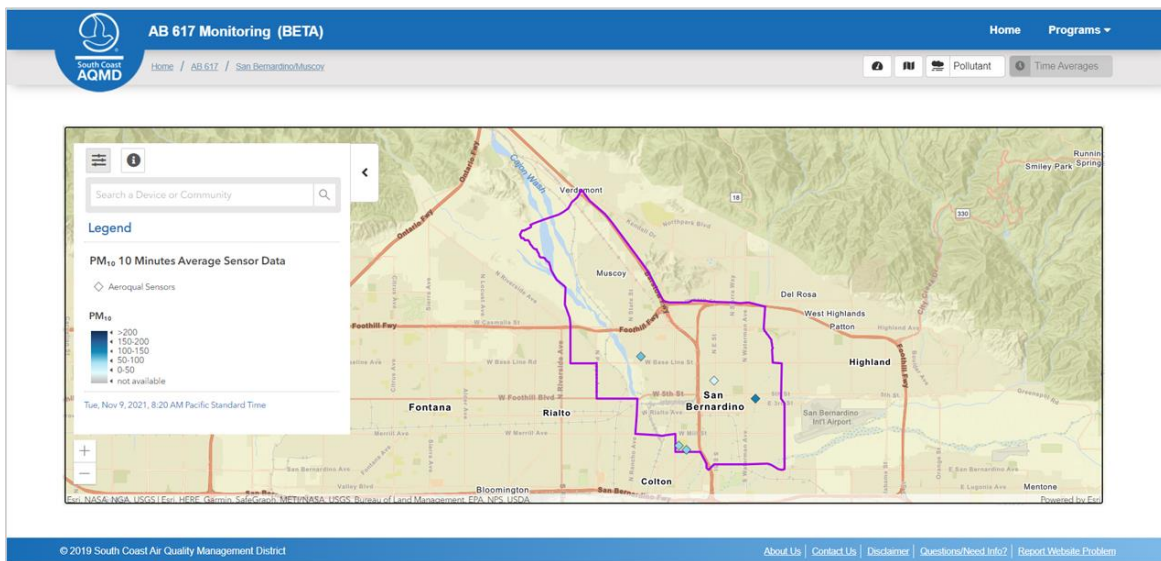


Map & Dashboard User Guide

Use maps and plots to view data from sensors in your community and learn more about your local air quality

AB 617 Dashboard



General Version

Last Updated: November 11, 2021 (version 8)



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About

Networks of air quality sensors can help answer questions about air quality in your community. Several of these networks have been deployed in AB 617 communities using Aeroqual AQY 1.0 sensor units deployed by community members. These are multi-pollutant sensors that measure ozone, nitrogen dioxide, and particulate matter.

The data collected by the AQY v1.0 sensor network is streamed into the Aeroqual Cloud system. Once there, the data is retrieved and monitored through applications that detect potential drift and potential sensor health issues. In addition, a monthly calibration is performed on the AQY v1.0 sensor network using the Aeroqual MOMent MAtching (MOMA) calibration approach to calibrate the sensor units to a selected proxy reference site.

The South Coast AQMD Air Quality Sensor Performance Evaluation Center (AQ-SPEC) has evaluated the performance of the Aeroqual AQY v1.0 sensor, with reports found on the Aeroqual AQY v1.0 sensor page.

Aeroqual AQY v1.0 - AQ-SPEC Evaluation Reports: www.aqmd.gov/aq-spec/sensordetail/aeroqual-aqy-v1.0

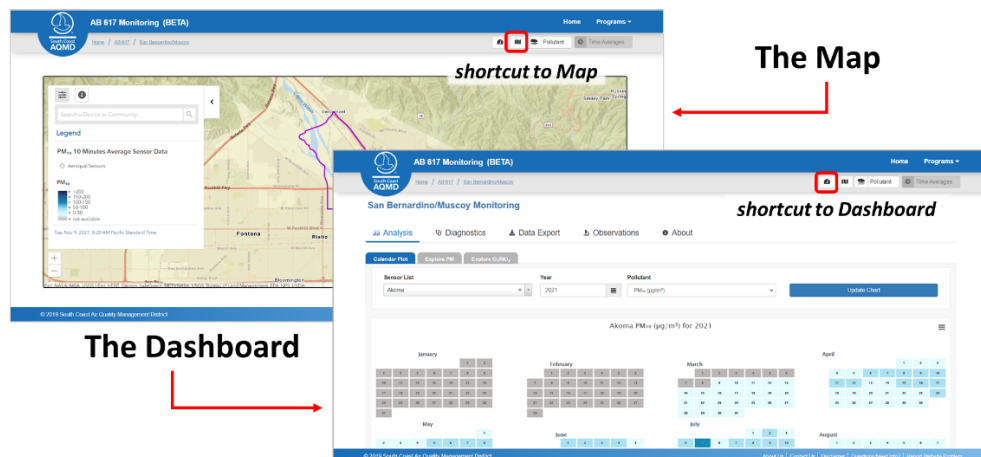
More information on Aeroqual AQY network: www.aqmd.gov/aq-spec/special-projects/aeroqual-aqy-deployments

