**Intercomparison of PurpleAir sensor performance over three years indoors and outdoors at a home: bias, precision, and limit of detection using an improved algorithm for calculating PM2.5**

***Supporting information***

Lance Wallace

Lwallace73gmail.com

**Table S-1. Estimates of PM2.5 concentration (µg/m3) comparing the ALT-CF3 algorithm to the Plantower CF1 algorithm. Time period: 1/10/2019 to 1/14/2022. Monitors 1 & 2.**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Valid N | Mean | Std. Err. | Lower Quartile | Median | Upper Quartile | 90th %tile | Max |
| **PurpleAir ALT-CF3 algorithm** |  |  |  |  |  |  |
| ***Monitor 1 indoors*** |  |  |  |  |  |  |  |  |
| 1a PM2.5  | 763102 | 3.9 | 0.02 | 0.64 | 1.4 | 2.7 | 6 | 1061 |
| 1b PM2.5  | 763102 | 3.8 | 0.02 | 0.63 | 1.3 | 2.7 | 5 | 1048 |
| Mean 1 PM2.5 | 763102 | 3.9 | 0.02 | 0.63 | 1.3 | 2.7 | 6 | 1043 |
| ***Monitor 2 indoors*** |  |  |  |  |  |  |  |  |
| 2a PM2.5 | 499296 | 4.6 | 0.03 | 0.83 | 1.6 | 3.0 | 6 | 1055 |
| 2b PM2.5 | 499296 | 4.5 | 0.02 | 0.87 | 1.7 | 3.0 | 6 | 908 |
| Mean 2 PM2.5 | 499296 | 4.5 | 0.02 | 0.86 | 1.7 | 3.0 | 6 | 981 |
| ***Monitor 2 outdoors*** |  |  |  |  |  |  |  |  |
| 2a PM2.5 | 242663 | 4.8 | 0.02 | 1.2 | 2.4 | 4.4 | 9 | 465 |
| 2b PM2.5 | 242663 | 4.9 | 0.02 | 1.1 | 2.3 | 4.3 | 10 | 473 |
| Mean 2 PM2.5 | 242663 | 4.8 | 0.02 | 1.2 | 2.4 | 4.4 | 9 | 469 |
|  |  |  |  |  |  |  |  |  |
| **Plantower CF1 algorithm** |  |  |  |  |  |  |  |
| ***Monitor 1 indoors*** |  |  |  |  |  |  |  |  |
| 1a PM2.5 | 758867 | 5.9 | 0.03 | 0.2 | 1.4 | 3.8 | 8.6 | 2312 |
| 1b PM2.5 | 763018 | 6.0 | 0.03 | 0.2 | 1.4 | 3.8 | 8.6 | 2582 |
| Mean 1 PM2.5 | 763070 | 6.0 | 0.03 | 0.21 | 1.4 | 3.8 | 8.6 | 2582 |
| ***Monitor 2 indoors*** |  |  |  |  |  |  |  |  |
| 2a PM2.5 | 493918 | 7.3 | 0.05 | 0.5 | 1.9 | 4.3 | 9.3 | 2806 |
| 2b PM2.5 | 499251 | 6.6 | 0.04 | 0.1 | 1.1 | 3.5 | 8.6 | 2300 |
| Mean 2 PM2.5 | 499275 | 7.0 | 0.05 | 0.31 | 1.5 | 3.9 | 8.9 | 2521 |
| ***Monitor 2 outdoors*** |  |  |  |  |  |  |  |  |
| 2a PM2.5 | 242541 | 8.4 | 0.04 | 1.3 | 3.5 | 7.5 | 17 | 791 |
| 2b PM2.5 | 242656 | 7.4 | 0.04 | 0.45 | 2.5 | 6.2 | 16 | 817 |
| Mean 2 PM2.5 | 242662 | 7.9 | 0.04 | 0.87 | 3.0 | 6.9 | 17 | 804 |

