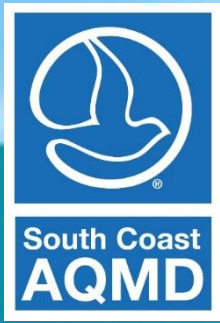


EPA STAR Grant

Community Monitoring – Technical Workshop



(Conducted October 2017 – August 2018)

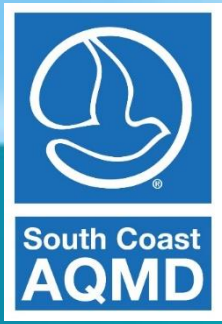


EPA STAR Grant

Engage, Educate, and Empower California Communities
on the Use and Applications
of “Low-cost” Air Monitoring Sensors

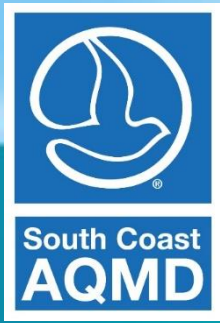
Main Objective

Provide communities across California with the knowledge necessary to appropriately select, use, and maintain “low-cost” sensors and to correctly interpret the collected data



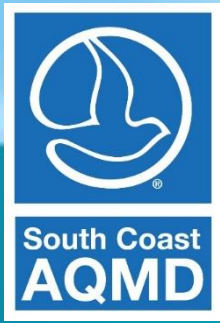
EPA STAR Grant

HOW?



Specific Aims

- Aim 1:** Develop new methods (TOOLKIT) to engage, educate, and empower local communities on the use and applications of “low-cost” sensors
- Aim 2:** Conduct field and laboratory testing to characterize the performance of commercially available “low-cost” sensors and to identify candidates for field deployment
- Aim 3:** Deploy the selected sensors in multiple California communities, and perform a thorough validation and interpretation of the collected data
- Aim 4:** Communicate the lessons learned to the public and organize outreach activities



Develop a Toolkit

Engage local communities to inform toolkit materials through in- person meetings and phone interviews. Survey community on their knowledge and perception of sensors.



Draft guidebook, training videos, and data collection checklist.

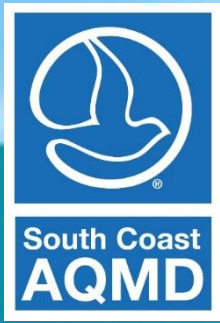


Share draft toolkit with community members and survey them regarding sensor use to assess if their interaction and perception of sensors has changed.



Revise toolkit materials based on community feedback.

Aim 1

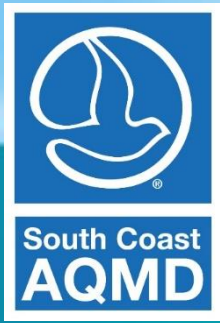


Field Testing

Aim 2

- Started in September, 2014
 - Over 30 sensors evaluated
- Process
 - Sensor tested in triplicates
 - Two month deployment
 - < ~ \$2,000: purchase
 - > ~ \$2,000: lease or borrow
- Location
 - Rubidoux station (main)
 - Inland site
 - Fully instrumented





www.aqmd.gov/aq-spec

Laboratory Testing

Aim 2

- Started in November, 2015
 - Over 10 sensors evaluated
- Process
 - Sensor tested in triplicates
- Location
 - SCAQMD Laboratory
 - Fully instrumented





Aim 2

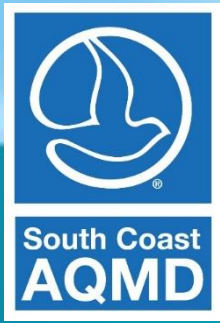
Most PM sensors showed:

- Minimal down time
- Moderate intra-model variability
- Strong correlation (R^2) with EPA “approved” instruments (e.g., FEM)

However...

- Sensor “calibration” is needed in most cases
- Very small particles (e.g. $< 0.5 \mu\text{m}$) are not detected
- Bias in algorithms used to convert particle counts to particle mass

PM Sensors							
Sensor Image	Manufacturer (Model)	Type	Pollutant(s)	Approx. Cost (USD)	*Field R^2	*Lab R^2	Summary Report
	AethLabs (microAeth)	Optical	BC (Black Carbon)	~\$6,500	$R^2 \sim 0.79$ to 0.94		
	Air Quality Egg (Version 1)	Optical	PM	~\$200	$R^2 \sim 0.0$		
	Air Quality Egg (Version 2)	Optical	PM	~\$240	PM _{2.5} : $R^2 \sim 0.79$ to 0.85 PM ₁₀ : $R^2 \sim 0.31$ to 0.40		
	Alphasense (OPC-N2)	Optical	PM _{1.0} , PM _{2.5} & PM ₁₀	~\$450	PM _{1.0} : $R^2 \sim 0.63$ to 0.82 PM _{2.5} : $R^2 \sim 0.38$ to 0.80 PM ₁₀ : $R^2 \sim 0.41$ to 0.60	$R^2 \sim 0.99$	PDF (1,291 KB)
	Dylos (DC1100)	Optical	PM _(0.5-2.5)	~\$300	$R^2 \sim 0.65$ to 0.85	$R^2 \sim 0.89$	PDF (1,384 KB)
	Foobot	Optical	PM _{2.5}	~\$200	$R^2 \sim 0.55$		
	HabitatMap (AirBeam)	Optical	PM _{2.5}	~\$200	$R^2 \sim 0.65$ to 0.70	$R^2 \sim 0.87$	PDF (1,144 KB)
	Hanvon (Hanvon N1)	Optical	PM _{2.5}	~\$200	$R^2 \sim 0.52$ to 0.79		
	MetOne (Neighborhood Monitor)	Optical	PM _{2.5}	~\$1,900	$R^2 \sim 0.53$ to 0.67		
	Moj China (Airtut)	Optical	PM _{2.5}	~\$150	$R^2 \sim 0.81$ to 0.88		
	Naneos (Partector)	Electrical	PM (LDSA: Lung-Deposited Surface Area)	~\$7,000	PM _{1.0} : $R^2 \sim 0.1$ PM _{2.5} : $R^2 \sim 0.2$		
	Origins (Laser Egg)	Optical	PM _{2.5} & PM ₁₀	~\$200	PM _{2.5} : $R^2 \sim 0.58$ PM ₁₀ : $R^2 \sim 0.0$		
	Perkin Elmer (ELM)	Optical	PM	~\$5,200	$R^2 \sim 0.0$		
	PurpleAir (PA-I)	Optical	PM _{1.0} , PM _{2.5} & PM ₁₀	~\$150	PM _{1.0} : $R^2 \sim 0.93$ to 0.95 PM _{2.5} : $R^2 \sim 0.77$ to 0.92 PM ₁₀ : $R^2 \sim 0.32$ to 0.44	PM _{1.0} : $R^2 \sim 0.95$ PM _{2.5} : $R^2 \sim 0.99$ PM ₁₀ : $R^2 \sim 0.97$	PDF (1,072 KB)
	PurpleAir (PA-II)	Optical	PM _{1.0} , PM _{2.5} & PM ₁₀	~\$200	PM _{1.0} : $R^2 \sim 0.96$ to 0.98 PM _{2.5} : $R^2 \sim 0.93$ to 0.97 PM ₁₀ : $R^2 \sim 0.66$ to 0.70	PM _{1.0} : $R^2 \sim 0.99$ PM _{2.5} : $R^2 \sim 0.99$ PM ₁₀ : $R^2 \sim 0.95$	PDF (1,328 KB)
	RTI (MicroPEM)	Optical	PM _{2.5}	~\$2,000	$R^2 \sim 0.65$ to 0.90	$R^2 \sim 0.99$	PDF (1,087 KB)
	Shinyei (PM Evaluation Kit)	Optical	PM _{2.5}	~\$1,000	$R^2 \sim 0.80$ to 0.90	$R^2 \sim 0.93$	PDF (1,156 KB)
	Speck	Optical	PM _{2.5}	~\$150	$R^2 \sim 0.32$		
	TSI (AirAssure)	Optical	PM _{2.5}	~\$1,500	$R^2 \sim 0.82$		