Once the data is processed as described above, the data is retrieved by South Coast AQMD and made available in the Map and Dashboard. The Map and Dashboard provide an interactive experience to explore the quality controlled (QC'd) calibrated AQY v1.0 data collected within the community. This User Guide will show you how to use the map and plotting features available in this tool; it also includes guiding questions to help you review the data.

The data displayed has passed QC checks and has been calibrated, which improves the quality and reliability of the data. However, given that the data was collected using low-cost air quality sensors, it is not directly comparable to data from regulatory air monitoring stations. For this reason, the data should be used for informational and educational purposes only.

For more information on AB 617 communities and activities: www.aqmd.gov/nav/about/initiatives/environmental-justice/ab617-134

Link to Map and Dashboard Tool: <https://aqportal.aqmd.gov/public/index>



This tool is comprised of two main parts: The Map and the Dashboard (shown above). The Map allows you to view the sensor network and explore recent data from individual sensors. The Dashboard provides a range of plots and visualizations that can be used to analyze and interpret current or historical data from individual sensors or the whole network.

Part I: Background

Site Descriptions and Types

Each sensor is identified by a name. On the “About” page in the Dashboard you can see the names and a description of each sensor’s location. In addition, sensors are assigned site types (also on the “About” page). Definitions of the site types are provided below. Site types may provide important context during data interpretation. For example, if you are comparing data from a near-source site to data from an area monitoring site, then knowing these categories may help to explain differences in trends or pollutant levels.

Site Types

- Community site – neighborhood: site selected by the community, not near any major sources
- Community site – sensitive receptor: site selected by the community and near a school, health care facility, or similar site where there are likely to be sensitive or vulnerable populations
- Community site – near source: site selected by the community and near a potential emissions source, such as a major roadway or industrial facility
- Air monitoring site - area: regulatory air monitoring station intended to collect data representative of a large population (these types of sites are intentionally located away from sources)
- Air monitoring site - near source: regulatory monitoring station located near a source of emissions

Color Scales The table below lists the limits that define the color scale for each pollutant. This color scale is intended to illustrate relative differences in pollutant levels, and the limits should not be used for any public health recommendations. For all pollutants, the same limits are applied across all time averaging periods. Though it should be noted that for O₃, the highest rolling 8-hr average value from the 24-hour period selected is used in place of an actual 24-hour average. This difference in approach is based on the typical daily trends associated with this pollutant.

	PM_{2.5} (µg/m³)	PM₁₀ (µg/m³)	O₃ (ppb)	NO₂ (ppb)
1	0-12	0-50	0-30	0-35
2	12-35	50-100	30-60	35-70
3	35-55	100-150	60-90	70-100
4	55-150	150-200	90-120	100-120
5	>150	>200	>120	>120

