Supplement of

Assessing the impact of anthropogenic pollution on isoprene-derived secondary organic aerosol formation in PM$_{2.5}$ collected from the Birmingham, Alabama ground site during the 2013 Southern Oxidant and Aerosol Study

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Table S1. Instrumentation and time resolution of collocated measurements at BHM.

| Category                | Variable               | Analyzer/Sensor                                      | Time Resolution (Interval, average) |
|-------------------------|------------------------|------------------------------------------------------|--------------------------------------|
| **Meteorology**         |                        |                                                      |                                      |
| Wind Speed/Direction    | RMYoung 81000 sonic    |                                                      | 5, 60                                |
| T/RH/BP                 | Paroscientific Met4A   |                                                      | 5, 60                                |
| T/RH                    | Vaisala                |                                                      | 5, 60                                |
| PAR                     | Licor                  |                                                      | 5, 60                                |
| Precipitation           | ETI-NOAH IV            |                                                      | 5, 60                                |
| Aerosol/cloud layers    | JenOptik CHM 15k ceilometer |                                              | 5, 60                                |
| Surface wetness         | Vaisala (SWS2)         |                                                      | 5, 60                                |
| **Trace Gases**         |                        |                                                      |                                      |
| O$_3$                   | Thermo 49i             |                                                      | 5, 60                                |
| CO                      | Thermo 48i             |                                                      | 5, 60                                |
| SO$_2$                  | Thermo 43i             |                                                      | 5, 60                                |
| NO                      | Thermo 42i             |                                                      | 5, 60                                |
| NO$_2$                  | Photolysis/Thermo 49i  |                                                      | 5, 60                                |
| HNO$_3$                 | Continuous denuder diff/Thermo 42i |                        | 5, 60                                |
| NO$_3$                  | Cat. reduction/Thermo 42i |                                                 | 5, 60                                |
| NH$_3$                  | Continuous denuder diff/Thermo 42i |                        | 5, 60                                |
| **Continuous PM**       |                        |                                                      |                                      |
| PM$_{2.5}$ Mass         | TEOM                   |                                                      | 60                                   |
| PM$_{2.5}$ coarse Mass  | Dichotomous TEOM       |                                                      | 60                                   |
| PM$_{2.5}$ SO$_4$       | Cat. reduction/Thermo 43i |                                                 | 60                                   |
| PM$_{2.5}$ NO$_3$       | Cat. reduction/Thermo 42i |                                                 | 60                                   |
| PM$_{2.5}$ NH$_4$       | Cat. oxidation/Thermo 42i |                                                | 60                                   |
| PM$_{2.5}$ TC/EC        | Sunset                 |                                                      | 60                                   |
| Dry Babs (880 nm)       | Radiance Research M903 |                                                      | 5, 60                                |
| Dry Bsp (530 nm)        | Magee 2ch. Aeth        |                                                      | 5, 60                                |
| Ambient Bsp (530 nm)    | Optec NGN-2a           |                                                      | 5, 60                                |
| **Filter-Based PM**     |                        |                                                      |                                      |
| PM$_{2.5}$ Mass         | gravimetry             |                                                      | 1440, daily                          |
| PM$_{2.5}$ ions         | IC                     |                                                      | 1440, 1 in 3 days                   |
| PM$_{2.5}$ major/minor elements | XRF                  |                                                      | 1440, daily                          |
| PM$_{2.5}$ water-soluble metals | ICPMS              |                                                      | 1440, 1 in 3 days                   |
| PM$_{2.5}$ OC/EC        | TOR                    |                                                      | 1440, 1 in 3 days                   |
| PM$_{coarse}$ Mass      | gravimetry             |                                                      | 1440, 1 in 3 days                   |
| PM$_{coarse}$ ions      | IC                     |                                                      | 1440, 1 in 3 days                   |
| PM$_{coarse}$ major/minor elements | XRF                  |                                                      | 1440, 1 in 3 days                   |
| PM$_{coarse}$ water-soluble metals | ICPMS           |                                                      | 1440, 1 in 3 days                   |
| **Hi-Vol Based PM**     |                        |                                                      |                                      |
| PM$_{2.5}$ OC/EC        | TOR                    |                                                      | 23-hr, daily                         |
| PM$_{2.5}$ ions         | IC                     |                                                      | 23-hr, daily                         |
| PM$_{2.5}$ (other)      | Various                |                                                      | 11-hr, daily                         |
Table S2. Correlation ($r^2$) of isoprene-derived SOA tracers and collocated measurements during regular day sampling (8 am – 7 pm).

