Supporting Information for:

# Atmospheric conditions and composition that influence $PM_{2.5}$ oxidative potential in Beijing, China

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*28 figures, 21 tables, 63 pages*

# **Section S1 :** APHH site location

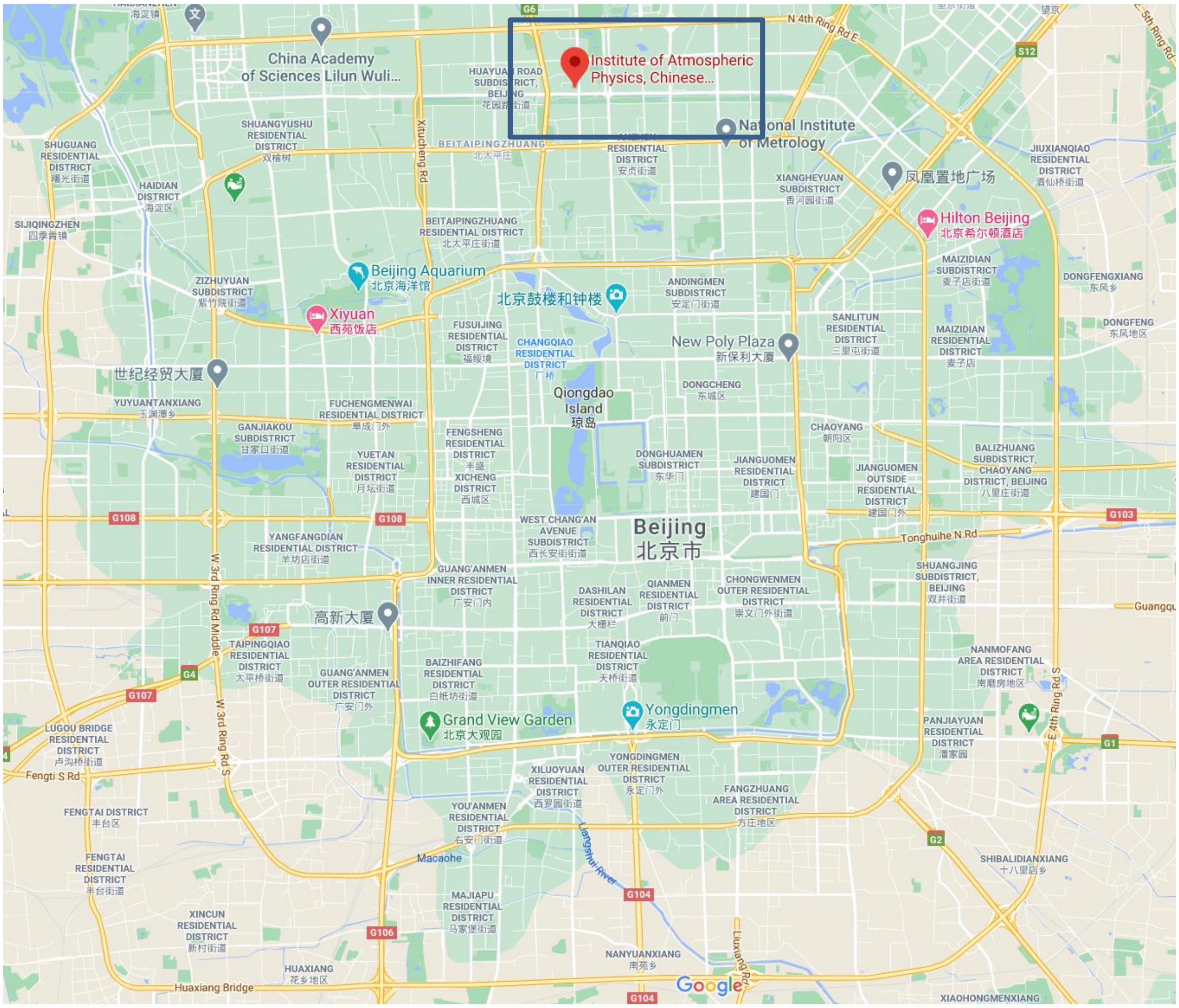


**Figure S 1.** Aerosol samples were collected at the Institute of Atmospheric Physics (IAP) in Beijing, China. Winter PM was collected during the months of Nov-Dec 2016 and summer PM was collected during the months of May-June 2017. A $PM_{2.5}$ high volume air sampler (RE-6070VFC, TICSH, USA) was used at a flow rate of ~1.06 $m^3$/min. PM was collected onto quartz microfiber filters (Whatman, 20.3 x 25.4 cm) with a collection area of 405 $cm^2$. Image taken from © Google Maps (Last access: 07.09.2020).

# **Section S2:** Detailed assay protocols

## Filter extraction for AA and DCFH assays

Depending on the mass of aerosol collected on the filter, between 1-3 punches of the filter were collected (0.78 – 2.34 $cm^2$), to ensure the measurement was above the respective assay's detection limit. Filter homogeneity was tested using the DCFH assay, to make sure filter punches at different locations of each respective sample filter were consistent. Filter punches were taken with a Teflon cutter (i.d. = 10 mm) to avoid contamination from transition metals, which could complicate quantification. The filter material was cut into small pieces and extracted into 1.5 mL of Milli-Q water (resistivity ≥ 18.2 M Ω $cm^{-1}$) and vortexed for three minutes. The resulting slurry was then extracted into a clean glass 5 mL syringe (Hamilton) via a home-built Teflon needle (i.d. = 1/8 in) connected via a Luer lock for analysis with the DCFH or AA assay, or extracted into a Teflon syringe fitted with a Luer lock (Medicine IVL05) to avoid trace metal contamination. The extraction mixture was then filtered through a 0.45 µm PTFE Iso-Disc filter (Supelco, 54144-U) to remove any remaining filter material, and split into three 833 µL aliquots for triplicate measurement. The OP of the resulting samples was then measured using the methods described below.

## DCFH protocol

The DCFH/HRP assay used here is described in detail in elsewhere (Fuller et al., 2014) and will be briefly described here. DCFH was freshly prepared daily using the following procedure: 10 mg of DCFH-DA was dissolved in 10 mL methanol (Milli-Q), with vortexing to aid dissolution. This stock solution was stored in the freezer at -18$^o$C for up to one week. 338 µL of DCFH-DA in methanol was reacted in the dark for 30 minutes with 2.77 mL NaOH (0.01 M) at room temperature. The reaction was subsequently quenched with 6.92 mL of 1 M potassium phosphate buffer solution. This solution was made up to 50 mL with water (Milli-Q) and stored on ice for maximum one day.

1.54 mg of HRP was dissolved in 50 mL of water (HPLC grade) to prepare a 10 units $mL^{-1}$ stock solution, which was stored in the fridge for maximum one week. From this stock solution, a 1.38 units $mL^{-1}$ reaction solution of HRP was prepared by taking 6.82 mL of HRP stock solution and adding the equivalent volume of 1 M potassium phosphate buffer. This solution was made up to 50 mL with water (Milli-Q) and stored on ice for maximum one day.

833 µL of filter extract (see Section "Filter Extraction" in the Supplementary Information) was added to 1084 µL HRP and the equivalent volume of DCFH. The reaction mixture was incubated at 37$^o$C for 15 minutes to allow complete reaction of the DCFH/HRP (Fuller et al., 2014). For each filter sample, three 833 µL aliquots of the filter extraction mixture were analysed in parallel as three technical replicates, to establish measurement uncertainty for each sample. Fluorescence measurements were then conducted in a modified cuvette holder (Ocean Optics model CUV). The fluorescent product 2,7-dichlorofluoroscein (DCF) was excited at $\lambda_{excitation}$ = 485 nm, fluorescence at $\lambda_{emission}$ = 520 nm by an LED (Roithner APG2C1-435 435 nm, 380 mW at 350 mA) at 2.56 V and 16 mA, connected to an optical fibre (Ocean Optics 00S-003948-07) that was subsequently coupled to an aspheric lens (Thorlabs, type C230TMD-A) to focus the light from the optical fibre into the cuvette holder. The same lens and optical fibre were then connected to a UV spectrometer (Ocean Optics UV2000+). The ROS concentration for each sample, in nmol $H_2O_2$ equivalents, was

then calculated using a $H_2O_2$ calibration curve (**Figure S2**). Filter blanks and chemical blanks were performed on a daily basis to monitor assay stability over multiple days of sample analysis.

## DCFH calibration curve

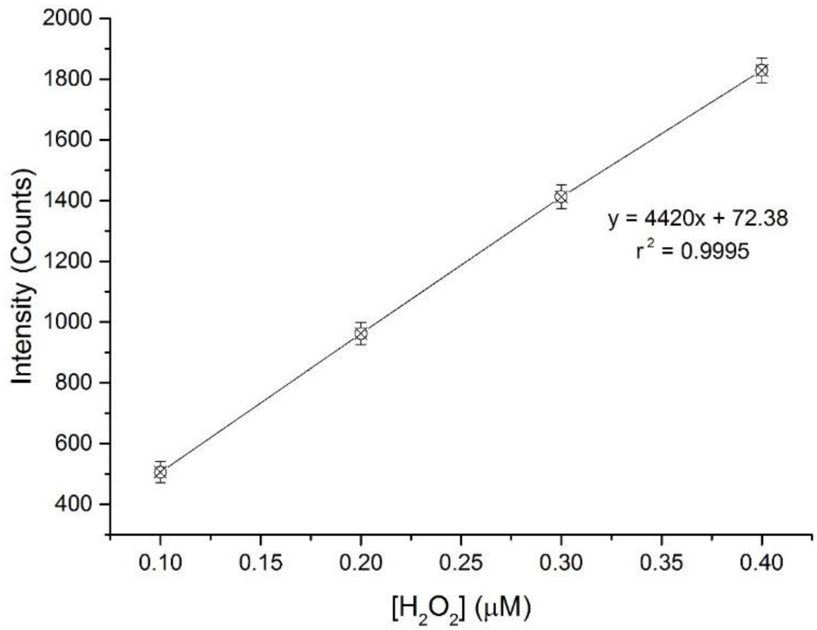


**Figure S 2.** Calibration curve for DCFH solution, plotted using 0.1 μM, 0.2 μM, 0.3 μM and 0.4 μM standard solutions of $H_2O_2$, with the background signal subtracted. Errors are derived from three repeats of each measurement.

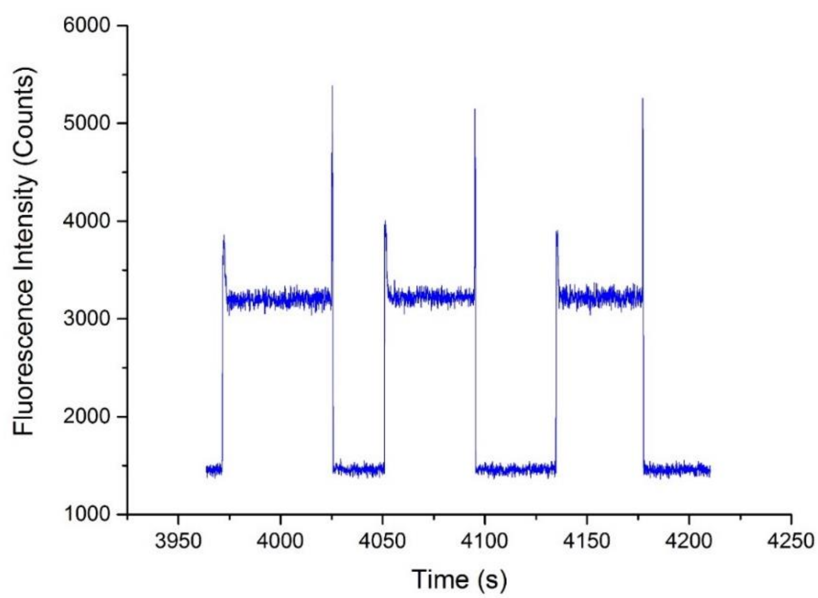


**Figure S 3.** The raw spectrum above illustrates three repeat DCFH assay measurements of one sample, and the consistency between the repeats shown here is representative of that across all of the samples. The error of each individual repeat originates from the inherent "noise" in the signal from the detector and was calculated using the standard deviation of the fluorescence intensity. The errors from the three repeats were combined to give the total error in the average fluorescence intensity of one sample.

# AA protocol

The ascorbic acid (AA) assay used in this study is described in detail in Campbell et al. (2019) and will be briefly described here. The AA method quantifies the oxidation product of AA, dehydroascorbic acid (DHA). Under acidic conditions, DHA reacts with *o*-phenylenediamine (OPDA) to form the product 3-(1,2-dihydroxyethyl)fluoro[3,4-b]quinoxaline-1-one (DFQ) (Burini, 2007; Deutsch & Weeks, 1965), a highly fluorescent compound which can be detected by fluorescence spectroscopy. Due to the 1:1 reaction stoichiometry between DHA and OPDA, monitoring the change in concentration of DFQ can therefore be related to the extent of oxidation of AA, and hence the OP of the sample.

A 200 µM AA solution was prepared as described elsewhere (Godri et al., 2011) in Chelex-resin treated Milli-Q purified water. The Chelex resin treatment was necessary to eliminate the presence of trace transition metals in already pure Milli-Q purified water (resistivity ≥ 18.2 M Ω $cm^{-1}$). 3 g of Chelex per 100 ml of solution was mixed for 24 hours (with constant stirring) before vacuum filtration in a Sartorius vacuum filtration unit, using a Whatman cellulose nitrate filter with 4.7 cm diameter and 0.45 µm pore size. This process was needed to ensure the background concentrations of transition metals were as low as possible, as their presence can cause the formation of DHA *via* ROS production or direct oxidation of AA. All solutions were prepared and contained in sterilized plastic bottles and containers to minimize contamination from trace metals and biological material. AA solutions were made fresh daily to ensure the background DHA concentration, formed from AA degradation in solution, was minimized, therefore keeping the background signal as low and stable as possible. OPDA was dissolved in 500 mL of 0.1 M HCl at a concentration of 46 mM.

833 µL of the filter extract in Milli-Q water at pH 7 (see Section "Filter Extraction" in the Supplementary Information) is added to 100 µL of AA and incubated at 37ºC for 40 minutes. The pH of the working AA solution was 2.5, which at this stage of method development was required to improve the signal stability, however the filter extraction is performed at pH 7 (Campbell et al., 2019). OPDA (46 mM, 100 µL) was added to the reaction mixture, and allowed 10 mins to react at room temperature. The fluorescent product of the condensation reaction of DHA + OPDA, 3-(1,2-dihydroxyethyl)-fluoro[3,4-b]quinoxaline-1-one (DFQ), was excited at $\lambda_{excitation}$ = 365 nm with a high-power UV LED (Roithner Lasertechnik, type UVLED-365-330-SMD). The assay is then expressed in terms of the DHA concentration using a calibration curve of known DHA concentrations (**Figure S4**). Filter blanks and chemical blanks were performed on a daily basis to monitor assay stability over multiple days of sample analysis.

## AA calibration curve

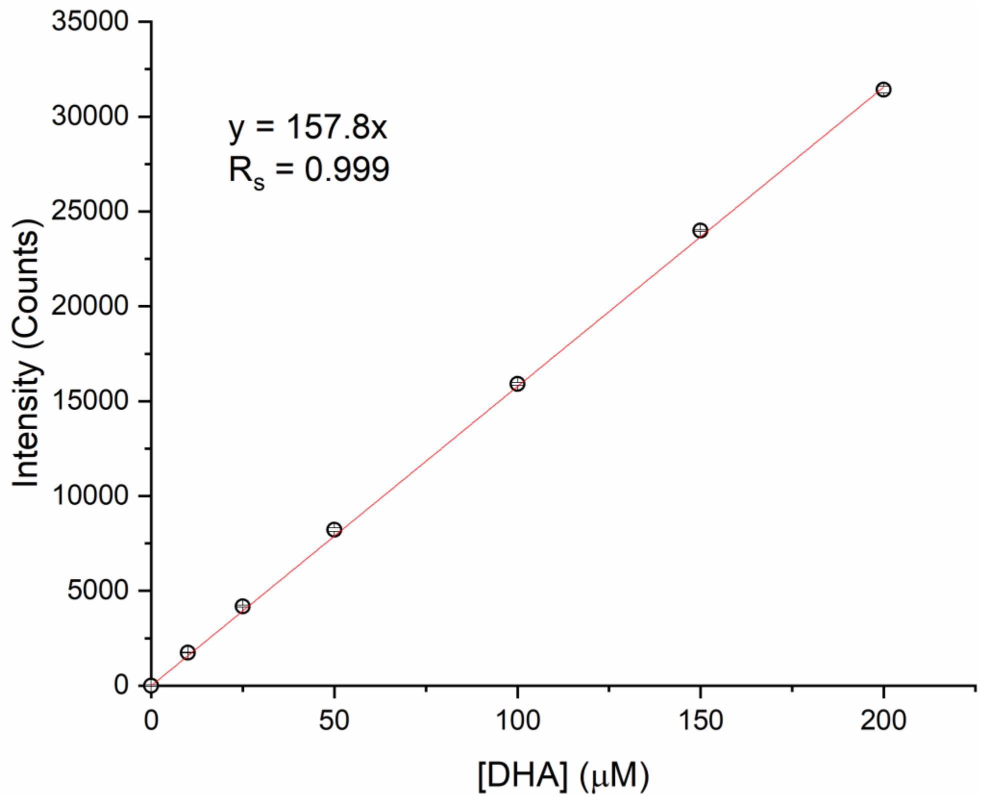


**Figure S 4.** DHA calibration for AA assay.

# DTT assay methods

The DTT protocol measures the oxidative potential of redox-active species in PM by adding DTT to PM extracts under biological conditions (37ºC, pH = 7.4). The redox-active compounds in the PM oxidise the DTT to the disulfide form, and the rate at which this reaction occurs can be measured by periodically stopping the reaction by adding 5,5'-dithiobis(2-nitrobenzoic acid) (DTNB) in excess. DTNB reacts with the remaining DTT to form DTT-disulfide and 2-nitro-5-thiobenzoic acid (TNB), TNB is a coloured product that can be measured at 412 nm. By quenching the reaction at various times with DTNB the linear rate of DTT consumption can be determined. This rate of consumption is corrected for the mass of PM in the reaction to get an intrinsic DTT value: $DTT_m$ (pmol DTT $min^{-1}$ $\mu g^{-1}$ $PM_{2.5}$), or volume normalised $DTT_v$ (nmol DTT $min^{-1}$ $m^{-3}$). For full details see Section S2 in the Supplementary Information. At present, saturation effects at high PM2.5 mass concentrations cannot be ruled out regarding the DTT assay (J. G. Charrier & Anastasio, 2012; Jessica G Charrier et al., 2016).

## DTT stock solution

10 mM DTT stock: 0.154 g of DTT was quantitatively transferred to a 100 mL volumetric flask and dissolved in DI water. It was stored in amber glass bottles in a fridge. 10 mM DTNB: 0.396 g of DTNB was quantitatively transferred to a 100 mL volumetric flask and dissolved in methanol; the stock was then transferred to an amber glass bottle with glass stopper (wrapped in aluminium foil to block light) and stored in a fridge. 0.5 M potassium phosphate buffer: 0.5 M dipotassium phosphate (dibasic) was prepared by quantitatively transferring 8.71 g $K_2HPO_4$ into a 100 mL volumetric flask and dissolving in DI water.0.5 M monopotassium phosphate (monobasic) was prepared by quantitatively transferring 1.701 g $KH_2PO_4$ into a 100 mL volumetric flask and dissolving in DI water. The monobasic solution was added to the dibasic solution until the pH stabilised at 7.40 and stored at room temperature in an acid washed glass bottle.0.05 µM PQN preparation (working solution), the 5 mM PQN stock was stored in a volumetric flask in a fridge (defrosted using a 37ºC water bath before use).

## DTT $PM_{2.5}$ filter extraction

Rectangle (1 x 1.5 cm, SA 150 $mm^2$) and circular (0.8 cm Ø, SA 50 $mm^2$) punches were taken from each filter to have ~20 µg $PM_{2.5}$ in the reaction (two rectangle punches were used for filter blanks). The equation for working out PM in reaction is:

$$\frac{\frac{Total\ PM\ on\ filter\ (\mu g)}{Filter\ SA\ (mm^2)} \times \sum SA\ of\ punches\ \ (mm^2)}{Final\ extract\ V\ (mL)} \times V\ of\ sample\ in\ reaction\ (mL)$$

For 47 mm Teflon filters the equation would be:

$$\frac{\frac{Total\ PM\ on\ filter\ (\mu g)}{855\ mm^2} \times \sum SA\ of\ punches\ \ (mm^2)}{10\ mL} \times 0.7\ mL = PM\ in\ reaction\ (\mu g)$$

These punches were extracted in 5 mL methanol for 15 minutes via sonication; the extracts were then dried to ~1-2 mL using nitrogen blowdown. These extracts were then made up to 10 mL (volumes differed by ±5 mL in order to get the $PM_{2.5}$ in reaction to ~20 µg) using DI water and then extracted again for 15 minutes via sonication. The PM extract was then filtered through a 0.45 µm syringe filter, this filter extract was used in the same volume as PQN and DI water blank (0.7 mL).

## DTT assay analysis

0.2 mM DTNB preparation: a 50 × dilution of the 10 mM DTNB stock was prepared by transferring 0.4 mL 10 mM DTNB into 19.6 mL DI water in a 50 mL amber glass bottle. 0.7 mL of 0.2 mM DTNB was transferred to 1.5 mL amber glass vials (5 vials per DTT run, one for each time point). (for other DTNB volumes: 29.4 mL DI & 0.6 mL DTNB, 39.2 mL DI & 0.8 mL DTNB)

0.7 mL of sample (PQN, PM extract, filter blank, or DI water) was transferred to an acid washed centrifuge tube with 0.2 mL 0.5 M k-buffer, this solution was heated to 37 ºC in a water bath. Just prior to starting the experiment a 1 mM DTT solution was prepared from the 10 mM DTT stock (5 mL 10 mM DTT stock made up in a 50 mL volumetric flask covered in foil to block light).

100 µL of 1 mM DTT was added to the sample / k-buffer solution. The solution was shaken and 100 µL of this solution was immediately transferred to an amber glass vial containing 0.2 mM DTNB, the coloured product of this reaction was immediately analysed using a dual-beam UV-vis.

At various time points (0, 10, 20, 30, and 40 minutes) 100 µL of the reaction solution was transferred to the 0.2 mM DTNB vials, each vial was immediately analysed using UV-vis. Three measurements were taken for each time point at 412 and 700 nm (700 nm is the background reading).

Two DTT runs are carried out at the same time, the second run is off-set from the first by 5 minutes so that samples are analysed every 5 minutes. The second run uses the same 1 mM DTT as the first run but the DTT in the beaker is replaced by DTT in the volumetric flask. If more than two runs are being carried out the 1 mM DTT will be remade for each set of two runs.

During the DTT experiments for our samples each day 2 filter blank DTT analysis were carried out along with 3 repeats of the first filter sample. To ensure the results were repeatable the results for that day were only kept if the coefficient of variation for both of these were below 15%. To account for day to day drift, periodically PQN positive standards were run through the DTT experiment.

## DTT calibration

For the calibration the solutions were not added to the water bath for heating and instead various concentrations of DTT solution were used. 0.7 mL of DI water and 0.2 mL 0.5 M k-buffer was added to five acid washed centrifuge tubes. Each tube had 100 µL of a different DTT concentration added and then had 100 µL removed and added to 0.2 mM DTNB, the DTT concentrations were:

- 100 µM: 5 mL in 50 mL DI
- 80 µM: 4 mL in 50 mL DI
- 60 µM: 3 mL in 50 mL DI
- 40 µM: 2 mL in 50 mL DI
- 20 µM: 1 mL in 50 mL DI
- 0 µM: 0.8 mL of DI water was used to take the place of DTT

The absorbance for each concentration was recorded in the same way as for samples and had the background reading at 700 nm and DI water absorbance subtracted from the absorbance at 412 nm. The absorbance (x-axis) is then plotted against DTT concentration (y-axis) to give the calibration curve:

The equation of the straight line is used to determine DTT concentration from absorbance; DTT conc. (µM) = 280.51 * absorbance – 7.697.

## DTT calibration curve

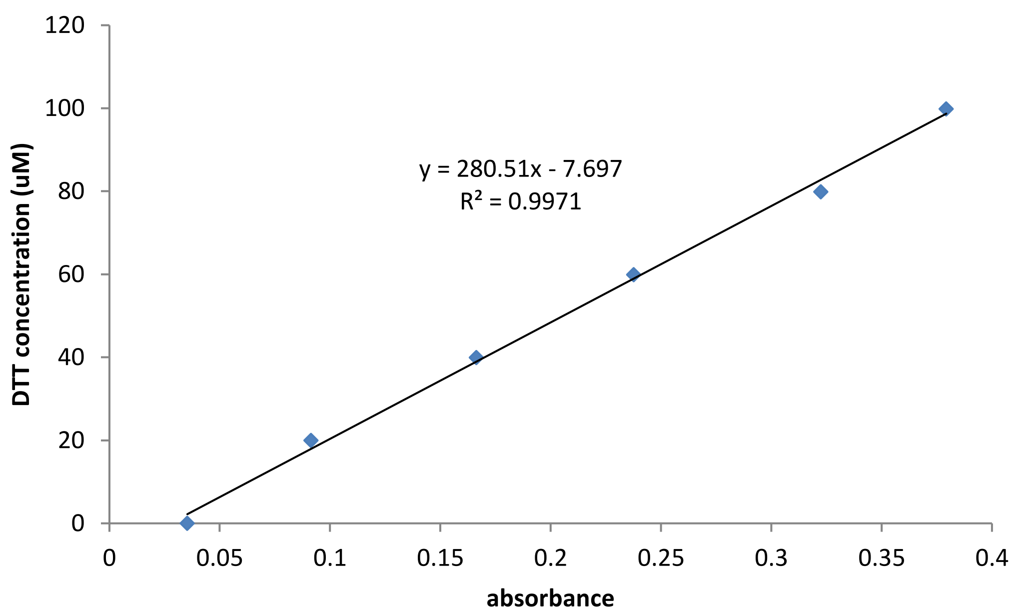


**Figure S 5.** Calibration for DTT assay**.**

# EPR protocol

PM suspensions were prepared fresh each day at a 1 mg/mL stock solution in a physiological buffer (Krebs buffer, composition in mM: 119 NaCl, 25 $NaHCO_3$, 5.5 D-glucose, 4.7 KCl, 1.17 $MgSO_4$, 1.18 $KH_2PO_4$, 2.5 $CaCl_2$), with 15 min sonication in a bath sonicator (FB15051; Fisherbrand, Loughborough, England).

Electron paramagnetic resonance was used to establish superoxide free radical ($O_2^{\cdot-}$) generation in the absence of cells or tissue. Suspensions were incubated with the spin trap, 1-hydroxyl-2,2,6,6-tetrame- thyl-4-oxo-piperidine (Tempone-H; 1 mM final concentration), a spin trap that shows selectivity for superoxide (Dikalov et al., 1997). Urban dust (UD; National Institute of Standards and Technology (NIST) SRM-1649a) and diesel exhaust particles (DEP; NIST SRM-2975) were used as reference material particles with known ability to generate superoxide in this assay. Pyrogallol, which spontaneously generates superoxide in aqueous solutions, was used as a non-particle positive control. The concentration of PM has been standardised so that all suspensions were tested at 0.3 mg/mL in physiological (Krebs) buffer.

Samples were kept at 37ºC throughout and measurements were taken after 60 min by drawing 50 µL of sample into a capillary tube (VWR International, Lutterworth, UK) and sealing with a plug of soft sealant (Cristaseal, VWR International). An X-band EPR spectrometer (Magnettech MS-200, Berlin, Germany) was used with the following parameters: microwave frequency, 9.3-9.55 Hz; microwave power, 20 mW; modulation frequency, 100 kHz; modulation amplitude, 1500 mG; center field, 3365 G; sweep width, 50 G; sweep time, 30 s; number of passes, 1. Baseline signals (Tempone-H in buffer alone) were subtracted from that of experimental readings. Free radical generation was quantified using the first derivative of the initial peak of the spectra obtained from reaction of Tempone-H with superoxide.

## **Section S3:** Filter homogeneity

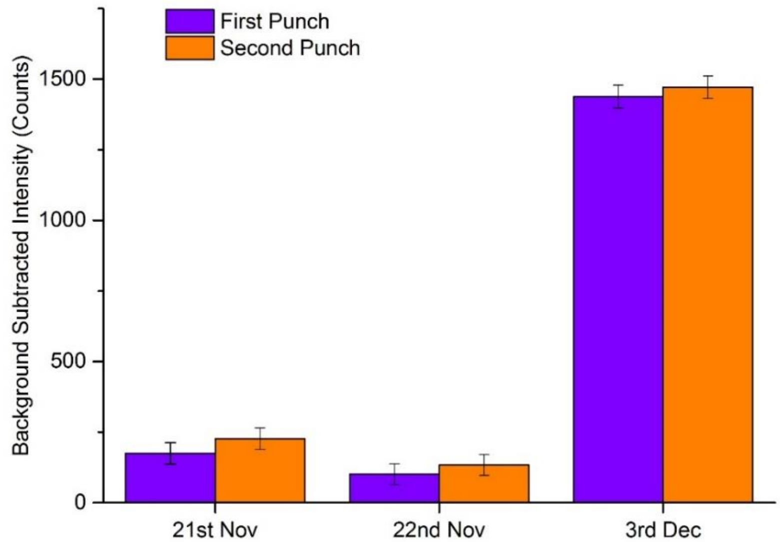


**Figure S 6*:*** Testing the homogeneity of the filters and the DCFH assay by taking two separate punches of each of the samples from 21$^{st}$ Nov, 22$^{nd}$ Nov and 3$^{rd}$ Dec 2016 (winter campaign). The errors are derived from the three repeat measurements of each punch. In each sample the two separate punches were within error of each other, confirming the validity of using two combined punches in the extraction process to boost the signal for the "clean" days and then consequently scaling by a factor of a half. Taking and measuring the separate punches of each sample on different days also confirmed the repeatability of the DCFH/HRP assay.

## **Section S4:** OP vs. $PM_{2.5}$ and average PM composition

**Table S 1.** Summary of $OP_v$ measurements for winter 2016 and summer 2017, including average $PM_{2.5}$ mass (ug $m^{-3}$).

| Assay ($OP_v$) | Season | Average $PM_{2.5}$ Mass (µg $m^{-3}$) | Average Assay Response * | Spearman $R_s$ ($OP_v$ vs $PM_{2.5}$) |
|---|---|---|---|---|
| **$AA_v$** | winter | 98.7 ± 75 | 32.4 ± 14.8 | 0.89 |
| **$DCFH_v$** | winter | 98.7 ± 75 | 0.71 ± 0.52 | 0.96 |
| **$EPR_v$** | winter | 98.7 ± 75 | $2.4\times10^6 \pm 1.6\times10^6$ | 0.89 |
| **$DTT_v$** | winter | 98.7 ± 75 | 2.9 ± 1.9 | 0.81 |
| **$AA_v$** | summer | 36.7 ± 16.8 | 8.5 ± 2.7 | 0.21 |
| **$DCFH_v$** | summer | 36.7 ± 16.8 | 0.17 ± 0.11 | 0.76 |
| **$EPR_v$** | summer | 36.7 ± 16.8 | $5.8\times10^5$ | 0.12 |
| **$DTT_v$** | summer | 36.7 ± 16.8 | 0.90 ± 0.40 | 0.61 |

Units: $AA_v$ = DHA µM $m^{-3}$, $DCFH_v$ = nmol $H_2O_2$ $m^{-3}$, $EPR_v$ = counts $m^{-3}$, $DTT_v$ = nmol DTT min $m^{-3}$

**Table S 2.** Summary of $OP_m$ measurements for winter 2016 and summer 2017, including average $PM_{2.5}$ mass (µg $m^{-3}$)

| Assay ($OP_m$) | Season | Average $PM_{2.5}$ Mass (µg $m^{-3}$) | Average Assay Response * |
|---|---|---|---|
| **$OP_{AA}$** | winter | 98.7 ± 75 | 0.47 ± 0.23 |
| **$OP_{DCFH}$** | winter | 98.7 ± 75 | 0.0071 ± 0.0031 |
| **$OP_{EPR}$** | winter | 98.7 ± 75 | 7362 ± 1457 |
| **$OP_{DTT}$** | winter | 98.7 ± 75 | 37.5 ± 14.4 |
| **$OP_{AA}$** | summer | 36.7 ± 16.8 | 0.32 ± 0.10 |
| **$OP_{DCFH}$** | summer | 36.7 ± 16.8 | 0.0057 ± 0.0028 |
| **$OP_{EPR}$** | summer | 36.7 ± 16.8 | 4993 ± 2408 |
| **$OP_{DTT}$** | summer | 36.7 ± 16.8 | 26.5 ± 9.1 |

Units: $OP_{AA}$ = DHA µ$g^{-1}$, $OP_{DCFH}$ = nmol $H_2O_2$ µ$g^{-1}$, $OP_{EPR}$ = counts µ$g^{-1}$, $OP_{DTT}$ = pmol $min^{-1}$ µ$g^{-1}$

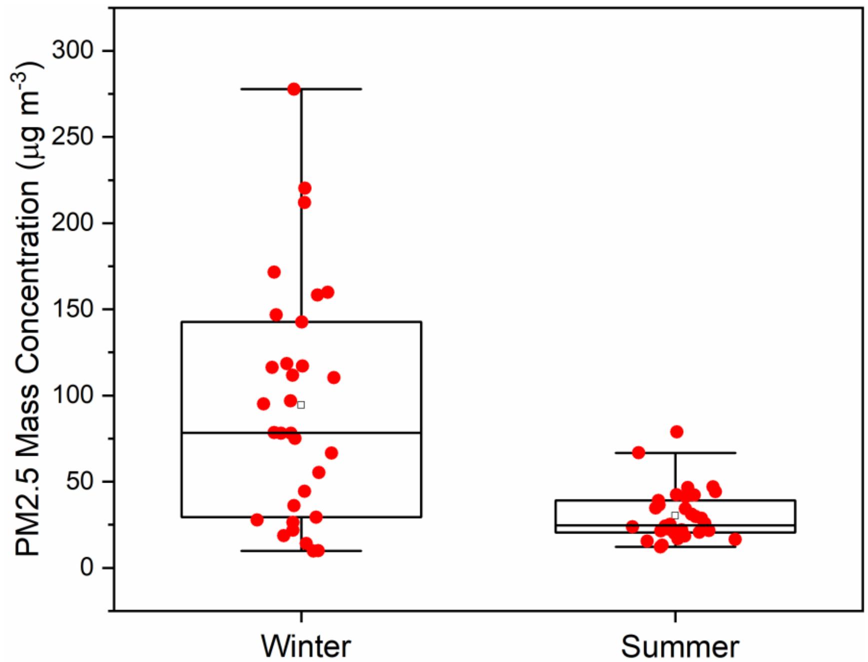


**Figure S 7.** $PM_{2.5}$ mass concentrations in both the winter (2016) and summer (2017) campaign.

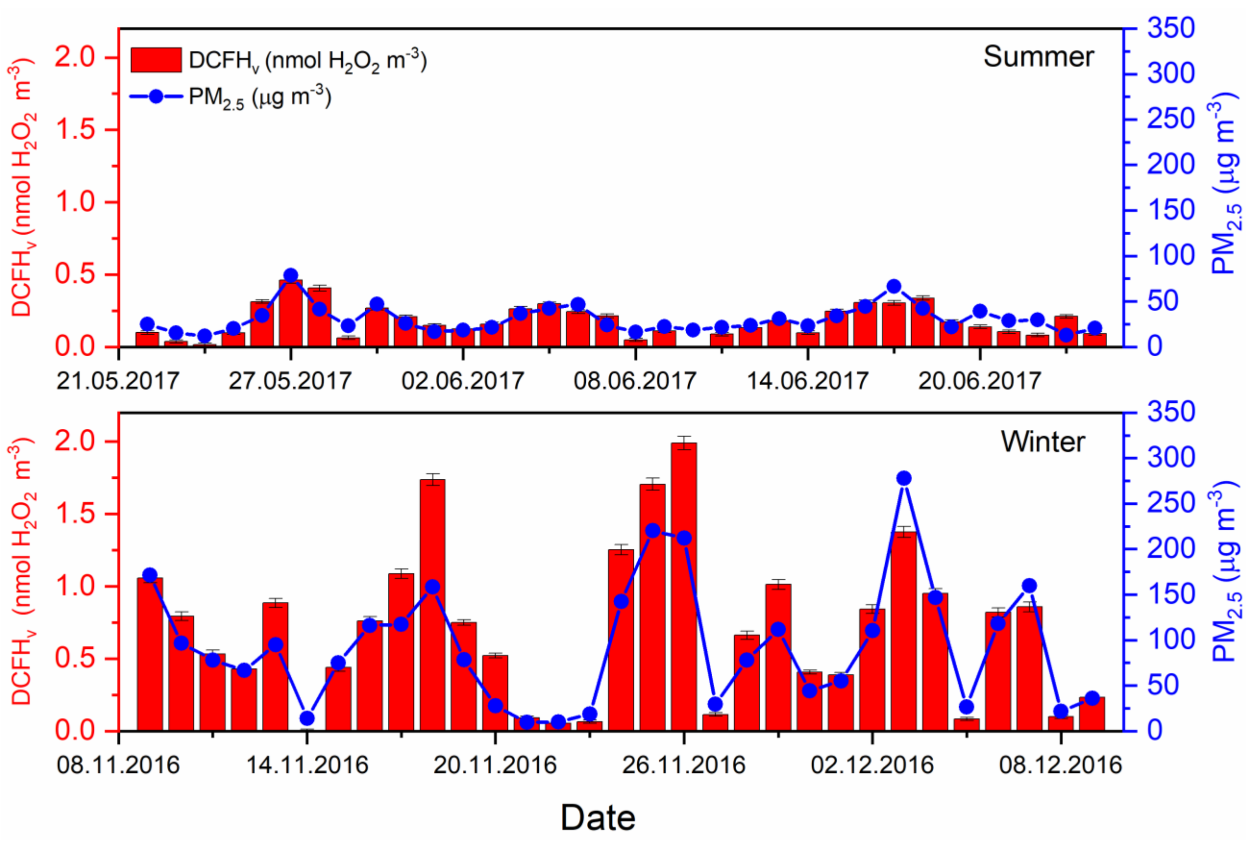


**Figure S 8.** 24- hour averaged $PM_{2.5}$ mass (blue) and $DCFH_v$ (red), analysed from a 24-hour high volume filter (red) (see section Filter Collection), for both Winter 2016 (08/11/2016 – 08/12/2016) and Summer 2017 (21/05/2017-24/06/2017).

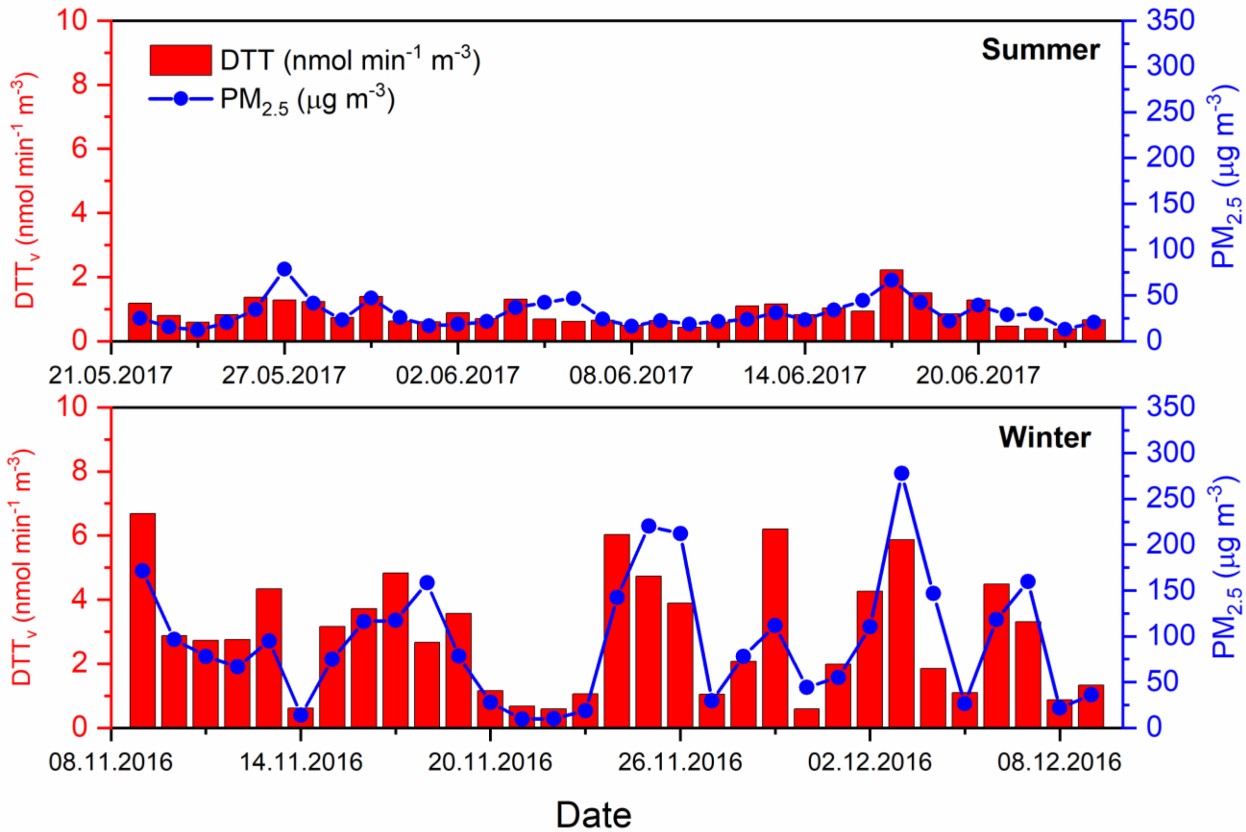


**Figure S 9.** 24- hour averaged $PM_{2.5}$ mass (blue) and $OP_{DTT}$ (red), analysed from a 24-hour high volume filter (red) (see section Filter Collection), for both Winter 2016 (08/11/2016 – 08/12/2016) and Summer 2017 (21/05/2017-24/06/2017).