**Table S-2. Estimates of PM2.5 concentration (µg/m3) comparing the ALT-CF3 algorithm to the Plantower CF1 algorithm. Time period: 6/18/20 to 1/14/22. Monitors 3 & 4.**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | N obs. | Mean | SE | Lower Quartile | Median | Upper Quartile | 90th %tile | Max |
| **ALT-CF3 algorithm**  |
| ***Monitor 3 outdoors*** |  |  |  |  |  |  |  |  |
| 3a PM2.5  | 356484 | 5.5 | 0.02 | 1.2 | 2.5 | 4.8 | 10 | 421 |
| 3b PM2.5 | 356484 | 5.9 | 0.02 | 1.3 | 2.6 | 5.2 | 10 | 472 |
| Mean 3 PM2.5 | 356484 | 5.7 | 0.02 | 1.3 | 2.6 | 5.0 | 10 | 444 |
| ***Monitor 3 indoors*** |  |  |  |  |  |  |  |  |
| 3a PM2.5 | 42204 | 7.5 | 0.08 | 2.3 | 3.8 | 7.9 | 15 | 322 |
| 3b PM2.5 | 42204 | 7.8 | 0.08 | 2.3 | 4.0 | 8.4 | 16 | 316 |
| Mean 3 PM2.5  | 42204 | 7.6 | 0.08 | 2.3 | 3.9 | 8.2 | 15 | 319 |
| ***Monitor 4 indoors*** |  |  |  |  |  |  |  |  |
| 4a PM2.5 | 370906 | 3.5 | 0.02 | 0.70 | 1.5 | 3.0 | 6 | 558 |
| 4b PM2.5  | 370906 | 3.7 | 0.02 | 0.74 | 1.6 | 3.3 | 7 | 508 |
| Mean 4 PM2.5 | 370906 | 3.6 | 0.02 | 0.73 | 1.6 | 3.1 | 6 | 526 |
|  |  |  |  |  |  |  |  |  |
| **Plantower CF1 algorithm** |
| ***Monitor 3 outdoors*** |  |  |  |  |  |  |  |  |
| 3a PM2.5 | 356473 | 8.4 | 0.04 | 1.3 | 3.3 | 7.2 | 16 | 718 |
| 3b PM2.5 | 356473 | 9.9 | 0.04 | 1.4 | 3.9 | 8.5 | 18 | 759 |
| Mean 3 | 356483 | 9.1 | 0.04 | 1.3 | 3.6 | 7.8 | 17 | 738 |
| ***Monitor 3 indoors*** |  |  |  |  |  |  |  |  |
| 3a PM2.5 | 42184 | 11.2 | 0.12 | 2.7 | 5.2 | 12.1 | 23 | 506 |
| 3b PM2.5 | 42202 | 13.1 | 0.14 | 3.2 | 6.1 | 13.9 | 27 | 606 |
| Mean 3 | 42203 | 12.1 | 0.13 | 3.0 | 5.6 | 13.0 | 25 | 556 |
| ***Monitor 4 indoors*** |  |  |  |  |  |  |  |  |
| 4a PM2.5 | 370888 | 5.0 | 0.03 | 0.28 | 1.6 | 4.1 | 9 | 921 |
| 4b PM2.5 | 370897 | 5.8 | 0.03 | 0.35 | 1.9 | 4.9 | 11 | 891 |
| Mean 4  | 370904 | 5.6 | 0.03 | 0.33 | 1.8 | 4.6 | 10 | 891 |

**Table S-3. Precision comparing the ALT-CF3 algorithm to the Plantower CF1 algorithm. Time period: 6/18/20 to 1/14/22. Monitors 3 & 4.**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | N obs. | Mean | SE | Lower Quartile | Median | Upper Quartile | 90th %tile | Max |
| **ALT-CF3 algorithm using precision cutoff at 0.2**  |
| Monitor 3 outdoors | 356484 | 0.06 | 7.E-05 | 0.02 | 0.05 | 0.08 | 0.12 | 0.20 |
| Monitor 3 indoors | 42204 | 0.04 | 2.E-04 | 0.02 | 0.04 | 0.06 | 0.09 | 0.20 |
| Monitor 4 indoors | 370906 | 0.07 | 8.E-05 | 0.03 | 0.06 | 0.10 | 0.14 | 0.20 |
| **Plantower CF1 algorithm using the ALT-CF3 precision cutoff at 0.2** |
| Monitor 3 outdoors | 343593 | 0.16 | 3.E-04 | 0.06 | 0.10 | 0.17 | 0.31 | 1 |
| Monitor 3 indoors | 42041 | 0.10 | 4.E-04 | 0.05 | 0.08 | 0.12 | 0.17 | 1 |
| Monitor 4 indoors | 324460 | 0.20 | 5.E-04 | 0.05 | 0.10 | 0.21 | 1 | 1 |
| **Plantower CF1 algorithm using the CF1 precision cutoff at 0.2** |
| Monitor 3 outdoors | 278256 | 0.09 | 9.E-05 | 0.05 | 0.08 | 0.12 | 0.16 | 0.20 |
| Monitor 3 indoors | 39011 | 0.08 | 2.E-04 | 0.05 | 0.08 | 0.11 | 0.14 | 0.20 |
| Monitor 4 indoors | 240097 | 0.08 | 1.E-04 | 0.04 | 0.08 | 0.12 | 0.16 | 0.20 |