Atmospheric
Measurement
Techniques

*Supplement of*

# A global analysis of climate-relevant aerosol properties retrieved from the network of Global Atmosphere Watch (GAW) near-surface observatories

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Table S1: Overview of aerosol absorption coefficient measurements. For each site, the instrument used for data collection and corresponding data availability are indicated. The statistics, i.e. median, 10th and 90th quantiles of $\sigma_{ap}$ are only reported when data availability is above 75% over the period of interest (year or season). For MLO and BRW, where data are screened for provenance from clean air sectors, summary statistics are reported despite the lower the data coverage.

| Station Acronym | Instrument | Data availability | | | | | Aerosol Absorption Coefficient $\sigma_{ap}$ (Mm$^{-1}$) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Year | DJF | MAM | JJA | SON | Year | | | DJF | | | MAM | | | JJA | | | SON | | |
| | | | | | | | Med. | q10th | q90th | Med. | q10th | q90th | Med. | q10th | q90th | Med. | q10th | q90th | Med. | q10th | q90th |
| ALT* | CLAP-3W | 79% | 85% | 96% | 98% | 35% | 0.07 | -0.01 | 0.39 | 0.15 | 0.03 | 0.56 | 0.19 | 0.03 | 0.47 | 0.01 | -0.03 | 0.11 | 0.00 | -0.02 | 0.05 |
| AMY | AE31 | 75% | 100% | 100% | 46% | 57% | 4.24 | 1.89 | 10.65 | 4.81 | 2.22 | 11.94 | 5 | 2.19 | 11.45 | | | | | | |
| APP | CLAP-3W | 97% | 97% | 98% | 93% | 98% | 1.5 | 0.49 | 3.12 | 1.34 | 0.44 | 3.15 | 1.3 | 0.44 | 3.38 | 1.69 | 0.78 | 3.04 | 1.57 | 0.48 | 3.06 |
| APT | MAAP | 94% | 100% | 100% | 77% | 100% | 0.59 | 0.16 | 2.44 | 0.86 | 0.23 | 4.95 | 0.5 | 0.15 | 1.35 | 0.46 | 0.11 | 1.45 | 0.56 | 0.2 | 3.43 |
| ARN | CLAP-3W | 70% | 34% | 73% | 94% | 78% | | | | | | | | | | 2.66 | 1.07 | 6.64 | 2.93 | 1.11 | 7.33 |
| BEO | CLAP-3W | 54% | 14% | 42% | 66% | 95% | | | | | | | | | | | | | 0.41 | 0.05 | 2.38 |
| BIR | PSAP-3W | 68% | 94% | 65% | 21% | 91% | | | | 0.66 | 0.1 | 3.61 | | | | | | | 0.49 | 0.09 | 2.69 |
| BKT | AE31 | 46% | 75% | 61% | 0% | 50% | | | | 2.73 | 0.61 | 6.31 | | | | | | | | | |
| BND | CLAP-3W | 91% | 96% | 90% | 95% | 84% | 1.8 | 0.55 | 3.96 | 1.5 | 0.42 | 3.79 | 1.34 | 0.46 | 3.2 | 2.2 | 0.82 | 4.32 | 2.22 | 0.84 | 4.4 |
| BRW* | CLAP-3W | 42% | 57% | 75% | 35% | 0% | 0.15 | 0.02 | 0.48 | 0.19 | 0.07 | 0.67 | 0.22 | 0.05 | 0.49 | 0.03 | 0 | 0.11 | | | |
| CGO | MAAP | 97% | 91% | 100% | 100% | 98% | 0.05 | 0.01 | 0.51 | 0.03 | 0 | 0.14 | 0.1 | 0 | 1.68 | 0.03 | 0 | 0.37 | 0.06 | 0.01 | 0.39 |
| CHC | AE31 | 98% | 98% | 97% | 99% | 98% | 0.87 | 0.09 | 3.01 | 0.52 | 0.03 | 1.95 | 0.54 | 0.05 | 1.96 | 1.23 | 0.27 | 3.57 | 1.36 | 0.33 | 3.89 |
| CMN | MAAP | 93% | 100% | 90% | 95% | 88% | 0.79 | 0.11 | 3.18 | 0.23 | 0.07 | 1.1 | 1.02 | 0.22 | 3.49 | 2.11 | 0.55 | 4.25 | 0.59 | 0.13 | 2.12 |
