Table S1: Summary of techniques used for monitoring hourly PM concentrations over the period 2014 to 2018 (USEPA parameter codes 81102 and 88101 for PM10 and PM2.5 respectively).

|  |  |
| --- | --- |
| Details of instruments used by county monitoring stations | Year |
|  | 2014 | 2015 | 2016 | 2017 | 2018 |
| PM10 |  |  |  |  |  |
| **Total number of counties providing monitoring data:** **Instruments in use:** | **27** | **30** | **31** | **31** | **31** |
| Beta attenuation (Met One)  | 25 | 26 | 27 | 27 | 27 |
| TEOM (R&P SA246B) | 8 | 8 | 8 | 8 | 5 |
| Gravimetric (AP 602 BAM) | - | - | - | 4 | 4 |
| Broadband spectroscopy (Teledene API T640X) | - | - | - | 1 | 2 |
|  |  |  |  |  |  |
| PM2.5 |  |  |  |  |  |
| **Total number of counties providing monitoring data:****Instrument in use:** | **32** | **33** | **35** | **36** | **37** |
| Beta attenuation (Met One BAM-1020) | 30 | 30 | 32 | 33 | 32 |
| TEOM-FDMS (Thermo Scientific 1400 or 1405-F) | 2 | 1 | 1 | 1 | 1 |
| Beta attenuation (Thermo Scientific)) | 1 | 2 | 2 | 2 | 2 |
| Beta attenuation (Teledyne 602) |  |  |  | 4 | 4 |
| Laser light scattering (GRIMM 180) | - |  | 2 | 2 | 1 |
| Broadband spectroscopy (Teledene API T640X) |  |  |  | 1 | 3 |

Table S2: Summary of the number of exceedances of various 24-hour guideline values (US AQI breakpoint concentrations) for PM10 in each US state over the period 2014 to 2019. The summary is based on monitoring data only from those stations reporting 1-hour measurements.

|  |  |
| --- | --- |
|  | 24-hour GVs |
| State | 155 µg m-3 | 255 µg m-3 | 355 µg m-3 |
| Alabama | 0 | 0 | 0 |
| Alaska | 458 | 32 | 14 |
| Arizona | 14650 | 3588 | 1716 |
| California | 19636 | 6176 | 3178 |
| Colorado | 0 | 0 | 0 |
| Connecticut | 0 | 0 | 0 |
| District of Columbia | 0 | 0 | 0 |
| Florida | 130 | 18 | 0 |
| Georgia | 0 | 0 | 0 |
| Idaho | 320 | 60 | 0 |
| Illinois | 43 | 0 | 0 |
| Indiana | 23 | 0 | 0 |
| Iowa | 54 | 0 | 0 |
| Kansas | 161 | 21 | 0 |
| Kentucky | 0 | 0 | 0 |
| Louisiana | 0 | 0 | 0 |
| Maine | 0 | 0 | 0 |
| Michigan | 160 | 0 | 0 |
| Minnesota | 90 | 0 | 0 |
| Mississippi | 0 | 0 | 0 |
| Missouri | 0 | 0 | 0 |
| Montana | 703 | 17 | 0 |
| Nebraska | 34 | 0 | 0 |
| Nevada | 1122 | 460 | 222 |
| New Hampshire | 0 | 0 | 0 |
| New Mexico | 3630 | 1173 | 517 |
| North Carolina | 0 | 0 | 0 |
| North Dakota | 34 | 10 | 0 |
| Ohio | 0 | 0 | 0 |
| Oklahoma | 163 | 61 | 0 |
| Oregon | 128 | 23 | 0 |
| Pennsylvania | 0 | 0 | 0 |
| South Carolina | 0 | 0 | 0 |
| South Dakota | 70 | 0 | 0 |
| Tennessee | 12 | 0 | 0 |
| Washington | 678 | 113 | 23 |
| West Virginia | 0 | 0 | 0 |
| Wisconsin | 0 | 0 | 0 |
| Wyoming | 163 | 58 | 12 |
| **Total** | **42462** | **11810** | **5682** |

Table S3: Summary of the number of exceedances of various 24-hour guideline values (US AQI breakpoint concentrations) for PM2.5 in each US state over the period 2014 to 2019. The summary is based on monitoring data only from those stations reporting 1-hour measurements.

|  |  |
| --- | --- |
|  | 24-hour GVs |
| State | 35 µg m-3 | 55 µg m-3 | 150 µg m-3 |
| Alabama | 2 | 0 | 0 |
| Alaska | 994 | 168 | 0 |
| Arizona | 2188 | 376 | 20 |
| California | 44406 | 15445 | 1156 |
| Colorado | 1763 | 329 | 34 |
| Connecticut | 184 | 7 | 0 |
| Delaware | 159 | 16 | 0 |
| District Of Columbia | 143 | 44 | 0 |
| Florida | 122 | 0 | 0 |
| Georgia | 449 | 60 | 0 |
| Hawaii | 642 | 22 | 0 |
| Idaho | 1564 | 177 | 0 |
| Illinois | 41 | 0 | 0 |
| Indiana | 1743 | 296 | 18 |
| Iowa | 67 | 19 | 0 |
| Kansas | 198 | 16 | 0 |
| Kentucky | 215 | 76 | 0 |
| Louisiana | 33 | 0 | 0 |
| Maine | 125 | 72 | 0 |
| Maryland | 119 | 0 | 0 |
| Massachusetts | 23 | 0 | 0 |
| Michigan | 211 | 10 | 0 |
| Minnesota | 988 | 158 | 0 |
| Mississippi | 46 | 0 | 0 |
| Missouri | 1010 | 85 | 0 |
| Montana | 11401 | 4656 | 212 |
| Nebraska | 165 | 0 | 0 |
| Nevada | 2312 | 737 | 3 |
| New Hampshire | 21 | 0 | 0 |
| New Jersey | 133 | 0 | 0 |
| New Mexico | 170 | 0 | 0 |
| New York | 0 | 0 | 0 |
| North Carolina | 803 | 309 | 0 |
| North Dakota | 2149 | 662 | 0 |
| Ohio | 305 | 18 | 0 |
| Oklahoma | 474 | 34 | 0 |
| Oregon | 274 | 0 | 0 |
| Pennsylvania | 3363 | 178 | 0 |
| Rhode Island | 111 | 24 | 0 |
| South Carolina | 205 | 108 | 0 |
| South Dakota | 766 | 62 | 0 |
| Tennessee | 36 | 7 | 0 |
| Texas | 735 | 38 | 0 |
| Utah | 3606 | 296 | 0 |
| Vermont | 182 | 0 | 0 |
| Virginia | 0 | 0 | 0 |
| Washington | 8764 | 3238 | 341 |
| West Virginia | 0 | 0 | 0 |
| Wisconsin | 114 | 0 | 0 |
| Wyoming | 1040 | 274 | 0 |
| **Total** | **94564** | **28017** | **1784** |

Table S4: Statistical summary of the PM10 (US EPA method 81102) concentration data (rolling 24-hour periods) used in this study. The summary is based on monitoring data only from those stations reporting 1-hour measurements and is not indicative of average concentrations within the specified states (for which the US EPA annual summary data should be consulted).