| SOA tracers | CO    | O$_3$  | NO$_x$ | NO$_2$ | SO$_2$ | NH$_3$ | SO$_4$ | NO$_3$ | NH$_4$ | OC     | WSOC | pH |
|-------------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|----|
| MAE/HMML-derived SOA tracers | 0.31  | 0.72   | 0.04   | 0.00   | 0.20   | 0.34   | 0.51   | 0.10   | 0.53   | 0.44   | 0.48 | 0.01 |
| 2-methylglyceric acid            | 0.14  | 0.44   | 0.01   | 0.00   | 0.09   | 0.15   | 0.19   | 0.03   | 0.27   | 0.09   | 0.12 | 0.00 |
| MAE-derived OS                   | 0.28  | 0.60   | 0.04   | 0.00   | 0.14   | 0.31   | 0.66   | 0.14   | 0.56   | 0.58   | 0.52 | 0.01 |
| IEPOX-derived SOA tracers        | 0.09  | 0.26   | 0.01   | 0.01   | 0.08   | 0.12   | 0.41   | 0.04   | 0.41   | 0.31   | 0.32 | 0.01 |
| 2-methylerythritol               | 0.04  | 0.30   | 0.03   | 0.00   | 0.05   | 0.04   | 0.31   | 0.00   | 0.31   | 0.24   | 0.30 | 0.01 |
| 2-methylthreitol                 | 0.02  | 0.20   | 0.02   | 0.00   | 0.06   | 0.03   | 0.21   | 0.00   | 0.23   | 0.13   | 0.19 | 0.00 |
| (E)-2-methylbut-3-ene-1,2,4-triol | 0.05  | 0.24   | 0.02   | 0.00   | 0.03   | 0.05   | 0.33   | 0.02   | 0.32   | 0.22   | 0.27 | 0.00 |
| (Z)-2-methylbut-3-ene-1,2,4-triol | 0.10  | 0.11   | 0.00   | 0.01   | 0.09   | 0.17   | 0.34   | 0.10   | 0.32   | 0.24   | 0.16 | 0.01 |
| 2-methylbut-3-ene-1,2,3-triol     | 0.11  | 0.11   | 0.00   | 0.01   | 0.09   | 0.18   | 0.36   | 0.10   | 0.34   | 0.25   | 0.17 | 0.01 |
| IEPOX-derived OS                 | 0.17  | 0.41   | 0.01   | 0.01   | 0.08   | 0.19   | 0.47   | 0.07   | 0.50   | 0.53   | 0.59 | 0.01 |
| IEPOX dimer                      | 0.00  | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00 | 0.00 |
| Other isoprene SOA tracers       |       |        |        |        |        |        |        |        |        |        |      |    |
| GA sulfate                       | 0.22  | 0.20   | 0.00   | 0.00   | 0.07   | 0.19   | 0.49   | 0.20   | 0.39   | 0.33   | 0.21 | 0.01 |
| Methylglyoxal-derived OS         | 0.25  | 0.40   | 0.01   | 0.01   | 0.11   | 0.11   | 0.57   | 0.05   | 0.46   | 0.41   | 0.47 | 0.01 |
| Isoprene-derived OSs             |       |        |        |        |        |        |        |        |        |        |      |    |
| C$_5$H$_7$O$_7$S                      | 0.13  | 0.34   | 0.01   | 0.01   | 0.02   | 0.17   | 0.35   | 0.11   | 0.40   | 0.21   | 0.28 | 0.00 |
| C$_5$H$_8$NO$_3$S                      | 0.02  | 0.37   | 0.12   | 0.06   | 0.00   | 0.01   | 0.48   | 0.12   | 0.38   | 0.18   | 0.12 | 0.11 |
| C$_5$H$_9$NO$_3$S *                   | 0.25  | 0.56   | 0.48   | 0.40   | 0.15   | 0.40   | 0.52   | 0.28   | 0.24   | 0.57   | 0.46 | 0.00 |
| Hydroxyacetone-derived OS         | 0.42  | 0.73   | 0.06   | 0.16   | 0.00   | 0.18   | 0.55   | 0.23   | 0.71   | 0.57   | 0.66 | 0.00 |
| Other tracer                      |       |        |        |        |        |        |        |        |        |        |      |    |
| Levoglucosan                      | 0.26  | 0.34   | 0.00   | 0.00   | 0.09   | 0.21   | 0.44   | 0.10   | 0.47   | 0.22   | 0.25 | 0.01 |

