Auckland Air Quality Report

Research and Evaluation Unit | RIMU

Auckland Council
Te Kaunihera o Tāmaki Makaurau

Data tables and graphics

Introduction:

This report presents data tables and graphics of air quality in Auckland. It has four sections: sections A and B present a general overview of air quality status in the Auckland region based on the data collected from the active monitoring sites. Section C provides a synopsis of source apportionment modelling of particulate matter samples collected at five ambient air quality monitoring sites across the Auckland region from 2006 to 2020. Section D focuses on one monitoring site – for this edition, the spotlight is on Penrose.

Summary:

- No breach of national air quality standards has occurred this year (January to June).
- Overall, air quality has slightly improved in Auckland.
- There is a downward trend in nitrogen dioxide (NO_2) concentration in the Auckland CBD.
- Sulphur dioxide (SO_2) concentrations in the monitoring sites are reducing.
- PM_{10} source apportionment modelling study revealed that 92% of the concentrations come from five common source contributors in Auckland urban sites. These sources are: biomass burning (mainly from home heating), motor vehicles, secondary sulphate, marine aerosol, and soils (windblown soil, road dust, and dust generated by earthworks, construction, and road works).
- Biomass burning source contributions to urban PM_{10} levels in Auckland were found to be increasing.
- The long-term trend analysis of motor vehicles, secondary sulphate, and soils contributions to PM_{10} shows that concentrations are decreasing over the monitoring period.

Read the frequently asked questions about the air quality monitoring in Auckland region.

For more information or questions, please send inquiries to environmentaldata@aucklandcouncil.govt.nz

Section A – Data tables

Table 1. Summary information about Auckland's air quality monitoring programme – January to June 2021

Number of active monitoring sites	10
Location of monitoring sites	Queen St, Customs St, Khyber Pass Rd, Penrose, Henderson, Takapuna, Glen Eden, Pakuranga, Papatoetoe, and Patumahoe
Standard contaminants monitored	PM_{10} (fine particles < 10 microns in diameter), carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), and sulphur dioxide (SO_2)
Other key contaminants monitored	$PM_{2.5}$ (fine particles < 2.5 microns in diameter), and black carbon
Number of exceedances in 2021 (National Environmental Standards for Air Quality) NESAQ	0
Number of exceedances (Auckland Ambient Air Quality Targets)	1
Maximum PM_{10} 24-hour mean (Jan - June)	30.5 µg m^{-3}(61% of NESAQ) ↔ recorded at Glen Eden on 17 June 2021
Maximum $PM_{2.5}$ 24-hour mean (Jan - June)	26.5 µg m^{-3}(106% of Auckland target) ↔ recorded at Pakuranga on 24 June 2021
Maximum NO_2 1-hour mean (Jan - June)	200 µg m^{-3}(100% of NESAQ) ↔ recorded at Customs St on 15 March 2021
Maximum SO_2 1-hour mean (Jan - June)	19 µg m^{-3}(5% of NESAQ) ↔ recorded at Penrose on 24 May 2021
Maximum O_3 1-hour mean (Jan - June)	68 µg m^{-3}(45% of NESAQ) ↔ recorded at Patumahoe on 21 February 2021
Maximum CO running 8-hour mean (Jan - June)	Approximately 1 mg m^{-3}(10% of NESAQ) ↔ recorded at Khyber Pass Rd in January 2021

Table 2. General trends of the key contaminants monitored for the last 6, 18 and 30 months.

Notes

PM$_{10}$ is monitored at Glen Eden, Henderson, Khyber Pass Rd, Pakuranga, Papatoetoe, Patumahoe, Penrose, Takapuna, and Queen St.

PM$_{2.5}$ is monitored at Customs St, Glen Eden, Pakuranga, Patumahoe, Penrose, Takapuna, and Queen St.

NO$_2$ is monitored at Customs St, Glen Eden, Henderson, Khyber Pass Rd, Patumahoe, Penrose, Takapuna, and Queen St.

Black carbon is monitored at Customs St, and Henderson.

CO is monitored at Khyber Pass Rd.

Ozone is monitored at Patumahoe.

SO$_2$ is monitored at Customs St, and Penrose.

🔴 indicates an upward trend.   🟢 indicates a downward trend.   🟡 indicates no trend.   **n/a** implies not applicable.

Site	PM$_{10}$ Last 6 months	Last 18 months	Last 30 months	PM$_{2.5}$ Last 6 months	Last 18 months	Last 30 months	NO$_2$ Last 6 months	Last 18 months	Last 30 months	Black carbon Last 6 months	Last 18 months	Last 30 months	Ozone Last 6 months	Last 18 months	Last 30 months	CO Last 6 months	Last 18 months	Last 30 months	SO$_2$ Last 6 months	Last 18 months	Last 30 months	AQI Last 6 months	Last 18 months	Last 30 months	Site
Customs Street	n/a	n/a	n/a	🔴	🟢	n/a	🔴	🟢	n/a	🔴	🟢	n/a	n/a	n/a	n/a	n/a	n/a	n/a	🟢	🟢	n/a	n/a	n/a	n/a	Customs Street
Glen Eden	🔴	🟡	🟢	🔴	🟢	🟡	🟢	🔴	🔴	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	🔴	🟡	🟡	Glen Eden
Henderson	🔴	🟢	🟢	n/a	n/a	n/a	🔴	🔴	🟢	🔴	🔴	🟡	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	🔴	🟢	🟡	Henderson
Khyber Pass Road	🔴	🟢	🟢	n/a	n/a	n/a	🟢	🟢	🟢	n/a	n/a	n/a	n/a	n/a	n/a	🔴	🟡	🟢	n/a	n/a	n/a	n/a	n/a	n/a	Khyber Pass Road
Pakuranga	🔴	🟢	🟢	🔴	🟡	🟢	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Pakuranga
Papatoetoe	🟢	🟡	🟢	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Papatoetoe
Patumahoe	🟢	🟢	🟢	🟢	🟡	🟢	🔴	🟡	🟢	n/a	n/a	n/a	🔴	🟡	🟢	n/a	n/a	n/a	n/a	n/a	n/a	🟢	🟢	🟢	Patumahoe
Penrose	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🔴	🟢	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	🔴	🟡	🟢	🟡	🟢	🟢	Penrose
Takapuna	🔴	🟡	🟢	🟢	🟡	🟢	🟢	🔴	🔴	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	🔴	🟢	🟢	Takapuna
Queen Street	🔴	🔴	🔴	🔴	🔴	🟡	🔴	🟡	🟢	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	🔴	🟡	🟡	Queen Street