| State Abbreviation | Year | Number of rolling 24-hour periods | Mean concentration / µg m-3 | Std. Deviation | Maximum concentration / µg m-3 |
| --- | --- | --- | --- | --- | --- |
| AK | 2014 | 56785 | 22.2 | 22.8 | 378 |
|  | 2015 | 46083 | 17.8 | 17.8 | 270 |
|  | 2016 | 48003 | 19.3 | 17.2 | 213 |
|  | 2017 | 49297 | 14.0 | 12.5 | 165 |
|  | 2018 | 56874 | 12.9 | 13.6 | 256 |
|  | 2019 | 62060 | 15.5 | 16.8 | 223 |
|  | All | 319102 | 16.9 | 17.5 | 378 |
| AL | 2014 | 31548 | 20.8 | 11.6 | 137 |
|  | 2015 | 32479 | 18.8 | 10.0 | 99 |
|  | 2016 | 31407 | 19.2 | 9.5 | 75 |
|  | 2017 | 30163 | 18.4 | 8.7 | 69 |
|  | 2018 | 28879 | 19.4 | 10.1 | 77 |
|  | 2019 | 31761 | 22.5 | 11.6 | 132 |
|  | All | 186237 | 19.8 | 10.4 | 137 |
| AZ | 2014 | 371997 | 36.4 | 35.4 | 985 |
|  | 2015 | 380882 | 27.6 | 27.9 | 985 |
|  | 2016 | 385211 | 32.5 | 27.6 | 1483 |
|  | 2017 | 389170 | 35.4 | 27.8 | 658 |
|  | 2018 | 417508 | 34.4 | 34.7 | 1240 |
|  | 2019 | 432954 | 26.3 | 26.8 | 990 |
|  | All | 2377722 | 32.0 | 30.5 | 1483 |
| CA | 2014 | 476119 | 28.3 | 23.4 | 775 |
|  | 2015 | 618672 | 24.5 | 45.6 | 4225 |
|  | 2016 | 652813 | 27.0 | 67.1 | 6512 |
|  | 2017 | 667193 | 28.6 | 48.0 | 3566 |
|  | 2018 | 695669 | 28.3 | 28.1 | 1101 |
|  | 2019 | 689807 | 23.8 | 46.2 | 5118 |
|  | All | 3800273 | 26.7 | 46.1 | 6512 |
| CO | 2014 | 27721 | 18.7 | 12.3 | 91 |
|  | 2015 | 23571 | 13.8 | 10.5 | 76 |
|  | 2016 | 22725 | 11.7 | 10.7 | 82 |
|  | 2017 | 21704 | 12.0 | 10.7 | 83 |
|  | 2018 | 18754 | 17.8 | 15.4 | 98 |
|  | 2019 | 26081 | 15.8 | 13.6 | 97 |
|  | All | 140556 | 15.1 | 12.6 | 98 |
| CT | 2015 | 24758 | 14.3 | 9.8 | 67 |
|  | 2016 | 24092 | 12.8 | 8.1 | 65 |
|  | 2017 | 23327 | 11.9 | 8.1 | 61 |
|  | 2018 | 41055 | 13.9 | 7.8 | 89 |
|  | 2019 | 68181 | 13.6 | 6.4 | 69 |
|  | All | 181413 | 13.4 | 7.7 | 89 |
| DC | 2014 | 8673 | 17.1 | 7.0 | 56 |
|  | 2015 | 8700 | 17.0 | 7.8 | 49 |
|  | 2016 | 7984 | 17.0 | 7.0 | 49 |
|  | 2017 | 7957 | 16.5 | 7.6 | 52 |
|  | 2018 | 8267 | 16.5 | 7.2 | 48 |
|  | 2019 | 8586 | 17.5 | 6.3 | 51 |
|  | All | 50167 | 17.0 | 7.2 | 56 |
| FL | 2014 | 105837 | 16.1 | 7.4 | 161 |
|  | 2015 | 111194 | 16.3 | 9.3 | 126 |
|  | 2016 | 108136 | 16.8 | 10.3 | 287 |
|  | 2017 | 103011 | 17.4 | 8.9 | 126 |
|  | 2018 | 141611 | 17.1 | 9.1 | 245 |
|  | 2019 | 160997 | 17.2 | 7.9 | 82 |
|  | All | 730786 | 16.9 | 8.8 | 287 |
| GA | 2014 | 8338 | 18.3 | 7.3 | 99 |
|  | 2015 | 8373 | 17.6 | 9.0 | 97 |
|  | 2016 | 8697 | 17.3 | 7.1 | 80 |
|  | 2017 | 10383 | 16.6 | 6.8 | 56 |
|  | 2018 | 16687 | 15.3 | 6.0 | 49 |
|  | 2019 | 16812 | 15.4 | 6.3 | 44 |
|  | All | 69290 | 16.4 | 7.0 | 99 |
| IA | 2014 | 8623 | 44.4 | 25.2 | 166 |
|  | 2015 | 8008 | 45.8 | 25.5 | 155 |
|  | 2016 | 8702 | 38.8 | 22.6 | 138 |
|  | 2017 | 8624 | 40.3 | 23.5 | 184 |
|  | 2018 | 8605 | 38.6 | 23.0 | 159 |
|  | 2019 | 8690 | 35.6 | 20.4 | 148 |
|  | All | 51252 | 40.5 | 23.7 | 184 |
| ID | 2014 | 49122 | 17.5 | 11.2 | 105 |
|  | 2015 | 51468 | 20.3 | 16.3 | 319 |
|  | 2016 | 51488 | 17.1 | 11.1 | 92 |
|  | 2017 | 50885 | 19.9 | 18.4 | 239 |
|  | 2018 | 50460 | 20.1 | 17.1 | 320 |
|  | 2019 | 48928 | 16.9 | 11.5 | 90 |
|  | All | 302351 | 18.7 | 14.7 | 320 |
| IL | 2014 | 14048 | 36.3 | 17.4 | 125 |
|  | 2015 | 16077 | 29.4 | 19.3 | 228 |
|  | 2016 | 15807 | 22.1 | 14.1 | 119 |
|  | 2017 | 8203 | 24.4 | 14.7 | 148 |
|  | 2018 | 14720 | 23.8 | 12.4 | 93 |
|  | 2019 | 11838 | 28.8 | 12.6 | 96 |
|  | All | 80693 | 27.6 | 16.2 | 228 |
| IN | 2014 | 20816 | 21.4 | 12.1 | 138 |
|  | 2015 | 24137 | 20.1 | 13.0 | 165 |
|  | 2016 | 25321 | 19.2 | 11.6 | 184 |
|  | 2017 | 25236 | 20.6 | 11.4 | 134 |
|  | 2018 | 25036 | 19.9 | 11.0 | 106 |
|  | 2019 | 23403 | 18.7 | 9.9 | 78 |
|  | All | 143949 | 20.0 | 11.6 | 184 |
| KS | 2014 | 48217 | 20.8 | 14.4 | 205 |
|  | 2015 | 51097 | 19.6 | 11.8 | 105 |
|  | 2016 | 64151 | 19.1 | 11.4 | 141 |
|  | 2017 | 70651 | 20.7 | 14.1 | 332 |
|  | 2018 | 72578 | 20.2 | 14.5 | 220 |
|  | 2019 | 62836 | 17.3 | 10.2 | 92 |
|  | All | 369530 | 19.6 | 12.9 | 332 |
| KY | 2014 | 16499 | 18.6 | 9.3 | 92 |
|  | 2015 | 17328 | 17.6 | 8.5 | 80 |
|  | 2016 | 16170 | 15.9 | 7.3 | 42 |
|  | 2017 | 15013 | 17.0 | 6.7 | 47 |
|  | 2018 | 15004 | 18.0 | 8.4 | 58 |
|  | 2019 | 15841 | 18.7 | 6.8 | 47 |
|  | All | 95855 | 17.6 | 8.0 | 92 |
| LA | 2014 | 41058 | 19.7 | 9.7 | 98 |
|  | 2015 | 41426 | 20.0 | 10.5 | 95 |
|  | 2016 | 41935 | 19.0 | 8.3 | 92 |
|  | 2017 | 41977 | 18.5 | 9.2 | 96 |
|  | 2018 | 42416 | 20.1 | 11.5 | 126 |
|  | 2019 | 39883 | 16.7 | 8.7 | 100 |
|  | All | 248695 | 19.0 | 9.8 | 126 |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| ME | 2014 | 5826 | 15.5 | 11.4 | 71 |
|  | 2015 | 8566 | 14.7 | 10.9 | 103 |
|  | 2016 | 8700 | 12.3 | 8.8 | 85 |
|  | 2017 | 8336 | 8.8 | 4.3 | 30 |
|  | 2018 | 5548 | 10.2 | 5.8 | 57 |
|  | 2019 | 8318 | 15.1 | 12.4 | 92 |
|  | All | 45294 | 12.8 | 9.8 | 103 |
| MI | 2014 | 42538 | 24.0 | 13.4 | 180 |
|  | 2015 | 41690 | 25.0 | 14.0 | 149 |
|  | 2016 | 41464 | 21.7 | 15.5 | 244 |
|  | 2017 | 42862 | 22.0 | 13.8 | 232 |
|  | 2018 | 34390 | 23.3 | 12.2 | 149 |
|  | 2019 | 42710 | 20.1 | 11.0 | 133 |
|  | All | 245654 | 22.7 | 13.5 | 244 |
| MN | 2014 | 40193 | 19.9 | 12.4 | 144 |
|  | 2015 | 55299 | 22.8 | 17.2 | 209 |
|  | 2016 | 58934 | 21.6 | 18.2 | 206 |
|  | 2017 | 59875 | 23.7 | 18.4 | 189 |
|  | 2018 | 62922 | 24.0 | 17.3 | 177 |
|  | 2019 | 47936 | 20.6 | 13.9 | 112 |
