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ENVIRONMENTAL SYSTEMS
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clarity

Clarity Showcase

March 5th, 2025

Welcome!

David Lu
Co-Founder & CEO

Paolo Micalizzi
Co-Founder & CTO

Meiling Gao, PhD
Co-Founder & COO

Azlan Mirnezami
TES AQMS Category Manager

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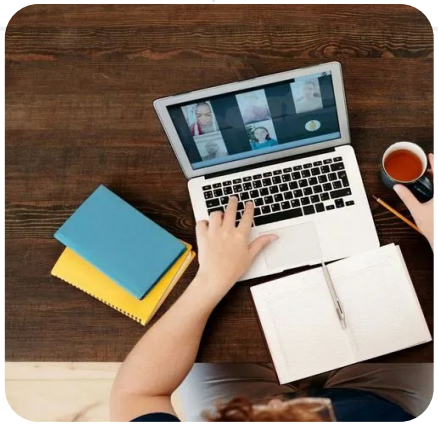
Introduced during last Showcase

Black Carbon Module

Global Calibration



Add-On Services

Introduced at the last Showcase

Black Carbon Module

Deploy anywhere

- Integrated heat shield & upgraded pump designed for multi-year outdoor use
- Optionally solar-powered with battery power system

Low-maintenance

- Easy to replace tape cartridge (once a year on average)
- Device status and notifications on Clarity Dashboard

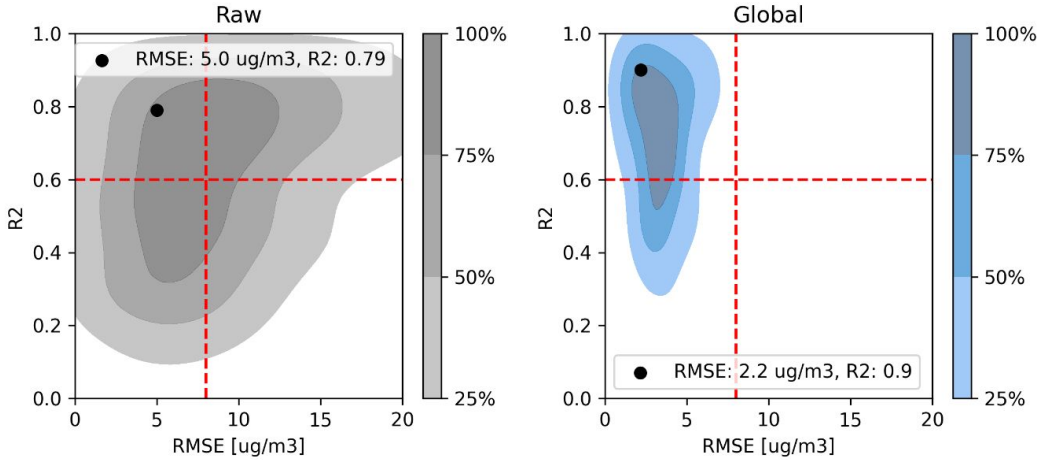
Research-grade measurements

- Accuracy comparable to Gold Standard (Magee AE33)
- Real-time source apportionment


RAC
For the better
brightline
DEFENSE
Black Carbon MODULE
clarity
AETHLABS

Introduced at the last Showcase

Global Calibration



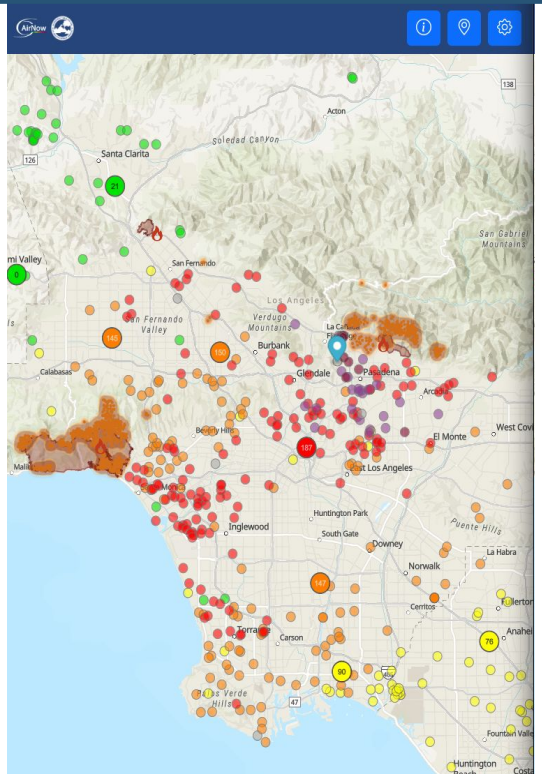
450+
Collocated Clarity Nodes

2,000+
Collocation Months

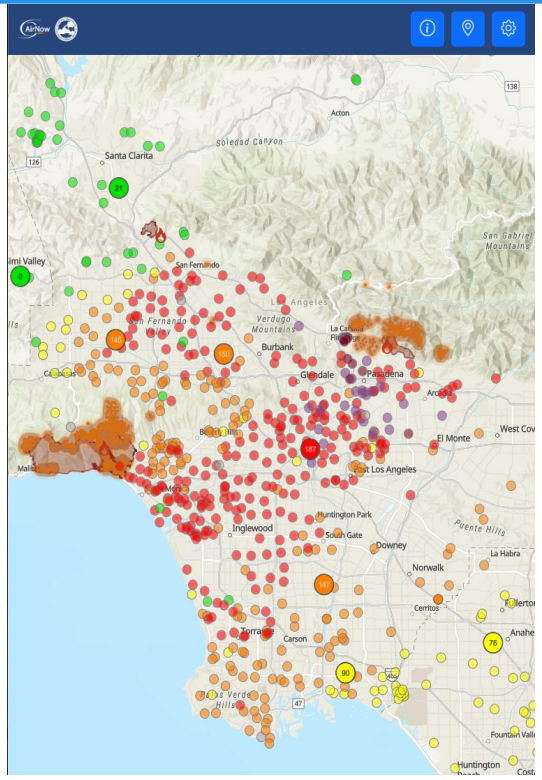
45+
Collocation Cities

6,000,000+
Collocated Measurements

EPA Fire & Smoke Map without Clarity



EPA Fire & Smoke Map with Clarity



Introduced at the last Showcase

Add-On Services

RAC
For the better

National Environment Agency
Safeguard · Nurture · Cherish

ADB
ASIAN DEVELOPMENT BANK

Environmental Management Bureau
National Capital Region

Alkali Environmental

Adams County
Colorado

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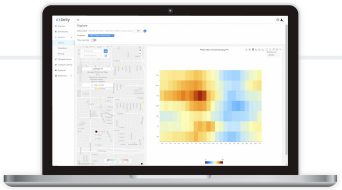
Sensing-as-a-Service℠

Air Monitoring Equipment

Measures all key air pollutants

- Quick and easy installation
- Solar-powered, always online
- Modular design for expandability
- Low-maintenance with free warranty



Clarity Cloud & Software

Cloud-based data analysis

- Natively-integrated IoT dashboard
- Secure data pipeline & storage
- Powerful APIs, analytics and visualization

Air Quality Expert Team

Scalable project support

- Highly qualified air quality experts
- Accurate and reliable data through Remote Calibration
- Responsive project management enabled by modern software stack

Guiding principles for Clarity products

1
Answer more questions

2
Trust your data

3
Accelerate your impact

Guiding principles for Clarity products

1

Answer more questions

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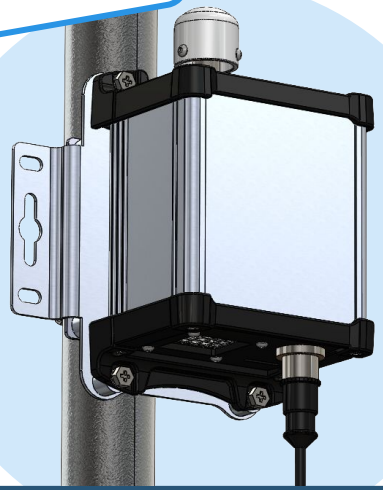
Two new Add-On Modules

Available now!

Multi-Gas Module

Piloting now!

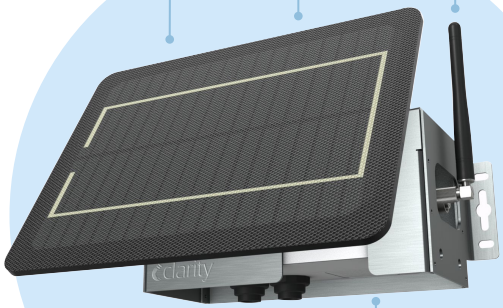


Dust Module

Weather/UV resistant (IPX3 Rated)

Solar powered

Global cellular connectivity

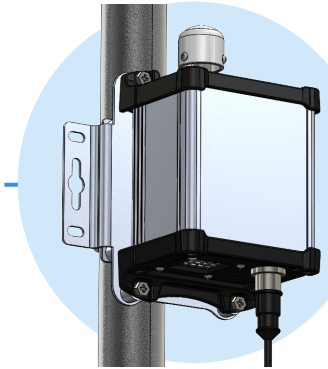


$PM_{2.5}$

NO_2

Easy installation < 10 minutes

Node-S provides power & cellular connectivity



Multi-Gas Module

Criteria pollutant and traffic emissions monitoring

Measurement Parameters

- Carbon Monoxide (CO)
- Ozone (O_3)
- Nitrogen Oxides (NO, NO_2 and NO_x)

Specifications

- Solar-powered — runs on Node-S power system
- UV-resistant, weatherproof housing

Available for purchase!

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Multi-Gas Module use cases

CO and wildfires

- CO is a byproduct of combustion, emitted by both wildfires and urban sources.
- Wildfires produce significantly more $PM_{2.5}$ per unit of CO than urban sources.
- The $PM_{2.5}$-to-CO ratio helps distinguish wildfire smoke from urban pollution.