* Found only in 6 of 120 filters

The correlations in this table are positive.
Table S3. Correlation ($r^2$) of isoprene-derived SOA tracers and collocated measurements during intensive 1 sampling (8 am – 11 am).

| SOA tracers | CO | O$_3$ | NO$_x$ | NO$_y$ | SO$_2$ | NH$_3$ | SO$_4$ | NO$_3$ | NH$_4$ | OC | WSOC | pH |
|-------------|----|------|-------|-------|-------|-------|-------|-------|-------|----|------|----|
| MAE/HMML-derived SOA tracers | 0.00 | 0.20 | 0.04 | 0.16 | 0.01 | 0.07 | 0.35 | 0.25 | 0.46 | 0.47 | 0.16 | 0.18 |
| 2-methylglyceric acid | 0.03 | 0.22 | 0.05 | 0.10 | 0.00 | 0.07 | 0.00 | 0.43 | 0.11 | 0.46 | 0.07 | 0.08 |
| MAE-derived OS | 0.01 | 0.09 | 0.02 | 0.12 | 0.01 | 0.03 | 0.72 | 0.06 | 0.62 | 0.26 | 0.08 | 0.18 |
| IEPOX-derived SOA tracers | 0.11 | 0.04 | 0.05 | 0.00 | 0.06 | 0.26 | 0.30 | 0.00 | 0.16 | 0.04 | 0.02 | 0.03 |
| 2-methylerythritol | 0.15 | 0.01 | 0.02 | 0.00 | 0.16 | 0.52 | 0.22 | 0.03 | 0.18 | 0.00 | 0.00 | 0.15 |
| 2-methylthreitol | 0.04 | 0.00 | 0.00 | 0.00 | 0.10 | 0.19 | 0.13 | 0.02 | 0.16 | 0.00 | 0.02 | 0.13 |
| (E)-2-methylbut-3-ene-1,2,4-triol | 0.12 | 0.03 | 0.06 | 0.01 | 0.01 | 0.27 | 0.23 | 0.00 | 0.11 | 0.11 | 0.05 | 0.00 |
| (Z)-2-methylbut-3-ene-1,2,4-triol | 0.13 | 0.02 | 0.05 | 0.01 | 0.03 | 0.32 | 0.28 | 0.00 | 0.08 | 0.09 | 0.05 | 0.00 |
| 2-methylbut-3-ene-1,2,3-triol | 0.07 | 0.02 | 0.02 | 0.00 | 0.02 | 0.26 | 0.22 | 0.01 | 0.03 | 0.04 | 0.28 | 0.01 |
| IEPOX-derived OS | 0.09 | 0.07 | 0.07 | 0.00 | 0.05 | 0.19 | 0.30 | 0.00 | 0.17 | 0.04 | 0.00 | 0.02 |
| IEPOX dimer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Other isoprene SOA tracers | | | | | | | | | | | | |
| GA sulfate | | | | | | | | | | | | |
| C$_5$H$_3$O$_6$S | 0.00 | 0.19 | 0.03 | 0.01 | 0.01 | 0.03 | 0.37 | 0.02 | 0.44 | 0.25 | 0.11 | 0.00 |
| Methylglyoxal-derived OS | | | | | | | | | | | | |
| C$_5$H$_2$O$_5$S | 0.05 | 0.05 | 0.18 | 0.28 | 0.02 | 0.00 | 0.01 | 0.11 | 0.24 | 0.09 | 0.56 | 0.03 |
| Isoprene-derived OSs | | | | | | | | | | | | |
| C$_5$H$_3$O$_6$S | 0.09 | 0.15 | 0.00 | 0.20 | 0.05 | 0.02 | 0.36 | 0.12 | 0.25 | 0.40 | 0.00 | 0.02 |
| C$_5$H$_3$NO$_4$S | 0.00 | 0.05 | 0.02 | 0.06 | 0.06 | 0.04 | 0.38 | 0.00 | 0.23 | 0.17 | 0.18 | 0.37 |
| C$_5$H$_6$N$_2$O$_3$S | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.21 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hydroxyacetone-derived OS | | | | | | | | | | | | |
| C$_5$H$_3$O$_6$S | 0.25 | 0.67 | 0.71 | 0.65 | 0.21 | 0.21 | 0.03 | 0.26 | 0.12 | 0.50 | 0.00 | 0.70 |
| Other tracer | | | | | | | | | | | | |
| Levoglucosan | 0.03 | 0.07 | 0.02 | 0.00 | 0.07 | 0.07 | 0.08 | 0.11 | 0.01 | 0.03 | 0.02 | 0.24 |