Deploy the sensor

Aim 3





PurpleAir PM Sensor

AQ-SPEC

Air Quality Sensor Performance Evaluation Center

Sensor Description

Manufacturer/Model:
PurpleAir PA-II

Pollutants:
PM₁, PM_{2.5}, PM₁₀

Measurement Range:
0 - 500 µg/m³

Type: Optical



Additional Information

Field evaluation report:
<http://www.aqmd.gov/aq-spec/evaluations/field>

Lab evaluation report:
<http://www.aqmd.gov/aq-spec/evaluations/laboratory>

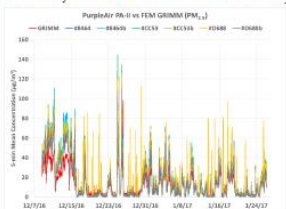
AQ-SPEC website:
<http://www.aqmd.gov/aq-spec>

Evaluation Summary

- Overall, the three PurpleAir PA-II sensors showed moderate to good accuracy, compared to the reference instrument for PM₁, PM_{2.5}, and PM₁₀, for a concentration range between 0 to 250 µg/m³.
- The three PA-II sensors exhibited high precision for most of the tested T/RH combinations.
- PA-II sensors showed low intra-model variability as well as good sensor a and b correlation in each node.
- PA-II sensors had good data recovery (95%).
- For PM₁ and PM_{2.5}, the PA-II sensors had high correlation with the reference instrument from both the field (PM₁₀ R² > 0.96, PM_{2.5} R² > 0.93) and laboratory studies (linear correlation PM₁ R² > 0.99, PM_{2.5} R² > 0.99). For PM₁₀, the PA-II sensors did not always follow the concentration change recorded by FEM instrument in the field (PM₁₀ R² > 0.66), however in the laboratory, the PA-II sensors followed the concentration ramping (increasing) change, reporting (PM₁₀ R² > 0.95).

Field Evaluation Highlights

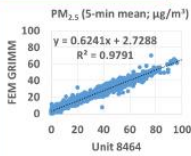
- Deployment period 12/18/2016- 01/26/2017: the three PA-II nodes correlated well the PM₁, PM_{2.5} concentration change as monitored by GRIMM and BAM. PA-II nodes did not always follow the PM₁₀ concentration change.
- The units showed 95-99% data recovery as well as low intra-model variability.



PM₁₀ R² ~ 0.96 to 0.98

PM_{2.5} R² ~ 0.93 to 0.97

PM₁₀ R² ~ 0.66 to 0.70



Correlation coefficient (R²) quantifies how the three sensors followed the PM concentration change by GRIMM.

An R² approaching the value of 1 reflects a near perfect agreement, whereas a value of 0 indicates a complete lack of correlation.

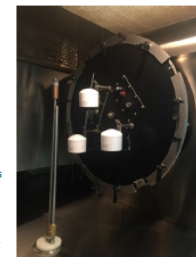
Laboratory Evaluation Highlights

Accuracy

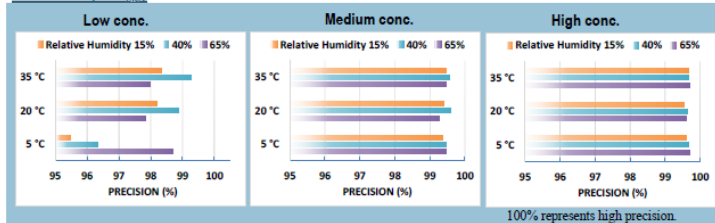
$$A (\%) = 100 - \frac{|X-R|}{R} \times 100$$

Steady State (#)	Sensor mean (µg/m ³)	GRIMM (µg/m ³)	Accuracy (%)
1	19.7	13.5	54.3
2	44.3	35.7	75.7
3	80.8	84.1	96.1
4	134.7	155.1	86.8
5	186.3	233.5	79.8

Accuracy was evaluated by a concentration ramping experiment at 20 °C and 40%. The sensor's readings at each ramping steady state are compared to the reference instrument.

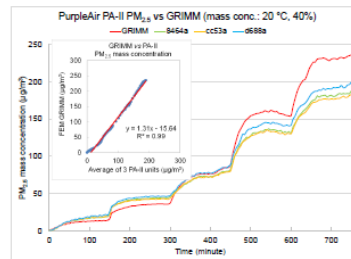


Precision (PM_{2.5})



Sensor's ability of generating precise measurements of PM concentration at low, medium, and high pollutant levels were evaluated under 9 combinations of T and RH, including extreme weather conditions like cold and dry (5

Linear Correlation Coefficient



The three PA-II sensors showed excellent correlation with the corresponding FEM PM_{2.5} data (R² = 0.99) at 20 °C and 40% RH.

For conc. ramping experiments of PM₁ and PM₁₀, please see full length lab reports.

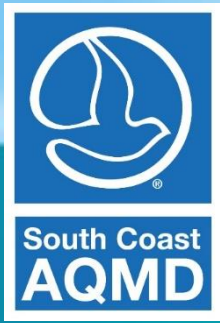
Climate Susceptibility

From the laboratory studies, temperature and relative humidity had minimal effect on the PA-II sensors' precision. At the set-points of RH changes, PA-II reported spiked changes in concentrations.

Observed Interferents

N/A

All documents, reports, data, and other information provided in this document are for informational use only. Mention of trade names or commercial products does not constitute endorsement or recommendation. The South Coast AQMD's AQ-SPEC program, as a government agency, recommends the interested parties to make purchase decisions based on their application.

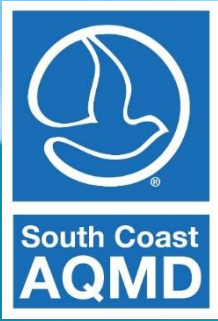


www.aqmd.gov/aq-spec

PurpleAir PM Sensor

Rationale for Selection

- Open-access data: this makes the data easily accessible to all community members (including those not hosting a sensor) and project leads
- Low-cost: the cost enables the distribution and installation of more sensors than initially proposed
- Performance: relatively well-performing sensor based on AQ-SPEC evaluation