| CPR* | CLAP-3W | 85% | 93% | 99% | 95% | 52% | 0.37 | -0.01 | 1.54 | 0.34 | -0.06 | 2.6 | 0.28 | -0.04 | 1.46 | 0.44 | 0.02 | 1.16 | | | |
| EGB | CLAP-3W | 85% | 94% | 64% | 97% | 86% | 1.14 | 0.3 | 3.51 | 0.91 | 0.3 | 3.1 | | | | 1.5 | 0.42 | 3.81 | 1.37 | 0.28 | 4.03 |
| ETL | CLAP-3W | 69% | 76% | 74% | 70% | 55% | | | | 0.38 | 0.24 | 0.85 | | | | | | | | | |
| GSN | CLAP-3W | 33% | 19% | 85% | 27% | 0% | | | | | | | 5.79 | 2.48 | 13.35 | | | | | | |
| HAC | AE31 | 85% | 91% | 71% | 81% | 99% | 0.46 | 0.03 | 1.69 | 0.1 | 0 | 0.55 | | | | 1.22 | 0.45 | 2.68 | 0.39 | 0.03 | 1.19 |
| HPB | MAAP | 96% | 99% | 99% | 100% | 87% | 1.52 | 0.43 | 3.87 | 1.54 | 0.38 | 5.95 | 1.69 | 0.45 | 3.6 | 1.47 | 0.49 | 3.55 | 1.37 | 0.41 | 3.41 |
| HYY | AE31 | 88% | 70% | 89% | 98% | 94% | 0.65 | 0.2 | 1.81 | | | | 0.49 | 0.16 | 1.18 | 0.63 | 0.2 | 1.61 | 0.77 | 0.25 | 2.16 |
| IPR | AE31 | 94% | 90% | 98% | 90% | 99% | 6.73 | 1.47 | 30.66 | 17.32 | 2.55 | 48.16 | 5.04 | 1.49 | 15.89 | 4.53 | 1.33 | 8.72 | 10.41 | 1.2 | 32.28 |
| IZO | MAAP | 55% | 45% | 84% | 91% | 0% | | | | | | | 0.41 | 0.1 | 2.36 | 0.54 | 0.08 | 3.14 | | | |
| JFJ | MAAP | 88% | 84% | 99% | 100% | 69% | 0.09 | 0.02 | 0.56 | 0.04 | 0.01 | 0.17 | 0.11 | 0.02 | 0.54 | 0.25 | 0.03 | 0.81 | | | |
| KOS | AE31 | 79% | 87% | 93% | 60% | 75% | 5.12 | 2.11 | 17.94 | 10.51 | 2.77 | 29.23 | 4.45 | 1.98 | 10.12 | | | | 6.99 | 2.6 | 16.27 |
| KPS* | CLAP-3W | 73% | 91% | 95% | 65% | 44% | | | | 8.47 | 2.49 | 19.84 | 3.89 | 1.78 | 9.06 | | | | | | |
| LEI | MAAP | 98% | 100% | 100% | 100% | 92% | 3.34 | 1.24 | 12.58 | 4.99 | 1.37 | 25.18 | 3.14 | 1.18 | 8.6 | 2.61 | 1.24 | 6.28 | 3.76 | 1.27 | 11.96 |
| LEI-E | MAAP | 94% | 78% | 99% | 100% | 100% | 7.74 | 2.7 | 19.29 | 10.14 | 2.32 | 32.27 | 7.69 | 2.91 | 15.73 | 7.95 | 3.15 | 17.18 | 6.59 | 2.36 | 17.32 |
| LEI-M | MAAP | 76% | 100% | 100% | 70% | 35% | 10.46 | 4.16 | 23.59 | 12.87 | 4.15 | 34.61 | 9.7 | 4.15 | 18.37 | | | | | | |
| LLN | PSAP-3W | 93% | 83% | 93% | 99% | 95% | 0.66 | 0.04 | 5.73 | 0.62 | 0.06 | 4.16 | 3.6 | 0.27 | 10.98 | 0.34 | 0.02 | 1.52 | 0.44 | 0.03 | 2.22 |
| MEL | MAAP | 99% | 97% | 99% | 100% | 98% | 2.01 | 0.69 | 8.25 | 3.75 | 0.89 | 20.8 | 2.05 | 0.65 | 5.32 | 1.39 | 0.61 | 2.88 | 2.25 | 0.7 | 7.28 |
| MLO* | CLAP-3W | 44% | 49% | 33% | 38% | 54% | 0.07 | -0.04 | 0.33 | 0.05 | -0.02 | 0.23 | 0.22 | 0.03 | 0.59 | 0.04 | -0.07 | 0.25 | 0.06 | -0.04 | 0.22 |

| Site | Type | % | % | % | % | % | G1a | G1b | G1c | G2a | G2b | G2c | G3a | G3b | G3c | G4a | G4b | G4c | G5a | G5b | G5c |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MSA | MAAP | 66% | 48% | 73% | 75% | 67% | | | | | | | | | | 1.52 | 0.29 | 3.52 | | | |
| MSY | MAAP | 84% | 46% | 93% | 98% | 97% | 2.21 | 0.64 | 4.98 | | | | 1.95 | 0.61 | 4.55 | 2.56 | 0.86 | 4.95 | 2.3 | 0.63 | 4.96 |
