Quick guide: PurpleAir for research

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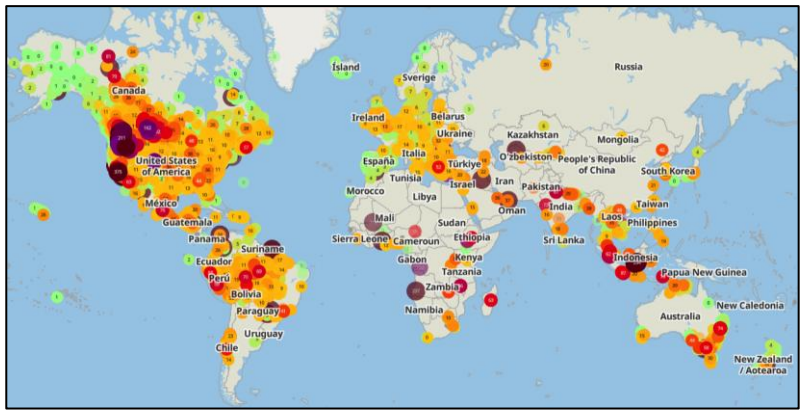
What is PurpleAir?

A global network of ~35,000 low-cost air-quality sensors. Sensors are purchased and installed by the public or other organisations and processed via PurpleAir to provide real-time and historical air quality data, accessible via online map or API.

The PurpleAir (PA-II).

Technical summary

Measure particulate matter (PM), with most sensor models containing two independent Plantower optical particle counters (channels A and B). PM_1, $PM_{2.5}$, PM_{10} estimates provided by proprietary manufacturer (CF = 'indoor', ATM = 'outdoor') and open-source (ALT) algorithms. A Bosch environmental sensor provides ancillary meteorological data. Data is available from a 2 min to daily resolution.



PurpleAir $PM_{2.5}$ via online map (https://map.purpleair.com/), retrieved 2026-08-26.

How accurate are the data?

Dense spatial and temporal observation comes in exchange for measurement uncertainty vs. regulatory monitors. Frequent challenges include high relative humidity[1], sensor degradation[2], high mass concentrations[3], and spatiotemporal variability in aerosol optical properties, requiring regional-specific corrections to improve accuracy (see below). Laboratory- and field-based evaluations are well detailed in the literature[4,5,6,7]. Indoor and outdoor $PM_{2.5}$ have extensively used for research with good agreement with regulatory measurements. PM_{10} is not recommended for research applications[8,9].

Regional data corrections

Measured light-scattering response is dependent on aerosol optical properties and hygroscopic growth, yielding spatiotemporal disparities between PurpleAir sensors and regulatory measurements depending on local environmental conditions. Corrections to sensor algorithms to reduce these discrepancies have been developed at regional and national scales[10,11], and for differing aerosol concentrations (e.g. extreme wildfire smoke)[10].

How to access data?

1) Map

Visual only, no substantial data-access route: https://map.purpleair.com/

2) REST API: https://community.purpleair.com/t/about-the-purpleair-api/7145/10

Primary interface for accessing real-time and historical endpoints. Metered via prepaid points, charged for base requests + per row per field.

For retrospective analysis: 1) Get an API key; 2) Identify relevant sensors; 3) choose the required fields and averaging interval; 4) retrieve history data per sensor.

The Data Download Tool can be used to generate code, estimate costs, and download historical data directly.

Some example costs:

1) One sensor, one-year, hourly average, 5 fields (air temperature, 4x $PM_{2.5}$) = 53100 points = \$0.05-0.53; 2) One sensor, one-year, 2 min, 5 fields (air temperature, 4x $PM_{2.5}$) = 1,580,000 points = \$1.58 - \$15.80.

3) Bulk requests

For large requests, it is recommended to contact PurpleAir directly.

Common retrieval pitfalls

- 'max_age' defaults to 7 days. Sensors offline for more will not appear in search.
- Corrections should be applied to the appropriate algorithm-derived estimate (e.g. CF vs. ALT).

Terms of service

Data use requires attribution. PurpleAir uses a Grantback license, applying to certain data derivatives. If intended use is not covered by the published license, researchers should obtain written clarification from PurpleAir if they wish to do the following: publish derived datasets, host data on a repository, incorporate data into a published model or open-source software.

QA/QC

Current QC approaches are limited, relying primarily on A/B channel agreement.

- $PM_{2.5}$ A/B channels within 5 µg m^{-3} or difference less than <61%[10].
- Screen observation records based on anomalous meteorological variables, e.g. RH > 100%, temperature < -50ºF or >150ºF, air pressure < 600 mbar.
- Check 'location_type': parameter designated by owners. After data retrieval, validate that temperature and humidity follow realistic diurnal cycles and evaluate against nearby meteorological stations to ensure sensor not located in an interior location.

References

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3. Barkjohn et al. (2022): https://doi.org/10.3390/s22249669
4. Sayahi et al. (2019): https://doi.org/10.1016/j.envpol.2018.11.065
5. Malings et al. (2019): https://doi.org/10.1080/02786826.2019.1623863
6. Mehadi et al. (2020): https://doi.org/10.1080/10962247.2019.1654036
7. Tryner et al. (2020: https://doi.org/10.1016/j.atmosenv.2019.117067
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9. Ouimette et al (2024): https://doi.org/10.1080/02786826.2023.2285935
10. Barkjohn et al. (2021): https://doi.org/10.5194/amt-14-4617-2021
11. Campmier et al. (2023): https://doi.org/10.5194/amt-16-4357-2023

Further low-cost AQ sensor evaluations and resources are available at: https://www.aqmd.gov/aq-spec

One-pager designed for researchers and air quality managers. Partially adapted from a PurpleAir presentation, given 18th August 2026.

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