www.purpleair.com/map

PurpleAir Sensors Map Me Install

vpapapos@gmail.com Logout

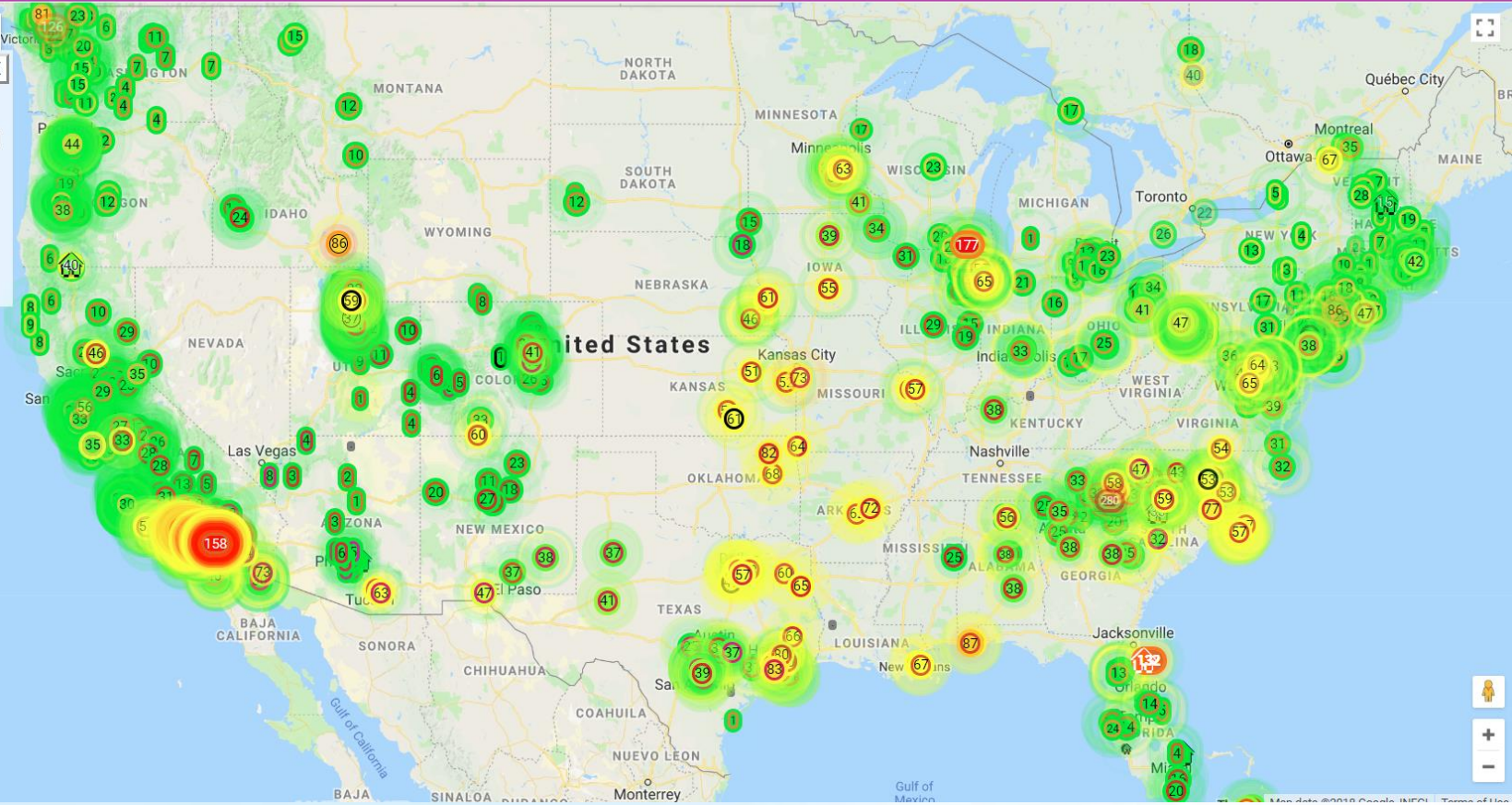
Search...

1798 online, 120 offline

V4:244

Units: Imperial
Marker's z-Index: Bad air on top
National Standard: AQI
Marker Size: Medium
Last Active: One Week

SCPLB_01
63



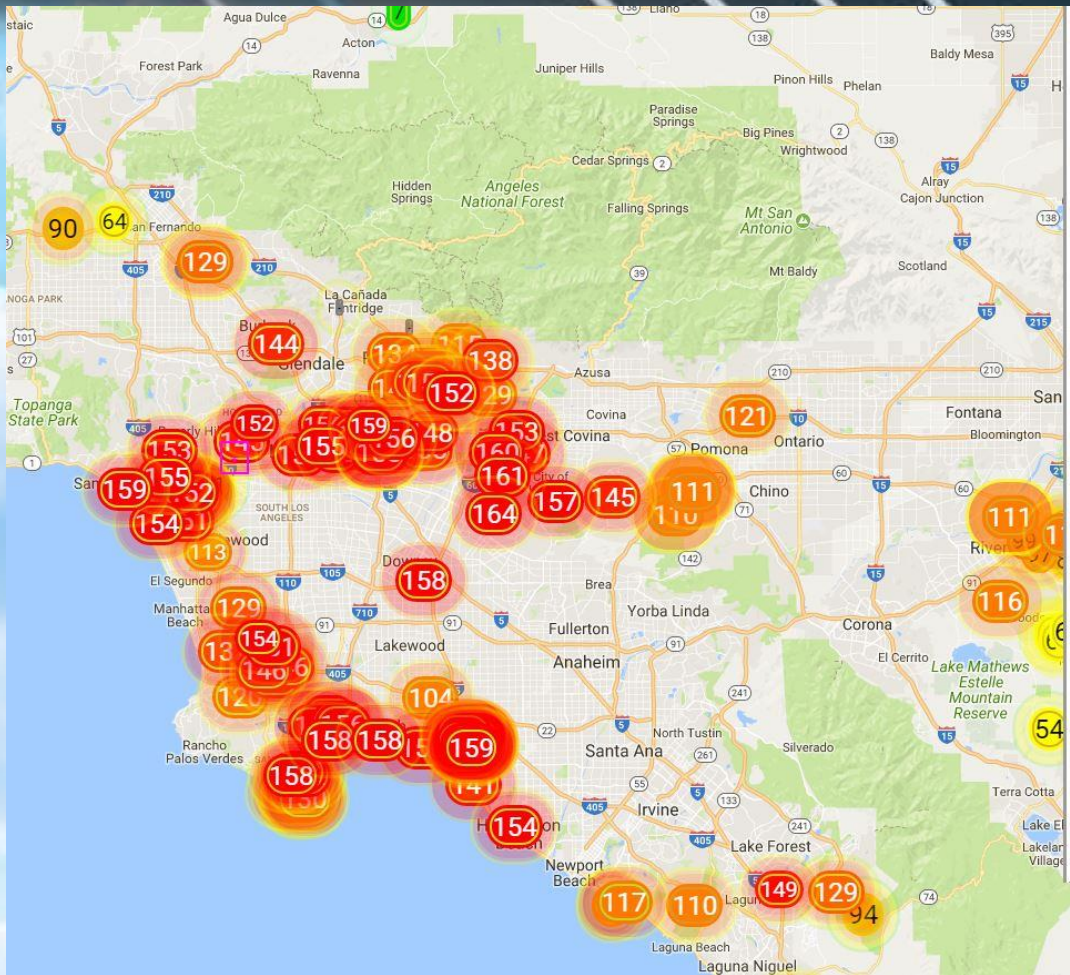
Map Satellite

Google





www.purpleair.com/map



On Tue Dec 26 2017 13:43:57 GMT-0800 (Pacific Standard Time)

Short-term PM2.5 is MEDIUM at 55µg/m3
If medium readings continue (for an hour or more), use the Air Quality Index to plan activities.