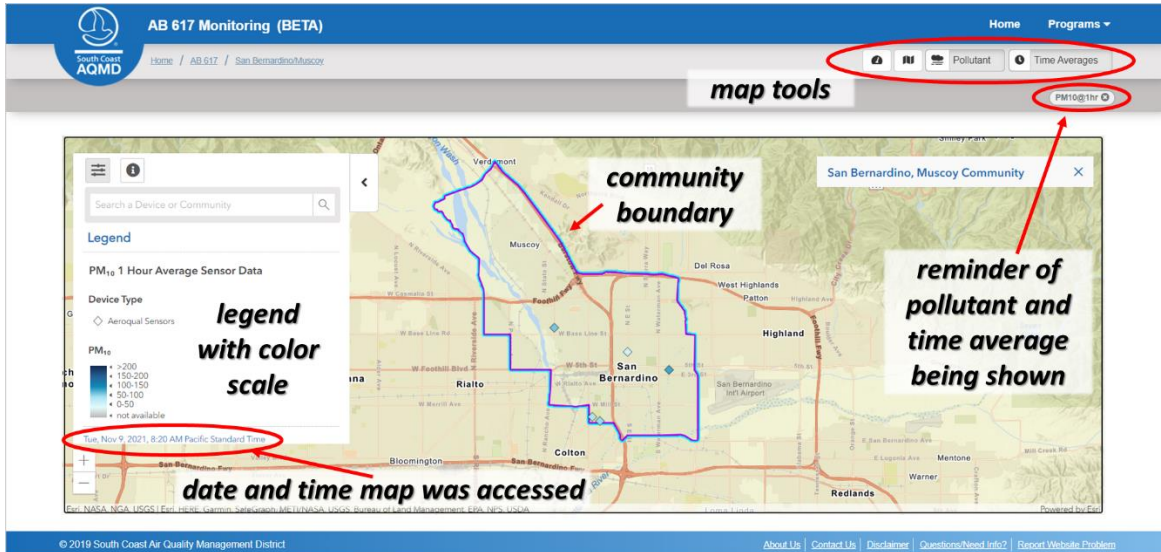
Note, for each category, if a value is equal to one of the limits then the value is included in the larger category (e.g., a PM_{2.5} value equal to 12.0 µg/m³ would be included in the second category)

Part II: Exploring the Data – The Map

The first part of the tool is the Map, which allows users to view the sensors on an interactive map and in relation to the AB 617 community boundary – providing insight into the spatial variability of air pollutants in the community. The type of sensor is indicated by the shape of the marker and colors are based on pollutant concentration.

Layout

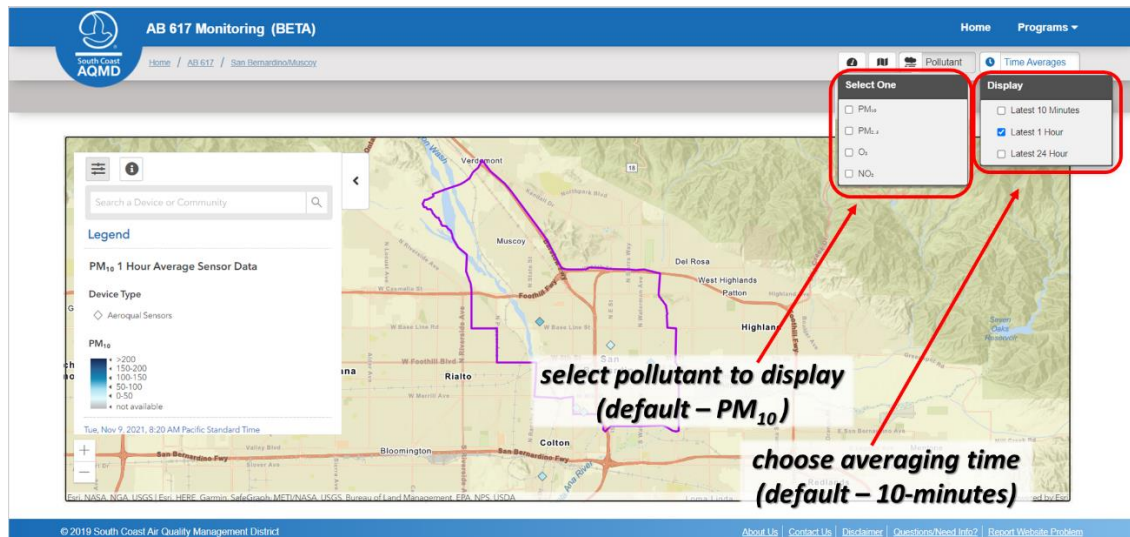
- Use the tools at the top of the map to control what and how sensor data is displayed.
- The legend on the left includes the color scale to help interpret the map.