| NGL | MAAP | 95% | 96% | 97% | 94% | 92% | 0.24 | 0.07 | 1.09 | 0.42 | 0.09 | 2.8 | 0.2 | 0.06 | 0.63 | 0.16 | 0.07 | 0.41 | 0.29 | 0.09 | 1.15 |
| NMY | MAAP | 100% | 100% | 100% | 100% | 100% | 0.01 | 0 | 0.03 | 0.01 | 0 | 0.03 | 0.01 | -0.01 | 0.02 | 0.01 | -0.01 | 0.02 | 0.02 | 0 | 0.04 |
| OPE | AE31 | 75% | 38% | 90% | 88% | 83% | 1.35 | 0.46 | 3.2 | | | | 1.43 | 0.5 | 2.82 | 1.11 | 0.43 | 2.61 | 1.47 | 0.43 | 3.8 |
| PAL | MAAP | 81% | 55% | 100% | 90% | 78% | 0.13 | 0.02 | 0.5 | | | | 0.17 | 0.04 | 0.53 | 0.14 | 0.02 | 0.54 | 0.07 | 0 | 0.35 |
| PDI* | AE31 | 84% | 94% | 85% | 94% | 62% | 4.99 | 0.83 | 32.24 | 7.93 | 3.37 | 18.44 | 23.52 | 4.03 | 57.61 | 1.32 | 0.42 | 3.58 | | | |
| PDM | AE16 | 51% | 47% | 98% | 59% | 0% | | | | | | | 0.26 | -0.49 | 1.15 | | | | | | |
| PUY | MAAP | 73% | 65% | 91% | 58% | 77% | | | | | | | 0.92 | 0.09 | 2.37 | | | | 0.44 | 0.05 | 2.24 |
| SGP* | PSAP-3W | 79% | 79% | 78% | 80% | 79% | 1.57 | 0.47 | 3.32 | 1.08 | 0.32 | 2.53 | 1.23 | 0.39 | 3.2 | 1.98 | 0.9 | 3.56 | 2.01 | 0.62 | 3.65 |
| SPL* | PSAP-3W | 77% | 71% | 94% | 94% | 47% | 0.45 | 0.12 | 1.3 | | | | 0.31 | 0.07 | 0.75 | 0.87 | 0.43 | 1.99 | | | |
| SUM | CLAP-3W | 85% | 84% | 87% | 76% | 92% | 0.04 | 0 | 0.15 | 0.02 | 0 | 0.09 | 0.07 | 0.02 | 0.19 | 0.06 | 0.01 | 0.23 | 0.02 | 0 | 0.09 |
| THD | CLAP-3W | 38% | 65% | 87% | 1% | 0% | | | | | | | 0.3 | 0.09 | 0.73 | | | | | | |
| TIK | MAAP | 97% | 93% | 100% | 94% | 99% | 0.21 | 0.02 | 1.98 | 1.31 | 0.14 | 3.41 | 0.49 | 0.13 | 1.68 | 0.05 | 0 | 0.35 | 0.08 | 0.01 | 0.43 |
| TLL | AE31 | 61% | 79% | 60% | 38% | 69% | | | | 1.11 | 0.47 | 3.47 | | | | | | | | | |
| TRL | PSAP-3W | 96% | 93% | 94% | 98% | 98% | 0.02 | 0 | 0.06 | 0.03 | 0.01 | 0.08 | 0.01 | 0 | 0.05 | 0 | 0 | 0.02 | 0.03 | 0.01 | 0.09 |
| UGR | MAAP | 93% | 99% | 91% | 97% | 83% | 8.5 | 3.45 | 28.29 | 12 | 3.68 | 38.07 | 6.19 | 2.7 | 16.31 | 7.53 | 3.82 | 18.75 | 11.01 | 4.24 | 38.3 |
| WAL | MAAP | 100% | 100% | 100% | 99% | 100% | 1.67 | 0.51 | 6.57 | 3.06 | 0.71 | 13.91 | 1.43 | 0.41 | 4.04 | 1.22 | 0.46 | 2.59 | 1.96 | 0.61 | 6.56 |
| ZEP | AE31 | 95% | 98% | 99% | 94% | 90% | 0.09 | 0.01 | 0.48 | 0.11 | 0.02 | 0.59 | 0.24 | 0.04 | 0.59 | 0.04 | 0 | 0.16 | 0.04 | 0 | 0.36 |
| ZSF | MAAP | 90% | 100% | 100% | 61% | 99% | 0.2 | 0.03 | 1.18 | 0.09 | 0.02 | 0.38 | 0.4 | 0.05 | 1.36 | | | | 0.14 | 0.02 | 0.85 |

* 2016 data was used for these sites

Table S2: Overview of aerosol scattering coefficient measurements. For each site, the instrument used for data collection and corresponding data availability are indicated. The statistics, i.e. median, 10th and 90th quantiles of $\sigma_{sp}$ are only reported when data availability is above 75% over the period of interest (year or season). For SPO, MLO and BRW, where data are screened for provenance from clean air sectors, summary statistics are reported regardless of the data coverage.