Short-term AQI **D4f8**

150 **Unhealthy for Sensitive Groups**

Good Moderate **Warning** Unhealthy Very Unhealthy Hazardous

101-150: Members of sensitive groups may experience health effects. The general public is not likely to be affected.

Trends Particles Sensor **Current Weather**

⚠ Channel A Running Averages

Real Time	Short-term	30 minute	1 hour	6 hour	24 hour	One week
144	149	152	154	155	127	73
53µg/m3	55µg/m3	57µg/m3	61µg/m3	63µg/m3	46µg/m3	23µg/m3

⚠ Channel B Running Averages

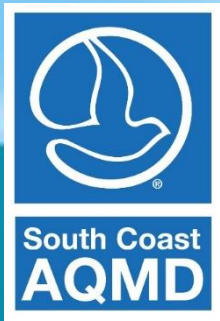
Real Time	Short-term	30 minute	1 hour	6 hour	24 hour	One week
146	150	152	155	157	133	75
54µg/m3	55µg/m3	58µg/m3	62µg/m3	67µg/m3	48µg/m3	23µg/m3

* Laser Temperature: 75°F * Laser Humidity: 32%

* Approximate conditions the laser is exposed to. Readings are affected by the electronics, sunlight or wind. Temperature may be elevated and humidity under estimated.

Real Time	Short-term Average	One Hour Average	24 Hour Average
-----------	--------------------	------------------	-----------------

ThingSpeak.com



www.purpleair.com/map

PurpleAir Shop Map Me Install

Search...

On Fri Jan 05 2018 10:57:24 GMT-0800 (Pacific Standard Time)
Short-term PM2.5 is MEDIUM at 37µg/m3
If medium readings continue (for an hour or more), use the Air Quality Index to plan activities.

Short-term AQI AQMD_NASA_8

106

Unhealthy for Sensitive Groups

Good Moderate Warning Unhealthy Very Unhealthy Hazardous

101-150: Members of sensitive groups may experience health effects. The general public is not likely to be affected.

Trends Particles Sensor Current Weather

Channel A Running Averages

Real Time	Short-term	30 minute	1 hour	6 hour	24 hour	One week
103	104	104	102	96	98	94
36µg/m3	37µg/m3	37µg/m3	36µg/m3	34µg/m3	34µg/m3	33µg/m3

Channel B Running Averages

Real Time	Short-term	30 minute	1 hour	6 hour	24 hour	One week
111	107	107	105	99	99	96
40µg/m3	38µg/m3	38µg/m3	37µg/m3	35µg/m3	35µg/m3	34µg/m3

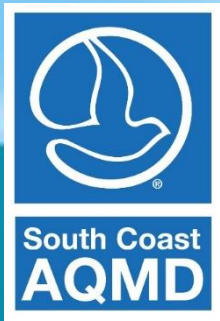
*** Laser Temperature: 90°F * Laser Humidity: 28%**
* Approximate conditions the laser is exposed to. Readings are affected by the electronics, sunlight or wind. Temperature may be elevated and humidity under estimated.