|  | All | 325159 | 22.3 | 16.8 | 209 |
| MO | 2018 | 82512 | 20.2 | 12.4 | 146 |
|  | 2019 | 76116 | 20.1 | 13.1 | 139 |
|  | All | 158628 | 20.2 | 12.8 | 146 |
| MS | 2018 | 8238 | 20.6 | 11.3 | 115 |
|  | 2019 | 8645 | 19.4 | 9.0 | 71 |
|  | All | 16883 | 20.0 | 10.2 | 115 |
| MT | 2014 | 107902 | 17.5 | 13.9 | 147 |
|  | 2015 | 105652 | 21.9 | 20.8 | 276 |
|  | 2016 | 102497 | 16.5 | 12.8 | 198 |
|  | 2017 | 100819 | 18.9 | 21.0 | 265 |
|  | 2018 | 102171 | 17.5 | 15.2 | 221 |
|  | 2019 | 102018 | 14.8 | 11.5 | 132 |
|  | All | 621059 | 17.9 | 16.4 | 276 |
| NC | 2014 | 7766 | 12.7 | 5.5 | 61 |
|  | 2015 | 13478 | 12.2 | 6.6 | 59 |
|  | 2016 | 50273 | 11.3 | 6.2 | 57 |
|  | 2017 | 66261 | 13.5 | 5.9 | 64 |
|  | 2018 | 64733 | 14.1 | 5.7 | 65 |
|  | 2019 | 59688 | 13.8 | 5.4 | 44 |
|  | All | 262199 | 13.2 | 5.9 | 65 |
| ND | 2014 | 68532 | 13.8 | 11.4 | 126 |
|  | 2015 | 75504 | 14.9 | 13.8 | 157 |
|  | 2016 | 76372 | 11.1 | 9.3 | 132 |
|  | 2017 | 81723 | 14.0 | 12.3 | 281 |
|  | 2018 | 72941 | 12.4 | 10.5 | 108 |
|  | 2019 | 71252 | 9.1 | 7.1 | 105 |
|  | All | 446324 | 12.6 | 11.2 | 281 |
| NE | 2014 | 25479 | 25.3 | 15.8 | 146 |
|  | 2015 | 25408 | 23.8 | 16.2 | 169 |
|  | 2016 | 25436 | 22.6 | 15.2 | 157 |
|  | 2017 | 32353 | 23.3 | 14.3 | 149 |
|  | 2018 | 19484 | 18.7 | 10.7 | 107 |
|  | 2019 | 16539 | 17.2 | 9.5 | 58 |
|  | All | 144699 | 22.3 | 14.5 | 169 |
| NH | 2014 | 5389 | 10.6 | 5.1 | 27 |
|  | 2015 | 7923 | 11.7 | 5.9 | 53 |
|  | 2016 | 8073 | 10.0 | 4.8 | 31 |
|  | 2017 | 8409 | 10.7 | 5.9 | 45 |
|  | 2018 | 7940 | 9.9 | 5.6 | 36 |
|  | 2019 | 7469 | 11.9 | 5.1 | 44 |
|  | All | 45203 | 10.8 | 5.5 | 53 |
| NM | 2014 | 75620 | 31.9 | 34.6 | 573 |
|  | 2015 | 78389 | 23.1 | 17.1 | 275 |
|  | 2016 | 79175 | 27.6 | 28.9 | 733 |
|  | 2017 | 84663 | 28.5 | 29.6 | 722 |
|  | 2018 | 85627 | 26.9 | 25.7 | 526 |
|  | 2019 | 109768 | 24.2 | 30.3 | 735 |
|  | All | 513242 | 26.8 | 28.5 | 735 |
| NV | 2014 | 180016 | 21.7 | 27.6 | 995 |
|  | 2015 | 179146 | 18.4 | 12.4 | 332 |
|  | 2016 | 186381 | 19.5 | 18.5 | 473 |
|  | 2017 | 188126 | 20.1 | 15.2 | 346 |
|  | 2018 | 168642 | 21.4 | 14.8 | 192 |
|  | 2019 | 163700 | 19.1 | 12.9 | 249 |
|  | All | 1066011 | 20.0 | 17.8 | 995 |
| OH | 2014 | 42724 | 18.8 | 10.9 | 132 |
|  | 2015 | 43105 | 19.0 | 12.4 | 118 |
|  | 2016 | 42808 | 15.6 | 9.7 | 99 |
|  | 2017 | 42403 | 14.3 | 9.6 | 85 |
|  | 2018 | 43829 | 14.2 | 9.6 | 93 |
|  | 2019 | 52023 | 15.2 | 9.2 | 112 |
|  | All | 266892 | 16.1 | 10.4 | 132 |
| OK | 2014 | 39060 | 22.8 | 19.1 | 351 |
|  | 2015 | 48879 | 19.0 | 12.1 | 139 |
|  | 2016 | 48256 | 18.2 | 9.7 | 110 |
|  | 2017 | 45326 | 18.4 | 10.2 | 207 |
|  | 2018 | 48088 | 20.3 | 15.1 | 347 |
|  | 2019 | 31726 | 18.4 | 14.5 | 306 |
|  | All | 261335 | 19.4 | 13.7 | 351 |
| OR | 2017 | 16945 | 18.0 | 24.0 | 314 |
|  | 2019 | 31906 | 17.8 | 10.9 | 86 |
|  | All | 48851 | 17.9 | 16.6 | 314 |
| PA | 2014 | 160039 | 17.3 | 9.0 | 89 |
|  | 2015 | 157697 | 17.3 | 9.7 | 111 |
|  | 2016 | 125532 | 15.9 | 9.6 | 109 |
|  | 2017 | 124995 | 15.7 | 9.9 | 135 |
|  | 2018 | 110123 | 15.1 | 9.1 | 110 |
|  | 2019 | 108690 | 16.2 | 9.0 | 119 |
|  | All | 787076 | 16.4 | 9.4 | 135 |
| SC | 2014 | 41478 | 16.4 | 7.3 | 102 |
|  | 2015 | 37960 | 16.1 | 7.8 | 75 |
|  | 2016 | 35938 | 16.2 | 9.0 | 144 |
|  | 2017 | 27170 | 15.9 | 7.2 | 89 |
|  | 2018 | 30196 | 14.8 | 6.6 | 52 |
|  | 2019 | 27224 | 14.9 | 6.7 | 81 |
|  | All | 199966 | 15.8 | 7.6 | 144 |
| SD | 2014 | 59295 | 18.6 | 15.5 | 150 |
|  | 2015 | 59238 | 19.5 | 16.4 | 165 |
|  | 2016 | 65637 | 17.2 | 14.1 | 168 |
|  | 2017 | 67882 | 17.3 | 13.9 | 172 |
|  | 2018 | 67861 | 17.5 | 15.5 | 151 |
|  | 2019 | 67008 | 15.8 | 15.6 | 212 |
|  | All | 386921 | 17.6 | 15.2 | 212 |
| TN | 2014 | 8736 | 23.7 | 13.3 | 118 |
|  | 2015 | 8736 | 26.1 | 16.8 | 168 |
|  | 2016 | 13280 | 19.6 | 9.7 | 120 |
|  | 2017 | 23956 | 16.6 | 6.4 | 73 |
|  | 2018 | 25020 | 16.9 | 8.4 | 140 |
|  | 2019 | 25203 | 16.7 | 7.5 | 60 |
|  | All | 104931 | 18.5 | 10.0 | 168 |
| WA | 2014 | 24164 | 21.1 | 17.9 | 236 |
|  | 2015 | 24088 | 22.3 | 26.2 | 592 |
|  | 2016 | 33966 | 17.2 | 11.1 | 177 |
|  | 2017 | 36909 | 21.6 | 25.1 | 293 |
|  | 2018 | 43112 | 20.5 | 21.1 | 325 |
|  | 2019 | 40529 | 18.6 | 12.5 | 125 |
|  | All | 202768 | 20.1 | 19.6 | 592 |
| WI | 2014 | 24798 | 12.7 | 6.8 | 60 |
|  | 2015 | 24614 | 12.3 | 7.4 | 53 |
|  | 2016 | 23012 | 11.7 | 6.6 | 60 |
|  | 2017 | 25342 | 11.8 | 6.9 | 62 |
|  | 2018 | 36855 | 14.4 | 7.7 | 50 |
|  | 2019 | 54494 | 15.2 | 7.2 | 96 |
|  | All | 189115 | 13.5 | 7.3 | 96 |
| WV | 2014 | 27647 | 13.4 | 6.7 | 50 |
|  | 2015 | 25587 | 13.1 | 7.1 | 48 |
|  | 2016 | 17379 | 14.9 | 7.3 | 52 |
|  | 2017 | 17367 | 13.4 | 6.9 | 45 |
|  | 2018 | 17210 | 13.8 | 7.3 | 42 |
|  | 2019 | 14633 | 15.1 | 7.6 | 56 |
|  | All | 119823 | 13.8 | 7.1 | 56 |
| WY | 2014 | 118235 | 11.4 | 9.8 | 161 |
|  | 2015 | 123088 | 10.9 | 10.6 | 195 |
|  | 2016 | 146825 | 11.8 | 11.3 | 136 |
|  | 2017 | 155511 | 12.1 | 13.4 | 369 |
|  | 2018 | 151217 | 12.7 | 12.6 | 192 |
|  | 2019 | 157635 | 10.4 | 10.2 | 168 |
|  | All | 852511 | 11.6 | 11.5 | 369 |
| All states | 2014 | 2390868 | 23.7 | 23.3 | 995 |
|  | 2015 | 2608300 | 21.2 | 27.3 | 4225 |
|  | 2016 | 2702584 | 21.8 | 36.9 | 6512 |
|  | 2017 | 2780032 | 22.9 | 29.3 | 3566 |
|  | 2018 | 2942787 | 22.7 | 22.9 | 1240 |
|  | 2019 | 3033916 | 19.7 | 26.8 | 5118 |
|  | All | 16458487 | 21.9 | 28.2 | 6512 |