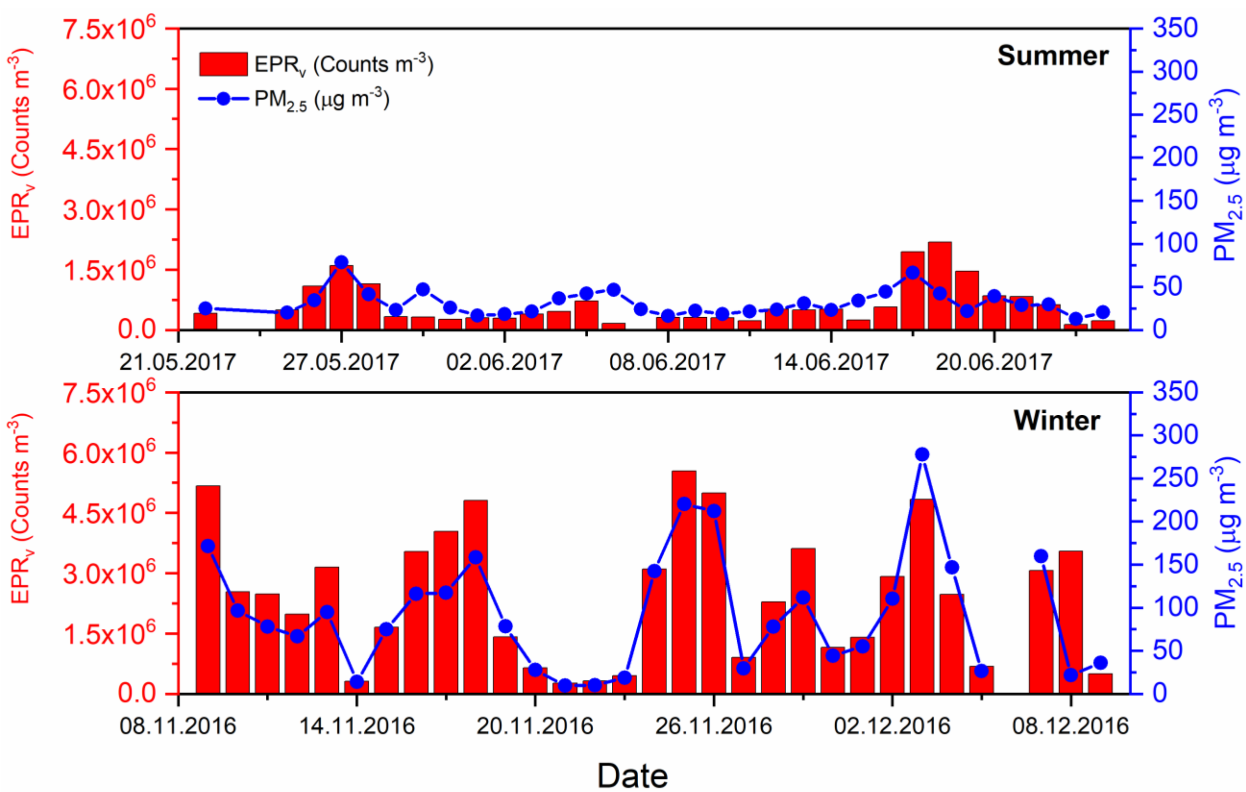

**Figure S 10.** 24- hour averaged $PM_{2.5}$ mass (blue) and $OP_{EPR}$ (red), analysed from a 24-hour high volume filter (red) (see section Filter Collection), for both Winter 2016 (08/11/2016 – 08/12/2016) and Summer 2017 (21/05/2017-24/06/2017).

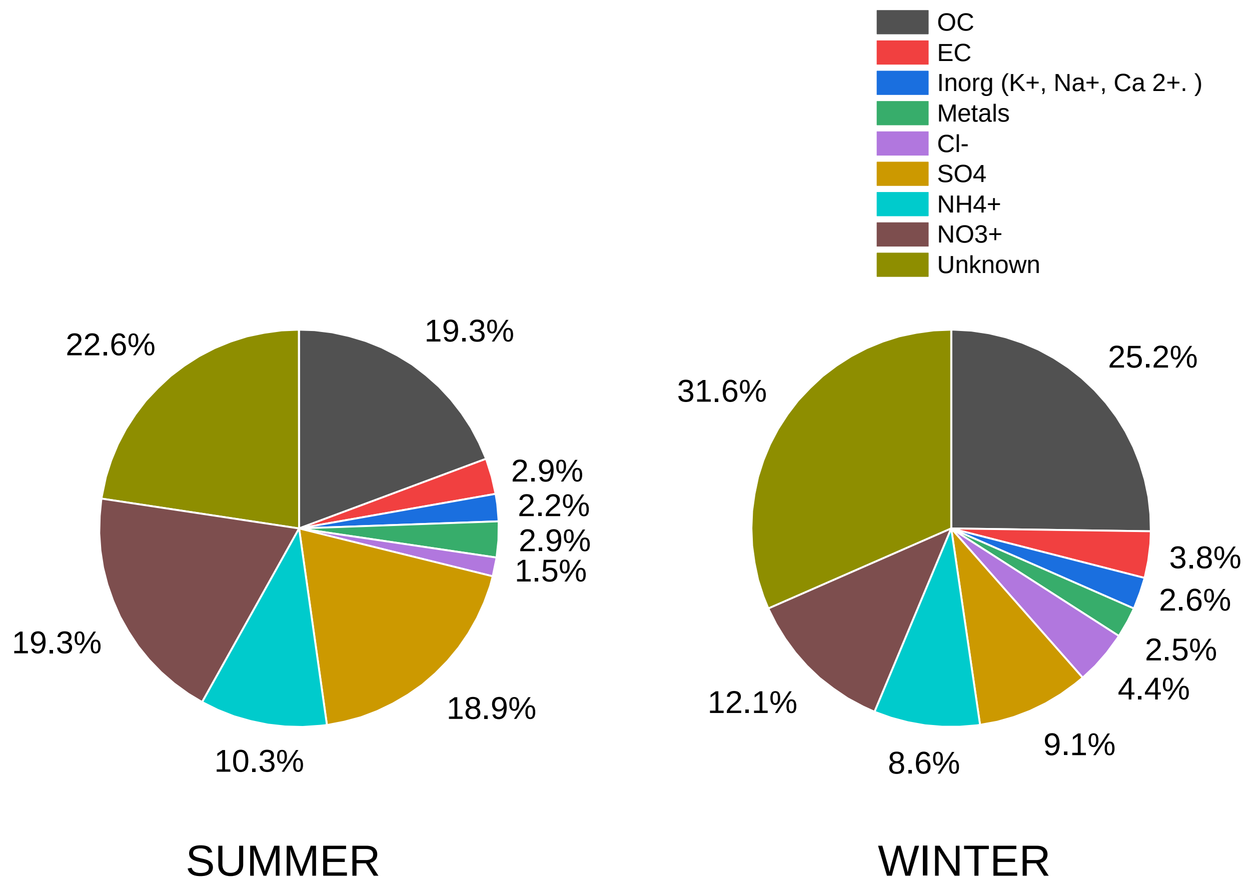


**Figure S 11.** Averaged $PM_{2.5}$ composition in winter and summer**.**

**Table S 3.** Cumulative scores where $R_s \geq 0.5$, out of a total of 117, for PM OP expressed as mass-normalised ($OP_m$) and volume normalised ($OP_v$).

| | $OP_m$ | | $OP_v$ | |
|---|---|---|---|---|
| **assay** | **winter** | **summer** | **winter** | **summer** |
| **AA** | 54 | 15 | 67 | 4 |
| **DCFH** | 8 | 2 | 52 | 18 |
| **EPR** | 3 | 1 | 41 | 0 |
| **DTT** | 18 | 8 | 52 | 15 |

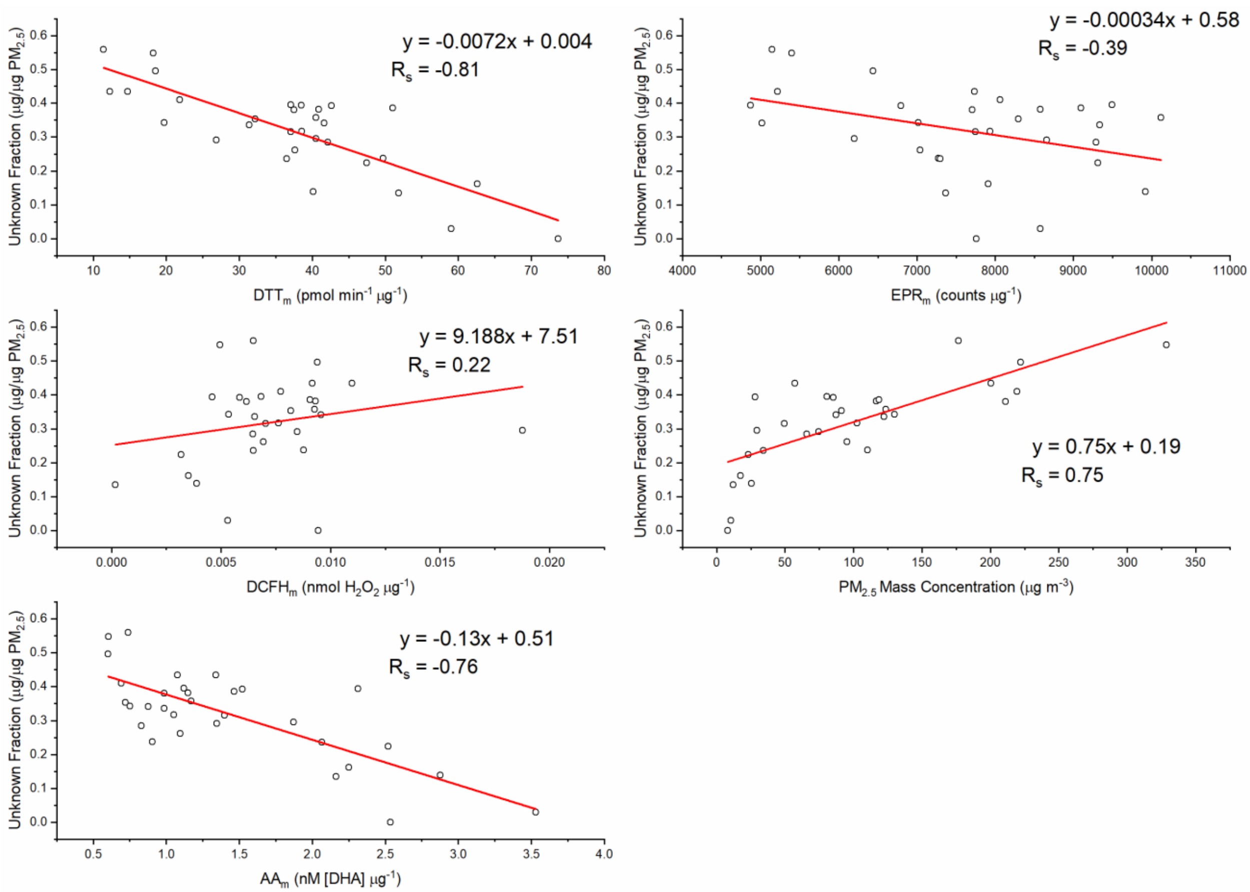


**Figure S 12.** Correlations between $OP_m$ values and the unknown composition percentage of $PM_{2.5}$ in this study. Statistically significant, inverse correlations are observed between $AA_m$ and $DTT_m$ with the unknown $PM_{2.5}$ composition, indicating that species within that fraction are responsible for the inhibition of $PM_{2.5}$ OP.

# **Section S5:** Summary statistics for all measurements

**Table S4 A.** Summary statistics for all mass-normalised measurements. SOA tracer data is not presented as it will be used for future publications. Abbeviations: MW: Mann-Whitney-U test; SD: standard deviation; OC: organic carbon; EC: elemental carbon; ORG: total organic fraction AMS; LOOOA: less-oxidised organic aerosol; MOOOA: more-oxidised organic aerosol; RH; relative humidity; T: temperature.

| feature | units | seasonal MW p-value | winter mean | winter min | winter max | winter SD | summer mean | summer min | summer max | summer SD |
|---|---|---|---|---|---|---|---|---|---|---|
| EPR | counts $\mu g^{-1}$ | 8.08E-06 | 7632.26 | 4872.00 | 10120.00 | 1481.83 | 4980.68 | 944.00 | 11824.00 | 2448.26 |
| AA | counts $\mu g^{-1}$ | 9.63E-03 | 331.04 | 141.37 | 783.31 | 166.36 | 224.06 | 95.52 | 339.58 | 74.24 |
| DTTm | nmol $min^{-1}$ $\mu g^{-1}$ | 1.67E-03 | 37.23 | 11.40 | 73.70 | 14.66 | 26.44 | 11.60 | 46.10 | 9.30 |
| DCFH | nmol $H_2O_2$ $\mu g^{-1}$ | 0.05 | 7.28E-03 | 1.75E-04 | 1.88E-02 | 3.16E-03 | 6.04E-03 | 1.30E-03 | 1.61E-02 | 2.88E-03 |
| total OC | µg/µg PM | 0.01 | 2.54E-01 | 1.20E-01 | 4.86E-01 | 9.64E-02 | 1.93E-01 | 7.95E-02 | 3.41E-01 | 6.36E-02 |
| total EC | µg/µg PM | 6.62E-03 | 3.79E-02 | 1.78E-02 | 6.97E-02 | 1.38E-02 | 2.91E-02 | 8.71E-03 | 7.44E-02 | 1.61E-02 |
| $K^+$ | µg/µg PM | 4.88E-04 | 1.41E-02 | 6.71E-03 | 3.07E-02 | 5.46E-03 | 9.88E-03 | 3.80E-03 | 2.62E-02 | 5.04E-03 |
| $Na^+$ | µg/µg PM | 0.96 | 5.54E-03 | 9.73E-04 | 1.21E-02 | 2.78E-03 | 6.33E-03 | 8.65E-04 | 3.31E-02 | 5.99E-03 |
| $Ca^{2+}$ | µg/µg PM | 0.79 | 6.50E-03 | 1.24E-03 | 2.56E-02 | 6.11E-03 | 6.01E-03 | 9.87E-04 | 2.11E-02 | 5.15E-03 |
| $NH_4^+$ | µg/µg PM | 0.83 | 8.62E-02 | 4.15E-02 | 1.41E-01 | 2.02E-02 | 1.03E-01 | 2.03E-03 | 3.88E-01 | 7.71E-02 |
| $NO_3^-$ | µg/µg PM | 7.80E-05 | 1.22E-01 | 6.62E-02 | 1.79E-01 | 3.02E-02 | 1.93E-01 | 7.52E-02 | 3.86E-01 | 8.24E-02 |
| $SO_4^{2-}$ | µg/µg PM | 4.57E-12 | 9.19E-02 | 4.05E-02 | 2.51E-01 | 4.05E-02 | 1.89E-01 | 1.04E-01 | 5.18E-01 | 7.64E-02 |
| $Cl^-$ | µg/µg PM | 4.03E-09 | 4.78E-02 | 1.64E-02 | 9.79E-02 | 1.96E-02 | 1.53E-02 | 4.04E-03 | 8.88E-02 | 1.60E-02 |
| Al | µg/µg PM | 0.60 | 6.93E-03 | 9.37E-04 | 2.06E-02 | 4.55E-03 | 6.81E-03 | 0 | 2.49E-02 | 5.65E-03 |
| Ti | µg/µg PM | 8.82E-03 | 9.29E-04 | 3.05E-05 | 8.24E-03 | 1.92E-03 | 6.65E-04 | 1.81E-04 | 1.75E-03 | 3.85E-04 |
| V | µg/µg PM | 3.58E-03 | 5.75E-05 | 8.83E-07 | 4.42E-04 | 1.08E-04 | 1.10E-04 | 3.36E-06 | 2.85E-04 | 9.08E-05 |
| Cr | µg/µg PM | 9.58E-06 | 4.08E-04 | 5.60E-05 | 1.64E-03 | 3.77E-04 | 1.48E-04 | 0 | 4.50E-04 | 1.03E-04 |
| Mn | µg/µg PM | 2.24E-03 | 5.84E-04 | 1.83E-04 | 2.78E-03 | 4.61E-04 | 8.04E-04 | 2.78E-04 | 2.27E-03 | 4.27E-04 |
| Fe | µg/µg PM | 9.16E-04 | 1.00E-02 | 2.64E-03 | 3.73E-02 | 6.84E-03 | 1.51E-02 | 5.88E-03 | 3.21E-02 | 7.04E-03 |
| Co | µg/µg PM | 0.49 | 8.79E-06 | 1.90E-06 | 5.07E-05 | 1.13E-05 | 2.38E-05 | 1.65E-06 | 4.84E-05 | 2.35E-05 |
| Ni | µg/µg PM | 0.05 | 8.41E-05 | 1.62E-05 | 5.25E-04 | 1.10E-04 | 6.05E-05 | 0 | 3.96E-04 | 9.44E-05 |
| Cu | µg/µg PM | 0.15 | 2.54E-04 | 1.75E-05 | 2.17E-03 | 3.65E-04 | 1.69E-04 | 1.35E-05 | 5.40E-04 | 1.30E-04 |
| Zn | µg/µg PM | 0.44 | 4.39E-03 | 1.17E-03 | 2.15E-02 | 3.92E-03 | 3.31E-03 | 1.53E-03 | 7.57E-03 | 1.41E-03 |
| Cd | µg/µg PM | 0.82 | 2.75E-04 | 1.25E-04 | 7.48E-04 | 1.49E-04 | 3.04E-04 | 4.04E-05 | 7.12E-04 | 2.90E-04 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sb** | µg/µg PM | 7.31E-09 | 9.28E-05 | 1.72E-05 | 2.04E-04 | 4.22E-05 | 1.86E-03 | 2.97E-04 | 3.94E-03 | 1.42E-03 |
| **Ba** | µg/µg PM | 1.31E-03 | 1.54E-04 | 2.43E-05 | 6.83E-04 | 1.75E-04 | 4.26E-04 | 1.48E-05 | 1.52E-03 | 3.99E-04 |
| **Pb** | µg/µg PM | 0.94 | 9.73E-04 | 6.40E-05 | 2.91E-03 | 6.35E-04 | 9.15E-04 | 2.82E-04 | 1.85E-03 | 4.07E-04 |
| **galactosan** | µg/µg PM | 5.24E-16 | 5.43E-04 | 7.35E-05 | 1.63E-03 | 3.72E-04 | 4.98E-05 | 1.68E-05 | 1.44E-04 | 2.74E-05 |
| **mannosan** | µg/µg PM | 3.41E-15 | 7.10E-04 | 1.00E-04 | 1.76E-03 | 4.27E-04 | 7.86E-05 | 1.47E-05 | 2.98E-04 | 5.84E-05 |
| **levoglucosan** | µg/µg PM | 3.65E-14 | 6.35E-03 | 9.56E-04 | 1.91E-02 | 4.04E-03 | 8.22E-04 | 2.14E-04 | 3.72E-03 | 6.88E-04 |
| **ORG** | µg/µg PM | 0.03 | 3.97E-01 | 3.01E-01 | 4.86E-01 | 5.84E-02 | 3.57E-01 | 1.99E-01 | 6.87E-01 | 1.01E-01 |
| **MOOOA** | µg/µg PM | 0.74 | 7.11E-02 | 1.66E-02 | 1.19E-01 | 2.84E-02 | 6.83E-02 | 1.61E-02 | 1.04E-01 | 2.71E-02 |
| **LOOOA** | µg/µg PM | 0.14 | 4.71E-02 | 7.00E-03 | 1.18E-01 | 3.16E-02 | 6.64E-02 | 7.38E-03 | 1.69E-01 | 4.52E-02 |
| **$O_3$** | ppb | 5.72E-16 | 8.47 | 2.36 | 25.81 | 5.87 | 53.92 | 8.40 | 98.47 | 21.10 |
| **CO** | ppb | 1.35E-11 | 1473.47 | 476.13 | 2820.28 | 671.32 | 527.69 | 282.16 | 1156.72 | 166.21 |
| **NO** | ppb | 1.12E-10 | 43.90 | 1.16 | 122.20 | 29.79 | 4.89 | 0.40 | 19.75 | 5.23 |
| **$NO_2$** | ppb | 4.73E-07 | 37.35 | 9.95 | 67.12 | 13.91 | 21.42 | 12.65 | 37.31 | 6.11 |
| **$NO_y$** | ppb | 6.66E-07 | 88.90 | 12.54 | 184.47 | 46.57 | 35.04 | 17.75 | 66.83 | 12.43 |
| **$SO_2$** | ppb | 1.95E-05 | 5.68 | 0.88 | 12.62 | 3.40 | 2.37 | 0.05 | 8.14 | 1.89 |
| **RH8** | % | 0.69 | 49.98 | 17.16 | 94.71 | 17.83 | 49.98 | 28.28 | 99.70 | 19.29 |
| **RH120** | % | 0.32 | 48.24 | 15.49 | 97.45 | 19.33 | 44.68 | 18.73 | 99.55 | 20.63 |
| **RH240** | % | 0.46 | 48.72 | 15.06 | 99.36 | 20.53 | 45.49 | 17.03 | 98.55 | 19.99 |
| **T8** | °C | 4.30E-18 | 5.33 | -2.23 | 10.95 | 3.25 | 26.52 | 18.22 | 33.45 | 3.81 |
| **T120** | °C | 4.30E-18 | 4.36 | -3.80 | 9.52 | 3.32 | 24.94 | 17.11 | 31.82 | 3.78 |
| **T240** | °C | 4.30E-18 | 3.62 | -5.12 | 8.33 | 3.41 | 23.86 | 16.46 | 30.98 | 3.81 |
| **methanol** | ppb | 0.02 | 20.30 | 1.59 | 53.22 | 14.42 | 27.64 | 11.16 | 43.53 | 8.23 |
| **acetonitrile** | ppb | 0.59 | 0.45 | 0.02 | 1.18 | 0.36 | 0.93 | -0.03 | 3.61 | 1.10 |
| **acetaldehyde** | ppb | 1.00 | 4.51 | 0.88 | 10.11 | 2.89 | 4.58 | 1.09 | 11.87 | 2.99 |
| **acrolein** | ppb | 2.12E-03 | 0.42 | 0.04 | 0.95 | 0.28 | 0.18 | -0.02 | 0.59 | 0.11 |
| **acetone** | ppb | 3.42E-03 | 2.65 | 0.46 | 6.14 | 1.65 | 3.82 | 1.49 | 6.26 | 1.17 |
| **isoprene** | ppb | 1.47E-02 | 1.09 | 0.02 | 2.42 | 0.76 | 0.51 | 0.07 | 1.32 | 0.26 |
| **methyl vinyl ketone /methacrolein** | ppb | 0.36 | 0.82 | 0 | 2.29 | 0.71 | 0.56 | -0.04 | 1.77 | 0.42 |
| **methyl ethyl ketone** | ppb | 0.37 | 0.22 | 0.04 | 0.49 | 0.14 | 0.35 | -0.13 | 1.07 | 0.33 |
| **benzene** | ppb | 1.28E-06 | 1.90 | 0.16 | 4.90 | 1.41 | 0.35 | 0.05 | 1.01 | 0.20 |
| **toluene** | ppb | 1.21E-03 | 1.85 | 0.04 | 4.72 | 1.46 | 0.44 | 0.15 | 0.88 | 0.19 |
| **C2-benzenes** | ppb | 1.69E-03 | 1.98 | 0.13 | 5.50 | 1.58 | 0.58 | 0.12 | 1.23 | 0.25 |
| **C3-benzenes** | ppb | 6.05E-03 | 0.48 | 0.01 | 1.17 | 0.37 | 0.14 | 0.01 | 0.31 | 0.07 |
| **J $O^1D$** | $s^{-1}$ | 1.47E-11 | 7.15E-07 | -1.40E-08 | 3.32E-06 | 5.88E-07 | 6.61E-06 | 1.17E-06 | 9.53E-06 | 2.21E-06 |
| **J $NO_2$** | $s^{-1}$ | 6.44E-10 | 7.84E-04 | 4.23E-05 | 2.22E-03 | 4.41E-04 | 2.78E-03 | 5.28E-04 | 3.73E-03 | 8.53E-04 |
| **naphthalene** | µg/µg PM | 1.37E-04 | 4.67E-06 | 1.43E-06 | 1.09E-05 | 2.40E-06 | 1.97E-06 | 2.61E-07 | 3.87E-06 | 1.36E-06 |
| **acenaphthylne** | µg/µg PM | 1.89E-06 | 9.18E-06 | 1.22E-06 | 2.07E-05 | 5.63E-06 | 9.98E-07 | 2.01E-07 | 2.54E-06 | 6.33E-07 |
| **acenaphthene** | µg/µg PM | 2.04E-03 | 1.36E-06 | 2.67E-07 | 3.71E-06 | 9.97E-07 | 4.78E-07 | 1.18E-07 | 1.99E-06 | 5.13E-07 |
| **fluorene** | µg/µg PM | 9.63E-08 | 1.04E-05 | 1.93E-06 | 2.28E-05 | 6.37E-06 | 1.19E-06 | 2.21E-07 | 2.18E-06 | 5.31E-07 |
| **phenanthrene** | µg/µg PM | 1.44E-09 | 1.52E-04 | 3.22E-05 | 3.54E-04 | 9.69E-05 | 7.68E-06 | 1.67E-06 | 1.53E-05 | 4.09E-06 |
| **fluoranthene** | µg/µg PM | 1.44E-09 | 2.03E-04 | 4.79E-05 | 4.54E-04 | 1.32E-04 | 2.14E-05 | 9.84E-06 | 3.98E-05 | 9.10E-06 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **pyrene** | µg/µg PM | 1.01E-08 | 1.75E-04 | 3.96E-05 | 3.93E-04 | 1.14E-04 | 2.55E-05 | 1.27E-05 | 5.46E-05 | 1.15E-05 |
| **benzo(a)-anthracene** | µg/µg PM | 1.44E-09 | 2.04E-04 | 3.84E-05 | 4.53E-04 | 1.32E-04 | 1.39E-05 | 5.10E-06 | 2.70E-05 | 6.37E-06 |
| **chrysene** | µg/µg PM | 1.44E-09 | 2.04E-04 | 5.63E-05 | 3.81E-04 | 1.12E-04 | 2.26E-05 | 1.31E-05 | 4.12E-05 | 8.41E-06 |
| **benzo(b)-fluoranthene** | µg/µg PM | 1.44E-09 | 1.97E-04 | 5.57E-05 | 3.88E-04 | 1.09E-04 | 3.22E-05 | 1.84E-05 | 5.46E-05 | 1.13E-05 |
| **benzo(k)-fluoranthene** | µg/µg PM | 4.93E-06 | 9.04E-05 | 2.19E-05 | 2.12E-04 | 5.54E-05 | 2.56E-05 | 1.26E-05 | 4.83E-05 | 9.88E-06 |
| **benzo(a)-pyrene** | µg/µg PM | 2.80E-07 | 2.95E-04 | 3.20E-05 | 7.07E-04 | 1.96E-04 | 2.68E-05 | 1.38E-05 | 4.45E-05 | 1.00E-05 |
| **indeno (1,2,3-cd)pyrene** | µg/µg PM | 3.84E-06 | 1.38E-04 | 3.07E-05 | 2.82E-04 | 7.67E-05 | 3.16E-05 | 1.63E-05 | 5.64E-05 | 1.18E-05 |
| **dibenzo-(a,h)-anthracene** | µg/µg PM | 1.44E-09 | 5.27E-05 | 1.02E-05 | 1.25E-04 | 3.39E-05 | 4.59E-06 | 1.98E-06 | 9.21E-06 | 2.17E-06 |
| **benzo(ghi)-perylene** | µg/µg PM | 5.36E-07 | 1.40E-04 | 3.23E-05 | 2.79E-04 | 7.94E-05 | 2.72E-05 | 7.41E-06 | 5.04E-05 | 1.24E-05 |
| **C24** | µg/µg PM | 4.50E-18 | 9.66E-04 | 1.72E-04 | 4.39E-03 | 9.68E-04 | 4.97E-05 | 1.13E-05 | 1.92E-04 | 4.50E-05 |
| **C25** | µg/µg PM | 3.95E-15 | 9.98E-04 | 1.70E-04 | 4.55E-03 | 9.85E-04 | 1.01E-04 | 1.17E-05 | 3.41E-04 | 9.03E-05 |
| **C26** | µg/µg PM | 7.54E-17 | 5.93E-04 | 8.88E-05 | 2.65E-03 | 5.71E-04 | 5.28E-05 | 2.21E-06 | 2.06E-04 | 4.05E-05 |
| **C27** | µg/µg PM | 6.00E-09 | 5.47E-04 | 8.31E-05 | 2.23E-03 | 4.73E-04 | 1.40E-04 | 4.90E-06 | 3.92E-04 | 9.00E-05 |
| **C28** | µg/µg PM | 3.52E-13 | 2.46E-04 | 3.56E-05 | 8.79E-04 | 1.97E-04 | 4.29E-05 | 1.38E-06 | 1.31E-04 | 2.59E-05 |
| **C29** | µg/µg PM | 2.61E-08 | 4.98E-04 | 6.84E-05 | 1.88E-03 | 3.83E-04 | 1.55E-04 | 4.38E-06 | 3.94E-04 | 8.30E-05 |
| **C30** | µg/µg PM | 5.94E-10 | 1.38E-04 | 1.98E-05 | 4.28E-04 | 1.14E-04 | 3.27E-05 | 1.33E-06 | 9.30E-05 | 1.99E-05 |
| **C31** | µg/µg PM | 3.09E-02 | 2.08E-04 | 3.15E-05 | 7.60E-04 | 1.62E-04 | 1.28E-04 | 2.47E-06 | 3.46E-04 | 8.08E-05 |
| **C32** | µg/µg PM | 1.62E-07 | 7.79E-05 | 3.47E-06 | 2.79E-04 | 5.51E-05 | 2.73E-05 | 1.23E-06 | 8.69E-05 | 1.96E-05 |
| **C33** | µg/µg PM | 1.18E-02 | 6.68E-05 | 7.91E-06 | 2.77E-04 | 7.01E-05 | 2.83E-05 | 3.15E-07 | 8.92E-05 | 2.12E-05 |
| **C34** | µg/µg PM | 3.38E-10 | 4.33E-05 | 3.32E-06 | 3.36E-04 | 5.95E-05 | 3.74E-06 | 3.13E-07 | 3.13E-05 | 5.59E-06 |
| **OH** | ppt | 8.70E-12 | 9.32E-02 | 5.98E-02 | 1.57E-01 | 3.05E-02 | 2.05E-04 | 5.29E-05 | 4.21E-04 | 8.39E-05 |
| **$HO_2$** | ppt | 6.64E-07 | 9.68E-01 | 3.36E-01 | 2.44 | 7.40E-01 | 5.15E-03 | 3.73E-04 | 1.17E-02 | 3.05E-03 |
| **$RO_2$** | ppt | 1.81E-10 | 1.77 | 6.44E-01 | 3.86 | 9.04E-01 | 3.11E-02 | 2.92E-03 | 1.00E-01 | 2.66E-02 |
| **palmitic acid** | µg/µg PM | 1.34E-10 | 8.83E-03 | 2.28E-04 | 1.13E-01 | 2.02E-02 | 8.20E-04 | 1.45E-04 | 2.18E-03 | 4.84E-04 |
| **stearic acid** | µg/µg PM | 2.21E-09 | 5.72E-03 | 1.16E-04 | 8.90E-02 | 1.60E-02 | 4.98E-04 | 9.01E-05 | 1.14E-03 | 2.68E-04 |
| **cholesterol** | µg/µg PM | 2.20E-01 | 3.11E-05 | 1.12E-06 | 2.34E-04 | 4.70E-05 | 1.41E-05 | 3.49E-06 | 3.36E-05 | 7.84E-06 |
| **17a(H)-22,29,30-trisnorhopane (C27a)** | µg/µg PM | 4.42E-17 | 4.03E-05 | 8.58E-06 | 1.50E-04 | 3.25E-05 | 1.86E-06 | 1.04E-07 | 1.14E-05 | 2.05E-06 |
| **17b(H),21a(H)-norhopane (C30ba)** | µg/µg PM | 8.24E-14 | 4.55E-05 | 8.98E-06 | 1.78E-04 | 3.75E-05 | 5.77E-06 | 2.08E-07 | 3.01E-05 | 5.93E-06 |

**Table S4 B.** Summary statistics for all volume-normalised measurements. SOA tracer data is not presented as it will be used for future publications.

| feature | units | seasonal MW p-value | winter mean | winter min | winter max | winter SD | summer mean | summer min | summer max | summer SD |
|---|---|---|---|---|---|---|---|---|---|---|
| **EPR** | counts $m^{-3}$ | 4.48E-07 | 2.46 E+06 | 2.64 E+05 | 5.54 E+06 | 1.64 E+06 | 6.43 E+05 | 1.37 E+05 | 2.18 E+06 | 5.18 E+05 |
| **AA** | [DHA] $m^{-3}$ | 1.12E-13 | 32.39 | 7.44 | 57.78 | 14.78 | 8.57 | 4.94 | 13.04 | 2.29 |
| **DTTm** | nmol $min^{-1} m^{-3}$ | 7.88E-07 | 2.94 | 0.59 | 6.68 | 1.85 | 0.90 | 0.38 | 2.22 | 0.40 |
| **DCFH** | [$H_2O_2$] $m^{-3}$ | 1.58E-05 | 0.71 | 2.47E-03 | 1.99 | 0.53 | 0.18 | -6.46E-03 | 0.46 | 0.11 |
| **total OC** | μg/m³ | 1.23E-07 | 20.18 | 3.95 | 48.81 | 12.27 | 6.51 | 1.82 | 12.71 | 2.33 |
| **total EC** | μg/m³ | 2.34E-07 | 3.23 | 0.28 | 6.58 | 1.93 | 0.92 | 0.24 | 1.66 | 0.36 |
| **$K^+$** | μg/m³ | 3.71E-05 | 1.32 | 0.15 | 3.80 | 1.04 | 0.38 | 0.11 | 2.05 | 0.36 |
| **$Na^+$** | μg/m³ | 7.28E-04 | 0.42 | 0.09 | 0.93 | 0.25 | 0.21 | 0.03 | 0.73 | 0.16 |
| **$Ca^{2+}$** | μg/m³ | 5.10E-06 | 0.34 | 0.16 | 0.62 | 0.12 | 0.18 | 0.03 | 0.36 | 0.10 |
| **$NH_4^+$** | μg/m³ | 7.04E-04 | 8.09 | 0.50 | 22.62 | 5.67 | 3.70 | 0.08 | 14.83 | 3.15 |
| **$NO_3^-$** | μg/m³ | 0.05 | 12.38 | 0.87 | 34.63 | 9.54 | 7.22 | 1.53 | 26.12 | 5.00 |
| **$SO_4^{2-}$** | μg/m³ | 0.95 | 8.51 | 1.27 | 24.21 | 7.16 | 6.92 | 1.96 | 19.48 | 4.01 |
| **$Cl^-$** | μg/m³ | 6.50E-09 | 3.70 | 0 | 8.73 | 2.34 | 0.48 | 0.12 | 1.96 | 0.42 |
| **Al** | μg/m³ | 6.68E-04 | 0.59 | 0.05 | 1.64 | 0.44 | 0.23 | 0 | 0.58 | 0.15 |
| **Ti** | μg/m³ | 0.09 | 0.04 | 2.27E-03 | 0.12 | 0.03 | 0.02 | 5.14E-03 | 0.04 | 0.01 |
| **V** | μg/m³ | 0.13 | 2.27E-03 | 3.23E-05 | 6.88E-03 | 1.93E-03 | 5.05E-03 | 1.10E-04 | 0.02 | 6.37E-03 |
| **Cr** | μg/m³ | 6.84E-11 | 0.02 | 4.78E-03 | 0.07 | 0.02 | 4.81E-03 | 9.50E-04 | 9.96E-03 | 2.50E-03 |
| **Mn** | μg/m³ | 0.09 | 0.04 | 9.05E-03 | 0.11 | 0.03 | 0.03 | 4.96E-03 | 0.08 | 0.01 |
| **Fe** | μg/m³ | 0.16 | 0.70 | 0.19 | 1.87 | 0.44 | 0.49 | 0.15 | 1.15 | 0.20 |
| **Co** | μg/m³ | 0.82 | 4.69E-04 | 1.96E-04 | 1.24E-03 | 2.56E-04 | 9.37E-04 | 7.00E-05 | 2.25E-03 | 1.16E-03 |
| **Ni** | μg/m³ | 2.57E-04 | 4.63E-03 | 1.38E-03 | 1.42E-02 | 3.05E-03 | 1.99E-03 | 1.40E-04 | 6.97E-03 | 2.03E-03 |
| **Cu** | μg/m³ | 2.08E-04 | 1.77E-02 | 1.49E-03 | 0.05 | 1.37E-02 | 6.23E-03 | 3.20E-04 | 0.02 | 5.13E-03 |
| **Zn** | μg/m³ | 6.57E-06 | 0.30 | 0.07 | 0.70 | 0.20 | 0.12 | 0.03 | 0.31 | 0.06 |
| **Cd** | μg/m³ | 0.05 | 0.02 | 3.55E-03 | 0.06 | 0.02 | 9.29E-03 | 1.41E-03 | 0.02 | 7.44E-03 |
| **Sb** | μg/m³ | 8.49E-04 | 9.04E-03 | 1.40E-04 | 0.02 | 6.69E-03 | 0.05 | 7.04E-03 | 0.12 | 0.04 |
| **Ba** | μg/m³ | 0.31 | 9.49E-03 | 7.19E-04 | 0.03 | 8.01E-03 | 1.20E-02 | 3.50E-04 | 0.04 | 9.63E-03 |
| **Pb** | μg/m³ | 9.41E-05 | 0.09 | 1.07E-02 | 0.31 | 0.07 | 0.03 | 4.82E-03 | 0.14 | 0.03 |
| **galactosan** | μg/m³ | 4.50E-18 | 0.04 | 3.14E-03 | 0.10 | 0.03 | 1.46E-03 | 3.46E-05 | 4.04E-03 | 8.39E-04 |
| **mannosan** | μg/m³ | 2.14E-17 | 0.05 | 3.83E-03 | 0.11 | 0.04 | 2.38E-03 | 3.48E-04 | 1.33E-02 | 2.25E-03 |
| **levoglucosan** | μg/m³ | 7.70E-16 | 0.48 | 0.03 | 1.00 | 0.31 | 0.03 | 2.72E-03 | 0.17 | 0.03 |
| **ORG** | μg/m³ | 8.39E-06 | 35.32 | 4.13 | 94.85 | 23.93 | 10.01 | 4.19 | 21.83 | 3.93 |
| **MOOOA** | μg/m³ | 2.71E-04 | 17.62 | 0.91 | 51.19 | 13.97 | 4.21 | 0.52 | 15.11 | 3.32 |
| **LOOOA** | μg/m³ | 6.43E-03 | 14.65 | 1.52 | 48.43 | 13.90 | 4.64 | 1.14 | 10.44 | 2.64 |
| **$O_3$** | ppb | 9.56E-04 | 9.00 | 0.71 | 27.00 | 7.23 | 2.79 | 0.49 | 7.96 | 1.68 |
| **CO** | ppb | 5.40E-03 | 8.03 | 0.26 | 22.95 | 7.12 | 1.89 | 0.60 | 5.20 | 1.02 |
| **NO** | ppb | 0.11 | 5.09 | 0.11 | 18.32 | 5.16 | 2.24 | 0.14 | 11.27 | 2.30 |
| **$NO_2$** | ppb | 5.72E-16 | 8.47 | 2.36 | 25.81 | 5.87 | 53.92 | 8.40 | 98.47 | 21.10 |
| **$NO_y$** | ppb | 1.35E-11 | 1.47 E+03 | 4.76 E+02 | 2.82 E+03 | 6.71 E+02 | 5.28 E+02 | 2.82 E+02 | 1.16 E+03 | 1.66 E+02 |
| **$SO_2$** | ppb | 1.12E-10 | 43.90 | 1.16 | 122.20 | 29.79 | 4.89 | 0.40 | 19.75 | 5.23 |
| **RH8** | % | 4.73E-07 | 37.35 | 9.95 | 67.12 | 13.91 | 21.42 | 12.65 | 37.31 | 6.11 |
| **RH120** | % | 6.66E-07 | 88.90 | 12.54 | 184.47 | 46.57 | 35.04 | 17.75 | 66.83 | 12.43 |
| **RH240** | % | 1.95E-05 | 5.68 | 0.88 | 12.62 | 3.40 | 2.37 | 0.05 | 8.14 | 1.89 |
| **T8** | °C | 0.69 | 49.98 | 17.16 | 94.71 | 17.83 | 49.98 | 28.28 | 99.70 | 19.29 |
| **T120** | °C | 0.32 | 48.24 | 15.49 | 97.45 | 19.33 | 44.68 | 18.73 | 99.55 | 20.63 |
| **T240** | °C | 0.46 | 48.72 | 15.06 | 99.36 | 20.53 | 45.49 | 17.03 | 98.55 | 19.99 |
| **methanol** | ppb | 4.30E-18 | 5.33 | -2.23 | 10.95 | 3.25 | 26.52 | 18.22 | 33.45 | 3.81 |
| **acetonitrile** | ppb | 4.30E-18 | 4.36 | -3.80 | 9.52 | 3.32 | 24.94 | 17.11 | 31.82 | 3.78 |
| **acetaldehyde** | ppb | 4.30E-18 | 3.62 | -5.12 | 8.33 | 3.41 | 23.86 | 16.46 | 30.98 | 3.81 |
| **acrolein** | ppb | 0.02 | 20.30 | 1.59 | 53.22 | 14.42 | 27.64 | 11.16 | 43.53 | 8.23 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **acetone** | ppb | 0.59 | 0.45 | 0.02 | 1.18 | 0.36 | 0.93 | -0.03 | 3.61 | 1.10 |
| **isoprene** | ppb | 1.00 | 4.51 | 0.88 | 10.11 | 2.89 | 4.58 | 1.09 | 11.87 | 2.99 |
| **methyl vinyl ketone /methacrolein** | ppb | 2.12E-03 | 0.42 | 0.04 | 0.95 | 0.28 | 0.18 | -0.02 | 0.59 | 0.11 |
| **methyl ethyl ketone** | ppb | 3.42E-03 | 2.65 | 0.46 | 6.14 | 1.65 | 3.82 | 1.49 | 6.26 | 1.17 |
| **benzene** | ppb | 0.01 | 1.09 | 0.02 | 2.42 | 0.76 | 0.51 | 0.07 | 1.32 | 0.26 |
| **toluene** | ppb | 0.36 | 0.82 | 0.00 | 2.29 | 0.71 | 0.56 | -0.04 | 1.77 | 0.42 |
| **C2-benzenes** | ppb | 0.37 | 0.22 | 0.04 | 0.49 | 0.14 | 0.35 | -0.13 | 1.07 | 0.33 |
| **C3-benzenes** | ppb | 1.28E-06 | 1.90 | 0.16 | 4.90 | 1.41 | 0.35 | 0.05 | 1.01 | 0.20 |
| **J $O^1D$** | $s^{-1}$ | 1.21E-03 | 1.85 | 0.04 | 4.72 | 1.46 | 0.44 | 0.15 | 0.88 | 0.19 |
| **J $NO_2$** | $s^{-1}$ | 1.69E-03 | 1.98 | 0.13 | 5.50 | 1.58 | 0.58 | 0.12 | 1.23 | 0.25 |
| **naphthalene** | μg/m³ | 6.05E-03 | 0.48 | 0.01 | 1.17 | 0.37 | 0.14 | 0.01 | 0.31 | 0.07 |
| **acenaphthylne** | μg/m³ | 1.47E-11 | 7.15E-07 | -1.39 E-08 | 3.32E-06 | 5.88E-07 | 6.61E-06 | 1.17E-06 | 9.53E-06 | 2.21E-06 |
| **acenaphthene** | μg/m³ | 1.49E-12 | 7.84E-04 | 4.23E-05 | 2.22E-03 | 4.41E-04 | 2.78E-03 | 5.28E-04 | 3.73E-03 | 8.53E-04 |
| **fluorene** | μg/m³ | 1.10E-07 | 2.71E-04 | 7.83E-05 | 4.88E-04 | 1.41E-04 | 5.69E-05 | 1.21E-05 | 1.61E-04 | 3.91E-05 |
| **phenanthrene** | μg/m³ | 9.97E-08 | 4.84E-04 | 1.63E-04 | 9.60E-04 | 2.93E-04 | 2.63E-05 | 1.05E-05 | 6.39E-05 | 1.32E-05 |
| **fluoranthene** | μg/m³ | 9.32E-06 | 7.15E-05 | 1.86E-05 | 1.70E-04 | 4.38E-05 | 1.28E-05 | 4.28E-06 | 3.26E-05 | 9.32E-06 |
| **pyrene** | μg/m³ | 1.38E-08 | 5.55E-04 | 2.30E-04 | 1.09E-03 | 3.26E-04 | 3.34E-05 | 1.24E-05 | 7.07E-05 | 1.49E-05 |
| **benzo(a)-anthracene** | μg/m³ | 1.44E-09 | 7.83E-03 | 3.15E-03 | 1.45E-02 | 3.94E-03 | 2.29E-04 | 4.26E-05 | 4.47E-04 | 9.89E-05 |
| **chrysene** | μg/m³ | 1.44E-09 | 9.78E-03 | 4.71E-03 | 1.97E-02 | 3.65E-03 | 6.90E-04 | 2.92E-04 | 1.67E-03 | 3.78E-04 |
| **benzo(b)-fluoranthene** | μg/m³ | 1.44E-09 | 8.34E-03 | 4.08E-03 | 1.69E-02 | 3.16E-03 | 7.72E-04 | 3.26E-04 | 1.38E-03 | 2.84E-04 |
| **benzo(k)-fluoranthene** | μg/m³ | 1.44E-09 | 1.00E-02 | 3.89E-03 | 1.86E-02 | 4.66E-03 | 3.98E-04 | 2.63E-04 | 5.09E-04 | 6.65E-05 |
| **benzo(a)-pyrene** | μg/m³ | 1.44E-09 | 1.07E-02 | 3.70E-03 | 1.99E-02 | 4.51E-03 | 6.90E-04 | 3.81E-04 | 1.16E-03 | 2.09E-04 |
| **indeno (1,2,3-cd)pyrene** | μg/m³ | 1.44E-09 | 1.03E-02 | 3.62E-03 | 1.77E-02 | 4.25E-03 | 9.92E-04 | 4.93E-04 | 1.73E-03 | 3.03E-04 |
| **dibenzo-(a,h)-anthracene** | μg/m³ | 1.44E-09 | 4.48E-03 | 2.20E-03 | 8.41E-03 | 1.65E-03 | 7.67E-04 | 4.69E-04 | 1.14E-03 | 1.81E-04 |
| **benzo(ghi)-perylene** | μg/m³ | 1.44E-09 | 1.50E-02 | 4.47E-03 | 2.98E-02 | 8.91E-03 | 8.01E-04 | 4.95E-04 | 1.18E-03 | 1.71E-04 |
| **C24** | μg/m³ | 1.44E-09 | 7.82E-03 | 2.20E-03 | 1.58E-02 | 4.57E-03 | 9.57E-04 | 5.51E-04 | 1.50E-03 | 2.61E-04 |
| **C25** | μg/m³ | 1.44E-09 | 2.70E-03 | 1.04E-03 | 5.23E-03 | 1.39E-03 | 1.35E-04 | 9.07E-05 | 2.31E-04 | 4.11E-05 |
| **C26** | μg/m³ | 1.44E-09 | 7.48E-03 | 2.61E-03 | 1.34E-02 | 3.75E-03 | 7.82E-04 | 3.94E-04 | 1.21E-03 | 1.84E-04 |
| **C27** | μg/m³ | 1.13E-18 | 0.07 | 6.07E-03 | 0.29 | 0.06 | 1.34E-03 | 5.60E-04 | 3.38E-03 | 6.98E-04 |
| **C28** | μg/m³ | 1.13E-18 | 0.07 | 6.26E-03 | 0.29 | 0.06 | 2.80E-03 | 3.88E-04 | 6.24E-03 | 1.49E-03 |
| **C29** | μg/m³ | 1.13E-18 | 0.04 | 4.35E-03 | 0.16 | 0.04 | 1.55E-03 | 7.29E-05 | 3.62E-03 | 6.50E-04 |
| **C30** | μg/m³ | 2.35E-15 | 0.04 | 4.47E-03 | 0.13 | 0.03 | 4.32E-03 | 1.62E-04 | 1.04E-02 | 1.90E-03 |
| **C31** | μg/m³ | 1.13E-18 | 0.02 | 2.33E-03 | 0.06 | 1.31E-02 | 1.35E-03 | 4.57E-05 | 2.32E-03 | 5.50E-04 |
| **C32** | μg/m³ | 1.65E-13 | 0.04 | 5.32E-03 | 0.10 | 0.03 | 5.19E-03 | 1.45E-04 | 0.02 | 3.37E-03 |
| **C33** | μg/m³ | 3.05E-15 | 8.89E-03 | 1.21E-03 | 0.02 | 5.66E-03 | 1.03E-03 | 4.40E-05 | 1.86E-03 | 4.20E-04 |
| **C34** | μg/m³ | 1.23E-07 | 1.38E-02 | 1.71E-03 | 0.03 | 8.29E-03 | 4.25E-03 | 8.17E-05 | 0.02 | 3.10E-03 |
| **OH** | ppt | 2.03E-12 | 5.38E-03 | 6.21E-04 | 0.02 | 3.68E-03 | 8.38E-04 | 4.05E-05 | 1.53E-03 | 3.84E-04 |
| **$HO_2$** | ppt | 1.14E-08 | 4.05E-03 | 3.38E-04 | 0.02 | 3.63E-03 | 9.29E-04 | 1.04E-05 | 3.16E-03 | 6.37E-04 |
| **$RO_2$** | ppt | 5.72E-16 | 2.79 | 0.14 | 8.57 | 2.47 | 0.11 | 0.01 | 0.72 | 0.13 |
| **palmitic acid** | μg/m³ | 8.70E-12 | 0.09 | 0.06 | 0.16 | 0.03 | 2.05E-04 | 5.29E-05 | 4.21E-04 | 8.39E-05 |
| **stearic acid** | μg/m³ | 6.64E-07 | 0.97 | 0.34 | 2.44 | 0.74 | 5.15E-03 | 3.73E-04 | 1.17E-02 | 3.05E-03 |
| **cholesterol** | μg/m³ | 1.81E-10 | 1.77E-03 | 6.44E-04 | 3.86E-03 | 9.04E-04 | 3.11E-05 | 2.92E-06 | 1.00E-04 | 2.66E-05 |
| **17a(H)-22,29,30-trisnorhopane (C27a)** | μg/m³ | 1.56E-16 | 0.34 | 0.03 | 1.17 | 0.26 | 0.03 | 0.01 | 0.07 | 0.01 |
| **17b(H),21a(H)-norhopane (C30ba)** | μg/m³ | 1.18E-15 | 0.19 | 0.02 | 0.92 | 0.21 | 0.02 | 0.01 | 0.04 | 0.01 |