Filtering and Selecting Pollutant Data to Display

Questions to consider:

- Is there a site where pollutant levels are consistently high or low? If so, what could be the cause?
- Are there any clear spatial gradients? (e.g., consistently higher levels on either the western side or eastern side of the community)

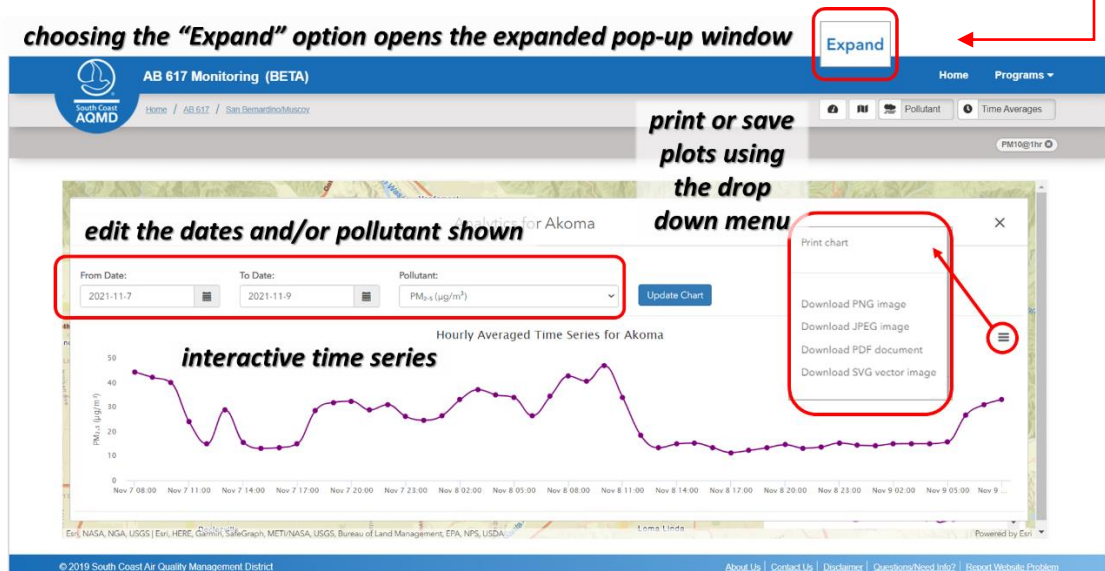
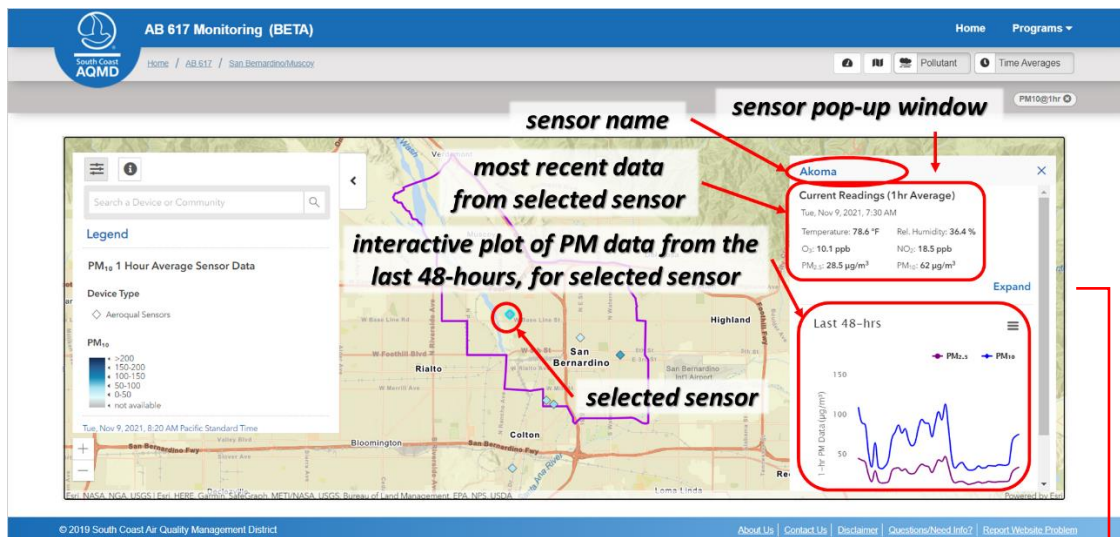


Sensor Pop-up Windows

- Clicking on a sensor opens a pop-up window providing current readings from the selected sensor and a time series plot on PM data or the prior 48-hours.
- Clicking the “Expand” option will then open the expanded pop-up window containing a larger timeseries for the same sensor where the dates and pollutant displayed may be changed.