| Station Acronym | Instrument | Data availability | | | | | Aerosol Scattering Coefficient $\sigma_{sp}$ (Mm$^{-1}$) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Year | DJF | MAM | JJA | SON | Year | | | DJF | | | MAM | | | JJA | | | SON | | |
| | | | | | | | Med. | q10th | q90th | Med. | q10th | q90th | Med. | q10th | q90th | Med. | q10th | q90th | Med. | q10th | q90th |
| ALT | TSI 3563 | 75% | 61% | 83% | 78% | 79% | 2.06 | 0.32 | 8.71 | | | | 5.37 | 1.59 | 12.96 | 0.74 | 0.13 | 2.28 | 1.37 | 0.26 | 3.66 |
| AMY | TSI 3563 | 45% | 61% | 92% | 25% | 1% | | | | | | | 72.88 | 29.36 | 210.43 | | | | | | |
| APP | TSI 3563 | 98% | 98% | 98% | 97% | 99% | 19.12 | 5.19 | 47.29 | 15.65 | 4.27 | 38.05 | 16.32 | 4.07 | 44.41 | 29 | 12.11 | 61.08 | 16.59 | 4.23 | 40.81 |
| ARN | TSI 3563 | 88% | 97% | 92% | 88% | 76% | 32.66 | 13.8 | 74.21 | 34.09 | 12.18 | 86.71 | 28.09 | 13.33 | 57.27 | 36.1 | 16.24 | 82.72 | 32.78 | 13.03 | 65.52 |
| BBE | NGN-2 | 48% | 47% | 76% | 51% | 19% | | | | | | | 8.71 | 1.25 | 25.98 | | | | | | |
| BEO | TSI 3563 | 86% | 72% | 96% | 81% | 95% | 8.12 | 0.59 | 44.77 | | | | 12.02 | 1.24 | 38.84 | 29.54 | 3.58 | 60.72 | 5.04 | 0.54 | 29.33 |
| BIR | TSI 3563 | 93% | 91% | 95% | 89% | 95% | 5.11 | 1.1 | 18.78 | 3.93 | 0.79 | 23.69 | 5.41 | 1.19 | 18.47 | 6.74 | 2.63 | 16.36 | 4.02 | 0.85 | 22.02 |
| BKT* | Aurora 3000 | 97% | 98% | 99% | 96% | 97% | 20.82 | 4.75 | 87.31 | 32.75 | 5.84 | 98.85 | 45.06 | 8.37 | 123.83 | 19.68 | 5.34 | 51.14 | 10.94 | 2.64 | 25.44 |
| BND | TSI 3563 | 92% | 97% | 92% | 96% | 84% | 22.84 | 8.02 | 55.8 | 26.11 | 9.22 | 70.75 | 18.43 | 6.56 | 44.52 | 24.41 | 9.07 | 48.48 | 22.94 | 7.57 | 59.31 |
| BRW* | TSI 3563 | 49% | 58% | 76% | 38% | 23% | 5.3 | 0.79 | 21.3 | 7.41 | 2.29 | 22.36 | 4.85 | 0.92 | 17.76 | 1.95 | 0.4 | 11.24 | 7.19 | 1.03 | 42.01 |
| CGO | Aurora 3000 | 99% | 97% | 100% | 100% | 100% | 4.05 | 1.44 | 9.38 | 4.43 | 1.92 | 8.42 | 4.28 | 1.51 | 18.33 | 3.35 | 1.14 | 7.5 | 4.05 | 1.43 | 8.53 |
| CHC | Aurora 3000 | 84% | 84% | 96% | 85% | 73% | 16.72 | 7.16 | 39.72 | 16.01 | 10.1 | 33.86 | 12.29 | 3.34 | 30.89 | 16.02 | 4.29 | 39.16 | | | |
| CMN | TSI 3563 | 69% | 79% | 32% | 70% | 94% | | | | 1.3 | 0.38 | 8.65 | | | | | | | 3.96 | 1.02 | 16.57 |
| CPR* | TSI 3563 | 44% | 85% | 60% | 7% | 24% | | | | 32.4 | 17.09 | 65.96 | | | | | | | | | |
| DEM | Aurora 3000 | 87% | 93% | 69% | 92% | 93% | 38 | 15.91 | 76.94 | 34.46 | 13.39 | 76.68 | | | | 49.73 | 26.65 | 88.08 | 32.44 | 13.6 | 59.04 |
| EGB | TSI 3563 | 83% | 100% | 73% | 72% | 89% | 13.24 | 3.98 | 48.65 | 13.63 | 3.97 | 59.94 | | | | | | | 13.35 | 3.56 | 48.01 |
| ETL | TSI 3563 | 98% | 100% | 93% | 99% | 100% | 6.84 | 1.98 | 24.95 | 5.29 | 2.13 | 13.73 | 6.29 | 2.16 | 11.91 | 14.01 | 3.64 | 44.88 | 5.96 | 1.25 | 31.76 |
| FKL | Aurora 3000 | 78% | 70% | 77% | 82% | 83% | 36.16 | 16.07 | 74.13 | | | | 37.02 | 18.11 | 74.07 | 50.47 | 28.11 | 91.15 | 29.11 | 12.49 | 53.31 |
| GBN | NGN-2 | 48% | 18% | 64% | 88% | 22% | | | | | | | | | | 11.11 | 4.1 | 26.29 | | | |
| GIF | Aurora M9003 | 81% | 66% | 99% | 100% | 58% | 10.14 | 1.65 | 59.32 | | | | 12.38 | 2.81 | 66.35 | 6.9 | 1.01 | 25.24 | | | |
| GSN* | TSI 3563 | 35% | 37% | 86% | 17% | 0% | | | | | | | 104.13 | 32.66 | 250.41 | | | | | | |
