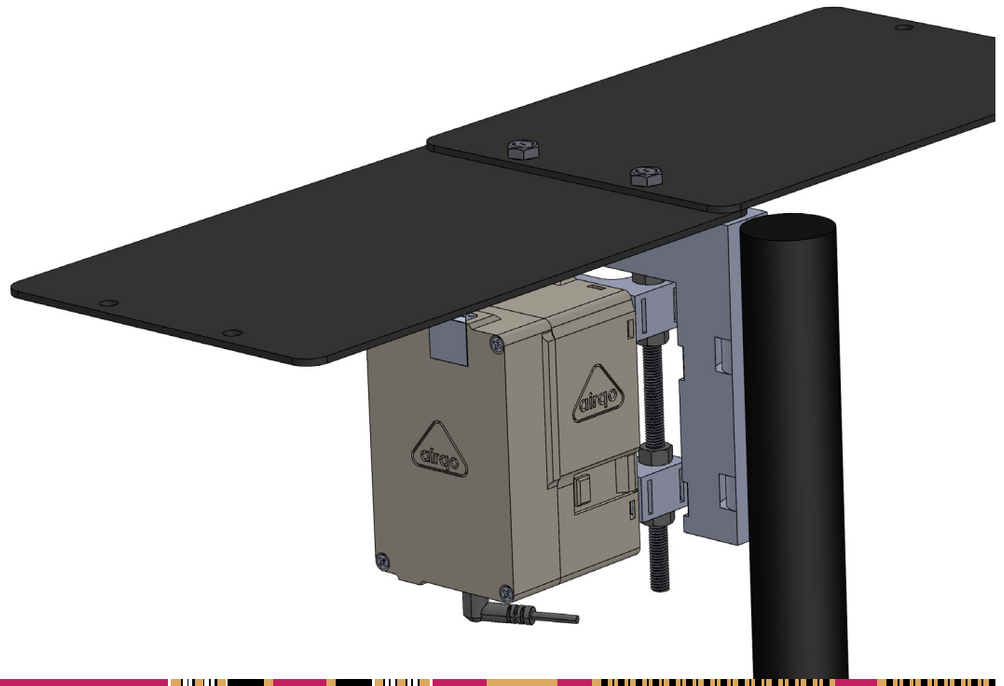
Binos Air Monitor

User Guide



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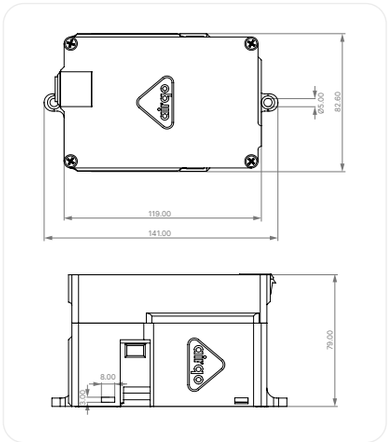
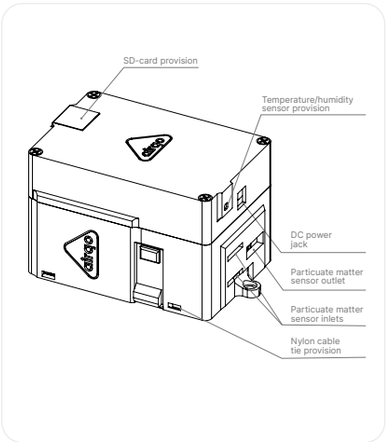
Know your Monitor

The Binos Air Monitor is a low-cost air quality monitor that measures Particulate Matter PM2.5 and PM10, as well as ambient meteorological conditions such as humidity and atmospheric pressure. Its built and uniquely designed to withstand environmental and physical conditions such as dust and extreme weather. Powered by either mains or solar, the monitor is optimised to work in settings characterised by unreliable power. It runs on a 2G GSM network configuration for IoT simards.