Questions to consider:

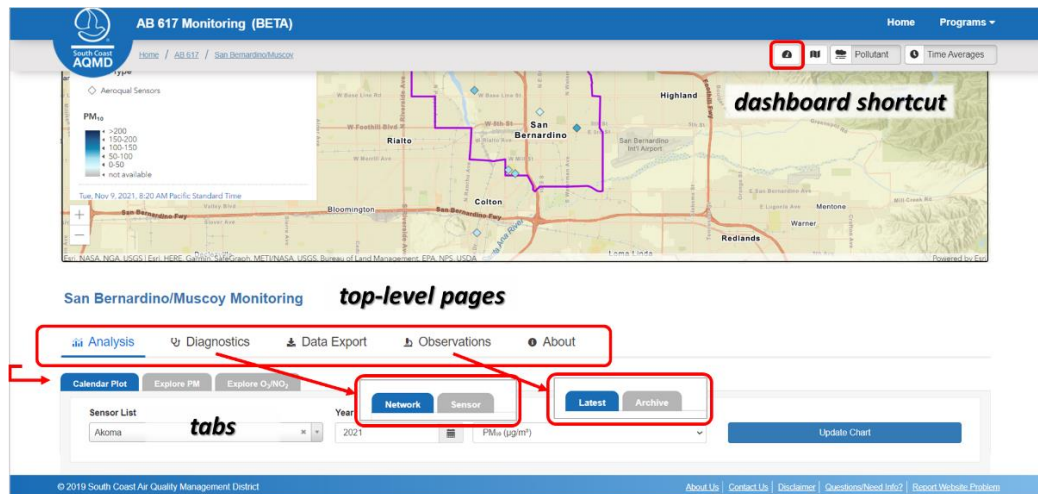
- Does the time series of the last 48-hours match your observations of local air quality?
- Does looking at the recent data from different sensors on the map reveal any interesting differences? If so, these differences could be further explored in the Dashboard below the Map.



Part III: Data Analysis Tools – The Dashboard

Layout

The Dashboard is below the map. You can also reach the Dashboard using the shortcut button. At the top of the webpage. The Dashboard is organized into five pages: Analysis, Diagnostics, Data Export, Observations, and About. Some pages also provide tabs offering different visualization and analysis tools.



Analysis

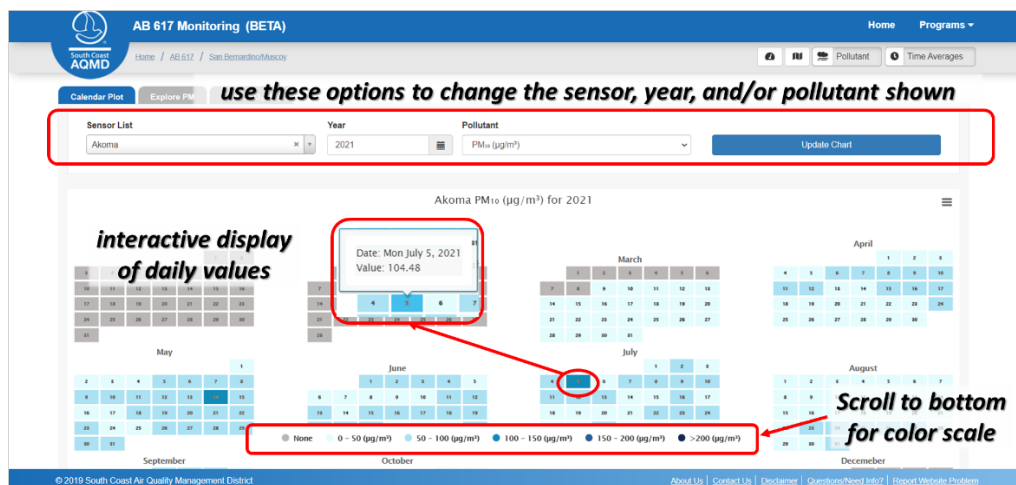
The Analysis page allows you to explore data from a single sensor using a wide variety of plots and visuals.

Calendar Plot

- The calendar plot shows the average daily pollutant concentrations. The greater the pollutant concentration, the darker the day is shaded. If a cell is grey, a value is not available.
- Use options at the top of the page to either change the year or pollutant displayed.
- You can also hover over a specific day to view the average value for that day.