| HAC | TSI 3563 | 81% | 81% | 52% | 92% | 98% | 11.87 | 0.5 | 56.17 | 1.69 | 0.12 | 8.01 | | | | 40.11 | 15.21 | 77.18 | 9.54 | 0.47 | 32.58 |
| HPB | TSI 3563 | 86% | 92% | 90% | 71% | 90% | 12.71 | 2.06 | 46.36 | 10.95 | 1.53 | 74.15 | 15.65 | 1.99 | 56.95 | | | | 10.41 | 2.23 | 34.16 |
| HYY | TSI 3563 | 94% | 95% | 92% | 95% | 96% | 6.88 | 2.7 | 20.36 | 6.64 | 2.26 | 25.61 | 6.06 | 2.63 | 13.69 | 10.2 | 3.6 | 22.75 | 6.32 | 2.42 | 20.06 |
| IPR | TSI 3563 | 96% | 96% | 98% | 91% | 98% | 38.06 | 6.36 | 157.73 | 84.81 | 8.75 | 247.77 | 28.29 | 5.47 | 118.92 | 30.62 | 7.29 | 64.26 | 45.31 | 5.69 | 142.65 |
| IZO | TSI 3563 | 53% | 40% | 82% | 90% | 0% | | | | | | | 4.46 | 1.48 | 63.88 | 8.98 | 1.74 | 156.26 | | | |
| JFJ | TSI 3563 | 93% | 91% | 82% | 100% | 99% | 0.91 | 0.14 | 8.73 | 0.39 | 0.09 | 1.9 | 1.3 | 0.21 | 8.57 | 4.2 | 0.44 | 13.15 | 0.54 | 0.12 | 3.5 |
| KOS | TSI 3563 | 72% | 52% | 89% | 72% | 76% | | | | | | | 27.14 | 10.23 | 67.95 | | | | 27.17 | 9.1 | 69.47 |
| KPS | TSI 3563 | 68% | 77% | 68% | 66% | 60% | | | | 150 | 38.8 | 341.2 | | | | | | | | | |
| LLN | TSI 3563 | 92% | 86% | 91% | 96% | 93% | 8.28 | 0.72 | 74.19 | 6.75 | 0.75 | 60.93 | 42.33 | 2.57 | 136.1 | 4.7 | 0.58 | 28.2 | 5.7 | 0.59 | 39.81 |
| MEL | TSI 3563 | 98% | 100% | 100% | 99% | 93% | 18.79 | 7.3 | 74.33 | 34.63 | 6.88 | 153.09 | 20.98 | 8.53 | 48.52 | 14.84 | 7.36 | 29.36 | 16.67 | 6.01 | 50.98 |

| Site | Instrument | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MLO* | TSI 3563 | 45% | 51% | 34% | 40% | 54% | 1.04 | 0.27 | 5.82 | 0.72 | 0.23 | 2.93 | 3.59 | 0.9 | 9.21 | 1.06 | 0.32 | 5.03 | 0.82 | 0.21 | 3.92 |
| MSA | Aurora 3000 | 62% | 50% | 75% | 57% | 67% | | | | | | | 19.02 | 3.4 | 57.12 | | | | | | |
| MSY | Aurora 3000 | 81% | 42% | 90% | 97% | 94% | 24.24 | 6.82 | 54.44 | | | | 18.16 | 6.26 | 44.25 | 30.46 | 10 | 56.95 | 25.47 | 7.17 | 52.43 |
| NMY | TSI 3563 | 64% | 55% | 96% | 88% | 16% | | | | | | | 1.5 | 0.6 | 5.44 | 1.4 | 0.46 | 5 | | | |
| OPE* | Aurora 3000 | 73% | 83% | 98% | 97% | 12% | | | | 4.62 | 0.25 | 43.4 | 2.43 | 0.71 | 9.42 | 3.7 | 0.97 | 8.07 | | | |
| PAL | TSI 3563 | 73% | 80% | 88% | 75% | 49% | | | | 3.52 | 0.56 | 11.28 | 5.99 | 1.93 | 12.79 | 8.35 | 2.29 | 27.58 | | | |
| PAZ | NGN-2 | 63% | 38% | 66% | 76% | 70% | | | | | | | | | | 5 | -3 | 20 | | | |
| PDI | Aurora 3000 | 97% | 95% | 96% | 99% | 98% | 35.17 | 4.72 | 166.54 | 53.51 | 6.84 | 164.71 | 98.56 | 28.31 | 282.97 | 11.93 | 1.47 | 43.61 | 25.63 | 6.68 | 125.93 |
| PDM | Aurora M9003 | 56% | 65% | 100% | 58% | 0% | | | | | | | 3.11 | 0.02 | 17.54 | | | | | | |
| PUY | TSI 3563 | 74% | 94% | 88% | 29% | 87% | | | | 3.05 | 0.26 | 20.99 | 12.32 | 0.68 | 46.76 | | | | 8.77 | 0.66 | 30.81 |
| SAL | Aurora 3000 | 86% | 90% | 89% | 70% | 95% | 51.84 | 21.89 | 136.19 | 53.58 | 21.16 | 188.31 | 37.32 | 16.42 | 88.86 | | | | 53.41 | 25.26 | 164.23 |
| SGP | TSI 3563 | 65% | 59% | 87% | 85% | 29% | | | | | | | 19.54 | 5.73 | 55.12 | 29.91 | 15.2 | 51.14 | | | |
| SPL* | TSI 3563 | 86% | 88% | 97% | 94% | 65% | 5.5 | 1.16 | 16.17 | 2.22 | 0.64 | 5.22 | 4.47 | 0.84 | 10.88 | 12.3 | 6.64 | 26.63 | | | |
| SPO | TSI 3563 | 28% | 76% | 26% | 11% | 0% | 0.35 | 0.15 | 0.66 | 0.37 | 0.2 | 0.65 | 0.32 | 0.16 | 0.96 | 0.17 | 0.03 | 0.41 | | | |
| SUM | TSI 3563 | 86% | 87% | 88% | 77% | 93% | 0.65 | 0.07 | 2.44 | 0.36 | -0.03 | 1.06 | 1 | 0.25 | 2.59 | 0.99 | 0.21 | 4.73 | 0.52 | 0.03 | 2.12 |