* Found only in 6 of 120 filters

The correlations in this table are positive.
Table S4. Correlation ($r^2$) of isoprene-derived SOA tracers and collocated measurements during intensive 2 sampling (12 pm – 3 pm).

| SOA tracers                          | CO | O$_3$ | NO$_x$ | NO$_2$ | NH$_3$ | SO$_4$ | NO$_3$ | NH$_4$ | OC | WSOC | pH  |
|--------------------------------------|----|-------|--------|--------|--------|--------|--------|--------|-----|------|-----|
| MAE/HMML-derived SOA tracers         | 0.13 | 0.42  | 0.00   | 0.12   | 0.04   | 0.01   | 0.14   | 0.05   | 0.29 | 0.55 | 0.19 | 0.00 |
| 2-methylglyceric acid                | 0.01 | 0.47   | 0.25   | 0.32   | 0.00   | 0.04   | 0.00   | 0.05   | 0.04 | 0.17 | 0.07 | 0.05 |
| MAE-derived OS                       | 0.15 | 0.20   | 0.04   | 0.01   | 0.06   | 0.00   | 0.18   | 0.15   | 0.31 | 0.49 | 0.24 | 0.03 |
| IEPOX-derived SOA tracers            | 0.22 | 0.00   | 0.04   | 0.08   | 0.00   | 0.21   | 0.34   | 0.32   | 0.37 | 0.46 | 0.81 | 0.02 |
| 2-methylerythritol                   | 0.41 | 0.00   | 0.13   | 0.14   | 0.01   | 0.16   | 0.48   | 0.24   | 0.50 | 0.42 | 0.77 | 0.01 |
| 2-methylthreitol                     | 0.29 | 0.00   | 0.03   | 0.07   | 0.00   | 0.07   | 0.22   | 0.41   | 0.39 | 0.32 | 0.70 | 0.02 |
| (E)-2-methylbut-3-ene-1,2,4-triol    | 0.17 | 0.00   | 0.04   | 0.07   | 0.01   | 0.17   | 0.30   | 0.31   | 0.29 | 0.44 | 0.61 | 0.02 |
| (Z)-2-methylbut-3-ene-1,2,4-triol    | 0.21 | 0.00   | 0.05   | 0.07   | 0.01   | 0.17   | 0.33   | 0.29   | 0.31 | 0.45 | 0.64 | 0.01 |
| 2-methylbut-3-ene-1,2,3-triol        | 0.03 | 0.02   | 0.00   | 0.02   | 0.03   | 0.07   | 0.13   | 0.21   | 0.06 | 0.09 | 0.62 | 0.03 |
| IEPOX-derived OS                     | 0.19 | 0.02   | 0.11   | 0.21   | 0.00   | 0.32   | 0.43   | 0.16   | 0.39 | 0.52 | 0.58 | 0.00 |