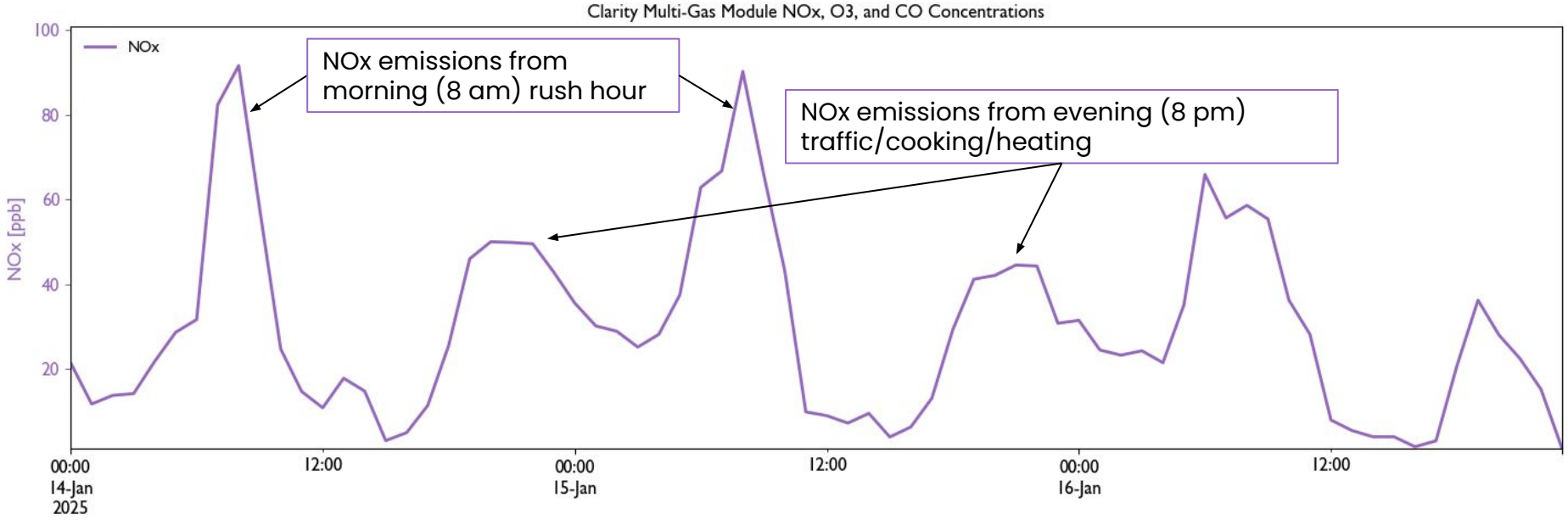
NO_x and traffic

- High NO and NO_2 levels identify traffic-related pollution hotspots.
- A higher NO-to-NO_2 ratio indicates fresh emissions near the source, while a lower ratio suggests chemical transformation as the air moves further away

O_3 non-attainment and smog formation

- Quantify diurnal pattern of NO_x (morning, evening peaks) and O_3 (afternoon peak)
- Elevated NO_x and O_3 together signal strong photochemical activity and smog formation.

An example from Berkeley



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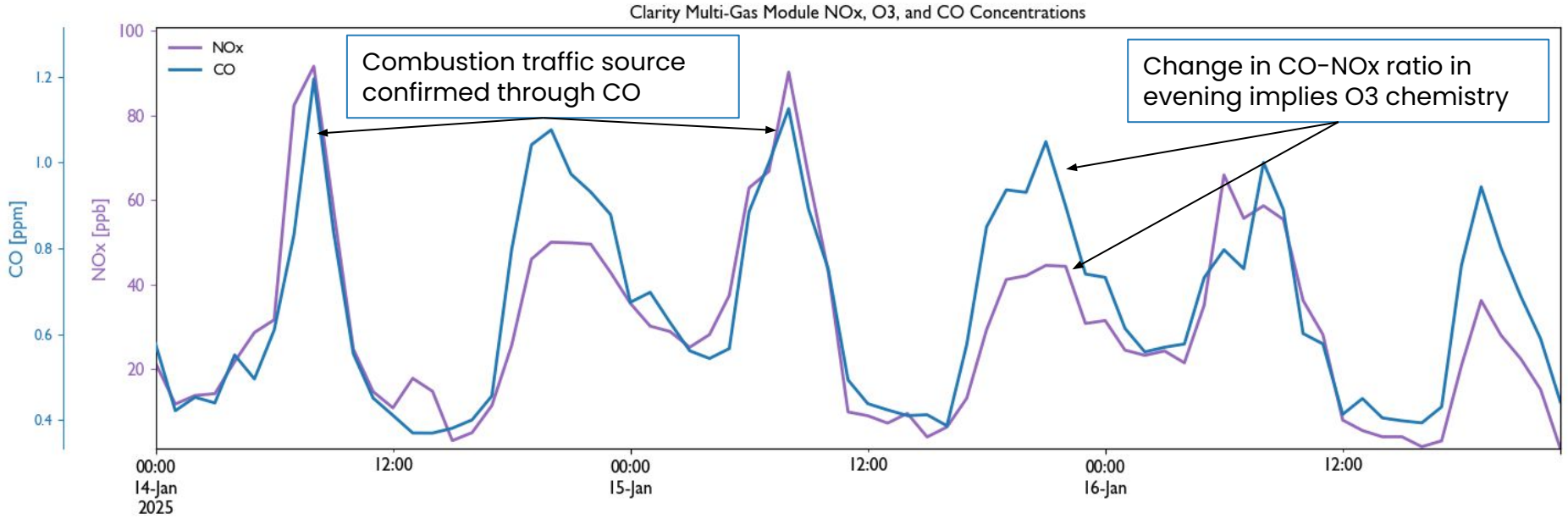

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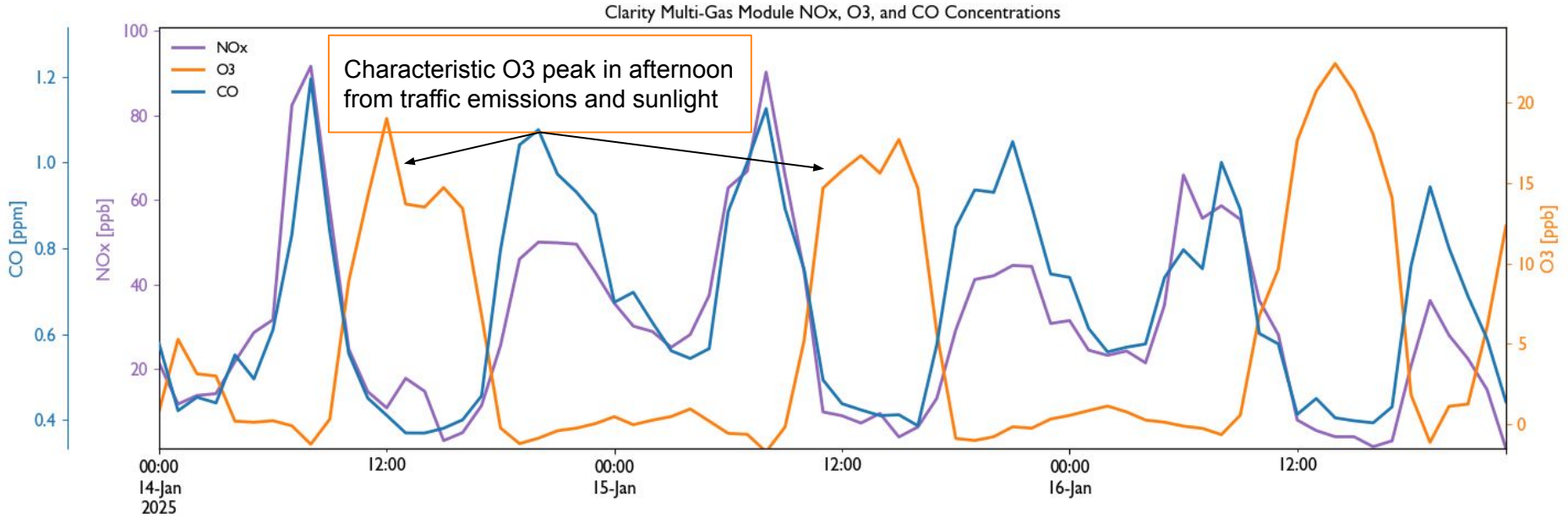
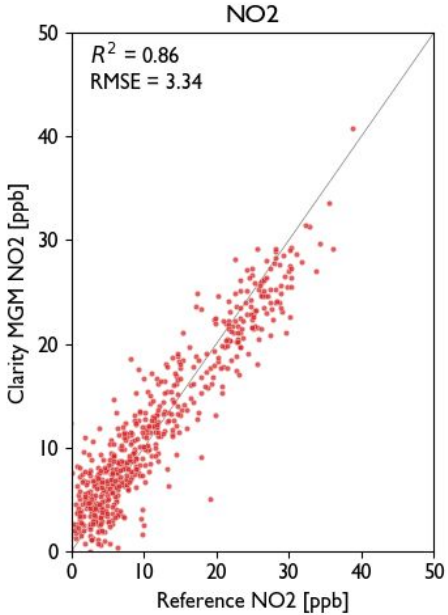
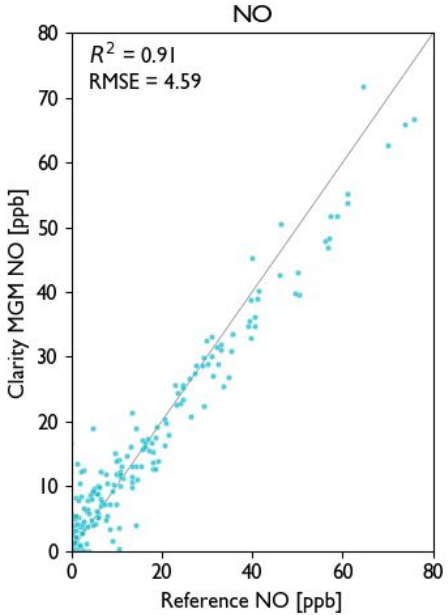
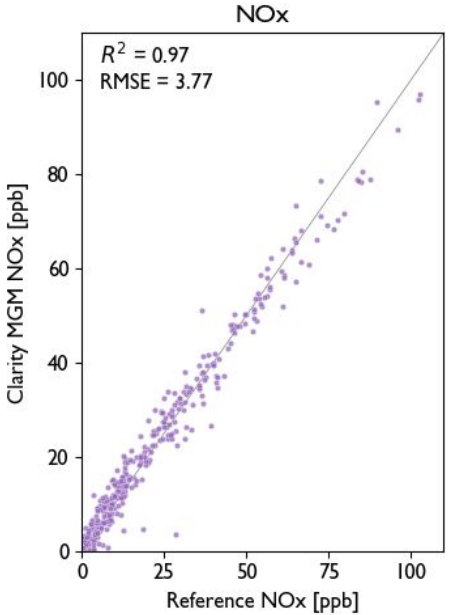
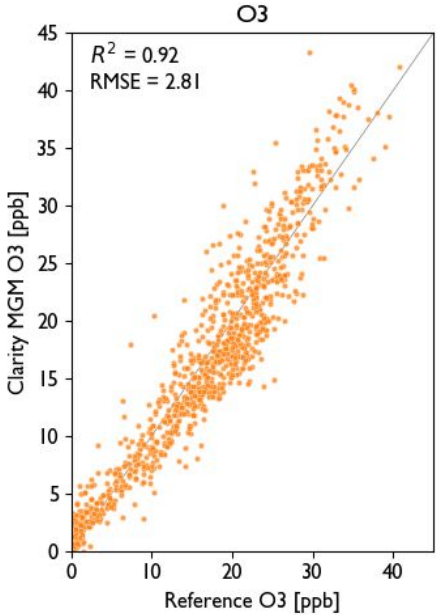


Preliminary performance data









Dust Module

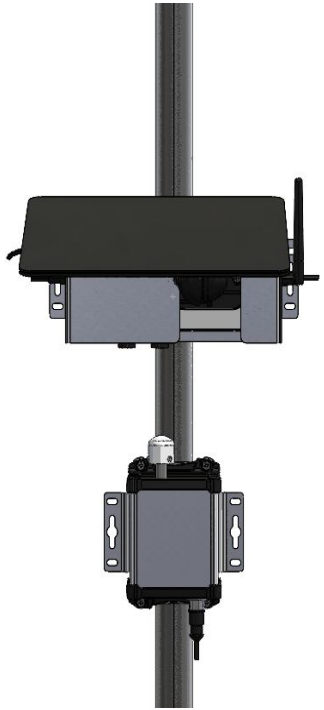
Accurate coarse mode PM detection

Measurement Parameters

- Particulate Matter (PM10)
- Total Suspended Particles (TSP)

Specifications

- TBD, still under development
- **Contact Clarity if you are interested in pilot testing!**



Available for pilots!