# **Section S6:** Volume-normalised concentration stacked bar plots

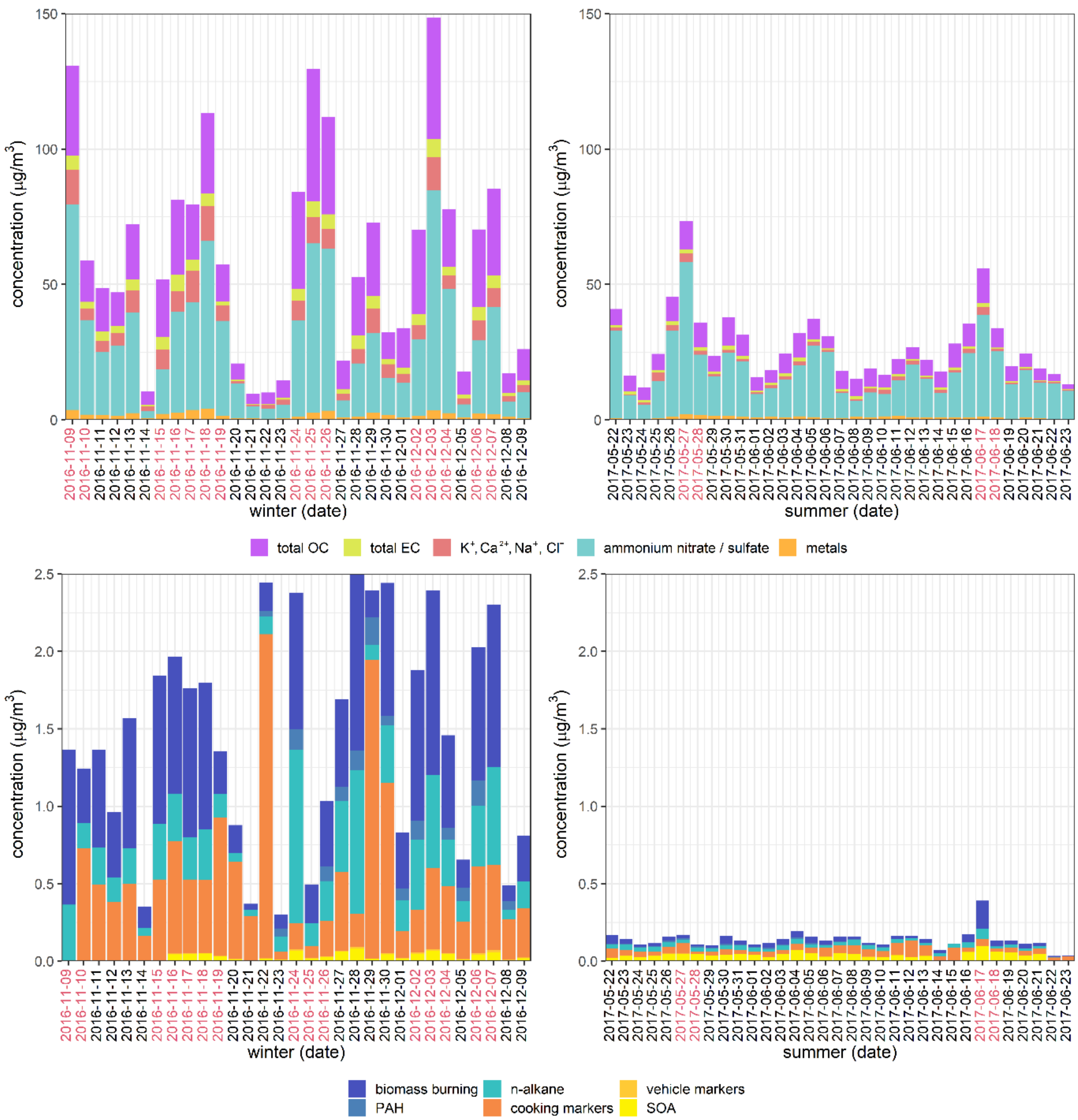


**Figure S13.** Abbreviations: OC: organic carbon ; EC: elemental carbon; PAH: polycyclic aromatic hydrocarbon; SOA: secondary organic aerosol "Metals" is the summed concentrations of Al, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Cd, Sb, Ba, Pb; "biomass burning" is the summed concentrations of palmitic acid, stearic acid and cholesterol; "PAH" is the summed concentrations of naphthalene, acenaphthylne, acenaphthene, fluorene, phenanthrene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene and benzo(ghi)perylene; "n-alkane" is the summed concentrations of C24, C25, C26, C27, C28, C29, C30, C31, C32, C33, C34; "cooking markers" is the summed concentrations of palmitic acid, stearic acid, cholesterol; "vehicle markers" is the summed concentrations of 17a(H)-22,29,30-trisnorhopane (C27a) and 17b(H),21a(H)-norhopane (C30ba); "SOA" is the summed concentrations of 2-methylthreitol, 2-methylerythritol, 2-methylglyceric acid, cis-2-methyl-1,3,4-trihydroxy-1-butene, -methyl-2,3,4-trihydroxy-1-butene, trans-2-methyl-1,3,4-trihydroxy-1-butene, C5-alkene triols, 2-methyltetrols, 3-hydroxyglutaric acid, cis-pinonic acid, acid, MBTCA, β-caryophyllinic acid, glutaric acid derivative, 3-acetylpentanedioic acid, 3-acetylhexanedioic acid, 3-isopropylpentanedioic acid and 2,3-dihydroxy-4-oxopentanoic acid. Dates marked in red indicate partial or total day haze events as described in Shi et al. (2019).

# **Section S7:** Assay correlations with individual component measurements

## Mass-normalised data

**Table S5.** Spearman rank correlations for all $EPR_m$ assay responses with all individual measurements. Benjamini-Hochberg adjusted p-values may be identical for different measurements as the correlations and adjustments are based on rank order.

| assay | feature | winter $R^2$ | winter p-value | winter BH p-value | summer $R^2$ | summer p-value | summer BH p-value |
|---|---|---|---|---|---|---|---|
| **EPR** | total OC | 0.28 | 0.13 | 0.34 | -0.10 | 0.61 | 0.86 |
| **EPR** | total EC | 0.45 | 1.11E-02 | 0.11 | -0.19 | 0.30 | 0.85 |
| **EPR** | $K^+$ | 0.33 | 7.01E-02 | 0.26 | 0.32 | 0.09 | 0.82 |
| **EPR** | $Na^+$ | 0.17 | 0.37 | 0.59 | 0.11 | 0.58 | 0.85 |
| **EPR** | $Ca^{2+}$ | 0.16 | 0.39 | 0.59 | 0.09 | 0.63 | 0.87 |
| **EPR** | $NH_4^+$ | 0.22 | 0.23 | 0.44 | 0.30 | 9.77E-02 | 0.82 |
| **EPR** | $NO_3^-$ | 0.11 | 0.56 | 0.71 | -0.16 | 0.39 | 0.85 |
| **EPR** | $SO_4^{2-}$ | 0.02 | 0.90 | 0.93 | 0.43 | 0.02 | 0.45 |
| **EPR** | $Cl^-$ | 0.21 | 0.27 | 0.48 | -0.14 | 0.47 | 0.85 |
| **EPR** | Al | -0.03 | 0.85 | 0.93 | -0.23 | 0.21 | 0.85 |
| **EPR** | Ti | 0.20 | 0.28 | 0.48 | -0.25 | 0.18 | 0.85 |
| **EPR** | V | 0.16 | 0.42 | 0.61 | -0.22 | 0.45 | 0.85 |
| **EPR** | Cr | 0.06 | 0.76 | 0.85 | -0.14 | 0.44 | 0.85 |
| **EPR** | Mn | 0.29 | 0.11 | 0.32 | -0.19 | 0.31 | 0.85 |
| **EPR** | Fe | 0.31 | 9.00E-02 | 0.28 | -0.06 | 0.74 | 0.91 |
| **EPR** | Co | 0.25 | 0.17 | 0.39 | below LOD | below LOD | below LOD |
| **EPR** | Ni | 0.33 | 7.42E-02 | 0.26 | 0.16 | 0.55 | 0.85 |
| **EPR** | Cu | 0.36 | 4.67E-02 | 0.22 | 0.04 | 0.85 | 0.92 |
| **EPR** | Zn | 0.31 | 9.14E-02 | 0.28 | 0.17 | 0.37 | 0.85 |
| **EPR** | Cd | 0.38 | 3.76E-02 | 0.22 | -0.30 | 0.62 | 0.87 |
| **EPR** | Sb | 0.40 | 2.46E-02 | 0.18 | 0.12 | 0.78 | 0.91 |
| **EPR** | Ba | 0.13 | 0.49 | 0.67 | -0.20 | 0.35 | 0.85 |
| **EPR** | Pb | 0.46 | 0.01 | 0.11 | 0.06 | 0.77 | 0.91 |
| **EPR** | galactosan | 0.21 | 0.25 | 0.45 | -0.49 | 1.02E-02 | 0.45 |
| **EPR** | mannosan | 0.28 | 0.13 | 0.34 | -0.19 | 0.34 | 0.85 |
| **EPR** | levoglucosan | 0.25 | 0.18 | 0.39 | -0.30 | 0.13 | 0.84 |
| **EPR** | ORG | 0.52 | 0.01 | 0.11 | 0.18 | 0.38 | 0.85 |
| **EPR** | MOOOA | -0.28 | 0.19 | 0.39 | -0.14 | 0.48 | 0.85 |
| **EPR** | LOOOA | -0.38 | 0.07 | 0.26 | 0.30 | 0.13 | 0.84 |
| **EPR** | O3 | 0.06 | 0.73 | 0.84 | 0.31 | 0.09 | 0.82 |
| **EPR** | CO | -0.16 | 0.39 | 0.59 | 0.10 | 0.61 | 0.86 |
| **EPR** | NO | -0.02 | 0.91 | 0.93 | -0.05 | 0.81 | 0.92 |
| **EPR** | $NO_2$ | -0.14 | 0.44 | 0.63 | 0.01 | 0.97 | 0.99 |
| **EPR** | $NO_y$ | -0.09 | 0.63 | 0.75 | -0.06 | 0.76 | 0.91 |
| **EPR** | $SO_2$ | -0.22 | 0.23 | 0.44 | 0.22 | 0.23 | 0.85 |
| **EPR** | RH8 | 0.02 | 0.91 | 0.93 | -0.16 | 0.42 | 0.85 |
| **EPR** | RH120 | -0.01 | 0.94 | 0.95 | -0.11 | 0.56 | 0.85 |
| **EPR** | RH240 | 0.00 | 0.98 | 0.98 | -0.11 | 0.58 | 0.85 |
| **EPR** | T8 | 0.06 | 0.76 | 0.85 | 0.36 | 0.06 | 0.82 |
| **EPR** | T120 | 0.02 | 0.90 | 0.93 | 0.32 | 0.09 | 0.82 |
| **EPR** | T240 | 0.02 | 0.90 | 0.93 | 0.31 | 9.96E-02 | 0.82 |
| **EPR** | methanol | -0.54 | 0.03 | 0.18 | -0.21 | 0.27 | 0.85 |
| **EPR** | acetonitrile | -0.41 | 0.10 | 0.30 | -0.19 | 0.33 | 0.85 |
| **EPR** | acetaldehyde | -0.38 | 0.14 | 0.34 | -0.29 | 0.13 | 0.84 |
| **EPR** | acrolein | -0.40 | 0.13 | 0.34 | 0.11 | 0.55 | 0.85 |
| **EPR** | acetone | -0.28 | 0.28 | 0.48 | 0.14 | 0.47 | 0.85 |
| **EPR** | isoprene | -0.37 | 0.14 | 0.36 | 0.01 | 0.97 | 0.99 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **EPR** | methyl vinyl ketone /methacrolein | -0.48 | 4.96E-02 | 0.22 | 0.07 | 0.73 | 0.91 |
| **EPR** | methyl ethyl ketone | -0.47 | 6.78E-02 | 0.26 | -0.16 | 0.40 | 0.85 |
| **EPR** | benzene | -0.33 | 0.20 | 0.40 | -0.22 | 0.26 | 0.85 |
| **EPR** | toluene | -0.42 | 8.98E-02 | 0.28 | 0.01 | 0.96 | 0.99 |
| **EPR** | C2-benzenes | -0.44 | 8.00E-02 | 0.28 | -0.01 | 0.96 | 0.99 |
| **EPR** | C3-benzenes | -0.45 | 9.24E-02 | 0.28 | 0.07 | 0.72 | 0.91 |
| **EPR** | J $O^1D$ | 0.11 | 0.57 | 0.71 | 0.28 | 0.13 | 0.84 |
| **EPR** | J $NO_2$ | 0.02 | 0.90 | 0.93 | 0.37 | 4.33E-02 | 0.82 |
| **EPR** | naphthalene | 0.69 | 6.54E-03 | 0.11 | -0.27 | 0.29 | 0.85 |
| **EPR** | acenaphthylne | 0.70 | 5.21E-03 | 0.11 | 0.07 | 0.83 | 0.92 |
| **EPR** | acenaphthene | 0.61 | 2.09E-02 | 0.18 | 0.22 | 0.52 | 0.85 |
| **EPR** | fluorene | 0.72 | 3.78E-03 | 0.11 | -0.17 | 0.55 | 0.85 |
| **EPR** | phenanthrene | 0.71 | 4.82E-03 | 0.11 | -0.02 | 0.93 | 0.98 |
| **EPR** | fluoranthene | 0.56 | 3.89E-02 | 0.22 | 0.25 | 0.32 | 0.85 |
| **EPR** | pyrene | 0.56 | 3.53E-02 | 0.22 | 0.23 | 0.36 | 0.85 |
| **EPR** | benzo(a)anthracene | 0.60 | 2.33E-02 | 0.18 | 0.00 | 0.99 | 0.99 |
| **EPR** | chrysene | 0.54 | 4.70E-02 | 0.22 | 0.14 | 0.58 | 0.85 |
| **EPR** | benzo(b)fluoranthene | 0.53 | 4.92E-02 | 0.22 | 0.07 | 0.78 | 0.91 |
| **EPR** | benzo(k)fluoranthene | 0.50 | 6.66E-02 | 0.26 | 0.08 | 0.75 | 0.91 |
| **EPR** | benzo(a)pyrene | 0.68 | 7.56E-03 | 0.11 | 0.03 | 0.92 | 0.98 |
| **EPR** | indeno(1,2,3-cd)pyrene | 0.73 | 2.92E-03 | 0.11 | 0.06 | 0.82 | 0.92 |
| **EPR** | dibenzo(a,h)-anthracene | 0.66 | 9.98E-03 | 0.11 | 0.16 | 0.53 | 0.85 |
| **EPR** | benzo(ghi)perylene | 0.71 | 4.45E-03 | 0.11 | 0.03 | 0.91 | 0.98 |
| **EPR** | C24 | 0.10 | 0.60 | 0.73 | -0.10 | 0.60 | 0.86 |
| **EPR** | C25 | 0.08 | 0.67 | 0.78 | -0.07 | 0.71 | 0.91 |
| **EPR** | C26 | 0.18 | 0.33 | 0.54 | -0.08 | 0.67 | 0.90 |
| **EPR** | C27 | 0.12 | 0.52 | 0.69 | 0.05 | 0.79 | 0.91 |
| **EPR** | C28 | 0.24 | 0.18 | 0.39 | -0.11 | 0.55 | 0.85 |
| **EPR** | C29 | 0.26 | 0.17 | 0.39 | 0.11 | 0.57 | 0.85 |
| **EPR** | C30 | 0.25 | 0.18 | 0.39 | -0.12 | 0.51 | 0.85 |
| **EPR** | C31 | 0.35 | 0.05 | 0.23 | 0.16 | 0.40 | 0.85 |
| **EPR** | C32 | 0.16 | 0.40 | 0.60 | -0.17 | 0.37 | 0.85 |
| **EPR** | C33 | 0.41 | 2.33E-02 | 0.18 | 0.15 | 0.41 | 0.85 |
| **EPR** | C34 | 0.36 | 4.65E-02 | 0.22 | -0.10 | 0.58 | 0.85 |
| **EPR** | OH | -0.44 | 0.10 | 0.30 | 0.15 | 0.45 | 0.85 |
| **EPR** | $HO_2$ | 0.19 | 0.56 | 0.71 | -0.04 | 0.84 | 0.92 |
| **EPR** | $RO_2$ | 0.20 | 0.54 | 0.71 | 0.45 | 1.37E-02 | 0.45 |
| **EPR** | palmitic acid | 0.10 | 0.58 | 0.72 | -0.18 | 0.34 | 0.85 |
| **EPR** | stearic acid | 0.07 | 0.72 | 0.83 | -0.22 | 0.24 | 0.85 |
| **EPR** | cholesterol | 0.27 | 0.15 | 0.37 | 0.01 | 0.98 | 0.99 |
| **EPR** | 17a(H)-22,29,30-trisnorhopane (C27a) | 0.12 | 0.52 | 0.69 | -0.33 | 6.85E-02 | 0.82 |
| **EPR** | 17b(H),21a(H)-norhopane (C30ba) | 0.09 | 0.64 | 0.76 | -0.30 | 9.92E-02 | 0.82 |
| **EPR** | 2-methylthreitol | 0.17 | 0.43 | 0.62 | 0.15 | 0.45 | 0.85 |
| **EPR** | 2-methylerythritol | 0.28 | 0.18 | 0.39 | 0.16 | 0.42 | 0.85 |
| **EPR** | 2-methylglyceric acid | 0.21 | 0.33 | 0.54 | 0.27 | 0.18 | 0.85 |
| **EPR** | cis-2-methyl-1,3,4-trihydroxy-1-butene | 0.28 | 0.19 | 0.39 | 0.06 | 0.76 | 0.91 |
| **EPR** | 3-methyl-2,3,4-trihydroxy-1-butene | 0.27 | 0.21 | 0.40 | 0.18 | 0.36 | 0.85 |
| **EPR** | trans-2-methyl-1,3,4-trihydroxy-1-butene | 0.25 | 0.24 | 0.45 | -0.06 | 0.76 | 0.91 |
| **EPR** | C5-alkene triols | 0.24 | 0.26 | 0.46 | 0.08 | 0.69 | 0.91 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **EPR** | 2-methyltetrols | 0.27 | 0.20 | 0.40 | 0.17 | 0.41 | 0.85 |
| **EPR** | 3-hydroxyglutaric acid | 0.15 | 0.48 | 0.66 | 0.04 | 0.85 | 0.92 |
| **EPR** | cis-pinonic acid | 0.15 | 0.47 | 0.65 | -0.26 | 0.18 | 0.85 |
| **EPR** | pinic acid | 0.18 | 0.40 | 0.60 | -0.23 | 0.26 | 0.85 |
| **EPR** | 3-methyl-1,2,3-butanetricarboxylic acid | 0.19 | 0.37 | 0.59 | -0.19 | 0.34 | 0.85 |
| **EPR** | β-caryophyllinic acid | 0.19 | 0.37 | 0.59 | 0.13 | 0.52 | 0.85 |
| **EPR** | glutaric acid derivative | 0.07 | 0.77 | 0.85 | 0.25 | 0.21 | 0.85 |
| **EPR** | 3-acetylpentanedioic acid | 0.03 | 0.87 | 0.93 | -0.16 | 0.43 | 0.85 |
| **EPR** | 3-acetylhexanedioic acid | 0.09 | 0.67 | 0.78 | -0.21 | 0.29 | 0.85 |
| **EPR** | 3-isopropyl-pentanedioic acid | 0.16 | 0.45 | 0.64 | -0.14 | 0.48 | 0.85 |
| **EPR** | 2,3-dihydroxy-4-oxopentanoic acid | 0.13 | 0.55 | 0.71 | 0.14 | 0.49 | 0.85 |

**Table S6.** Spearman rank correlations for all $AA_m$ assay responses with all individual measurements.

| assay | feature | winter $R^2$ | winter p-value | winter BH p-value | summer $R^2$ | summer p-value | summer BH p-value |
|---|---|---|---|---|---|---|---|
| **AA** | total OC | 0.72 | 4.59E-06 | 2.89E-05 | 0.50 | 3.16E-03 | 2.13E-02 |
| **AA** | total EC | 0.51 | 3.58E-03 | 7.10E-03 | 0.46 | 7.72E-03 | 3.44E-02 |
| **AA** | $K^+$ | 0.36 | 4.69E-02 | 5.57E-02 | -0.05 | 0.77 | 0.83 |
| **AA** | $Na^+$ | 0.70 | 9.90E-06 | 5.88E-05 | 0.20 | 0.28 | 0.48 |
| **AA** | $Ca^{2+}$ | 0.78 | 3.80E-07 | 4.93E-06 | 0.37 | 4.13E-02 | 0.11 |
| **AA** | $NH_4^+$ | 0.04 | 0.82 | 0.83 | -0.13 | 0.48 | 0.62 |
| **AA** | $NO_3^-$ | -0.43 | 1.59E-02 | 2.18E-02 | -0.26 | 0.14 | 0.29 |
| **AA** | $SO_4^{2-}$ | -0.06 | 0.73 | 0.75 | -0.24 | 0.18 | 0.35 |
| **AA** | $Cl^-$ | 0.87 | 9.77E-10 | 1.05E-07 | 0.09 | 0.63 | 0.75 |
| **AA** | Al | 0.19 | 0.30 | 0.34 | 0.06 | 0.75 | 0.83 |
| **AA** | Ti | 0.34 | 6.70E-02 | 7.71E-02 | 0.27 | 0.12 | 0.26 |
| **AA** | V | 0.54 | 2.34E-03 | 5.12E-03 | 0.29 | 0.29 | 0.48 |
| **AA** | Cr | 0.73 | 3.97E-06 | 2.88E-05 | 0.15 | 0.42 | 0.61 |
| **AA** | Mn | 0.74 | 1.65E-06 | 1.47E-05 | 0.33 | 5.81E-02 | 0.14 |
| **AA** | Fe | 0.76 | 5.54E-07 | 5.93E-06 | 0.41 | 1.67E-02 | 5.76E-02 |
| **AA** | Co | 0.83 | 1.01E-08 | 5.39E-07 | -0.50 | 0.67 | 0.78 |
| **AA** | Ni | 0.80 | 8.86E-08 | 2.53E-06 | 0.05 | 0.84 | 0.87 |
| **AA** | Cu | 0.49 | 5.59E-03 | 9.20E-03 | -0.07 | 0.73 | 0.82 |
| **AA** | Zn | 0.77 | 7.02E-07 | 6.83E-06 | -0.19 | 0.28 | 0.48 |
| **AA** | Cd | 0.50 | 4.11E-03 | 7.79E-03 | 0.40 | 0.50 | 0.65 |
| **AA** | Sb | 0.10 | 0.61 | 0.65 | 0.03 | 0.93 | 0.95 |
| **AA** | Ba | 0.40 | 2.51E-02 | 3.28E-02 | 0.16 | 0.45 | 0.62 |
| **AA** | Pb | 0.56 | 1.09E-03 | 2.93E-03 | -0.22 | 0.22 | 0.39 |
| **AA** | galactosan | 0.47 | 7.04E-03 | 1.11E-02 | 0.62 | 3.05E-04 | 4.67E-03 |
| **AA** | mannosan | 0.53 | 2.00E-03 | 4.65E-03 | 0.56 | 1.42E-03 | 1.18E-02 |
| **AA** | levoglucosan | 0.51 | 3.12E-03 | 6.29E-03 | 0.47 | 1.09E-02 | 4.18E-02 |
| **AA** | ORG | 0.84 | 3.53E-07 | 4.93E-06 | 0.68 | 5.26E-05 | 1.41E-03 |
| **AA** | MOOOA | -0.71 | 8.69E-05 | 3.44E-04 | 0.59 | 7.24E-04 | 8.61E-03 |
| **AA** | LOOOA | -0.44 | 2.96E-02 | 3.70E-02 | -0.41 | 2.83E-02 | 8.18E-02 |
| **AA** | $O_3$ | 0.34 | 6.10E-02 | 7.10E-02 | -0.54 | 1.05E-03 | 1.03E-02 |
| **AA** | CO | -0.38 | 3.66E-02 | 4.44E-02 | -0.11 | 0.55 | 0.69 |
| **AA** | NO | -0.50 | 4.32E-03 | 7.79E-03 | 0.31 | 0.08 | 0.18 |
| **AA** | $NO_2$ | -0.39 | 2.98E-02 | 3.70E-02 | 0.13 | 0.47 | 0.62 |
| **AA** | $NO_y$ | -0.46 | 8.41E-03 | 1.27E-02 | 0.23 | 0.20 | 0.38 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **AA** | $SO_2$ | -0.39 | 3.16E-02 | 3.89E-02 | -0.37 | 3.46E-02 | 9.49E-02 |
| **AA** | RH8 | -0.58 | 6.57E-04 | 2.01E-03 | -0.07 | 0.69 | 0.80 |
| **AA** | RH120 | -0.57 | 8.65E-04 | 2.50E-03 | -0.15 | 0.42 | 0.61 |
| **AA** | RH240 | -0.52 | 2.73E-03 | 5.72E-03 | -0.16 | 0.39 | 0.58 |
| **AA** | T8 | -0.42 | 1.90E-02 | 2.51E-02 | -0.24 | 0.20 | 0.37 |
| **AA** | T120 | -0.45 | 1.12E-02 | 1.61E-02 | -0.18 | 0.34 | 0.53 |
| **AA** | T240 | -0.46 | 9.63E-03 | 1.41E-02 | -0.12 | 0.51 | 0.65 |
| **AA** | methanol | -0.65 | 4.99E-03 | 8.34E-03 | -0.05 | 0.78 | 0.83 |
| **AA** | acetonitrile | -0.59 | 1.25E-02 | 1.76E-02 | -0.16 | 0.38 | 0.57 |
| **AA** | acetaldehyde | -0.65 | 4.37E-03 | 7.79E-03 | -0.14 | 0.45 | 0.62 |
| **AA** | acrolein | -0.68 | 3.79E-03 | 7.38E-03 | 0.07 | 0.70 | 0.80 |
| **AA** | acetone | -0.65 | 4.57E-03 | 8.01E-03 | -0.32 | 8.15E-02 | 0.19 |
| **AA** | isoprene | -0.62 | 7.61E-03 | 1.16E-02 | 0.25 | 0.18 | 0.35 |
| **AA** | methyl vinyl ketone /methacrolein | -0.65 | 4.37E-03 | 7.79E-03 | 0.11 | 0.57 | 0.70 |
| **AA** | methyl ethyl ketone | 0.16 | 0.56 | 0.61 | -0.14 | 0.46 | 0.62 |
| **AA** | benzene | -0.59 | 1.25E-02 | 1.76E-02 | 0.06 | 0.73 | 0.82 |
| **AA** | toluene | -0.66 | 4.17E-03 | 7.79E-03 | -0.08 | 0.66 | 0.77 |
| **AA** | C2-benzenes | -0.65 | 4.78E-03 | 8.19E-03 | -0.09 | 0.61 | 0.74 |
| **AA** | C3-benzenes | -0.60 | 1.81E-02 | 2.44E-02 | -0.01 | 0.95 | 0.96 |
| **AA** | J $O^1D$ | -0.16 | 0.41 | 0.45 | -0.39 | 2.32E-02 | 7.09E-02 |
| **AA** | J $NO_2$ | -0.11 | 0.56 | 0.61 | -0.44 | 1.02E-02 | 4.06E-02 |
| **AA** | naphthalene | 0.68 | 7.56E-03 | 1.16E-02 | 0.53 | 2.01E-02 | 6.53E-02 |
| **AA** | acenaphthylne | 0.71 | 4.82E-03 | 8.19E-03 | 0.63 | 2.20E-02 | 6.92E-02 |
| **AA** | acenaphthene | 0.59 | 2.74E-02 | 3.49E-02 | 0.23 | 0.47 | 0.62 |
| **AA** | fluorene | 0.67 | 8.70E-03 | 1.29E-02 | 0.38 | 0.14 | 0.29 |
| **AA** | phenanthrene | 0.74 | 2.45E-03 | 5.23E-03 | 0.38 | 9.51E-02 | 0.22 |
| **AA** | fluoranthene | 0.96 | 9.47E-08 | 2.53E-06 | 0.06 | 0.79 | 0.83 |
| **AA** | pyrene | 0.95 | 2.77E-07 | 4.93E-06 | 0.24 | 0.31 | 0.50 |
| **AA** | benzo(a)anthracene | 0.87 | 5.68E-05 | 2.34E-04 | 0.50 | 2.40E-02 | 7.14E-02 |
| **AA** | chrysene | 0.92 | 4.08E-06 | 2.88E-05 | 0.45 | 4.75E-02 | 0.12 |
| **AA** | benzo(b)fluoranthene | 0.88 | 3.11E-05 | 1.58E-04 | 0.48 | 3.30E-02 | 9.28E-02 |
| **AA** | benzo(k)fluoranthene | 0.95 | 2.77E-07 | 4.93E-06 | 0.53 | 1.57E-02 | 5.59E-02 |
| **AA** | benzo(a)pyrene | 0.81 | 4.32E-04 | 1.45E-03 | 0.60 | 5.60E-03 | 3.00E-02 |
| **AA** | indeno(1,2,3-cd)pyrene | 0.62 | 1.86E-02 | 2.49E-02 | 0.55 | 1.16E-02 | 4.30E-02 |
| **AA** | dibenzo(a,h)-anthracene | 0.69 | 6.54E-03 | 1.04E-02 | 0.56 | 9.61E-03 | 3.95E-02 |
| **AA** | benzo(ghi)perylene | 0.82 | 3.31E-04 | 1.18E-03 | 0.58 | 6.74E-03 | 3.28E-02 |
| **AA** | C24 | 0.53 | 1.94E-03 | 4.62E-03 | 0.53 | 1.66E-03 | 1.27E-02 |
| **AA** | C25 | 0.51 | 3.04E-03 | 6.25E-03 | 0.50 | 3.19E-03 | 2.13E-02 |
| **AA** | C26 | 0.54 | 1.55E-03 | 3.76E-03 | 0.47 | 6.24E-03 | 3.18E-02 |
| **AA** | C27 | 0.55 | 1.26E-03 | 3.29E-03 | 0.47 | 5.48E-03 | 3.00E-02 |
| **AA** | C28 | 0.53 | 2.23E-03 | 4.98E-03 | 0.49 | 3.41E-03 | 2.14E-02 |
| **AA** | C29 | 0.56 | 9.99E-04 | 2.74E-03 | 0.34 | 5.12E-02 | 0.13 |
| **AA** | C30 | 0.59 | 4.52E-04 | 1.47E-03 | 0.53 | 1.44E-03 | 1.18E-02 |
| **AA** | C31 | 0.57 | 7.79E-04 | 2.31E-03 | 0.45 | 8.62E-03 | 3.69E-02 |
| **AA** | C32 | 0.61 | 2.59E-04 | 9.56E-04 | 0.55 | 8.57E-04 | 9.17E-03 |
| **AA** | C33 | 0.57 | 9.01E-04 | 2.54E-03 | 0.20 | 0.27 | 0.47 |
| **AA** | C34 | 0.55 | 1.47E-03 | 3.67E-03 | 0.46 | 7.67E-03 | 3.44E-02 |
| **AA** | OH | -0.14 | 6.21E-01 | 6.57E-01 | -0.02 | 0.90 | 0.93 |
| **AA** | $HO_2$ | 0.03 | 9.31E-01 | 9.31E-01 | -0.10 | 0.61 | 0.74 |
| **AA** | $RO_2$ | 0.12 | 7.13E-01 | 7.41E-01 | -0.17 | 0.36 | 0.55 |
| **AA** | palmitic acid | 0.69 | 2.23E-05 | 1.19E-04 | 0.61 | 1.56E-04 | 3.33E-03 |
| **AA** | stearic acid | 0.69 | 2.15E-05 | 1.19E-04 | 0.57 | 6.05E-04 | 8.09E-03 |
| **AA** | cholesterol | 0.59 | 5.36E-04 | 1.69E-03 | -0.13 | 0.46 | 0.62 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **AA** | 17a(H)-22,29,30-trisnorhopane (C27a) | 0.68 | 3.62E-05 | 1.76E-04 | 0.67 | 1.84E-05 | 7.84E-04 |
| **AA** | 17b(H),21a(H)-norhopane (C30ba) | 0.67 | 4.68E-05 | 2.18E-04 | 0.74 | 9.87E-07 | 1.06E-04 |
| **AA** | 2-methylthreitol | 0.73 | 5.56E-05 | 2.34E-04 | 0.20 | 0.31 | 0.50 |
| **AA** | 2-methylerythritol | 0.45 | 2.59E-02 | 3.34E-02 | 0.17 | 0.37 | 0.57 |
| **AA** | 2-methylglyceric acid | 0.60 | 2.13E-03 | 4.86E-03 | 0.23 | 0.24 | 0.42 |
| **AA** | cis-2-methyl-1,3,4-trihydroxy-1-butene | 0.80 | 3.35E-06 | 2.76E-05 | 0.05 | 0.78 | 0.83 |
| **AA** | 3-methyl-2,3,4-trihydroxy-1-butene | 0.83 | 4.15E-07 | 4.93E-06 | 0.14 | 0.47 | 0.62 |
| **AA** | trans-2-methyl-1,3,4-trihydroxy-1-butene | 0.66 | 4.19E-04 | 1.45E-03 | 0.44 | 1.78E-02 | 5.95E-02 |
| **AA** | C5-alkene triols | 0.73 | 5.39E-05 | 2.34E-04 | 0.31 | 0.10 | 0.23 |
| **AA** | 2-methyltetrols | 0.55 | 5.86E-03 | 9.51E-03 | 0.18 | 0.34 | 0.53 |
| **AA** | 3-hydroxyglutaric acid | 0.49 | 1.44E-02 | 2.00E-02 | -0.01 | 0.96 | 0.96 |
| **AA** | cis-pinonic acid | 0.79 | 4.31E-06 | 2.88E-05 | 0.70 | 2.20E-05 | 7.84E-04 |
| **AA** | pinic acid | 0.69 | 2.20E-04 | 8.41E-04 | 0.51 | 4.36E-03 | 2.59E-02 |
| **AA** | 3-methyl-1,2,3-butanetricarboxylic acid | 0.43 | 3.79E-02 | 4.55E-02 | 0.63 | 2.61E-04 | 4.65E-03 |
| **AA** | β-caryophyllinic acid | 0.06 | 0.78 | 0.80 | -0.05 | 0.79 | 0.83 |
| **AA** | glutaric acid derivative | 0.30 | 0.18 | 0.21 | 0.30 | 0.11 | 0.24 |
| **AA** | 3-acetylpentanedioic acid | 0.39 | 5.62E-02 | 6.61E-02 | 0.30 | 0.11 | 0.24 |
| **AA** | 3-acetylhexanedioic acid | 0.08 | 0.70 | 0.74 | 0.35 | 6.21E-02 | 0.15 |
| **AA** | 3-isopropyl-pentanedioic acid | 0.62 | 1.36E-03 | 3.47E-03 | 0.27 | 0.16 | 0.32 |
| **AA** | 2,3-dihydroxy-4-oxopentanoic acid | 0.34 | 0.10 | 0.12 | 0.11 | 0.57 | 0.70 |