Section B. Key air contaminants across the 10 air monitoring sites (January to June)
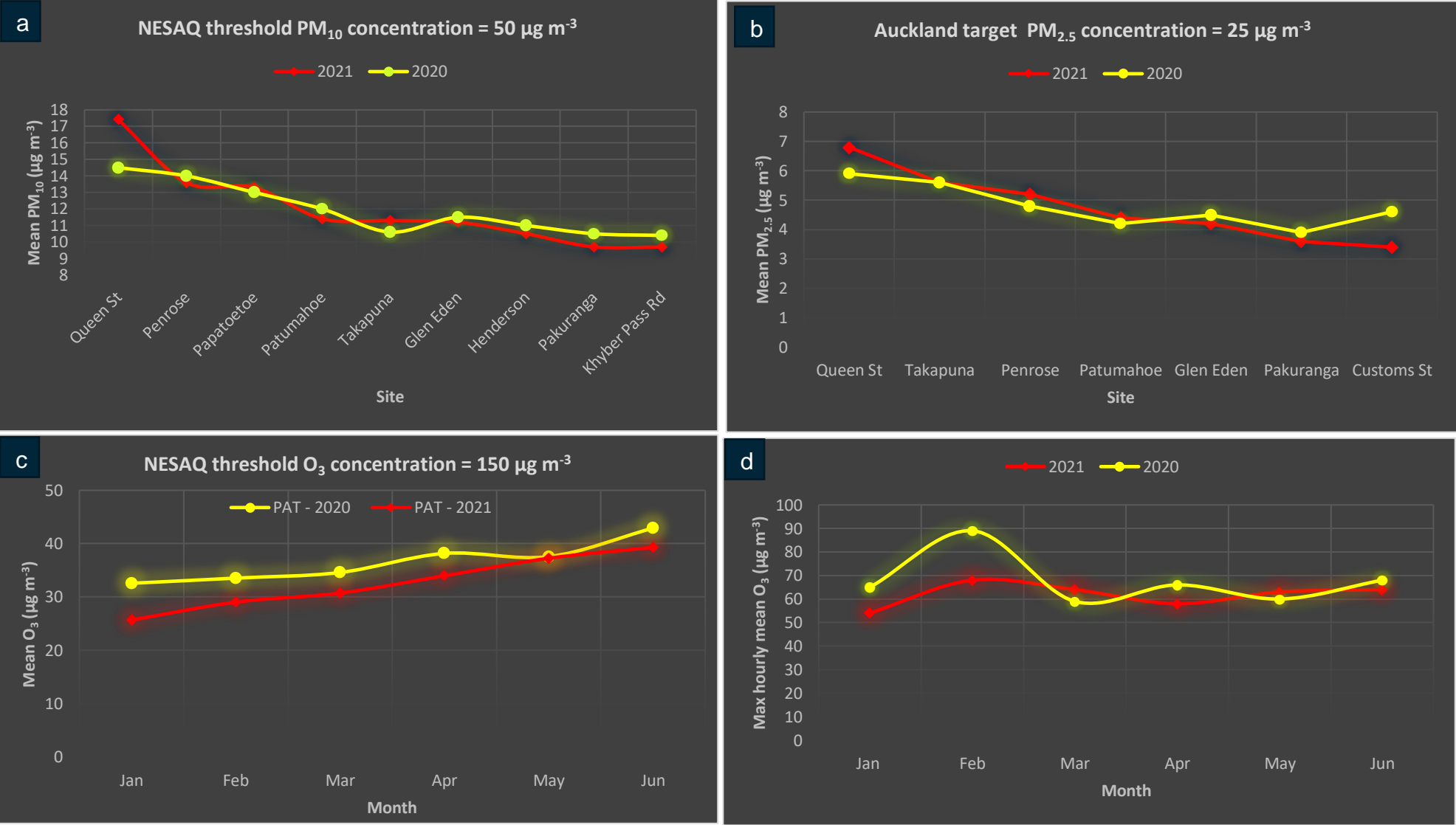
Figure 1. Monthly mean concentration of air contaminants. Plots **a, b, c,** and **d** represent PM_{10}, $PM_{2.5}$, O_3, and maximum hourly O_3 concentrations at Patumahoe respectively. Note: PAT= Patumahoe.
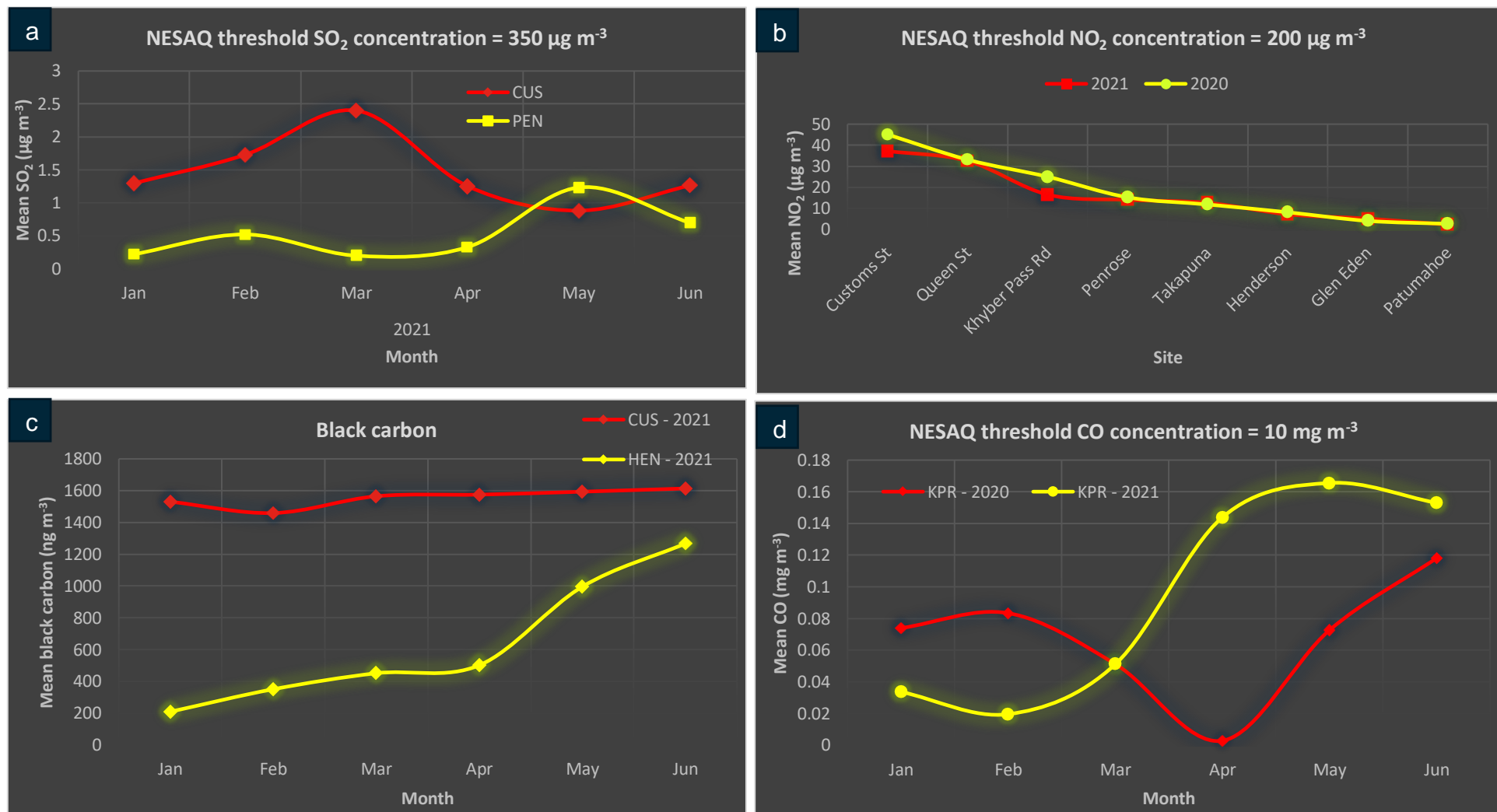
Figure 2. Monthly mean concentration of air contaminants. Plots **a, b, c** and **d** represent SO_2, NO_2, Black carbon, and CO respectively: Note: CUS = Customs St, PEN = Penrose, HEN = Henderson, KPR = Khyber Pass Rd.