| IEPOX dimer                          | 0.00 | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00 | 0.00 | 0.00 | 0.00 |
| Other isoprene SOA tracers           |     |       |        |        |        |        |        |        |      |      |      |      |
| GA sulfate                           | 0.24 | 0.23   | 0.00   | 0.08   | 0.00   | 0.06   | 0.32   | 0.23   | 0.46 | 0.46 | 0.48 | 0.00 |
| Methylglyoxal-derived OS             | 0.27 | 0.28   | 0.01   | 0.02   | 0.01   | 0.06   | 0.29   | 0.00   | 0.29 | 0.33 | 0.43 | 0.03 |
| Isoprene-derived OSs                 |     |       |        |        |        |        |        |        |      |      |      |      |
| C$_5$H$_7$O$_7$S$^-$                 | 0.14 | 0.02   | 0.06   | 0.07   | 0.03   | 0.06   | 0.16   | 0.00   | 0.18 | 0.18 | 0.09 | 0.00 |
| C$_5$H$_9$NO$_9$S$^-$                | 0.00 | 0.15   | 0.07   | 0.05   | 0.21   | 0.34   | 0.03   | 0.05   | 0.00 | 0.06 | 0.00 | 0.18 |
| C$_5$H$_9$N$_2$O$_{11}$S$^-$         | 0.00 | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00 | 0.00 | 0.00 | 0.00 |
| Hydroxyacetone-derived OS            |     |       |        |        |        |        |        |        |      |      |      |      |
| C$_5$H$_9$O$_8$S$^-$                 | 0.09 | 0.40   | 0.01   | 0.01   | 0.10   | 0.05   | 0.04   | 0.07   | 0.10 | 0.07 | 0.62 | 0.01 |
| Other tracer                         |     |       |        |        |        |        |        |        |      |      |      |      |
| Levoglucosan                         | 0.03 | 0.00   | 0.22   | 0.13   | 0.00   | 0.01   | 0.03   | 0.17   | 0.00 | 0.02 | 0.00 | 0.07 |

* Found only in 6 of 120 filters

The correlations in this table are positive.
Table S5. Correlation ($r^2$) of isoprene-derived SOA tracers and collocated measurements during intensive 3 sampling (4 pm – 7 pm).