**Table S7.** Spearman rank correlations for all $DTT_m$ assay responses with all individual measurements.

| assay | feature | winter $R^2$ | winter p-value | winter BH p-value | summer $R^2$ | summer p-value | summer BH p-value |
|---|---|---|---|---|---|---|---|
| **DTT** | total OC | 0.59 | 4.33E-04 | 4.77E-03 | 0.58 | 3.87E-04 | 2.07E-02 |
| **DTT** | total EC | 0.32 | 7.79E-02 | 0.12 | 0.52 | 1.78E-03 | 2.66E-02 |
| **DTT** | $K^+$ | 0.32 | 7.79E-02 | 0.12 | 0.27 | 0.15 | 0.29 |
| **DTT** | $Na^+$ | 0.72 | 5.71E-06 | 6.11E-04 | 0.41 | 2.09E-02 | 8.27E-02 |
| **DTT** | $Ca^{2+}$ | 0.69 | 2.58E-05 | 9.21E-04 | 0.46 | 9.87E-03 | 5.03E-02 |
| **DTT** | $NH_4^+$ | 0.37 | 4.12E-02 | 7.60E-02 | 0.42 | 1.50E-02 | 6.44E-02 |
| **DTT** | $NO_3^-$ | -0.05 | 0.78 | 0.81 | 0.10 | 0.58 | 0.71 |
| **DTT** | $SO_4^{2-}$ | 0.32 | 7.53E-02 | 0.12 | 0.04 | 0.82 | 0.87 |
| **DTT** | $Cl^-$ | 0.63 | 2.88E-04 | 4.77E-03 | 0.40 | 2.24E-02 | 8.33E-02 |
| **DTT** | Al | -0.13 | 0.47 | 0.51 | -0.04 | 0.80 | 0.87 |
| **DTT** | Ti | 0.21 | 0.27 | 0.32 | 0.20 | 0.26 | 0.44 |
| **DTT** | V | 0.38 | 4.11E-02 | 7.60E-02 | -0.29 | 0.30 | 0.46 |
| **DTT** | Cr | 0.45 | 1.17E-02 | 3.06E-02 | 0.33 | 6.42E-02 | 0.16 |
| **DTT** | Mn | 0.66 | 5.79E-05 | 1.55E-03 | 0.24 | 0.18 | 0.35 |
| **DTT** | Fe | 0.69 | 1.90E-05 | 9.21E-04 | 0.48 | 4.49E-03 | 3.43E-02 |
| **DTT** | Co | 0.53 | 1.98E-03 | 1.08E-02 | 1.00 | 0.00 | 0.00 |
| **DTT** | Ni | 0.52 | 2.60E-03 | 1.21E-02 | 0.31 | 0.22 | 0.38 |
| **DTT** | Cu | 0.27 | 0.15 | 0.19 | 0.07 | 0.73 | 0.80 |
| **DTT** | Zn | 0.60 | 4.73E-04 | 4.77E-03 | 0.10 | 0.59 | 0.71 |
| **DTT** | Cd | 0.59 | 4.79E-04 | 4.77E-03 | 0.30 | 0.62 | 0.73 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **DTT** | Sb | 0.06 | 0.74 | 0.77 | -0.15 | 0.70 | 0.78 |
| **DTT** | Ba | 0.46 | 8.55E-03 | 2.45E-02 | 0.33 | 0.11 | 0.23 |
| **DTT** | Pb | 0.59 | 4.90E-04 | 4.77E-03 | 0.15 | 0.40 | 0.57 |
| **DTT** | galactosan | 0.20 | 0.28 | 0.33 | 0.38 | 4.49E-02 | 0.14 |
| **DTT** | mannosan | 0.22 | 0.23 | 0.29 | 0.48 | 8.89E-03 | 4.85E-02 |
| **DTT** | levoglucosan | 0.19 | 0.31 | 0.35 | 0.41 | 2.93E-02 | 0.10 |
| **DTT** | ORG | 0.40 | 5.05E-02 | 8.72E-02 | 0.20 | 0.29 | 0.46 |
| **DTT** | MOOOA | -0.44 | 3.35E-02 | 6.89E-02 | 0.18 | 0.35 | 0.50 |
| **DTT** | LOOOA | -0.39 | 5.74E-02 | 9.44E-02 | -0.37 | 4.57E-02 | 0.14 |
| **DTT** | $O_3$ | 0.28 | 0.13 | 0.18 | -0.21 | 0.24 | 0.41 |
| **DTT** | CO | -0.45 | 1.06E-02 | 2.85E-02 | -0.19 | 0.30 | 0.46 |
| **DTT** | NO | -0.53 | 1.94E-03 | 1.08E-02 | 0.09 | 0.63 | 0.73 |
| **DTT** | $NO_2$ | -0.48 | 5.97E-03 | 2.00E-02 | -0.09 | 0.64 | 0.73 |
| **DTT** | $NO_y$ | -0.49 | 4.99E-03 | 1.84E-02 | -0.10 | 0.59 | 0.71 |
| **DTT** | $SO_2$ | -0.60 | 3.21E-04 | 4.77E-03 | -0.06 | 0.73 | 0.80 |
| **DTT** | RH8 | -0.26 | 0.16 | 0.21 | -0.11 | 0.56 | 0.71 |
| **DTT** | RH120 | -0.27 | 0.15 | 0.19 | -0.12 | 0.54 | 0.71 |
| **DTT** | RH240 | -0.19 | 0.30 | 0.34 | -0.11 | 0.55 | 0.71 |
| **DTT** | T8 | -0.26 | 0.16 | 0.20 | -0.19 | 0.31 | 0.46 |
| **DTT** | T120 | -0.29 | 0.12 | 0.17 | -0.19 | 0.31 | 0.46 |
| **DTT** | T240 | -0.30 | 9.63E-02 | 0.14 | -0.15 | 0.44 | 0.59 |
| **DTT** | methanol | -0.74 | 6.80E-04 | 5.60E-03 | -0.19 | 0.30 | 0.46 |
| **DTT** | acetonitrile | -0.66 | 3.99E-03 | 1.60E-02 | -0.28 | 0.13 | 0.26 |
| **DTT** | acetaldehyde | -0.75 | 5.99E-04 | 5.34E-03 | -0.10 | 0.61 | 0.72 |
| **DTT** | acrolein | -0.71 | 2.11E-03 | 1.08E-02 | 0.01 | 0.94 | 0.95 |
| **DTT** | acetone | -0.73 | 9.80E-04 | 7.41E-03 | -0.04 | 0.82 | 0.87 |
| **DTT** | isoprene | -0.69 | 2.35E-03 | 1.14E-02 | -0.10 | 0.61 | 0.72 |
| **DTT** | methyl vinyl ketone /methacrolein | -0.72 | 1.04E-03 | 7.41E-03 | -0.13 | 0.48 | 0.64 |
| **DTT** | methyl ethyl ketone | -0.31 | 0.25 | 0.30 | -0.15 | 0.42 | 0.58 |
| **DTT** | benzene | -0.64 | 5.45E-03 | 1.94E-02 | -0.20 | 0.28 | 0.45 |
| **DTT** | toluene | -0.70 | 1.91E-03 | 1.08E-02 | -0.09 | 0.65 | 0.73 |
| **DTT** | C2-benzenes | -0.71 | 1.54E-03 | 1.03E-02 | -0.11 | 0.57 | 0.71 |
| **DTT** | C3-benzenes | -0.69 | 4.77E-03 | 1.82E-02 | -0.04 | 0.85 | 0.89 |
| **DTT** | J $O^1D$ | 0.10 | 0.59 | 0.62 | -0.24 | 0.17 | 0.33 |
| **DTT** | J $NO_2$ | 0.02 | 0.92 | 0.93 | -0.23 | 0.20 | 0.37 |
| **DTT** | naphthalene | 0.56 | 3.53E-02 | 7.00E-02 | 0.24 | 0.33 | 0.49 |
| **DTT** | acenaphthylne | 0.72 | 3.78E-03 | 1.60E-02 | 0.37 | 0.22 | 0.38 |
| **DTT** | acenaphthene | 0.61 | 2.09E-02 | 4.85E-02 | 0.52 | 8.49E-02 | 0.19 |
| **DTT** | fluorene | 0.82 | 3.79E-04 | 4.77E-03 | 0.54 | 2.93E-02 | 0.10 |
| **DTT** | phenanthrene | 0.75 | 2.03E-03 | 1.08E-02 | 0.31 | 0.19 | 0.35 |
| **DTT** | fluoranthene | 0.67 | 8.70E-03 | 2.45E-02 | 0.18 | 0.43 | 0.59 |
| **DTT** | pyrene | 0.69 | 6.54E-03 | 2.12E-02 | 0.41 | 7.33E-02 | 0.18 |
| **DTT** | benzo(a)anthracene | 0.61 | 1.97E-02 | 4.69E-02 | 0.60 | 5.02E-03 | 3.58E-02 |
| **DTT** | chrysene | 0.54 | 4.70E-02 | 8.38E-02 | 0.51 | 2.26E-02 | 8.33E-02 |
| **DTT** | benzo(b)fluoranthene | 0.60 | 2.21E-02 | 5.02E-02 | 0.55 | 1.16E-02 | 5.66E-02 |
| **DTT** | benzo(k)fluoranthene | 0.62 | 1.86E-02 | 4.52E-02 | 0.54 | 1.37E-02 | 6.37E-02 |
| **DTT** | benzo(a)pyrene | 0.58 | 3.04E-02 | 6.50E-02 | 0.63 | 2.73E-03 | 2.66E-02 |
| **DTT** | indeno(1,2,3-cd)pyrene | 0.63 | 1.65E-02 | 4.21E-02 | 0.63 | 2.73E-03 | 2.66E-02 |
| **DTT** | dibenzo(a,h)-anthracene | 0.66 | 1.07E-02 | 2.85E-02 | 0.68 | 1.01E-03 | 2.63E-02 |
| **DTT** | benzo(ghi)perylene | 0.56 | 3.53E-02 | 7.00E-02 | 0.59 | 6.07E-03 | 3.82E-02 |
| **DTT** | C24 | 0.25 | 0.18 | 0.23 | 0.45 | 7.86E-03 | 4.67E-02 |
| **DTT** | C25 | 0.21 | 0.26 | 0.31 | 0.49 | 3.88E-03 | 3.22E-02 |
| **DTT** | C26 | 0.27 | 0.15 | 0.19 | 0.54 | 1.22E-03 | 2.63E-02 |
| **DTT** | C27 | 0.30 | 0.10 | 0.15 | 0.53 | 1.45E-03 | 2.63E-02 |
| **DTT** | C28 | 0.36 | 4.82E-02 | 8.45E-02 | 0.51 | 2.46E-03 | 2.66E-02 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **DTT** | C29 | 0.35 | 5.64E-02 | 9.44E-02 | 0.52 | 2.12E-03 | 2.66E-02 |
| **DTT** | C30 | 0.37 | 3.88E-02 | 7.42E-02 | 0.53 | 1.48E-03 | 2.63E-02 |
| **DTT** | C31 | 0.40 | 2.61E-02 | 5.78E-02 | 0.49 | 3.92E-03 | 3.22E-02 |
| **DTT** | C32 | 0.38 | 3.74E-02 | 7.27E-02 | 0.45 | 9.06E-03 | 4.85E-02 |
| **DTT** | C33 | 0.50 | 3.77E-03 | 1.60E-02 | 0.47 | 5.67E-03 | 3.79E-02 |
| **DTT** | C34 | 0.42 | 1.73E-02 | 4.31E-02 | 0.33 | 5.81E-02 | 0.16 |
| **DTT** | OH | 0.03 | 0.91 | 0.93 | 0.40 | 3.26E-02 | 0.11 |
| **DTT** | $HO_2$ | 0.52 | 8.42E-02 | 0.13 | 0.02 | 0.91 | 0.94 |
| **DTT** | $RO_2$ | 0.25 | 0.44 | 0.49 | 0.11 | 0.57 | 0.71 |
| **DTT** | palmitic acid | 0.48 | 7.85E-03 | 2.40E-02 | 0.34 | 5.07E-02 | 0.15 |
| **DTT** | stearic acid | 0.47 | 8.39E-03 | 2.45E-02 | 0.33 | 6.25E-02 | 0.16 |
| **DTT** | cholesterol | 0.30 | 0.11 | 0.15 | 0.34 | 5.02E-02 | 0.15 |
| **DTT** | 17a(H)-22,29,30-trisnorhopane (C27a) | 0.30 | 0.11 | 0.16 | 0.42 | 1.61E-02 | 6.64E-02 |
| **DTT** | 17b(H),21a(H)-norhopane (C30ba) | 0.28 | 0.14 | 0.18 | 0.42 | 1.44E-02 | 6.41E-02 |
| **DTT** | 2-methylthreitol | 0.34 | 0.11 | 0.15 | 0.02 | 0.90 | 0.94 |
| **DTT** | 2-methylerythritol | 0.39 | 5.74E-02 | 9.44E-02 | -0.02 | 0.94 | 0.95 |
| **DTT** | 2-methylglyceric acid | 0.28 | 0.19 | 0.24 | 0.09 | 0.64 | 0.73 |
| **DTT** | cis-2-methyl-1,3,4-trihydroxy-1-butene | 0.53 | 7.47E-03 | 2.35E-02 | 0.21 | 0.27 | 0.45 |
| **DTT** | 3-methyl-2,3,4-trihydroxy-1-butene | 0.56 | 4.03E-03 | 1.60E-02 | 0.28 | 0.14 | 0.28 |
| **DTT** | trans-2-methyl-1,3,4-trihydroxy-1-butene | 0.44 | 3.20E-02 | 6.70E-02 | 0.36 | 5.46E-02 | 0.15 |
| **DTT** | C5-alkene triols | 0.45 | 2.65E-02 | 5.78E-02 | 0.31 | 0.11 | 0.23 |
| **DTT** | 2-methyltetrols | 0.38 | 7.07E-02 | 0.11 | 0.01 | 0.97 | 0.97 |
| **DTT** | 3-hydroxyglutaric acid | 0.18 | 0.39 | 0.44 | 0.18 | 0.36 | 0.51 |
| **DTT** | cis-pinonic acid | 0.54 | 5.95E-03 | 2.00E-02 | 0.33 | 0.08 | 0.19 |
| **DTT** | pinic acid | 0.36 | 8.80E-02 | 0.13 | 0.36 | 5.49E-02 | 0.15 |
| **DTT** | 3-methyl-1,2,3-butanetricarboxylic acid | 0.24 | 0.26 | 0.31 | 0.39 | 3.45E-02 | 0.11 |
| **DTT** | β-caryophyllinic acid | -0.12 | 0.59 | 0.62 | 0.33 | 8.25E-02 | 0.19 |
| **DTT** | glutaric acid derivative | -0.02 | 0.92 | 0.93 | 0.31 | 0.11 | 0.23 |
| **DTT** | 3-acetylpentanedioic acid | 0.22 | 0.30 | 0.35 | 0.33 | 8.42E-02 | 0.19 |
| **DTT** | 3-acetylhexanedioic acid | -0.01 | 0.98 | 0.98 | 0.31 | 0.10 | 0.23 |
| **DTT** | 3-isopropyl-pentanedioic acid | 0.42 | 4.29E-02 | 7.77E-02 | 0.21 | 0.28 | 0.45 |
| **DTT** | 2,3-dihydroxy-4-oxopentanoic acid | 0.12 | 0.57 | 0.61 | 0.29 | 0.13 | 0.26 |

**Table S8.** Spearman rank correlations for all $DCFH_m$ assay responses with all individual measurements.

| assay | feature | winter $R^2$ | winter p-value | winter BH p-value | summer $R^2$ | summer p-value | summer BH p-value |
|---|---|---|---|---|---|---|---|
| **DCFH** | total OC | -0.41 | 2.25E-02 | 9.64E-02 | -0.25 | 0.17 | 0.45 |
| **DCFH** | total EC | -0.47 | 7.15E-03 | 5.79E-02 | -0.34 | 5.32E-02 | 0.38 |
| **DCFH** | $K^+$ | 0.38 | 3.68E-02 | 0.14 | -0.05 | 0.80 | 0.90 |
| **DCFH** | $Na^+$ | -0.14 | 0.46 | 0.65 | -0.03 | 0.87 | 0.94 |
| **DCFH** | $Ca^{2+}$ | -0.33 | 7.62E-02 | 0.23 | -0.24 | 0.20 | 0.47 |
| **DCFH** | $NH_4^+$ | 0.34 | 6.17E-02 | 0.20 | -0.21 | 0.26 | 0.50 |
| **DCFH** | $NO_3^-$ | 0.40 | 2.54E-02 | 0.10 | 0.05 | 0.79 | 0.90 |
| **DCFH** | $SO_4^{2-}$ | 0.31 | 9.27E-02 | 0.26 | 0.10 | 0.57 | 0.79 |
| **DCFH** | $Cl^-$ | -0.38 | 4.48E-02 | 0.16 | -0.23 | 0.21 | 0.48 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **DCFH** | Al | -0.24 | 0.20 | 0.40 | 0.15 | 0.40 | 0.63 |
| **DCFH** | Ti | 0.11 | 0.58 | 0.67 | -0.13 | 0.48 | 0.70 |
| **DCFH** | V | 0.14 | 0.46 | 0.65 | -0.09 | 0.76 | 0.89 |
| **DCFH** | Cr | -0.18 | 0.34 | 0.57 | -0.16 | 0.37 | 0.60 |
| **DCFH** | Mn | -0.06 | 0.75 | 0.78 | -0.16 | 0.40 | 0.63 |
| **DCFH** | Fe | -0.21 | 0.26 | 0.46 | -0.31 | 8.37E-02 | 0.38 |
| **DCFH** | Co | -0.22 | 0.23 | 0.44 | 0.50 | 0.67 | 0.85 |
| **DCFH** | Ni | -0.20 | 0.29 | 0.50 | -0.29 | 0.25 | 0.50 |
| **DCFH** | Cu | -0.29 | 0.12 | 0.30 | -0.23 | 0.27 | 0.50 |
| **DCFH** | Zn | -0.11 | 0.56 | 0.67 | 0.15 | 0.40 | 0.63 |
| **DCFH** | Cd | 0.11 | 0.55 | 0.67 | 0.20 | 0.75 | 0.89 |
| **DCFH** | Sb | -0.20 | 0.29 | 0.50 | -0.74 | 3.66E-02 | 0.37 |
| **DCFH** | Ba | -0.30 | 9.87E-02 | 0.26 | -0.24 | 0.26 | 0.50 |
| **DCFH** | Pb | 0.17 | 0.36 | 0.57 | 0.20 | 0.28 | 0.52 |
| **DCFH** | galactosan | -0.13 | 0.49 | 0.66 | -0.27 | 0.16 | 0.45 |
| **DCFH** | mannosan | -0.26 | 0.15 | 0.34 | -0.25 | 0.19 | 0.45 |
| **DCFH** | levoglucosan | -0.33 | 7.41E-02 | 0.23 | -0.21 | 0.27 | 0.50 |
| **DCFH** | ORG | -0.40 | 5.57E-02 | 0.19 | 0.03 | 0.90 | 0.94 |
| **DCFH** | MOOOA | 0.25 | 0.24 | 0.44 | 0.19 | 0.33 | 0.56 |
| **DCFH** | LOOOA | 0.63 | 1.00E-03 | 2.09E-02 | 0.44 | 2.00E-02 | 0.37 |
| **DCFH** | $O_3$ | -0.17 | 0.36 | 0.57 | 0.09 | 0.64 | 0.84 |
| **DCFH** | CO | 0.11 | 0.54 | 0.67 | 0.21 | 0.25 | 0.50 |
| **DCFH** | NO | 0.06 | 0.73 | 0.78 | -0.17 | 0.36 | 0.59 |
| **DCFH** | $NO_2$ | -0.09 | 0.64 | 0.71 | 0.01 | 0.96 | 0.97 |
| **DCFH** | $NO_y$ | 0.06 | 0.74 | 0.78 | -0.04 | 0.83 | 0.92 |
| **DCFH** | $SO_2$ | 0.17 | 0.35 | 0.57 | 0.07 | 0.70 | 0.87 |
| **DCFH** | RH8 | 0.56 | 9.49E-04 | 2.09E-02 | 0.10 | 0.60 | 0.81 |
| **DCFH** | RH120 | 0.55 | 1.27E-03 | 2.09E-02 | 0.17 | 0.36 | 0.59 |
| **DCFH** | RH240 | 0.56 | 1.03E-03 | 2.09E-02 | 0.17 | 0.36 | 0.59 |
| **DCFH** | T8 | 0.14 | 0.46 | 0.65 | 0.06 | 0.77 | 0.89 |
| **DCFH** | T120 | 0.14 | 0.45 | 0.65 | 0.02 | 0.91 | 0.95 |
| **DCFH** | T240 | 0.12 | 0.52 | 0.66 | -0.02 | 0.93 | 0.96 |
| **DCFH** | methanol | 0.17 | 0.51 | 0.66 | 0.26 | 0.17 | 0.45 |
| **DCFH** | acetonitrile | 0.32 | 0.22 | 0.43 | 0.39 | 0.03 | 0.37 |
| **DCFH** | acetaldehyde | 0.37 | 0.14 | 0.33 | 0.39 | 0.03 | 0.37 |
| **DCFH** | acrolein | 0.24 | 0.38 | 0.58 | -0.08 | 0.69 | 0.87 |
| **DCFH** | acetone | 0.38 | 0.14 | 0.32 | 0.26 | 0.16 | 0.45 |
| **DCFH** | isoprene | 0.41 | 9.83E-02 | 0.26 | -0.43 | 1.92E-02 | 0.37 |
| **DCFH** | methyl vinyl ketone /methacrolein | 0.25 | 0.34 | 0.57 | -0.41 | 2.33E-02 | 0.37 |
| **DCFH** | methyl ethyl ketone | 0.10 | 0.71 | 0.77 | 0.30 | 0.11 | 0.42 |
| **DCFH** | benzene | 0.32 | 0.21 | 0.42 | 0.25 | 0.19 | 0.45 |
| **DCFH** | toluene | 0.34 | 0.18 | 0.39 | 0.29 | 0.12 | 0.43 |
| **DCFH** | C2-benzenes | 0.39 | 0.12 | 0.31 | 0.22 | 0.24 | 0.50 |
| **DCFH** | C3-benzenes | 0.25 | 0.38 | 0.58 | -0.07 | 0.72 | 0.87 |
| **DCFH** | J $O^1D$ | -0.06 | 0.76 | 0.78 | -0.10 | 0.60 | 0.81 |
| **DCFH** | J $NO_2$ | -0.08 | 0.66 | 0.73 | -0.11 | 0.54 | 0.77 |
| **DCFH** | naphthalene | -0.64 | 1.38E-02 | 7.76E-02 | -0.14 | 0.59 | 0.81 |
| **DCFH** | acenaphthylne | -0.67 | 8.12E-03 | 5.79E-02 | -0.49 | 0.11 | 0.41 |
| **DCFH** | acenaphthene | -0.52 | 5.86E-02 | 0.20 | -0.22 | 0.50 | 0.72 |
| **DCFH** | fluorene | -0.65 | 1.14E-02 | 7.17E-02 | -0.38 | 0.17 | 0.45 |
| **DCFH** | phenanthrene | -0.60 | 2.21E-02 | 9.64E-02 | -0.09 | 0.73 | 0.87 |
| **DCFH** | fluoranthene | -0.68 | 7.56E-03 | 5.79E-02 | 0.09 | 0.72 | 0.87 |
| **DCFH** | pyrene | -0.71 | 4.82E-03 | 5.16E-02 | -0.11 | 0.66 | 0.85 |
| **DCFH** | benzo(a)anthracene | -0.79 | 7.95E-04 | 2.09E-02 | -0.44 | 0.06 | 0.38 |
| **DCFH** | chrysene | -0.80 | 6.28E-04 | 2.09E-02 | -0.32 | 0.18 | 0.45 |
| **DCFH** | benzo(b)fluoranthene | -0.75 | 2.03E-03 | 2.65E-02 | -0.31 | 0.19 | 0.45 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **DCFH** | benzo(k)fluoranthene | -0.70 | 5.63E-03 | 5.48E-02 | -0.42 | 7.26E-02 | 0.38 |
| **DCFH** | benzo(a)pyrene | -0.77 | 1.37E-03 | 2.09E-02 | -0.43 | 6.87E-02 | 0.38 |
| **DCFH** | indeno(1,2,3-cd)pyrene | -0.61 | 1.97E-02 | 9.58E-02 | -0.41 | 8.23E-02 | 0.38 |
| **DCFH** | dibenzo(a,h)-anthracene | -0.67 | 8.12E-03 | 5.79E-02 | -0.49 | 3.27E-02 | 0.37 |
| **DCFH** | benzo(ghi)perylene | -0.75 | 2.23E-03 | 2.65E-02 | -0.41 | 7.80E-02 | 0.38 |
| **DCFH** | C24 | -0.42 | 1.73E-02 | 8.98E-02 | -0.26 | 0.16 | 0.45 |
| **DCFH** | C25 | -0.45 | 1.09E-02 | 7.17E-02 | -0.22 | 0.23 | 0.49 |
| **DCFH** | C26 | -0.38 | 3.38E-02 | 0.13 | -0.30 | 9.98E-02 | 0.40 |
| **DCFH** | C27 | -0.42 | 1.76E-02 | 8.98E-02 | -0.31 | 8.84E-02 | 0.38 |
| **DCFH** | C28 | -0.30 | 0.10 | 0.26 | -0.27 | 0.13 | 0.45 |
| **DCFH** | C29 | -0.28 | 0.13 | 0.31 | -0.34 | 5.40E-02 | 0.38 |
| **DCFH** | C30 | -0.26 | 0.16 | 0.34 | -0.31 | 8.80E-02 | 0.38 |
| **DCFH** | C31 | -0.32 | 7.91E-02 | 0.24 | -0.44 | 1.10E-02 | 0.37 |
| **DCFH** | C32 | -0.38 | 3.34E-02 | 0.13 | -0.34 | 5.32E-02 | 0.38 |
| **DCFH** | C33 | -0.15 | 0.42 | 0.62 | -0.29 | 0.10 | 0.40 |
| **DCFH** | C34 | -0.22 | 0.24 | 0.44 | -0.19 | 0.30 | 0.53 |
| **DCFH** | OH | -0.24 | 0.40 | 0.60 | 0.15 | 0.44 | 0.66 |
| **DCFH** | $HO_2$ | 0.18 | 0.57 | 0.67 | -0.04 | 0.84 | 0.92 |
| **DCFH** | $RO_2$ | 0.04 | 0.90 | 0.90 | 0.10 | 0.62 | 0.82 |
| **DCFH** | palmitic acid | -0.12 | 0.51 | 0.66 | -0.37 | 3.84E-02 | 0.37 |
| **DCFH** | stearic acid | -0.05 | 0.77 | 0.78 | -0.35 | 5.21E-02 | 0.38 |
| **DCFH** | cholesterol | -0.12 | 0.53 | 0.66 | -0.33 | 6.74E-02 | 0.38 |
| **DCFH** | 17a(H)-22,29,30-trisnorhopane (C27a) | -0.45 | 1.29E-02 | 7.65E-02 | -0.26 | 0.16 | 0.45 |
| **DCFH** | 17b(H),21a(H)-norhopane (C30ba) | -0.42 | 2.12E-02 | 9.64E-02 | -0.22 | 0.23 | 0.49 |
| **DCFH** | 2-methylthreitol | -0.25 | 0.24 | 0.44 | -0.01 | 0.95 | 0.97 |
| **DCFH** | 2-methylerythritol | -0.10 | 0.63 | 0.71 | 0.00 | 1.00 | 1.00 |
| **DCFH** | 2-methylglyceric acid | -0.28 | 0.19 | 0.40 | -0.11 | 0.57 | 0.79 |
| **DCFH** | cis-2-methyl-1,3,4-trihydroxy-1-butene | -0.26 | 0.22 | 0.43 | -0.19 | 0.32 | 0.56 |
| **DCFH** | 3-methyl-2,3,4-trihydroxy-1-butene | -0.15 | 0.48 | 0.66 | -0.35 | 0.07 | 0.38 |
| **DCFH** | trans-2-methyl-1,3,4-trihydroxy-1-butene | -0.18 | 0.40 | 0.60 | -0.28 | 0.15 | 0.45 |
| **DCFH** | C5-alkene triols | -0.20 | 0.36 | 0.57 | -0.29 | 0.13 | 0.45 |
| **DCFH** | 2-methyltetrols | -0.14 | 0.51 | 0.66 | -0.03 | 0.88 | 0.94 |
| **DCFH** | 3-hydroxyglutaric acid | 0.11 | 0.59 | 0.68 | -0.05 | 0.79 | 0.90 |
| **DCFH** | cis-pinonic acid | -0.35 | 9.49E-02 | 0.26 | -0.54 | 0.00 | 0.32 |
| **DCFH** | pinic acid | -0.30 | 0.15 | 0.34 | -0.42 | 0.03 | 0.37 |
| **DCFH** | 3-methyl-1,2,3-butanetricarboxylic acid | 0.14 | 0.51 | 0.66 | -0.26 | 0.17 | 0.45 |
| **DCFH** | β-caryophyllinic acid | -0.09 | 0.67 | 0.73 | 0.15 | 0.44 | 0.66 |
| **DCFH** | glutaric acid derivative | 0.07 | 0.74 | 0.78 | -0.23 | 0.24 | 0.50 |
| **DCFH** | 3-acetylpentanedioic acid | 0.06 | 0.77 | 0.78 | 0.04 | 0.85 | 0.93 |
| **DCFH** | 3-acetylhexanedioic acid | -0.11 | 0.60 | 0.68 | -0.26 | 0.18 | 0.45 |
| **DCFH** | 3-isopropyl-pentanedioic acid | -0.12 | 0.57 | 0.67 | -0.03 | 0.89 | 0.94 |
| **DCFH** | 2,3-dihydroxy-4-oxopentanoic acid | 0.13 | 0.56 | 0.67 | -0.15 | 0.44 | 0.66 |

## Volume-normalised data

**Table S9.** Spearman rank correlations for all $EPR_v$ assay responses with all individual measurements.

| assay | feature | winter $R^2$ | winter p-value | winter BH p-value | summer $R^2$ | summer p-value | summer BH p-value |
|---|---|---|---|---|---|---|---|
| **EPR** | total OC | 0.85 | 3.24E-09 | 1.15E-07 | 0.14 | 0.44 | 0.91 |
| **EPR** | total EC | 0.82 | 2.31E-08 | 2.47E-07 | 0.02 | 0.91 | 0.99 |
| **EPR** | $K^+$ | 0.80 | 1.51E-07 | 1.27E-06 | 0.20 | 0.30 | 0.89 |
| **EPR** | $Na^+$ | 0.71 | 1.27E-05 | 6.46E-05 | 0.10 | 0.59 | 0.97 |
| **EPR** | $Ca^{2+}$ | 0.55 | 2.08E-03 | 7.16E-03 | 0.36 | 0.05 | 0.89 |
| **EPR** | $NH_4^+$ | 0.86 | 1.06E-09 | 1.13E-07 | -0.04 | 0.82 | 0.99 |
| **EPR** | $NO_3^-$ | 0.83 | 1.00E-08 | 1.38E-07 | -0.12 | 0.53 | 0.97 |
| **EPR** | $SO_4^{2-}$ | 0.84 | 6.78E-09 | 1.38E-07 | 0.06 | 0.74 | 0.98 |
| **EPR** | $Cl^-$ | 0.83 | 1.37E-08 | 1.63E-07 | 0.16 | 0.39 | 0.91 |
| **EPR** | Al | 0.72 | 7.24E-06 | 4.08E-05 | -0.21 | 0.24 | 0.89 |
| **EPR** | Ti | 0.37 | 5.15E-02 | 8.23E-02 | -0.27 | 0.13 | 0.89 |
| **EPR** | V | 0.23 | 0.23 | 0.25 | -0.10 | 0.73 | 0.98 |
| **EPR** | Cr | 0.69 | 2.73E-05 | 1.33E-04 | -0.06 | 0.75 | 0.98 |
| **EPR** | Mn | 0.84 | 8.39E-09 | 1.38E-07 | -0.20 | 0.27 | 0.89 |
| **EPR** | Fe | 0.80 | 8.59E-08 | 8.36E-07 | -0.27 | 0.14 | 0.89 |
| **EPR** | Co | 0.75 | 1.80E-06 | 1.20E-05 | 0.50 | 0.67 | 0.98 |
| **EPR** | Ni | 0.66 | 6.91E-05 | 3.21E-04 | 0.06 | 0.82 | 0.99 |
| **EPR** | Cu | 0.75 | 1.80E-06 | 1.20E-05 | -0.15 | 0.45 | 0.91 |
| **EPR** | Zn | 0.80 | 1.54E-07 | 1.27E-06 | -0.10 | 0.60 | 0.97 |
| **EPR** | Cd | 0.83 | 1.04E-08 | 1.38E-07 | -0.60 | 0.28 | 0.89 |
| **EPR** | Sb | 0.85 | 2.88E-09 | 1.15E-07 | -0.23 | 0.56 | 0.97 |
| **EPR** | Ba | 0.57 | 1.08E-03 | 4.14E-03 | -0.33 | 0.11 | 0.89 |
| **EPR** | Pb | 0.84 | 4.71E-09 | 1.26E-07 | -0.17 | 0.36 | 0.91 |
| **EPR** | galactosan | 0.49 | 6.29E-03 | 1.87E-02 | -0.20 | 0.26 | 0.89 |
| **EPR** | mannosan | 0.48 | 6.63E-03 | 1.92E-02 | -0.09 | 0.62 | 0.97 |
| **EPR** | levoglucosan | 0.52 | 3.49E-03 | 1.13E-02 | -0.10 | 0.58 | 0.97 |
| **EPR** | ORG | 0.85 | 2.70E-07 | 2.06E-06 | -0.21 | 0.28 | 0.89 |
| **EPR** | MOOOA | 0.79 | 6.26E-06 | 3.72E-05 | -0.19 | 0.33 | 0.89 |
| **EPR** | LOOOA | 0.82 | 2.05E-06 | 1.29E-05 | -0.12 | 0.56 | 0.97 |
| **EPR** | $O_3$ | -0.31 | 9.76E-02 | 0.13 | -0.05 | 0.78 | 0.99 |
| **EPR** | CO | 0.31 | 9.76E-02 | 0.13 | -0.07 | 0.72 | 0.98 |
| **EPR** | NO | 0.52 | 3.05E-03 | 1.02E-02 | 0.21 | 0.26 | 0.89 |
| **EPR** | $NO_2$ | 0.42 | 2.11E-02 | 4.70E-02 | 0.18 | 0.32 | 0.89 |
| **EPR** | $NO_y$ | 0.47 | 8.83E-03 | 2.49E-02 | 0.14 | 0.45 | 0.91 |
| **EPR** | $SO_2$ | 0.45 | 1.32E-02 | 3.53E-02 | -0.14 | 0.45 | 0.91 |
| **EPR** | RH8 | 0.59 | 5.36E-04 | 2.29E-03 | -0.35 | 0.06 | 0.89 |
| **EPR** | RH120 | 0.60 | 5.23E-04 | 2.29E-03 | -0.34 | 0.07 | 0.89 |
| **EPR** | RH240 | 0.55 | 1.83E-03 | 6.54E-03 | -0.32 | 0.08 | 0.89 |
| **EPR** | T8 | 0.28 | 0.13 | 0.17 | 0.20 | 0.29 | 0.89 |
| **EPR** | T120 | 0.27 | 0.15 | 0.19 | 0.20 | 0.30 | 0.89 |
| **EPR** | T240 | 0.25 | 0.19 | 0.22 | 0.23 | 0.23 | 0.89 |
| **EPR** | methanol | 0.51 | 4.56E-02 | 7.73E-02 | 0.00 | 0.99 | 0.99 |
| **EPR** | acetonitrile | 0.47 | 6.39E-02 | 9.63E-02 | -0.19 | 0.32 | 0.89 |
| **EPR** | acetaldehyde | 0.53 | 3.50E-02 | 6.64E-02 | -0.08 | 0.65 | 0.98 |
| **EPR** | acrolein | 0.48 | 6.87E-02 | 0.10 | 0.15 | 0.43 | 0.91 |
| **EPR** | acetone | 0.51 | 4.41E-02 | 7.62E-02 | 0.22 | 0.23 | 0.89 |
| **EPR** | isoprene | 0.51 | 4.13E-02 | 7.62E-02 | 0.04 | 0.85 | 0.99 |
| **EPR** | methyl vinyl ketone /methacrolein | 0.56 | 2.35E-02 | 5.04E-02 | 0.10 | 0.61 | 0.97 |
| **EPR** | methyl ethyl ketone | 3.57E-03 | 0.99 | 0.99 | -0.10 | 0.59 | 0.97 |
| **EPR** | benzene | 0.51 | 4.27E-02 | 7.62E-02 | -0.19 | 0.31 | 0.89 |
| **EPR** | toluene | 0.57 | 2.02E-02 | 4.60E-02 | -0.08 | 0.68 | 0.98 |
| **EPR** | C2-benzenes | 0.57 | 2.02E-02 | 4.60E-02 | -0.17 | 0.37 | 0.91 |
| **EPR** | C3-benzenes | 0.38 | 0.17 | 0.21 | -0.15 | 0.44 | 0.91 |
| **EPR** | J $O^1D$ | 0.30 | 0.11 | 0.15 | 0.23 | 0.20 | 0.89 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **EPR** | J $NO_2$ | 0.30 | 0.12 | 0.16 | 0.29 | 0.11 | 0.89 |
| **EPR** | naphthalene | 0.64 | 1.91E-02 | 4.60E-02 | -0.17 | 0.48 | 0.95 |
| **EPR** | acenaphthylne | 0.37 | 0.21 | 0.24 | -0.14 | 0.64 | 0.98 |
| **EPR** | acenaphthene | 0.36 | 0.23 | 0.25 | 0.06 | 0.86 | 0.99 |
| **EPR** | fluorene | 0.52 | 7.07E-02 | 0.10 | -0.33 | 0.21 | 0.89 |
| **EPR** | phenanthrene | 0.50 | 8.19E-02 | 0.12 | -0.02 | 0.94 | 0.99 |
| **EPR** | fluoranthene | 0.60 | 2.87E-02 | 5.79E-02 | 0.19 | 0.42 | 0.91 |
| **EPR** | pyrene | 0.64 | 1.78E-02 | 4.53E-02 | 0.28 | 0.24 | 0.89 |
| **EPR** | benzo(a)anthracene | 0.51 | 7.43E-02 | 0.11 | 0.32 | 0.17 | 0.89 |
| **EPR** | chrysene | 0.68 | 1.03E-02 | 2.84E-02 | 0.13 | 0.59 | 0.97 |
| **EPR** | benzo(b)fluoranthene | 0.71 | 6.09E-03 | 1.86E-02 | 0.01 | 0.96 | 0.99 |
| **EPR** | benzo(k)fluoranthene | 0.74 | 4.11E-03 | 1.29E-02 | 0.01 | 0.98 | 0.99 |
| **EPR** | benzo(a)pyrene | 0.40 | 0.17 | 0.21 | -0.01 | 0.96 | 0.99 |
| **EPR** | indeno(1,2,3-cd)pyrene | 0.62 | 2.52E-02 | 5.28E-02 | -0.02 | 0.94 | 0.99 |
| **EPR** | dibenzo(a,h)-anthracene | 0.45 | 0.13 | 0.17 | 0.21 | 0.38 | 0.91 |
| **EPR** | benzo(ghi)perylene | 0.57 | 4.38E-02 | 7.62E-02 | -0.05 | 0.83 | 0.99 |
| **EPR** | C24 | 0.39 | 3.27E-02 | 6.36E-02 | -0.12 | 0.52 | 0.97 |
| **EPR** | C25 | 0.39 | 3.54E-02 | 6.64E-02 | 0.05 | 0.80 | 0.99 |
| **EPR** | C26 | 0.40 | 2.75E-02 | 5.65E-02 | -0.03 | 0.87 | 0.99 |
| **EPR** | C27 | 0.37 | 4.64E-02 | 7.73E-02 | 0.27 | 0.14 | 0.89 |
| **EPR** | C28 | 0.42 | 2.02E-02 | 4.60E-02 | 0.08 | 0.66 | 0.98 |
| **EPR** | C29 | 0.43 | 1.69E-02 | 4.42E-02 | 0.27 | 0.13 | 0.89 |
| **EPR** | C30 | 0.40 | 3.04E-02 | 6.02E-02 | 0.03 | 0.85 | 0.99 |
| **EPR** | C31 | 0.42 | 1.99E-02 | 4.60E-02 | 0.27 | 0.14 | 0.89 |
| **EPR** | C32 | 0.42 | 2.21E-02 | 4.84E-02 | 0.01 | 0.94 | 0.99 |
| **EPR** | C33 | 0.35 | 5.90E-02 | 9.15E-02 | 0.20 | 0.28 | 0.89 |
| **EPR** | C34 | 0.36 | 5.24E-02 | 8.25E-02 | 0.01 | 0.95 | 0.99 |
| **EPR** | OH | -0.12 | 0.69 | 0.72 | 0.19 | 0.32 | 0.89 |
| **EPR** | HO2 | -0.09 | 0.79 | 0.81 | -0.17 | 0.37 | 0.91 |
| **EPR** | RO2 | -0.25 | 0.47 | 0.49 | 0.10 | 0.60 | 0.97 |
| **EPR** | palmitic acid | 0.01 | 0.96 | 0.97 | -0.09 | 0.63 | 0.97 |
| **EPR** | stearic acid | 0.04 | 0.83 | 0.85 | -0.15 | 0.41 | 0.91 |
| **EPR** | cholesterol | 0.22 | 0.25 | 0.27 | 0.06 | 0.76 | 0.98 |
| **EPR** | 17a(H)-22,29,30-trisnorhopane (C27a) | 0.37 | 4.70E-02 | 7.73E-02 | 0.25 | 0.17 | 0.89 |
| **EPR** | 17b(H),21a(H)-norhopane (C30ba) | 0.37 | 4.89E-02 | 7.92E-02 | 0.06 | 0.74 | 0.98 |
| **EPR** | 2-methylthreitol | 0.28 | 0.20 | 0.23 | -0.04 | 0.85 | 0.99 |
| **EPR** | 2-methylerythritol | 0.42 | 4.33E-02 | 7.62E-02 | -0.06 | 0.75 | 0.98 |
| **EPR** | 2-methylglyceric acid | 0.39 | 6.34E-02 | 9.63E-02 | 0.23 | 0.23 | 0.89 |
| **EPR** | cis-2-methyl-1,3,4-trihydroxy-1-butene | 0.27 | 0.21 | 0.24 | 0.00 | 0.98 | 0.99 |
| **EPR** | 3-methyl-2,3,4-trihydroxy-1-butene | 0.31 | 0.16 | 0.19 | 0.21 | 0.28 | 0.89 |
| **EPR** | trans-2-methyl-1,3,4-trihydroxy-1-butene | 0.29 | 0.18 | 0.22 | 0.12 | 0.54 | 0.97 |
| **EPR** | C5-alkene triols | 0.27 | 0.22 | 0.25 | 0.13 | 0.49 | 0.96 |
| **EPR** | 2-methyltetrols | 0.38 | 7.66E-02 | 0.11 | -0.06 | 0.76 | 0.98 |
| **EPR** | 3-hydroxyglutaric acid | 0.31 | 0.15 | 0.19 | -0.03 | 0.86 | 0.99 |
| **EPR** | cis-pinonic acid | 0.25 | 0.26 | 0.28 | -0.22 | 0.26 | 0.89 |
| **EPR** | pinic acid | 0.26 | 0.24 | 0.26 | -0.35 | 0.06 | 0.89 |
| **EPR** | 3-methyl-1,2,3-butanetricarboxylic acid | 0.22 | 0.31 | 0.32 | -0.03 | 0.89 | 0.99 |
| **EPR** | β-caryophyllinic acid | 0.33 | 0.13 | 0.17 | 0.16 | 0.42 | 0.91 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| EPR | glutaric acid derivative | 0.31 | 0.15 | 0.19 | -0.03 | 0.88 | 0.99 |
| EPR | 3-acetylpentanedioic acid | 0.79 | 8.19E-06 | 4.38E-05 | -0.22 | 0.24 | 0.89 |
| EPR | 3-acetylhexanedioic acid | 0.66 | 6.41E-04 | 2.64E-03 | -0.26 | 0.17 | 0.89 |
| EPR | 3-isopropyl-pentanedioic acid | 0.63 | 1.23E-03 | 4.55E-03 | -0.02 | 0.91 | 0.99 |
| EPR | 2,3-dihydroxy-4-oxopentanoic acid | 0.66 | 6.75E-04 | 2.67E-03 | 0.07 | 0.74 | 0.98 |