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Dust Module use cases

Fence-line dust control

- Ideal for industrial sites, mines, and construction sites
- Captures both fine particles (equipment exhaust) and coarse dust (blasting, drilling, earth-moving)

Community monitoring & transparency

- Builds trust by sharing real-time dust data with communities neighboring industrial operations
- Quantifies visible dust clouds and shows mitigation efforts

Health impact quantification

- Quantify coarse mode PM levels in areas with high natural dust resuspension, unpaved roads, wildfires ash

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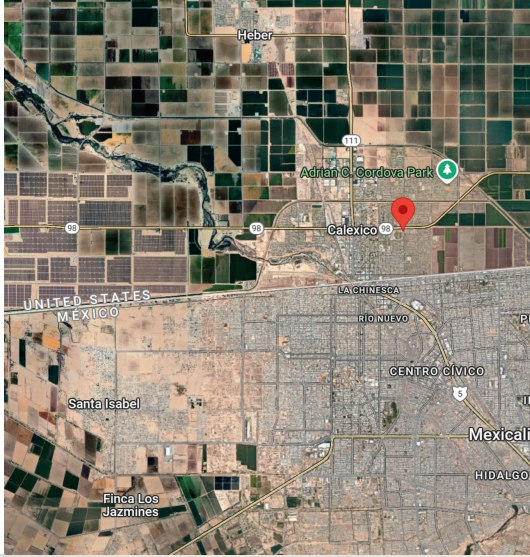
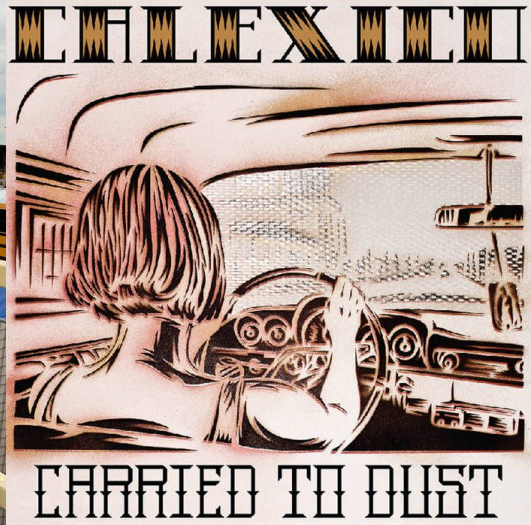
Objective: Identify monitoring site with challenging test conditions.

Criteria:

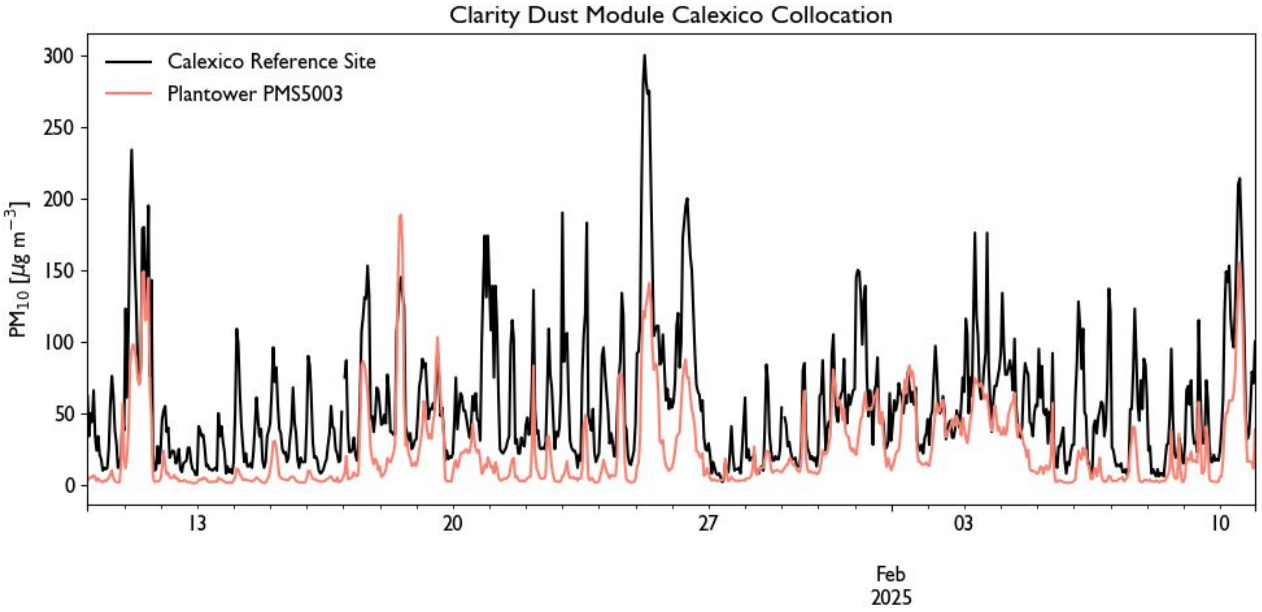
- $PM_{2.5}$ and PM_{10} FEM instrumentation
- Frequent PM_{10} concentrations peaks (>250 µg/m³)
- Distinct $PM_{2.5}$ / PM_{10} regimes (dust + urban sources)
- Elevated median PM_{10} levels

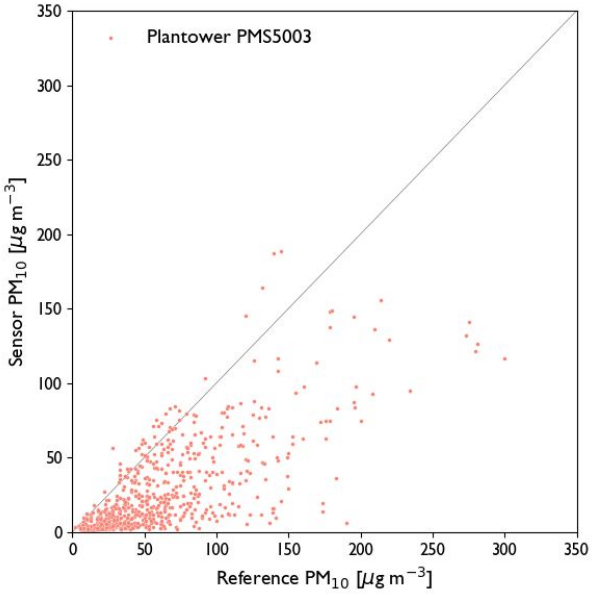
Finding: Calexico satisfied all criteria.





Dust Module


Clarity Dust Module Calexico Collocation
Calexico Reference Site
Plantower PMS5003
PM10 [μg m−3]
300
250
200
150
100
50
0
13
20
27
03
10
Feb
2025


Plantower PMS5003
Sensor PM10 [μg m−3]
Reference PM10 [μg m−3]
350
300
250
200
150
100
50
0
0
50
100
150
200
250
300
350