1.1 Technical Specifications

1.1.1 Physical qualities	
Dimensions	41.00 x 82.60 x 79.00 mm (L x W x H)
Weight	500g
1.1.2 Air quality measurements	
Particulate matter	Range of measurement 0.3~1.0;1.0~2.5;2.5~10 in Micrometer(μm)
Effective range for PM2.5	0~500 μg/m3
Maximum range for PM2.5	≥1000 μg/m3
Maximum consistency error for PM2.5	±10%@100~500 μg/m3 ±10 μg/m3@0~100 μg/m3
Standard volume	0.1l

1.1 Technical Specifications

1.1.3 Other measured parameters	
Single response time	<1s
Data resolution	60-90 seconds
1.1.3 Other measured parameters	
PM10	0-500 μg/m3
GPS	Sensitivity: up to -161 dB
	Horizontal accuracy +/- 2.5m
Temperature	Internal and external temperature (monitor health)
Relative humidity	Range 0-99%m Response time 1s, +/- Accuracy tolerance: ±3 % Hysteresis: ±1%
Atmospheric pressure	30 - 110 kPa, Accuracy: ±1.5 Pa/K
1.1.4 Communication	
Technology and frequency	Quad-band GSM/GPRS. 2G Frequencies: GSM 850MHz, EGSM 900MHz DCS 1800MHz and PCS 1900MHz
Data accessibility	AirQo dashboard, AirQo API, AirQo App
1.1.5 Power supply & battery	
Input Voltage	5-12V
Battery	3.7 V LiPo 3.5AH / Li-ion 8.8 AH
Power	1.1W normal use 0.098W Save mode
Current Draw	220 mA Normal use 19.6mA Save mode 300 mA Transmission
Solar	6W (Maximum Power) 1.2 A (Operating Current) 5V (Operating Voltage) 1.15A(Open Circuit current) 6V (Open Circuit Voltage)
Charge Time	90 minutes @5v, 2A.
1.1.6 Operating conditions	
Deployment setting	Outdoor/ambient conditions
Operating temperature	0-45 oC
Safety	Not compatible with fire, flames, and immersion in water

1.2 Monitor Package contents

- 1X Binos Air Monitor
- 2X Solar Panels with mounting parts
- 1X Mounting pole
- 2X Monitor carriers
- 1X Binos Air Monitor 5v 2A Power Adapter
- Screws, Wall Anchors and Cable-ties
- 1X Operation and Installation Manual
- 1X Data Accessibility Guide (optional)

Installation Guide

This section offers user-friendly guidance on monitor installation making use of the package tool kit provided as part of the full product. As part of the product packaging, you are provided with mounting equipment to support pole, wall, or face mounting. Before installation, take note of the following pre-installation precautions.

2.1 Do's And Don'ts

- Install the monitor in a location with free air circulation
- Install the device at least 4 meters off the ground. Avoid surface installation to protect the sensor from dust particles collecting on the surface. This affects the quality of the sensor readings
- Avoid installing the monitor next to a pollution source such as an active waste incineration facility, active smoke sources, and sinks such as under trees and vegetation
- Install the monitor vertically with sensor vents facing downwards.
- Mount the monitor at normal human breathing height (about 1.5-2m above the ground)

2.1.1 Installation site guidelines

The process of finding an appropriate place to site and install the AirQo outdoor air quality monitor is equally important. Indeed, the site where a sensor is placed can impact the usefulness of the data. The table below briefly outlines some key logistical considerations and recommendations to help with determining where to place the sensor.

Considerations	Breakdown
Security	> Availability of security agencies and infrastructure on site (Security guards/ agents, CCTV Cameras, security lights etc) > Secure locations e.g. within a police station, secure neighbourhoods
Power Access	Stable power supply from the mains or other sources. In case of frequent power outages in the region, a backup generator, UPS or other alternative power options should be considered. For solar installation, the site should assure: > Sunshine reliability > Site should be located away from trees or tall buildings that could shield or cast a shadow on the solar panels
Communication reliability	> The site of installation choice should have good communication signal strength to ease data transfer and monitor communication with the AirQo platform > The installation site should be away from electromagnetic interferences from sources such as high voltage power lines
Site/location Accessibility	The site of choice should be accessible with approval from local authorities and with an access road leading to the site.
Pollution sinks	The installation should be done away from pollution sinks such as: > Trees or vegetative cover > High walls or storey buildings
Pollution sinks	Unless the main objective is to understand pollution sources, the installation site should be situated away from: > Waste incinerators > Barbecue grill > Compost pit with active burning > Construction site > Hyperlocal sources such as roads, chimney

