



*Supplement of*

**Development of multi-channel whole-air sampling equipment onboard an unmanned aerial vehicle for investigating volatile organic compounds' vertical distribution in the planetary boundary layer**

**Suding Yang et al.**

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**Table S1.** Linearity ( $R^2$ ), minimum detection limit (MDL), and precision (relative standard deviation, RSD) of measured parameters.

| Species                | $R^2$ | MDL<br>(ppbv) | RSD<br>(n=5) | Species                  | $R^2$ | MDL<br>(ppbv) | RSD<br>(n=5) |
|------------------------|-------|---------------|--------------|--------------------------|-------|---------------|--------------|
| <b>Alkanes</b>         |       |               |              | toluene                  | 0.999 | 0.006         | 0.8%         |
| ethane                 | 1.000 | 0.037         | 1.3%         | ethylbenzene             | 0.995 | 0.003         | 0.7%         |
| propane                | 0.998 | 0.032         | 1.1%         | m/p-xylene               | 0.998 | 0.004         | 0.5%         |
| isobutane              | 0.999 | 0.016         | 1.2%         | o-xylene                 | 0.999 | 0.003         | 0.5%         |
| n-Butane               | 1.000 | 0.025         | 1.2%         | styrene                  | 0.998 | 0.003         | 0.9%         |
| cyclopentane           | 0.999 | 0.008         | 0.3%         | isopropylbenzene         | 1.000 | 0.008         | 0.6%         |
| isopentane             | 0.996 | 0.007         | 1.2%         | n-propylbenzene          | 1.000 | 0.003         | 1.3%         |
| n-Pentane              | 0.999 | 0.007         | 1.4%         | 3-ethyltoluene           | 0.999 | 0.005         | 1.0%         |
| 2,2-dimethylbutane     | 0.999 | 0.011         | 0.6%         | 4-ethyltoluene           | 1.000 | 0.006         | 0.8%         |
| 2,3-dimethylbutane     | 1.000 | 0.005         | 0.3%         | 1,3,5-trimethylbenzene   | 0.999 | 0.002         | 1.8%         |
| 2-methylpentane        | 1.000 | 0.009         | 0.7%         | 2-ethyltoluene           | 1.000 | 0.004         | 1.5%         |
| 3-methylpentane        | 0.999 | 0.006         | 0.5%         | 1,2,4-trimethylbenzene   | 0.999 | 0.006         | 1.3%         |
| n-hexane               | 0.999 | 0.004         | 0.4%         | 1,2,3-trimethylbenzene   | 0.999 | 0.006         | 1.4%         |
| 2,4-dimethylpentane    | 0.998 | 0.003         | 1.0%         | 1,3-diethylbenzene       | 0.999 | 0.006         | 2.3%         |
| methylcyclopentane     | 1.000 | 0.002         | 1.1%         | 1,4-diethylbenzene       | 0.996 | 0.005         | 2.4%         |
| 2-methylhexane         | 1.000 | 0.002         | 0.7%         | <b>OVOCs</b>             |       |               |              |
| cyclohexane            | 1.000 | 0.004         | 1.0%         | acetaldehyde             | 0.997 | 0.043         | 3.7%         |
| 2,3-dimethylpentane    | 0.999 | 0.015         | 0.5%         | acrolein                 | 0.996 | 0.012         | 2.4%         |
| 3-methylhexane         | 1.000 | 0.013         | 1.1%         | propanal                 | 0.999 | 0.030         | 1.8%         |
| 2,2,4-trimethylpentane | 0.999 | 0.003         | 1.0%         | acetone                  | 0.999 | 0.033         | 1.7%         |
| n-heptane              | 0.999 | 0.009         | 0.6%         | MTBE                     | 0.997 | 0.013         | 2.7%         |
| methylcyclohexane      | 1.000 | 0.003         | 0.8%         | methacrolein             | 0.999 | 0.008         | 3.2%         |
| 2,3,4-trimethylpentane | 0.996 | 0.003         | 0.3%         | n-butanal                | 0.999 | 0.011         | 1.9%         |
| 2-methylheptane        | 0.990 | 0.005         | 1.2%         | methylvinylketone        | 0.999 | 0.018         | 2.1%         |
| 3-methylheptane        | 0.990 | 0.009         | 1.0%         | methylethylketone        | 1.000 | 0.019         | 0.8%         |
| octane                 | 0.991 | 0.005         | 1.3%         | 2-pentanone              | 1.000 | 0.012         | 3.5%         |
| n-nonane               | 0.999 | 0.007         | 1.3%         | n-pentanal               | 1.000 | 0.021         | 4.1%         |
| n-decane               | 1.000 | 0.009         | 1.5%         | 3-pentanone              | 1.000 | 0.020         | 2.2%         |
| undecane               | 0.995 | 0.008         | 1.7%         | n-hexanal                | 0.999 | 0.015         | 1.6%         |
| dodecane               | 0.992 | 0.011         | 2.4%         | <b>Nitrile</b>           |       |               |              |
| <b>Alkenes</b>         |       |               |              | Acetonitrile             | 0.998 | 0.039         | 1.3%         |
| ethylene               | 0.999 | 0.039         | 0.6%         | <b>Halocarbons</b>       |       |               |              |
| propene                | 1.000 | 0.018         | 0.9%         | Freon114(C2F4Cl2)        | 0.999 | 0.006         | 1.2%         |
| trans-2-Butene         | 0.999 | 0.009         | 1.1%         | Chloromethane            | 1.000 | 0.020         | 2.1%         |
| 1-Butene               | 1.000 | 0.020         | 1.6%         | Vinylchloride            | 0.997 | 0.023         | 1.2%         |
| cis-2-Butene           | 1.000 | 0.008         | 0.8%         | Bromomethane             | 0.995 | 0.024         | 1.1%         |
| 1,3-Butadiene          | 0.998 | 0.014         | 0.5%         | Chloroethane             | 0.995 | 0.021         | 1.7%         |
| 1-pentene              | 1.000 | 0.009         | 1.0%         | Freon11(CFC13)           | 0.998 | 0.014         | 1.3%         |
| trans-2-pentene        | 0.999 | 0.009         | 0.9%         | Freon113(C2F3Cl3)        | 0.998 | 0.016         | 1.2%         |
| isoprene               | 0.999 | 0.010         | 0.5%         | 1,1-Dichloroethylene     | 1.000 | 0.017         | 2.0%         |
| cis-2-pentene          | 0.999 | 0.006         | 0.6%         | Dichloromethane          | 1.000 | 0.014         | 0.6%         |
| 1-hexene               | 0.998 | 0.005         | 0.4%         | 1,1-Dichloroethane       | 1.000 | 0.014         | 0.3%         |
| <b>Alkyne</b>          |       |               |              | cis-1,2Dichloroethylene  | 1.000 | 0.009         | 0.7%         |
| acetylene              | 0.999 | 0.039         | 0.4%         | Chloroform               | 1.000 | 0.015         | 0.6%         |
| <b>Aromatics</b>       |       |               |              | 1,1,1-Trichloroethane    | 0.999 | 0.016         | 0.6%         |
| benzene                | 0.998 | 0.004         | 0.8%         | carbontetrachloromethane | 0.998 | 0.020         | 0.5%         |