Table S5: Statistical summary of the PM2.5 (US EPA method 88101) concentration data (rolling 24-hour periods) used in this study. The summary is based on monitoring data only from those stations reporting 1-hour measurements and is not indicative of average concentrations within the specified states (for which the US EPA annual summary data should be consulted).

| State abbreviation | Year | Number of rolling 24-hour periods | Mean concentration / µg m-3 | Std. Deviation | Maximum concentration / µg m-3 |
| --- | --- | --- | --- | --- | --- |
| AK | 2014 | 51343 | 5.7 | 6.9 | 127 |
|  | 2015 | 43519 | 5.7 | 6.0 | 79 |
|  | 2016 | 39941 | 5.3 | 5.2 | 50 |
|  | 2017 | 41824 | 4.8 | 5.3 | 63 |
|  | 2018 | 41766 | 5.1 | 4.4 | 45 |
|  | 2019 | 34199 | 6.8 | 7.0 | 112 |
|  | All | 252592 | 5.5 | 5.9 | 127 |
| AL | 2014 | 7503 | 11.6 | 4.8 | 36 |
|  | 2015 | 6771 | 11.6 | 5.1 | 29 |
|  | 2016 | 6474 | 10.5 | 4.4 | 25 |
|  | 2017 | 9932 | 11.1 | 5.0 | 30 |
|  | 2018 | 7449 | 9.5 | 4.6 | 25 |
|  | 2019 | 16736 | 10.0 | 4.7 | 35 |
|  | All | 54865 | 10.6 | 4.8 | 36 |
| AZ | 2014 | 115503 | 7.9 | 5.5 | 171 |
|  | 2015 | 122704 | 7.2 | 4.9 | 61 |
|  | 2016 | 136264 | 7.4 | 5.2 | 152 |
|  | 2017 | 136218 | 8.2 | 6.0 | 165 |
|  | 2018 | 143306 | 7.8 | 5.5 | 199 |
|  | 2019 | 144037 | 6.5 | 4.3 | 48 |
|  | All | 798032 | 7.5 | 5.3 | 199 |
| CA | 2014 | 482122 | 9.0 | 7.5 | 207 |
|  | 2015 | 487387 | 8.9 | 7.4 | 293 |
|  | 2016 | 529077 | 8.1 | 5.8 | 112 |
|  | 2017 | 551610 | 9.5 | 10.2 | 558 |
|  | 2018 | 586778 | 10.8 | 13.3 | 268 |
|  | 2019 | 605623 | 7.0 | 5.1 | 161 |
|  | All | 3242597 | 8.9 | 8.8 | 558 |
| CO | 2014 | 41814 | 7.3 | 5.0 | 57 |
|  | 2015 | 61222 | 7.3 | 5.2 | 76 |
|  | 2016 | 95154 | 6.7 | 4.1 | 46 |
|  | 2017 | 114309 | 7.1 | 4.7 | 66 |
|  | 2018 | 124382 | 7.9 | 6.7 | 168 |
|  | 2019 | 131874 | 6.9 | 4.9 | 62 |
|  | All | 568755 | 7.2 | 5.3 | 168 |
| CT | 2014 | 24010 | 9.1 | 5.9 | 42 |
|  | 2015 | 32552 | 8.6 | 5.6 | 36 |
|  | 2016 | 62189 | 7.2 | 4.6 | 64 |
|  | 2017 | 62044 | 6.0 | 4.5 | 28 |
|  | 2018 | 65055 | 7.2 | 4.5 | 33 |
|  | 2019 | 68363 | 7.3 | 4.1 | 40 |
|  | All | 314213 | 7.3 | 4.7 | 64 |
| DC | 2014 | 8559 | 10.0 | 4.4 | 31 |
|  | 2015 | 13721 | 10.4 | 5.4 | 40 |
|  | 2016 | 13666 | 10.0 | 4.8 | 40 |
|  | 2017 | 29217 | 9.6 | 4.4 | 35 |
|  | 2018 | 33957 | 8.8 | 4.4 | 29 |
|  | 2019 | 34208 | 8.3 | 5.0 | 70 |
|  | All | 133328 | 9.2 | 4.8 | 70 |
| DE | 2014 | 32574 | 9.1 | 5.5 | 63 |
|  | 2015 | 25544 | 9.0 | 5.4 | 38 |
|  | 2016 | 25344 | 7.7 | 4.3 | 33 |
|  | 2017 | 33251 | 7.6 | 4.2 | 52 |
|  | 2018 | 32920 | 7.5 | 3.8 | 29 |
|  | 2019 | 42835 | 7.8 | 4.1 | 36 |
|  | All | 192468 | 8.1 | 4.6 | 63 |
| FL | 2014 | 12220 | 10.0 | 4.6 | 33 |
|  | 2015 | 19819 | 9.1 | 3.9 | 39 |
|  | 2016 | 37295 | 7.8 | 3.6 | 33 |
|  | 2017 | 39966 | 8.7 | 4.0 | 37 |
|  | 2018 | 100908 | 7.5 | 3.2 | 47 |
|  | 2019 | 148906 | 7.4 | 3.2 | 34 |
|  | All | 359114 | 7.8 | 3.5 | 47 |
| GA | 2014 | 15563 | 11.2 | 5.6 | 40 |
|  | 2015 | 16626 | 11.3 | 5.9 | 57 |
|  | 2016 | 12091 | 11.2 | 6.1 | 74 |
|  | 2017 | 25671 | 9.6 | 5.4 | 55 |
|  | 2018 | 76603 | 8.8 | 4.4 | 56 |
|  | 2019 | 85320 | 9.8 | 4.7 | 78 |
|  | All | 231874 | 9.7 | 5.0 | 78 |
| HI | 2014 | 89202 | 5.7 | 4.3 | 52 |
|  | 2015 | 110278 | 6.0 | 4.8 | 30 |
|  | 2016 | 110124 | 6.1 | 5.5 | 47 |
|  | 2017 | 105498 | 5.4 | 4.8 | 35 |
|  | 2018 | 98288 | 5.2 | 5.9 | 59 |
|  | 2019 | 103701 | 2.8 | 2.3 | 76 |
|  | All | 617091 | 5.2 | 4.9 | 76 |
| IA | 2016 | 196 | 6.1 | 4.2 | 14 |
|  | 2017 | 15413 | 7.9 | 4.9 | 73 |
|  | 2018 | 17277 | 8.1 | 4.3 | 29 |
|  | 2019 | 34790 | 8.4 | 4.9 | 40 |
|  | All | 67676 | 8.2 | 4.7 | 73 |
| ID | 2014 | 38786 | 9.1 | 8.2 | 74 |
|  | 2015 | 19392 | 9.0 | 8.1 | 73 |
|  | 2016 | 13474 | 5.8 | 4.1 | 30 |
|  | 2017 | 15526 | 8.2 | 7.9 | 76 |
|  | 2018 | 12546 | 5.5 | 5.8 | 56 |
|  | 2019 | 8400 | 4.0 | 2.1 | 13 |
|  | All | 108124 | 7.7 | 7.4 | 76 |
| IL | 2015 | 7614 | 8.7 | 4.0 | 26 |
|  | 2016 | 17044 | 8.6 | 3.7 | 22 |
|  | 2017 | 71583 | 9.0 | 4.1 | 37 |
|  | 2018 | 110660 | 9.3 | 4.3 | 38 |
|  | 2019 | 122409 | 9.0 | 4.4 | 36 |
|  | All | 329310 | 9.1 | 4.3 | 38 |
| IN | 2014 | 128548 | 12.0 | 6.6 | 70 |
|  | 2015 | 139124 | 10.2 | 5.9 | 111 |
|  | 2016 | 144609 | 8.7 | 4.8 | 171 |
|  | 2017 | 148489 | 8.3 | 4.3 | 66 |
|  | 2018 | 146497 | 8.9 | 4.9 | 103 |
|  | 2019 | 153362 | 8.9 | 4.7 | 38 |
|  | All | 860629 | 9.4 | 5.4 | 171 |
| KS | 2016 | 15972 | 4.9 | 2.7 | 16 |
|  | 2017 | 33281 | 6.9 | 4.3 | 44 |
|  | 2018 | 34736 | 7.9 | 5.3 | 53 |
|  | 2019 | 44964 | 7.6 | 4.6 | 74 |
|  | All | 128953 | 7.2 | 4.6 | 74 |
| KY | 2014 | 27695 | 11.5 | 5.7 | 63 |
|  | 2015 | 23710 | 10.6 | 5.5 | 76 |
|  | 2016 | 24118 | 9.1 | 4.0 | 30 |
|  | 2017 | 32670 | 9.4 | 4.1 | 50 |
|  | 2018 | 72421 | 9.1 | 4.3 | 40 |
|  | 2019 | 113598 | 8.8 | 3.9 | 40 |
|  | All | 294212 | 9.4 | 4.5 | 76 |
| LA | 2014 | 8193 | 9.9 | 5.3 | 34 |
|  | 2015 | 8460 | 12.0 | 4.4 | 36 |
|  | 2016 | 8489 | 11.5 | 3.6 | 26 |
|  | 2017 | 8483 | 10.3 | 3.8 | 31 |
|  | 2018 | 8138 | 10.3 | 5.0 | 39 |
|  | 2019 | 8473 | 8.3 | 3.8 | 26 |
|  | All | 50236 | 10.4 | 4.5 | 39 |
| MA | 2014 | 49515 | 7.5 | 3.9 | 29 |
|  | 2015 | 63627 | 6.6 | 4.4 | 36 |
|  | 2016 | 95649 | 5.9 | 3.8 | 30 |
|  | 2017 | 104468 | 6.3 | 4.3 | 39 |
|  | 2018 | 105865 | 6.8 | 4.5 | 32 |
|  | 2019 | 116598 | 6.8 | 3.7 | 34 |
|  | All | 535722 | 6.6 | 4.1 | 39 |
| MD | 2014 | 79617 | 9.3 | 4.7 | 36 |
|  | 2015 | 80439 | 9.2 | 5.4 | 39 |
|  | 2016 | 88335 | 7.6 | 4.3 | 39 |
|  | 2017 | 85668 | 7.7 | 4.1 | 41 |
|  | 2018 | 89427 | 7.5 | 4.2 | 31 |
|  | 2019 | 93089 | 6.8 | 4.0 | 38 |
|  | All | 516575 | 8.0 | 4.6 | 41 |
| ME | 2014 | 37883 | 6.9 | 4.6 | 44 |
|  | 2015 | 57114 | 7.0 | 4.6 | 37 |
|  | 2016 | 58765 | 6.1 | 4.2 | 83 |
|  | 2017 | 60216 | 6.1 | 4.0 | 35 |
|  | 2018 | 66508 | 5.6 | 4.1 | 94 |
|  | 2019 | 61209 | 5.2 | 4.1 | 100 |
|  | All | 341695 | 6.1 | 4.3 | 100 |
| MI | 2014 | 12848 | 9.9 | 5.8 | 40 |
|  | 2015 | 15128 | 10.3 | 5.2 | 44 |
|  | 2016 | 13066 | 9.2 | 4.5 | 39 |
|  | 2017 | 21530 | 9.2 | 4.6 | 42 |
|  | 2018 | 16535 | 10.1 | 5.9 | 36 |
|  | 2019 | 72305 | 9.0 | 5.4 | 62 |
|  | All | 151412 | 9.3 | 5.3 | 62 |
| MN | 2014 | 161146 | 7.0 | 4.8 | 44 |
|  | 2015 | 159165 | 6.6 | 4.7 | 72 |
|  | 2016 | 168179 | 5.7 | 4.2 | 61 |
|  | 2017 | 174791 | 6.1 | 4.1 | 34 |
|  | 2018 | 182533 | 6.7 | 4.7 | 41 |
|  | 2019 | 174439 | 6.0 | 4.6 | 128 |
|  | All | 1020253 | 6.3 | 4.5 | 128 |
| MO | 2014 | 106272 | 10.0 | 5.8 | 56 |
|  | 2015 | 106325 | 9.2 | 5.1 | 69 |
|  | 2016 | 109463 | 7.9 | 4.2 | 75 |