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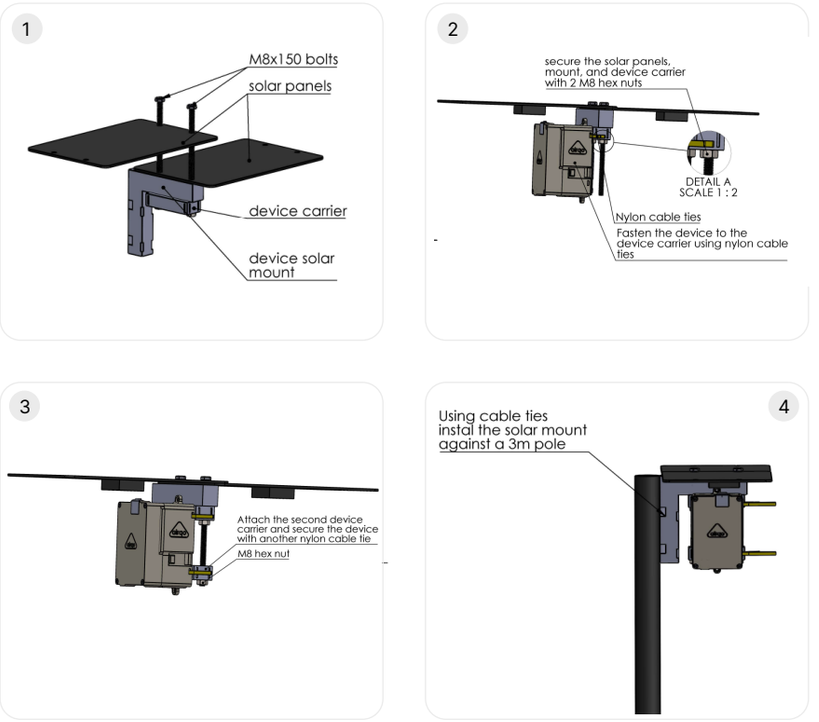
2.1.2 Pre-Installation Checks

- Check whether you have all the tools and equipment
- Ensure there are no physical damages to the monitor
- Take the monitor out of the packaging
- Set up the installation location such as a pole, wall, or mount on a flat surface
- Make sure the installation location can allow at least 270-degree airflow around the monitor inlet
- Check the battery specification to understand whether the Monitor is solar, or mains powered. Bigger battery specifications are normally reserved mainly for solar-powered Monitors. It is worthy to note there are no limitations in having a solar-powered Monitor powered by mains. The solar-powered configuration is the desired design option selected by the AirQo team to address the power challenges in Africa

2.1.4 Installation setup procedure



2.1.3 Powering the monitor

> Plug the provided power adapter into a socket and power cord into the monitor. If using a plug other than that provided by AirQo, make sure the plug specifications are 5V, 2A.

> The monitor should beep twice to indicate power-up and battery charging

Deeping on the number of beeps, the status of the monitor can be known as summarised in the table below:

Monitor alarms

Alarms	Alarm Tones	Tone Details	Duration
Power on	One beep	High	0.5 second
Transmission failure	One beep	Low	0.5 second
Low battery	Two beeps (repeated 8 seconds)	Low High	1 second
Monitor restart	Three beeps	High Low High	1.5 second

2.1.4 Maintenance

To ensure safety of the system, maintenance should never be performed when the monitor is powered or connected to the power adapter. Binos Air Monitor contains very sensitive sensors that damage when exposed to electro-static discharge and extra precautions should be observed to protect sensors susceptible to electro-static discharge.

Basic maintenance toolkit

Essential tools: Simple dust blowing mechanism

Optional tools: spare sensors

Troubleshooting

(i) Monitor not transmitting data at all

Issue	Identification of the issue	Solution
Power Issue	> Check whether the monitor is plugged > Check the solar panels	> Check whether the cable from the panels is clearly plugged in the monitor. Plug the monitor if unplugged > Clean the solar panels using soft cloth or squeegee to clean the upper surface
Communication	> Sim-card out of data > Sim-card non functional/ cut off by the provider > GSM malfunction	> Load data if local sim-card used > Reach out to AirQo > Listen to the sound made by the monitor to know whether it is a GSM issue
Sensor Issue	> No data being reported by the sensors (PM levels = 0.0)	> Replace the sensors

(ii) Incorrect/inconsistent data

Issue	Identification of the issue	Solution
Communication	> Monitor taking long to post (possible cause is low battery and the monitor will be making bulk updates)	> Leave the monitor to fully charge and re-evaluate
Sensor Issue	> Low intra sensor correlation (< 0.98) > Sensor reporting low or higher data than expected	> Replacing the sensors > Blowing dust off the sensor inlets