Real Time Short-term Average One Hour Average 24 Hour Average

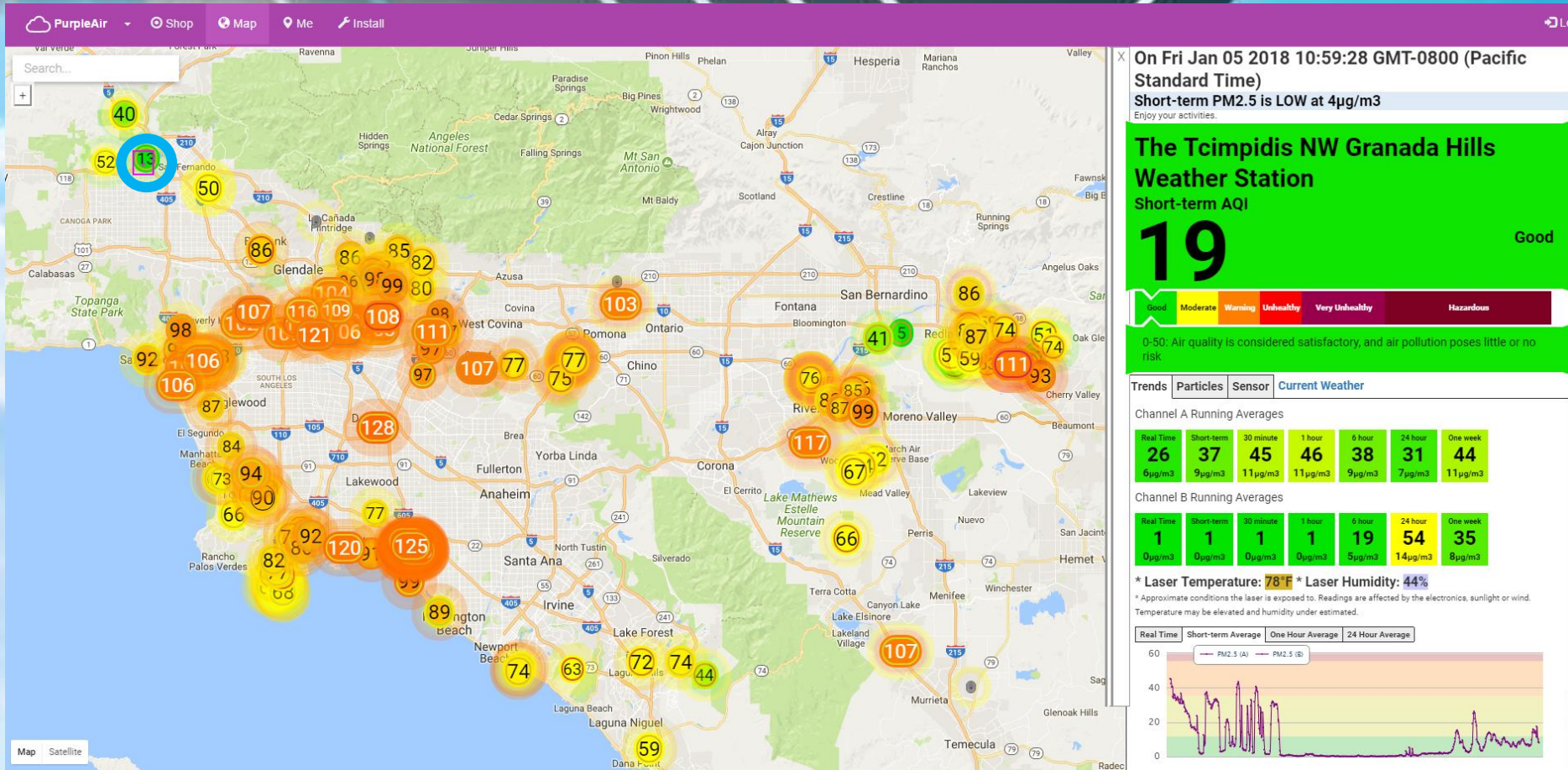
150
100
50
0
-50

1. Jan 2. Jan 3. Jan 4. Jan 5. Jan

Date

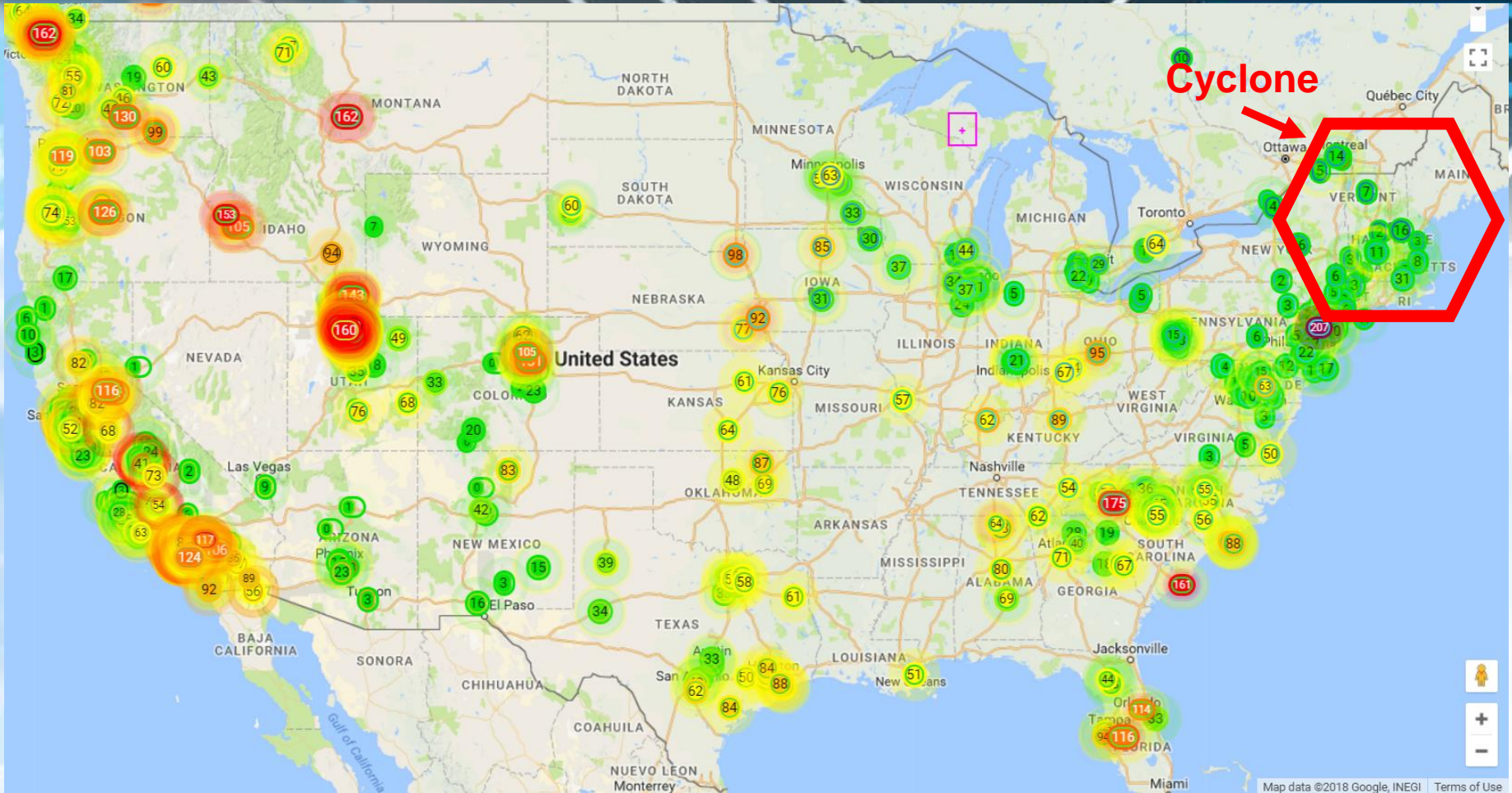


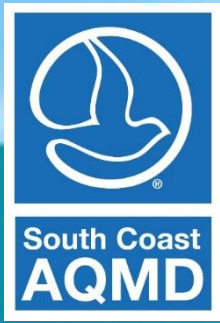
www.purpleair.com/map





www.purpleair.com/map





Air Sensor Questionnaire



South Coast
AQMD

Contact Information

1. Full Name: _____
 2. Address: _____
 3. Phone number: _____
 4. e-mail: _____
5. Are you willing to participate in our low-cost sensor project that will involve installing a small air sensor in your apartment/house and allowing it to collect data for 12 to 15 months?
 Yes No
6. Will you be able to provide a wireless internet connection for the sensor?
 Yes No
7. Are you interested in learning how to set up and install an air sensor outdoors at your apartment/house?
 Yes No

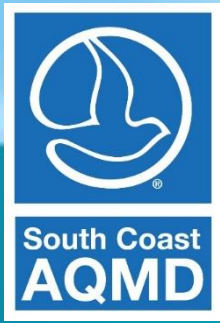
Context and Awareness of Air Quality and Sensors

1. To what extent do you agree with the following statement: "Issues related to air quality affect me and/or my family?"
Strongly disagree Disagree Neutral/Undecided Agree Strongly agree
2. How concerned are you about air quality?
Not at all Slightly Moderately Very Extremely
3. How concerned are you about air quality affect you and/or your family (e.g., trigger asthma, affect visibility, cause coughing or other respiratory problems)?
Not at all Slightly Moderately Very Almost Always
4. In your opinion, how often does air quality affect you and/or your family (e.g., trigger asthma, affect visibility, cause coughing or other respiratory problems)?
Never Seldom Sometimes Often Almost Always
5. What air pollutants are you concerned about in your area?
 Particle pollution Ozone Diesel exhaust
 Nitrogen oxides (NOx) Traffic emissions Smog
 Other (please specify: _____) Volatile Organic Compounds (VOCs) I am not concerned about air pollution
6. What are the biggest causes of air quality problems where you live, so far as you know?
 Cars Industry Residential wood burning
 Refinerries Auto repair shops Ports I don't know
 Other (please specify: _____)
7. How do you typically get information about air quality in your community?
 News outlet Federal government website Local government website
 Phone app Social media Other (please specify: _____)
8. How often do you check local air quality information before planning your outdoor activities or other behaviors (e.g., opening windows, exercising outdoors, etc)?
Never Seldom Sometimes Often Almost always

8. How familiar are you with low-cost air quality sensors?
Not at all Slightly Moderately Very Extremely
9. In your opinion, how credible are data from low-cost air quality sensors?
Very Poor Poor Acceptable Good Very good
10. For what types of applications do you think low-cost air quality sensors could be useful to you and your community?
 Understanding local pollution sources Personal air quality information Planning for outdoor activities
 Other (please specify: _____)
11. What issues do you think are important to consider before selecting an air pollution sensor to monitor air quality?
 Sensor sensitivity Sensor selectivity Interferences Ease of use Price Portability
 Battery life Reliability Accuracy Precision Weight
 Durability Other (please specify: _____) I don't know
12. Do you think you would change your behavior (e.g., choose to exercise indoors or during a different time of day) based on air quality sensor data?
 Yes No I don't know