| THD | TSI 3563 | 37% | 62% | 85% | 1% | 0% | | | | | | | 16.06 | 4.02 | 41.31 | | | | | | |
| TIK | TSI 3563 | 83% | 76% | 67% | 92% | 99% | 7.28 | 1.35 | 29.78 | 19.7 | 6.79 | 41.53 | | | | 3.53 | 0.63 | 21.67 | 4.76 | 1.32 | 15.67 |
| TLL | Aurora 3000 | 95% | 85% | 97% | 100% | 100% | 10.29 | 1.28 | 30.7 | 26.75 | 14.67 | 57.71 | 11.98 | 2.14 | 23.36 | 2.5 | 0.53 | 7.84 | 10.1 | 3.45 | 21.36 |
| TRL | TSI 3563 | 99% | 98% | 100% | 100% | 100% | 0.76 | 0.36 | 2.15 | 0.74 | 0.42 | 1.2 | 0.6 | 0.27 | 1.27 | 0.96 | 0.34 | 3.42 | 0.9 | 0.44 | 2.48 |
| UGR | TSI 3563 | 91% | 87% | 93% | 88% | 93% | 44.13 | 17.95 | 101.91 | 55.5 | 15.52 | 151.97 | 36.07 | 16.2 | 74.88 | 46 | 24.82 | 76.43 | 42.08 | 17.98 | 96.09 |
| ZSF | TSI 3563 | 67% | 65% | 96% | 58% | 50% | | | | | | | 7.16 | 0.56 | 31.88 | | | | | | |

* 2016 data was used for these sites

Table S3: Overview of CN measurements. For each site, the instrument used for data collection and corresponding data availability are indicated. The statistics, i.e. median, 10th and 90th percentiles of Ntot, are only reported when data availability is above 75% over the period of interest (year or season).

| Station Name | Instrument | Data availability | | | | | $N_{tot}$ (cm$^{-3}$) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Year | | | DJF | | | MAM | | | JJA | | | SON | | |
| | | Year | DJF | MAM | JJA | SON | Med. | 10th per. | 90th per. | Med. | 10th per. | 90th per. | Med. | 10th per. | 90th per. | Med. | 10th per. | 90th per. | Med. | 10th per. | 90th per. |
| Welgegund | MPSS | 93% | 87% | 96% | 97% | 92% | 3798 | 1369 | 14024 | 3513 | 1286 | 12806 | 3916 | 1401 | 12627 | 3755 | 1506 | 14292 | 4004 | 1286 | 16185 |
| Mt. Waliguan* | CPC | 55% | 56% | 98% | 66% | 0% | - | - | - | - | - | - | 2021 | 735 | 5712 | - | - | - | - | - | - |
| Anmyeon –do | MPSS | 50% | 34% | 0% | 67% | 100% | - | - | - | - | - | - | - | - | - | - | - | - | 4247 | 2257 | 7659 |
| Gosan* | CPC | 34% | 39% | 76% | 21% | 0% | - | - | - | - | - | - | 2761 | 1439 | 5049 | - | - | - | - | - | - |
| Lulin | CPC | 89% | 87% | 94% | 86% | 89% | 1106 | 388 | 2779 | 810 | 307 | 2034 | 1466 | 554 | 2661 | 1080 | 380 | 3214 | 1121 | 395 | 3238 |
| Mount Chacaltaya | MPSS | 82% | 94% | 89% | 91% | 52% | 2644 | 578 | 15307 | 1246 | 410 | 5588 | 2252 | 526 | 13827 | 5483 | 1303 | 27475 | - | - | - |
| Egbert | CPC | 94% | 100% | 77% | 100% | 99% | 2594 | 648 | 7295 | 2541 | 683 | 7126 | 1329 | 281 | 5071 | 2701 | 1120 | 6464 | 3893 | 913 | 9022 |
| East Trout Lake | CPC | 98% | 100% | 93% | 100% | 100% | 1116 | 189 | 3328 | 731 | 135 | 2742 | 724 | 192 | 3592 | 1508 | 707 | 3723 | 1159 | 162 | 3533 |
| Alert | CPC | 84% | 86% | 87% | 81% | 83% | 153 | 53 | 426 | 101 | 53 | 235 | 201 | 77 | 354 | 256 | 66 | 686 | 88 | 37 | 379 |
| Barrow | CPC | 49% | 44% | 54% | 52% | 48% | 128 | 40 | 599 | 148 | 48 | 354 | 132 | 54 | 417 | 140 | 36 | 1038 | 107 | 26 | 623 |
| Bondville | CPC | 71% | 68% | 70% | 59% | 89% | - | - | - | - | - | - | - | - | - | - | - | - | 2222 | 660 | 5848 |
| Appalachian State University, Boone | CPC | 86% | 50% | 97% | 97% | 99% | 2555 | 1146 | 5309 | - | - | - | 2815 | 1146 | 6522 | 2339 | 1304 | 3984 | 2593 | 1070 | 5064 |
| Trinidad Head | CPC | 41% | 66% | 99% | 1% | 0% | - | - | - | - | - | - | 628 | 251 | 1668 | - | - | - | - | - | - |