Table S1 continued.

| Species                   | R <sup>2</sup> | MDL<br>(ppbv) | RSD<br>(n=5) | Species             | R <sup>2</sup> | MDL<br>(ppbv) | RSD<br>(n=5) |
|---------------------------|----------------|---------------|--------------|---------------------|----------------|---------------|--------------|
| 1,2-Dichloroethane        | 0.999          | 0.021         | 0.3%         | Chlorobenzene       | 0.999          | 0.042         | 1.1%         |
| trans-1,3-Dichloropropene | 1.000          | 0.017         | 1.2%         | 1,3-Dichlorobenzene | 0.999          | 0.021         | 0.5%         |
| cis-1,3-Dichloropropene   | 0.999          | 0.017         | 1.1%         | 1,4-Dichlorobenzene | 0.999          | 0.017         | 0.9%         |
| 1,1,2-Trichloroethane     | 0.999          | 0.009         | 0.9%         | Benzylchloride      | 0.999          | 0.021         | 1.3%         |
| 1,2-Dibromoethane         | 0.998          | 0.011         | 1.3%         | 1,2-Dichlorobenzene | 0.999          | 0.050         | 0.7%         |
| 1,2-Dichloropropane       | 0.999          | 0.011         | 0.7%         | Trichloroethylene   | 1.000          | 0.014         | 0.9%         |