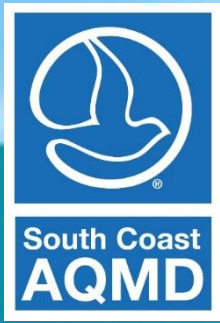
Demographic Information

- For statistical purposes, we must ask:
1. What is your age?
 12-17 18-24 25-34 35-44 45-54 55-64 65+
2. Which categories best describe you (check all that apply):
 White Black or African American American Indian/Alaska Native
 Hawaiian Native or Pacific Islander Middle Eastern or North African Asian
 Hispanic, Latino, or Spanish origin Other
3. Highest level of education attained (if currently enrolled, the highest degree received):
 Some high school, no diploma High school graduate, diploma or the equivalent
 Some college credit, no degree Trade/technical/vocational training
 Associate degree Bachelor's degree
 Master's degree Doctorate degree (Ph.D.) Professional Degree (e.g. M.D. or J.D.)
4. How many people live in your home (Including yourself)? _____
 Yes No
5. Do you have any children under the age of 18 living in your household?
If yes, please provide their ages: _____

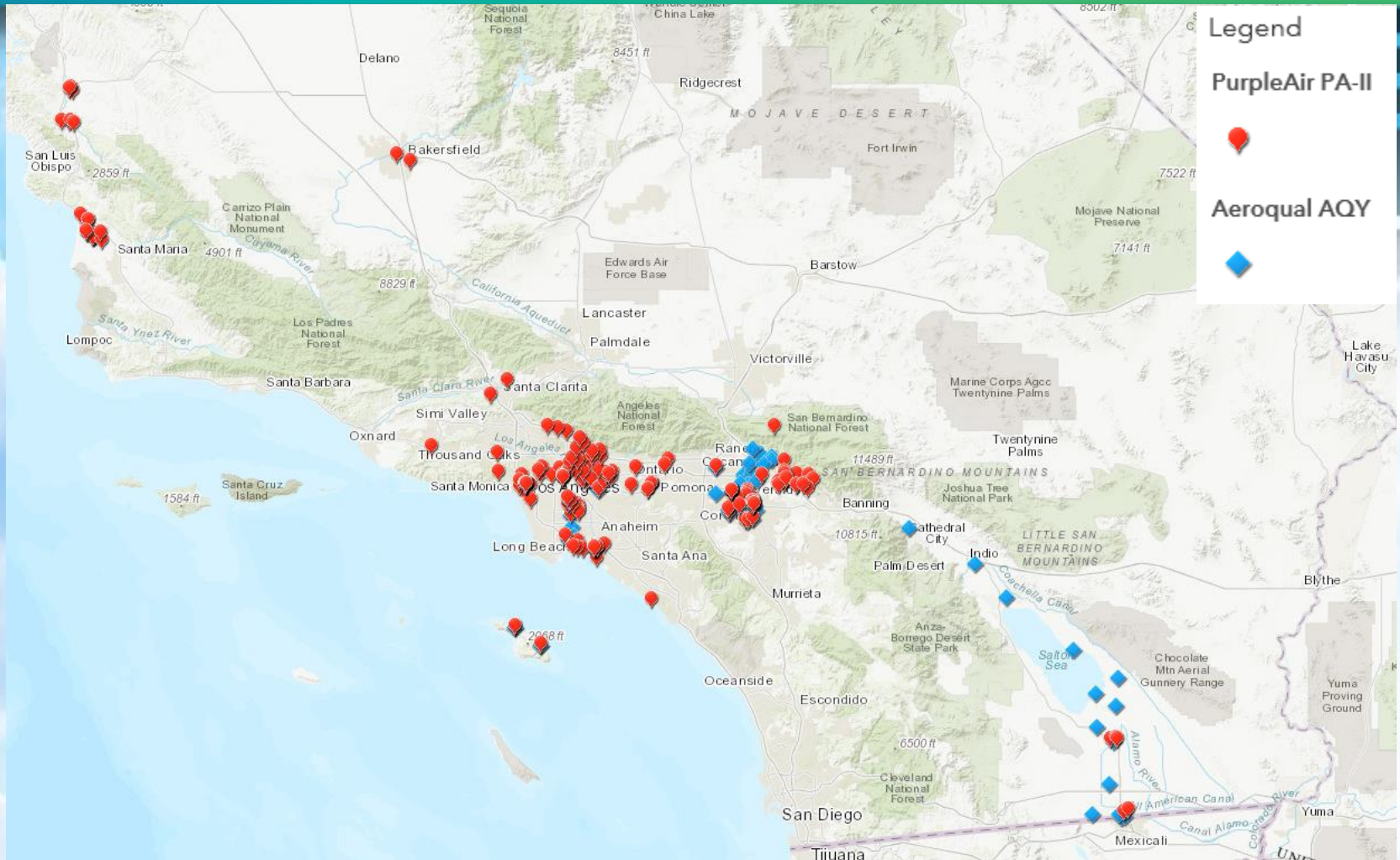


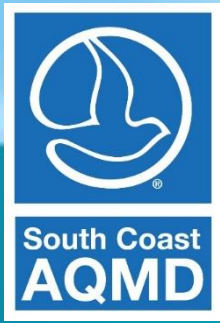
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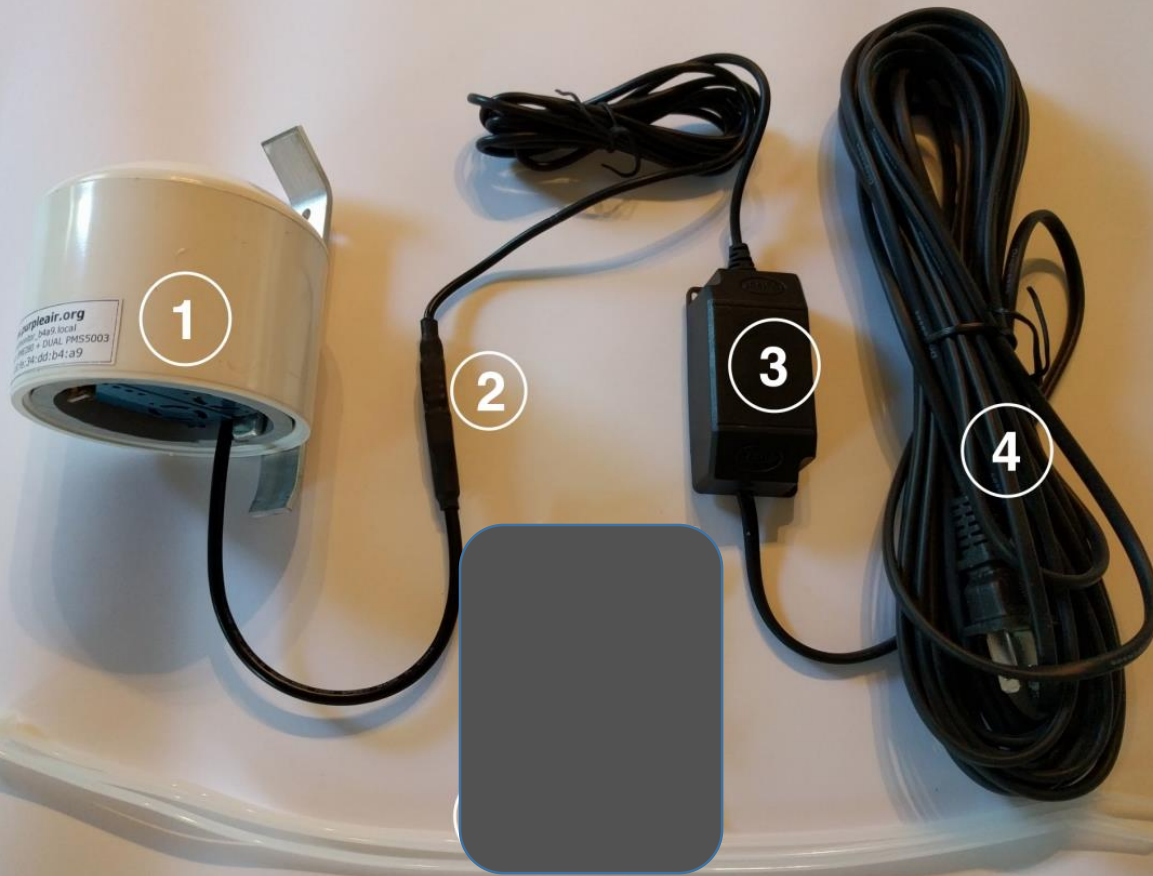