|  | 2017 | 108401 | 8.1 | 4.1 | 56 |
|  | 2018 | 108284 | 8.1 | 4.1 | 57 |
|  | 2019 | 108148 | 7.9 | 4.3 | 75 |
|  | All | 646893 | 8.5 | 4.7 | 75 |
| MS | 2017 | 5419 | 9.7 | 4.3 | 36 |
|  | 2018 | 67405 | 8.9 | 4.1 | 52 |
|  | 2019 | 69354 | 8.9 | 4.1 | 33 |
|  | All | 142178 | 9.0 | 4.1 | 52 |
| MT | 2014 | 109255 | 6.8 | 6.0 | 100 |
|  | 2015 | 117347 | 8.9 | 12.6 | 207 |
|  | 2016 | 127842 | 6.3 | 7.2 | 327 |
|  | 2017 | 126989 | 9.6 | 13.4 | 205 |
|  | 2018 | 126173 | 7.2 | 8.1 | 124 |
|  | 2019 | 126103 | 5.6 | 5.2 | 69 |
|  | All | 733709 | 7.4 | 9.4 | 327 |
| NC | 2014 | 68668 | 9.6 | 4.6 | 39 |
|  | 2015 | 69668 | 9.3 | 4.8 | 43 |
|  | 2016 | 87449 | 8.4 | 6.4 | 115 |
|  | 2017 | 114278 | 8.0 | 4.0 | 37 |
|  | 2018 | 144417 | 7.8 | 3.9 | 39 |
|  | 2019 | 153097 | 7.8 | 3.9 | 32 |
|  | All | 637577 | 8.3 | 4.6 | 115 |
| ND | 2014 | 68688 | 4.5 | 4.1 | 50 |
|  | 2015 | 76429 | 5.6 | 8.0 | 124 |
|  | 2016 | 71541 | 3.1 | 4.4 | 46 |
|  | 2017 | 80664 | 5.4 | 5.2 | 92 |
|  | 2018 | 81631 | 5.4 | 5.0 | 57 |
|  | 2019 | 84941 | 4.3 | 3.2 | 87 |
|  | All | 463894 | 4.8 | 5.3 | 124 |
| NE | 2014 | 15338 | 8.7 | 5.2 | 39 |
|  | 2015 | 16809 | 8.9 | 4.6 | 40 |
|  | 2016 | 17101 | 8.0 | 4.6 | 52 |
|  | 2017 | 16196 | 9.6 | 4.0 | 38 |
|  | 2018 | 16114 | 8.7 | 4.6 | 37 |
|  | 2019 | 16874 | 7.3 | 4.3 | 26 |
|  | All | 98432 | 8.5 | 4.6 | 52 |
| NH | 2014 | 41405 | 7.7 | 4.4 | 36 |
|  | 2015 | 33493 | 7.2 | 4.3 | 37 |
|  | 2016 | 39369 | 5.3 | 3.5 | 37 |
|  | 2017 | 47349 | 5.0 | 3.4 | 26 |
|  | 2018 | 43685 | 5.0 | 3.6 | 30 |
|  | 2019 | 48534 | 4.6 | 3.2 | 30 |
|  | All | 253835 | 5.7 | 3.9 | 37 |
| NJ | 2015 | 8215 | 11.3 | 5.5 | 36 |
|  | 2016 | 83024 | 9.0 | 4.3 | 39 |
|  | 2017 | 80402 | 9.0 | 4.4 | 44 |
|  | 2018 | 87842 | 8.8 | 4.5 | 34 |
|  | 2019 | 96203 | 8.5 | 4.5 | 43 |
|  | All | 355686 | 8.9 | 4.5 | 44 |
| NM | 2014 | 21336 | 6.7 | 3.6 | 34 |
|  | 2015 | 32110 | 7.4 | 3.9 | 32 |
|  | 2016 | 31276 | 7.9 | 4.9 | 45 |
|  | 2017 | 23705 | 6.9 | 4.2 | 32 |
|  | 2018 | 85287 | 6.1 | 3.7 | 42 |
|  | 2019 | 93482 | 6.0 | 3.8 | 51 |
|  | All | 287196 | 6.5 | 4.0 | 51 |
| NV | 2014 | 90485 | 7.6 | 6.8 | 108 |
|  | 2015 | 79553 | 7.1 | 5.8 | 98 |
|  | 2016 | 83792 | 6.9 | 5.2 | 74 |
|  | 2017 | 109274 | 6.7 | 5.3 | 136 |
|  | 2018 | 108914 | 7.2 | 6.8 | 155 |
|  | 2019 | 111465 | 5.4 | 3.7 | 36 |
|  | All | 583483 | 6.8 | 5.7 | 155 |
| NY | 2014 | 28294 | 6.6 | 3.8 | 27 |
|  | 2015 | 42061 | 6.9 | 4.7 | 33 |
|  | 2016 | 40267 | 5.6 | 3.5 | 29 |
|  | 2017 | 42589 | 5.9 | 3.8 | 31 |
|  | 2018 | 43782 | 6.0 | 4.1 | 26 |
|  | 2019 | 51678 | 6.8 | 3.8 | 35 |
|  | All | 248671 | 6.3 | 4.0 | 35 |
| OH | 2014 | 22217 | 12.1 | 5.8 | 41 |
|  | 2015 | 47831 | 11.3 | 5.8 | 64 |
|  | 2016 | 46167 | 9.4 | 4.6 | 41 |
|  | 2017 | 32802 | 9.3 | 4.5 | 33 |
|  | 2018 | 96521 | 9.4 | 4.9 | 50 |
|  | 2019 | 132645 | 9.3 | 4.7 | 47 |
|  | All | 378183 | 9.8 | 5.0 | 64 |
| OK | 2014 | 62034 | 8.8 | 4.8 | 48 |
|  | 2015 | 62816 | 7.9 | 3.9 | 58 |
|  | 2016 | 70849 | 7.8 | 4.1 | 70 |
|  | 2017 | 79342 | 8.4 | 4.5 | 79 |
|  | 2018 | 91330 | 9.2 | 4.9 | 55 |
|  | 2019 | 99928 | 8.7 | 4.3 | 50 |
|  | All | 466299 | 8.5 | 4.5 | 79 |
| OR | 2019 | 16994 | 10.3 | 8.1 | 52 |
|  | All | 16994 | 10.3 | 8.1 | 52 |
| PA | 2014 | 238761 | 11.1 | 5.8 | 65 |
|  | 2015 | 262173 | 10.6 | 6.0 | 70 |
|  | 2016 | 284093 | 9.3 | 5.0 | 47 |
|  | 2017 | 299325 | 9.5 | 5.1 | 50 |
|  | 2018 | 300924 | 8.8 | 5.0 | 52 |
|  | 2019 | 320667 | 8.7 | 5.2 | 89 |
|  | All | 1705943 | 9.6 | 5.4 | 89 |
| RI | 2014 | 39286 | 5.4 | 4.1 | 47 |
|  | 2015 | 40281 | 7.6 | 5.0 | 98 |
|  | 2016 | 42247 | 6.7 | 3.9 | 29 |
|  | 2017 | 42184 | 6.1 | 3.5 | 25 |
|  | 2019 | 41490 | 5.5 | 3.6 | 29 |
|  | All | 205488 | 6.3 | 4.1 | 98 |
| SC | 2014 | 6860 | 8.6 | 4.2 | 35 |
|  | 2015 | 12388 | 7.7 | 4.5 | 27 |
|  | 2016 | 21939 | 8.8 | 7.7 | 145 |
|  | 2017 | 19480 | 7.5 | 4.1 | 28 |
|  | 2018 | 25243 | 6.8 | 4.2 | 40 |
|  | 2019 | 28836 | 7.4 | 3.8 | 24 |
|  | All | 114746 | 7.7 | 5.0 | 145 |
| SD | 2014 | 49019 | 5.5 | 4.2 | 39 |
|  | 2015 | 68013 | 6.6 | 5.7 | 63 |
|  | 2016 | 67246 | 4.7 | 3.7 | 42 |
|  | 2017 | 68078 | 5.6 | 4.6 | 72 |
|  | 2018 | 68623 | 5.5 | 4.3 | 48 |
|  | 2019 | 68367 | 4.5 | 3.6 | 56 |
|  | All | 389346 | 5.4 | 4.5 | 72 |
| TN | 2014 | 27238 | 8.8 | 3.8 | 28 |
|  | 2016 | 2007 | 10.3 | 6.5 | 61 |
|  | 2017 | 79068 | 7.7 | 3.7 | 35 |
|  | 2018 | 120714 | 7.4 | 3.7 | 34 |
|  | 2019 | 134412 | 7.4 | 3.6 | 37 |
|  | All | 363439 | 7.6 | 3.7 | 61 |
| TX | 2014 | 22417 | 10.2 | 5.5 | 44 |
|  | 2015 | 23441 | 9.2 | 4.8 | 41 |
|  | 2016 | 24881 | 8.8 | 4.6 | 31 |
|  | 2017 | 52158 | 9.1 | 4.7 | 39 |
|  | 2018 | 129175 | 9.4 | 5.6 | 84 |
|  | 2019 | 228678 | 8.6 | 4.5 | 91 |
|  | All | 480750 | 9.0 | 5.0 | 91 |
| UT | 2014 | 58792 | 7.5 | 6.7 | 103 |
|  | 2015 | 68701 | 7.0 | 5.9 | 88 |
|  | 2016 | 81382 | 6.2 | 5.8 | 64 |
|  | 2017 | 103201 | 6.8 | 6.7 | 86 |
|  | 2019 | 142528 | 5.9 | 5.1 | 52 |
|  | All | 454604 | 6.5 | 6.0 | 103 |
| VA | 2015 | 8736 | 10.1 | 4.4 | 31 |
|  | 2016 | 18170 | 8.2 | 3.5 | 30 |
|  | 2017 | 16609 | 8.0 | 3.9 | 29 |
|  | 2019 | 24771 | 8.0 | 4.2 | 34 |
|  | All | 68286 | 8.3 | 4.0 | 34 |
| VT | 2014 | 24715 | 6.1 | 5.5 | 50 |
|  | 2015 | 33315 | 6.2 | 5.1 | 44 |
|  | 2016 | 33974 | 4.8 | 3.5 | 30 |
|  | 2017 | 33055 | 5.3 | 3.5 | 25 |
|  | 2019 | 34404 | 6.1 | 3.6 | 33 |
|  | All | 159463 | 5.7 | 4.3 | 50 |
| WA | 2014 | 111852 | 7.1 | 5.6 | 72 |
|  | 2015 | 121750 | 7.3 | 5.7 | 104 |
|  | 2016 | 141911 | 6.2 | 4.8 | 68 |
|  | 2017 | 150208 | 8.4 | 11.8 | 226 |
|  | 2018 | 151373 | 8.0 | 12.1 | 351 |
|  | 2019 | 155049 | 7.1 | 5.3 | 52 |
|  | All | 832143 | 7.4 | 8.4 | 351 |
| WI | 2017 | 144137 | 6.4 | 4.0 | 46 |
|  | 2018 | 157002 | 7.4 | 4.9 | 38 |
|  | 2019 | 167148 | 7.4 | 4.8 | 43 |
|  | All | 468287 | 7.1 | 4.6 | 46 |
| WV | 2016 | 3525 | 8.7 | 3.8 | 29 |
|  | 2017 | 8404 | 8.4 | 3.5 | 20 |
|  | 2018 | 7085 | 8.6 | 3.3 | 21 |
|  | 2019 | 3829 | 8.2 | 3.0 | 22 |
|  | All | 22843 | 8.5 | 3.4 | 29 |
| WY | 2014 | 80980 | 3.9 | 3.0 | 24 |
|  | 2015 | 88191 | 4.1 | 4.6 | 63 |
|  | 2016 | 96600 | 3.7 | 2.9 | 37 |
|  | 2017 | 90629 | 4.6 | 5.8 | 94 |
|  | 2018 | 89627 | 4.3 | 4.7 | 53 |
|  | 2019 | 89686 | 2.7 | 2.0 | 25 |
|  | All | 535713 | 3.9 | 4.1 | 94 |
| All states | 2014 | 2718556 | 8.3 | 6.2 | 207 |
|  | 2015 | 2933562 | 8.2 | 6.4 | 293 |
|  | 2016 | 3341630 | 7.2 | 5.2 | 327 |
|  | 2017 | 3895604 | 7.8 | 6.8 | 558 |
|  | 2018 | 4325706 | 8.1 | 7.2 | 351 |
|  | 2019 | 5068749 | 7.2 | 4.7 | 161 |
|  | All  | 22283807 | 7.7 | 6.1 | 558 |