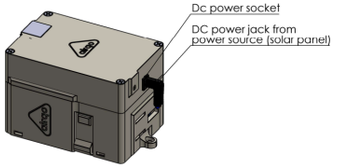
Guide to maintaining Binos Air Monitor

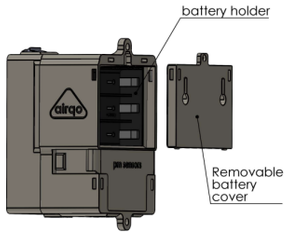
Power issues

> Use a soft cloth or squeegee to clean the upper surface of the solar panel

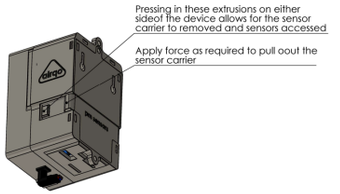
> Check whether the cable from the panels is clearly plugged in the monitor

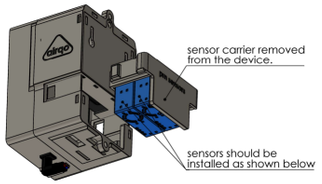
> Replace the batteries if issue is not resolved





Replacing the Sensors and battery

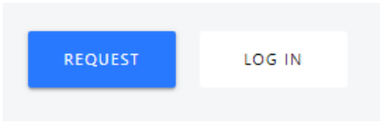




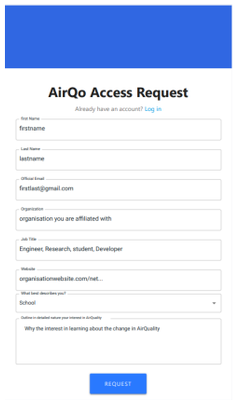
Data Access

3.1 Joining the AirQo platform

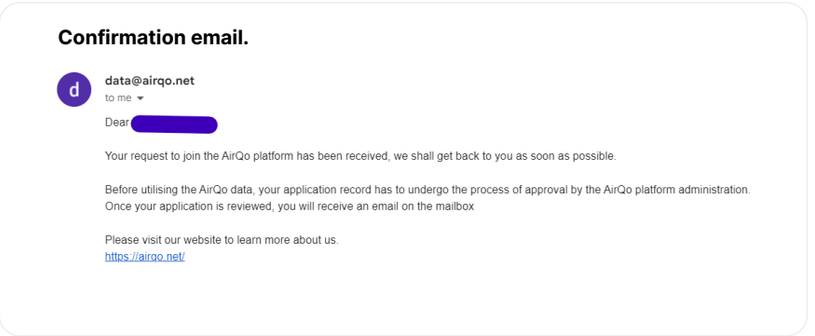
To access and visualize the data collected, you need to set up an account on the AirQo platform, follow this link: https://platform.airqo.net. You will be presented with a



For new users, click on **REQUEST** to be redirected to the page illustrated below and required to fill in some details.



After filing in the required details, click REQUEST to register. Upon registration, you will receive a confirmation email.



After approval by the AirQo Platform Administrator, you will receive a follow-up email on the steps required to access and use the Analytics Platform. The details include:

1. Your username
2. Your temporary password which you are encouraged to change
3. The Analytics Platform access link
4. The Analytics API documentation link
5. The Terms and Conditions for use
6. A Video Demonstration on how to use the platform

Congratulations, you can now access your air quality data on the AirQo app, website and API

3.1.1 Platform Features

3.1.2 The Analytics Dashboard

The Analytics Dashboard is the first point of entry to the AirQo data platform. It is an interface that allows users to display data graphically to identify trends, correlations, make informed decisions and generate reports. The displayed graphs on the dashboard represent data received from the specified AirQloud Monitors with information about:

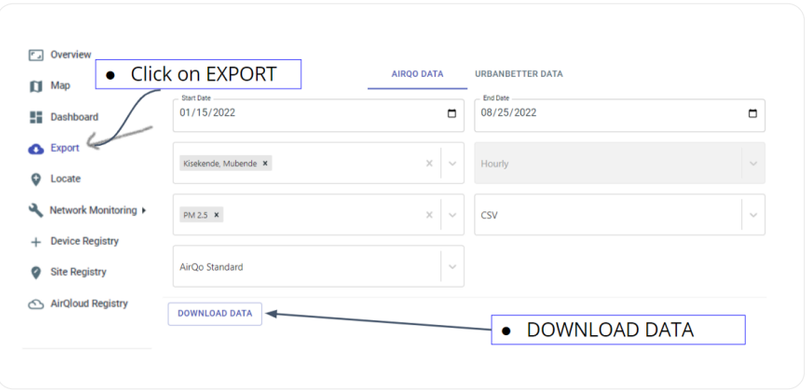
1 The monitors in the AirQloud categorised according to their AQI readings
2 The mean daily particulate matter concentration (PM2.5), collected from the AirQloud's sites over a span of 28 days and represented by bar graph and
3 The daily exceedances of the AirQloud's sites above the WHO recommended pollution levels represented by bar graph

3.1.3 Data Visualisation

The dashboard is customizable and allows for creation of different types of graphs that represent data as needed by the user. This feature is accessed through the ADD CHART button and allows for customization of data according to a select network of monitors. Sites are the main data points and should be selected before plotting on a chosen chart.

3.1.4 Data Export

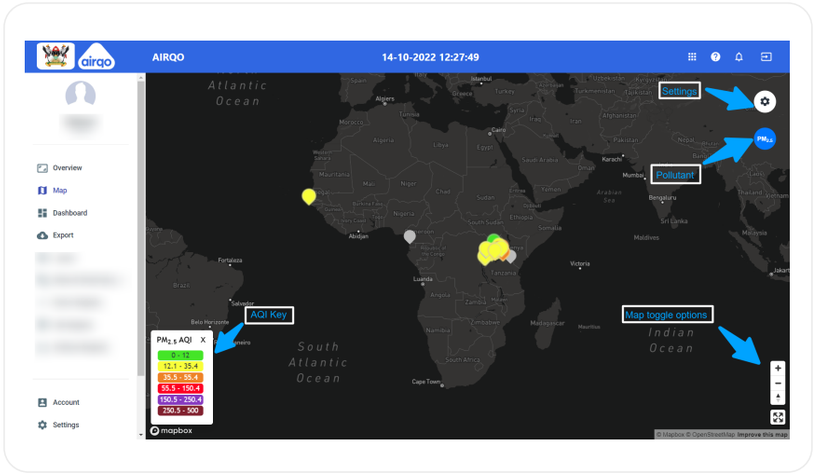
The AirQo platform provides the option to access and download air quality datasets. This Export feature can be found on the platform sidebar. Here, you'll be able to stipulate a range of dates required, desired sites, pollutant(s), file type and data standard before exporting data.



3.1.5 The Air Quality Map

The air quality map shows an overview of AQI readings across the AirQo network. This allows users to view the distribution of Binos Air Monitors across Africa and other affiliated devices across the world, as well as view predicted air quality values for the various AirQlouds represented through a heatmap. The AQI key in the bottom left corner allows users to make sense of the AQI readings shown by the monitors and it changes according to the pollutant chosen.

To check if your monitor is online and is registered on the AirQo network for data access and visualisation, log into the AirQo Analytics Platform and check on the map to see whether it is connected.



Toggles on the map for more visualisations

Click on the settings symbol in the upper right corner, and choose:

1 Heatmap to view the predicted AQI per AirQloud by zooming into the AirQloud and hovering over with a cursor
2 Sensors to view the available air quality monitoring devices and their AQI readings
3 Calibrated Values to view calibrated monitor readings

Click on the Pollutant button on the top right corner of the map (in blue) in order to view AQI readings according to PM2.5 or PM10.