**Table S2.** Adsorption loss and 7-day recovery of VOC species.

| VOC species |                        | Adsorption loss* (%) | Ambient sample in Quartz |              |               | Ambient sample in SUMMA |              |               | Standard gas in Quartz |              |               |
|-------------|------------------------|----------------------|--------------------------|--------------|---------------|-------------------------|--------------|---------------|------------------------|--------------|---------------|
|             |                        |                      | 0 day (ppbv)             | 7 day (ppbv) | recovery rate | 0 day (ppbv)            | 7 day (ppbv) | recovery rate | 0 day (ppbv)           | 7 day (ppbv) | recovery rate |
| Alkanes     | ethane                 | 1.3                  | 2.515                    | 2.483        | 98.7%         | 5.556                   | 5.465        | 98.4%         | 2.040                  | 2.046        | 100.3%        |
|             | propane                | 0.8                  | 0.987                    | 1.050        | 106.4%        | 1.475                   | 1.527        | 103.5%        | 1.994                  | 2.015        | 101.0%        |
|             | isobutane              | -0.7                 | 0.209                    | 0.203        | 97.1%         | 0.310                   | 0.312        | 100.6%        | 1.922                  | 2.079        | 108.2%        |
|             | n-butane               | 0.3                  | 0.273                    | 0.275        | 100.7%        | 0.425                   | 0.462        | 108.7%        | 2.054                  | 2.056        | 100.1%        |
|             | cyclopentane           | -0.8                 | 0.048                    | 0.046        | 95.8%         | 0.034                   | 0.033        | 97.1%         | 2.109                  | 2.054        | 97.4%         |
|             | isopentane             | -0.2                 | 0.141                    | 0.135        | 95.7%         | 0.230                   | 0.219        | 95.2%         | 2.024                  | 2.096        | 103.6%        |
|             | n-pentane              | -1.5                 | 0.092                    | 0.097        | 105.4%        | 0.164                   | 0.163        | 99.4%         | 1.962                  | 1.937        | 98.7%         |
|             | 2,2-dimethylbutane     | 0                    | 0.008                    | 0.007        | 87.5%         | 0.012                   | 0.011        | 91.7%         | 1.973                  | 1.914        | 97.0%         |
|             | 2,3-dimethylbutane     | 1.8                  | 0.093                    | 0.078        | 83.9%         | 0.108                   | 0.093        | 86.1%         | 2.001                  | 1.897        | 94.8%         |
|             | 2-methylpentane        | -1.9                 | 0.061                    | 0.053        | 86.9%         | 0.070                   | 0.066        | 94.3%         | 2.055                  | 1.995        | 97.1%         |
|             | 3-methylpentane        | -2.7                 | 0.043                    | 0.043        | 100.0%        | 0.047                   | 0.048        | 102.1%        | 1.954                  | 2.085        | 106.7%        |
|             | n-pentane              | 1.6                  | 0.048                    | 0.046        | 95.8%         | 0.034                   | 0.033        | 97.1%         | 2.109                  | 1.954        | 92.7%         |
|             | n-hexane               | -0.7                 | 0.068                    | 0.073        | 107.4%        | 0.073                   | 0.074        | 101.4%        | 2.129                  | 2.090        | 98.1%         |
|             | 2,4-dimethylpentane    | -0.3                 | -                        | -            | -             | 0.008                   | 0.007        | 87.5%         | 2.100                  | 1.815        | 86.4%         |
|             | methylcyclopentane     | 1.3                  | 0.043                    | 0.042        | 97.7%         | 0.047                   | 0.046        | 97.9%         | 2.112                  | 2.087        | 98.9%         |
|             | 2-methylhexane         | 1.5                  | 0.027                    | 0.023        | 85.2%         | 0.022                   | 0.018        | 81.8%         | 2.192                  | 1.922        | 87.7%         |
|             | cyclohexane            | 1.2                  | 0.032                    | 0.029        | 90.6%         | 0.026                   | 0.023        | 88.5%         | 2.074                  | 1.942        | 93.6%         |
|             | 2,3-dimethylpentane    | 2.8                  | -                        | -            | -             | -                       | -            | -             | 1.968                  | 1.813        | 92.1%         |
|             | 3-methylhexane         | 0.7                  | 0.015                    | 0.013        | 86.7%         | 0.023                   | 0.020        | 87.0%         | 2.012                  | 1.888        | 93.8%         |
|             | 2,2,4-trimethylpentane | 1.3                  | 0.013                    | 0.014        | 107.7%        | 0.017                   | 0.015        | 88.2%         | 2.103                  | 1.996        | 94.9%         |
|             | n-heptane              | 2.4                  | 0.023                    | 0.019        | 82.6%         | 0.031                   | 0.030        | 96.8%         | 2.039                  | 1.866        | 91.5%         |