Table S6: Full results of the validation study for PM10 based on an ROC model developed using data from all US states for the period 2014 to 2019. *C*max24(TPR) is the value of *C*max24 that will achieve true positive rates (TPRs) of 90%, 95%, 99% and 100% for the selected 24-hour GVs. The predicted false positive rate (FPR) is also shown. *C*max24(TPR) can be considered to be a 1-hour threshold concentration (TC).

|  |  |  |  |
| --- | --- | --- | --- |
|  | GV = 155 (AQI >100: Unhealthy for sensitive groups) | GV = 255 (AQI >150: Unhealthy) | GV = 355 (AQI >200: Very unhealthy) |
| Test Year | *C*max24(TPR) (1-hour TC) | PredTPR | Actual TPR | Actual FPR | *C*max24(TPR) (1-hour TC) | Pred TPR | Actual TPR | Actual FPR | *C*max24(TPR) (1-hour TC) | Pred TPR | Actual TPR | Actual FPR |
| 2014 | 186  | 100 | 100 | 4.35 (3.82) | 305  | 100 | 100 | 1.95 (1.73) | 560 | 100 | 100 | 0.74 (0.69) |
|  | 221 | 99 | 99.9  | 3.14 (2.79) | 390  | 99 | 100 | 1.29 (1.14) | 707 | 99 | 98.6 | 0.54 (0.45) |
|  | 271  | 95 | 98.8 | 2.18 (1.94) | 679  | 95 | 97.9 | 0.53 (0.45) | 984 | 96.6 | 89.2 | 0.29 (0.24) |
|  | 339  | 90 | 97.5 | 1.42 (1.22) | 877  | 90 | 91.1 | 0.34 (0.27) |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2015 | 186 | 100 | 100 | 3.51 (3.96) | 305 | 100 | 100 | 1.56 (1.80) | 560 | 100 | 100 | 0.57 (0.71) |
|  | 226 | 99 | 99.9 | 2.49 (2.78) | 399 | 99 | 99.4  | 0.96 (1.14) | 693 | 99 | 100 | 0.40 (0.54) |
|  | 275 | 95 | 98.6 | 1.74 (1.96) | 678 | 95 | 99.1 | 0.39 (0.48) | 980 | 95 | 100 | 0.40 (0.26) |
|  | 360 | 90 | 95.2 | 1.19 (1.04) | 864 | 90 | 95.8  | 0.24 (0.30) |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2016 | 186 | 100 | 100 | 4.26 (3.82) | 305 | 100 | 100 | 1.97 (1.72) | 560 | 100 | 100 | 0.79 (0.66) |
|  | 221 | 99 | 100 | 3.12 (2.80) | 389 | 99 | 100 | 1.36 (1.13) | 693 | 99 | 100 | 0.55 (0.46) |
|  | 267 | 95 | 100 | 2.25 (1.98) | 632 | 95 | 99.8 | 0.60 (0.51) | 984 | 95 | 97.7 | 0.27 (0.24) |
|  | 340 | 90 | 99.9 | 1.48 (1.27) | 838 | 90 | 95.4 | 0.35 (0.30) |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2017 | 186 | 100 | 99.9 | 4.22 (3.83) | 305 | 100 | 100 | 1.96 (1.72) | 561 | 100 | 100 | 0.76 (0.66) |
|  | 232 | 99 | 97.8 | 2.89 (2.54) | 439 | 99 | 98.1 | 1.08 (0.93) | 693 | 99 | 99.6 | 0.54 (0.46) |
|  | 312 | 95 | 87.0 | 1.70 (1.50) | 693 | 95 | 95.8 | 0.50 (0.43) | 984 | 95 | 98.2 | 0.27 (0.24) |
|  | 425 | 90 | 77.9 | 0.96 (0.83) | 875 | 90 | 93.0 | 0.31 (0.28) |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2018 | 194 | 100 | 99.7 | 3.68 (3.60) | 308 | 100 | 99.4 | 1.77 (1.73) | 591 | 100 | 99.2 | 0.69 (0.61) |
|  | 234 | 99 | 97.0 | 2.60 (2.56) | 495 | 99 | 94.4 | 0.83 (0.77) | 738 | 99 | 96.0 | 0.46 (0.42) |
|  | 298 | 95 | 90.7 | 1.67 (1.67) | 777 | 95 | 84.2 | 0.37 (0.35) | 984  | 96.1 | 93.3 | 0.29 (0.23) |
|  | 410 | 90 | 81.7 | 0.90 (0.91) | 947 | 90 | 81.2 | 0.27 (0.23) |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2019 | 186 | 100 | 100 | 4.27 (4.07) | 305 | 100 | 100 | 1.37 (1.85) | 577 | 100 | 99.9 | 0.45 (0.69) |
|  | 227 | 99 | 100 | 3.06 (2.83) | 399 | 99 | 99.9 | 0.84 (1.18) | 713 | 99 | 97.7 | 0.31 (0.49) |
|  | 281 | 95 | 100 | 2.13 (1.92) | 693 | 95 | 97.4 | 0.31 (0.47) | 984 | 95.9 | 94.1 | 0.17 (0.27) |
|  | 371 | 90 | 100 | 1.33 (1.15) | 913 | 90 | 85.8 | 0.18 (0.27) |  |  |  |  |