Questions to consider:

- Do you see any interesting air quality events? (e.g., a single day of elevated pollutant levels)
- How do pollutant levels vary seasonally? Can you explain these trends?

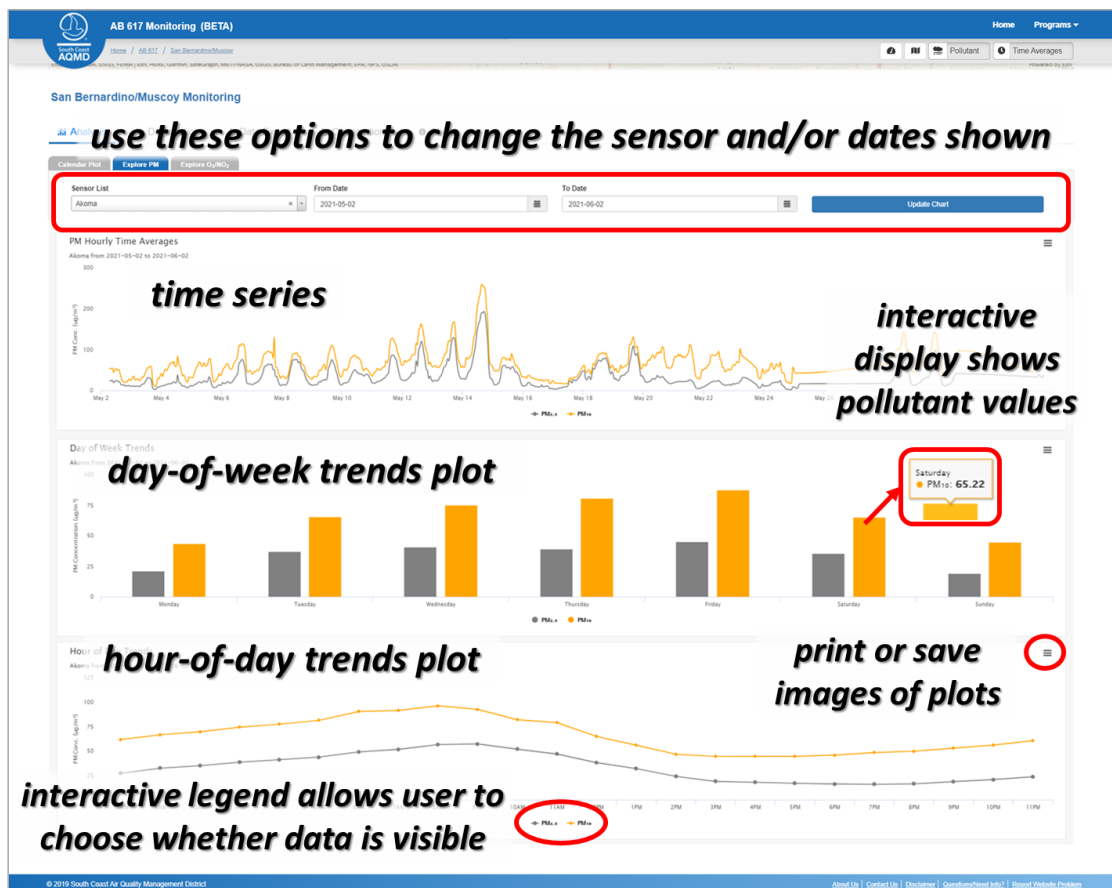


Explore PM & Explore O₃/NO₂

- The second and third tab on the Analysis page offer tools to examine the sensor data for temporal patterns or patterns over time. Note, the only difference between the two tabs is that one displays data for particulate pollutants and one displays data for gas-phase pollutants.
- The options at the top of each tab control the sensor and dates shown in all three plots below.
- The first plot is a simple interactive time series which is defaulted to last 30-days and displays hourly averaged concentrations.
- The second plot displays the average for each day of the week across the timeframe selected, defaulted to last 30-days. For example, the bar for Monday indicates the average concentration for all the Mondays within the time frame selected. This plot provides the day of week pollutant trend information.
- The third plot displays the average for each hour of the day across the timeframe selected. For example, the value shown for 1:00 am would be the average data collected between 1:00 and 1:59 am for every day within the time frame. This plot provides the diurnal air pollutant trend information.