| SOA tracers               | CO  | O$_3$ | NO$_x$ | NO$_2$ | SO$_x$ | NH$_3$ | SO$_4$ | NO$_3$ | NH$_4$ | OC   | WSOC | pH  |
|----------------------------|-----|-------|--------|--------|--------|--------|--------|--------|--------|------|------|-----|
| MAE/HMML-derived SOA      | 0.01| 0.47  | 0.45   | 0.39   | 0.47   | 0.00   | 0.19   | 0.10   | 0.12   | 0.54 | 0.23 | 0.15|
| tracers                   |     |       |        |        |        |        |        |        |        |      |      |     |
| 2-methylglyceric acid     | 0.12| 0.37  | 0.03   | 0.17   | 0.25   | 0.00   | 0.00   | 0.05   | 0.02   | 0.34 | 0.50 | 0.15|
| MAE-derived OS            | 0.00| 0.37  | 0.44   | 0.39   | 0.41   | 0.01   | 0.25   | 0.09   | 0.13   | 0.45 | 0.04 | 0.10|
| IEPOX-derived SOA         | 0.10| 0.15  | 0.18   | 0.14   | 0.50   | 0.17   | 0.47   | 0.00   | 0.18   | 0.31 | 0.24 | 0.03|
| tracers                   |     |       |        |        |        |        |        |        |        |      |      |     |
| 2-methylerythritol        | 0.03| 0.34  | 0.08   | 0.04   | 0.58   | 0.12   | 0.34   | 0.01   | 0.14   | 0.42 | 0.22 | 0.00|
| 2-methylthreitol          | 0.04| 0.32  | 0.03   | 0.01   | 0.43   | 0.17   | 0.25   | 0.03   | 0.14   | 0.54 | 0.21 | 0.01|
| (E)-2-methylbut-3-ene-1,2,4-triol | 0.00| 0.21  | 0.05   | 0.02   | 0.70   | 0.13   | 0.33   | 0.00   | 0.12   | 0.38 | 0.01 | 0.02|
| (Z)-2-methylbut-3-ene-1,2,4-triol | 0.00| 0.21  | 0.09   | 0.05   | 0.77   | 0.14   | 0.41   | 0.00   | 0.13   | 0.27 | 0.01 | 0.01|
| 2-methylbut-3-ene-1,2,3-triol | 0.54| 0.00  | 0.12   | 0.13   | 0.00   | 0.01   | 0.18   | 0.04   | 0.06   | 0.00 | 0.33 | 0.02|
| IEPOX-derived OS          | 0.15| 0.10  | 0.17   | 0.12   | 0.42   | 0.16   | 0.41   | 0.00   | 0.15   | 0.24 | 0.29 | 0.03|
| IEPOX dimer               | 0.00| 0.00  | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00 | 0.00 | 0.00|
| Other isoprene SOA tracers|     |       |        |        |        |        |        |        |        |      |      |     |
| GA sulfate                |     |       |        |        |        |        |        |        |        |      |      |     |
| C$_2$H$_5$O$_5$S$^-$       | 0.20| 0.28  | 0.43   | 0.32   | 0.02   | 0.00   | 0.19   | 0.16   | 0.30   | 0.55 | 0.01 | 0.21|
| Methylglyoxal-derived OS  |     |       |        |        |        |        |        |        |        |      |      |     |
| C$_3$H$_5$O$_5$S$^-$       | 0.26| 0.16  | 0.01   | 0.01   | 0.10   | 0.12   | 0.57   | 0.34   | 0.60   | 0.03 | 0.00 | 0.02|
| Isoprene-derived OSs      |     |       |        |        |        |        |        |        |        |      |      |     |
| C$_3$H$_5$O$_5$S$^-$       | 0.06| 0.18  | 0.19   | 0.13   | 0.12   | 0.14   | 0.45   | 0.02   | 0.35   | 0.55 | 0.02 | 0.00|
| C$_3$H$_5$N$_5$O$_5$S$^-$  | 0.06| 0.45  | 0.00   | 0.03   | 0.80   | 0.05   | 0.44   | 0.03   | 0.18   | 0.27 | 0.15 | 0.00|
| C$_3$H$_7$NO$_3$O$_5$S$^-$ | 0.00| 0.00  | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00 | 0.00 | 0.00|
| Hydroxyacetone-derived OS |     |       |        |        |        |        |        |        |        |      |      |     |
| C$_3$H$_5$O$_5$S$^-$       | 0.49| 0.01  | 0.10   | 0.20   | 0.13   | 0.05   | 0.44   | 0.24   | 0.11   | 0.06 | 0.29 | 0.10|
| Other tracer              |     |       |        |        |        |        |        |        |        |      |      |     |
| Levoglucosan              | 0.00| 0.01  | 0.02   | 0.04   | 0.00   | 0.06   | 0.00   | 0.02   | 0.00   | 0.20 | 0.01 | 0.04|