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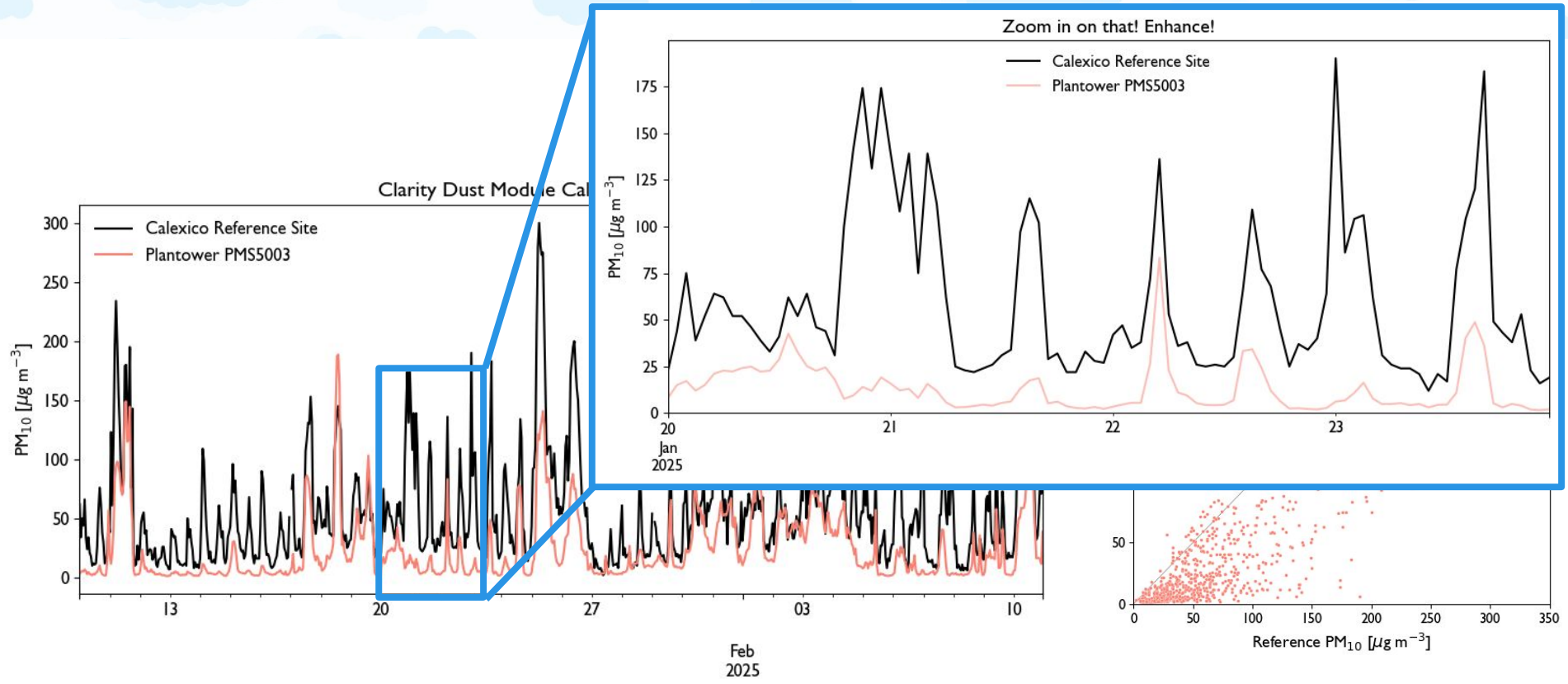
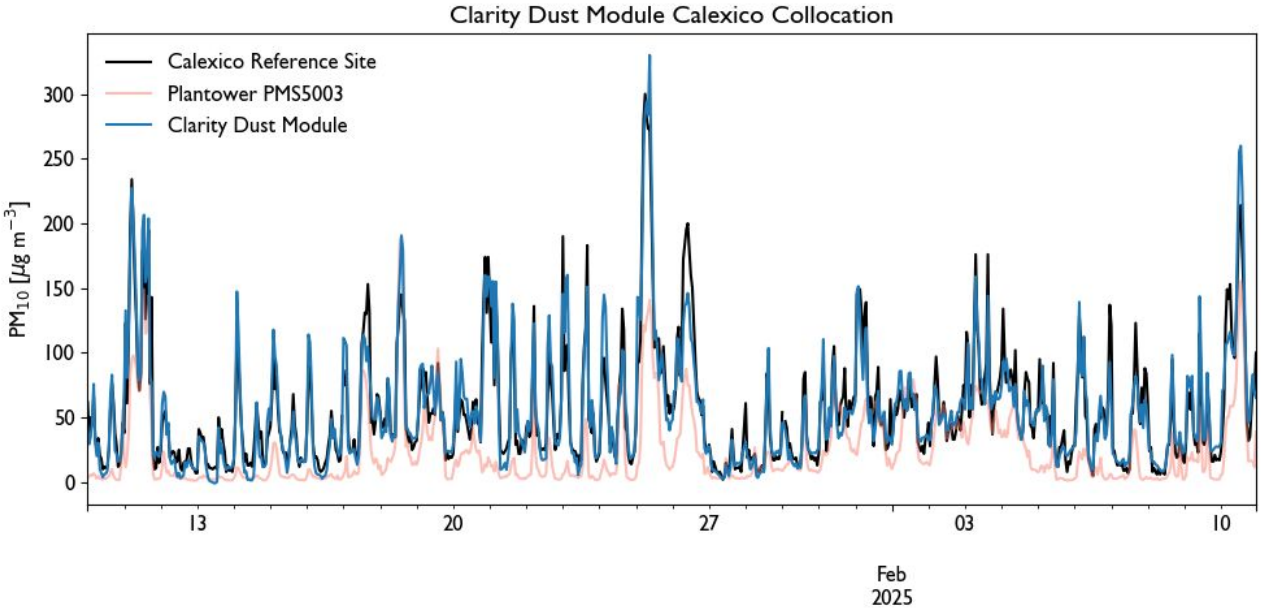


Dust Module


Clarity Dust Module Calexico Collocation
Calexico Reference Site
Plantower PMS5003
Clarity Dust Module
PM10 [μg m−3]
0
50
100
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13
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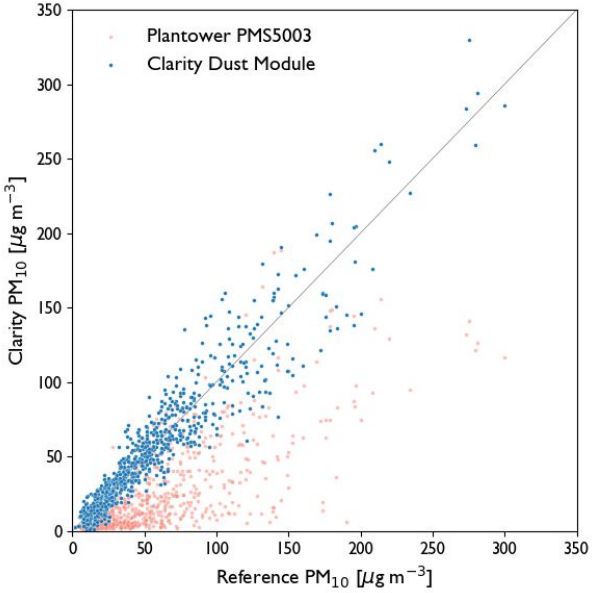
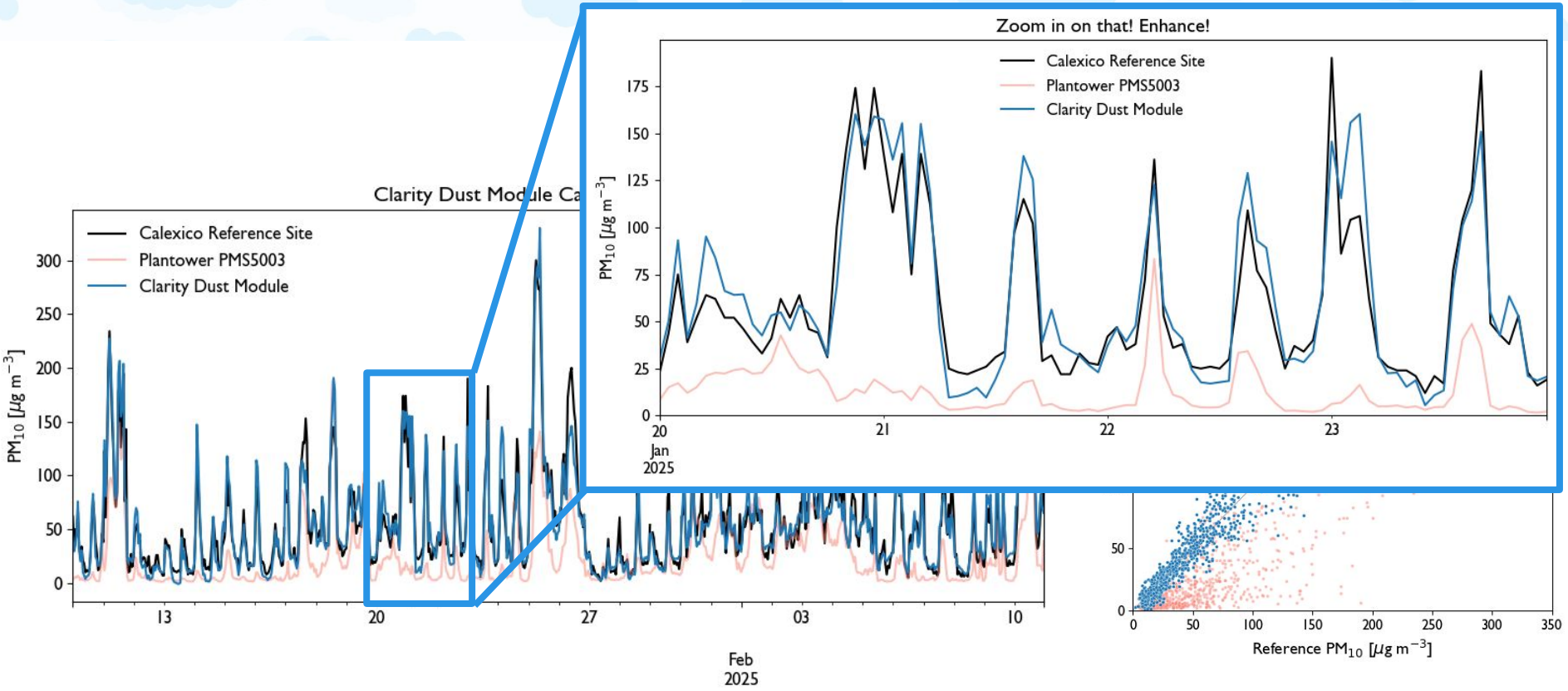
Feb
2025


Plantower PMS5003
Clarity Dust Module
Clarity PM10 [μg m−3]
Reference PM10 [μg m−3]
0
50
100
150
200
250
300
350


Zoom in on that! Enhance!
Calexico Reference Site
Plantower PMS5003
Clarity Dust Module
PM10 [μg m−3]
175
150
125
100
75
50
25
0
20
Jan
2025
21
22
23
Clarity Dust Module Ca
Calexico Reference Site
Plantower PMS5003
Clarity Dust Module
PM10 [μg m−3]
300
250
200
150
100
50
0
13
20
27
03
10
Feb
2025
50
0
0
50
100
150
200
250
300
350
Reference PM10 [μg m−3]