Section C. PM$_{10}$ source apportionment modelling for Auckland urban sites
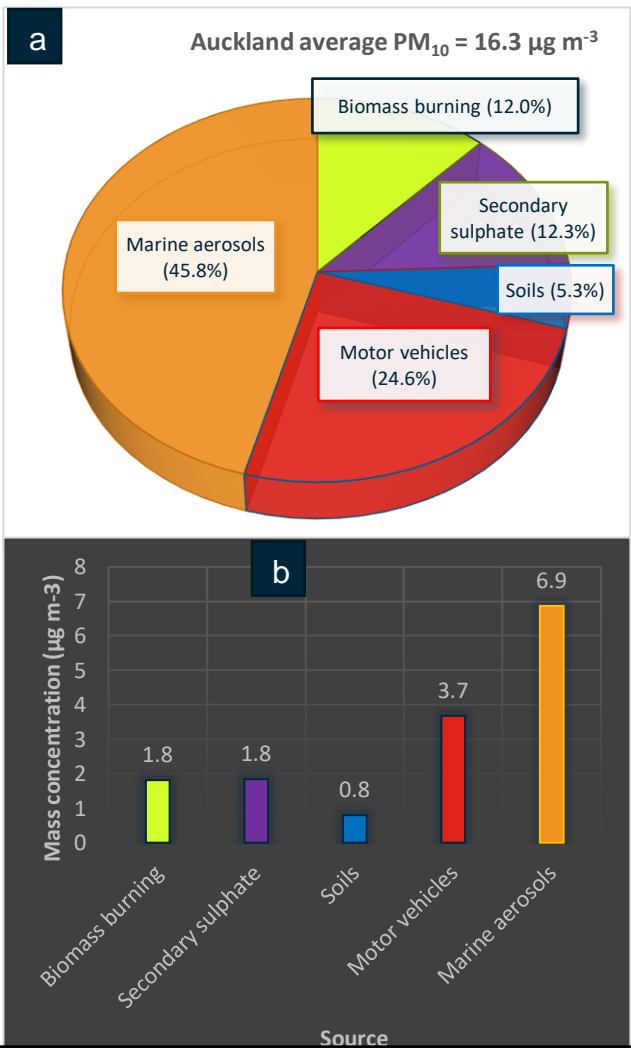
Figure 3. Auckland region urban average source contributions to PM$_{10}$. Plots **a** and **b** show the per cent of sum, and source mass contributions respectively. The receptor model is based on elemental concentrations in particulate matter samples collected from Queen St, Penrose, Takapuna, Henderson, and Khyber Pass Road.
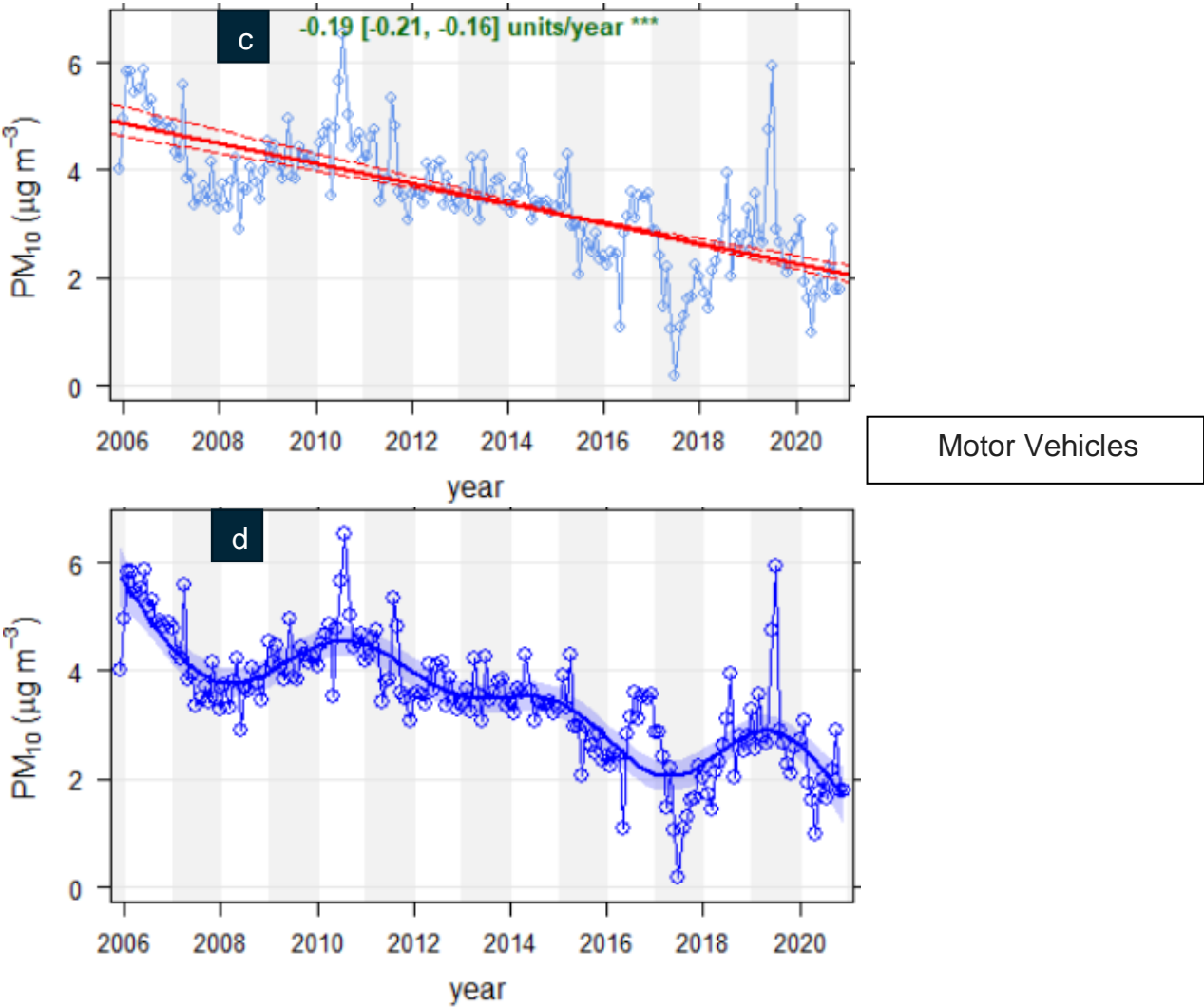
Figure 4. Long-term trends in PM$_{10}$ motor vehicles source contributions across monitored sites showing that concentrations have decreased (statistically significant at the 99.9% confidence interval). Plot **c** shows the deseasonalised monthly mean contribution. The solid red line shows the trend estimate and the dashed red lines show the 95% confidence intervals for the trend based on resampling methods. The overall trend is shown at the top-left as -0.19 per year and the 95% confidence intervals in the slope from -0.21– (-0.16) units/year. The ∗∗∗ show that the trend is significant to the 0.001 level. Plot **d** shows the smooth trend in contributions. The shading shows the estimated 95% confidence intervals.
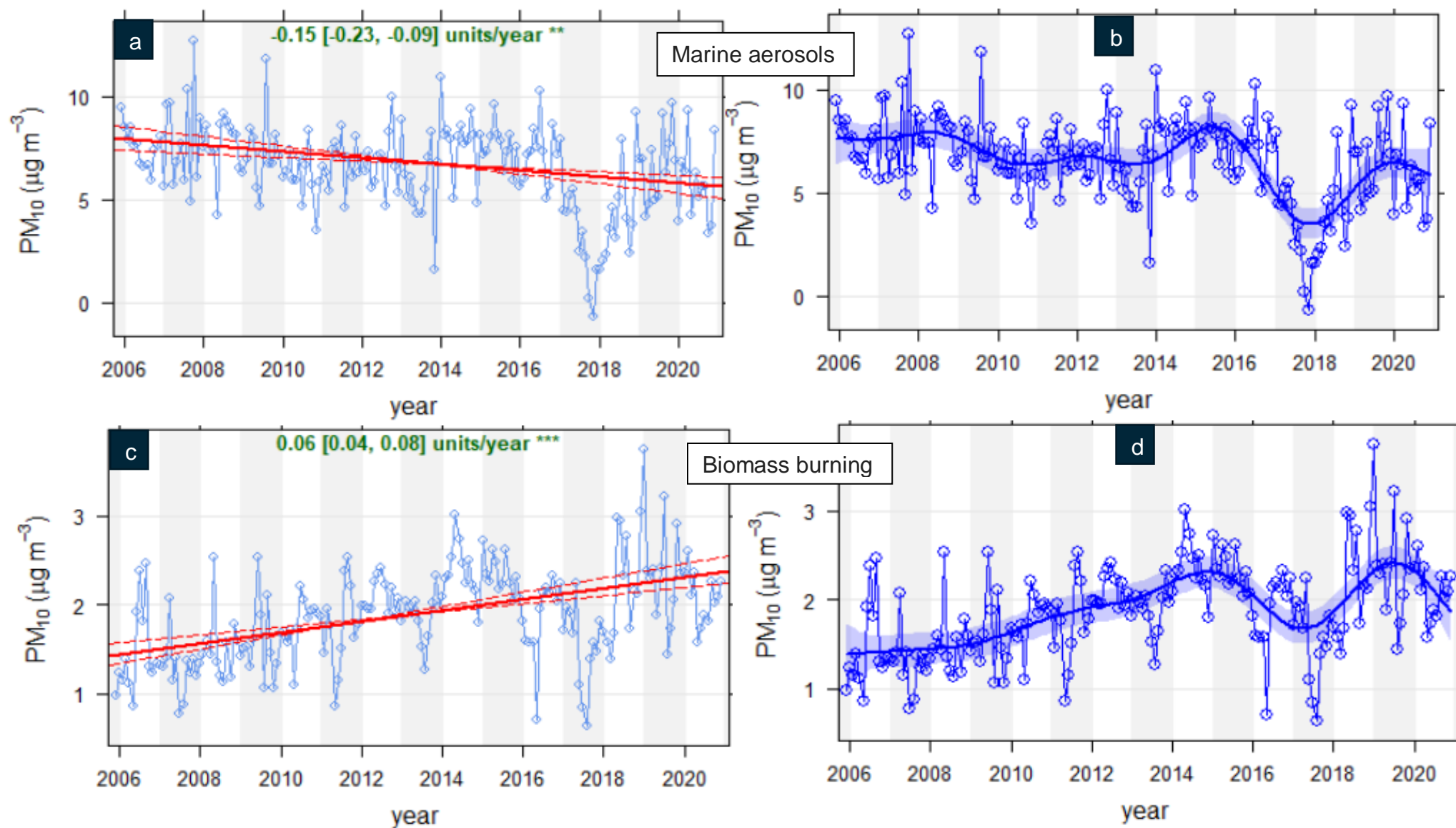
Figure 5. Long-term trends in PM_{10} source contributions across monitored sites: plots **a** and **b** show that concentrations of marine aerosols have decreased (statistically significant at the 99.9% confidence interval); Plots **c** and **d** show that concentrations of biomass burning have increased (statistically significant at the 99.9% confidence interval).
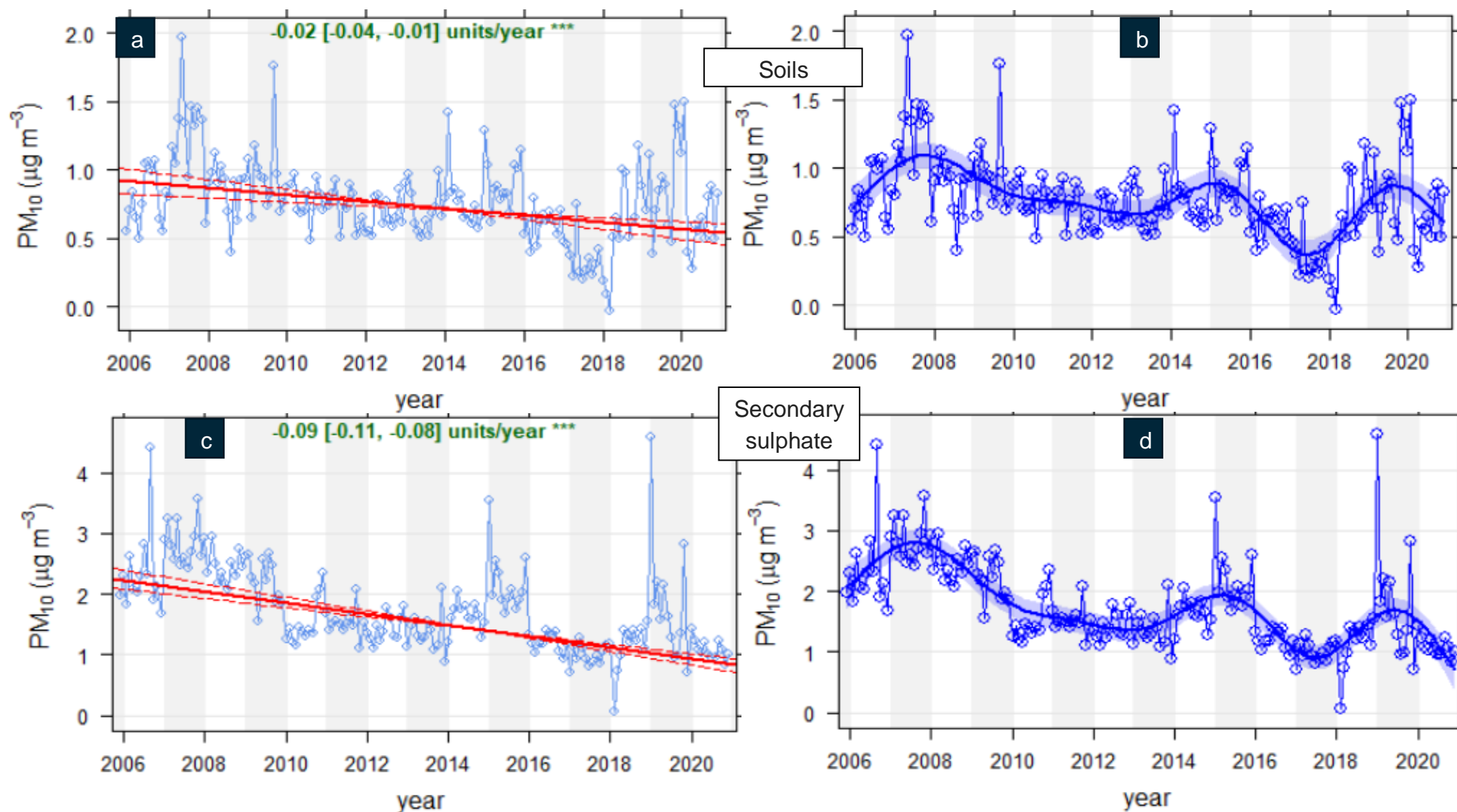
Figure 6. Long-term trends in PM_{10} soils and secondary sulphate source contributions across all Auckland monitored sites showing that concentrations have decreased (statistically significant at the 95% confidence interval). Plots **a** and **b** are for soils; and plots **c** and **d** are for secondary sulphate.