|             | methylcyclohexane      | -0.5                 | 0.019                    | 0.019        | 100.0%        | 0.021                   | 0.023        | 109.5%        | 1.954                  | 1.910        | 97.8%         |
|             | 2,3,4-trimethylpentane | 1.1                  | 0.005                    | 0.005        | 100.0%        | -                       | -            | -             | 1.976                  | 2.087        | 105.6%        |
|             | 2-methylheptane        | -0.3                 | -                        | -            | -             | 0.015                   | 0.012        | 80.0%         | 1.997                  | 2.035        | 101.9%        |
|             | 3-methylheptane        | -1.3                 | -                        | -            | -             | -                       | -            | -             | 2.016                  | 1.994        | 98.9%         |
|             | octane                 | 0.4                  | -                        | -            | -             | -                       | -            | -             | 2.017                  | 2.058        | 102.0%        |
|             | n-nonane               | -0.8                 | 0.020                    | 0.018        | 90.0%         | 0.035                   | 0.031        | 88.6%         | 2.152                  | 1.982        | 92.1%         |
|             | n-decane               | -0.5                 | 0.017                    | 0.016        | 94.1%         | 0.278                   | 0.259        | 93.2%         | 2.162                  | 1.994        | 92.2%         |
|             | undecane               | 1.1                  | 0.102                    | 0.095        | 93.1%         | 0.082                   | 0.068        | 82.9%         | 1.931                  | 1.884        | 97.6%         |
|             | dodecane               | 1.8                  | -                        | -            | -             | 0.143                   | 0.128        | 89.5%         | 2.119                  | 1.907        | 90.0%         |
| Alkenes     | ethylene               | 0.6                  | 0.694                    | 0.660        | 95.1%         | 1.478                   | 1.391        | 94.1%         | 2.051                  | 1.990        | 97.1%         |
|             | propene                | 1.2                  | 0.204                    | 0.188        | 92.2%         | 0.263                   | 0.258        | 98.1%         | 2.031                  | 1.985        | 97.8%         |
|             | trans-2-butene         | 1.1                  | 0.011                    | 0.010        | 90.9%         | 0.008                   | 0.007        | 87.5%         | 2.125                  | 1.986        | 93.5%         |
|             | 1-butene               | -1.5                 | 0.040                    | 0.041        | 102.5%        | 0.034                   | 0.032        | 94.1%         | 2.029                  | 1.917        | 94.5%         |
|             | cis-2-Butene           | 1                    | -                        | -            | -             | -                       | -            | -             | 1.925                  | 1.803        | 93.7%         |
|             | trans-2-pentene        | -2.1                 | 0.003                    | 0.0026       | 86.7%         | -                       | -            | -             | 1.964                  | 2.026        | 103.2%        |
|             | isoprene               | -0.1                 | 0.026                    | 0.024        | 92.3%         | 0.038                   | 0.031        | 81.6%         | 1.910                  | 1.803        | 94.4%         |
|             | cis-2-pentene          | -0.3                 | -                        | -            | -             | 0.079                   | 0.061        | 77.2%         | 2.018                  | 2.088        | 103.5%        |
|             | 1-hexene               | -0.4                 | 0.017                    | 0.013        | 76.5%         | 0.009                   | 0.007        | 77.8%         | 2.163                  | 2.010        | 92.9%         |
|             | 1,3-butadiene          | -0.8                 | 0.015                    | 0.014        | 93.3%         | 0.021                   | 0.019        | 90.5%         | 2.066                  | 1.903        | 92.1%         |
| Aromatics   | acetylene              | -0.5                 | 0.541                    | 0.534        | 98.7%         | 1.206                   | 1.233        | 102.2%        | 2.025                  | 2.045        | 101.0%        |
|             | benzene                | 0.3                  | 0.105                    | 0.111        | 105.7%        | 0.148                   | 0.145        | 98.0%         | 2.044                  | 2.000        | 97.8%         |
|             | toluene                | -1.4                 | 0.170                    | 0.167        | 98.2%         | 0.231                   | 0.225        | 97.4%         | 2.121                  | 2.020        | 95.2%         |
|             | ethylbenzene           | -1.1                 | 0.041                    | 0.045        | 109.8%        | 0.061                   | 0.059        | 96.7%         | 2.150                  | 2.130        | 99.1%         |
|             | m/p-xylene             | 1.2                  | 0.134                    | 0.130        | 97.0%         | 0.188                   | 0.179        | 95.2%         | 2.127                  | 1.944        | 91.4%         |
|             | o-xylene               | 2.8                  | 0.050                    | 0.049        | 98.0%         | 0.070                   | 0.073        | 104.3%        | 2.060                  | 2.066        | 100.3%        |