**Table S10.** Spearman rank correlations for all $AA_v$ assay responses with all individual measurements.

| assay | feature | winter $R^2$ | winter p-value | winter BH p-value | summer $R^2$ | summer p-value | summer BH p-value |
|---|---|---|---|---|---|---|---|
| AA | total OC | 0.92 | 2.14E-13 | 1.14E-11 | 0.49 | 3.66E-03 | 0.10 |
| AA | total EC | 0.88 | 9.30E-11 | 2.47E-09 | 0.30 | 9.43E-02 | 0.39 |
| AA | $K^+$ | 0.86 | 8.60E-10 | 1.15E-08 | 0.23 | 0.22 | 0.54 |
| AA | $Na^+$ | 0.81 | 4.32E-08 | 3.56E-07 | 0.14 | 0.47 | 0.66 |
| AA | $Ca^{2+}$ | 0.43 | 1.68E-02 | 2.64E-02 | 0.12 | 0.53 | 0.73 |
| AA | $NH_4^+$ | 0.84 | 3.71E-09 | 3.30E-08 | 0.16 | 0.36 | 0.64 |
| AA | $NO_3^-$ | 0.84 | 3.24E-09 | 3.15E-08 | 0.35 | 4.50E-02 | 0.27 |
| AA | $SO_4^{2-}$ | 0.75 | 1.05E-06 | 6.25E-06 | 0.47 | 5.64E-03 | 0.10 |
| AA | $Cl^-$ | 0.93 | 5.23E-14 | 5.59E-12 | 0.02 | 0.90 | 0.92 |
| AA | Al | 0.65 | 7.89E-05 | 2.28E-04 | 0.23 | 0.20 | 0.54 |
| AA | Ti | 0.29 | 1.20E-01 | 1.42E-01 | 0.17 | 0.34 | 0.64 |
| AA | V | 0.11 | 0.57 | 0.61 | 0.41 | 0.13 | 0.46 |
| AA | Cr | 0.67 | 3.40E-05 | 1.10E-04 | -0.12 | 0.52 | 0.72 |
| AA | Mn | 0.85 | 1.16E-09 | 1.38E-08 | 0.36 | 4.08E-02 | 0.27 |
| AA | Fe | 0.76 | 9.09E-07 | 5.72E-06 | 0.22 | 0.21 | 0.54 |
| AA | Co | 0.70 | 1.04E-05 | 4.13E-05 | -0.50 | 0.67 | 0.78 |
| AA | Ni | 0.62 | 2.30E-04 | 5.71E-04 | -0.43 | 0.11 | 0.42 |
| AA | Cu | 0.71 | 7.93E-06 | 3.54E-05 | 0.07 | 0.72 | 0.78 |
| AA | Zn | 0.87 | 2.68E-10 | 4.10E-09 | 0.15 | 0.40 | 0.66 |
| AA | Cd | 0.87 | 1.39E-10 | 2.47E-09 | 0.20 | 0.75 | 0.80 |
| AA | Sb | 0.88 | 1.16E-10 | 2.47E-09 | 0.18 | 0.63 | 0.77 |
| AA | Ba | 0.40 | 2.66E-02 | 3.56E-02 | -0.17 | 0.40 | 0.66 |
| AA | Pb | 0.91 | 1.65E-12 | 5.90E-11 | 0.18 | 0.31 | 0.64 |
| AA | galactosan | 0.66 | 5.19E-05 | 1.63E-04 | 0.20 | 0.27 | 0.60 |
| AA | mannosan | 0.66 | 5.81E-05 | 1.78E-04 | 0.26 | 0.14 | 0.47 |
| AA | levoglucosan | 0.68 | 2.51E-05 | 8.97E-05 | 0.21 | 0.23 | 0.54 |
| AA | ORG | 0.90 | 3.09E-09 | 3.15E-08 | 0.54 | 2.27E-03 | 0.08 |
| AA | MOOOA | 0.81 | 1.38E-06 | 7.75E-06 | 0.49 | 7.35E-03 | 0.10 |
| AA | LOOOA | 0.76 | 1.48E-05 | 5.64E-05 | 0.40 | 3.07E-02 | 0.25 |
| AA | $O_3$ | -0.07 | 0.69 | 0.72 | 0.08 | 0.68 | 0.78 |
| AA | CO | 0.10 | 0.58 | 0.61 | 0.14 | 0.44 | 0.66 |
| AA | NO | 0.36 | 4.43E-02 | 5.64E-02 | 0.03 | 0.86 | 0.90 |
| AA | $NO_2$ | 0.23 | 0.22 | 0.24 | 0.13 | 0.48 | 0.68 |
| AA | $NO_y$ | 0.29 | 0.11 | 0.13 | 0.13 | 0.45 | 0.66 |
| AA | $SO_2$ | 0.23 | 0.20 | 0.23 | 0.15 | 0.41 | 0.66 |
| AA | RH8 | 0.53 | 1.96E-03 | 3.82E-03 | 0.17 | 0.36 | 0.64 |
| AA | RH120 | 0.52 | 2.52E-03 | 4.72E-03 | 0.17 | 0.35 | 0.64 |
| AA | RH240 | 0.50 | 4.22E-03 | 7.52E-03 | 0.17 | 0.36 | 0.64 |
| AA | T8 | 0.16 | 0.38 | 0.43 | 0.07 | 0.71 | 0.78 |
| AA | T120 | 0.15 | 0.42 | 0.47 | 0.08 | 0.67 | 0.78 |
| AA | T240 | 0.14 | 0.45 | 0.50 | 0.07 | 0.70 | 0.78 |
| AA | methanol | 0.54 | 2.47E-02 | 3.42E-02 | 0.15 | 0.43 | 0.66 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **AA** | acetonitrile | 0.53 | 2.97E-02 | 3.93E-02 | 0.11 | 0.54 | 0.73 |
| **AA** | acetaldehyde | 0.56 | 1.84E-02 | 2.70E-02 | 0.10 | 0.60 | 0.77 |
| **AA** | acrolein | 0.51 | 4.27E-02 | 5.53E-02 | 0.18 | 0.33 | 0.64 |
| **AA** | acetone | 0.56 | 2.04E-02 | 2.95E-02 | 0.16 | 0.40 | 0.66 |
| **AA** | isoprene | 0.56 | 1.84E-02 | 2.70E-02 | 0.04 | 0.83 | 0.88 |
| **AA** | methyl vinyl ketone /methacrolein | 0.57 | 1.78E-02 | 2.70E-02 | 0.14 | 0.46 | 0.66 |
| **AA** | methyl ethyl ketone | -0.08 | 0.78 | 0.79 | 0.14 | 0.45 | 0.66 |
| **AA** | benzene | 0.56 | 1.84E-02 | 2.70E-02 | 0.03 | 0.87 | 0.90 |
| **AA** | toluene | 0.60 | 1.12E-02 | 1.82E-02 | -0.14 | 0.44 | 0.66 |
| **AA** | C2-benzenes | 0.58 | 1.55E-02 | 2.48E-02 | -0.26 | 0.16 | 0.47 |
| **AA** | C3-benzenes | 0.51 | 5.37E-02 | 6.76E-02 | -0.11 | 0.54 | 0.73 |
| **AA** | J $O^1D$ | 0.25 | 0.18 | 0.20 | 0.07 | 0.69 | 0.78 |
| **AA** | J $NO_2$ | 0.33 | 7.84E-02 | 9.64E-02 | 0.14 | 0.43 | 0.66 |
| **AA** | naphthalene | 0.88 | 3.11E-05 | 1.04E-04 | 0.13 | 0.59 | 0.76 |
| **AA** | acenaphthylne | 0.80 | 6.28E-04 | 1.32E-03 | 0.26 | 0.39 | 0.66 |
| **AA** | acenaphthene | 0.69 | 6.54E-03 | 1.11E-02 | 0.00 | 1.00 | 1.00 |
| **AA** | fluorene | 0.86 | 6.85E-05 | 2.03E-04 | 0.22 | 0.42 | 0.66 |
| **AA** | phenanthrene | 0.90 | 9.56E-06 | 3.93E-05 | 0.12 | 0.62 | 0.77 |
| **AA** | fluoranthene | 0.89 | 2.00E-05 | 7.37E-05 | 0.13 | 0.59 | 0.76 |
| **AA** | pyrene | 0.92 | 2.98E-06 | 1.60E-05 | 0.04 | 0.87 | 0.90 |
| **AA** | benzo(a)anthracene | 0.84 | 1.86E-04 | 4.99E-04 | 0.02 | 0.92 | 0.93 |
| **AA** | chrysene | 0.96 | 9.47E-08 | 6.76E-07 | 0.22 | 0.35 | 0.64 |
| **AA** | benzo(b)fluoranthene | 0.96 | 5.08E-08 | 3.88E-07 | 0.42 | 6.24E-02 | 0.31 |
| **AA** | benzo(k)fluoranthene | 0.90 | 9.56E-06 | 3.93E-05 | 0.40 | 7.69E-02 | 0.34 |
| **AA** | benzo(a)pyrene | 0.73 | 2.92E-03 | 5.30E-03 | 0.43 | 5.74E-02 | 0.31 |
| **AA** | indeno(1,2,3-cd)pyrene | 0.92 | 4.08E-06 | 1.99E-05 | 0.45 | 4.59E-02 | 0.27 |
| **AA** | dibenzo(a,h)-anthracene | 0.85 | 9.77E-05 | 2.75E-04 | 0.28 | 0.23 | 0.54 |
| **AA** | benzo(ghi)perylene | 0.92 | 4.08E-06 | 1.99E-05 | 0.18 | 0.44 | 0.66 |
| **AA** | C24 | 0.59 | 5.00E-04 | 1.11E-03 | -0.38 | 2.82E-02 | 0.25 |
| **AA** | C25 | 0.59 | 4.94E-04 | 1.11E-03 | -0.22 | 0.21 | 0.54 |
| **AA** | C26 | 0.60 | 3.52E-04 | 8.55E-04 | -0.09 | 0.63 | 0.77 |
| **AA** | C27 | 0.58 | 6.29E-04 | 1.32E-03 | 0.06 | 0.74 | 0.80 |
| **AA** | C28 | 0.59 | 4.78E-04 | 1.11E-03 | 0.25 | 0.16 | 0.47 |
| **AA** | C29 | 0.63 | 1.32E-04 | 3.63E-04 | 0.26 | 0.15 | 0.47 |
| **AA** | C30 | 0.58 | 5.96E-04 | 1.30E-03 | 0.28 | 0.11 | 0.42 |
| **AA** | C31 | 0.62 | 2.30E-04 | 5.71E-04 | 0.33 | 6.14E-02 | 0.31 |
| **AA** | C32 | 0.56 | 9.59E-04 | 1.94E-03 | 0.24 | 0.19 | 0.54 |
| **AA** | C33 | 0.52 | 2.45E-03 | 4.68E-03 | 0.22 | 0.21 | 0.54 |
| **AA** | C34 | 0.55 | 1.23E-03 | 2.45E-03 | 0.08 | 0.66 | 0.78 |
| **AA** | OH | -0.14 | 0.62 | 0.65 | -0.11 | 0.58 | 0.76 |
| **AA** | $HO_2$ | -0.01 | 0.98 | 0.98 | -0.08 | 0.68 | 0.78 |
| **AA** | $RO_2$ | 0.04 | 0.90 | 0.91 | -0.09 | 0.65 | 0.78 |
| **AA** | palmitic acid | 0.07 | 0.70 | 0.72 | 0.30 | 8.71E-02 | 0.37 |
| **AA** | stearic acid | 0.11 | 0.58 | 0.61 | 0.36 | 3.96E-02 | 0.27 |
| **AA** | cholesterol | 0.28 | 0.13 | 0.15 | 0.09 | 0.62 | 0.77 |
| **AA** | 17a(H)-22,29,30-trisnorhopane (C27a) | 0.61 | 3.74E-04 | 8.90E-04 | 0.32 | 6.63E-02 | 0.31 |
| **AA** | 17b(H),21a(H)-norhopane (C30ba) | 0.59 | 6.72E-04 | 1.38E-03 | 0.21 | 0.23 | 0.54 |
| **AA** | 2-methylthreitol | 0.47 | 2.17E-02 | 3.05E-02 | 0.18 | 0.36 | 0.64 |
| **AA** | 2-methylerythritol | 0.59 | 2.66E-03 | 4.92E-03 | 0.21 | 0.29 | 0.61 |
| **AA** | 2-methylglyceric acid | 0.52 | 9.76E-03 | 1.61E-02 | 0.35 | 6.41E-02 | 0.31 |
| **AA** | cis-2-methyl-1,3,4-trihydroxy-1-butene | 0.56 | 4.51E-03 | 7.90E-03 | 0.29 | 0.12 | 0.44 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **AA** | 3-methyl-2,3,4-trihydroxy-1-butene | 0.47 | 2.14E-02 | 3.05E-02 | 0.28 | 0.14 | 0.47 |
| **AA** | trans-2-methyl-1,3,4-trihydroxy-1-butene | 0.48 | 1.81E-02 | 2.70E-02 | 0.51 | 4.58E-03 | 0.10 |
| **AA** | C5-alkene triols | 0.46 | 2.52E-02 | 3.42E-02 | 0.46 | 1.18E-02 | 0.13 |
| **AA** | 2-methyltetrols | 0.56 | 4.66E-03 | 8.04E-03 | 0.19 | 0.31 | 0.64 |
| **AA** | 3-hydroxyglutaric acid | 0.46 | 2.49E-02 | 3.42E-02 | 0.49 | 7.35E-03 | 0.10 |
| **AA** | cis-pinonic acid | 0.39 | 5.74E-02 | 7.15E-02 | 0.29 | 0.12 | 0.44 |
| **AA** | pinic acid | 0.42 | 4.29E-02 | 5.53E-02 | 0.22 | 0.24 | 0.55 |
| **AA** | 3-methyl-1,2,3-butanetricarboxylic acid | 0.29 | 0.18 | 0.20 | 0.24 | 0.22 | 0.54 |
| **AA** | β-caryophyllinic acid | 0.53 | 7.32E-03 | 1.22E-02 | 0.38 | 4.39E-02 | 0.27 |
| **AA** | glutaric acid derivative | 0.33 | 0.11 | 0.14 | 0.22 | 0.25 | 0.57 |
| **AA** | 3-acetylpentanedioic acid | 0.83 | 6.97E-07 | 4.66E-06 | 0.59 | 7.82E-04 | 0.05 |
| **AA** | 3-acetylhexanedioic acid | 0.75 | 2.94E-05 | 1.01E-04 | 0.43 | 2.00E-02 | 0.19 |
| **AA** | 3-isopropyl-pentanedioic acid | 0.69 | 1.98E-04 | 5.18E-04 | 0.58 | 8.98E-04 | 0.05 |
| **AA** | 2,3-dihydroxy-4-oxopentanoic acid | 0.78 | 5.96E-06 | 2.77E-05 | 0.47 | 1.07E-02 | 0.13 |

**Table S11.** Spearman rank correlations for all $DTT_v$ assay responses with all individual measurements.

| assay | feature | winter $R^2$ | winter p-value | winter BH p-value | summer $R^2$ | summer p-value | summer BH p-value |
|---|---|---|---|---|---|---|---|
| **DTT** | total OC | 0.84 | 2.82E-09 | 1.24E-07 | 0.64 | 5.77E-05 | 5.91E-03 |
| **DTT** | total EC | 0.78 | 1.83E-07 | 2.40E-06 | 0.41 | 1.79E-02 | 7.97E-02 |
| **DTT** | $K^+$ | 0.77 | 3.15E-07 | 3.37E-06 | 0.56 | 1.02E-03 | 1.32E-02 |
| **DTT** | $Na^+$ | 0.77 | 5.07E-07 | 4.93E-06 | 0.40 | 2.68E-02 | 1.02E-01 |
| **DTT** | $Ca^{2+}$ | 0.64 | 1.56E-04 | 5.76E-04 | 0.19 | 0.30 | 0.53 |
| **DTT** | $NH_4^+$ | 0.81 | 3.76E-08 | 6.71E-07 | 0.60 | 2.48E-04 | 5.91E-03 |
| **DTT** | $NO_3^-$ | 0.78 | 2.02E-07 | 2.40E-06 | 0.53 | 1.39E-03 | 1.32E-02 |
| **DTT** | $SO_4^{2-}$ | 0.75 | 1.07E-06 | 8.21E-06 | 0.62 | 1.37E-04 | 5.91E-03 |
| **DTT** | $Cl^-$ | 0.83 | 6.75E-09 | 1.81E-07 | 0.24 | 0.18 | 0.38 |
| **DTT** | Al | 0.47 | 7.38E-03 | 1.58E-02 | 0.20 | 0.27 | 0.50 |
| **DTT** | Ti | 0.23 | 0.22 | 0.30 | 0.24 | 0.17 | 0.37 |
| **DTT** | V | 0.09 | 0.66 | 0.70 | -0.12 | 0.68 | 0.84 |
| **DTT** | Cr | 0.59 | 4.94E-04 | 1.39E-03 | 0.28 | 0.12 | 0.31 |
| **DTT** | Mn | 0.80 | 5.82E-08 | 8.90E-07 | 0.40 | 1.97E-02 | 8.43E-02 |
| **DTT** | Fe | 0.75 | 1.07E-06 | 8.21E-06 | 0.37 | 3.21E-02 | 0.12 |
| **DTT** | Co | 0.63 | 1.41E-04 | 5.39E-04 | 0.50 | 0.67 | 0.84 |
| **DTT** | Ni | 0.57 | 7.46E-04 | 1.95E-03 | -0.18 | 0.53 | 0.75 |
| **DTT** | Cu | 0.64 | 1.15E-04 | 4.72E-04 | 0.29 | 0.15 | 0.35 |
| **DTT** | Zn | 0.77 | 6.08E-07 | 5.42E-06 | 0.53 | 1.48E-03 | 1.32E-02 |
| **DTT** | Cd | 0.83 | 8.62E-09 | 1.84E-07 | 0.10 | 0.87 | 0.94 |
| **DTT** | Sb | 0.84 | 3.46E-09 | 1.24E-07 | -0.14 | 0.71 | 0.86 |
| **DTT** | Ba | 0.47 | 7.38E-03 | 1.58E-02 | 0.01 | 0.94 | 0.97 |
| **DTT** | Pb | 0.85 | 1.39E-09 | 1.24E-07 | 0.53 | 1.38E-03 | 1.32E-02 |
| **DTT** | galactosan | 0.50 | 4.29E-03 | 9.97E-03 | 0.42 | 1.46E-02 | 7.09E-02 |
| **DTT** | mannosan | 0.54 | 1.80E-03 | 4.59E-03 | 0.48 | 4.87E-03 | 3.72E-02 |
| **DTT** | levoglucosan | 0.53 | 2.15E-03 | 5.36E-03 | 0.56 | 6.21E-04 | 1.11E-02 |
| **DTT** | ORG | 0.79 | 4.49E-06 | 2.40E-05 | 0.63 | 2.76E-04 | 5.91E-03 |
| **DTT** | MOOOA | 0.80 | 2.95E-06 | 1.68E-05 | 0.32 | 0.10 | 0.25 |
| **DTT** | LOOOA | 0.67 | 3.63E-04 | 1.11E-03 | 0.42 | 2.34E-02 | 9.64E-02 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **DTT** | $O_3$ | -0.07 | 0.73 | 0.75 | 0.24 | 0.19 | 0.39 |
| **DTT** | CO | -0.03 | 0.88 | 0.89 | 0.05 | 0.79 | 0.89 |
| **DTT** | NO | 0.27 | 0.14 | 0.20 | -0.11 | 0.52 | 0.75 |
| **DTT** | $NO_2$ | 0.12 | 0.54 | 0.57 | -0.03 | 0.86 | 0.94 |
| **DTT** | $NO_y$ | 0.21 | 0.26 | 0.34 | -0.10 | 0.57 | 0.77 |
| **DTT** | $SO_2$ | 0.04 | 0.85 | 0.87 | 0.34 | 5.00E-02 | 0.17 |
| **DTT** | RH8 | 0.62 | 1.96E-04 | 6.76E-04 | 0.10 | 0.60 | 0.77 |
| **DTT** | RH120 | 0.61 | 2.78E-04 | 9.02E-04 | 0.11 | 0.54 | 0.75 |
| **DTT** | RH240 | 0.60 | 3.81E-04 | 1.13E-03 | 0.12 | 0.52 | 0.75 |
| **DTT** | T8 | 0.22 | 0.23 | 0.31 | 0.20 | 0.29 | 0.51 |
| **DTT** | T120 | 0.21 | 0.26 | 0.34 | 0.16 | 0.38 | 0.63 |
| **DTT** | T240 | 0.20 | 0.27 | 0.34 | 0.15 | 0.44 | 0.67 |
| **DTT** | methanol | 0.25 | 0.32 | 0.38 | 0.01 | 0.94 | 0.97 |
| **DTT** | acetonitrile | 0.21 | 0.41 | 0.46 | 0.06 | 0.74 | 0.87 |
| **DTT** | acetaldehyde | 0.25 | 0.32 | 0.38 | 0.12 | 0.52 | 0.75 |
| **DTT** | acrolein | 0.20 | 0.46 | 0.50 | 0.03 | 0.86 | 0.94 |
| **DTT** | acetone | 0.26 | 0.31 | 0.38 | 0.32 | 7.91E-02 | 0.22 |
| **DTT** | isoprene | 0.28 | 0.27 | 0.34 | -0.33 | 6.57E-02 | 0.19 |
| **DTT** | methyl vinyl ketone /methacrolein | 0.25 | 0.34 | 0.39 | -0.22 | 0.24 | 0.45 |
| **DTT** | methyl ethyl ketone | -0.22 | 0.42 | 0.46 | 0.17 | 0.36 | 0.61 |
| **DTT** | benzene | 0.25 | 0.33 | 0.39 | -0.03 | 0.86 | 0.94 |
| **DTT** | toluene | 0.29 | 0.26 | 0.34 | 0.01 | 0.97 | 0.98 |
| **DTT** | C2-benzenes | 0.28 | 0.27 | 0.34 | -0.05 | 0.78 | 0.89 |
| **DTT** | C3-benzenes | 0.24 | 0.39 | 0.44 | 0.01 | 0.95 | 0.97 |
| **DTT** | J $O^1D$ | 0.48 | 7.82E-03 | 1.60E-02 | 0.00 | 0.99 | 0.99 |
| **DTT** | J $NO_2$ | 0.48 | 7.73E-03 | 1.60E-02 | 0.10 | 0.58 | 0.77 |
| **DTT** | naphthalene | 0.85 | 1.36E-04 | 5.39E-04 | -0.04 | 0.89 | 0.95 |
| **DTT** | acenaphthylne | 0.88 | 3.83E-05 | 1.78E-04 | 0.09 | 0.76 | 0.89 |
| **DTT** | acenaphthene | 0.79 | 7.08E-04 | 1.89E-03 | 0.03 | 0.91 | 0.97 |
| **DTT** | fluorene | 0.92 | 2.98E-06 | 1.68E-05 | 0.29 | 0.27 | 0.50 |
| **DTT** | phenanthrene | 0.93 | 2.14E-06 | 1.43E-05 | 0.13 | 0.59 | 0.77 |
| **DTT** | fluoranthene | 0.81 | 4.32E-04 | 1.25E-03 | 0.33 | 0.15 | 0.35 |
| **DTT** | pyrene | 0.82 | 3.31E-04 | 1.04E-03 | 0.29 | 0.21 | 0.42 |
| **DTT** | benzo(a)anthracene | 0.83 | 2.17E-04 | 7.24E-04 | 0.19 | 0.43 | 0.67 |
| **DTT** | chrysene | 0.92 | 2.98E-06 | 1.68E-05 | 0.33 | 0.15 | 0.35 |
| **DTT** | benzo(b)fluoranthene | 0.93 | 2.14E-06 | 1.43E-05 | 0.57 | 8.28E-03 | 5.21E-02 |
| **DTT** | benzo(k)fluoranthene | 0.86 | 8.20E-05 | 3.66E-04 | 0.46 | 3.97E-02 | 0.14 |
| **DTT** | benzo(a)pyrene | 0.75 | 2.23E-03 | 5.42E-03 | 0.54 | 1.40E-02 | 7.09E-02 |
| **DTT** | indeno(1,2,3-cd)pyrene | 0.90 | 1.24E-05 | 6.30E-05 | 0.54 | 1.43E-02 | 7.09E-02 |
| **DTT** | dibenzo(a,h)-anthracene | 0.85 | 9.77E-05 | 4.18E-04 | 0.40 | 7.81E-02 | 0.22 |
| **DTT** | benzo(ghi)perylene | 0.89 | 1.58E-05 | 7.68E-05 | 0.28 | 0.23 | 0.45 |
| **DTT** | C24 | 0.40 | 2.61E-02 | 4.46E-02 | -0.19 | 0.28 | 0.50 |
| **DTT** | C25 | 0.40 | 2.63E-02 | 4.46E-02 | -0.08 | 0.68 | 0.84 |
| **DTT** | C26 | 0.42 | 1.89E-02 | 3.42E-02 | 0.15 | 0.41 | 0.65 |
| **DTT** | C27 | 0.41 | 2.28E-02 | 4.00E-02 | 0.25 | 0.16 | 0.35 |
| **DTT** | C28 | 0.47 | 7.91E-03 | 1.60E-02 | 0.33 | 6.48E-02 | 0.19 |
| **DTT** | C29 | 0.47 | 8.28E-03 | 1.64E-02 | 0.44 | 1.12E-02 | 6.33E-02 |
| **DTT** | C30 | 0.41 | 2.07E-02 | 3.69E-02 | 0.37 | 3.64E-02 | 0.13 |
| **DTT** | C31 | 0.42 | 1.74E-02 | 3.21E-02 | 0.33 | 6.31E-02 | 0.19 |
| **DTT** | C32 | 0.46 | 9.63E-03 | 1.87E-02 | 0.28 | 0.12 | 0.30 |
| **DTT** | C33 | 0.39 | 2.98E-02 | 4.98E-02 | 0.42 | 1.62E-02 | 7.54E-02 |
| **DTT** | C34 | 0.39 | 3.22E-02 | 5.30E-02 | 0.07 | 0.69 | 0.84 |
| **DTT** | OH | -0.02 | 0.95 | 0.95 | 0.19 | 0.34 | 0.58 |
| **DTT** | $HO_2$ | 0.34 | 0.28 | 0.34 | -0.05 | 0.79 | 0.89 |
| **DTT** | $RO_2$ | 0.30 | 0.34 | 0.39 | 0.15 | 0.42 | 0.66 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **DTT** | palmitic acid | 0.07 | 0.70 | 0.72 | 0.06 | 0.72 | 0.86 |
| **DTT** | stearic acid | 0.08 | 0.68 | 0.72 | 0.11 | 0.54 | 0.75 |
| **DTT** | cholesterol | 0.16 | 0.39 | 0.44 | 0.61 | 1.79E-04 | 5.91E-03 |
| **DTT** | 17a(H)-22,29,30-trisnorhopane (C27a) | 0.43 | 1.67E-02 | 3.13E-02 | 0.07 | 0.69 | 0.84 |
| **DTT** | 17b(H),21a(H)-norhopane (C30ba) | 0.36 | 5.12E-02 | 8.17E-02 | 0.01 | 0.96 | 0.98 |
| **DTT** | 2-methylthreitol | 0.36 | 8.32E-02 | 0.12 | 0.15 | 0.44 | 0.67 |
| **DTT** | 2-methylerythritol | 0.54 | 6.25E-03 | 1.42E-02 | 0.18 | 0.35 | 0.59 |
| **DTT** | 2-methylglyceric acid | 0.37 | 7.62E-02 | 0.11 | 0.35 | 6.17E-02 | 0.19 |
| **DTT** | cis-2-methyl-1,3,4-trihydroxy-1-butene | 0.38 | 6.84E-02 | 0.11 | 0.24 | 0.21 | 0.42 |
| **DTT** | 3-methyl-2,3,4-trihydroxy-1-butene | 0.42 | 4.24E-02 | 6.88E-02 | 0.29 | 0.13 | 0.31 |
| **DTT** | trans-2-methyl-1,3,4-trihydroxy-1-butene | 0.38 | 6.98E-02 | 0.11 | 0.49 | 6.82E-03 | 4.56E-02 |
| **DTT** | C5-alkene triols | 0.34 | 0.10 | 0.15 | 0.42 | 2.47E-02 | 9.79E-02 |
| **DTT** | 2-methyltetrols | 0.49 | 1.44E-02 | 2.74E-02 | 0.16 | 0.40 | 0.64 |
| **DTT** | 3-hydroxyglutaric acid | 0.28 | 0.19 | 0.27 | 0.57 | 1.13E-03 | 1.32E-02 |
| **DTT** | cis-pinonic acid | 0.33 | 0.12 | 0.17 | -0.10 | 0.60 | 0.77 |
| **DTT** | pinic acid | 0.27 | 0.20 | 0.28 | 0.25 | 0.19 | 0.39 |
| **DTT** | 3-methyl-1,2,3-butanetricarboxylic acid | 0.15 | 0.48 | 0.52 | -0.12 | 0.55 | 0.75 |
| **DTT** | β-caryophyllinic acid | 0.40 | 5.51E-02 | 8.67E-02 | 0.58 | 1.08E-03 | 1.32E-02 |
| **DTT** | glutaric acid derivative | 0.22 | 0.31 | 0.38 | 0.29 | 0.13 | 0.32 |
| **DTT** | 3-acetylpentanedioic acid | 0.69 | 1.69E-04 | 6.04E-04 | 0.35 | 6.09E-02 | 0.19 |
| **DTT** | 3-acetylhexanedioic acid | 0.59 | 2.39E-03 | 5.67E-03 | 0.50 | 6.32E-03 | 4.51E-02 |
| **DTT** | 3-isopropyl-pentanedioic acid | 0.54 | 6.45E-03 | 1.44E-02 | 0.47 | 1.04E-02 | 6.17E-02 |
| **DTT** | 2,3-dihydroxy-4-oxopentanoic acid | 0.65 | 6.34E-04 | 1.74E-03 | 0.55 | 1.83E-03 | 1.51E-02 |

**Table S12.** Spearman rank correlations for all $DCFH_v$ assay responses with all individual measurements.

| assay | feature | winter $R^2$ | winter p-value | winter BH p-value | summer $R^2$ | summer p-value | summer BH p-value |
|---|---|---|---|---|---|---|---|
| **DCFH** | total OC | 0.89 | 2.02E-11 | 4.32E-10 | 0.64 | 5.84E-05 | 6.94E-04 |
| **DCFH** | total EC | 0.80 | 8.64E-08 | 5.77E-07 | 0.20 | 0.28 | 0.45 |
| **DCFH** | $K^+$ | 0.86 | 4.11E-10 | 5.24E-09 | 0.53 | 1.98E-03 | 1.18E-02 |
| **DCFH** | $Na^+$ | 0.75 | 9.48E-07 | 5.63E-06 | 0.17 | 0.35 | 0.54 |
| **DCFH** | $Ca^{2+}$ | 0.47 | 8.62E-03 | 1.54E-02 | -0.10 | 0.59 | 0.74 |
| **DCFH** | $NH_4^+$ | 0.96 | 5.41E-17 | 5.79E-15 | 0.41 | 1.75E-02 | 5.50E-02 |
| **DCFH** | $NO_3^-$ | 0.91 | 5.98E-13 | 2.13E-11 | 0.62 | 1.14E-04 | 1.02E-03 |
| **DCFH** | $SO_4^{2-}$ | 0.93 | 9.51E-14 | 5.09E-12 | 0.77 | 1.89E-07 | 6.73E-06 |
| **DCFH** | $Cl^-$ | 0.86 | 4.41E-10 | 5.24E-09 | 0.08 | 0.66 | 0.78 |
| **DCFH** | Al | 0.68 | 2.22E-05 | 9.51E-05 | 0.24 | 0.18 | 0.35 |
| **DCFH** | Ti | 0.32 | 8.55E-02 | 0.10 | 0.21 | 0.25 | 0.43 |
| **DCFH** | V | 0.19 | 0.31 | 0.33 | 0.26 | 0.35 | 0.54 |
| **DCFH** | Cr | 0.68 | 2.48E-05 | 1.02E-04 | 0.16 | 0.39 | 0.58 |
| **DCFH** | Mn | 0.86 | 3.64E-10 | 5.24E-09 | 0.37 | 3.48E-02 | 9.99E-02 |
| **DCFH** | Fe | 0.77 | 5.07E-07 | 3.19E-06 | 0.20 | 0.25 | 0.43 |
| **DCFH** | Co | 0.73 | 2.89E-06 | 1.55E-05 | 0.50 | 0.67 | 0.78 |
| **DCFH** | Ni | 0.62 | 1.82E-04 | 6.48E-04 | -0.26 | 0.35 | 0.54 |
| **DCFH** | Cu | 0.69 | 1.54E-05 | 7.18E-05 | 0.36 | 6.87E-02 | 0.17 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **DCFH** | Zn | 0.84 | 8.10E-09 | 6.19E-08 | 0.63 | 8.19E-05 | 8.76E-04 |
| **DCFH** | Cd | 0.87 | 1.51E-10 | 2.70E-09 | 0.10 | 0.87 | 0.94 |
| **DCFH** | Sb | 0.81 | 4.20E-08 | 3.00E-07 | -0.21 | 0.59 | 0.74 |
| **DCFH** | Ba | 0.41 | 2.28E-02 | 3.44E-02 | -0.13 | 0.55 | 0.70 |
| **DCFH** | Pb | 0.90 | 9.75E-12 | 2.61E-10 | 0.63 | 9.23E-05 | 8.98E-04 |
| **DCFH** | galactosan | 0.57 | 7.39E-04 | 2.26E-03 | 0.44 | 1.10E-02 | 4.37E-02 |
| **DCFH** | mannosan | 0.57 | 8.21E-04 | 2.44E-03 | 0.42 | 1.58E-02 | 5.13E-02 |
| **DCFH** | levoglucosan | 0.58 | 6.71E-04 | 2.11E-03 | 0.42 | 1.55E-02 | 5.13E-02 |
| **DCFH** | ORG | 0.91 | 1.01E-09 | 1.08E-08 | 0.74 | 5.14E-06 | 9.16E-05 |
| **DCFH** | MOOOA | 0.90 | 3.09E-09 | 3.00E-08 | 0.50 | 5.86E-03 | 2.78E-02 |
| **DCFH** | LOOOA | 0.89 | 4.01E-09 | 3.30E-08 | 0.70 | 2.28E-05 | 3.05E-04 |
| **DCFH** | $O_3$ | -0.23 | 0.21 | 0.24 | 0.33 | 6.00E-02 | 0.15 |
| **DCFH** | CO | 0.27 | 0.13 | 0.16 | 0.20 | 0.25 | 0.43 |
| **DCFH** | NO | 0.44 | 1.34E-02 | 2.13E-02 | -0.24 | 0.18 | 0.35 |
| **DCFH** | $NO_2$ | 0.32 | 8.07E-02 | 0.10 | -0.02 | 0.91 | 0.95 |
| **DCFH** | $NO_y$ | 0.40 | 2.51E-02 | 3.73E-02 | -0.09 | 0.63 | 0.76 |
| **DCFH** | $SO_2$ | 0.37 | 3.83E-02 | 5.19E-02 | 0.26 | 0.14 | 0.29 |
| **DCFH** | RH8 | 0.71 | 8.94E-06 | 4.35E-05 | 0.23 | 0.22 | 0.40 |
| **DCFH** | RH120 | 0.69 | 1.67E-05 | 7.46E-05 | 0.27 | 0.13 | 0.28 |
| **DCFH** | RH240 | 0.65 | 7.07E-05 | 2.80E-04 | 0.28 | 0.13 | 0.28 |
| **DCFH** | T8 | 0.25 | 0.18 | 0.21 | 0.25 | 0.18 | 0.35 |
| **DCFH** | T120 | 0.24 | 0.19 | 0.21 | 0.21 | 0.26 | 0.43 |
| **DCFH** | T240 | 0.23 | 0.21 | 0.24 | 0.17 | 0.36 | 0.55 |
| **DCFH** | methanol | 0.57 | 1.61E-02 | 2.53E-02 | 0.15 | 0.41 | 0.59 |
| **DCFH** | acetonitrile | 0.59 | 1.21E-02 | 1.99E-02 | 0.37 | 4.16E-02 | 0.11 |
| **DCFH** | acetaldehyde | 0.67 | 3.01E-03 | 7.66E-03 | 0.28 | 0.13 | 0.28 |
| **DCFH** | acrolein | 0.63 | 9.41E-03 | 1.65E-02 | -0.08 | 0.68 | 0.79 |
| **DCFH** | acetone | 0.67 | 3.01E-03 | 7.66E-03 | 0.32 | 8.03E-02 | 0.19 |
| **DCFH** | isoprene | 0.65 | 4.78E-03 | 1.00E-02 | -0.42 | 2.02E-02 | 6.16E-02 |
| **DCFH** | methyl vinyl ketone /methacrolein | 0.62 | 7.61E-03 | 1.38E-02 | -0.29 | 0.11 | 0.24 |
| **DCFH** | methyl ethyl ketone | -0.14 | 0.59 | 0.62 | 0.33 | 7.14E-02 | 0.17 |
| **DCFH** | benzene | 0.64 | 5.68E-03 | 1.11E-02 | 0.14 | 0.44 | 0.62 |
| **DCFH** | toluene | 0.66 | 3.81E-03 | 8.67E-03 | 0.14 | 0.46 | 0.62 |
| **DCFH** | C2-benzenes | 0.66 | 3.99E-03 | 8.71E-03 | 0.02 | 0.91 | 0.95 |
| **DCFH** | C3-benzenes | 0.51 | 4.98E-02 | 6.58E-02 | -0.08 | 0.69 | 0.79 |
| **DCFH** | J $O^1D$ | 0.22 | 0.25 | 0.27 | 0.13 | 0.46 | 0.62 |
| **DCFH** | J $NO_2$ | 0.23 | 0.23 | 0.25 | 0.14 | 0.43 | 0.62 |
| **DCFH** | naphthalene | 0.82 | 3.31E-04 | 1.07E-03 | -0.16 | 0.51 | 0.67 |
| **DCFH** | acenaphthylne | 0.57 | 3.20E-02 | 4.44E-02 | -0.01 | 0.99 | 0.99 |
| **DCFH** | acenaphthene | 0.59 | 2.60E-02 | 3.81E-02 | 0.06 | 0.85 | 0.92 |
| **DCFH** | fluorene | 0.70 | 5.21E-03 | 1.03E-02 | 0.02 | 0.95 | 0.97 |
| **DCFH** | phenanthrene | 0.70 | 5.21E-03 | 1.03E-02 | 0.36 | 0.12 | 0.25 |
| **DCFH** | fluoranthene | 0.78 | 9.94E-04 | 2.88E-03 | 0.58 | 7.29E-03 | 3.25E-02 |
| **DCFH** | pyrene | 0.77 | 1.23E-03 | 3.47E-03 | 0.48 | 3.23E-02 | 9.61E-02 |
| **DCFH** | benzo(a)anthracene | 0.59 | 2.74E-02 | 3.96E-02 | 0.28 | 0.24 | 0.43 |
| **DCFH** | chrysene | 0.82 | 3.31E-04 | 1.07E-03 | 0.60 | 5.16E-03 | 2.63E-02 |
| **DCFH** | benzo(b)fluoranthene | 0.86 | 8.20E-05 | 3.03E-04 | 0.67 | 1.21E-03 | 7.62E-03 |
| **DCFH** | benzo(k)fluoranthene | 0.86 | 8.20E-05 | 3.03E-04 | 0.55 | 1.19E-02 | 4.56E-02 |
| **DCFH** | benzo(a)pyrene | 0.49 | 7.83E-02 | 9.85E-02 | 0.60 | 5.16E-03 | 2.63E-02 |
| **DCFH** | indeno(1,2,3-cd)pyrene | 0.72 | 3.78E-03 | 8.67E-03 | 0.54 | 1.34E-02 | 4.77E-02 |
| **DCFH** | dibenzo(a,h)-anthracene | 0.69 | 6.07E-03 | 1.16E-02 | 0.30 | 0.20 | 0.37 |
| **DCFH** | benzo(ghi)perylene | 0.72 | 3.48E-03 | 8.38E-03 | 0.18 | 0.46 | 0.62 |
| **DCFH** | C24 | 0.48 | 6.40E-03 | 1.20E-02 | -0.42 | 1.58E-02 | 5.13E-02 |
| **DCFH** | C25 | 0.47 | 7.32E-03 | 1.35E-02 | -0.34 | 5.42E-02 | 0.14 |
| **DCFH** | C26 | 0.50 | 3.94E-03 | 8.71E-03 | -0.11 | 0.54 | 0.70 |
| **DCFH** | C27 | 0.45 | 1.05E-02 | 1.79E-02 | 0.04 | 0.84 | 0.92 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **DCFH** | C28 | 0.51 | 3.46E-03 | 8.38E-03 | 0.19 | 0.29 | 0.46 |
| **DCFH** | C29 | 0.54 | 1.72E-03 | 4.71E-03 | 0.31 | 7.53E-02 | 0.18 |
| **DCFH** | C30 | 0.50 | 4.32E-03 | 9.25E-03 | 0.13 | 0.47 | 0.63 |
| **DCFH** | C31 | 0.52 | 2.70E-03 | 7.23E-03 | -0.01 | 0.97 | 0.98 |
| **DCFH** | C32 | 0.51 | 3.52E-03 | 8.38E-03 | -0.02 | 0.90 | 0.95 |
| **DCFH** | C33 | 0.37 | 3.83E-02 | 5.19E-02 | 0.24 | 0.19 | 0.35 |
| **DCFH** | C34 | 0.42 | 1.85E-02 | 2.87E-02 | -0.06 | 0.75 | 0.85 |
| **DCFH** | OH | 0.03 | 0.92 | 0.93 | 0.02 | 0.92 | 0.95 |
| **DCFH** | $HO_2$ | 0.05 | 0.88 | 0.90 | -0.10 | 0.61 | 0.76 |
| **DCFH** | $RO_2$ | -0.02 | 0.95 | 0.95 | 0.09 | 0.63 | 0.76 |
| **DCFH** | palmitic acid | 0.07 | 0.71 | 0.73 | -0.05 | 0.79 | 0.89 |
| **DCFH** | stearic acid | 0.11 | 0.56 | 0.59 | 0.04 | 0.81 | 0.90 |
| **DCFH** | cholesterol | 0.21 | 0.26 | 0.28 | 0.45 | 8.19E-03 | 3.37E-02 |
| **DCFH** | 17a(H)-22,29,30-trisnorhopane (C27a) | 0.45 | 1.32E-02 | 2.13E-02 | -0.09 | 0.63 | 0.76 |
| **DCFH** | 17b(H),21a(H)-norhopane (C30ba) | 0.45 | 1.21E-02 | 1.99E-02 | -0.16 | 0.37 | 0.55 |
| **DCFH** | 2-methylthreitol | 0.38 | 6.37E-02 | 8.11E-02 | 0.46 | 1.24E-02 | 4.59E-02 |
| **DCFH** | 2-methylerythritol | 0.55 | 5.15E-03 | 1.03E-02 | 0.50 | 5.97E-03 | 2.78E-02 |
| **DCFH** | 2-methylglyceric acid | 0.45 | 2.92E-02 | 4.12E-02 | 0.62 | 2.92E-04 | 2.41E-03 |
| **DCFH** | cis-2-methyl-1,3,4-trihydroxy-1-butene | 0.36 | 8.16E-02 | 0.10 | 0.39 | 3.64E-02 | 9.99E-02 |
| **DCFH** | 3-methyl-2,3,4-trihydroxy-1-butene | 0.34 | 0.10 | 0.12 | 0.32 | 8.88E-02 | 0.20 |
| **DCFH** | trans-2-methyl-1,3,4-trihydroxy-1-butene | 0.45 | 2.89E-02 | 4.12E-02 | 0.72 | 1.02E-05 | 1.55E-04 |
| **DCFH** | C5-alkene triols | 0.40 | 5.33E-02 | 6.96E-02 | 0.61 | 4.88E-04 | 3.73E-03 |
| **DCFH** | 2-methyltetrols | 0.52 | 9.76E-03 | 1.68E-02 | 0.48 | 7.77E-03 | 3.33E-02 |
| **DCFH** | 3-hydroxyglutaric acid | 0.41 | 4.79E-02 | 6.41E-02 | 0.58 | 8.98E-04 | 6.00E-03 |
| **DCFH** | cis-pinonic acid | 0.34 | 0.11 | 0.13 | -0.20 | 0.29 | 0.46 |
| **DCFH** | pinic acid | 0.39 | 6.30E-02 | 8.11E-02 | 0.39 | 3.56E-02 | 9.99E-02 |
| **DCFH** | 3-methyl-1,2,3-butanetricarboxylic acid | 0.28 | 0.18 | 0.21 | -0.02 | 0.92 | 0.95 |
| **DCFH** | β-caryophyllinic acid | 0.47 | 2.03E-02 | 3.11E-02 | 0.82 | 4.82E-08 | 2.58E-06 |
| **DCFH** | glutaric acid derivative | 0.32 | 0.13 | 0.15 | 0.55 | 2.22E-03 | 1.25E-02 |
| **DCFH** | 3-acetylpentanedioic acid | 0.89 | 4.01E-09 | 3.30E-08 | 0.58 | 8.98E-04 | 6.00E-03 |
| **DCFH** | 3-acetylhexanedioic acid | 0.79 | 3.81E-06 | 1.94E-05 | 0.77 | 1.28E-06 | 2.74E-05 |
| **DCFH** | 3-isopropylpentanedioic acid | 0.69 | 2.15E-04 | 7.40E-04 | 0.77 | 1.18E-06 | 2.74E-05 |
| **DCFH** | 2,3-dihydroxy-4-oxopentanoic acid | 0.81 | 1.58E-06 | 8.91E-06 | 0.89 | 8.16E-11 | 8.73E-09 |

# **Section S8:** Multivariate modelling (mass-normalised data only)

## PCA model

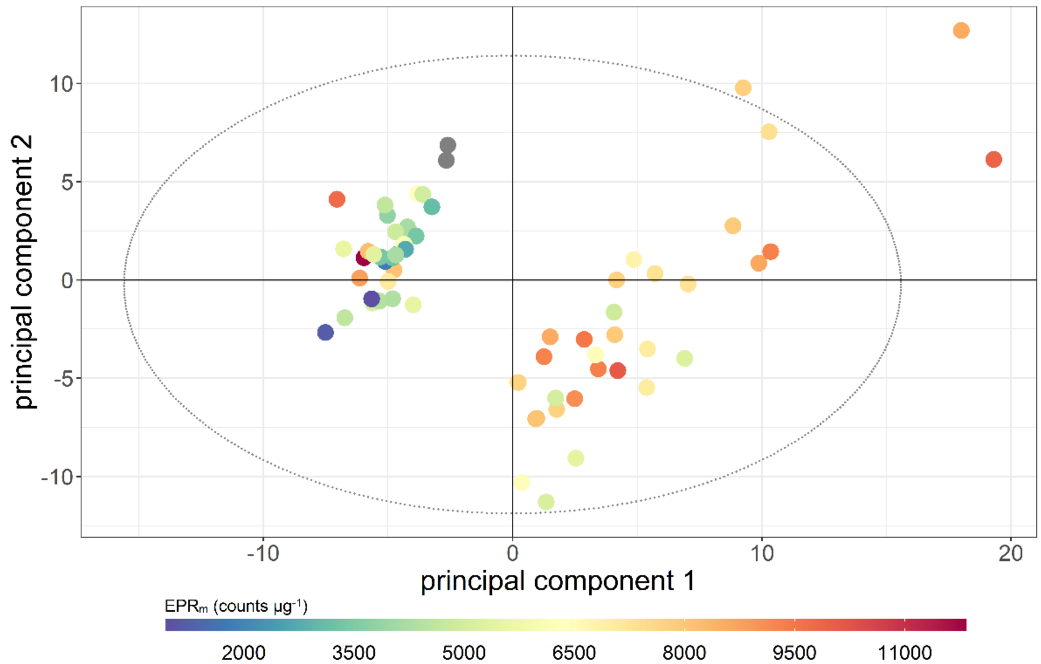


**Figure S14.** PCA scores plot coloured by $EPR_m$ response. PC 1 $R^2X$ 35.0%, $Q^2$ 28.4%; PC 2 $R^2X$ 19.4%, $Q^2$ 19.7 PC 1 $R^2X$ 35.9%, $Q^2$ 29.3%; PC 2 $R^2X$ 19.3%, $Q^2$ 23.7%; the model included four principal components, with a cumulative $R^2X$ of 68.2% and $Q^2$ of 50.5%.