Guiding principles for Clarity products

1

Answer more questions

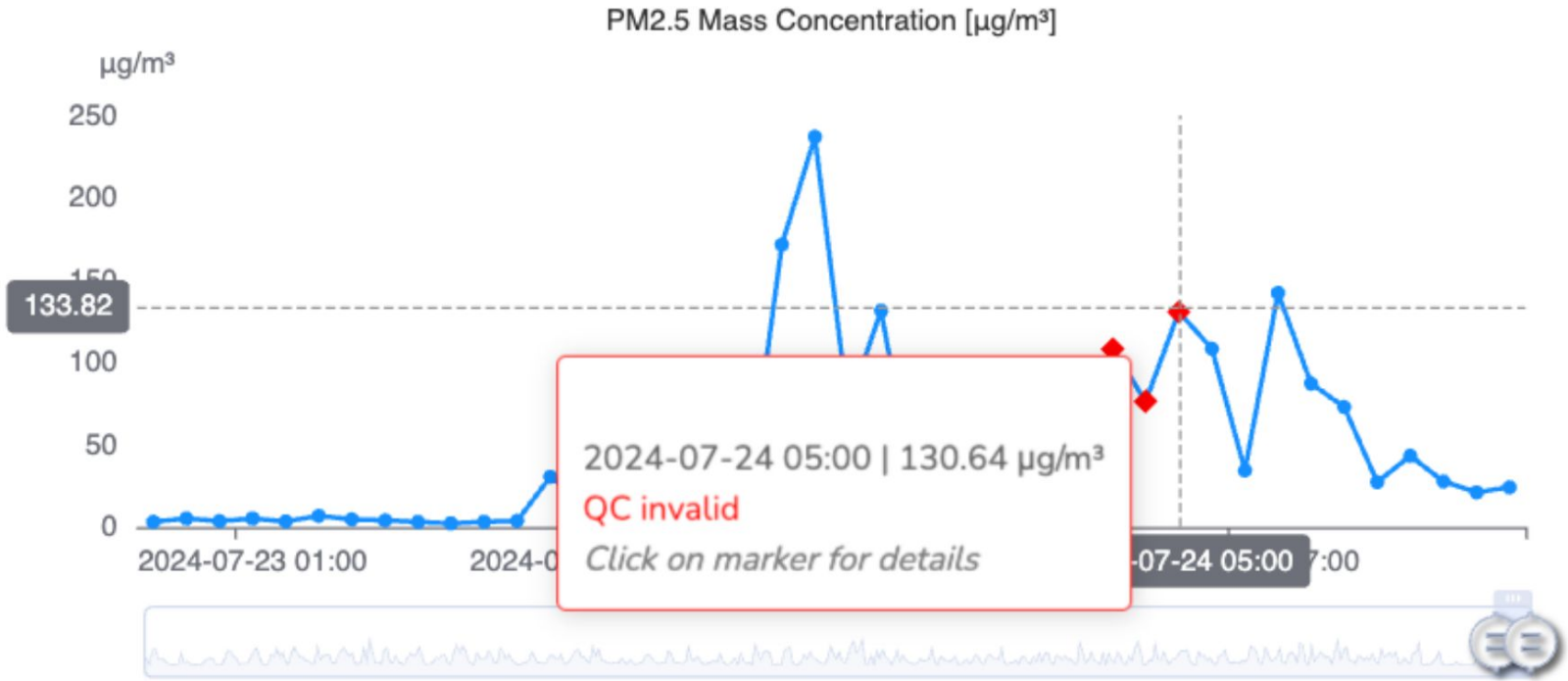
2

Trust your data

3

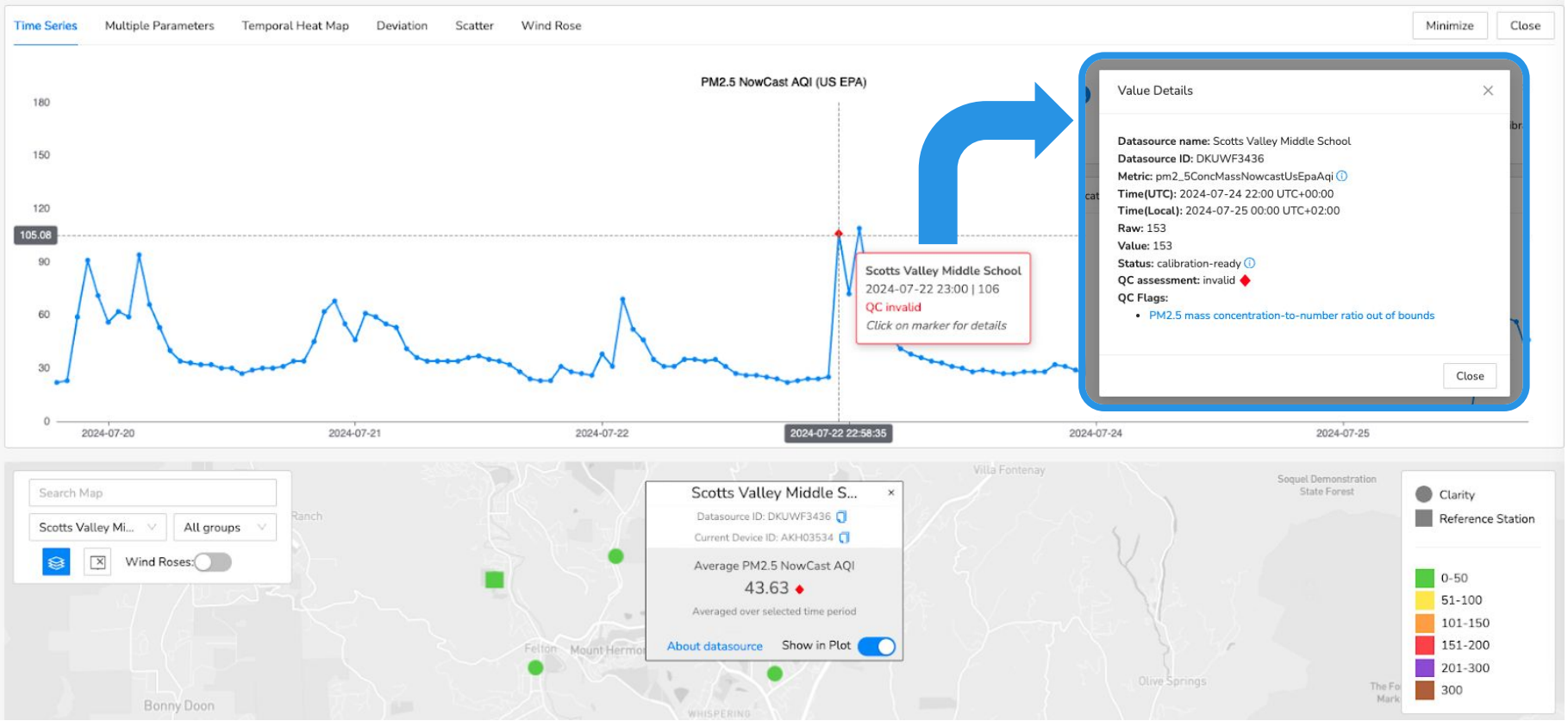
Accelerate your impact

Automated QC



Automated QC in the Clarity Cloud

QC flags to easily identify suspicious measurements



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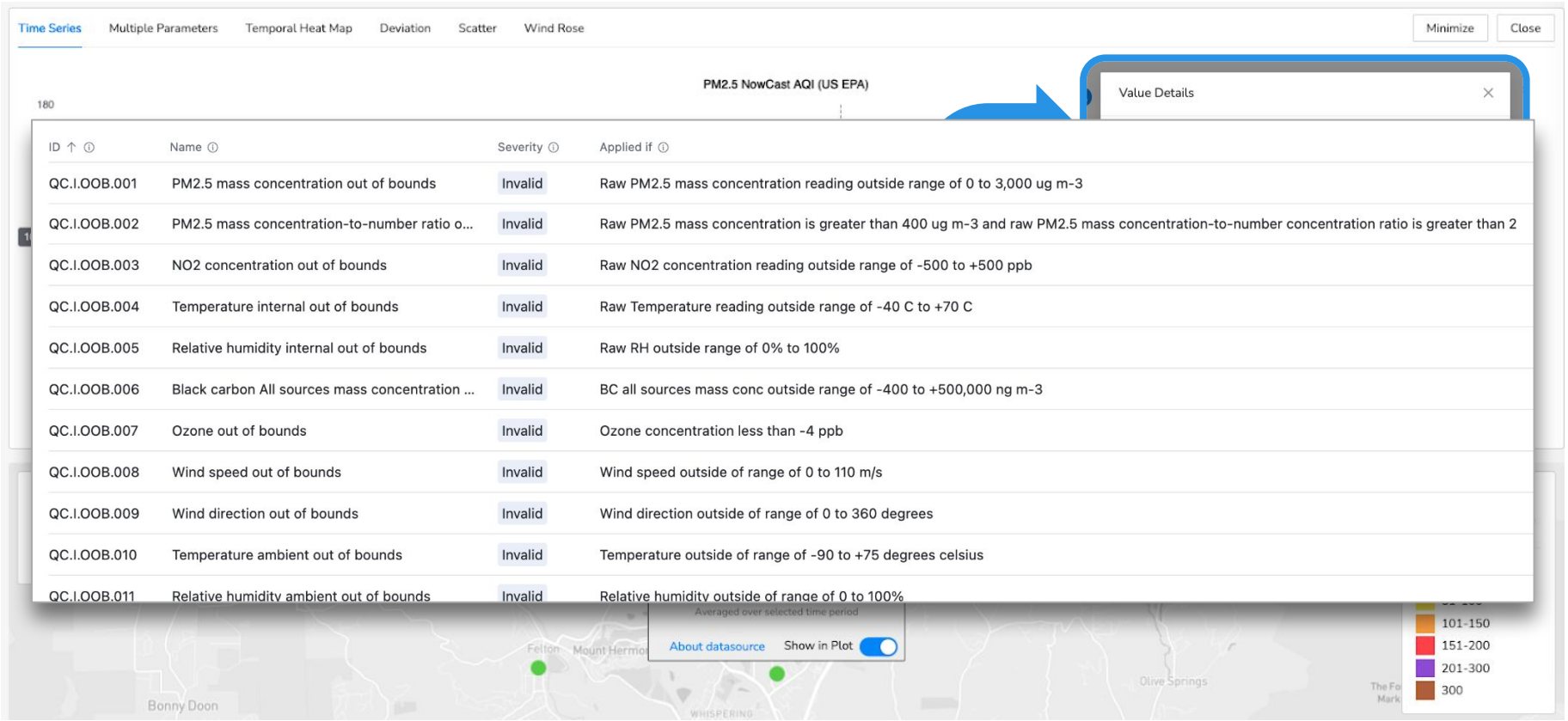
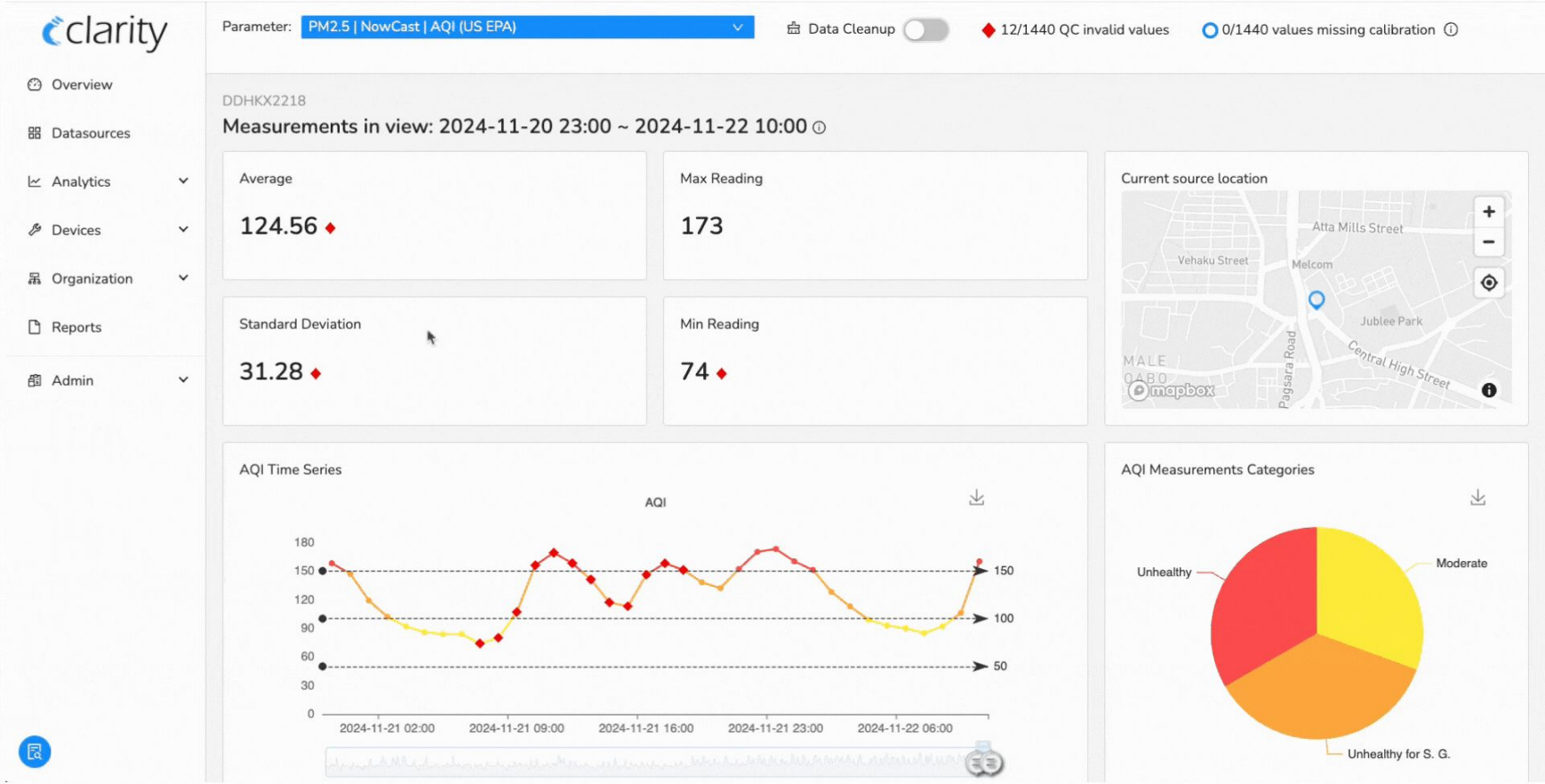