Section D. Focus on a monitoring site: Penrose (Gavin Street)

Figure 7. 2021 mean concentrations of PM10 at Penrose. Plots **a, b, c**, and **d** show calendar plot, day, month, and hour variations respectively. Plots **b**, **c** and **d** also shows the comparisons to a rural site. Note: PEN = Penrose, PAT = Patumahoe.

Figure 8. Long-term trends in PM₁₀ at Penrose (2006 to June 2021). Plot **a** is a trend heat map showing the variation in PM$_{10}$ concentrations by year and hour of the day. Plot **b** depicts the trends in PM$_{10}$ by season with a seasonal averaging time and panel for each season. Plot **c** shows the temporal variations (the shaded bars are the 95 percentile confidence limits in the mean). Plot **d** shows the deseasonalised monthly mean concentrations of PM$_{10}$. The solid red line shows the trend estimate and the dashed red lines show the 95% confidence intervals for the trend based on resampling methods. The overall trend is shown at the top-left as -0.24 (µg m⁻³) per year and the 95% confidence intervals in the slope from -0.31 − (-0.18) µg m⁻³/year. The ∗∗∗ show that the trend is significant to the 0.001 level.

Figure 9. 2021 mean concentrations of PM$_{2.5}$ at Penrose. Plots **a, b, c**, and **d** show calendar plot, day, month, and hour variations respectively. Plots **b**, **c** and **d** also shows the comparisons to a rural site. Note: PEN = Penrose, PAT = Patumahoe.
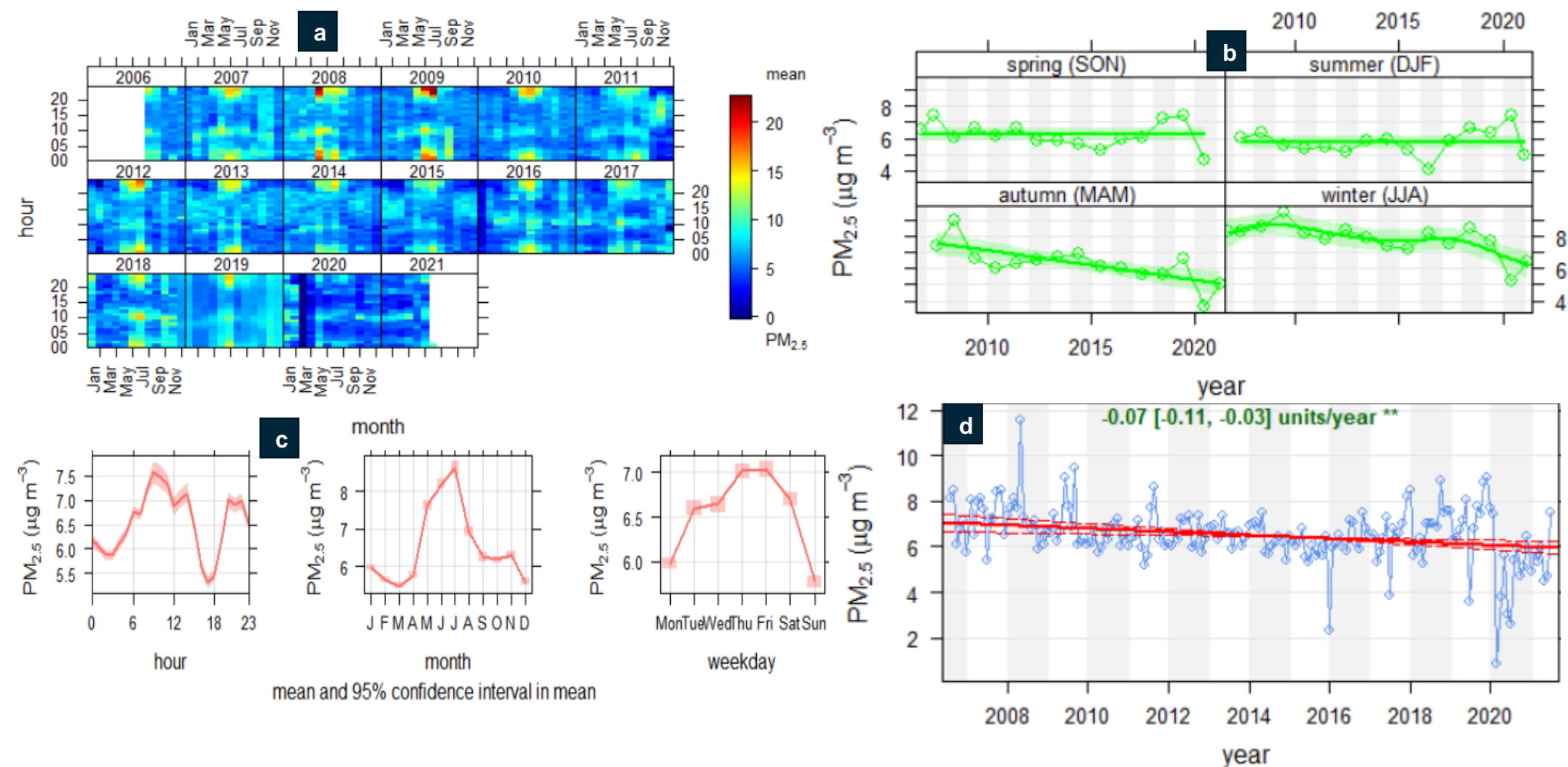
Figure 10. Long-term trends in PM$_{2.5}$ at Penrose (2006 to June 2021). Plot **a** is a trend heat map showing the variation in PM$_{2.5}$ concentrations by year and hour of the day. Plot **b** depicts the trends in PM$_{2.5}$ by season with a seasonal averaging time and panel for each season. Plot **c** shows the temporal variations (the shaded bars are the 95 percentile confidence limits in the mean). Plot **d** shows the deseasonalised monthly mean concentrations of PM$_{2.5}$. The solid red line shows the trend estimate and the dashed red lines show the 95% confidence intervals for the trend based on resampling methods. The overall trend is shown at the top-left as -0.07 (µg m^{-3}) per year and the 95% confidence intervals in the slope from -0.11 – (-0.03) µg m^{-3}/year. The ∗∗∗ show that the trend is significant to the 0.001 level.