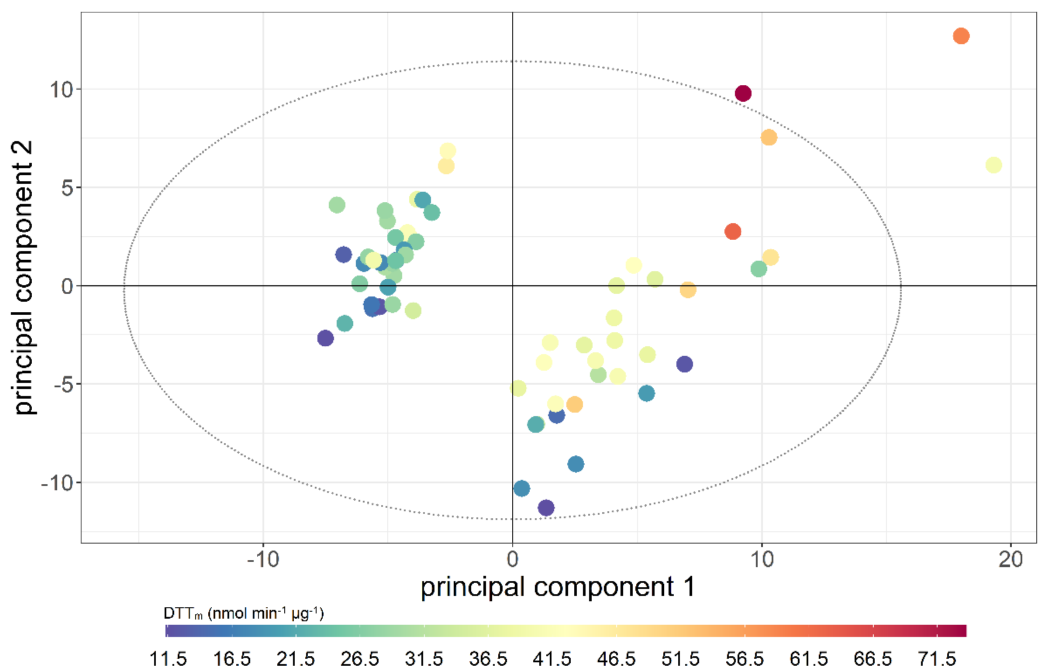


**Figure S15.** PCA scores plot coloured by $DTT_m$ assay response. Performance parameters same as Figure S14.

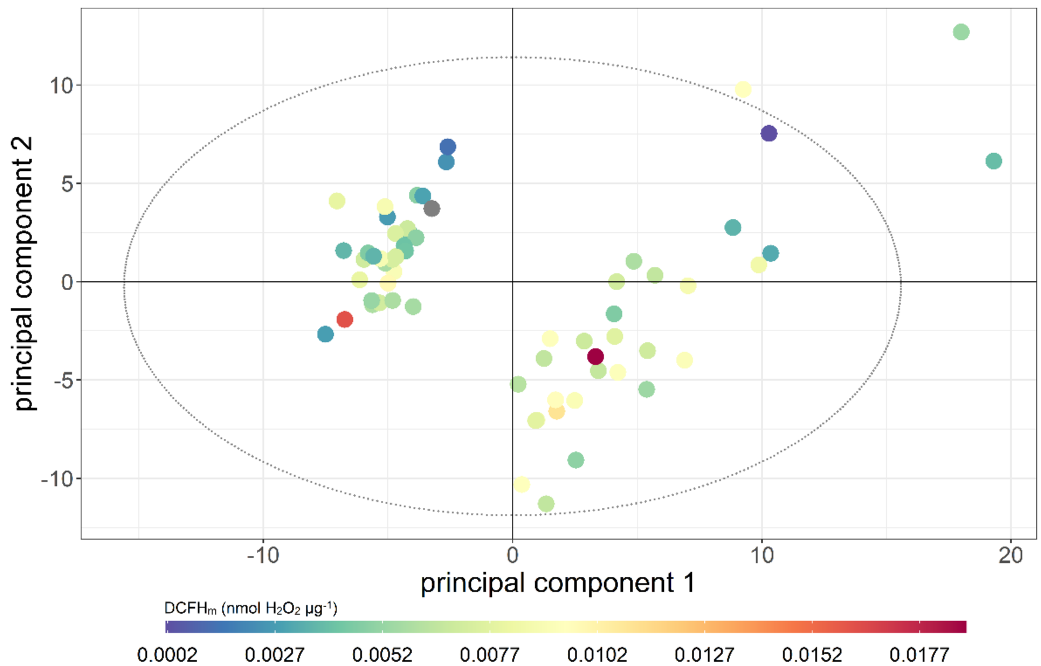


**Figure S16.** PCA scores plot coloured by $DCFH_m$ assay response. Performance parameters same as Figure S14.

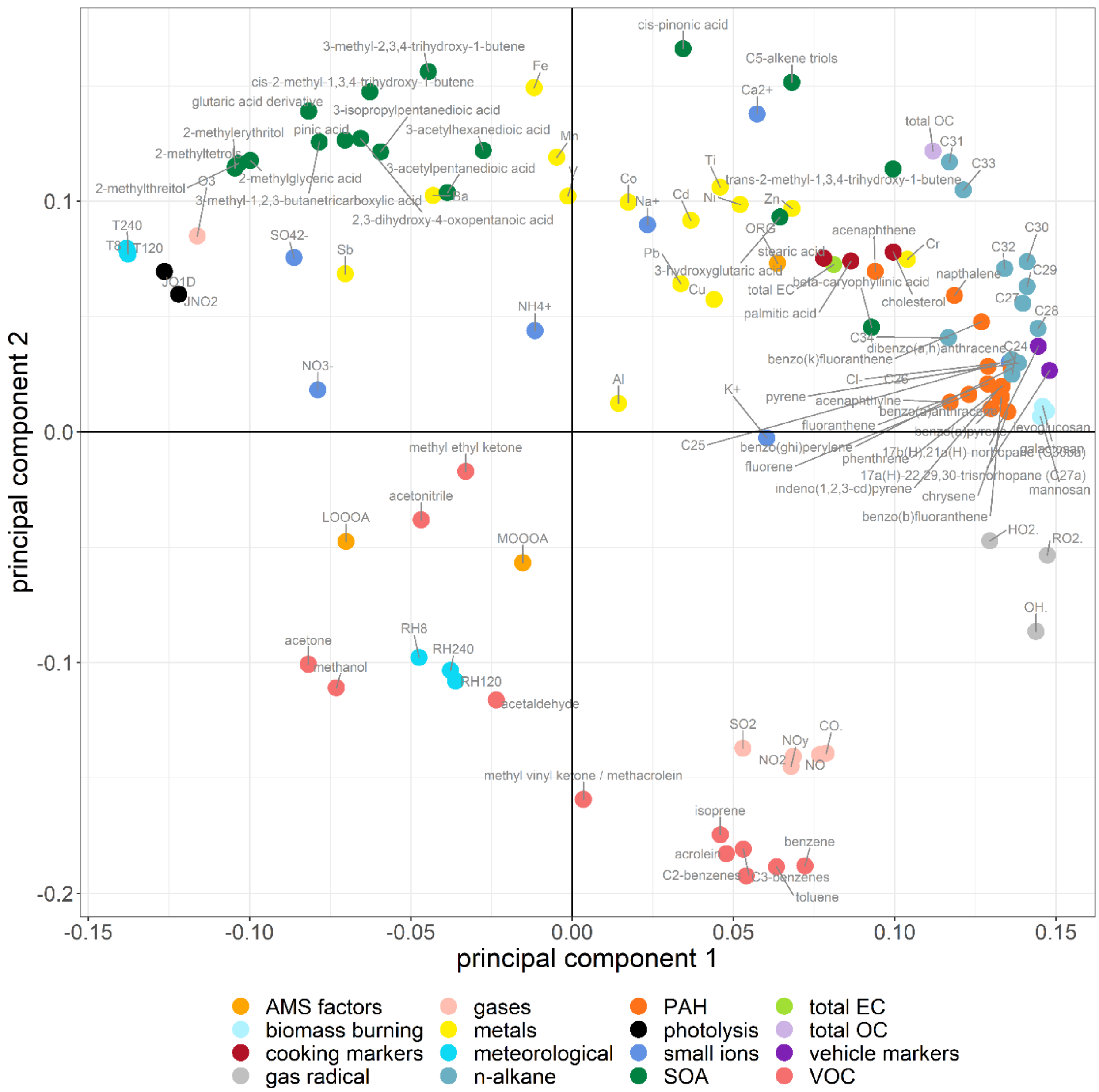


**Figure S17.** Principal components analysis loading plot for all data points. Points are coloured by measurement category.

# PLSR models

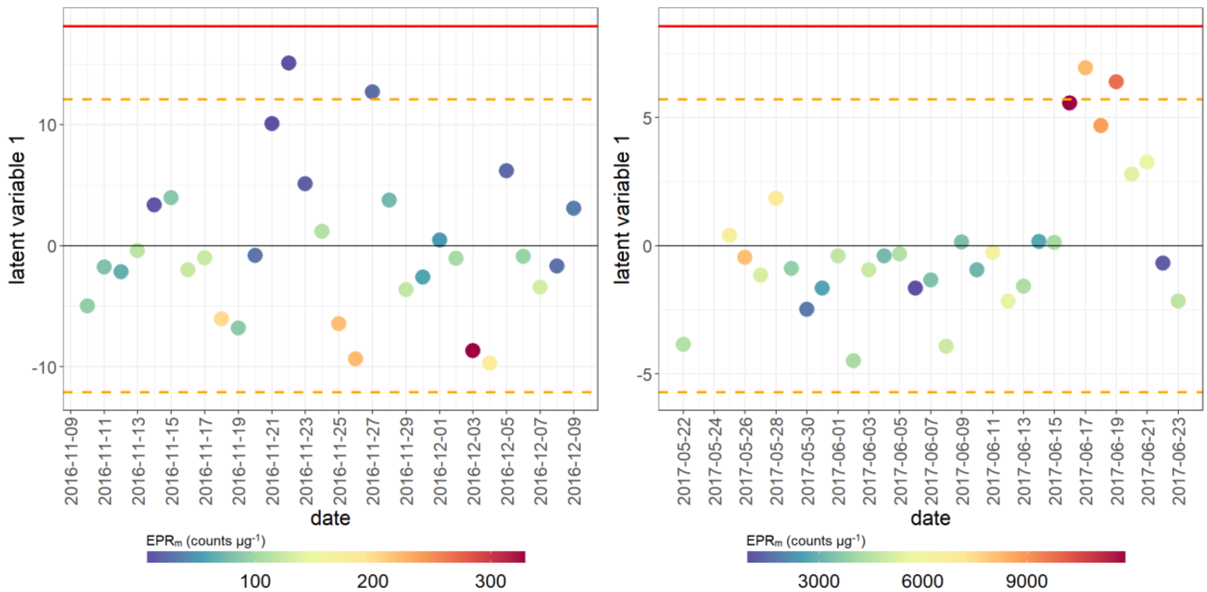


**Figure S18.** PLSR scores plots for $EPR_m$ assay. Left: winter samples, LV 1 $R^2Y$ 43.2%, $Q^2$ 19.3%; right: summer samples LV 1 $R^2Y$ 11.3%, $Q^2$ -10.0%. Models optimised to a single latent variable only.

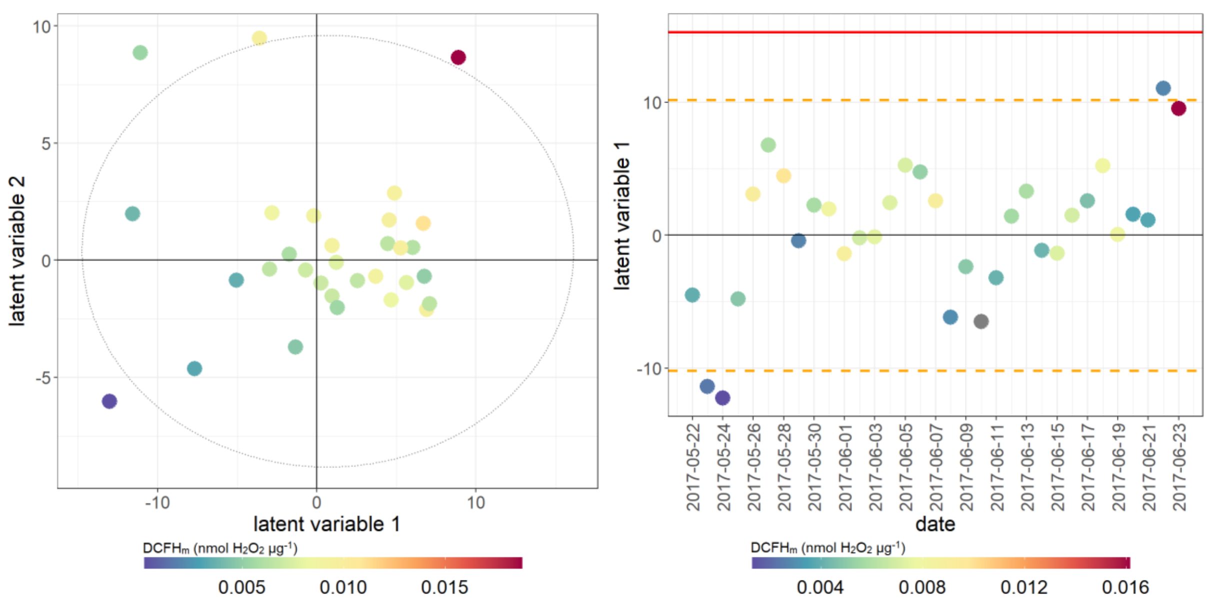


**Figure S19.** PLSR scores plot for $DCFH_m$ assay. Left: winter samples, optimised to two latent variables; LV 1 $R^2Y$ 40.8%, $Q^2$ 21.9%, LV 2 $R^2Y$ 31.2%, $Q^2$ 36.5% (second component slightly overfits model); right: summer samples, optimised to one latent variable; LV 1 $R^2Y$ 28.2%, $Q^2$ -6.6%.

# VIP plots

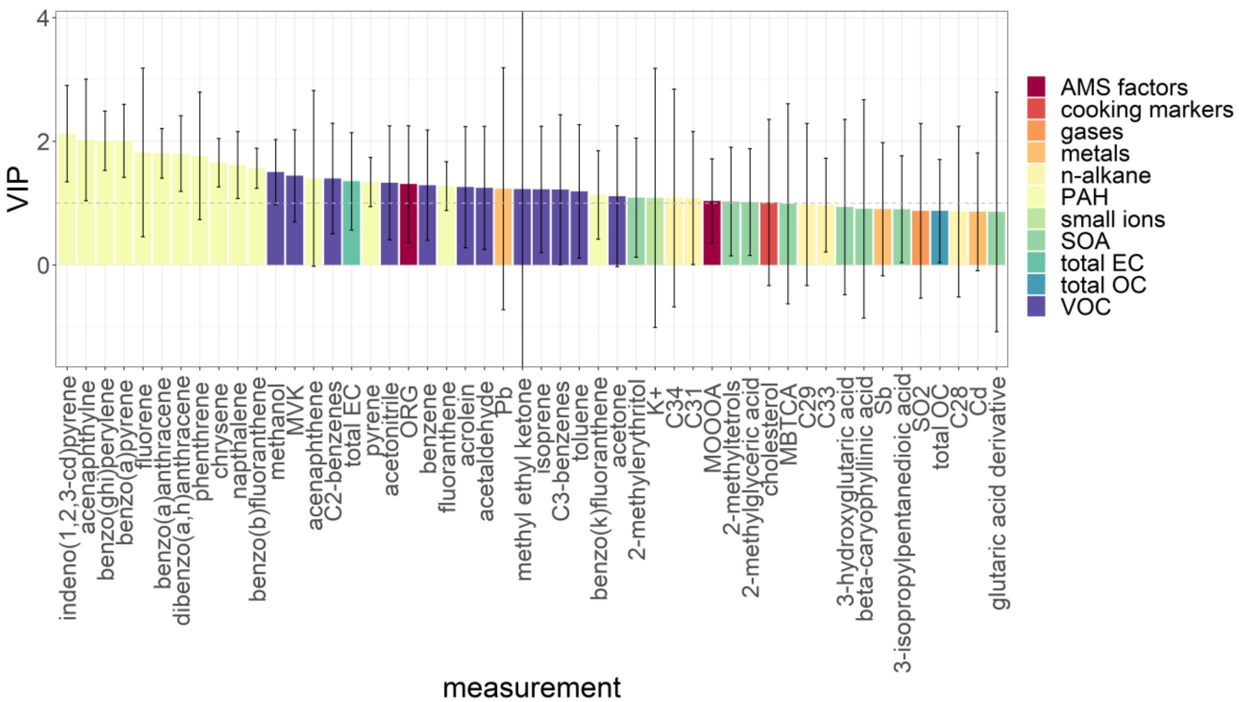


**Figure S20.** Variable importance in projection (VIP) plot for winter $EPR_m$ PLSR model (top 50 features only). Error bars represent the standard error or the mean for each feature, and are often large due to the intrinsic noisiness and instability of the individual measurements. Terms with VIP > 1 contribute most significantly to the model. **Abbreviations:** 3MTHB: 3-methyl-2,3,4-trihydroxy-1-butene; C2MTHB: cis-2-methyl-1,3,4-trihydroxy-1-butene; T2MTHB: trans-2-methyl-1,3,4-trihydroxy-1-butene; 17a-TNH:17a(H)-22,29,30-trisnorhopane (C27a); 17b-NH: 17b(H),21a(H)-norhopane (C30ba); MVK: methyl vinyl ketone or methacrolein.

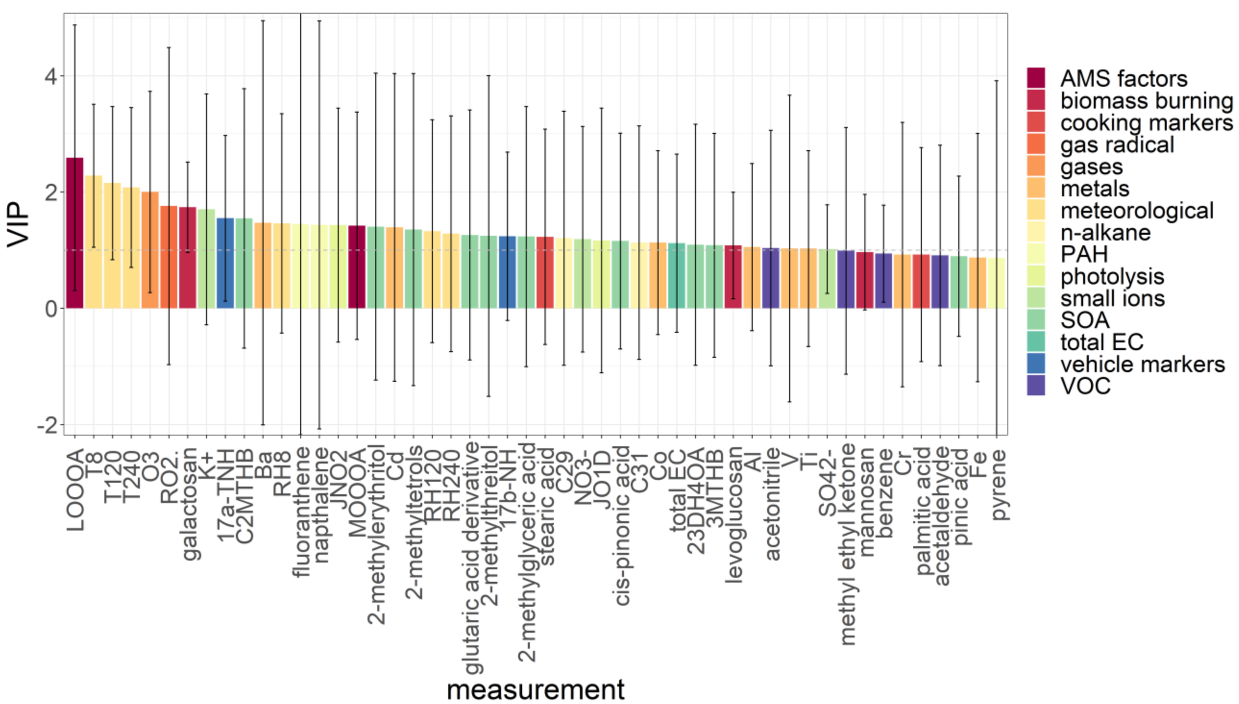


**Figure S21.** Variable importance in projection (VIP) plot for summer $EPR_m$ PLSR model (top 50 features only).

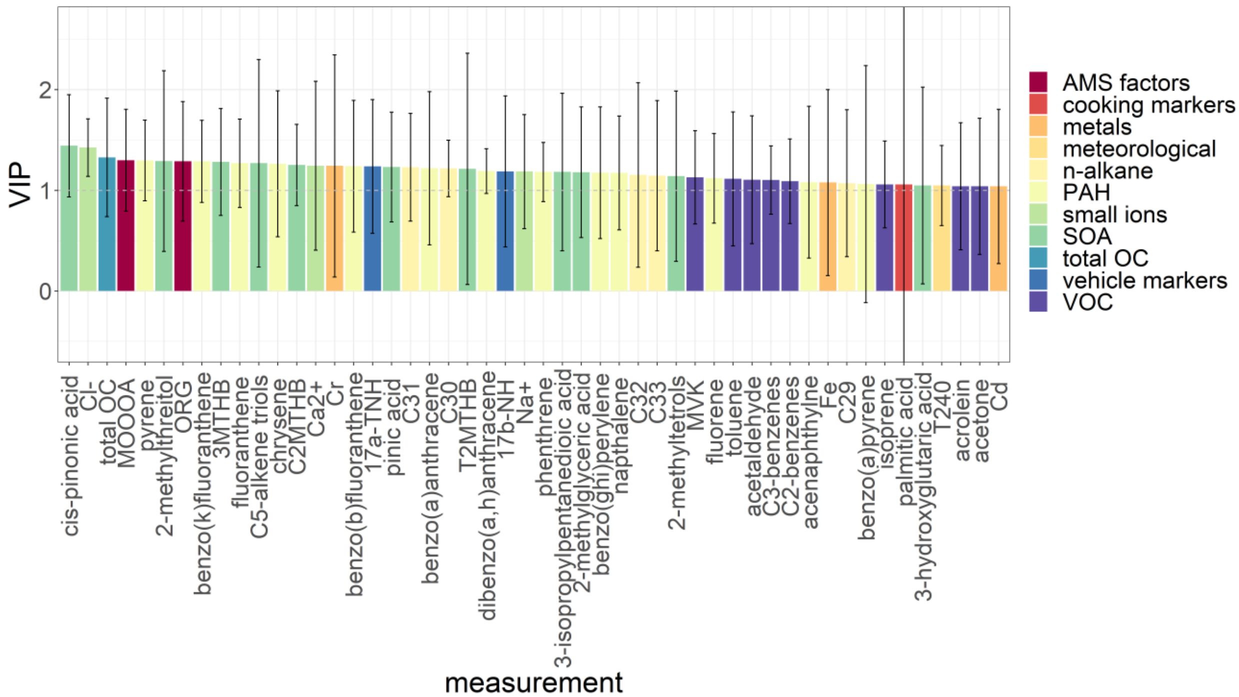

**Figure S22.** Variable importance in projection (VIP) plot for winter $AA_m$ PLSR model (top 50 features only). Reproduced from main text for clarity.

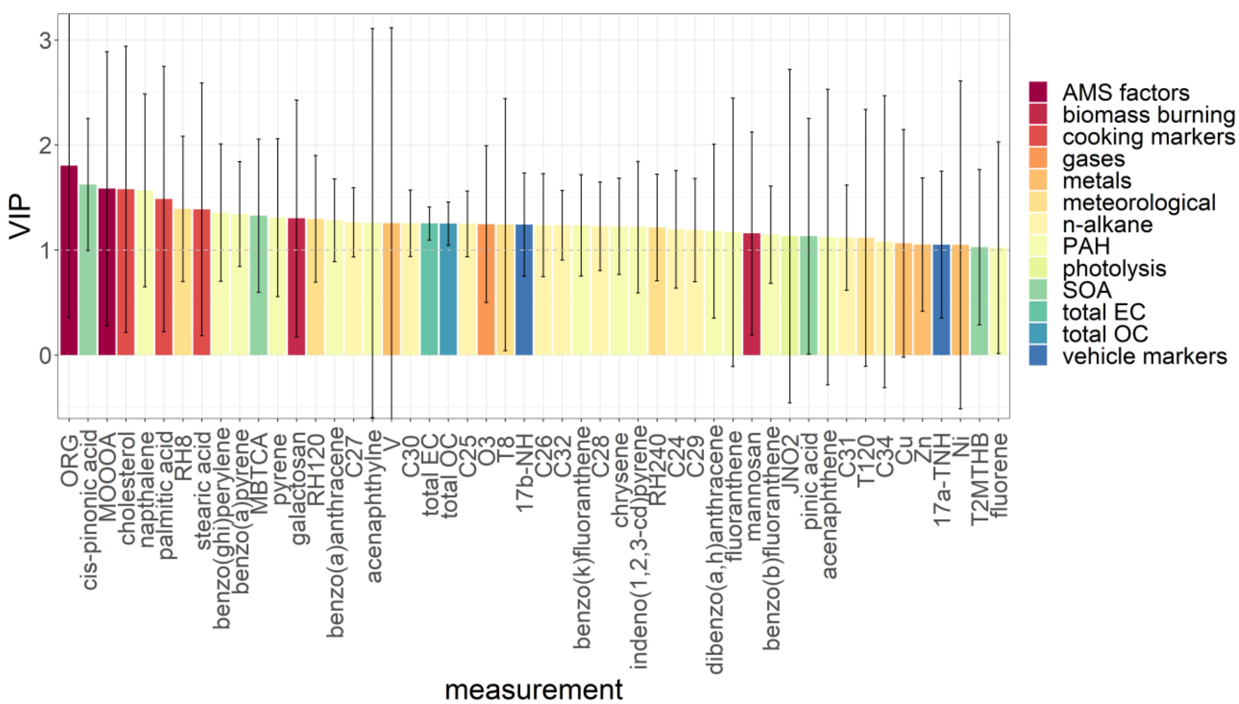

**Figure S23.** Variable importance in projection (VIP) plot for summer $AA_m$ PLSR model (top 50 features only).

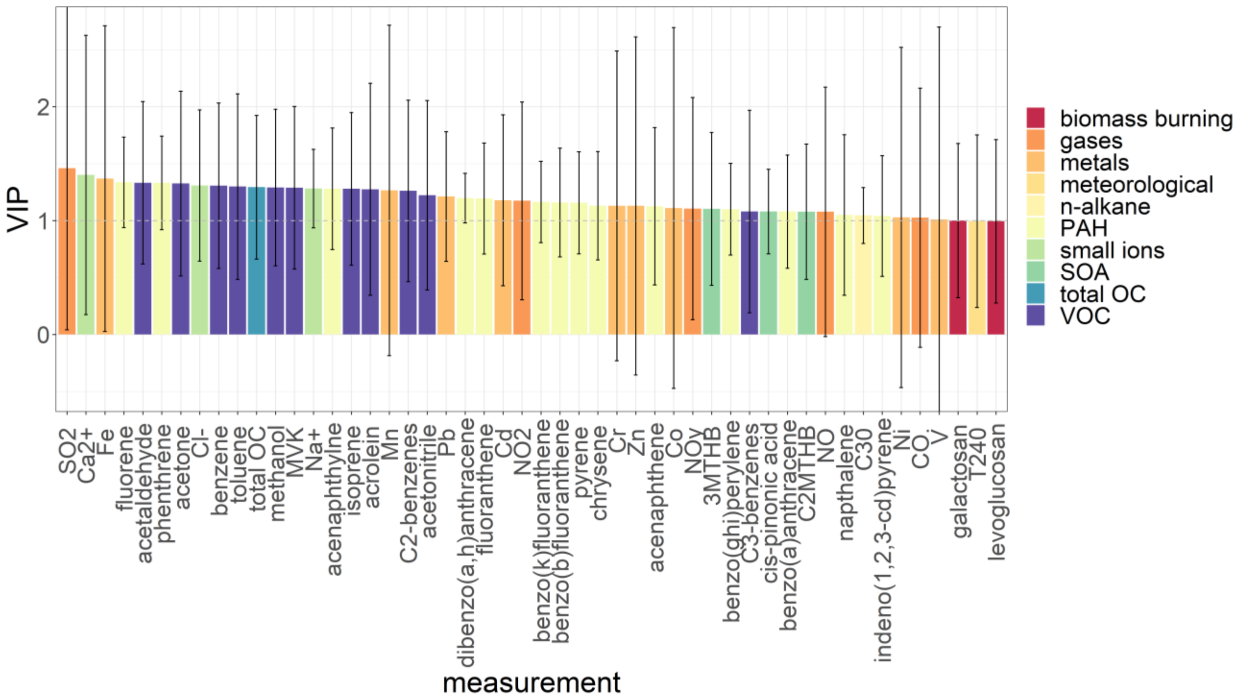


**Figure S24.** Variable importance in projection (VIP) plot for winter $DTT_m$ PLSR model (top 50 features only). Reproduced from main text for clarity.

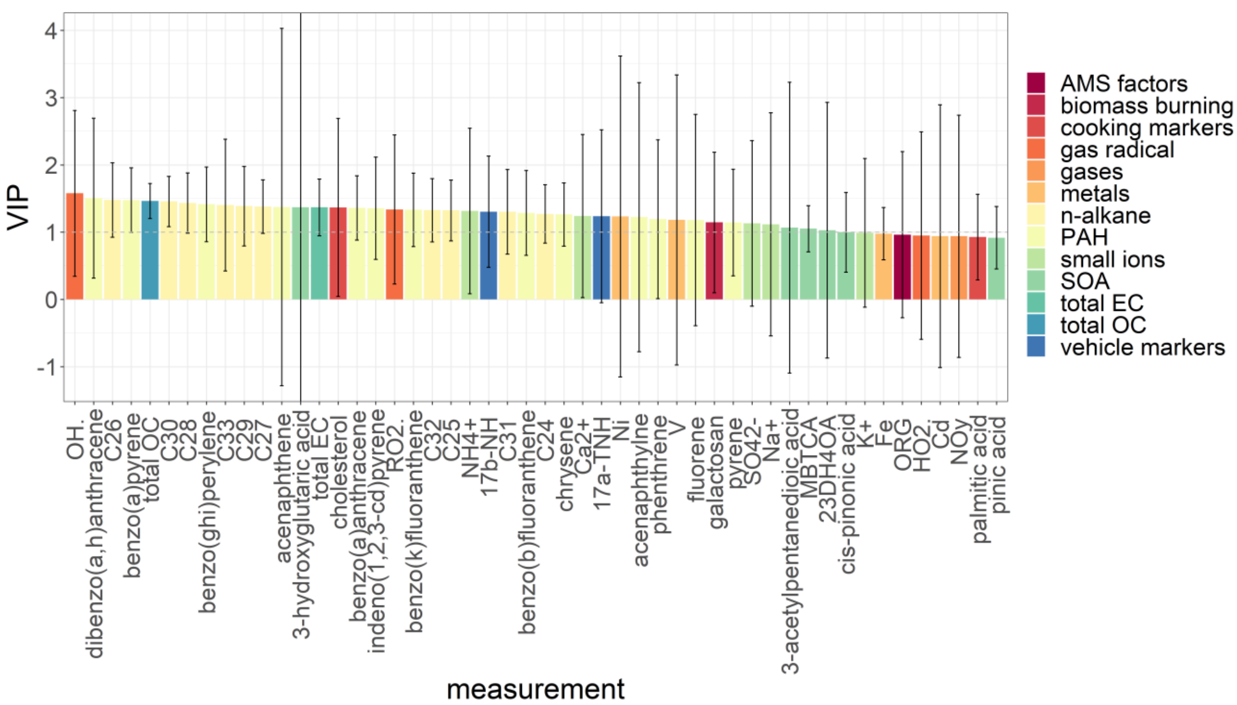


**Figure S25.** Variable importance in projection (VIP) plot for summer $DTT_m$ PLSR model (top 50 features only).

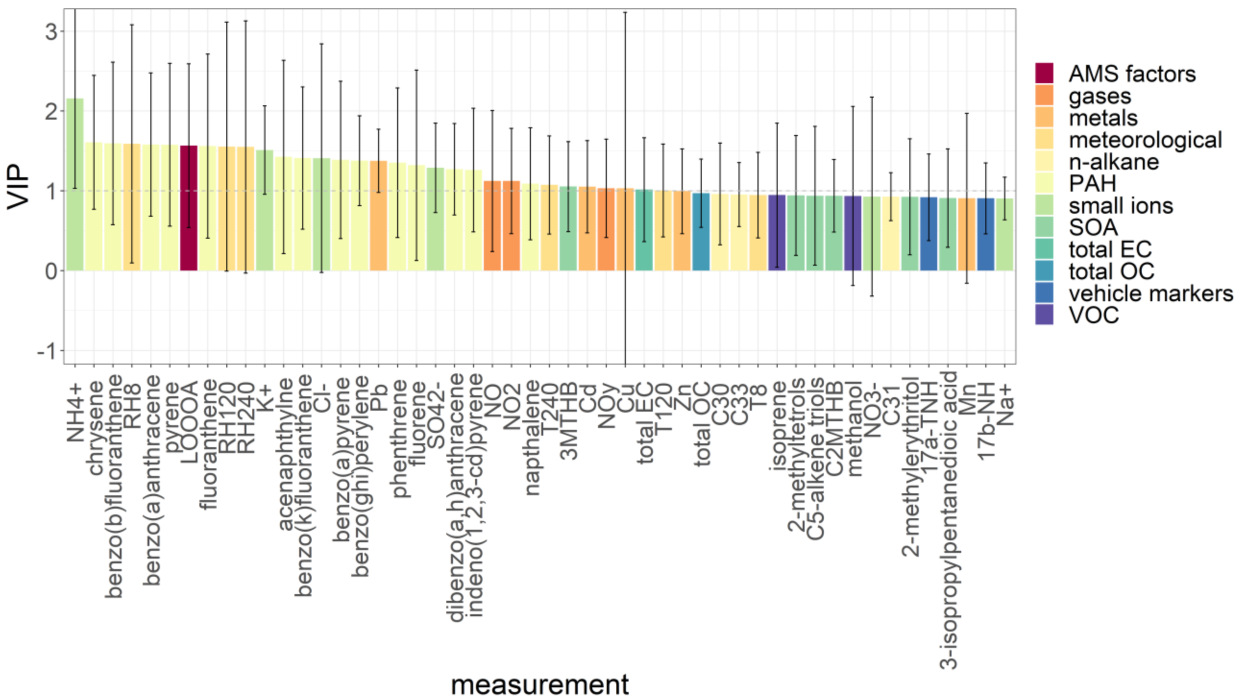


**Figure S26.** Variable importance in projection (VIP) plot for winter $DCFH_m$ PLSR model (top 50 features only).

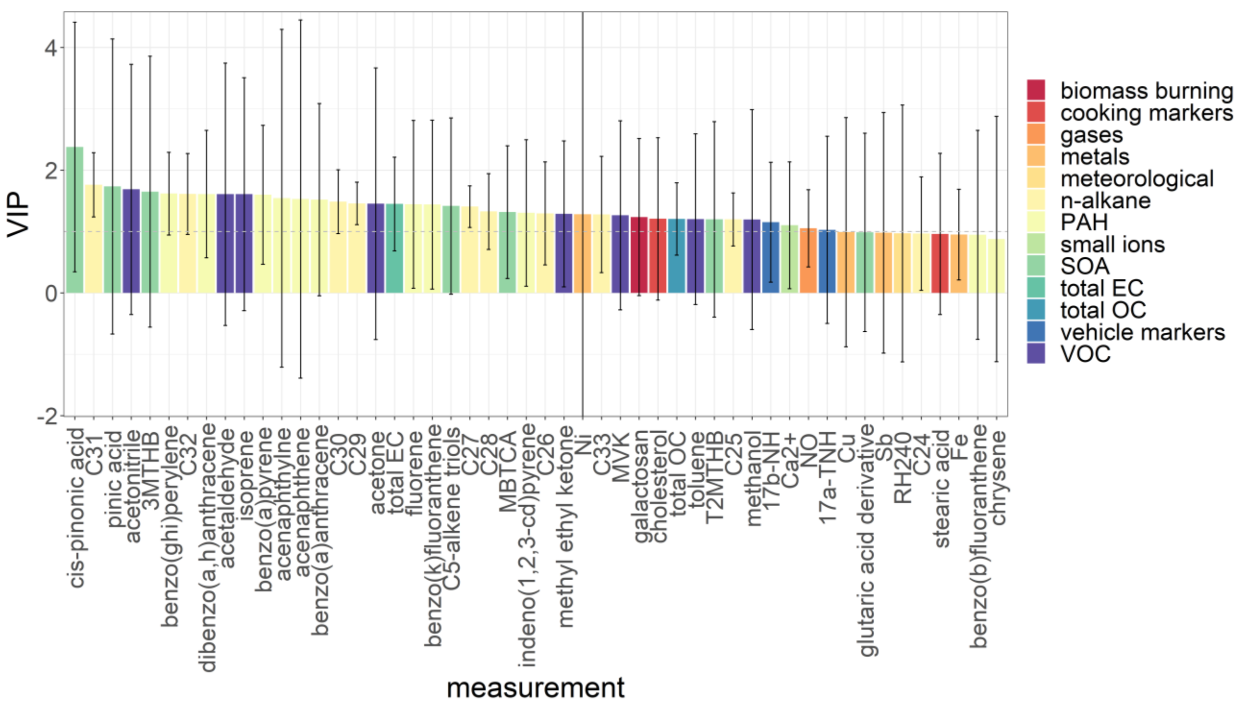


**Figure S27.** Variable importance in projection (VIP) plot for summer $DCFH_m$ PLSR model (top 50 features only).

# **Section S9:** SPECIEUROPE database search methods

A combination of literature search and the SPECIEUROPE database (Pernigotti et al., 2016) was used to derive subsets of individual measurements for multiple linear regression modelling. The aim of this analysis was to putatively identify the influence of known PM sources on the OP assay responses. The same panel was used for both mass-normalised and volume-normalised data model derivation. The SPECIEUROPE database was downloaded in csv format from https://source-apportionment.jrc.ec.europa.eu/Specieurope/profiles.aspx?source=999 (accessed on 25 May 2020) and imported into R for manipulation. All database sampling locations and dates were included, as any relevant components of a source type were potentially of interest, and single components (e.g. potassium) could be included across multiple source types (e.g. cement, salt, biomass burning, exhaust). The SPECIATE database (Simon et al., 2010) (https://www.epa.gov/sites/production/files/2020-07/speciate_5.1_0.zip) was considered for use, but is very extensive, making database investigation and search term collation less straightforward.