ID	Name	Severity	Applied if
QC.I.OOB.001	PM2.5 mass concentration out of bounds	Invalid	Raw PM2.5 mass concentration reading outside range of 0 to 3,000 ug m-3
QC.I.OOB.002	PM2.5 mass concentration-to-number ratio o...	Invalid	Raw PM2.5 mass concentration is greater than 400 ug m-3 and raw PM2.5 mass concentration-to-number concentration ratio is greater than 2
QC.I.OOB.003	NO2 concentration out of bounds	Invalid	Raw NO2 concentration reading outside range of -500 to +500 ppb
QC.I.OOB.004	Temperature internal out of bounds	Invalid	Raw Temperature reading outside range of -40 C to +70 C
QC.I.OOB.005	Relative humidity internal out of bounds	Invalid	Raw RH outside range of 0% to 100%
QC.I.OOB.006	Black carbon All sources mass concentration ...	Invalid	BC all sources mass conc outside range of -400 to +500,000 ng m-3
QC.I.OOB.007	Ozone out of bounds	Invalid	Ozone concentration less than -4 ppb
QC.I.OOB.008	Wind speed out of bounds	Invalid	Wind speed outside of range of 0 to 110 m/s
QC.I.OOB.009	Wind direction out of bounds	Invalid	Wind direction outside of range of 0 to 360 degrees
QC.I.OOB.010	Temperature ambient out of bounds	Invalid	Temperature outside of range of -90 to +75 degrees celsius
QC.I.OOB.011	Relative humidity ambient out of bounds	Invalid	Relative humidity outside of range of 0 to 100%

Automated QC in the Clarity Cloud

Data Cleanup Toggle to easily remove QC-flagged measurements



Guiding principles for Clarity products

1

Answer more questions

2

Trust your data

3

Accelerate your impact

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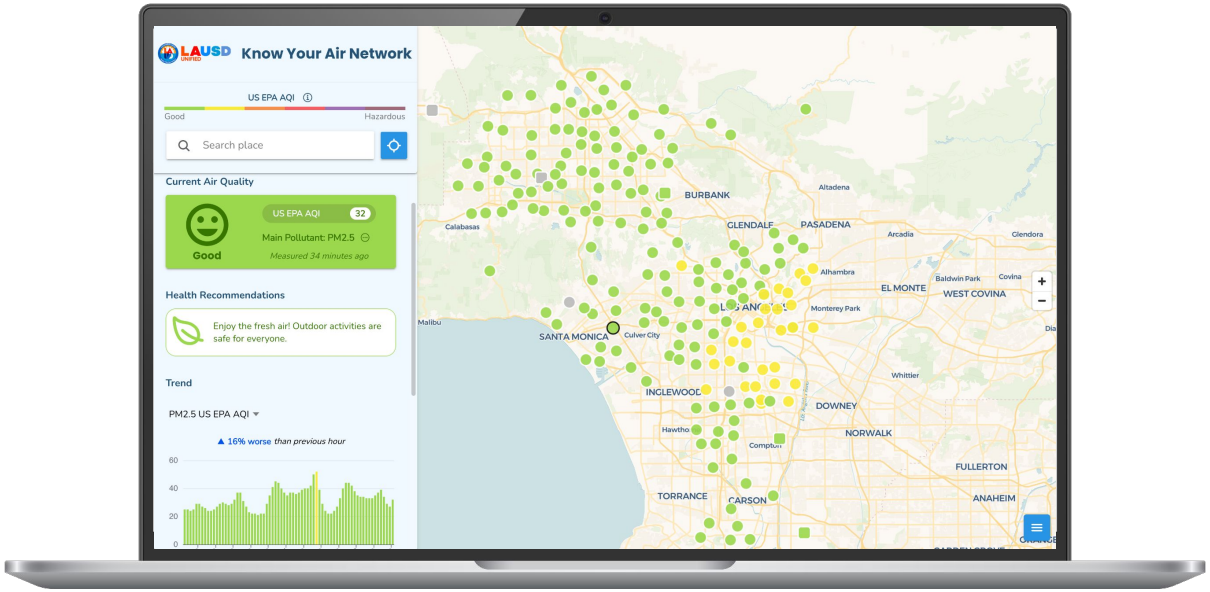
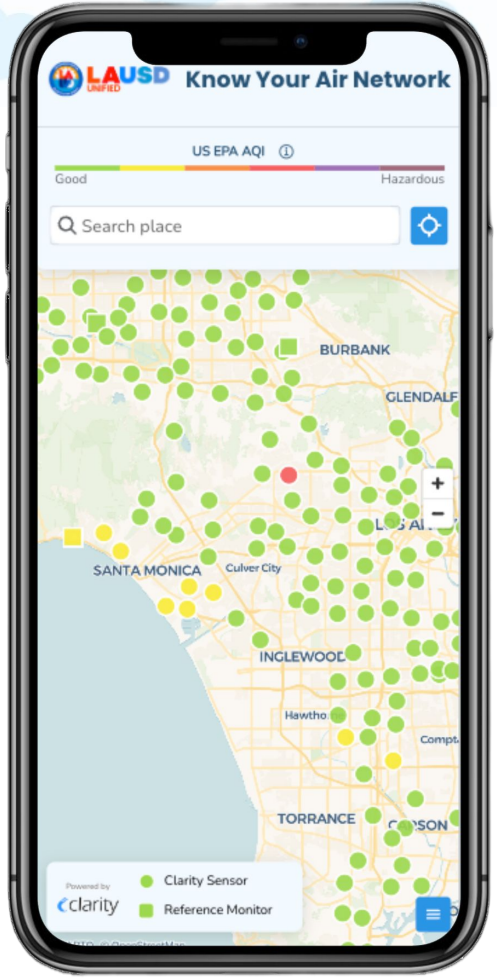
New and improved OpenMap public data sharing platform





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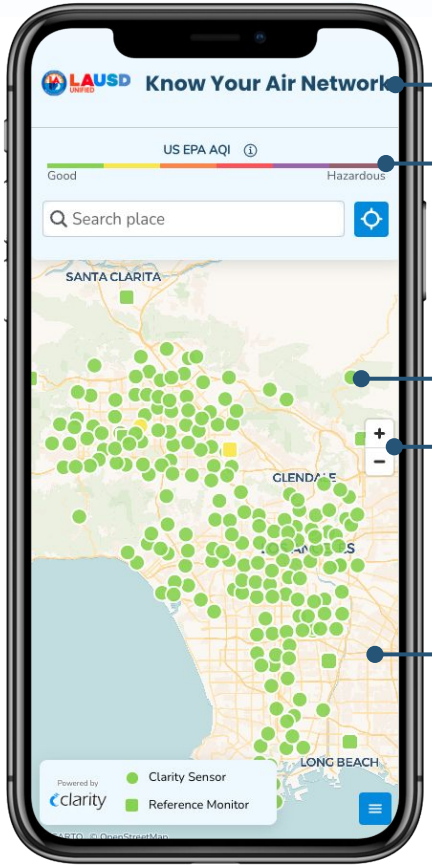

Customizable Branding

Configurable AQI

Live data

Intuitive map-based UI

Mobile friendly

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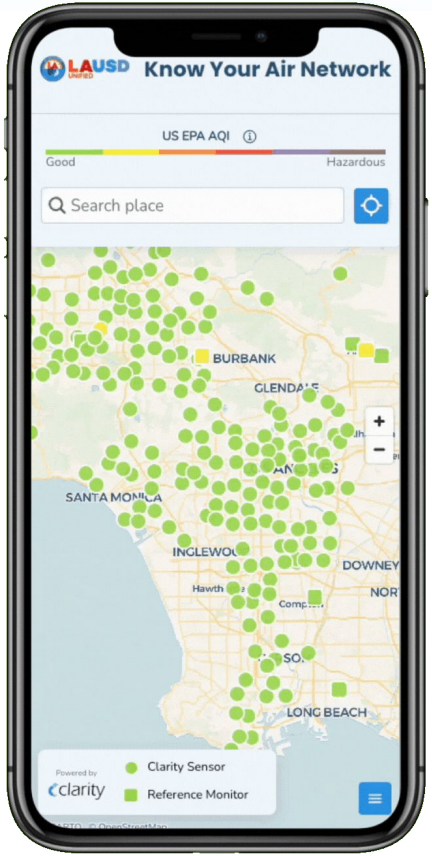

Easily search location and view relevant air quality information

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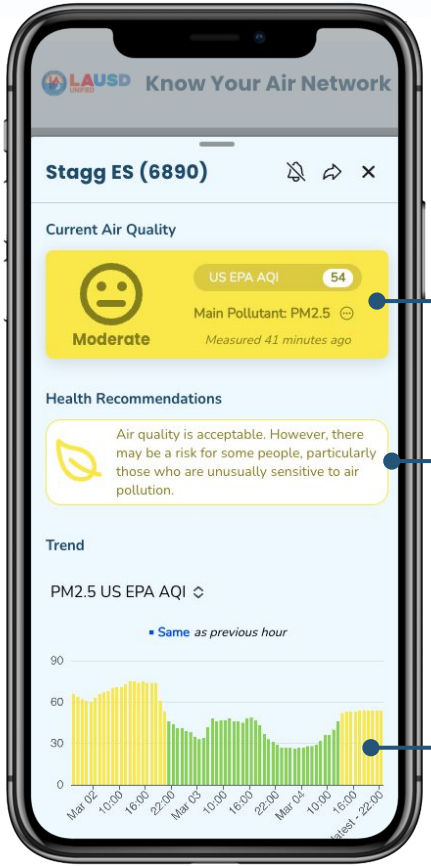