Table S7: Full results of the validation study for PM2.5 based on an ROC model developed using data from all US states for the period 2014 to 2019. *C*max24(TPR) is the value of *C*max24 that will achieve true positive rates (TPRs) of 90%, 95%, 99% and 100% for the selected 24-hour GVs. The predicted false positive rate (FPR) is also shown. *C*max24(TPR) can be considered to be a 1-hour threshold concentration (TC).

|  |  |  |  |
| --- | --- | --- | --- |
|  | GV = 35.5 (AQI >100: Unhealthy for sensitive groups) | GV = 55.5 (AQI >150: Unhealthy) | GV = 150.5 (AQI >200: Very unhealthy) |
| Test Year | *C*max24(TPR) (1-hour TC) | Pred TPR | Actual TPR | Actual FPR | *C*max24(TPR) (1-hour TC) | Pred TPR | Actual TPR | Actual FPR | *C*max24(TPR) (1-hour TC) | PredTPR | Actual TPR | Actual FPR |
| 2014 | 41 | 100 | 100 | 3.73 (2.62) | 65 | 100 | 99.4 | 1.02 (0.80) | 178 | 100 | 100 | 0.08 (0.09) |
|  | 45 | 99 | 99.5 | 2.72 (2.04) | 70 | 99 | 99.4 | 0.82 (0.65) | 183 | 99 | 100 | 0.07 (0.08) |
|  | 50 | 95 | 95.9 | 1.89 (1.42) | 78 | 95 | 91.3 | 0.59 (0.48) | 189 | 95 | 100 | 0.07 (0.07) |
|  | 54 | 90 | 89.4 | 1.47 (1.11) | 83 | 90 | 85.4 | 0.48 (0.41) | 201 | 90 | 100 | 0.06 (0.07) |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2015 | 41 | 100 | 100 | 3.51 (2.65) | 64 | 100 | 100 | 0.97 (0.82) | 178 | 100 | 100 | 0.08 (0.09) |
|  | 45 | 99 | 99.3 | 2.57 (1.97) | 70 | 99 | 99.1 | 0.72 (0.66) | 183 | 99 | 100 | 0.08 (0.08) |
|  | 50 | 95 | 97.0 | 1.75 (1.45) | 77 | 95 | 96.5 | 0.53 (0.50) | 189 | 95 | 93.3 | 0.07 (0.07) |
|  | 53 | 90 | 93.5 | 1.42 (1.15) | 82 | 90 | 92.2 | 0.44 (0.43) | 201 | 90 | 93.3 | 0.06 (0.06) |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2016 | 41 | 100 | 100 | 2.86 (2.90) | 65 | 100 | 100 | 0.75 (0.84) | 178 | 100 | 100 | 0.08 (0.08) |
|  | 45 | 99 | 99.1 | 2.10 (2.03) | 70 | 99 | 98.5 | 0.60 (0.68) | 183 | 99 | 100 | 0.08 (0.08) |
|  | 50 | 95 | 94.5 | 1.44 (1.48) | 77 | 95 | 93 | 0.46 (0.51) | 189 | 95 | 100 | 0.07 (0.07) |
|  | 54 | 90 | 87.7 | 1.12 (1.16) | 82 | 90 | 88 | 0.40 (0.43) | 201 | 90 | 100 | 0.06 (0.06) |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2017 | 41 | 100 | 100 | 2.96 (2.88) | 64 | 100 | 100 | 1.03 (0.80) | 178 | 100 | 100 | 0.12 (0.08) |
|  | 45 | 99 | 99.4 | 2.16 (2.10) | 70 | 99 | 99.2 | 0.82 (0.64) | 183 | 99 | 100 | 0.11 (0.07) |
|  | 50 | 95 | 95.4 | 1.60 (1.45) | 77 | 95 | 95.4 | 0.64 (0.47) | 194 | 95 | 87.6 | 0.09 (0.06) |
|  | 53 | 90 | 91.4 | 1.33 (1.15) | 83 | 90 | 87.0 | 0.51 (0.40) | 209 | 90 | 74.3 | 0.07 (0.05) |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2018 | 41 | 100 | 100 | 2.82 (2.91) | 65 | 100 | 100 | 0.88 (0.82) | 184 | 100 | 97.8 | 0.10 (0.07) |
|  | 46 | 99 | 98.3 | 1.89 (1.99) | 70 | 99 | 98.9 | 0.71 (0.66) | 184 | 99 | 97.8 | 0.10 (0.07) |
|  | 50 | 95 | 94.6 | 1.43 (1.49) | 77 | 95 | 96.1 | 0.57 (0.50) | 188 | 95 | 97.1 | 0.10 (0.07) |
|  | 53 | 90 | 91.9 | 1.18 (1.19) | 81 | 90 | 93.3 | 0.50 (0.43) | 192 | 90 | 95.5 | 0.09 (0.06) |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2019 | 42 | 100 | 99.9 | 2.12 (2.92) | 65 | 100 | 100 | 0.54 (0.91) | 178 | 100 | 100 | 0.05 (0.10) |
|  | 46 | 99 | 96.9 | 1.43 (2.15) | 70 | 99 | 97.5 | 0.44 (0.73) | 183 | 99 | 100 | 0.04 (0.09) |
|  | 50 | 95 | 91.1 | 1.07 (1.60) | 77 | 95 | 95.6 | 0.34 (0.55) | 189 | 95 | 100 | 0.04 (0.08) |
|  | 54 | 90 | 83.4 | 0.83 (1.24) | 82 | 90 | 94.2 | 0.29 (0.47) | 202 | 90 | 100 | 0.03 (0.07) |

Table S8: Full results of the validation study for PM10 based on an ROC model developed using only data from California for the period 2014 to 2019. *C*max24(TPR) is the value of *C*max24 that will achieve true positive rates (TPRs) of 90%, 95%, 99% and 100% for the selected 24-hour GVs. The predicted false positive rate (FPR) is also shown. *C*max24(TPR) can be considered to be a 1-hour threshold concentration (TC).