The source categories were derived from common categories observed in the literature. Soil was considered for a separate category; however, insufficient information was available as to whether this would be a relevant influence on the urban sampling site, and the models produced were poor, and thus this category was not pursued further. To obtain the broad category subsets, a list of search terms was manually constructed using the "Name" and "Specie" columns from the database, which both had to be manually relabelled to ensure exact match of search words (due to spelling inconsistencies). The search terms used for the "Name" column included (in no particular order): "brake", "car", "wood", "fire", "fireplace", "fuel", "combustion", "coal", "dust", "vehicle", "exhaust", "burn" and/or "burning", "power", "urban", "suburban", "road", "taxi", "tire" and/or "tyre", "traffic". To simplify subsets, the following terms were excluded, which were related mainly to agricultural and heavy/light industrial processes: "aluminium", "asphalt", "bronze", "CaCl2", "ceramic", "cruise", "crustal", "fertilizer", "frit", "harbour", "industry" and/or "industrial", "lignite", "lime", "metal", "mill", "nitrate", "olive", "ore", "pellet", "petrochem*", "phosphate", "plant", "poor state of pavement", "production", "rock", "salt", "ship", "slag", "steel", "tile", "tobacco", "works". All entries containing any of these terms in the "Name" field were removed from further analysis. Of the remaining entries, compounds in the "Specie" field were relabelled to match labelling of the collated APHH dataset columns, and 51 compounds could be matched between the APHH dataset and the reduced SPECIEUROPE database.

The filtered entries were then assigned manually to match each of the six specified source categories. "Vehicle emissions" included all Name entries containing "brake", "car", "fuel", "combustion", "vehicle", "exhaust", "road", "taxi", "tire" and/or "tyre", "traffic". "Biomass burning" included "wood", "fire", all terms including "fireplace", "fuel", "combustion", "burn" and/or "burning". "Coal/fossil fuel combustion", included all terms containing "boiler", "fireplace", "fuel", "combustion", "burn" and/or "burning", "power". "Dust" included most Name entries containing "dust", including "ammonium nitrate (secondary)", "ammonium sulfate (secondary)", "salt marine", "soil dust", "NaCl", "CaCl2", "MgCl2", and "Mix of NaCl and CaCl2". Both "cooking markers" and "biogenic SOA" associated categories (e.g. categories relating to "soil" and "burning leaves" were deemed to be too broad and not representative of biogenic SOA; no cooking categories are included in the database) were derived purely from literature sources as they are poorly represented in the SPECIEUROPE database. A full breakdown of which measurements were included in the final model panel for each source category is given in **Table S13**, with reasons for feature non-selection and literature sources used.

The final list of subsets was then again examined manually, and compounds which were less representative of the source category removed. Any features missing more than 33% of the season measurements were excluded after the initial round of modelling if replacement by the median was observed to exert a strong influence on the MLR model residuals. Residuals were examined for bias with respect to sample order and distribution, and most sample order bias was related to missing measurements, which tended to be at the beginning and end of each season. All models were visualised with plots (example in **Figure S28**), which gave the predicted vs. actual OP assay response values (error bars indicate variability of the predicted response over 500 rounds of bootstrapped cross-validation of the model), residuals plotted with respect to run order, the variability of feature coefficients through model cross-validation, the stacked concentration data over the season sampling period, and kernel density distributions of residuals. Final models for the mass-normalised data are provided in **Tables S14-S21**. All concentrations were expressed as μg/μg or μg/m$^3$ and converted from ng where appropriate.

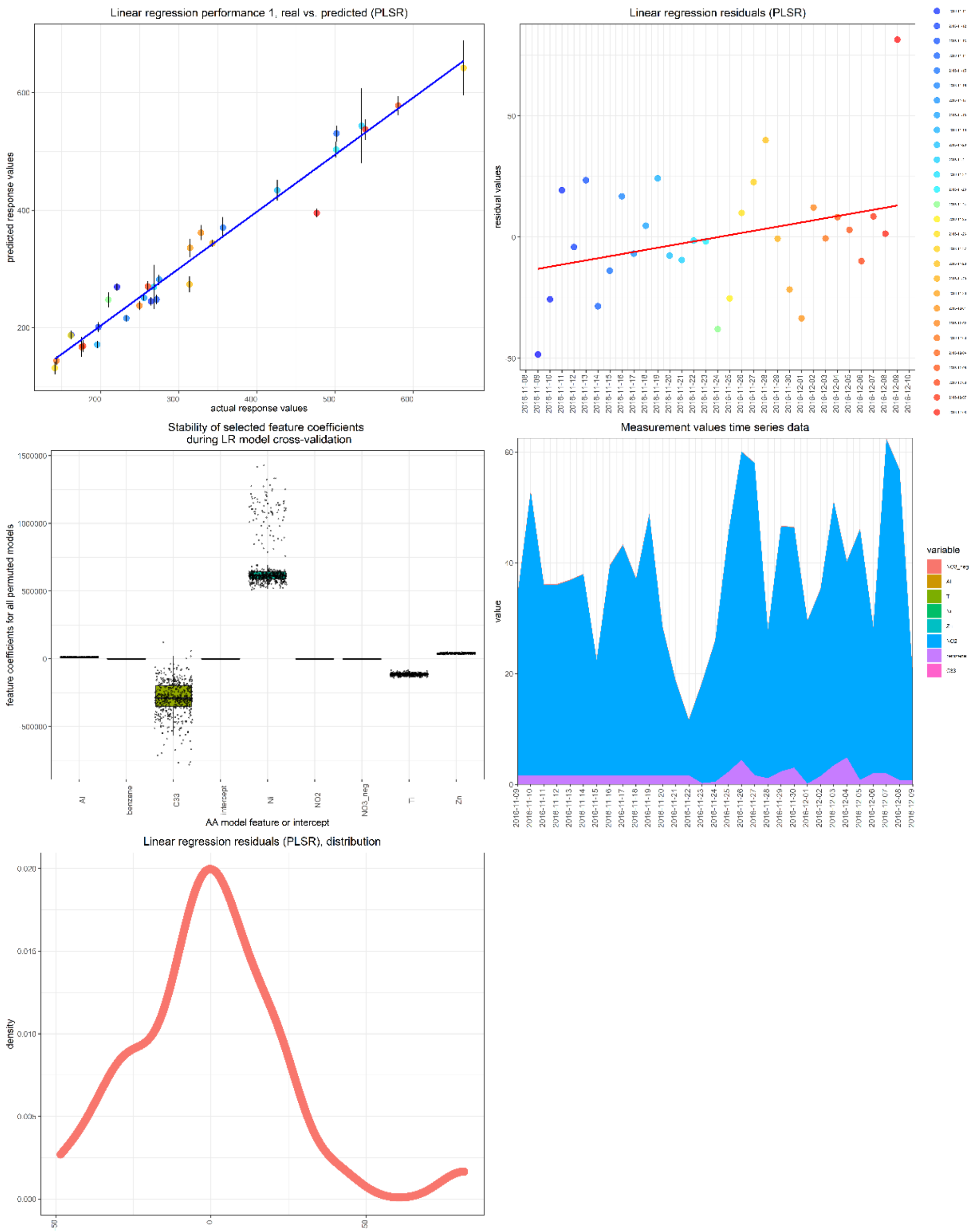


**Figure S28.** Example plot for MLR model (winter AA$_m$ model).

**Table S13.** Source category assignment of individual measured PM components used to derive MLR models, from both SPECIEUROPE categories and literature sources.

| measurement | category | vehicle emissions | biomass burning | coal/ fossil fuel combustion | cooking markers | dust | biogenic SOA | notes |
|---|---|---|---|---|---|---|---|---|
| **total OC** | total carbon | - | - | - | - | - | - | Not included due to overlap with multiple separate measurements |
| **total EC** | total carbon | **1** (Cao et al., 2004; Yang et al., 2005; Y. L. Zhang et al., 2015) | **1** (Ji et al., 2016; Y. L. Zhang et al., 2015) | **1** (Y. L. Zhang et al., 2015) | 0 | 0 | 0 | |
| **$K^+$** | small ions | **1** | **1** (F. Duan et al., 2004; J. Yu et al., 2018) | **1** | 0 | **1** (Q. Liu, Liu, et al., 2014) | 0 | Included for vehicle emissions and fossil fuel combustion to test differences from biomass burning |
| **$Na^+$** | small ions | **1** (Zíková et al., 2016) | 0 | 0 | 0 | **1** (Q. Liu, Liu, et al., 2014) | 0 | |
| **$Ca^{2+}$** | small ions | **1** | 0 | 0 | 0 | **1** (Huang et al., 2017; Q. Liu, Liu, et al., 2014; S. Y. Yu et al., 2019) | 0 | |
| **$NH_4^+$** | small ions | - | - | - | - | - | - | Not included as influences multiple chemical processes |
| **$NO_3^-$** | small ions | **1** (Chen et al., 2014; Zíková et al., 2016) | 0 | 0 | 0 | 0 | **1** (Fry et al., 2014; Wang et al., 2018) | |
| **$SO_4^{2-}$** | small ions | 0 | 0 | **1** (Ianniello et al., 2011) | 0 | **1** (Q. Liu, Liu, et al., 2014; X. Liu et al., 2005) | **1** (Fry et al., 2014; Wang et al., 2018) | |
| **$Cl^-$** | small ions | 0 | 0 | **1** (Chen et al., 2014; Ianniello et al., 2011; S. | 0 | **1** (Ianniello et al., 2011) | 0 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Y. Yu et al., 2019) | | | | |
| **Al** | metals | **1** | 0 | 0 | 0 | **1** | 0 | |
| **Ti** | metals | **1** | 0 | 0 | 0 | **1** | 0 | |
| **V** | metals | **1** | 0 | 0 | 0 | 0 | 0 | |
| **Cr** | metals | **1** | 0 | 0 | 0 | 0 | 0 | |
| **Mn** | metals | **1** | 0 | 0 | 0 | **1** (S. Y. Yu et al., 2019) | 0 | |
| **Fe** | metals | **1** (Zíková et al., 2016) | 0 | 0 | 0 | **1** (Q. Liu, Liu, et al., 2014; S. Y. Yu et al., 2019) | 0 | |
| **Co** | metals | **1** | 0 | 0 | 0 | 0 | 0 | |
| **Ni** | metals | **1** | 0 | 0 | 0 | 0 | 0 | |
| **Cu** | metals | **1** (Q. Liu, Baumgartner, et al., 2014) | **1** | **1** | 0 | 0 | 0 | |
| **Zn** | metals | **1** (Q. Liu, Baumgartner, et al., 2014; Zíková et al., 2016) | 0 | **1** (Zíková et al., 2016) | 0 | **1** | 0 | |
| **Cd** | metals | **1** | 0 | **1** | 0 | 0 | 0 | |
| **Sb** | metals | **1** | 0 | **1** | 0 | 0 | 0 | |
| **Ba** | metals | **1** | 0 | **1** | 0 | 0 | 0 | |
| **Pb** | metals | **1** | 0 | **1** (Q. Liu, Liu, et al., 2014; Zíková et al., 2016) | 0 | 0 | 0 | |
| **galactosan** | biomass burning | 0 | 1 | 0 | 0 | 0 | 0 | |
| **mannosan** | biomass burning | 0 | 1 | 0 | 0 | 0 | 0 | |
| **levoglucosan** | biomass burning | 0 | **1** (T. Zhang et al., 2008) | 0 | 0 | 0 | 0 | |
| **ORG** | AMS factors | 0 | 0 | 0 | 0 | 0 | 0 | |
| **MOOOA** | AMS factors | - | - | - | - | - | - | Not included, composite measurements |
| **LOOOA** | AMS factors | - | - | - | - | - | - | |
| **$O_3$** | gases | **1** (J. Duan et al., 2008) | **1** | 0 | 0 | 0 | **1** (Ghirardo et al., 2016) | |
| **CO** | gases | **1** | **1** | **1** | **1** | 0 | **1** | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | (J. Duan et al., 2008) | (Y. Zhang et al., 2017) | (Y. Zhang et al., 2017) | | | | |
| **NO** | gases | **1** (Du et al., 2012) | 0 | 0 | 0 | 0 | 0 | |
| **$NO_2$** | gases | **1** (Du et al., 2012) | 0 | 0 | 0 | 0 | 0 | |
| **$NO_y$** | gases | 1 (Du et al., 2012; J. Duan et al., 2008) | 0 | 0 | 0 | 0 | 0 | |
| **$SO_2$** | gases | 0 | 0 | **1** (Ji et al., 2016) | 0 | 0 | 0 | |
| **RH8** | meteo | - | - | - | - | - | - | Not included as influences multiple processes, difficult to interpret |
| **RH120** | meteo | - | - | - | - | - | - | |
| **RH240** | meteo | - | - | - | - | - | - | |
| **T8** | meteo | - | - | - | - | - | - | |
| **T120** | meteo | - | - | - | - | - | - | |
| **T240** | meteo | - | - | - | - | - | - | |
| **methanol** | VOC | - | - | - | - | - | - | Missing multiple measurements, not included as confers strong bias / instability on models and residuals |
| **acetonitrile** | VOC | - | - | - | - | - | - | |
| **acetaldehyde** | VOC | - | - | - | - | - | - | |
| **acrolein** | VOC | - | - | - | - | - | - | |
| **acetone** | VOC | - | - | - | - | - | - | |
| **isoprene** | VOC | 0 | 0 | 0 | 0 | 0 | **1** (J. Duan et al., 2008; Ghirardo et al., 2016) | Missing multiple measurements |
| **methyl vinyl ketone /methacrolein** | VOC | 0 | 0 | 0 | 0 | 0 | **1** (Pang et al., 2009) | |
| **methyl ethyl ketone** | VOC | 0 | 0 | 0 | 0 | 0 | **1** (Shao et al., 2009) | |
| **benzene** | VOC | **1** (J. Duan et al., 2008) | 0 | 0 | 0 | 0 | 0 | |
| **toluene** | VOC | **1** (J. Duan et al., 2008) | 0 | 0 | 0 | 0 | 0 | |
| **C2-benzenes** | VOC | **1** (Squires et al., 2020) | 0 | 0 | 0 | 0 | 0 | Composite measurements but not overlapping with other measured components |
| **C3-benzenes** | VOC | **1** (Squires et al., 2020) | 0 | 0 | 0 | 0 | 0 | |
| $JO^1D$ | photolysis | | - | - | - | - | - | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | - | | | | | | Not included as influences multiple chemical processes, difficult to interpret exact influence |
| $JNO_2$ | photolysis | - | - | - | - | - | - | |
| naphthalene | PAH | - | - | - | - | - | - | Missing multiple measurements, not included as confers strong bias / instability on models and residuals |
| acenaphthylne | PAH | - | - | - | - | - | - | |
| acenaphthene | PAH | - | - | - | - | - | - | |
| fluorene | PAH | - | - | - | - | - | - | |
| phenanthrene | PAH | - | - | - | - | - | - | |
| fluoranthene | PAH | - | - | - | - | - | - | |
| pyrene | PAH | - | - | - | - | - | - | |
| benzo(a)-anthracene | PAH | - | - | - | - | - | - | |
| chrysene | PAH | - | - | - | - | - | - | |
| benzo(b)-fluoranthene | PAH | - | - | - | - | - | - | |
| benzo(k)-fluoranthene | PAH | - | - | - | - | - | - | |
| benzo(a)-pyrene | PAH | - | - | - | - | - | - | |
| indeno(1,2,3-cd)pyrene | PAH | - | - | - | - | - | - | |
| dibenzo(a,h)-anthracene | PAH | - | - | - | - | - | - | |
| benzo(ghi)-perylene | PAH | - | - | - | - | - | - | |
| **C24** | n-alkane | **1** | 0 | **1** | 0 | 0 | 0 | Ref. for all n-alkanes: (Li et al., 2013; Z. H. Zhang et al., 2017) |
| **C25** | n-alkane | **1** | 0 | **1** | 0 | 0 | 0 | |
| **C26** | n-alkane | **1** | 0 | **1** | 0 | 0 | 0 | |
| **C27** | n-alkane | **1** | 0 | **1** | 0 | 0 | 0 | |
| **C28** | n-alkane | **1** | 0 | **1** | 0 | 0 | 0 | |
| **C29** | n-alkane | **1** | 0 | **1** | 0 | 0 | 0 | |
| **C30** | n-alkane | **1** | 0 | **1** | 0 | 0 | 0 | |
| **C31** | n-alkane | **1** | 0 | **1** | 0 | 0 | 0 | |
| **C32** | n-alkane | **1** | 0 | **1** | 0 | 0 | 0 | |
| **C33** | n-alkane | **1** | 0 | **1** | 0 | 0 | 0 | |
| **C34** | n-alkane | **1** | 0 | **1** | 0 | 0 | 0 | |
| OH | gas radical | - | - | - | - | - | - | Not included, influences multiple aerosol chemistries |
| $HO_2$ | gas radical | - | - | - | - | - | - | |
| $RO_2$ | gas radical | - | - | - | - | - | - | |
| **palmitic acid** | cooking markers | 0 | 0 | 0 | **1** (Li et al., 2013) | 0 | 0 | |
| **stearic acid** | cooking markers | 0 | 0 | 0 | **1** (Li et al., 2013) | 0 | 0 | |
| **cholesterol** | cooking markers | 0 | 0 | 0 | **1** (He et al., 2006) | 0 | 0 | |
| **17a(H)-22,29,30-trisnorhopane (C27a)** | vehicle markers | **1** (He et al., 2006) | 0 | 0 | 0 | 0 | 0 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **17b(H),21a(H)-norhopane (C30ba)** | vehicle markers | **1** (He et al., 2006) | 0 | 0 | 0 | 0 | 0 | |
| **2-methyl-threitol** | SOA | 0 | 0 | 0 | 0 | 0 | **1** (Ding et al., 2012) | |
| **2-methyl-erythritol** | SOA | 0 | 0 | 0 | 0 | 0 | **1** (Ding et al., 2012) | |
| **2-methyl-glyceric acid** | SOA | 0 | 0 | 0 | 0 | 0 | **1** (Ding et al., 2012) | |
| **cis-2-methyl-1,3,4-trihydroxy-1-butene** | SOA | 0 | 0 | 0 | 0 | 0 | **1** | |
| **3-methyl-2,3,4-trihydroxy-1-butene** | SOA | 0 | 0 | 0 | 0 | 0 | **1** | |
| **trans-2-methyl-1,3,4-trihydroxy-1-butene** | SOA | 0 | 0 | 0 | 0 | 0 | **1** | |
| C5-alkene triols | SOA | - | - | - | - | - | - | Not included, composite measurements |
| 2-methyltetrols | SOA | - | - | - | - | - | - | |
| **3-hydroxy-glutaric acid** | SOA | 0 | 0 | 0 | 0 | 0 | **1** (Ding et al., 2012) | |
| **cis-pinonic acid** | SOA | 0 | 0 | 0 | 0 | 0 | **1** (Ding et al., 2012) | |
| **pinic acid** | SOA | 0 | 0 | 0 | 0 | 0 | **1** (Ding et al., 2012) | |
| **3-methyl-1,2,3-butanetricarboxylic acid** | SOA | 0 | 0 | 0 | 0 | 0 | **1** (Ding et al., 2012) | |
| **β-caryophyllinic acid** | SOA | 0 | 0 | 0 | 0 | 0 | **1** (Ding et al., 2012) | |
| glutaric acid derivative | SOA | - | - | - | - | - | - | Not included, composite measurement |
| **3-acetyl-pentanedioic acid** | SOA | 0 | 0 | 0 | 0 | 0 | **1** | |
| **3-acetyl-hexanedioic acid** | SOA | 0 | 0 | 0 | 0 | 0 | **1** | |
| **3-isopropyl-pentanedioic acid** | SOA | 0 | 0 | 0 | 0 | 0 | **1** | |
| **2,3-dihydroxy-4-oxopentanoic acid** | SOA | 0 | 0 | 0 | 0 | 0 | **1** (Ding et al., 2012) | |

# **Section S10:** Multiple linear regression model parameters (mass-normalised only)

## Winter $OP_m$ EPR

**Table S14.** MLR model parameters for winter EPR source models. Coefficient variation represents variance in cross-validated models through 500 fully random permutations with bootstrapping. Values are (mean(min,max)) of the permuted model term coefficients.

| | vehicle emissions | biomass burning | coal / fossil fuel | cooking markers | dust | biogenic SOA |
|---|---|---|---|---|---|---|
| **model terms** | total EC + Ba + NO + benzene + C27 + C31 + C32 + C33 | total EC + $K^+$ + mannosan + levoglucosan | total EC + $SO_4^{2-}$ + Cu + Cd + Ba + C27 + C30 + C31 | CO + palmitic acid + stearic acid + cholesterol | $K^+$ + $Cl^-$ + Al + Ti | $NO_3^-$ + O3 + CO + methyl ethyl ketone + cis-2-methyl-1,3,4-trihydroxy-1-butene + MBTCA + 3-acetylpentanedioic acid + 2,3-dihydroxy-4-oxopentanoic acid |
| **residuals deviance min** | -1.51E+03 | -2.24E+03 | -1.49E+03 | -2.49E+03 | -2.52E+03 | -2.26E+03 |
| **residuals deviance median** | -6.41E+00 | 2.30E+02 | 1.50E+02 | -6.80E+01 | -1.16E+02 | 1.20E+02 |
| **residuals deviance mean** | -2.32E-12 | -1.41E-12 | -2.58E-12 | -1.76E-12 | 7.92E-13 | -1.55E-12 |
| **residuals deviance max** | 9.31E+02 | 2.58E+03 | 1.09E+03 | 2.78E+03 | 2.59E+03 | 1.50E+03 |
| **null deviance** | 6.59E+07 | 6.59E+07 | 6.59E+07 | 6.59E+07 | 6.59E+07 | 6.59E+07 |
| **residual deviance** | 8.23E+06 | 3.88E+07 | 1.08E+07 | 5.33E+07 | 5.09E+07 | 2.94E+07 |
| **$R^2$** | **0.88** | 0.41 | **0.84** | 0.19 | 0.23 | 0.55 |
| **intercept coefficient** | 6.93E+03 | 4.05E+03 | 1.66E+03 | 8.19E+03 | 5.90E+03 | 1.13E+04 |
| **coefficient 1** | 6.82E+04 | 5.71E+04 | 1.25E+05 | -6.05E-01 | 9.14E+04 | 1.11E+04 |
| **coefficient 2** | -6.46E+06 | 1.23E+05 | 1.93E+04 | 1.71E+04 | 2.14E+04 | -2.40E+02 |
| **coefficient 3** | 2.25E+01 | -2.24E+06 | -1.64E+06 | -2.99E+04 | -6.25E+04 | -1.69E+00 |
| **coefficient 4** | -8.38E+02 | 1.99E+05 | 5.43E+06 | 1.16E+07 | -1.58E+05 | -6.17E+03 |
| **coefficient 5** | -6.31E+06 | - | -5.33E+06 | - | - | 1.27E+09 |
| **coefficient 6** | 1.20E+07 | - | -3.16E+06 | - | - | 1.50E+08 |
| **coefficient 7** | -1.34E+07 | - | -2.03E+07 | - | - | 9.43E+08 |
| **coefficient 8** | 2.44E+07 | - | 1.79E+07 | - | - | -1.46E+08 |
| **intercept coeff. variation** | 6.99e+03 (6.26e+03, 7.99e+03) | 4.09e+03 (2.54e+03, 5.53e+03) | 1.57e+03 (-4.51e+02, 3.21e+03) | 8.23e+03 (7.51e+03, 9.29e+03) | 5.90e+03 (3.95e+03, 7.78e+03) | 1.14e+04 (6.61e+03, 1.42e+04) |
| **coeff. variation 1** | 6.95e+04 (4.74e+04, 9.98e+04) | 5.74e+04 (2.00e+04, 9.83e+04) | 1.26e+05 (9.67e+04, 1.52e+05) | -6.05e-01 (-1.11e+00, 2.72e-01) | 8.66e+04 (-1.17e+04, 1.68e+05) | 1.10e+04 (-7.19e+03, 2.34e+04) |
| **coeff. variation 2** | -6.54e+06 (-8.95e+06, -5.29e+06) | 1.23e+05 (4.05e+04, 2.17e+05) | 1.99e+04 (1.04e+04, 3.88e+04) | 2.98e+04 (-3.45e+05, 4.78e+05) | 2.23e+04 (-1.63e+03, 5.39e+04) | -2.45e+02 (-3.97e+02, -9.78e+01) |
| **coeff. variation 3** | 2.21e+01 (1.20e+01, 3.20e+01) | -1.64e+06 (-9.78e+06, 1.12e+07) | -1.42e+06 (-4.60e+06, 5.44e+06) | -6.41e+04 (-9.24e+05, 4.25e+05) | -5.93e+04 (-1.48e+05, 2.25e+05) | -1.71e+00 (-2.80e+00, -4.07e-01) |
| **coeff. variation 4** | -8.51e+02 (-1.33e+03, -5.78e+02) | 1.22e+05 (-1.40e+06, 1.19e+06) | 5.48e+06 (2.20e+06, 8.67e+06) | 1.13e+07 (-1.81e+06, 4.24e+07) | -1.50e+05 (-5.25e+05, 1.03e+06) | -5.97e+03 (-1.14e+04, 2.23e+02) |

| | | | | | | |
|---|---|---|---|---|---|---|
| **coeff. variation 5** | -6.27e+06 (-7.95e+06, -4.46e+06) | - | -5.52e+06 (-8.44e+06, -4.12e+06) | - | - | 1.28e+09 (6.13e+06, 2.76e+09) |
| **coeff. variation 6** | 1.23e+07 (7.97e+06, 1.92e+07) | - | -3.21e+06 (-5.71e+06, -8.09e+05) | - | - | 1.50e+08 (-2.32e+07, 2.59e+08) |
| **coeff. variation 7** | -1.49e+07 (-3.52e+07, -4.89e+06) | - | -2.03e+07 (-3.65e+07, -1.13e+07) | - | - | 9.09e+08 (-5.59e+08, 2.68e+09) |
| **coeff. variation 8** | 2.39e+07 (1.06e+07, 3.29e+07) | - | 1.79e+07 (1.01e+07, 2.88e+07) | - | - | -1.47e+08 (-2.88e+08, 4.38e+07) |
| **intercept std error** | 6.20E+02 | 9.07E+02 | 8.89E+02 | 7.23E+02 | 1.02E+03 | 1.90E+03 |
| **std error 1** | 1.18E+04 | 1.98E+04 | 1.67E+04 | 4.05E-01 | 5.23E+04 | 7.58E+03 |
| **std error 2** | 7.65E+05 | 4.27E+04 | 6.07E+03 | 1.98E+05 | 1.53E+04 | 7.76E+01 |
| **std error 3** | 5.29E+00 | 1.85E+06 | 4.65E+05 | 2.46E+05 | 5.86E+04 | 5.97E-01 |
| **std error 4** | 1.45E+02 | 1.97E+05 | 1.42E+06 | 6.95E+06 | 1.57E+05 | 2.34E+03 |
| **std error 5** | 8.09E+05 | - | 9.20E+05 | - | - | 6.17E+08 |
| **std error 6** | 2.45E+06 | - | 9.81E+05 | - | - | 5.31E+07 |
| **std error 7** | 3.66E+06 | - | 4.29E+06 | - | - | 5.45E+08 |
| **std error 8** | 5.32E+06 | - | 3.95E+06 | - | - | 6.22E+07 |
| **intercept p-value** | **1.52E-10** | **1.38E-04** | 7.49E-02 | **1.48E-11** | **4.18E-06** | **5.55E-06** |
| **p-value 1** | **8.36E-06** | 7.88E-03 | **1.81E-07** | 1.47E-01 | 9.25E-02 | 1.56E-01 |
| **p-value 2** | **2.36E-08** | 7.72E-03 | **4.34E-03** | 9.32E-01 | 1.74E-01 | **5.25E-03** |
| **p-value 3** | **3.26E-04** | 2.38E-01 | **1.88E-03** | 9.04E-01 | 2.96E-01 | **9.65E-03** |
| **p-value 4** | **8.34E-06** | 3.22E-01 | **9.54E-04** | 1.07E-01 | 3.23E-01 | 1.53E-02 |
| **p-value 5** | **9.03E-08** | - | **7.82E-06** | - | - | 5.12E-02 |
| **p-value 6** | **6.94E-05** | - | **3.92E-03** | - | - | 1.00E-02 |
| **p-value 7** | **1.42E-03** | - | **9.92E-05** | - | - | 9.73E-02 |
| **p-value 8** | **1.47E-04** | - | **1.64E-04** | - | - | 2.85E-02 |

## Summer $OP_m$ EPR

**Table S15.** MLR model parameters for summer EPR source models**.**

| | **vehicle emissions** | **biomass burning** | **coal / fossil fuel** | **cooking markers** | **dust** | **biogenic SOA** |
|---|---|---|---|---|---|---|
| **model terms** | total EC + Ni + CO + NO + NOy + C26 + C27 + C30 | total EC + $K^+$ + galactosan + $O_3$ | total EC + $SO_4^{2-}$ + Zn + Pb + $SO_2$ + C29 | CO + palmitic acid + stearic acid + cholesterol | K+ + Na+ + Cl- + Al | $SO_4^{2-}$ + O3 + 2-methylglyceric acid + MBTCA |
| **residuals deviance min** | -2.60E+03 | -3.73E+03 | -4.09E+03 | -3.79E+03 | -2.93E+03 | -4.88E+03 |
| **residuals deviance median** | -1.20E+02 | -7.73E+01 | -1.61E+02 | -2.46E+02 | -3.39E+02 | -2.11E+02 |
| **residuals deviance mean** | 5.66E-12 | -5.52E-14 | 3.49E-12 | -3.67E-12 | 9.51E-13 | 5.52E-14 |
| **residuals deviance max** | 2.47E+03 | 4.95E+03 | 3.35E+03 | 6.12E+03 | 5.74E+03 | 5.10E+03 |
| **null deviance** | 1.80E+08 | 1.80E+08 | 1.80E+08 | 1.80E+08 | 1.80E+08 | 1.80E+08 |
| **residual deviance** | 5.08E+07 | 1.28E+08 | 7.99E+07 | 1.61E+08 | 1.39E+08 | 1.17E+08 |
| **$R^2$** | 0.72 | 0.29 | 0.56 | 0.11 | 0.23 | 0.35 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **intercept coefficient** | 5.82E+03 | 1.50E+03 | 2.74E+03 | 6.03E+03 | 4.10E+03 | -1.83E+03 |
| **coefficient 1** | -2.79E+05 | 2.39E+04 | -1.85E+05 | 2.67E-01 | 1.66E+05 | 7.66E+03 |
| **coefficient 2** | 2.70E+07 | 1.40E+05 | 7.97E+03 | 4.40E+06 | 2.02E+05 | 5.29E+01 |
| **coefficient 3** | 8.54E+00 | -2.02E+07 | 5.77E+05 | -9.85E+06 | -7.49E+04 | 1.71E+07 |
| **coefficient 4** | 3.99E+02 | 4.42E+01 | -2.50E+06 | 5.44E+06 | -1.30E+05 | -7.83E+06 |
| **coefficient 5** | -2.09E+02 | - | 2.88E+02 | - | - | - |
| **coefficient 6** | -1.77E+08 | - | 3.73E+07 | - | - | - |
| **coefficient 7** | 6.68E+07 | - | - | - | - | - |
| **coefficient 8** | 2.12E+08 | - | - | - | - | - |
| **intercept coeff. variation** | 5.91e+03 (3.20e+03, 8.70e+03) | 1.51e+03 (-3.86e+03, 3.97e+03) | 5.17e+01 (-3.15e+03, 4.46e+03) | 6.40e+03 (2.58e+03, 1.07e+04) | 3.99e+03 (1.15e+03, 5.82e+03) | 2.23e+03 (-6.93e+02, 5.15e+03) |
| **coeff. variation 1** | -2.80e+05 (-3.89e+05, -1.85e+05) | 2.45e+04 (-2.14e+04, 1.07e+05) | -1.47e+05 (-2.60e+05, -7.37e+04) | 7.52e-03 (-5.17e+00, 4.65e+00) | 2.24e+05 (1.81e+04, 4.43e+05) | 3.72e+01 (5.55e-02, 6.67e+01) |
| **coeff. variation 2** | 2.77e+07 (1.03e+07, 5.55e+07) | 1.43e+05 (3.12e+04, 3.16e+05) | 1.83e+04 (-1.46e+03, 4.06e+04) | 2.48e+06 (-1.89e+06, 1.18e+07) | 7.48e+04 (-4.28e+05, 4.45e+05) | 2.13e+07 (5.27e+06, 4.09e+07) |
| **coeff. variation 3** | 8.39e+00 (5.35e+00, 1.19e+01) | -2.14e+07 (-6.56e+07, -5.13e+06) | 6.12e+05 (8.79e+04, 1.19e+06) | -7.01e+06 (-2.60e+07, 3.21e+06) | -1.13e+05 (-3.99e+05, 5.16e+04) | 5.71e+08 (-1.13e+09, 1.16e+09) |
| **coeff. variation 4** | 3.98e+02 (1.41e+02, 6.46e+02) | 4.40e+01 (5.21e+00, 1.00e+02) | -2.45e+06 (-3.92e+06, -4.04e+05) | 3.46e+06 (-8.57e+07, 8.04e+07) | -1.48e+06 (-4.00e+06, 4.94e+05) | -8.04e+08 (-1.50e+09, 2.30e+08) |
| **coeff. variation 5** | -2.10e+02 (-3.17e+02, -1.17e+02) | - | 3.80e+02 (1.26e+02, 6.43e+02) | - | - | 2.81e+07 (-6.68e+06, 5.87e+07) |
| **coeff. variation 6** | -1.75e+08 (-2.59e+08, -1.04e+08) | - | 3.39e+07 (2.17e+07, 5.11e+07) | - | - | - |
| **coeff. variation 7** | 6.68e+07 (4.52e+07, 9.11e+07) | - | - | - | - | - |
| **coeff. variation 8** | 2.10e+08 (5.16e+07, 3.25e+08) | - | - | - | - | - |
| **intercept std error** | 1432.08 | 2141.16 | 1.49E+03 | 2123.54 | 981.42 | 2054.73 |
| **std error 1** | 4.94E+04 | 3.37E+04 | 37435.18 | 2.76 | 8.63E+04 | 5101.29 |
| **std error 2** | 7.00E+06 | 8.08E+04 | 4601.03 | 3.77E+06 | 1.69E+05 | 19.25 |
| **std error 3** | 2.14 | 1.85E+07 | 3.50E+05 | 6.93E+06 | 5.89E+04 | 5.88E+06 |
| **std error 4** | 142.36 | 22.54 | 1.17E+06 | 5.43E+07 | 7.37E+04 | 6.02E+06 |
| **std error 5** | 53.56 | - | 174.27 | - | - | - |
| **std error 6** | 3.56E+07 | - | 7.28E+06 | - | - | - |
| **std error 7** | 1.02E+07 | - | - | - | - | - |
| **std error 8** | 5.27E+07 | - | - | - | - | - |
| **intercept p-value** | **0.0004** | 0.49 | 0.08 | **0.01** | 0.00 | 0.38 |
| **p-value 1** | **0.0001** | 0.48 | **4.04E-05** | 0.92 | 0.06 | 0.14 |
| **p-value 2** | **0.0007** | 0.09 | 0.10 | 0.25 | 0.24 | 0.01 |
| **p-value 3** | **0.0005** | 0.29 | 0.11 | 0.17 | 0.21 | 0.01 |
| **p-value 4** | **0.01** | 0.06 | **0.04** | 0.92 | 0.09 | 0.20 |
| **p-value 5** | **0.0007** | - | 0.11 | - | - | - |
| **p-value 6** | **4.58E-05** | - | **2.39E-05** | - | - | - |
| **p-value 7** | **9.57E-07** | - | - | - | - | - |
| **p-value 8** | **4.95E-04** | - | - | - | - | - |

## Winter $OP_m$ AA

**Table S16.** MLR model parameters for winter AA source models.

| | vehicle emissions | biomass burning | coal / fossil fuel | cooking markers | dust | biogenic SOA |
|---|---|---|---|---|---|---|
| **model terms** | $Ca^{2+}$ + $NO_3^-$ + Cr + Co + Ni + Zn + $O_3$ + C33 | Cu + mannosan + levoglucosan + $O_3$ | $SO_4^{2-}$ + Cl- + Cu + Zn + Cd + Pb + C30 + C32 | CO + palmitic acid + stearic acid + cholesterol | $Ca^{2+}$ + $Cl^-$ + Al + Ti + Mn + Fe + Zn | NO3_neg + methyl vinyl ketone/ methacrolein + methyl ethyl ketone + 2-methylglyceric acid + trans-2-methyl-1,3,4-trihydroxy-1-butene + cis-pinonic acid` + MTBCA + 3-acetylhexanedioic acid |
| **residuals deviance min** | -9.02E+01 | -1.44E+02 | -1.64E+02 | -1.97E+02 | -1.15E+02 | -8.77E+01 |
| **residuals deviance median** | -1.03E+00 | -2.18E+01 | 7.85E+00 | -1.55E+01 | 1.20E+01 | -2.41E+00 |
| **residuals deviance mean** | 6.33E-14 | 5.78E-14 | 2.70E-14 | 9.44E-14 | 8.34E-14 | -9.35E-14 |
| **residuals deviance max** | 5.65E+01 | 2.97E+02 | 9.32E+01 | 2.37E+02 | 1.36E+02 | 9.10E+01 |
| **null deviance** | 8.30E+05 | 8.30E+05 | 8.30E+05 | 8.30E+05 | 8.30E+05 | 8.30E+05 |
| **residual deviance** | 4.49E+04 | 4.27E+05 | 1.01E+05 | 2.84E+05 | 1.01E+05 | 4.32E+04 |
| **$R^2$** | **0.95** | 0.49 | **0.88** | 0.66 | **0.88** | **0.95** |
| **intercept coefficient** | 2.05E+02 | 1.16E+02 | 2.80E+01 | 2.93E+02 | -6.17E+01 | 3.94E+02 |
| **coefficient 1** | 1.78E+04 | 1.09E+05 | -9.86E+02 | -5.61E-02 | 2.23E+04 | -2.09E+03 |
| **coefficient 2** | -1.22E+03 | -2.79E+05 | 6.26E+03 | 3.95E+04 | 4.69E+03 | -5.53E+01 |
| **coefficient 3** | 4.25E+05 | 4.35E+04 | -2.03E+05 | -4.50E+04 | 5.82E+03 | 3.42E+02 |
| **coefficient 4** | -3.63E+07 | 1.28E+01 | 4.87E+04 | 9.51E+05 | -6.17E+04 | 1.76E+06 |
| **coefficient 5** | 1.62E+06 | - | 2.93E+05 | - | 2.08E+05 | 8.02E+06 |
| **coefficient 6** | 1.73E+04 | - | -1.36E+05 | - | -1.46E+04 | 1.02E+06 |
| **coefficient 7** | 7.46E+00 | - | -9.48E+05 | - | 1.54E+04 | 1.63E+06 |
| **coefficient 8** | 4.65E+05 | - | 1.53E+06 | - | - | -6.23E+07 |
| **intercept coeff. variation** | 2.01e+02 (9.30e+01, 3.09e+02) | 1.14e+02 (-9.76e+00, 2.04e+02) | 3.40e+01 (-1.06e+02, 1.94e+02) | 2.91e+02 (1.98e+02, 3.69e+02) | -5.57e+01 (-1.55e+02, 4.29e+01) | 3.95e+02 (3.03e+02, 5.04e+02) |
| **coeff. variation 1** | 1.75e+04 (2.17e+03, 3.17e+04) | 1.81e+05 (-1.67e+04, 8.59e+05) | -9.83e+02 (-2.36e+03, 1.10e+02) | -5.64e-02 (-9.13e-02, -9.72e-03) | 2.22e+04 (8.51e+03, 4.06e+04) | -2.09e+03 (-2.72e+03, -1.46e+03) |
| **coeff. variation 2** | -1.21e+03 (-1.97e+03, -5.41e+02) | -1.88e+05 (-5.21e+05, 1.05e+06) | 5.89e+03 (2.67e+03, 8.42e+03) | 3.68e+04 (-8.66e+02, 7.98e+04) | 4.23e+03 (2.91e+02, 6.89e+03) | -5.66e+01 (-9.70e+01, -2.21e+01) |
| **coeff. variation 3** | 4.21e+05 (2.35e+05, 7.77e+05) | 3.22e+04 (-1.16e+05, 6.15e+04) | -1.59e+05 (-3.54e+05, 2.57e+05) | -3.90e+04 (-9.48e+04, 2.07e+04) | 5.95e+03 (-3.73e+03, 1.46e+04) | 3.48e+02 (1.04e+02, 5.05e+02) |
| **coeff. variation 4** | -3.59e+07 (-5.59e+07, -7.59e+06) | 1.21e+01 (8.17e-01, 1.92e+01) | 5.06e+04 (1.58e+03, 7.61e+04) | 9.67e+05 (-3.82e+05, 3.42e+06) | -5.48e+04 (-1.61e+05, 1.85e+04) | 1.71e+06 (-4.30e+05, 3.04e+06) |
| **coeff. variation 5** | 1.66e+06 (6.82e+05, 4.58e+06) | - | 2.39e+05 (-1.92e+05, 5.62e+05) | - | 2.10e+05 (-3.66e+05, 6.32e+05) | 7.67e+06 (2.29e+06, 1.31e+07) |
| **coeff. variation 6** | 1.82e+04 (-1.15e+04, 3.14e+04) | - | -1.28e+05 (-1.89e+05, 4.82e+04) | - | -1.37e+04 (-3.48e+04, 1.39e+04) | 1.05e+06 (5.71e+05, 1.85e+06) |
| **coeff.** | 7.42e+00 | - | -9.65e+05 | - | 1.60e+04 | 1.80e+06 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **variation 7** | (3.64e+00, 1.01e+01) | | (-2.48e+06, 6.62e+05) | | (-4.31e+04, 4.61e+04) | (4.48e+05, 6.07e+06) |
| **coeff. variation 8** | 4.21e+05 (-2.28e+04, 8.85e+05) | - | 1.55e+06 (-9.23e+05, 4.71e+06) | - | - | -6.20e+07 (-8.43e+07, -4.37e+07) |
| **intercept std error** | 4.39E+01 | 5.08E+01 | 5.35E+01 | 5.28E+01 | 4.33E+01 | 5.43E+01 |
| **std error 1** | 5.60E+03 | 6.64E+04 | 5.31E+02 | 2.95E-02 | 6.47E+03 | 3.14E+02 |
| **std error 2** | 3.06E+02 | 2.14E+05 | 1.39E+03 | 1.45E+04 | 1.01E+03 | 1.80E+01 |
| **std error 3** | 6.66E+04 | 2.14E+04 | 5.49E+04 | 1.79E+04 | 2.87E+03 | 1.04E+02 |
| **std error 4** | 7.40E+06 | 4.70E+00 | 1.19E+04 | 5.07E+05 | 1.59E+04 | 7.57E+05 |
| **std error 5** | 6.20E+05 | - | 1.67E+05 | - | 1.11E+05 | 2.66E+06 |
| **std error 6** | 4.03E+03 | - | 3.74E+04 | - | 8.60E+03 | 3.76E+05 |
| **std error 7** | 1.78E+00 | - | 4.07E+05 | - | 7.10E+03 | 6.58E+05 |
| **std error 8** | 1.76E+05 | - | 7.24E+05 | - | - | 1.39E+07 |
| **intercept p-value** | **1.16E-04** | **0.03** | 0.61 | **7.86E-06** | 0.17 | **2.82E-07** |
| **p-value 1** | **4.25E-03** | 0.11 | 0.08 | 0.07 | **2.18E-03** | **1.05E-06** |
| **p-value 2** | **6.18E-04** | 0.20 | **1.73E-04** | **0.01** | **1.17E-04** | **0.01** |
| **p-value 3** | **2.02E-06** | 0.05 | **1.24E-03** | **0.02** | **0.05** | **3.41E-03** |
| **p-value 4** | **6.64E-05** | 0.01 | **4.65E-04** | 0.07 | **7.68E-04** | **0.03** |
| **p-value 5** | **0.02** | - | 0.09 | - | 0.07 | **0.01** |
| **p-value 6** | **3.01E-04** | - | **1.43E-03** | - | 0.10 | **0.01** |
| **p-value 7** | **3.77E-04** | - | **0.03** | - | **0.04** | **0.02** |
| **p-value 8** | **0.01** | - | **0.05** | - | - | **1.87E-04** |