Participating Communities

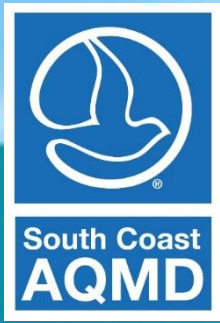




PurpleAir PM Sensor



- 1) PA-II Dual Laser Sensor.
- 2) Micro USB connector.
- 3) 5V 2A USB Outdoor Power Supply.
- 4) 17 foot power cable.

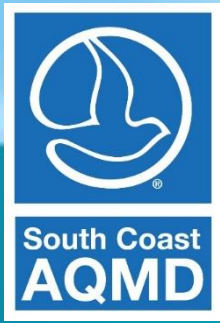


3 STEPS

1. INSTALLATION

2. WiFi CONFIGURATION

3. REGISTRATION



INSTALLATION

www.purpleair.com/install

Install



Installing Your PurpleAir Sensor

Congratulations PurpleAir sensor owner!

Installation Tips

- The housing is designed to protect the device from the elements while allowing air to flow freely past the two laser counters.
- The power supply should be mounted so that it will not be submersed in water or covered by snow.
- Use a "drip loop" to prevent water running down wires and into electronics.
- If possible, mount the sensor in a shady spot out of direct sun.
- If possible, mount the sensor away from vents or other local sources of pollution like BBQ's.
- Use either cable ties or a screw to mount the sensor and power supply.
- Connect the power supply to a power outlet and tuck the wires away.



Next: Configure WiFi

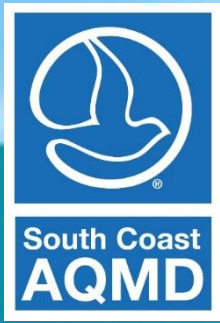
Press continue to configure your sensor to connect to WiFi...

[Continue »](#)

Skip to: Register

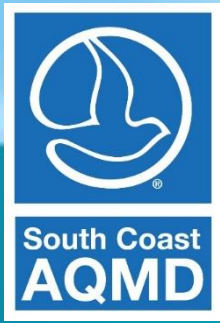
Press register to skip WiFi setup and register the sensor on the PurpleAir map...

[Register »](#)

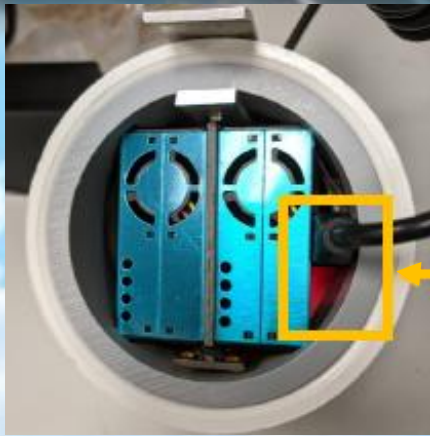


Siting



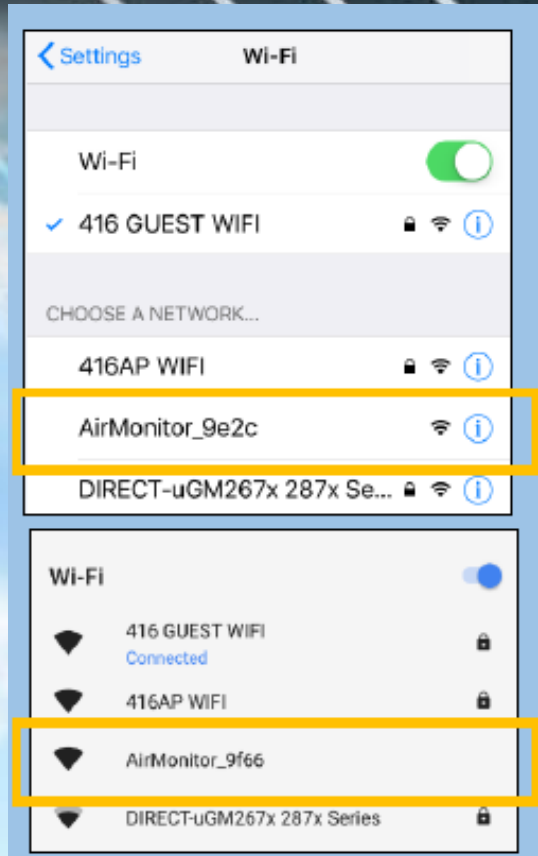


WiFi CONFIGURATION



Plug in the power chord and ensure that the power is turned on.

You will see a red light if powered.



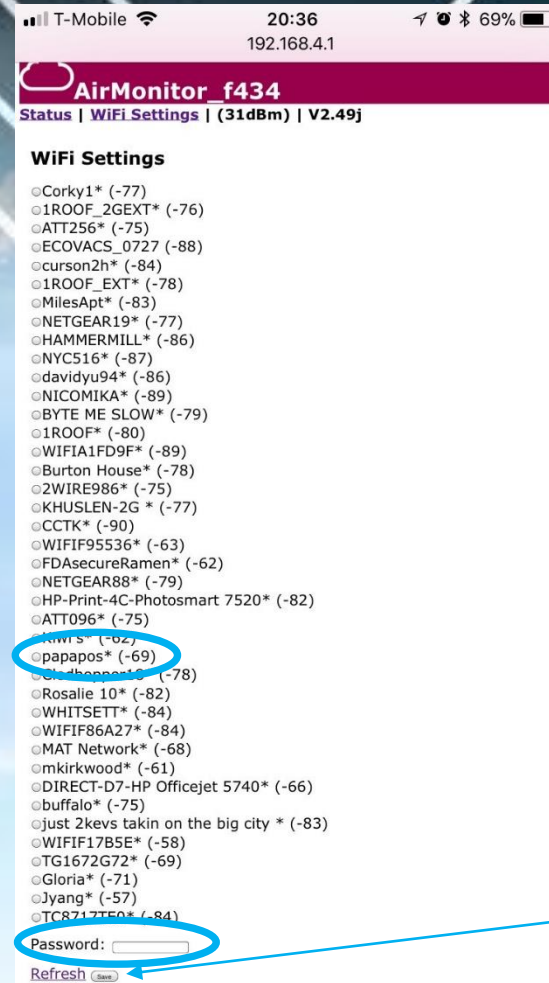
On a device:

1. Go to "Settings" and Click on "Wi-Fi" settings.
2. On the list of WiFi network names, find "AirMonitor_XXXX" (XXXX will be actual letters and numbers like "9f66")

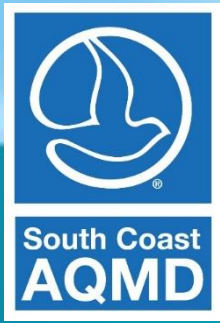


WiFi CONFIGURATION

Go To → 192.168.4.1



SAVE!