* Found only in 6 of 120 filters

The correlations in this table are positive.
Table S6. Correlation ($r^2$) of isoprene-derived SOA tracers and collocated measurements during intensive 4 and regular nighttime (8 pm – 7 am next day).

| SOA tracers                      | CO  | O$_3$ | NO$_x$ | NO$_2$ | NH$_3$ | SO$_4$ | NO$_3$ | NH$_4$ | OC   | WSOC | pH  |
|----------------------------------|-----|-------|--------|--------|--------|--------|--------|--------|------|------|-----|
| MAE/HMML-derived SOA tracers     | 0.35| 0.08  | 0.18   | 0.21   | 0.17   | 0.39   | 0.48   | 0.15   | 0.42 | 0.53 | 0.15| 0.01 |
| 2-methylglyceric acid             | 0.18| 0.00  | 0.13   | 0.10   | 0.12   | 0.18   | 0.17   | 0.05   | 0.22 | 0.17 | 0.01| 0.04 |
| MAE-derived OS                   | 0.35| 0.14  | 0.15   | 0.17   | 0.11   | 0.32   | 0.51   | 0.17   | 0.36 | 0.58 | 0.20| 0.00 |
| IEPOX-derived SOA tracers        | 0.10| 0.10  | 0.02   | 0.03   | 0.08   | 0.10   | 0.37   | 0.02   | 0.30 | 0.27 | 0.15| 0.00 |
| 2-methylerythritol               | 0.02| 0.12  | 0.00   | 0.00   | 0.05   | 0.01   | 0.23   | 0.00   | 0.20 | 0.14 | 0.09| 0.00 |
| 2-methylthreitol                 | 0.06| 0.09  | 0.00   | 0.01   | 0.09   | 0.05   | 0.38   | 0.01   | 0.30 | 0.21 | 0.15| 0.00 |
| (E)-2-methylbut-3-ene-1,2,4-triol| 0.09| 0.08  | 0.02   | 0.03   | 0.10   | 0.10   | 0.35   | 0.03   | 0.28 | 0.26 | 0.11| 0.00 |
| (Z)-2-methylbut-3-ene-1,2,4-triol| 0.07| 0.07  | 0.01   | 0.02   | 0.10   | 0.07   | 0.32   | 0.02   | 0.27 | 0.22 | 0.08| 0.00 |
| 2-methylbut-3-ene-1,2,3-triol     | 0.02| 0.05  | 0.00   | 0.01   | 0.03   | 0.02   | 0.18   | 0.01   | 0.16 | 0.15 | 0.09| 0.00 |
| IEPOX-derived OS                 | 0.17| 0.10  | 0.08   | 0.10   | 0.01   | 0.16   | 0.27   | 0.03   | 0.21 | 0.31 | 0.14| 0.01 |
| IEPOX dimer                      | 0.00| 0.00  | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00 | 0.00 | 0.00| 0.00 |

Other isoprene SOA tracers

GA sulfate

$\text{C}_2\text{H}_3\text{O}_6\text{S}^-$

Methylglyoxal-derived OS

$\text{C}_3\text{H}_2\text{O}_5^-$

Isoprene-derived OSs

$\text{C}_3\text{H}_7\text{O}_6\text{S}^-$

$\text{C}_3\text{H}_6\text{NO}_6\text{S}^-$

$\text{C}_3\text{H}_9\text{N}_2\text{O}_1\text{S}^*$

Hydroxyacetone-derived OS

$\text{C}_9\text{H}_7\text{O}_6\text{S}^-$

Other tracer

Levoglucosan

0.23  0.00  0.22  0.24  0.08  0.21  0.13  0.01  0.18  0.25  0.11  0.00

* Found only in 6 of 120 filters

The correlations in this table are positive.
### Table S7. Regression and correlation ($r^2$) analysis at the 95% confidence interval