## Summer $OP_m$ AA

**Table S17.** MLR model parameters for summer AA source models**.**

| | **vehicle emissions** | **biomass burning** | **coal / fossil fuel** | **cooking markers** | **dust** | **biogenic SOA** |
|---|---|---|---|---|---|---|
| **model terms** | total EC + $NO_3^-$ + Ti + Fe + Zn + O3 + $NO_2$ + C33 | total EC + mannosan + $O_3$ + CO | Zn + Cd + Ba + C24 + C26 + C27 + C30 + C31 | CO + palmitic acid + stearic acid + cholesterol | Al + Ti + Fe + Zn | $O_3$ + CO + methyl ethyl ketone + 2-methylglyceric acid + 3-hydroxyglutaric acid + cis-pinonic acid + β-caryophyllinic acid + 2,3-dihydroxy-4-oxopentanoic acid |
| **residuals deviance min** | -9.07E+01 | -1.02E+02 | -1.12E+02 | -1.64E+02 | -1.11E+02 | -7.37E+01 |
| **residuals deviance median** | 4.16E+00 | -4.01E+00 | 4.01E+00 | -7.39E+00 | 5.42E+00 | -3.51E+00 |
| **residuals deviance mean** | -1.90E-13 | -1.16E-13 | -1.07E-13 | -3.70E-14 | -1.38E-13 | -1.69E-13 |
| **residuals deviance max** | 1.07E+02 | 9.60E+01 | 7.44E+01 | 1.10E+02 | 1.13E+02 | 9.45E+01 |
| **null deviance** | 1.76E+05 | 1.76E+05 | 1.76E+05 | 1.76E+05 | 1.76E+05 | 1.76E+05 |
| **residual deviance** | 4.84E+04 | 9.30E+04 | 6.87E+04 | 1.41E+05 | 9.38E+04 | 4.58E+04 |
| **$R^2$** | **0.73** | 0.47 | 0.61 | 0.20 | 0.47 | **0.74** |
| **intercept coefficient** | 6.43E+02 | 1.85E+02 | 1.88E+02 | 1.62E+02 | 1.91E+02 | 1.99E+02 |
| **coefficient 1** | 6.13E+02 | 1.85E+02 | 1.87E+02 | 1.69E+02 | 1.93E+02 | 2.03E+02 |
| **coefficient 2** | -6.34E+03 | 1.21E+03 | -3.81E+04 | 9.89E-03 | -2.61E+03 | -1.94 |
| **coefficient 3** | -3.01E+02 | 4.46E+05 | 2.68E+05 | -1.23E+05 | -7.22E+04 | 0.09 |
| **coefficient 4** | -1.29E+05 | -1.46 | -9.19E+04 | 3.30E+05 | 1.28E+04 | -6.11E+01 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **coefficient 5** | 2.16E+04 | 0.09 | 2.03E+06 | -9.59E+05 | -2.93E+04 | -2.08E+05 |
| **coefficient 6** | -4.51E+04 | - | -4.75E+06 | - | - | -3.31E+06 |
| **coefficient 7** | -3.01 | - | 8.33E+05 | - | - | 7.32E+05 |
| **coefficient 8** | -6.41 | - | 7.49E+06 | - | - | 1.74E+06 |
| **intercept coeff. variation** | 6.13e+02 (5.32e+02, 7.31e+02) | 1.82e+02 (4.40e+01, 2.60e+02) | 1.83e+02 (7.99e+01, 2.71e+02) | 1.63e+02 (-3.29e+01, 2.48e+02) | 1.93e+02 (1.60e+02, 2.30e+02) | 1.99e+02 (2.86e+01, 3.69e+02) |
| **coeff. variation 1** | -6.31e+03 (-8.61e+03, -3.08e+03) | 1.17e+03 (-3.61e+02, 2.44e+03) | -3.90e+04 (-5.85e+04, -2.31e+04) | 1.81e-02 (-9.21e-02, 2.78e-01) | -2.76e+03 (-9.37e+03, 9.92e+02) | -1.93e+00 (-2.95e+00, -8.56e-01) |
| **coeff. variation 2** | -3.09e+02 (-5.22e+02, -1.08e+02) | 4.77e+05 (3.17e+05, 1.25e+06) | 2.87e+05 (-1.63e+05, 6.02e+05) | -9.83e+04 (-2.79e+05, 2.96e+05) | -6.75e+04 (-1.85e+05, 9.23e+04) | 9.43e-02 (-3.20e-03, 2.50e-01) |
| **coeff. variation 3** | -1.28e+05 (-2.23e+05, -2.86e+04) | -1.45e+00 (-2.27e+00, -6.51e-01) | -9.53e+04 (-1.66e+05, -2.22e+04) | 2.96e+05 (-3.03e+05, 7.03e+05) | 1.28e+04 (7.60e+03, 1.83e+04) | -6.07e+01 (-1.11e+02, -8.97e-01) |
| **coeff. variation 4** | 2.15e+04 (1.44e+04, 2.80e+04) | 9.50e-02 (2.23e-02, 2.54e-01) | 2.16e+06 (1.40e+06, 4.82e+06) | -1.06e+06 (-6.76e+06, 1.09e+06) | -2.96e+04 (-4.29e+04, -1.97e+04) | -2.04e+05 (-4.34e+05, 3.60e+04) |
| **coeff. variation 5** | -4.58e+04 (-6.47e+04, -3.20e+04) | - | -4.81e+06 (-9.74e+06, -1.61e+06) | - | - | -3.30e+06 (-5.67e+06, 2.16e+06) |
| **coeff. variation 6** | -3.01e+00 (-3.66e+00, -2.24e+00) | - | 7.94e+05 (-2.48e+05, 1.58e+06) | - | - | 7.34e+05 (4.03e+05, 1.18e+06) |
| **coeff. variation 7** | -6.27e+00 (-1.01e+01, -3.97e+00) | - | 7.51e+06 (3.54e+06, 1.18e+07) | - | - | 1.74e+06 (1.13e+06, 2.63e+06) |
| **coeff. variation 8** | 2.17e+06 (9.47e+05, 3.09e+06) | - | -5.42e+05 (-1.34e+06, 3.37e+05) | - | - | - |
| **intercept std error** | 9.24E+01 | 5.80E+01 | 3.39E+01 | 6.36E+01 | 2.91E+01 | 6.86E+01 |
| **std error 1** | 1.89E+03 | 8.16E+02 | 9.96E+03 | 0.08 | 3.50E+03 | 0.51 |
| **std error 2** | 1.10E+02 | 1.96E+05 | 1.06E+05 | 7.10E+04 | 6.15E+04 | 0.06 |
| **std error 3** | 4.31E+04 | 0.66 | 4.06E+04 | 1.56E+05 | 2.87E+03 | 2.78E+01 |
| **std error 4** | 4.42E+03 | 0.07 | 7.56E+05 | 1.61E+06 | 9.25E+03 | 1.25E+05 |
| **std error 5** | 9.35E+03 | - | 1.45E+06 | - | - | 1.46E+06 |
| **std error 6** | 0.65 | - | 3.74E+05 | - | - | 1.94E+05 |
| **std error 7** | 1.89 | - | 2.15E+06 | - | - | 4.71E+05 |
| **std error 8** | 7.92E+05 | - | 3.26E+05 | - | - | - |
| **intercept p-value** | **7.42E-07** | **3.48E-03** | **1.15E-05** | **1.31E-02** | **6.81E-07** | **0.01** |
| **p-value 1** | **2.64E-03** | 0.15 | **8.23E-04** | 0.90 | 0.41 | **6.31E-04** |
| **p-value 2** | **1.17E-02** | **0.03** | **1.86E-02** | 0.10 | 0.38 | 0.19 |
| **p-value 3** | **6.38E-03** | **0.04** | **0.03** | **0.04** | **3.04E-04** | **0.02** |
| **p-value 4** | **5.44E-05** | 0.21 | **1.29E-02** | 0.56 | **0.01** | **0.04** |
| **p-value 5** | **6.40E-05** | - | **3.18E-03** | - | - | 0.10 |
| **p-value 6** | **1.11E-04** | - | **0.04** | - | - | **4.93E-04** |
| **p-value 7** | **2.39E-03** | - | **1.92E-03** | - | - | 0.19 |
| **p-value 8** | **1.20E-02** | - | 0.08 | - | - | **4.55E-03** |

## Winter $OP_m$ DTT

**Table S18.** MLR model parameters for winter DTT source models.

| | vehicle emissions | biomass burning | coal / fossil fuel | cooking markers | dust | biogenic SOA |
|---|---|---|---|---|---|---|
| **model terms** | $Ca^{2+}$ + Fe + Cu + Sb + Pb + CO + $NO_y$ + 17b(H),21a(H)-norhopane (C30ba) | $K^+$ + Cu + mannosan + CO | $Cl^-$ + Ba + Pb + $SO_2$ + C28 + C29 + C30 + C31 | CO + palmitic acid + stearic acid + cholesterol | $Ca^{2+}$ + Al + Ti + Mn | CO + isoprene + methyl vinyl ketone /methacrolein + 2-methylerythritol + cis-pinonic acid + β-caryophyllinic acid + 3-acetyl-pentanedioic acid |
| **residuals deviance min** | -6.88E+00 | -1.75E+01 | -1.02E+01 | -1.95E+01 | -1.40E+01 | -1.64E+01 |
| **residuals deviance median** | -4.13E-01 | -2.86E+00 | -7.95E-01 | -1.35E+00 | -8.35E-01 | -6.62E-01 |
| **residuals deviance mean** | 3.52E-14 | -1.35E-14 | -3.84E-15 | 4.41E-15 | 1.82E-14 | 6.07E-15 |
| **residuals deviance max** | 8.30E+00 | 2.19E+01 | 1.24E+01 | 2.46E+01 | 2.23E+01 | 1.36E+01 |
| **null deviance** | 6.45E+03 | 6.45E+03 | 6.45E+03 | 6.45E+03 | 6.45E+03 | 6.45E+03 |
| **residual deviance** | 5.51E+02 | 3.55E+03 | 9.09E+02 | 3.92E+03 | 1.82E+03 | 1.38E+03 |
| **$R^2$** | **0.91** | 0.45 | **0.86** | 0.39 | **0.72** | **0.79** |
| **intercept coefficient** | 23.19 | 45.54 | 27.30 | 47.15 | 21.48 | 29.72 |
| **coefficient 1** | 6.73E+03 | 7.48E+02 | 1.93E+02 | -0.01 | 2.58E+03 | 0.00 |
| **coefficient 2** | -3.49E+03 | 1.38E+04 | 3.33E+04 | 2.60E+03 | -8.60E+02 | 17.64 |
| **coefficient 3** | -3.40E+04 | -5.91E+03 | 1.02E+04 | -3.04E+03 | -6.66E+03 | -23.10 |
| **coefficient 4** | 1.58E+05 | -0.01 | -2.04 | -8.68E+03 | 1.91E+04 | 6.71E+05 |
| **coefficient 5** | 1.79E+04 | - | 6.14E+04 | - | - | 1.26E+05 |
| **coefficient 6** | -0.02 | - | -5.11E+04 | - | - | -5.67E+04 |
| **coefficient 7** | 0.19 | - | -1.17E+05 | - | - | -1.32E+07 |
| **coefficient 8** | -2.42E+05 | - | 1.14E+05 | - | - | - |
| **intercept coeff. variation** | 2.36e+01 (1.08e+01, 4.30e+01) | 4.43e+01 (2.54e+01, 5.98e+01) | 2.71e+01 (1.39e+01, 4.22e+01) | 4.70e+01 (3.73e+01, 5.87e+01) | 2.12e+01 (1.17e+01, 2.69e+01) | 3.01e+01 (1.70e+01, 4.27e+01) |
| **coeff. variation 1** | 6.86e+03 (4.75e+03, 9.66e+03) | 7.35e+02 (1.17e+02, 1.43e+03) | 1.95e+02 (-3.65e+01, 4.06e+02) | -1.05e-02 (-1.89e-02, -4.62e-03) | 2.53e+03 (1.66e+03, 3.34e+03) | -3.63e-03 (-8.93e-03, 7.99e-04) |
| **coeff. variation 2** | -3.53e+03 (-5.43e+03, -2.05e+03) | 1.73e+04 (-6.68e+03, 6.64e+04) | 3.35e+04 (1.02e+04, 5.16e+04) | 2.33e+03 (-1.41e+03, 6.19e+03) | -8.25e+02 (-1.47e+03, 2.64e+02) | 1.81e+01 (-1.64e+00, 3.49e+01) |
| **coeff. variation 3** | -3.62e+04 (-8.38e+04, -2.25e+04) | -5.56e+03 (-1.98e+04, 7.05e+03) | 1.02e+04 (5.43e+03, 1.53e+04) | -2.37e+03 (-7.83e+03, 4.89e+03) | -6.64e+03 (-1.08e+04, -4.14e+03) | -2.36e+01 (-4.49e+01, -1.52e+00) |
| **coeff. variation 4** | 1.61e+05 (8.52e+04, 2.73e+05) | -1.20e-02 (-1.89e-02, -4.71e-03) | -2.00e+00 (-2.86e+00, -7.45e-01) | -7.29e+03 (-1.83e+05, 2.02e+05) | 1.99e+04 (1.14e+04, 3.94e+04) | 6.64e+05 (1.61e+05, 9.85e+05) |
| **coeff. variation 5** | 1.81e+04 (1.25e+04, 2.51e+04) | - | 6.10e+04 (1.10e+03, 1.40e+05) | - | - | 1.24e+05 (1.12e+04, 1.84e+05) |
| **coeff. variation 6** | -1.73e-02 (-2.94e-02, -7.29e-03) | - | -5.12e+04 (-7.94e+04, -3.02e+04) | - | - | -5.86e+04 (-9.16e+04, -1.92e+04) |
| **coeff.** | 2.04e-01 | - | -1.16e+05 | - | - | -1.25e+07 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **variation 7** | (4.88e-02, 4.00e-01) | | (-2.68e+05, 1.65e+04) | | | (-2.38e+07, -2.30e+06) |
| **coeff. variation 8** | -2.51e+05 (-3.79e+05, -1.49e+05) | - | 1.14e+05 (4.20e+04, 2.22e+05) | - | - | - |
| **intercept std error** | 4.91 | 9.53 | 5.10 | 6.20 | 3.79 | 7.37 |
| **std error 1** | 8.16E+02 | 4.00E+02 | 8.69E+01 | 0.00 | 5.22E+02 | 2.56E-03 |
| **std error 2** | 5.95E+02 | 6.05E+03 | 8.41E+03 | 1.70E+03 | 3.56E+02 | 8.13 |
| **std error 3** | 5.58E+03 | 5.62E+03 | 2.80E+03 | 2.11E+03 | 1.91E+03 | 8.30 |
| **std error 4** | 3.26E+04 | 3.49E-03 | 0.40 | 5.96E+04 | 5.45E+03 | 2.33E+05 |
| **std error 5** | 2.82E+03 | - | 2.71E+04 | - | - | 3.80E+04 |
| **std error 6** | 0.00 | - | 1.45E+04 | - | - | 1.32E+04 |
| **std error 7** | 0.06 | - | 5.21E+04 | - | - | 3.62E+06 |
| **std error 8** | 4.00E+04 | - | 4.19E+04 | - | - | - |
| **intercept p-value** | **1.04E-04** | **6.06E-05** | **2.25E-05** | **4.49E-08** | **5.77E-06** | **5.20E-04** |
| **p-value 1** | **3.53E-08** | 0.07 | **0.04** | **0.01** | **3.85E-05** | 0.20 |
| **p-value 2** | **6.63E-06** | **0.03** | **6.63E-04** | 0.14 | **0.02** | **0.04** |
| **p-value 3** | **3.99E-06** | 0.30 | **1.42E-03** | 0.16 | **1.77E-03** | **0.01** |
| **p-value 4** | **7.45E-05** | **1.55E-03** | **4.51E-05** | 0.89 | **1.71E-03** | **0.01** |
| **p-value 5** | **2.21E-06** | - | **0.03** | - | - | **2.97E-03** |
| **p-value 6** | **2.66E-04** | - | **1.90E-03** | - | - | **2.62E-04** |
| **p-value 7** | **2.86E-03** | - | **0.03** | - | - | **1.40E-03** |
| **p-value 8** | **4.27E-06** | - | **0.01** | - | - | - |

## Summer $OP_m$ DTT

**Table S19.** MLR model parameters for summer DTT source models**.**

| | vehicle emissions | biomass burning | coal / fossil fuel | cooking markers | dust | biogenic SOA |
|---|---|---|---|---|---|---|
| **model terms** | total EC + Cr + Co + Ni + Pb + C25 + C26 + C27 | total EC + $K^+$ + mannosan + $O_3$ | $Cl^-$ + Ba + Pb + C25 + C26 + C27 + C28 | CO + palmitic acid + stearic acid + cholesterol | $K^+$ + Al + Mn + Fe | isoprene + 2-methylthreitol + 2-methylerythritol + 3-methyl-2,3,4-trihydroxy-1-butene + trans-2-methyl-1,3,4-trihydroxy-1-butene + 3-hydroxy-glutaric acid + pinic acid + 3-acetylpentane-dioic acid |
| **residuals deviance min** | -10.52 | -12.40 | -8.31 | -12.94 | -10.09 | -12.59 |
| **residuals deviance median** | -0.59 | -0.62 | -0.32 | 0.68 | 0.11 | 1.15 |
| **residuals deviance mean** | 8.88E-15 | -1.62E-16 | 8.50E-15 | -4.14E-15 | 5.39E-17 | 3.12E-15 |
| **residuals deviance max** | 8.20 | 17.30 | 11.84 | 16.14 | 12.17 | 10.50 |
| **null deviance** | 2.77E+03 | 2.77E+03 | 2.77E+03 | 2.77E+03 | 2.77E+03 | 2.77E+03 |
| **residual deviance** | 5.58E+02 | 1.62E+03 | 8.85E+02 | 1.77E+03 | 1.49E+03 | 1.08E+03 |
| **$R^2$** | **0.80** | 0.41 | 0.68 | 0.36 | 0.46 | 0.61 |
| **intercept coefficient** | -1.81 | 7.34 | 7.60 | 22.04 | 14.69 | 18.08 |
| **coefficient 1** | -2.88E+02 | 3.30E+02 | 1.54E+02 | -0.01 | 2.69E+02 | -7.40 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **coefficient 2** | 5.11E+04 | 4.43E+02 | 6.78E+03 | 1.04E+04 | -1.15E+03 | 3.02E+05 |
| **coefficient 3** | 2.40E+05 | 3.59E+04 | 6.69E+03 | -1.63E+04 | -1.07E+04 | -1.70E+05 |
| **coefficient 4** | -4.48E+04 | 0.04 | -2.55E+05 | 5.98E+05 | 1.69E+03 | 4.64E+06 |
| **coefficient 5** | 6.65E+03 | - | 5.84E+05 | - | - | -2.05E+06 |
| **coefficient 6** | -2.36E+05 | - | 1.47E+05 | - | - | 6.07E+05 |
| **coefficient 7** | 5.63E+05 | - | -4.20E+05 | - | - | 5.04E+04 |
| **coefficient 8** | 9.83E+04 | - | - | - | - | 2.47E+06 |
| **intercept coeff. variation** | -2.12e+00 (-8.51e+00, 5.23e+00) | 6.83e+00 (-4.67e+00, 1.61e+01) | 7.46e+00 (-1.32e+00, 1.40e+01) | 2.16e+01 (2.80e+00, 2.98e+01) | 1.47e+01 (9.49e+00, 2.38e+01) | 1.74e+01 (5.29e+00, 3.30e+01) |
| **coeff. variation 1** | -2.78e+02 (-6.23e+02, -1.97e+01) | 3.25e+02 (3.50e+01, 5.86e+02) | 1.45e+02 (-8.58e+01, 3.83e+02) | -8.79e-03 (-1.91e-02, 1.54e-02) | 2.34e+02 (-5.82e+02, 5.73e+02) | -7.29e+00 (-1.94e+01, 1.21e+00) |
| **coeff. variation 2** | 5.15e+04 (3.13e+04, 7.04e+04) | 4.57e+02 (5.68e+01, 9.78e+02) | 6.45e+03 (-3.33e+03, 1.33e+04) | 1.27e+04 (-3.57e+03, 4.96e+04) | -1.15e+03 (-1.72e+03, -4.58e+02) | 2.87e+05 (-9.55e+04, 5.26e+05) |
| **coeff. variation 3** | 2.57e+05 (3.38e+04, 4.97e+05) | 4.23e+04 (1.47e+04, 1.27e+05) | 6.79e+03 (2.27e+03, 1.30e+04) | -1.97e+04 (-7.94e+04, 1.41e+04) | -1.06e+04 (-2.33e+04, -3.69e+02) | -1.62e+05 (-2.83e+05, 3.10e+04) |
| **coeff. variation 4** | -4.69e+04 (-1.29e+05, -4.42e+03) | 4.77e-02 (-7.66e-02, 1.50e-01) | -2.57e+05 (-3.62e+05, -1.67e+05) | 5.93e+05 (2.02e+05, 8.31e+05) | 1.70e+03 (1.21e+03, 2.31e+03) | 4.64e+06 (2.41e+06, 6.90e+06) |
| **coeff. variation 5** | 6.81e+03 (3.75e+03, 1.07e+04) | - | 6.08e+05 (3.68e+05, 1.10e+06) | 2.16e+01 (2.80e+00, 2.98e+01) | 1.47e+01 (9.49e+00, 2.38e+01) | -2.13e+06 (-4.36e+06, 1.65e+05) |
| **coeff. variation 6** | -2.32e+05 (-3.00e+05, -1.65e+05) | - | 1.46e+05 (8.47e+04, 2.34e+05) | - | - | 6.28e+05 (2.50e+05, 1.44e+06) |
| **coeff. variation 7** | 5.50e+05 (4.05e+05, 7.07e+05) | - | -4.33e+05 (-8.60e+05, -1.74e+05) | - | - | 5.78e+04 (2.48e+04, 1.83e+05) |
| **coeff. variation 8** | 9.83e+04 (2.12e+04, 1.49e+05) | - | - | - | - | 2.32e+06 (-2.88e+05, 3.61e+06) |
| **intercept std error** | 4.47 | 7.44 | 4.16 | 7.12 | 3.82 | 6.04 |
| **std error 1** | 1.58E+02 | 1.08E+02 | 8.17E+01 | 0.01 | 2.71E+02 | 6.03 |
| **std error 2** | 1.11E+04 | 2.80E+02 | 4.21E+03 | 7.95E+03 | 3.29E+02 | 1.15E+05 |
| **std error 3** | 1.54E+05 | 2.60E+04 | 3.01E+03 | 1.75E+04 | 5.48E+03 | 5.76E+04 |
| **std error 4** | 2.27E+04 | 0.08 | 5.96E+04 | 1.81E+05 | 3.98E+02 | 1.09E+06 |
| **std error 5** | 2.15E+03 | - | 1.53E+05 | - | - | 1.08E+06 |
| **std error 6** | 4.36E+04 | - | 4.70E+04 | - | - | 2.28E+05 |
| **std error 7** | 9.98E+04 | - | 1.96E+05 | - | - | 2.50E+04 |
| **std error 8** | 3.94E+04 | - | - | - | - | 1.03E+06 |
| **intercept p-value** | 0.69 | 0.33 | 0.08 | **4.42E-03** | **6.32E-04** | **6.33E-03** |
| **p-value 1** | 0.08 | **4.84E-03** | 0.07 | 0.31 | 0.33 | 0.23 |
| **p-value 2** | **1.14E-04** | 0.13 | 0.12 | 0.20 | **1.59E-03** | **1.52E-02** |
| **p-value 3** | 0.13 | 0.18 | **0.04** | 0.36 | 0.06 | **6.88E-03** |
| **p-value 4** | 0.06 | 0.58 | **2.37E-04** | **2.60E-03** | **2.26E-04** | **2.80E-04** |
| **p-value 5** | **4.89E-03** | - | **7.68E-04** | - | - | 0.07 |
| **p-value 6** | **1.49E-05** | - | **4.34E-03** | - | - | **1.36E-02** |
| **p-value 7** | **8.15E-06** | - | **0.04** | - | - | **0.05** |
| **p-value 8** | **1.98E-02** | - | - | - | - | **2.49E-02** |

# Winter $OP_m$ DCFH

**Table S20.** MLR model parameters for winter DCFH source models.

| | vehicle emissions | biomass burning | coal / fossil fuel | cooking markers | dust | biogenic SOA |
|---|---|---|---|---|---|---|
| **model terms** | Mn + Co + Zn + CO + NO2 + C24 + C25 + C34 | total EC + Cu + galactosan + levoglucosan + $O_3$ + CO | $SO_4^{2-}$ + Cu + Pb + C25 + C26 + C28 + C29 + C31 | CO + palmitic acid + stearic acid + cholesterol | $K^+$ + $Na^+$ + $Cl^-$ + Fe | $SO_4^{2-}$ + CO + 2-methylerythritol + cis-2-methyl-1,3,4-trihydroxy-1-butene + 3-methyl-2,3,4-trihydroxy-1-butene + trans-2-methyl-1,3,4-trihydroxy-1-butene + cis-pinonic acid + β-caryophyllinic acid |
| **residuals deviance min** | -2.45E-03 | -4.85E-03 | -2.86E-03 | -6.28E-03 | -3.01E-03 | -6.01E-03 |
| **residuals deviance median** | 8.78E-05 | -5.43E-05 | -2.04E-04 | -7.06E-05 | -4.94E-05 | -1.37E-04 |
| **residuals deviance mean** | -2.14E-17 | -2.93E-18 | -2.51E-18 | -1.08E-18 | 1.91E-18 | -3.32E-18 |
| **residuals deviance max** | 1.97E-03 | 6.66E-03 | 4.00E-03 | 1.05E-02 | 8.74E-03 | 5.13E-03 |
| **null deviance** | 2.99E-04 | 2.99E-04 | 2.99E-04 | 2.99E-04 | 2.99E-04 | 2.99E-04 |
| **residual deviance** | 3.21E-05 | 1.25E-04 | 7.57E-05 | 2.74E-04 | 1.49E-04 | 1.36E-04 |
| **$R^2$** | **0.89** | 0.58 | **0.75** | 0.08 | 0.50 | 0.55 |
| **intercept coefficient** | 1.34E-02 | 0.02 | 4.57E-03 | 7.57E-03 | 6.40E-03 | 0.01 |
| **coefficient 1** | -10.67 | -0.09 | 0.05 | -4.14E-08 | 0.38 | 0.07 |
| **coefficient 2** | -334.25 | -1.90 | -2.52 | 0.26 | 0.21 | -2.46E-06 |
| **coefficient 3** | 2.19 | 20.15 | 1.50 | -0.32 | -0.09 | -1.99E+02 |
| **coefficient 4** | 4.71E-06 | -1.79 | -13.39 | -23.43 | -0.15 | -5.61E+03 |
| **coefficient 5** | -2.97E-04 | -2.85E-04 | 34.14 | - | - | 2.69E+03 |
| **coefficient 6** | 24.92 | -2.40E-06 | -24.61 | - | - | 3.12E+02 |
| **coefficient 7** | -23.91 | - | 6.27 | - | - | -56.66 |
| **coefficient 8** | -59.27 | - | -31.26 | - | - | 15.85 |
| **intercept coeff. variation** | 1.30e-02 (9.71e-03, 1.56e-02) | 1.75e-02 (1.07e-02, 2.56e-02) | 4.69e-03 (2.81e-03, 8.33e-03) | 7.45e-03 (4.26e-03, 9.82e-03) | 6.33e-03 (3.86e-03, 8.63e-03) | 8.19e-03 (1.81e-03, 1.18e-02) |
| **coeff. variation 1** | -1.02e+01 (-1.61e+01, -3.06e+00) | -9.52e-02 (-2.00e-01, 1.26e-02) | 4.70e-02 (-3.41e-03, 6.58e-02) | 9.41e-09 (-1.34e-06, 1.22e-06) | 3.90e-01 (2.31e-01, 6.69e-01) | 6.82e-02 (3.10e-02, 1.05e-01) |
| **coeff. variation 2** | -3.34e+02 (-4.50e+02, -9.60e+01) | -1.44e+00 (-5.16e+00, 4.49e+00) | -3.21e+00 (-2.54e+01, -1.59e+00) | 1.58e-01 (-1.63e+00, 1.53e+00) | 2.01e-01 (-3.96e-02, 4.95e-01) | -2.51e-06 (-4.12e-06, 1.19e-06) |
| **coeff. variation 3** | 2.14e+00 (9.87e-01, 2.72e+00) | 2.08e+01 (6.99e+00, 3.30e+01) | 1.61e+00 (4.14e-01, 4.02e+00) | -1.24e-01 (-1.79e+00, 2.42e+00) | -8.59e-02 (-1.66e-01, -2.11e-02) | -2.05e+02 (-3.62e+02, 5.40e+01) |
| **coeff. variation 4** | 4.65e-06 (3.11e-06, 6.75e-06) | -1.84e+00 (-2.95e+00, -5.93e-01) | -1.41e+01 (-3.57e+01, 3.70e+00) | -2.34e+01 (-1.36e+02, 3.46e+01) | -1.59e-01 (-3.44e-01, 8.32e-02) | -5.73e+03 (-9.85e+03, 1.47e+03) |
| **coeff. variation 5** | -2.88e-04 (-3.84e-04, -1.66e-04) | -2.72e-04 (-5.07e-04, -1.72e-05) | 3.55e+01 (3.06e+00, 7.77e+01) | - | - | 2.81e+03 (1.06e+02, 5.39e+03) |
| **coeff. variation 6** | 2.52e+01 (1.77e+01, 4.14e+01) | -2.35e-06 (-4.71e-06, -5.10e-07) | -2.55e+01 (-5.96e+01, 1.24e+00) | - | - | 3.28e+02 (-2.03e+01, 6.90e+02) |
| **coeff.** | -2.42e+01 | 1.75e-02 | 5.82e+00 | | - | -5.75e+01 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **variation 7** | (-4.06e+01, -1.63e+01) | (1.07e-02, 2.56e-02) | (-9.04e+00, 1.51e+01) | | | (-1.67e+02, -2.85e+01) |
| **coeff. variation 8** | -5.61e+01 (-7.88e+01, -1.80e+01) | -9.52e-02 (-2.00e-01, 1.26e-02) | -2.96e+01 (-4.40e+01, 2.00e+00) | - | - | 1.63e+01 (5.17e+00, 2.94e+01) |
| **intercept std error** | 1.23E-03 | 3.50E-03 | 1.12E-03 | 1.64E-03 | 1.55E-03 | 1.98E-03 |
| **std error 1** | 1.71 | 0.05 | 0.01 | 9.17E-07 | 0.09 | 0.02 |
| **std error 2** | 35.34 | 1.24 | 1.08 | 0.45 | 0.22 | 9.26E-07 |
| **std error 3** | 0.24 | 6.71 | 0.86 | 0.56 | 0.03 | 84.29 |
| **std error 4** | 7.74E-07 | 0.64 | 7.37 | 15.74 | 0.09 | 2011.24 |
| **std error 5** | 4.03E-05 | 1.34E-04 | 13.71 | - | - | 1065.22 |
| **std error 6** | 5.80 | 1.23E-06 | 9.03 | - | - | 133.67 |
| **std error 7** | 5.82 | - | 4.16 | - | - | 20.70 |
| **std error 8** | 9.48 | - | 8.92 | - | - | 5.30 |
| **intercept p-value** | **2.47E-10** | **3.68E-05** | **4.92E-04** | **9.09E-05** | **3.35E-04** | **3.79E-04** |
| **p-value 1** | **2.84E-06** | **0.05** | **6.03E-04** | 0.96 | **3.86E-04** | **7.76E-04** |
| **p-value 2** | **3.30E-09** | 0.14 | **0.03** | 0.57 | 0.36 | **1.43E-02** |
| **p-value 3** | **7.07E-09** | **6.18E-03** | 0.10 | 0.57 | **6.61E-03** | **0.03** |
| **p-value 4** | **3.97E-06** | **1.00E-02** | 0.08 | 0.15 | 0.12 | **1.07E-02** |
| **p-value 5** | **2.24E-07** | **0.04** | **0.02** | - | - | **0.02** |
| **p-value 6** | **2.92E-04** | 0.06 | **1.24E-02** | - | - | **0.03** |
| **p-value 7** | **4.66E-04** | - | 0.15 | - | - | **1.20E-02** |
| **p-value 8** | **2.71E-06** | - | **2.01E-03** | - | - | **6.75E-03** |

## Summer $OP_m$ DCFH

**Table S21.** MLR model parameters for summer DCFH source models**.**

| | **vehicle emissions** | **biomass burning** | **coal / fossil fuel** | **cooking markers** | **dust** | **biogenic SOA** |
|---|---|---|---|---|---|---|
| **model terms** | total EC +<br>Ba +<br>$O_3$ +<br>CO +<br>$NO_y$ +<br>C29 +<br>C31 | total EC +<br>$K^+$ +<br>$O_3$ +<br>CO | $SO_4^{2-}$ +<br>$Cl^-$ +<br>Cu +<br>Cd +<br>C24 +<br>C26 +<br>C28 +<br>C31 | CO +<br>palmitic acid +<br>stearic acid +<br>cholesterol | $Na^+$ +<br>$Ca^{2+}$ +<br>Mn +<br>Zn | $SO_4^{2-}$ +<br>CO +<br>isoprene +<br>methyl ethyl ketone +<br>3-methyl-2,3,4-trihydroxy-1-butene +<br>trans-2-methyl-1,3,4-trihydroxy-1-butene +<br>3-hydroxyglutaric acid +<br>β-caryophyllinic acid |
| **residuals deviance min** | -2.92E-03 | -3.33E-03 | -3.48E-03 | -4.25E-03 | -3.61E-03 | -2.61E-03 |
| **residuals deviance median** | -3.00E-04 | 6.18E-05 | 1.98E-04 | -3.06E-06 | 1.81E-04 | 2.69E-04 |
| **residuals deviance mean** | 9.79E-18 | 5.06E-19 | -3.64E-18 | -9.46E-19 | -1.49E-18 | -2.37E-19 |
| **residuals deviance max** | 4.05E-03 | 7.66E-03 | 4.17E-03 | 8.23E-03 | 9.00E-03 | 2.33E-03 |
| **null deviance** | 2.57E-04 | 2.57E-04 | 2.57E-04 | 2.57E-04 | 2.57E-04 | 2.57E-04 |
| **residual deviance** | 9.72E-05 | 1.78E-04 | 7.38E-05 | 1.96E-04 | 1.89E-04 | 7.78E-05 |
| **$R^2$** | 0.62 | 0.31 | **0.71** | 0.24 | 0.26 | **0.70** |
| **intercept coefficient** | 0.02 | 9.63E-03 | -0.01 | 0.01 | 0.01 | -1.76E-03 |
| **coefficient 1** | -0.29 | -0.11 | 0.05 | 2.20E-06 | 0.40 | 0.04 |
| **coefficient 2** | 4.64 | 0.05 | -0.09 | 3.12 | -0.34 | 3.41E-06 |
| **coefficient 3** | -1.61E-04 | -5.64E-05 | 9.23 | -7.55 | -2.54 | -7.01E-03 |
| **coefficient 4** | 1.14E-05 | 4.20E-06 | 5.99 | -1.26E+02 | 0.44 | 5.11E-03 |
| **coefficient 5** | -1.26E-04 | | 6.84E+01 | | | -6.21E+02 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **coefficient 6** | 4.68E+01 | | -2.22E+02 | | | 1.14E+03 |
| **coefficient 7** | -3.33E+01 | | 3.54E+02 | | | -2.33E+02 |
| **coefficient 8** | | | -3.90E+01 | | | -3.99E+01 |
| **intercept coeff. variation** | 1.67e-02 (8.77e-03, 2.51e-02) | 9.59e-03 (4.76e-03, 1.30e-02) | -6.12e-03 (-1.13e-02, 1.04e-03) | 8.02e-03 (4.61e-03, 1.23e-02) | 6.57e-03 (4.37e-03, 9.38e-03) | -1.57e-03 (-8.17e-03, 4.77e-03) |
| **coeff. variation 1** | -2.88e-01 (-4.07e-01, -1.05e-01) | -1.09e-01 (-1.53e-01, -2.24e-02) | 5.01e-02 (2.43e-02, 6.96e-02) | 1.92e-06 (-3.92e-06, 7.22e-06) | 4.09e-01 (4.37e-02, 7.66e-01) | 4.38e-02 (1.01e-02, 5.71e-02) |
| **coeff. variation 2** | 4.57e+00 (8.96e-01, 7.21e+00) | 4.73e-02 (-8.93e-02, 2.18e-01) | -8.92e-02 (-1.29e-01, -4.39e-02) | 2.96e+00 (-7.34e+00, 9.07e+00) | -3.43e-01 (-4.88e-01, -1.48e-01) | 3.55e-06 (3.88e-07, 1.08e-05) |
| **coeff. variation 3** | -1.61e-04 (-2.46e-04, -6.22e-05) | -5.49e-05 (-1.10e-04, -3.45e-06) | 8.73e+00 (2.19e+00, 1.43e+01) | -7.24e+00 (-1.88e+01, 9.31e+00) | -2.75e+00 (-7.56e+00, -1.48e+00) | -7.06e-03 (-1.12e-02, -3.59e-03) |
| **coeff. variation 4** | 1.11e-05 (2.76e-06, 1.84e-05) | 4.01e-06 (-4.63e-06, 7.96e-06) | 5.62e+00 (-2.69e+00, 8.70e+00) | -1.29e+02 (-2.18e+02, -3.09e+01) | 4.37e-01 (-2.19e-01, 1.03e+00) | 5.06e-03 (1.77e-03, 7.27e-03) |
| **coeff. variation 5** | -1.26e-04 (-1.90e-04, -2.89e-05) | | 6.58e+01 (2.86e+01, 8.99e+01) | | | -5.97e+02 (-9.78e+02 ,-5.52e+01) |
| **coeff. variation 6** | 4.76e+01 (2.65e+01, 7.13e+01) | | -2.15e+02 (-3.03e+02, -1.16e+02) | | | 1.12e+03 (2.09e+02, 1.69e+03) |
| **coeff. variation 7** | -3.36e+01 (-5.69e+01, -1.95e+01) | | 3.46e+02 (1.91e+02, 4.72e+02) | | | -2.32e+02 (-4.54e+02, -8.63e+01) |
| **coeff. variation 8** | | | -3.86e+01 (-6.26e+01, -2.51e+01) | | | -3.97e+01 (-6.81e+01, -6.33e-01) |
| **intercept std error** | 2.83E-03 | 2.59E-03 | 2.80E-03 | 2.37E-03 | 1.22E-03 | 2.78E-03 |
| **std error 1** | 0.08 | 0.03 | 0.01 | 3.06E-06 | 0.24 | 7.57E-03 |
| **std error 2** | 1.65 | 0.09 | 0.03 | 2.65 | 0.14 | 2.42E-06 |
| **std error 3** | 3.72E-05 | 2.90E-05 | 4.17 | 5.82 | 1.30 | 1.78E-03 |
| **std error 4** | 3.08E-06 | 3.06E-06 | 3.16 | 6.02E+01 | 0.41 | 1.36E-03 |
| **std error 5** | 3.83E-05 | | 2.26E+01 | | | 2.72E+02 |
| **std error 6** | 1.38E+01 | | 6.22E+01 | | | 3.30E+02 |
| **std error 7** | 1.14E+01 | | 8.53E+01 | | | 6.31E+01 |
| **std error 8** | | | 7.96 | | | 1.41E+01 |
| **intercept p-value** | **3.72E-06** | **8.89E-04** | **0.03** | **2.55E-03** | **1.34E-05** | 0.53 |
| **p-value 1** | **8.62E-04** | **3.56E-03** | **7.28E-06** | 0.48 | 0.10 | **3.96E-06** |
| **p-value 2** | **9.27E-03** | 0.60 | **0.01** | 0.25 | **0.02** | 0.17 |
| **p-value 3** | **2.10E-04** | 0.06 | **0.04** | 0.20 | 0.06 | **6.08E-04** |
| **p-value 4** | **1.06E-03** | 0.18 | 0.07 | **0.04** | 0.30 | **1.00E-03** |
| **p-value 5** | **3.01E-03** | | **5.82E-03** | | | **0.03** |
| **p-value 6** | **2.37E-03** | | **1.57E-03** | | | **2.11E-03** |
| **p-value 7** | **7.40E-03** | | **3.61E-04** | | | **1.15E-03** |
| **p-value 8** | | | **5.38E-05** | | | **9.31E-03** |

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