REGISTRATION

www.purpleair.com/register

Register Your PurpleAir device

Congratulations, you are one step away from adding your device to the map!

Please complete the following form to place your sensor on the PurpleAir Map:

Device-Id (MAC)* Printed on the device label just above the bar code. Please include the colons (:)

Associated Email* This email address would have been used in the device purchase or other communication with PurpleAir. (A copy of this sensor registration will be e-mailed to this address.)

Installed* Outside Inside

Location Name* The name that appears on the map **SCTV_##**

Visibility* Public (everyone) Private (only me)

Set a location on the map

Map Location* (drag the marker to adjust)

Latitude 34.0286226

Longitude -117.8103367

Interactive Map

Data Processors

In addition to PurpleAir, send data and the sensors "Map Location" to these 3rd party services:

Data Processor #1 To help citizen science, share your device's location and sensor readings with Weather Underground, an IBM business.

Weather Underground

Create new Weather Underground sensor ID

Data Processor #2 None



Device Owner's Information

This person can manage the device on the PurpleAir web site and may receive device notifications.

Owner's Name* We use this name when sending alerts for this device.

Probably Your First & Last name

Owner's Email* Used as a key to link you with this device. It must match any current value you may have set before.

An email address

SMS Alert Phone Number May be used to send text alerts for this device.

Your phone number

PurpleAir Terms Of Use And Conditions

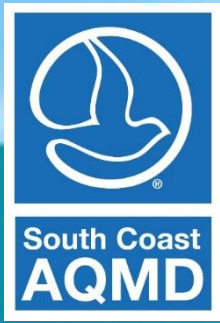
(Updated as of June 1, 2017)

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I agree with the terms and conditions

Register



Logbook/e-journal/e-diary thoughts

Where is the sensor:

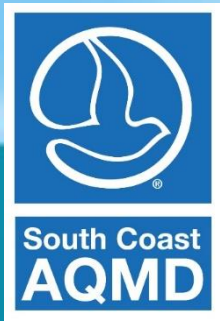
- Where is your low-cost air sensing device located?

Air quality awareness:

- Did you look at the data today?
- Were air quality values higher or lower than yesterday?
- If the values were higher, what do you think caused them?
- If the values were lower, what do you think happened?
- What types of activities around your home could be contributing to particle levels at your sensor?
- Have you looked at air quality information from another source (e.g., www.airnow.gov , www.aqmd.gov)?
- If so, how do the PM values differ?

Weather:

- Is it windy today?
- Is it rainy today?



www.purpleair.com/map



U.S. EPA Science To Achieve Results Grant:
*Engage, Educate and Empower California Communities
 on the Use and Applications of Low-Cost Air Monitoring Sensors*

Log-Notes

User Name:

Sensor ID:

Address/Location:

Date (mm/dd/yy)	Time	Sensor Reading					Activity/Observation/Event
		Short-term AQI	Channel A Real-time PM _{2.5} (µg/m ³)	Channel A 24-hour PM _{2.5} (µg/m ³)	Channel B Real-time PM _{2.5} (µg/m ³)	Channel B 24-hour PM _{2.5} (µg/m ³)	
		37	9	40	10	41	

[Particle Pollution \(PM\)](#)

PM _{2.5}	primary	1 year	12.0 µg/m ³	annual mean, averaged over 3 years
	secondary	1 year	15.0 µg/m ³	annual mean, averaged over 3 years
	primary and secondary	24 hours	35 µg/m ³	98th percentile, averaged over 3 years

On Wed Jan 03 2018 10:16:29 GMT-0800 (Pacific Standard Time)

Short-term PM2.5 is LOW at 9µg/m3

Short-term AQI

37

AQMD_NASA_8

Good



0-50: Air quality is considered satisfactory, and air pollution poses little or no risk

Trends Particles Sensor Current Weather

Channel A Running Averages



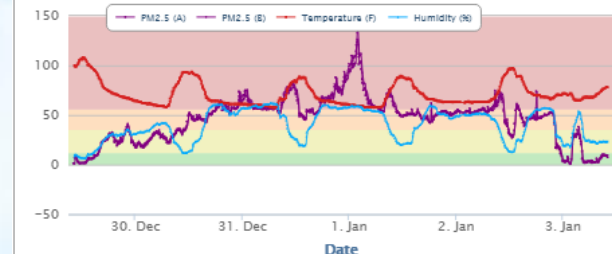
Channel B Running Averages

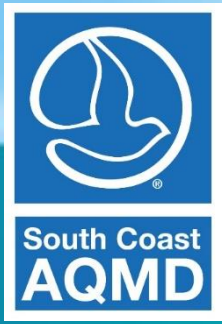


* Laser Temperature: 79°F * Laser Humidity: 24%

* Approximate conditions the laser is exposed to. Readings are affected by the electronics, sunlight or wind. Temperature may be elevated and humidity under estimated.

Real Time Short-term Average One Hour Average 24 Hour Average





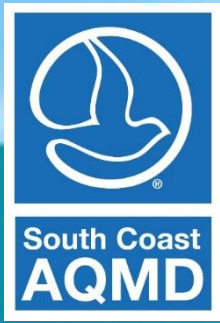
Community Surveys/Workshops

Surveys/Workshops before/during/after the sensor deployment to assess the Community:

- Knowledge of air pollution, monitoring, and exposure
- Perception of sensor operation and data usefulness

GOAL -> Inform the Sensor Educational Toolkit:

- Informational material about “low-cost” sensors
- Best practices for data collection and interpretation
- Analysis reports
- Identification of pollution sources



Key Qs...and As

Q: How many sensors will be deployed during this study?

A: We have already purchased over 400 PM sensors to be deployed throughout California communities. We are also working with University of Auckland and Aeroqual (New Zealand) to deploy 100 of their multi-pollutant sensor devices.

Q: Where will the sensors be deployed?

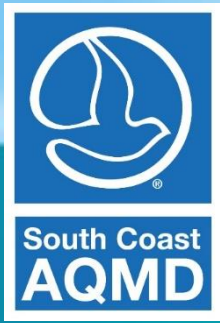
A: Outdoors, at a location suitable to collect representative air quality data.

Q: What is going to happen with the sensors after the project ends?

A: The PM sensor is yours to keep and the sensor data will be posted online even after the end of the study.

Q: How are residents/project participants going to access the data?

A: Via dedicated website.



Key Qs...and As

Q: Is the data going to be presented in a way that is easy to interpret?

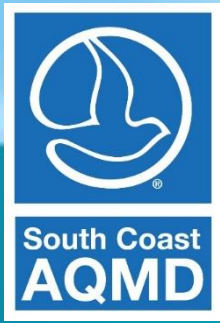
A: Yes. One of the main goals of this study is to communicate air quality data in a way that is easy to interpret by the general public.

Q: Other than providing access to WiFi and access to a power outlet, what other commitments are required from project participants?

A: Commitment to participate in meetings/workshops before, during and after the sensors have been deployed.

Q: Can schools participate in the project? If so, can they use the sensors as an educational tool?

A: Yes. We will work with a few schools in different parts of California, deploy sensors at students' and teachers' homes, and educate them in the use and operation of air quality sensors.



Thank you!