| Variables | Regression Statistics |  
|-----------|----------------------|
|           | Y                   | x | Number of observations | Multiple $r$ | $r^2$ | Adjusted $r^2$ | Standard error | $p$-value |
| Nighttime: MAE/HMML-derived SOA vs P[NO$_3$] | MAE/HMML - derived SOA | P[NO$_3$] | 40 | 0.7532 | 0.5673 | 0.5559 | 12.5098 | 2.05E-08 |
| Nighttime: IEPOX-derived SOA vs P[NO$_3$] | IEPOX-derived SOA | P[NO$_3$] | 40 | 0.5086 | 0.2587 | 0.2392 | 393.7399 | 8.05E-04 |
| Regular day sampling: MAE/HMML-derived SOA vs O$_3$ | MAE/HMML - derived SOA | O$_3$ | 30 | 0.8457 | 0.7153 | 0.7051 | 8.9517 | 4.00E-09 |
| Daytime: 2-methyltetrols vs O$_3$ | 2-methyltetrols | O$_3$ | 64 | 0.3610 | 0.1303 | 0.1163 | 254.4175 | 3.39E-03 |
| Intensive 3: MAE/HMML-derived SOA vs O$_3$ | MAE/HMML - derived SOA | O$_3$ | 15 | 0.6844 | 0.4683 | 0.4274 | 18.3128 | 4.89E-03 |
| Intensive 3: 2-methyltetrols vs O$_3$ | 2-methyltetrols | O$_3$ | 15 | 0.5844 | 0.3415 | 0.2908 | 259.0249 | 2.22E-02 |
| MAE/HMML-derived SOA vs SO$_4$ | MAE/HMML - derived SOA | SO$_4$ | 117 | 0.5779 | 0.3340 | 0.3282 | 15.8648 | 8.96E-12 |
| IEPOX-derived SOA vs SO$_4$ | IEPOX-derived SOA | SO$_4$ | 117 | 0.6027 | 0.3632 | 0.3577 | 310.4400 | 6.51E-13 |
**Figure S1.** The locations of the three sampling sites during 2013 SOAS: BHM, CTR, and LRK. BHM was the focused site in this study.

**Figure S2.** $^1$H NMR (400 MHz, D$_2$O) of the MAE/HMML-derived OS.
Figure S3. (a) Comparison of organic carbon (OC) and water soluble organic carbon (WSOC), suggesting that 35% of OC at BHM was WSOC. (b) Comparison of IEPOX- and MAE-derived SOA tracers with WSOC, indicating that IEPOX- and MAE-derived SOA tracers explained 18 and 0.4% of the WSOC, respectively.
Figure S4. Diurnal variations of (a) meteorology, (b) O$_3$ and CO, (c) NO$_y$, NO, NO$_2$, and NO$_x$, and (d) PM$_{2.5}$ constituents at BHM during the 2013 SOAS campaign. High temperature and low RH were observed at 2-4 pm local time. O$_3$ reached its maximum, while CO dropped to its minimum in early afternoon. NO$_x$ and NO$_y$ were high during early morning hours and declined in the afternoon due to photochemical processes. No significant diurnal variation was observed for NH$_3$, SO$_2$, SO$_4^{2-}$, NH$_4^+$, and NO$_3^-$.
Figure S5. The bar chart shows average daytime and nighttime concentrations of isoprene-derived SOA tracers with 95% confident interval. No significant variation between daytime and nighttime was observed.
Figure S6. The box-and-whisker plot (n = 15) of (a) MAE/HMML-SOA, (b) MAE/HMML-OS, and (c) 2-MG. These demonstrate that the statistical distribution of SOA abundance during each intensive sampling period. No significant variation amongst intensive samples was observed.
Figure S7. The box-and-whisker plot (n = 15) of (a) IEPOX-derived SOA, (b) IEPOX-OS, (c) 2-methyltetrols, and (d) (E)-2-methylbut-3-ene-1,2,4-triol. These demonstrate that the statistical distribution of SOA abundance during each intensive sampling period. No significant variation amongst intensive samples was observed.