Figure 11. 2021 mean concentrations of NO₂ at Penrose. Plots **a, b, c**, and **d** show calendar plot, day, month, and hour variations respectively. Plots **b**, **c** and **d** also shows the comparisons to a rural site. Note: PEN = Penrose, PAT = Patumahoe.
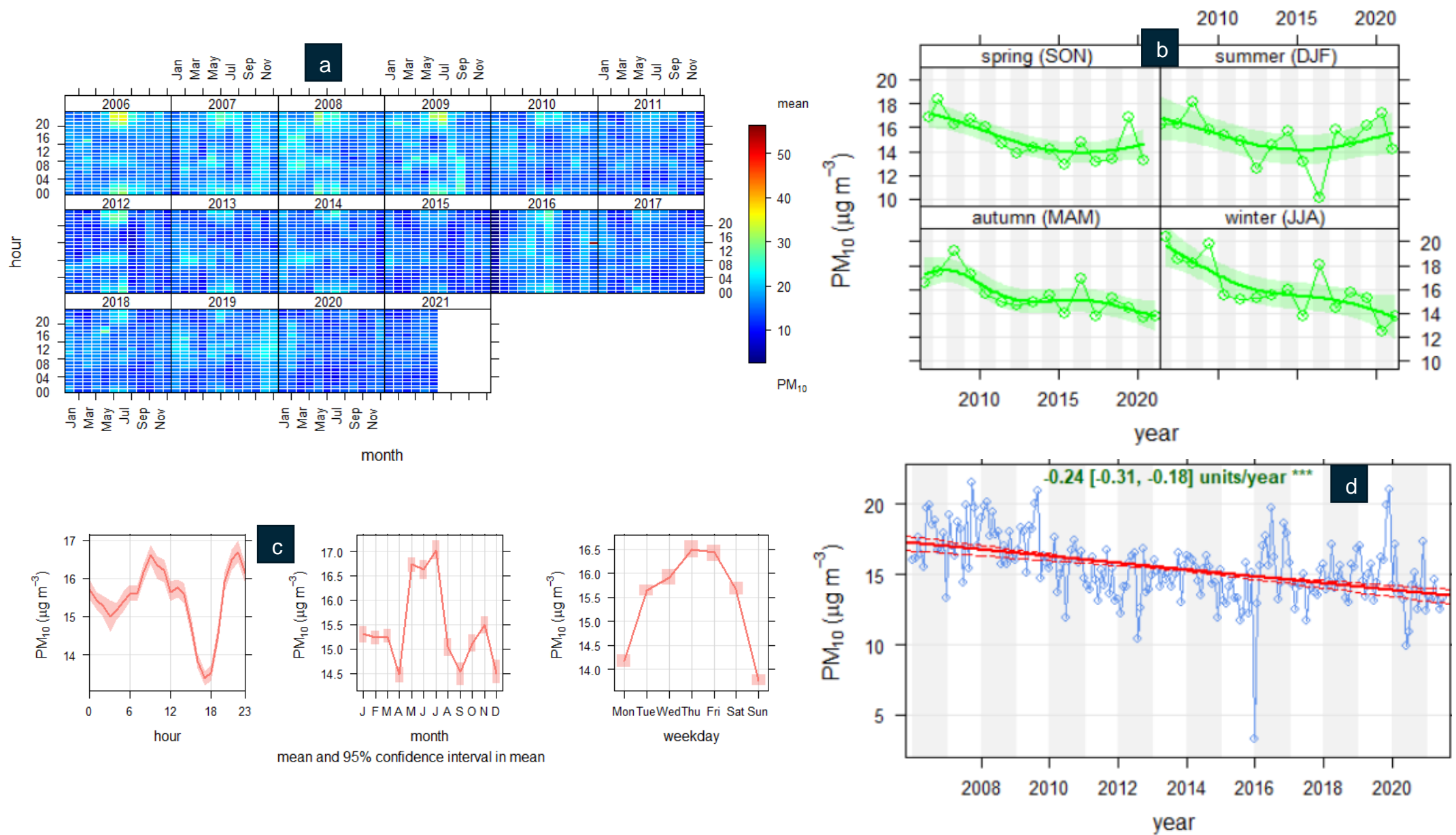
Figure 12. Long-term trends in NO$_2$ at Penrose (2006 to June 2021). Plot **a** is a trend heat map showing the variation in NO$_2$ concentrations by year and hour of the day. Plot **b** depicts the trends in NO$_2$ by season with a seasonal averaging time and panel for each season. Plot **c** shows the temporal variations (the shaded bars are the 95 percentile confidence limits in the mean). Plot **d** shows the deseasonalised monthly mean concentrations of NO$_2$. The solid red line shows the trend estimate