Straightforward messaging

Modifiable AQI-based health tips

Clear charts

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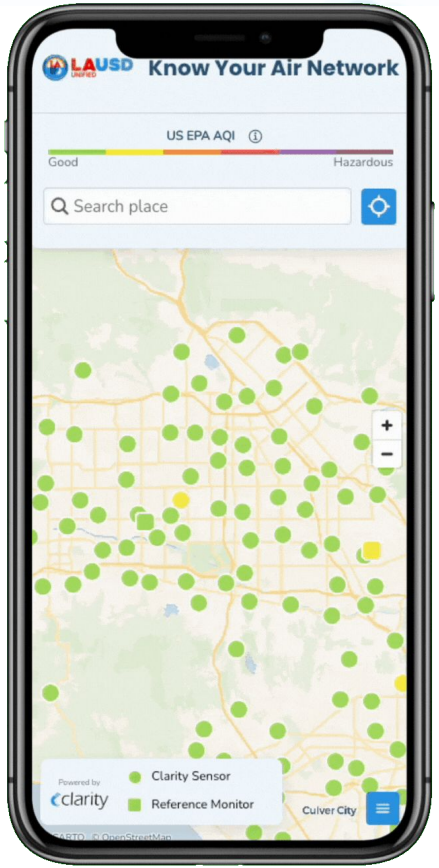

Subscribe to unhealthy air email notifications

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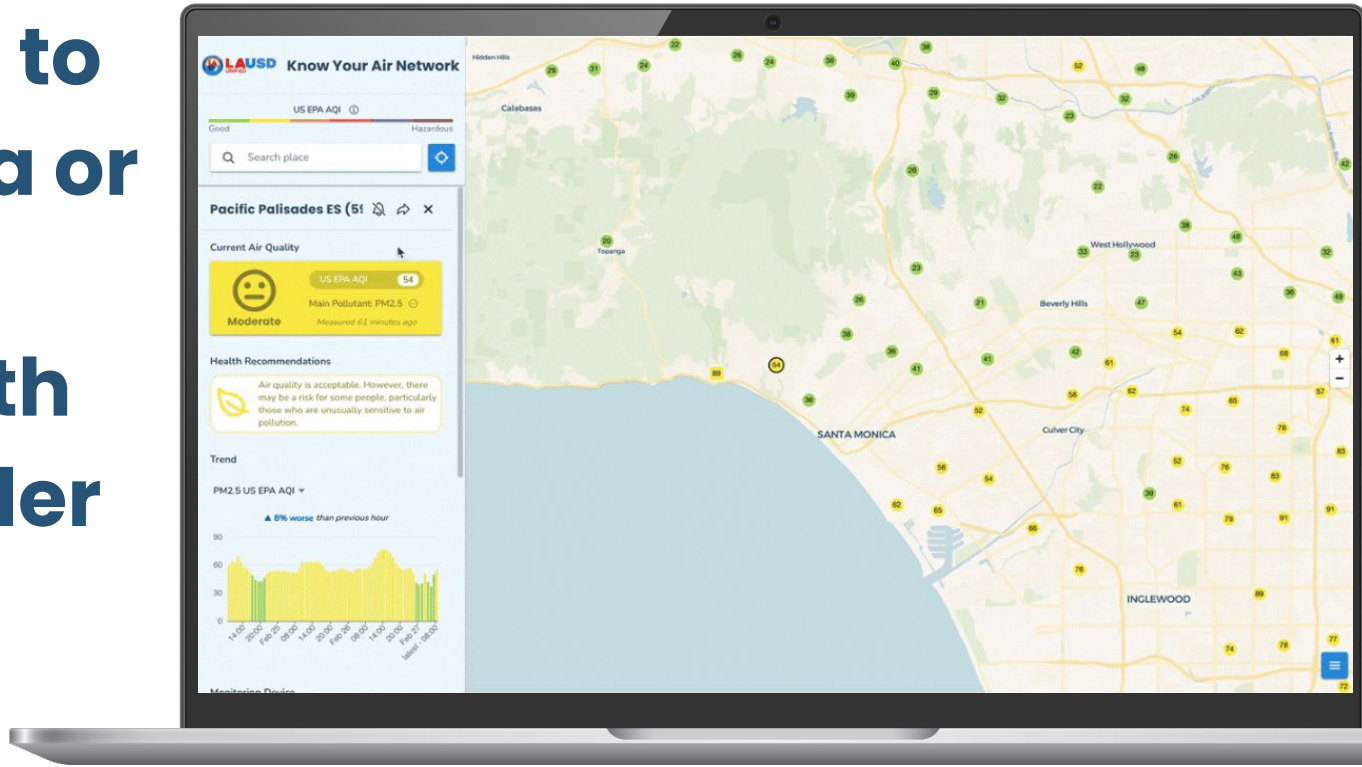
Easily share to social media or embed on websites with widget builder



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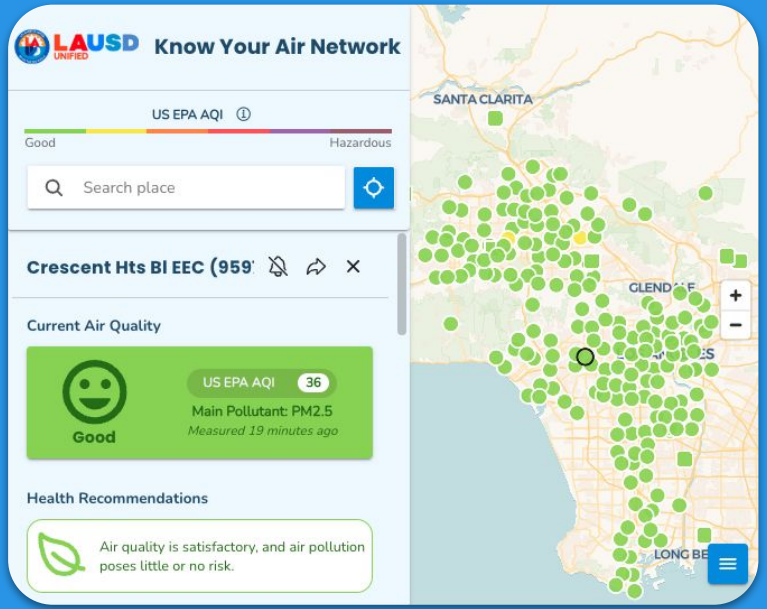
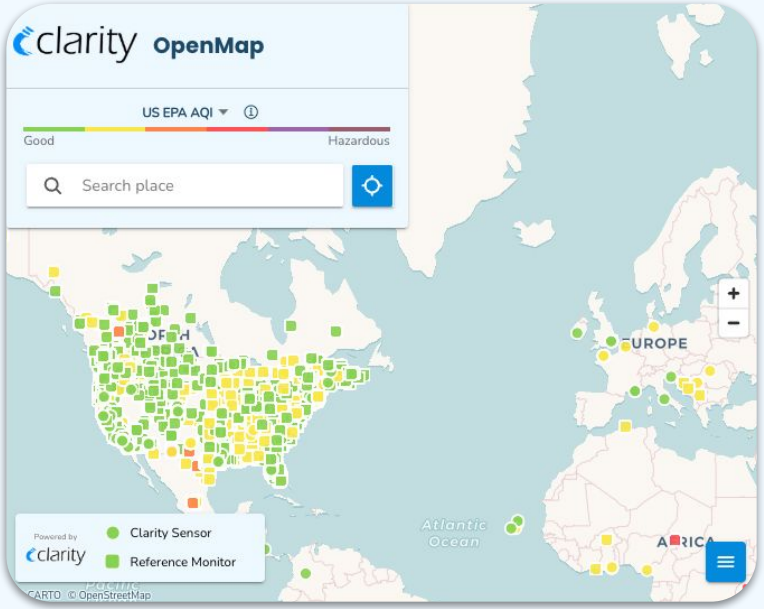
OpenMap Plus



Full-featured

OpenMap



Included with Sensing-as-a-Service

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New Add-On Services Available

Additional EPM Time

Data Analysis

Network Design Workshops

Program Design

Deployment Support

Air Quality trainings

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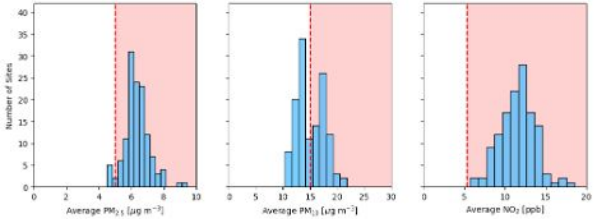
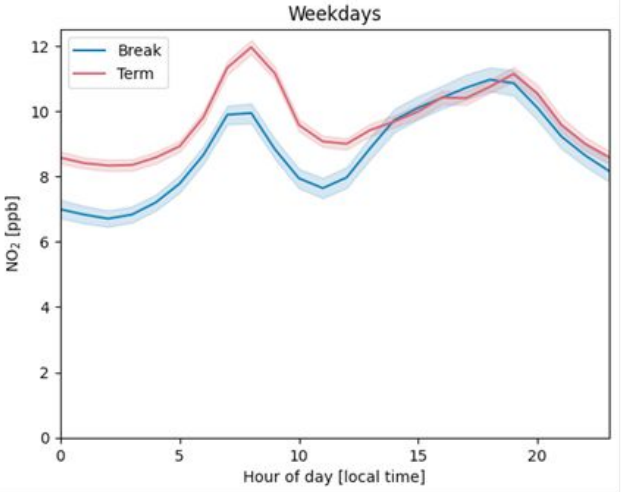
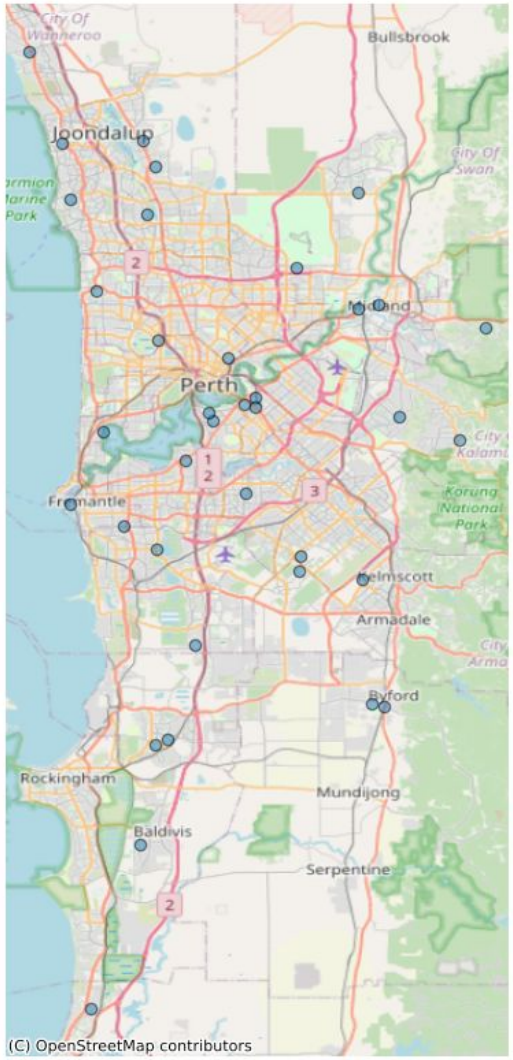
RAC For the better

