What is behind our Monthly Air Quality bulletin

Graph at pg. 1: Daily averages in Kolwezi

Instrument

In September 2026, we installed an AirGradient Open Air monitor (O-1PST) in the Musonoie neighborhood of Kolwezi (Democratic Republic of Congo). The instrument is powered by a solar energy system consisting of a 40 W solar panel, a car battery, and a solar charge controller. The same system also powers a TP-Link M7005 mobile WiFi hotspot, which enables continuous upload of data to the AirGradient Dashboard. This device is also registered on the public AirGradient air quality map.

AirGradient individually tests and calibrates each device for $PM_{2.5}$, relative humidity (RH), and selected other parameters.[1,2] Independent tests run by the Air Quality Sensor Performance Evaluation Center have also demonstrated the monitor's strong performance in measuring $PM_{2.5}$.[3] The Factory Test and Calibration Report of our device reports a RMSE of 0.6 µg/m^3 for $PM_{2.5,}$ based on comparisons with a Palas Fidas 200 PM reference instrument, while the accuracy for RH measurements is ±2 percentage points.

Data source

At the beginning of each month, we download the data for the just completed month from the AirGradient Dashboard. We get data in two formats: 1-day buckets and 1-hour buckets (i.e., daily and hourly averages).

Our analysis relies primarily on selected variables from the daily dataset: the date and time (column "Local Date/Time"), the number of measurements included in each daily average (column "# aggregated records"), and the calibrated daily $PM_{2.5}$ concentrations (column "PM2.5 (µg/m^3) corrected"). We use the hourly dataset only to identify "wet days": from this file, we extract only the date and time ("Local Date/Time") and the corrected relative humidity ("Humidity (%) corrected").

Data processing

First, we use the number of aggregated records to calculate the daily dataset's **data completeness** (equation (1); 1440 is the theoretical number of datapoints per day).

$$\text{data completeness} = \frac{\#\ \text{aggregated records}}{1440} \cdot 100 \qquad (1)$$

This number enables us to identify days on which the sensor may not have operated properly. We set a minimum threshold of 75% for a daily average to be considered valid, corresponding to 18 hours of data. Days with data completeness <75% are shown in grey in the final graph and excluded from the calculation of the monthly statistics.

Second, we **calculate the monthly statistics**. They include monthly minimum, maximum, and average $PM_{2.5}$ concentrations. We also calculate the minimum, maximum, and average ratios between daily $PM_{2.5}$ concentrations and the World Health Organization 24-hour guideline 15 µg/m^3.[4] All calculations are performed in Excel including only days that met the data completeness threshold.

Third, we **assign a color to each day** according to the AirGradient's classification,[5] which is based on the US Air Quality Index.[6,7] This classification uses the following ranges for daily $PM_{2.5}$ concentrations.

Definition	Color	Range of $PM_{2.5}$ (µg/m^3)
Good		0–9.0
Moderate		9.0–35.4
Unhealthy for sensitive groups		35.4–55.4
Unhealthy		55.4–125.4
Very unhealthy		125.4–225.4
Hazardous		≥225.4

Fourth, we **identify potentially wet days**, which are marked with a raindrop symbol in the graph. Rainfall is known to remove particles from the atmosphere through wet deposition. Thus, identifying rainy or, more generally, wet days can help us interpret daily variations in $PM_{2.5}$. As we do not currently have access to local rainfall data, we use the hourly dataset to identify days with at **least 6 hours with relative humidity ≥ 80%**. For September 2026, we cross-checked this criterium by asking a local collaborator to report rainfall events. We are also seeking access to the meteorological data from the Kolwezi's airport to confirm the validity of this approach. We emphasize that this RH-based criterium should not be considered universally applicable for identifying wet days: it is an operational definition based on average climatic conditions in Kolwezi.

Graph at pg. 2: Comparison with other cities worldwide

Each month, we compare the monthly average $PM_{2.5}$ concentration in Kolwezi with the corresponding monthly average recorded in other cities of the world. This data is retrieved from the online database IQAir.

References

(1) *Calibration Algorithms | AirGradient Knowledge Base*. https://www.airgradient.com/documentation/kb/kb-diy-calibration-algorithms (accessed 2026-11-10)

(2) *How Your AirGradient Monitor Handles Calibration and Data Processing*. AirGradient. https://www.airgradient.com/blog/airgradient-calibration-and-data-processing (accessed 2026-11-10)

(3) Air Quality Sensor Performance Evaluation Center (AQ-SPEC). *Field Evaluation Report for AirGradient Open Air O-1PST [Revision 0]*; F20260301.0; South Coast Air Quality Management District, 2026. https://www.airgradient.com/documents/performance-reports/airgradient-outdoor-aq-spec-report.pdf

(4) World Health Organization. WHO Global Air Quality Guidelines: Particulate Matter, Ozone, Nitrogen Dioxide, Sulfur Dioxide and Carbon Monoxide, 2021. https://www.who.int/publications/i/item/9789240034228/ (accessed 2025-11-24)

(5) *AirGradient Dashboard: Measurements and Interpretation | AirGradient Knowledge Base*. https://www.airgradient.com/documentation/kb/airgradient-dashboard-measurement-and-interpretation#pm25-breakpoints-and-color-codes-in-%CE%BCgm3 (accessed 2026-11-10)

(6) *Technical Assistance Document for the Reporting of Daily Air Quality – the Air Quality Index (AQI)*; Environmental Protection Agency, 2018. https://www.airnow.gov/sites/default/files/2020-05/aqi-technical-assistance-document-sept2018.pdf

(7) *AQI Basics*. AirNow.gov. https://www.airnow.gov/aqi/aqi-basics (accessed 2026-02-04)