| Steamboat Springs Colorado (Storm Peak Lab.)* | CPC | 88% | 89% | 93% | 92% | 79% | 2159 | 803 | 6709 | 1657 | 624 | 5005 | 2161 | 672 | 7562 | 2773 | 1410 | 8373 | 2062 | 905 | 6262 |
| Cape San Juan* | CPC | 61% | 34% | 31% | 96% | 84% | - | - | - | - | - | - | - | - | - | 1153 | 629 | 2688 | 1372 | 721 | 3125 |
| Cape Grim | CPC | 87% | 54% | 94% | 99% | 100% | 559 | 136 | 2797 | - | - | - | 722 | 166 | 3213 | 282 | 93 | 2847 | 583 | 170 | 2797 |
| Mauna Loa | CPC | 44% | 49% | 39% | 44% | 44% | 409 | 280 | 696 | 414 | 280 | 749 | 376 | 275 | 642 | 438 | 304 | 694 | 408 | 254 | 708 |
| Samoa (Cape Matatula)* | CPC | 71% | 65% | 66% | 74% | 80% | - | - | - | - | - | - | - | - | - | - | - | - | 330 | 221 | 431 |
| Sonnblick | CPC | 96% | 100% | 100% | 84% | 100% | 1027 | 291 | 2562 | 636 | 189 | 1529 | 1223 | 417 | 3096 | 1737 | 720 | 2993 | 811 | 270 | 2093 |
| BEO Moussala* | MPSS | 38% | 48% | 91% | 10% | 2% | - | - | - | - | - | - | 670 | 215 | 1864 | - | - | - | - | - | - |
| Jungfraujoch | MPSS | 85% | 78% | 74% | 92% | 98% | 193 | 56 | 590 | 106 | 32 | 338 | - | - | - | 378 | 162 | 786 | 158 | 62 | 392 |
| Kosetice | MPSS | 95% | 97% | 93% | 93% | 96% | 2690 | 1111 | 5159 | 2162 | 617 | 4849 | 2807 | 1323 | 5948 | 3371 | 2067 | 6131 | 2192 | 1117 | 3916 |
| Prague-Suchdol | MPSS | 89% | 95% | 97% | 68% | 95% | 6077 | 2528 | 13129 | 5719 | 2022 | 12304 | 5132 | 2391 | 11641 | - | - | - | 6352 | 2906 | 13820 |
| Waldhof | MPSS | 94% | 99% | 86% | 92% | 98% | 3350 | 1524 | 6309 | 2519 | 1103 | 5380 | 3701 | 1508 | 7501 | 4162 | 2193 | 7407 | 3110 | 1760 | 5301 |
| Schauinsland | MPSS | 93% | 98% | 84% | 94% | 96% | 1873 | 491 | 4448 | 832 | 318 | 2009 | 2878 | 935 | 5671 | 2794 | 1281 | 5182 | 1599 | 518 | 3436 |
| Neuglobsow | MPSS | 96% | 100% | 89% | 100% | 97% | 2579 | 1025 | 5507 | 1601 | 637 | 3145 | 2246 | 914 | 5247 | 3718 | 2055 | 7019 | 2892 | 1453 | 5266 |
| Hohenpeissenberg | MPSS | 69% | 56% | 86% | 96% | 38% | - | - | - | - | - | - | 2872 | 1233 | 5011 | 3066 | 1458 | 5370 | - | - | - |
| Melpitz | MPSS | 94% | 99% | 100% | 99% | 79% | 4434 | 2154 | 8361 | 3769 | 1727 | 6936 | 4602 | 2154 | 9538 | 5278 | 2871 | 11767 | 4154 | 2219 | 6643 |
| Zugspitze-Schneefernerhaus | MPSS | 66% | 84% | 92% | 37% | 53% | - | - | - | 520 | 162 | 1496 | 1298 | 302 | 3425 | - | - | - | - | - | - |
| Leipzig TROPOS | MPSS | 88% | 91% | 89% | 87% | 84% | 5088 | 2486 | 10182 | 4889 | 2120 | 9525 | 5114 | 2426 | 10303 | 5594 | 3080 | 12012 | 4697 | 2501 | 9346 |
| Annaberg-Buchholz | MPSS | 64% | 95% | 66% | 24% | 70% | - | - | - | 4987 | 1622 | 17827 | - | - | - | - | - | - | - | - | - |
| Dresden-Nord* | MPSS | 77% | 76% | 84% | 58% | 91% | 7962 | 4037 | 15213 | 7558 | 3471 | 15836 | 7414 | 4008 | 13749 | - | - | - | 8272 | 4025 | 15455 |
| Dresden-Winckelmannstrasse | MPSS | 70% | 97% | 77% | 33% | 75% | - | - | - | 4414 | 1596 | 9953 | 4411 | 2335 | 10394 | - | - | - | 4097 | 1979 | 9051 |
| Leipzig-Eisenbahnstrasse | MPSS | 96% | 94% | 100% | 100% | 90% | 8573 | 3859 | 18002 | 7233 | 2903 | 16737 | 9467 | 4862 | 17970 | 10375 | 5511 | 21266 | 6875 | 3289 | 14810 |
| Leipzig-Mitte* | MPSS | 86% | 91% | 94% | 69% | 87% | 10130 | 4634 | 21699 | 9512 | 3759 | 22274 | 10556 | 5087 | 21435 | - | - | - | 11056 | 5146 | 22994 |