Traffic-related air pollution in Perth, Australia

- Combination of **200+ Nodes and modeling covering 9,730 km^2**
- Examples of analyses: Relationship between traffic and road characteristics with air pollution; Global and regional air quality guideline exceedances, spatial variations across local governments
- Air pollution exposure at 37 schools
    - School-related traffic may contribute **15% increase** in NO_2 levels at schools in the mornings.
    - All 37 schools have recorded **at least 1 day above** the WHO recommendations for NO_2







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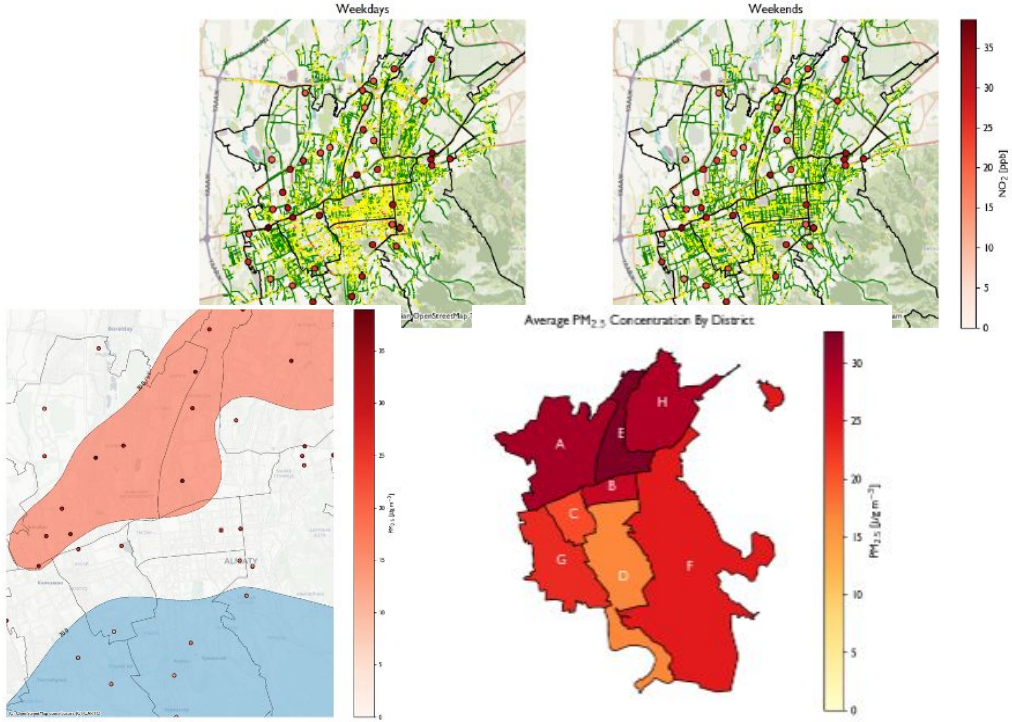
ADB ASIAN DEVELOPMENT BANK

Low Emission Zone Recommendations for ADB and Almaty City, Kazakhstan

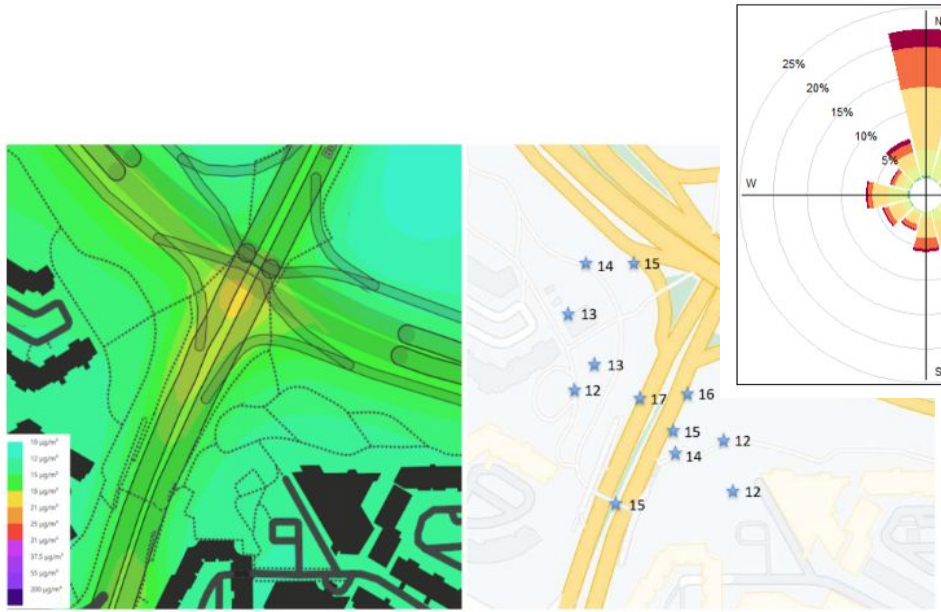
- Combined multi-year 50 sensor network with GIS data to provide **recommendations for development of a Low Emission Zone (LEZ)**
- Data layers: traffic volume, pedestrian and bike lanes, public transit
- **Identified potential hotspots of air pollution** within the city to provide recommendations for which areas to target for initial LEZ planning efforts



Air Pollution at Residential Estates in Singapore near major expressways

National Environment Agency
Safeguard · Nurture · Cherish

- Combination of monitoring and modeling
- Estimated air pollution concentrations within residential estates to **inform urban planning policies**
- Examples: exceedances of AQG, distance from roadway analyses, vertical distribution, seasonal (monsoon versus inter-monsoon)



https://www.undp.org/policy-centre/singapore/blog/innovative-air-quality-monitoring-singapore-insights-low-cost-sensor-study-national-environment-agency-nea

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Guiding principles for Clarity products

1

Answer more questions

2

Trust your data

3

Accelerate your impact

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Multi-Gas Module

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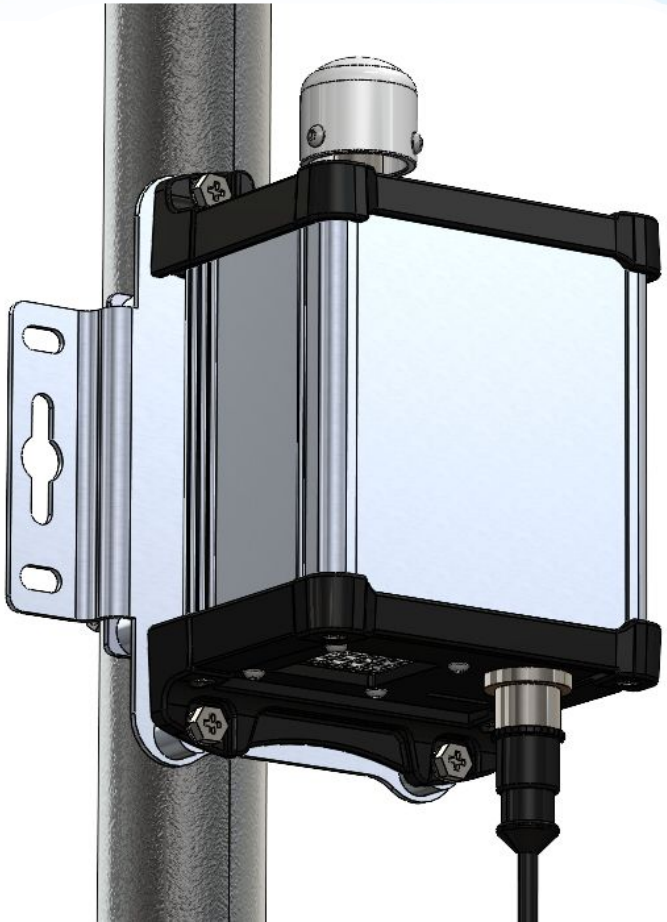

Dust Module

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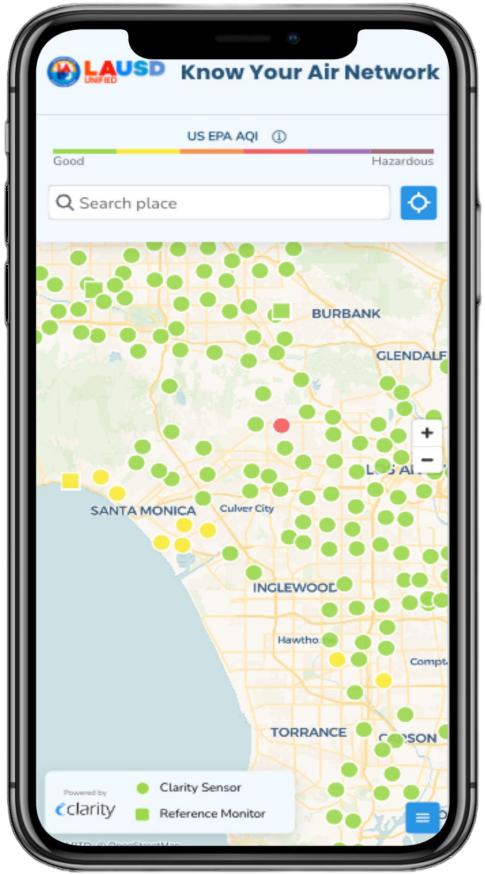

OpenMap Plus

Contact us for pricing!

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Additional EPM Time

Data Analysis

Program Design

Deployment Support

Network Design Workshops

Air Quality Trainings

Add-On Services

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Multi-Gas Module

New

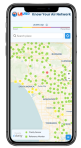
Dust Module

Coming Soon

Clarity Cloud & Software

Automatic QC

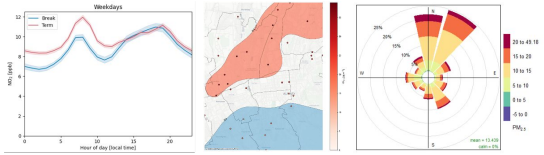
New



New Openmap

New

Air Quality Expert Team



Enhanced Add-On Services

New

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COMMUNITY AIR SENSOR WORKSHOP 2025

March 18–19, 2025

10 AM – 2 PM ET (tentatively)
Online (link will be provided)

Register here:

communityairsensor.org

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For more information please contact Azlan Mirnezami Thomson Environmental Systems

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