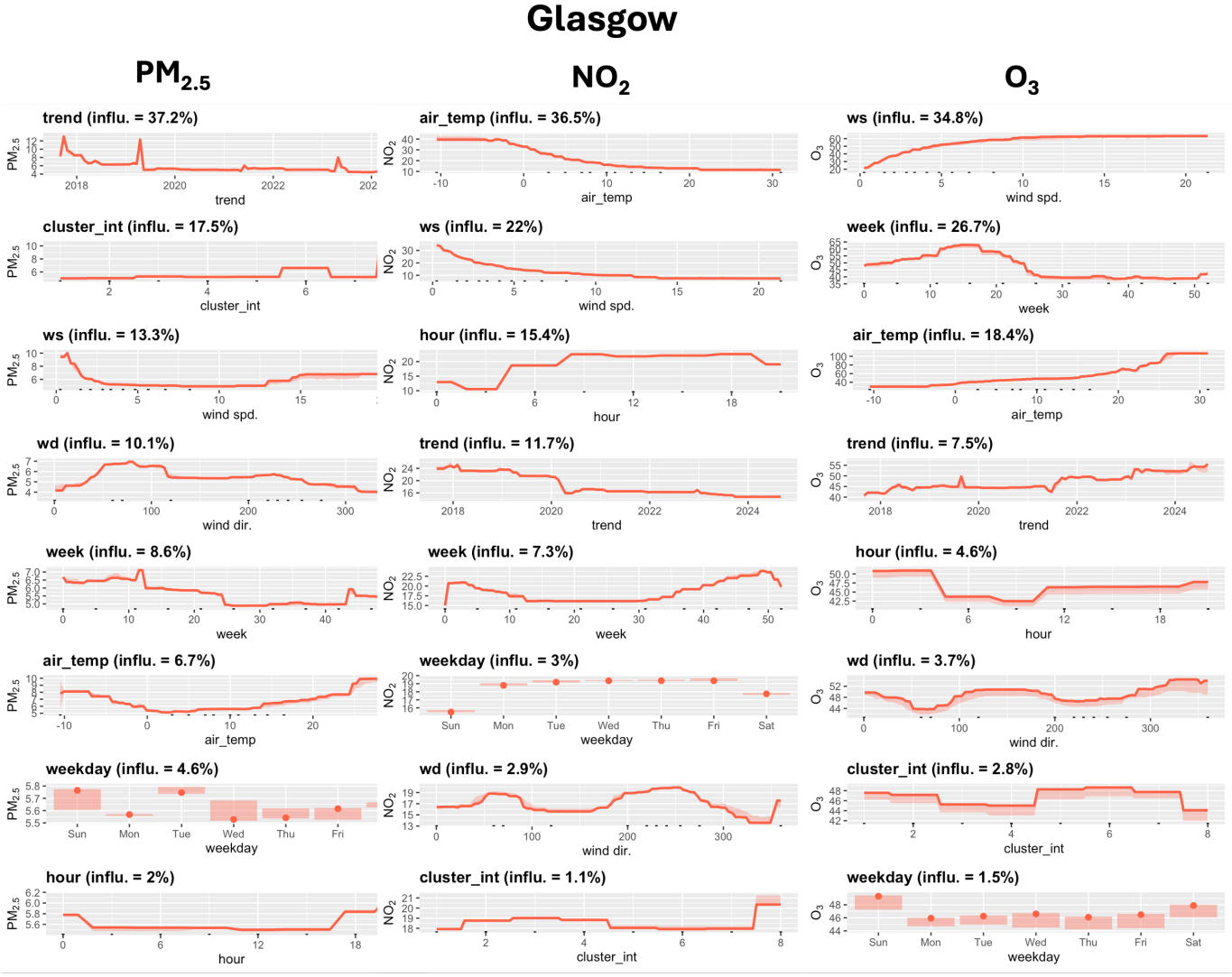


**Fig. S29.** Partial dependencies produced by the deweather module for Glasgow (2017-2014).