| Deutschneudorf | MPSS | 76% | 74% | 100% | 99% | 32% | 3692 | 1513 | 10893 | - | - | - | 3813 | 1715 | 11181 | 4381 | 2059 | 17022 | - | - | - |

| Station Name | Instrument | Data availability | | | | | $N_{tot}$ (cm$^{-3}$) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Year | DJF | MAM | JJA | SON | Year | | | DJF | | | MAM | | | JJA | | | SON | | |
| Madrid* | MPSS | 57% | 76% | 52% | 41% | 59% | - | - | - | 10107 | 2127 | 24045 | - | - | - | - | - | - | - | - | - |
| El Arenosillo | CPC | 55% | 34% | 59% | 44% | 82% | - | - | - | - | - | - | - | - | - | - | - | - | 6332 | 3575 | 14475 |
| Montseny | MPSS | 88% | 94% | 97% | 100% | 59% | 3007 | 1158 | 8261 | 1847 | 805 | 4712 | 3252 | 1407 | 8232 | 4247 | 1806 | 11519 | - | - | - |
| Värriö | MPSS | 98% | 100% | 96% | 99% | 98% | 391 | 77 | 2027 | 178 | 48 | 554 | 624 | 142 | 2164 | 1355 | 273 | 2874 | 240 | 53 | 995 |
| Hyytiälä | MPSS | 94% | 94% | 91% | 98% | 93% | 1259 | 430 | 3074 | 812 | 330 | 2006 | 1526 | 620 | 3865 | 2011 | 892 | 3735 | 928 | 336 | 2136 |
| Pallas (Sammaltunturi) | MPSS | 95% | 87% | 98% | 98% | 97% | 356 | 68 | 1839 | 146 | 51 | 526 | 627 | 128 | 2296 | 1050 | 208 | 2300 | 222 | 47 | 1183 |
| Pic du Midi | CPC | 40% | 52% | 0% | 30% | 80% | - | - | - | - | - | - | - | - | - | - | - | - | 788 | 223 | 3403 |
| SIRTA Atmospheric Research Obs. | MPSS | 80% | 67% | 82% | 100% | 72% | 3331 | 1218 | 8253 | - | - | - | 3530 | 1599 | 8221 | 3722 | 1422 | 9462 | - | - | - |
| Obs. Perenne de l'Environnement | MPSS | 83% | 85% | 79% | 68% | 99% | 2412 | 995 | 4775 | 2018 | 760 | 4826 | 3192 | 1660 | 5482 | - | - | - | 1926 | 891 | 3367 |
| Puy de Dome* | MPSS | 80% | 91% | 88% | 93% | 49% | 1968 | 457 | 5080 | 785 | 300 | 2490 | 2177 | 538 | 5119 | 2948 | 978 | 6566 | - | - | - |
| Finokalia | MPSS | 76% | 34% | 82% | 100% | 85% | 2731 | 1427 | 4969 | - | - | - | 2716 | 1662 | 5237 | 3353 | 2095 | 5116 | 2320 | 1400 | 4741 |
| DEM_Athens | MPSS | 68% | 65% | 65% | 64% | 77% | - | - | - | - | - | - | - | - | - | - | - | - | 5754 | 2500 | 13515 |
| Helmos Mountain | MPSS | 73% | 56% | 69% | 78% | 89% | - | - | - | - | - | - | - | - | - | 1862 | 899 | 3389 | 637 | 233 | 2047 |
| K-puszta | MPSS | 70% | 57% | 100% | 62% | 60% | - | - | - | - | - | - | 4983 | 2661 | 11650 | - | - | - | - | - | - |
| Ispra | MPSS | 96% | 97% | 97% | 91% | 99% | 6810 | 3057 | 14382 | 10071 | 3577 | 18774 | 5849 | 3171 | 11066 | 5757 | 2868 | 9581 | 7528 | 2845 | 13641 |
| Mt Cimone | CPC | 71% | 66% | 100% | 100% | 16% | - | - | - | - | - | - | 1089 | 434 | 2509 | 1216 | 695 | 2352 | - | - | - |
| Birkenes II | MPSS | 86% | 99% | 69% | 79% | 97% | 1009 | 232 | 2878 | 553 | 149 | 1555 | - | - | - | 1889 | 867 | 4158 | 963 | 212 | 2551 |
| Zeppelin mountain | MPSS | 74% | 34% | 68% | 96% | 96% | - | - | - | - | - | - | - | - | - | 276 | 79 | 981 | 62 | 19 | 342 |
| Neumayer | CPC | 100% | 99% | 100% | 100% | 100% | 252 | 49 | 783 | 496 | 275 | 1397 | 186 | 51 | 701 | 62 | 36 | 155 | 293 | 116 | 530 |
| Trollhaugen | MPSS | 100% | 99% | 100% | 100% | 100% | 306 | 45 | 761 | 537 | 319 | 1385 | 155 | 48 | 528 | 55 | 33 | 167 | 375 | 153 | 603 |
| South Pole | CPC | 72% | 86% | 25% | 87% | 92% | 217 | 33 | 461 | 316 | 225 | 649 | 240 | 134 | 590 | 38 | 25 | 71 | 244 | 83 | 473 |

* 2016 data was used for these sites