and the dashed red lines show the 95% confidence intervals for the trend based on resampling methods. The overall trend is shown at the top-left as -0.61 (µg m^{-3}) per year and the 95% confidence intervals in the slope from -0.72 – (-0.53) µg m^{-3}/year. The ✳✳✳ show that the trend is significant to the 0.001 level.
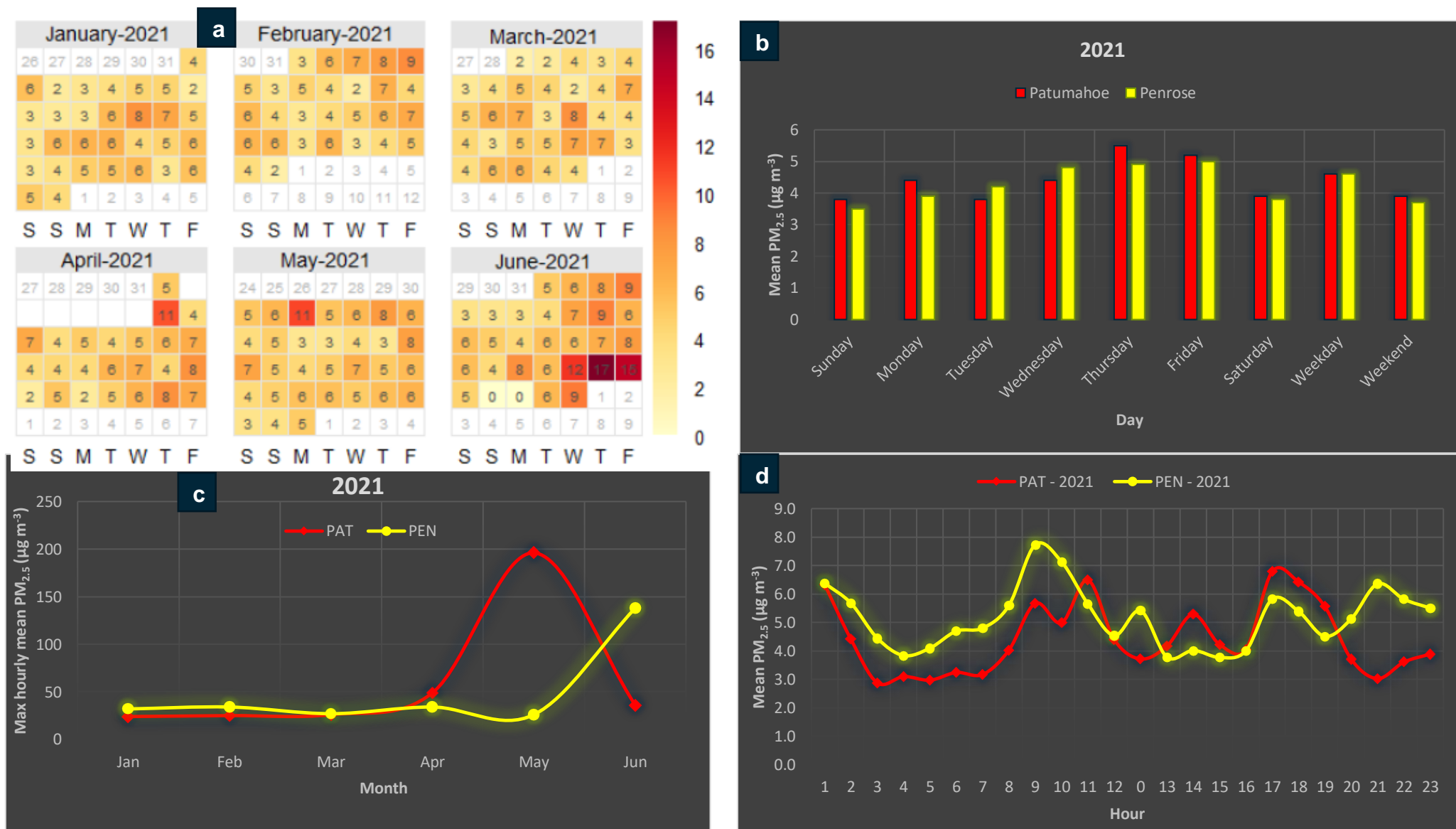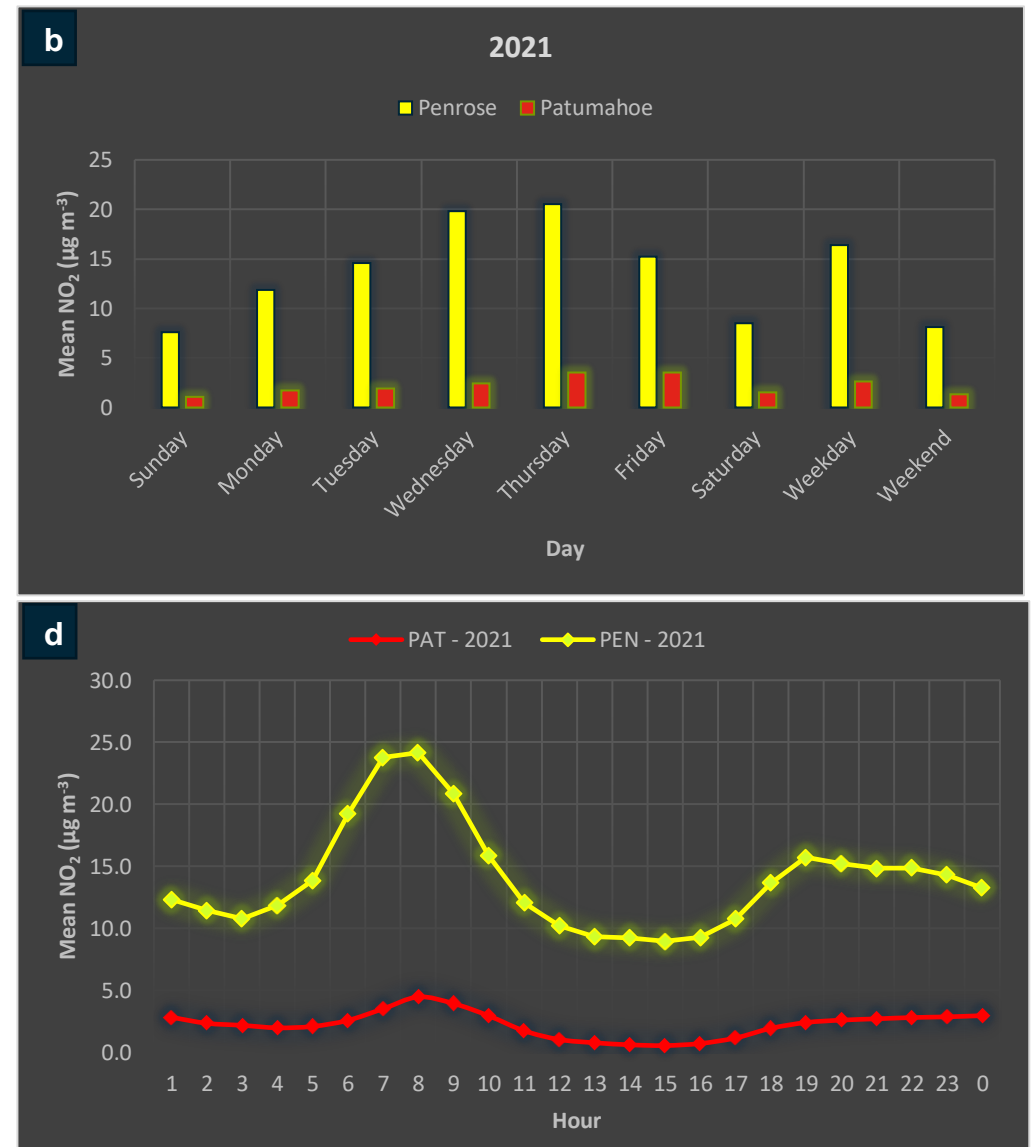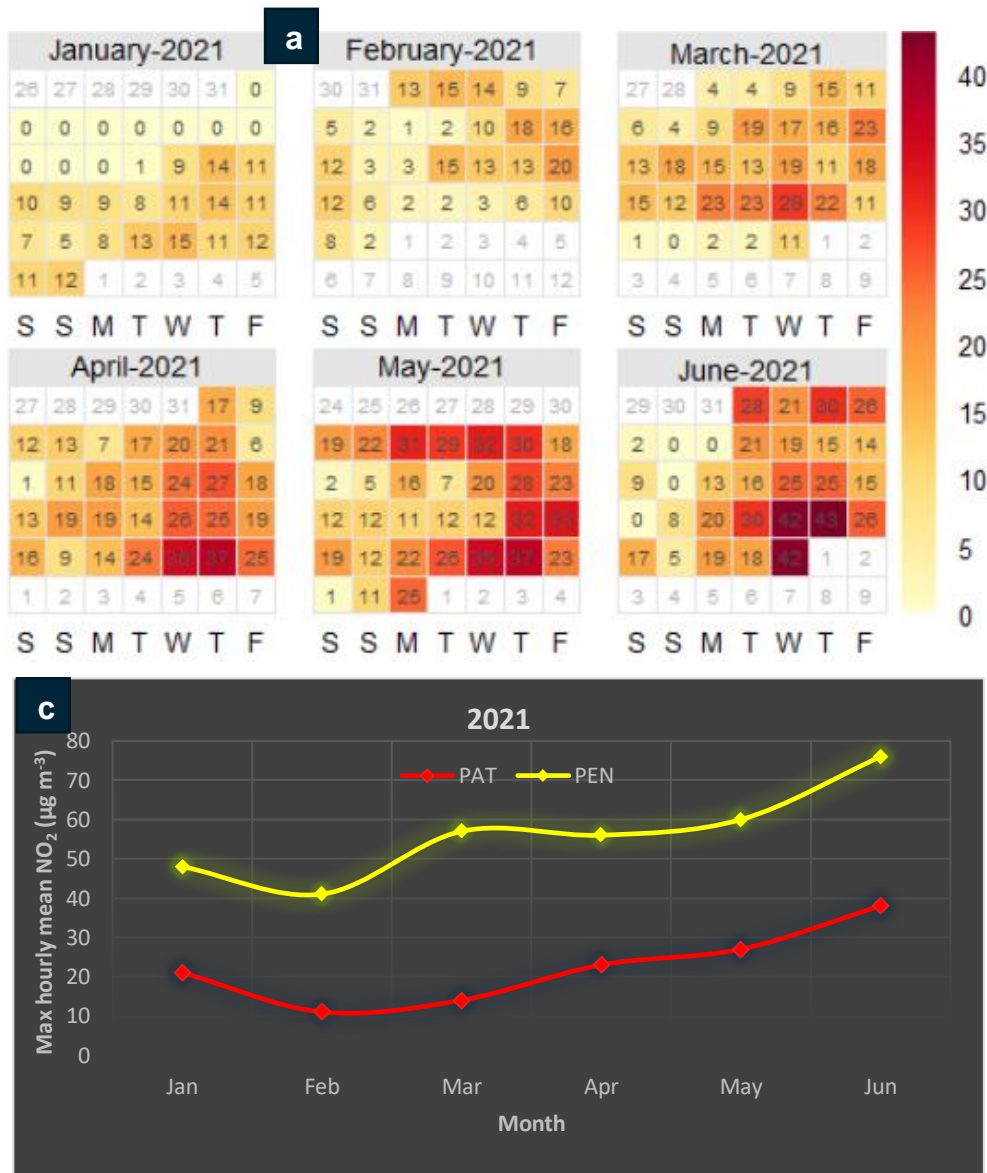
Figure 13. 2021 mean concentrations of SO₂ at Penrose. Plots **a, b, c**, and **d** show calendar plot, day, month, and hour variations respectively. Plots **b, c** and **d** also shows the comparisons to Customs St. Note: PEN = Penrose, CUS = Customs St.
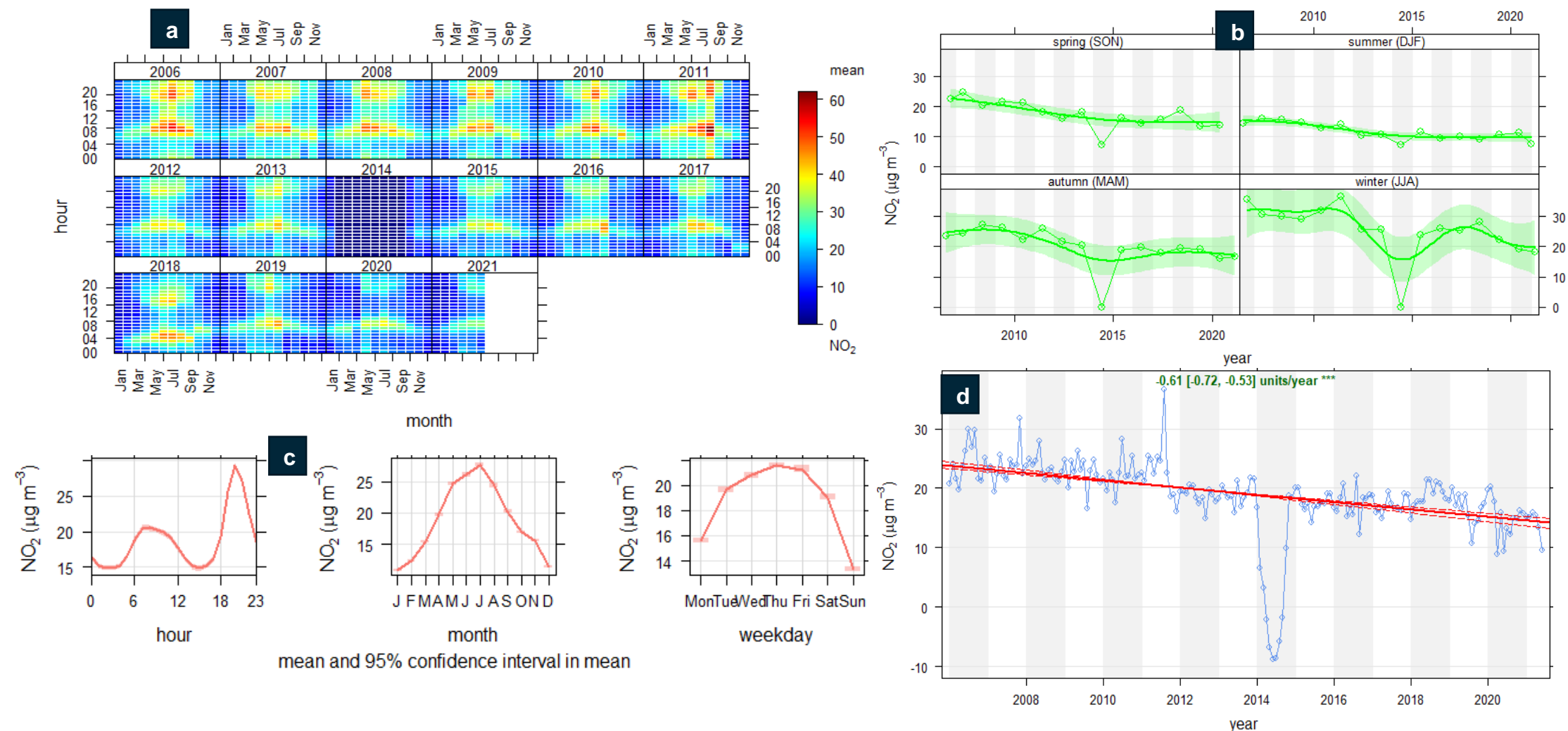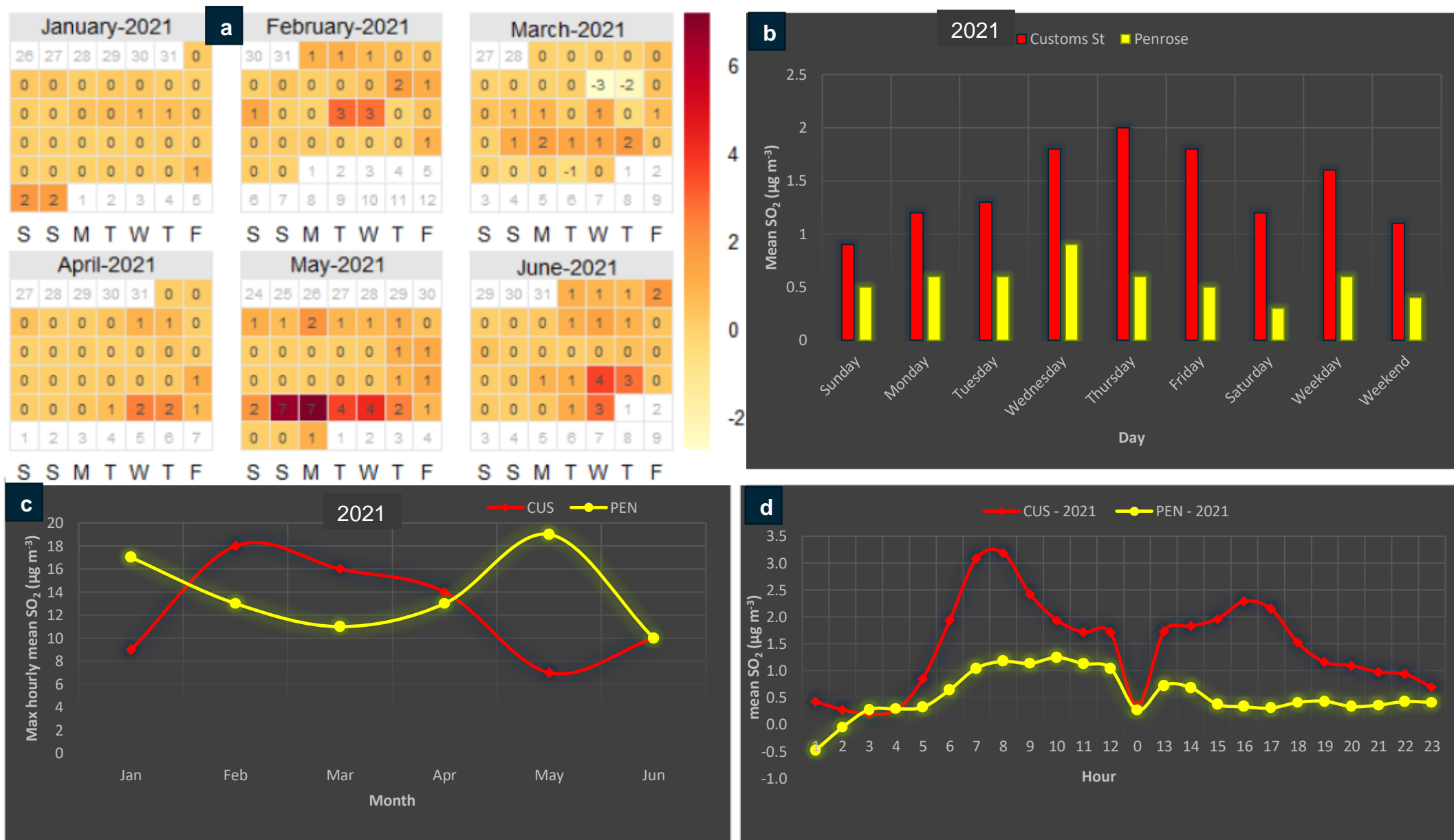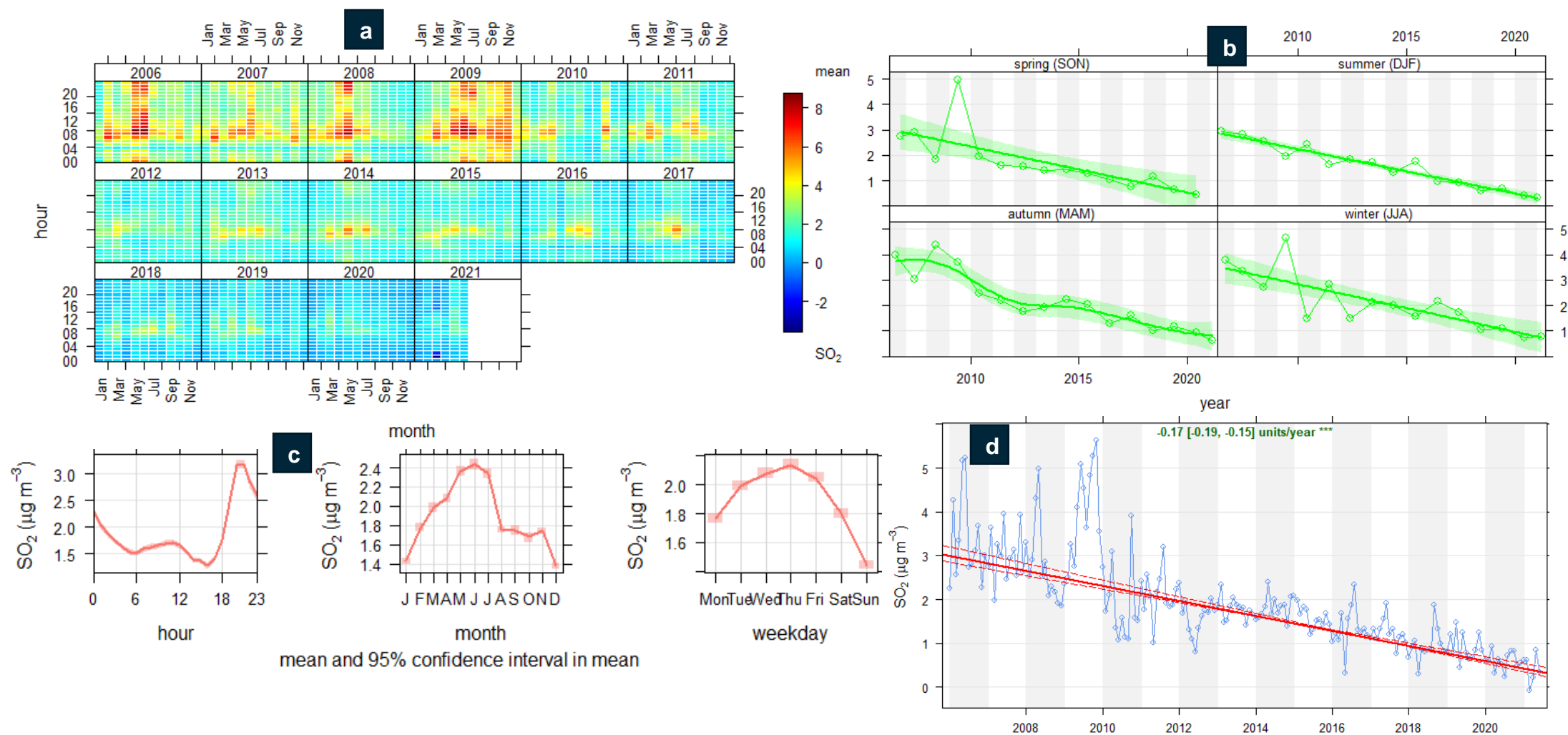
Figure 14. Long-term trends in SO₂ at Penrose (2006 to June 2021). Plot **a** is a trend heat map showing the variation in SO₂ concentrations by year and hour of the day. Plot **b** depicts the trends in NO₂ by season with a seasonal averaging time and panel for each season. Plot **c** shows the temporal variations (the shaded bars are the 95 percentile confidence limits in the mean). Plot **d** shows the deseasonalised monthly mean concentrations of SO₂. The solid red line shows the trend estimate and the dashed red lines show the 95% confidence intervals for the trend based on resampling methods. The overall trend is shown at the top-left as -0.17 (µg m⁻³) per year and the 95% confidence intervals in the slope from -0.19 – (-0.15) µg m⁻³/year. The ∗∗∗ show that the trend is significant to the 0.001 level.