Questions to consider:

- *Is there a day of the week or time of day when pollutant levels tend to be highest/lowest?*
- *How do the weekends compare to the weekdays? Why might this be the case?*
- *How do pollutant levels vary throughout a typical day? When do pollutant levels tend to be lowest?*
- *Are these temporal patterns consistent across different sensors in the community?*



Diagnostics

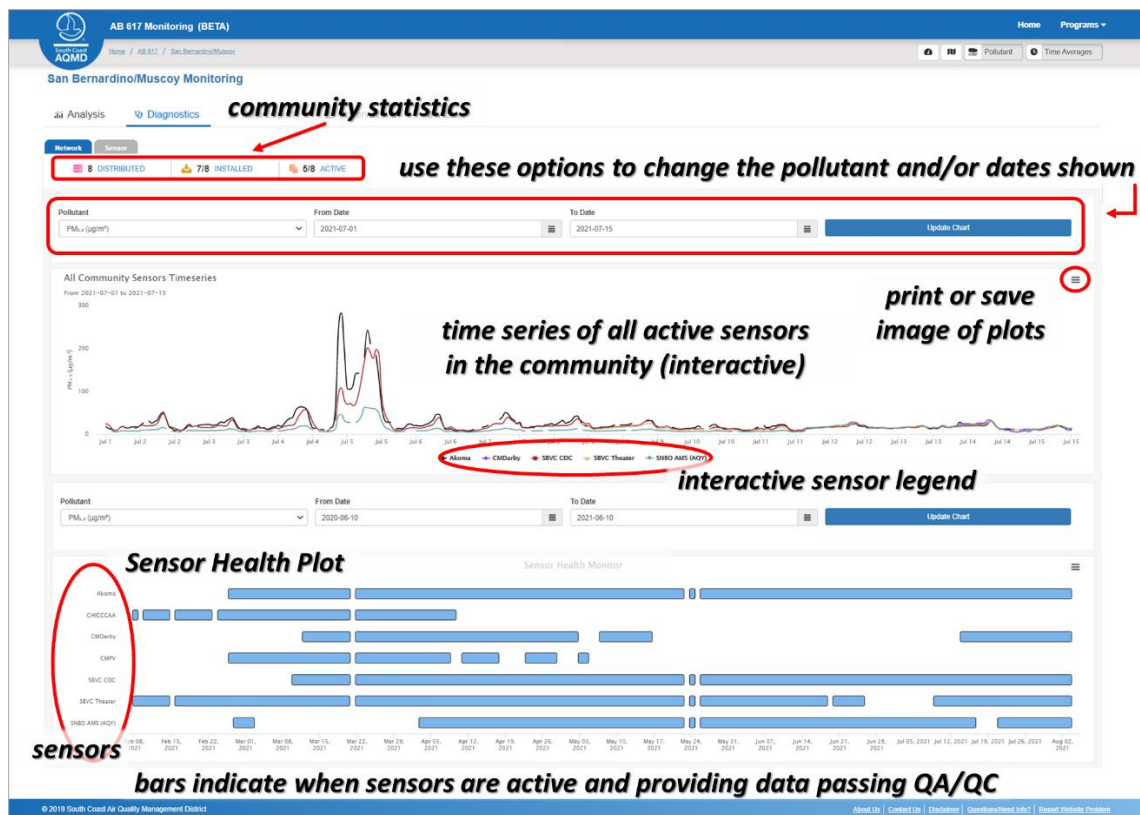
The Diagnostics page allows you to review data from the whole network and directly compare two sensors.

Network

- In the Network tab, you can view data from all active sensors in the community and an Aeroqual AQY v1.0 unit placed at a nearby air monitoring station.
- This allows for a qualitative comparison of the data.
- Use the tools at the top to change the dates and/or pollutant displayed.
- You can also view a Sensor Health Plot, which shows when data is available and passing QA/QC for each individual sensor – knowing this information can help you plan your analysis of the network data (the default period for this plot is the previous year).
- Note, on this page community statistics are also available, including the number of sensors distributed, installed, and currently active (or sending data).