|             |                           |      |       |       |        |       |       |        |       |       |        |
|-------------|---------------------------|------|-------|-------|--------|-------|-------|--------|-------|-------|--------|
|             | styrene                   | -1.6 | 0.016 | 0.013 | 81.3%  | 0.035 | 0.030 | 85.7%  | 2.017 | 1.965 | 97.4%  |
|             | isopropylbenzene          | -1.3 | -     | -     | -      | 0.015 | 0.014 | 93.3%  | 2.087 | 2.024 | 97.0%  |
|             | n-propylbenzene           | 1.2  | 0.008 | 0.007 | 87.5%  | 0.028 | 0.026 | 92.9%  | 2.184 | 1.985 | 90.9%  |
|             | 3-ethyltoluene            | -0.8 | 0.014 | 0.012 | 85.7%  | -     | -     | -      | 1.929 | 1.989 | 103.1% |
|             | 4-ethyltoluene            | 1.2  | -     | -     | -      | 0.044 | 0.037 | 84.1%  | 1.922 | 1.837 | 95.6%  |
|             | 1,3,5-trimethylbenzene    | 0.9  | 0.008 | 0.007 | 87.5%  | -     | -     | -      | 2.128 | 2.099 | 98.6%  |
|             | 2-ethyltoluene            | -2.1 | 0.018 | 0.018 | 100.0% | 0.026 | 0.027 | 103.8% | 1.906 | 2.040 | 107.0% |
|             | 1,2,4-trimethylbenzene    | 1.9  | 0.020 | 0.018 | 90.0%  | 0.051 | 0.046 | 90.2%  | 2.152 | 2.089 | 97.1%  |
|             | 1,2,3-trimethylbenzene    | -2.6 | -     | -     | -      | -     | -     | -      | 2.130 | 2.136 | 100.3% |
|             | 1,3-diethylbenzene        | -2.4 | -     | -     | -      | 0.033 | 0.035 | 106.1% | 2.157 | 2.009 | 93.1%  |
|             | 1,4-diethylbenzene        | -3.8 | 0.011 | 0.009 | 81.8%  | 0.051 | 0.046 | 90.6%  | 2.158 | 1.981 | 91.8%  |
| OVOCs       | MTBE                      | 1.3  | 0.040 | 0.034 | 85.0%  | 0.059 | 0.054 | 91.5%  | 1.928 | 1.998 | 103.6% |
|             | acetaldehyde              | -2.3 | 0.582 | 0.497 | 85.4%  | 0.437 | 0.372 | 85.1%  | 2.012 | 2.089 | 103.9% |
|             | acrolein                  | -2.9 | 0.019 | 0.016 | 84.2%  | 0.064 | 0.056 | 87.5%  | 2.000 | 1.815 | 90.7%  |
|             | propanal                  | -4.4 | 0.187 | 0.191 | 102.1% | 0.101 | 0.089 | 88.1%  | 2.165 | 1.889 | 87.2%  |
|             | acetone                   | -3.4 | 3.216 | 2.456 | 76.4%  | 1.453 | 1.140 | 78.5%  | 1.996 | 1.972 | 98.8%  |
|             | acetonitrile              | -2.3 | 0.048 | 0.046 | 95.8%  | 0.074 | 0.074 | 100.0% | 1.971 | 1.942 | 98.5%  |
|             | methacrolein              | -2.9 | 0.044 | 0.041 | 93.2%  | 0.012 | 0.013 | 108.3% | 2.149 | 2.077 | 96.7%  |
|             | n-butanal                 | -1.9 | 0.124 | 0.110 | 88.7%  | 0.058 | 0.053 | 91.4%  | 2.136 | 1.929 | 90.3%  |
|             | methylvinylketone         | 2.3  | 0.061 | 0.054 | 88.5%  | 0.028 | 0.025 | 89.3%  | 2.114 | 1.982 | 93.8%  |
|             | methylethylketone         | -0.5 | 0.104 | 0.097 | 93.3%  | 0.090 | 0.081 | 90.0%  | 2.171 | 1.946 | 89.6%  |
|             | 2-pentanone               | -1.2 | 0.018 | 0.018 | 100.0% | -     | -     | -      | 2.008 | 2.008 | 100.0% |
|             | n-pentanal                | 1.7  | 0.144 | 0.151 | 104.9% | 0.034 | 0.032 | 94.1%  | 1.962 | 2.033 | 103.6% |
|             | 3-pentanone               | -1.4 | -     | -     | -      | -     | -     | -      | 1.998 | 1.816 | 90.9%  |
|             | n-hexanal                 | -0.7 | 0.593 | 0.582 | 98.1%  | 0.151 | 0.132 | 87.4%  | 2.132 | 1.952 | 91.6%  |
| Halocarbons | Freon114                  | -1.2 | 0.010 | 0.010 | 100.0% | 0.013 | 0.013 | 100.0% | 1.983 | 2.008 | 101.3% |
|             | Chloromethane             | 2.3  | 0.283 | 0.281 | 99.3%  | 0.403 | 0.414 | 102.7% | 1.947 | 1.904 | 97.8%  |
|             | Vinylchloride             | -1.9 | -     | -     | -      | -     | -     | -      | 2.061 | 2.047 | 99.3%  |
|             | Bromomethane              | 1.6  | -     | -     | -      | -     | -     | -      | 2.007 | 2.008 | 100.0% |
|             | Chloroethane              | -3.8 | -     | -     | -      | -     | -     | -      | 2.018 | 1.917 | 95.0%  |
|             | Freon11                   | -1.7 | 0.145 | 0.155 | 106.9% | 0.179 | 0.188 | 105.0% | 2.017 | 2.026 | 100.4% |
|             | Freon113                  | -0.4 | 0.043 | 0.039 | 90.7%  | 0.057 | 0.055 | 96.5%  | 2.051 | 2.080 | 101.4% |
|             | 1,1-Dichloroethylene      | 2.5  | -     | -     | -      | -     | -     | -      | 2.103 | 2.058 | 97.9%  |
|             | Dichloromethane           | 0.5  | 0.283 | 0.270 | 95.4%  | 0.327 | 0.351 | 107.3% | 2.020 | 2.088 | 103.4% |
|             | 1,1-Dichloroethane        | -0.3 | 0.034 | 0.032 | 94.1%  | 0.023 | 0.021 | 91.3%  | 2.170 | 2.089 | 96.3%  |
|             | cis-1,2Dichloroethylene   | 0.8  | -     | -     | -      | -     | -     | -      | 2.195 | 2.177 | 99.2%  |
|             | Chloroform                | -1.5 | 0.299 | 0.289 | 96.7%  | 0.120 | 0.131 | 109.2% | 1.986 | 1.985 | 100.0% |
|             | 1,1,1-Trichloroethane     | -1.4 | -     | -     | -      | -     | -     | -      | 1.970 | 2.096 | 106.4% |
|             | carbon tetrachloride      | -0.7 | 0.047 | 0.046 | 97.9%  | 0.066 | 0.066 | 100.0% | 2.062 | 2.081 | 100.9% |
|             | 1,2-Dichloroethane        | 0.8  | 0.137 | 0.147 | 107.3% | 0.111 | 0.121 | 109.0% | 1.984 | 1.928 | 97.2%  |
|             | Trichloroethylene         | -1.1 | -     | -     | -      | -     | -     | -      | 1.891 | 1.880 | 99.5%  |
|             | 1,2-Dichloropropane       | -0.7 | 0.020 | 0.018 | 90.0%  | 0.027 | 0.026 | 96.3%  | 1.997 | 2.082 | 104.3% |
|             | trans-1,3-Dichloropropene | 1.2  | -     | -     | -      | -     | -     | -      | 2.171 | 2.148 | 98.9%  |
|             | 1,1,2-Trichloroethane     | -0.9 | -     | -     | -      | 0.009 | 0.010 | 111.1% | 2.186 | 2.265 | 103.6% |
|             | cis-1,3-Dichloropropene   | 2.2  | -     | -     | -      | -     | -     | -      | 1.989 | 1.923 | 96.7%  |