|  |  |  |
| --- | --- | --- |
| GV = 155 (AQI >100: Unhealthy for sensitive groups) | GV = 255 (AQI >150: Unhealthy) | GV = 355 (AQI >200: Very unhealthy) |
| *C*max24(TPR) (1-hour TC) | Pred TPR | Actual TPR | Actual FPR | *C*max24(TPR) (1-hour TC) | Pred TPR | Actual TPR | Actual FPR | *C*max24(TPR) (1-hour TC) | Pred TPR | Actual TPR | Actual FPR |
| 186 | 100 | 100 | 3.63 (4.75) | 305 | 100 | 100 | 1.58 (2.34) | 556 | 100 | 100 | 0.61 (0.92) |
| 215 | 99 | 99.7 | 2.78 (3.72) | 406 | 99 | 99.0 | 0.98 (1.46) | 658 | 99 | 100 | 0.47 (0.69) |
| 262 | 95 | 97.7 | 1.93 (2.64) | 627 | 95 | 97.2 | 0.49 (0.67) | 967 | 95 | 97.5 | 0.24 (0.31) |
| 336 | 90 | 93.7 | 1.22 (1.69) | 780 | 90 | 94.7 | 0.33 (0.43) |  |  |  |  |

Table S9: Full results of the validation study for PM2.5 based on an ROC model developed using only data from California for the period 2014 to 2019. *C*max24(TPR) is the value of *C*max24 that will achieve true positive rates (TPRs) of 90%, 95%, 99% and 100% for the selected 24-hour GVs. The predicted false positive rate (FPR) is also shown. *C*max24(TPR) can be considered to be a 1-hour threshold concentration (TC).

|  |  |  |
| --- | --- | --- |
| GV = 35.5 (AQI >100: Unhealthy for sensitive groups) | GV = 55.5 (AQI >150: Unhealthy) | GV = 150.5 (AQI >200: Very unhealthy) |
| 1hr TC  | Pred TPR | Actual TPR | Actual FPR | 1hr TC  | Pred TPR | Actual TPR | Actual FPR | 1hr TC  | Pred TPR | Actual TPR | Actual FPR |
| 43 | 100 | 99.6 | 2.16 (4.31) | 66 | 100 | 99.5 | 0.67 (1.53) | 178 | 100 | 100 | 0.07 (0.17) |
| 47 | 99 | 97.2 | 1.60 (3.02) | 72 | 99 | 97.1 | 0.53 (1.10) | 183 | 99 | 100 | 0.07 (0.15) |
| 52 | 95 | 90.4 | 1.14 (2.22) | 78 | 95 | 94.1 | 0.42 (0.90) | 199 | 95 | 82.6 | 0.05 (0.11) |
| 55 | 90 | 85.8 | 0.96 (1.86) | 83 | 90 | 88.9 | 0.36 (0.75) | 209 | 90 | 74.2 | 0.05 (0.10) |

Table S10: Ratios of C24: Cmax24, by state for PM10 over the period 2014 to 2019. The summary is based on monitoring data only from those stations reporting 1-hour measurements.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| State | N |  | Mean | Std. Deviation |
| Alabama | 186,237 |  | 0.494 | 0.137 |
| Alaska | 319,076 |  | 0.408 | 0.135 |
| Arizona | 2,377,721 |  | 0.412 | 0.144 |
| California | 3,798,723 |  | 0.470 | 0.153 |
| Colorado | 140,556 |  | 0.383 | 0.128 |
| Connecticut | 181,295 |  | 0.539 | 0.193 |
| District Of Columbia | 50,167 |  | 0.522 | 0.133 |
| Florida | 730,710 |  | 0.539 | 0.146 |
| Georgia | 69,290 |  | 0.595 | 0.137 |
| Idaho | 302,351 |  | 0.435 | 0.131 |
| Illinois | 80,693 |  | 0.452 | 0.139 |
| Indiana | 143,949 |  | 0.485 | 0.150 |
| Iowa | 51,252 |  | 0.390 | 0.124 |
| Kansas | 369,530 |  | 0.492 | 0.146 |
| Kentucky | 95,855 |  | 0.542 | 0.136 |
| Louisiana | 248,692 |  | 0.537 | 0.133 |
| Maine | 45,294 |  | 0.451 | 0.149 |
| Michigan | 245,639 |  | 0.446 | 0.133 |
| Minnesota | 325,141 |  | 0.475 | 0.157 |
| Mississippi | 16,883 |  | 0.636 | 0.143 |
| Missouri | 158,628 |  | 0.546 | 0.155 |
| Montana | 621,059 |  | 0.414 | 0.136 |
| Nebraska | 144,699 |  | 0.482 | 0.155 |
| Nevada | 1,065,941 |  | 0.439 | 0.151 |
| New Hampshire | 45,203 |  | 0.473 | 0.134 |
| New Mexico | 513,231 |  | 0.383 | 0.146 |
| North Carolina | 261,939 |  | 0.566 | 0.144 |
| North Dakota | 446,305 |  | 0.498 | 0.151 |
| Ohio | 266,892 |  | 0.498 | 0.146 |
| Oklahoma | 261,335 |  | 0.522 | 0.148 |
| Oregon | 48,836 |  | 0.428 | 0.171 |
| Pennsylvania | 787,076 |  | 0.517 | 0.140 |
| South Carolina | 199,966 |  | 0.517 | 0.138 |
| South Dakota | 386,910 |  | 0.415 | 0.147 |
| Tennessee | 104,931 |  | 0.547 | 0.141 |
| Washington | 202,768 |  | 0.455 | 0.139 |
| West Virginia | 119,812 |  | 0.511 | 0.137 |
| Wisconsin | 189,115 |  | 0.573 | 0.136 |
| Wyoming | 852,439 |  | 0.385 | 0.169 |
| **All states** | **16,456,139** |  | **0.462** | **0.156** |

Table S11: Ratios of C24: Cmax24, by state for PM10 over the period 2014 to 2019. The summary is based on monitoring data only from those stations reporting 1-hour measurements.

|  |  |  |  |
| --- | --- | --- | --- |
| State | N | Mean | Std. Deviation |
| Alabama | 54,865 | 0.493 | 0.140 |
| Alaska | 252,403 | 0.344 | 0.194 |
| Arizona | 797,631 | 0.440 | 0.200 |
| California | 3,241,798 | 0.470 | 0.177 |
| Colorado | 568,740 | 0.502 | 0.155 |
| Connecticut | 314,069 | 0.504 | 0.260 |
| Delaware | 192,350 | 0.605 | 0.141 |
| District Of Columbia | 133,328 | 0.534 | 0.134 |
| Florida | 359,114 | 0.555 | 0.183 |
| Georgia | 231,833 | 0.612 | 0.187 |
| Hawaii | 615,609 | 0.383 | 0.354 |
| Idaho | 108,124 | 0.443 | 0.150 |
| Illinois | 329,310 | 0.458 | 0.137 |
| Indiana | 860,626 | 0.522 | 0.171 |
| Iowa | 67,676 | 0.537 | 0.155 |
| Kansas | 128,951 | 0.515 | 0.169 |
| Kentucky | 294,212 | 0.612 | 0.161 |
| Louisiana | 50,236 | 0.559 | 0.193 |
| Maine | 341,641 | 0.439 | 0.220 |
| Maryland | 516,356 | 0.514 | 0.197 |
| Massachusetts | 535,311 | 0.436 | 0.303 |
| Michigan | 151,412 | 0.472 | 0.151 |
| Minnesota | 1,020,090 | 0.471 | 0.173 |
| Mississippi | 142,178 | 0.672 | 0.136 |
| Missouri | 646,889 | 0.499 | 0.201 |
| Montana | 733,652 | 0.377 | 0.189 |
| Nebraska | 98,432 | 0.530 | 0.148 |
| Nevada | 579,363 | 0.446 | 0.506 |
| New Hampshire | 253,722 | 0.433 | 0.205 |
| New Jersey | 355,686 | 0.533 | 0.124 |
| New Mexico | 287,196 | 0.454 | 0.146 |
| New York | 248,671 | 0.521 | 0.164 |
| North Carolina | 637,453 | 0.517 | 0.167 |
| North Dakota | 463,598 | 0.350 | 0.991 |
| Ohio | 378,183 | 0.562 | 0.136 |
| Oklahoma | 466,292 | 0.612 | 0.156 |
| Oregon | 16,994 | 0.460 | 0.172 |
| Pennsylvania | 1,705,918 | 0.527 | 0.275 |
| Rhode Island | 205,348 | 0.463 | 0.208 |
| South Carolina | 114,745 | 0.508 | 0.731 |
| South Dakota | 389,298 | 0.410 | 0.335 |
| Tennessee | 363,439 | 0.512 | 0.156 |
| Texas | 480,750 | 0.487 | 0.171 |
| Utah | 454,591 | 0.513 | 0.186 |
| Vermont | 159,451 | 0.518 | 0.187 |
| Virginia | 68,286 | 0.503 | 0.153 |
| Washington | 832,096 | 0.476 | 0.149 |
| West Virginia | 22,843 | 0.564 | 0.130 |
| Wisconsin | 468,286 | 0.556 | 0.161 |
| Wyoming | 535,585 | 0.346 | 0.214 |
| **All states** | **22,274,630** | **0.483** | **0.269** |