Map Controls

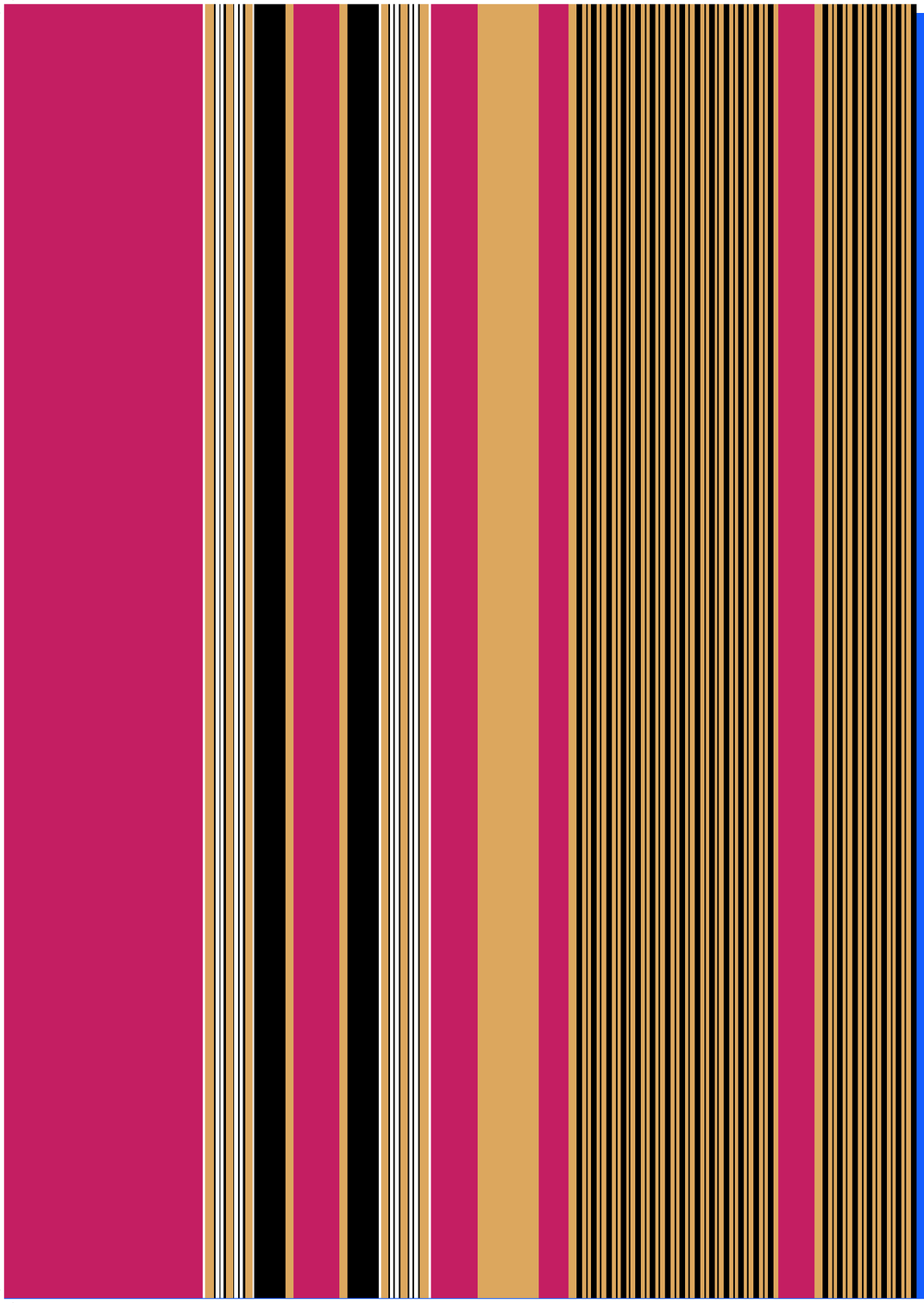
The map allows you to zoom in and out using your mouse/trackpad controls to have better visibility depending on the area of interest. But there's also accessibility controls in the bottom right corner that allow users to zoom into the map, zoom out of the map, rotate the map and also view the map in full screen mode.

Feedback

The Analytics Platform allows users to give feedback by toggling the feedback option on. This option appears as the last option on the platform sidebar. Feedback ranges from, but is not limited to, queries, challenges, experiences, need for support, compliments among others. Our team responds to feedback as quickly as they can.

3.1.6 Data Access through the AirQo API

In addition to the existence of the platform, data access is also available via the AirQo API. To utilise the AirQo API for data access, please review the documentation accessed via this link: https://docs.airqo.net/airqo-rest-api-documentation/



AirQo's vision

Clean air for all African cities

Our mission

Collect, analyse and model air quality data and work with partners to reduce air pollution and raise awareness of its effects in African cities.

Participating in air quality monitoring and adding the Binos Air Monitor to the network, you join a team of other air quality data contributors in your local community, city, and country. Ultimately contributing to closing the existing air quality data gaps in Africa.

Know Your Air!

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