|                     |      |       |       |        |       |       |        |       |       |        |
|---------------------|------|-------|-------|--------|-------|-------|--------|-------|-------|--------|
| 1,2-Dibromoethane   | -1.3 | -     | -     | -      | -     | -     | -      | 2.180 | 2.124 | 97.4%  |
| Chlorobenzene       | 0    | 0.013 | 0.013 | 100.0% | -     | -     | -      | 1.932 | 2.010 | 104.1% |
| 1,3-Dichlorobenzene | -2.5 | -     | -     | -      | 0.017 | 0.017 | 100.0% | 1.908 | 1.894 | 99.2%  |
| 1,4-Dichlorobenzene | 1.3  | 0.042 | 0.036 | 109.5% | 0.033 | 0.035 | 106.1% | 1.973 | 1.999 | 101.3% |
| Benzylchloride      | 2.1  | -     | -     | -      | -     | -     | -      | 2.011 | 1.981 | 98.5%  |
| 1,2-Dichlorobenzene | -2.4 | -     | -     | -      | -     | -     | -      | 2.088 | 1.999 | 95.7%  |

\*: Adsorption loss = (with sampler – direct injection) / direct injection

-: Detection limit not exceeded

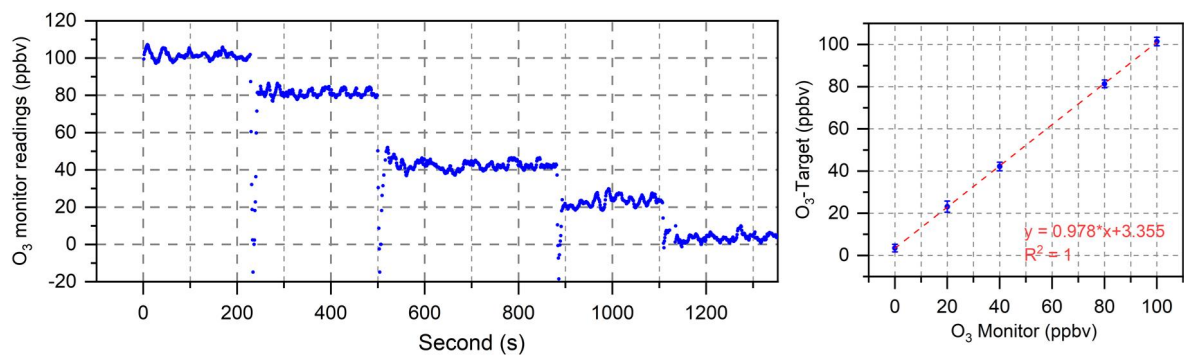
**Table S3.** Information of regulatory instruments used for comparison experiments.