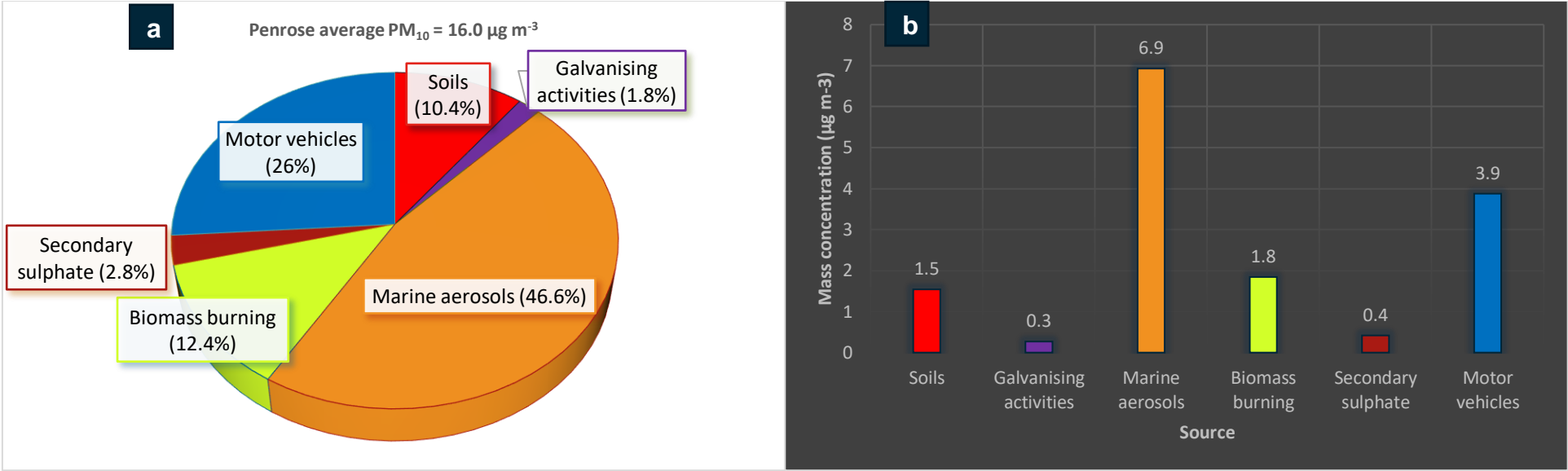**PM$_{10}$ source apportionment modelling for Penrose**

Figure 15. Penrose site average source contributions to PM$_{10}$. Plots **a** and **b** show the per cent of sum, and source mass contributions respectively. The receptor model is based on elemental concentrations in particulate matter samples collected on filters from 10/05/2006 to 25/06/2016. The six sources contributed to 93% of the mean PM$_{10}$ concentration for the period.

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