| Parameters      | Model | Measure method           | Temporal resolution |
|-----------------|-------|--------------------------|---------------------|
| O <sub>3</sub>  | 49iQ  | ultraviolet absorption   | 1min                |
| NO <sub>2</sub> | 42i-D | chemiluminescence        | 5min                |
| CO              | 48iQ  | infrared absorption      | 5min                |
| SO <sub>2</sub> | 43iQ  | ultraviolet fluorescence | 1min                |

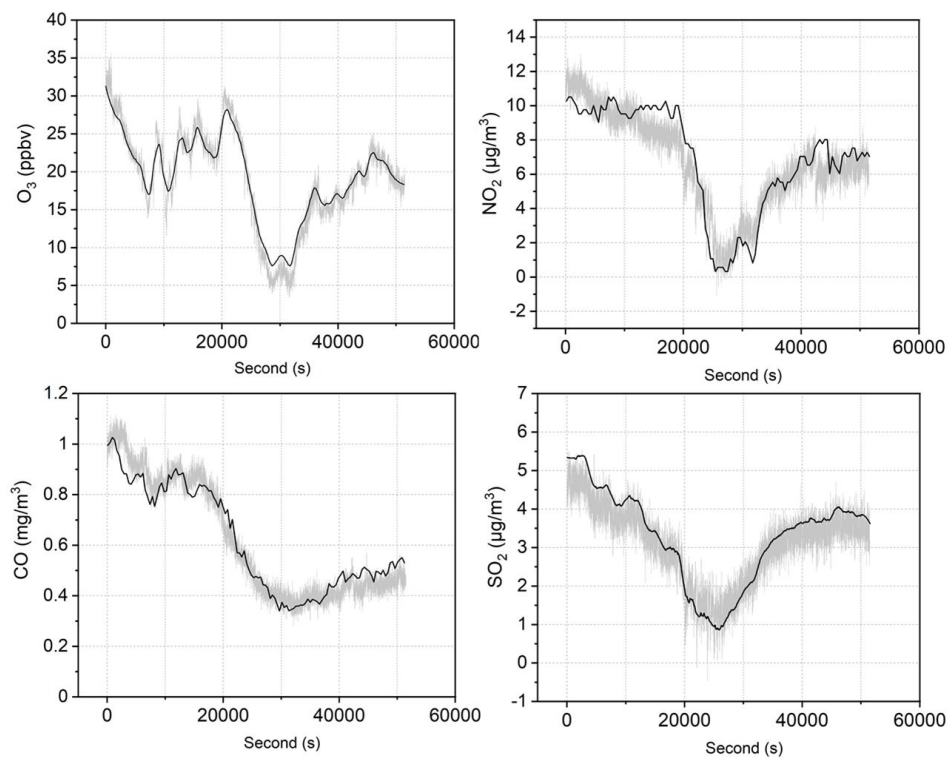
**Table S4.** Execution time and boundary layer height for each mission.

| Flight | Date    | flight period | PBLH (m) | Flight | Date    | flight period | PBLH (m) |
|--------|---------|---------------|----------|--------|---------|---------------|----------|
| 1      | Dec. 22 | 06:36-07:04   | 74       | 14     | Dec. 30 | 07:25-07:51   | 53       |
| 2      | Dec. 22 | 10:15-10:41   | 196      | 15     | Dec. 30 | 10:26-10:52   | 208      |
| 3      | Dec. 22 | 13:52-14:18   | 673      | 16     | Dec. 30 | 14:05-14:32   | 474      |
| 4      | Dec. 22 | 16:18-16:43   | 582      | 16     | Dec. 30 | 16:11-16:37   | 496      |
| 5      | Dec. 22 | 19:25-19:52   | 81       | 18     | Dec. 30 | 18:22-18:48   | 147      |
| 6      | Dec. 28 | 07:16-07:43   | 152      | 19     | Jan. 4  | 07:41-08:08   | 69       |
| 7      | Dec. 28 | 10:35-11:01   | 334      | 20     | Jan. 4  | 10:35-11:01   | 334      |
| 8      | Dec. 28 | 13:46-14:13   | 558      | 21     | Jan. 4  | 14:22-14:54   | 965      |
| 9      | Dec. 28 | 19:28-19:54   | 144      | 22     | Jan. 4  | 18:31-18:59   | 168      |
| 10     | Dec. 29 | 06:59-07:27   | 53       | 23     | Jan. 5  | 07:32-07:59   | 64       |
| 11     | Dec. 29 | 10:54-11:21   | 207      | 24     | Jan. 5  | 10:26-10:52   | 202      |
| 12     | Dec. 29 | 14:32-14:59   | 869      | 25     | Jan. 5  | 14:06-14:32   | 812      |
| 13     | Dec. 29 | 19:03-19:27   | 89       | 26     | Jan. 5  | 18:28-18:54   | 207      |

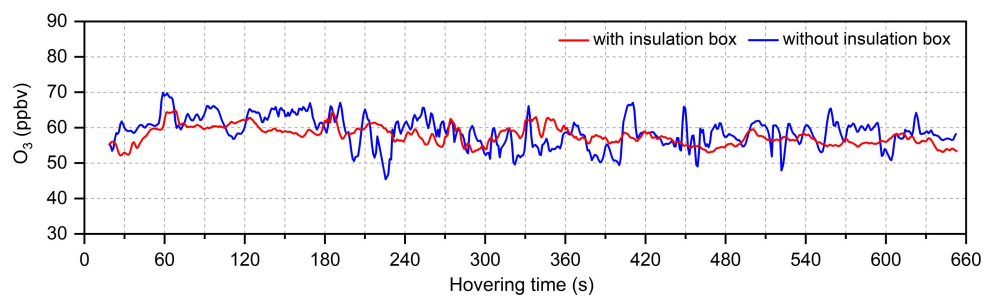




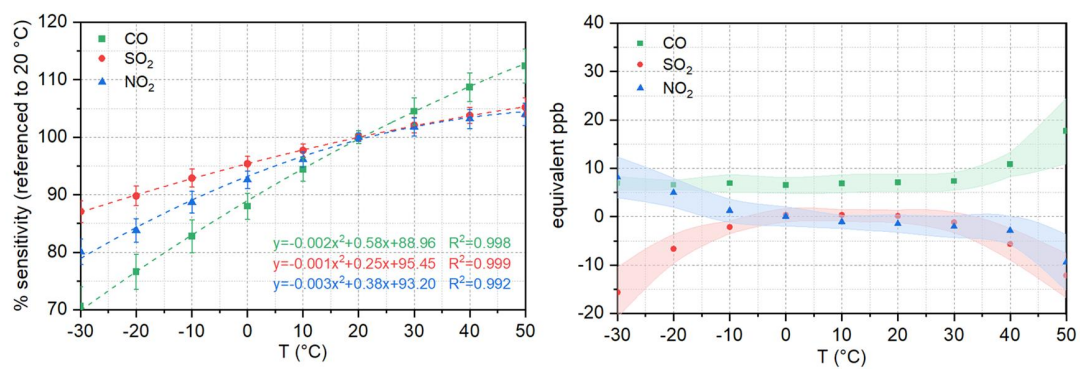
**Figure S1.** Calibration results of the ozone monitor.



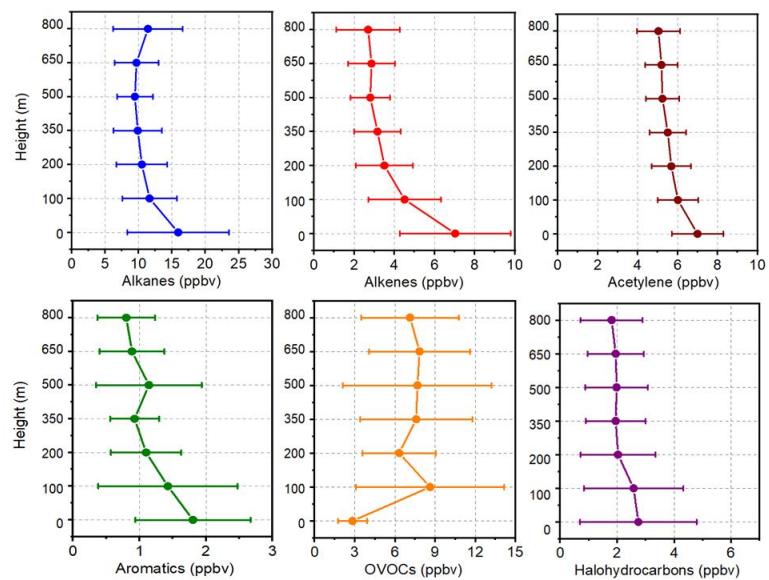
**Figure S2.** Comparison measurement results of ozone monitor and electrochemical sensor with regulatory instruments.



**Figure S3.** Volatility of readings from the ozone monitor with/without the insulation box.



**Figure S4.** Left: Influence of temperature change on the measurement results of the sensor. Right: Influence of temperature change on the sensor's null point.



**Figure S5.** Vertical profiles of different VOC groups in field experiment (average results of all samples).