Questions to consider:

- Are the trends similar across all sensors?
- Do any sensors typically display higher levels? If so, are these sensors installed near pollution sources and labeled as CS-NrSrc sites?
- When were the most sensors active? (these periods are ideal for directly comparing sensor data)

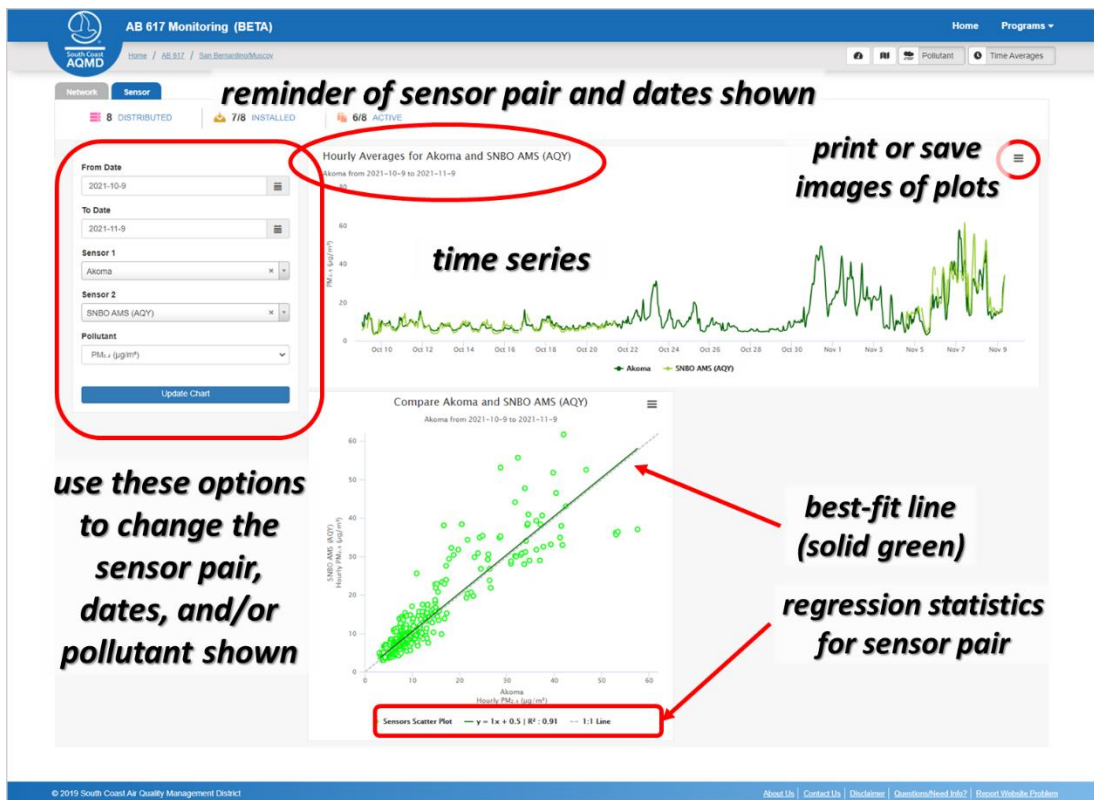


Sensor

- The tools in the Sensor tab can be used to directly compare two selected sensors.
- Use the options on the left to select a timeframe, two sensors, and the pollutant you would like to display.
- The plots illustrate (1) how well the sensors agree with each other (see the scatter plot) and (2) how the trends between the two sensors compare (see the time series plot). Remember, that many factors (e.g., distance, nearby sources, etc.) influence how similar or different the data may be from the two sites.
- In terms of the regression statistics, a slope close to 1.0 indicates that Sensor 1 and Sensor 2 are reflecting similar levels. A slope offset indicates that one sensor is experiencing higher values than the other sensor. The intercept can be an indicator of bias (e.g., whether Sensor 1 may be consistently under or over-predicting pollutant concentrations in comparison to Sensor 2). The coefficient of determination R^2 tells us how well the trends agree between the two sites; an R^2 closer to 1.0 indicates more agreement and an R^2 closer to 0.0 indicates less agreement.

Questions to consider:

- Consider, does the data from the two sensors agree in terms of trends and/or levels?
- If not, why might this be the case? Consider the distance between the two sensors, the types of sites, geography of the region, and potential sources nearer to one site or the other.



Data Export

On the Data Export page, you can preview data and download data that has passed QC checks.

- Use the tools on the left to change the sensor, time frame, and averaging time selected.
- Downloaded data is in an Excel format.

Questions to consider:

- Would you like to try a more custom analysis or try to create a custom visualization not available in the current version of the Dashboard? If so, it may be possible to do this by downloading the data and working in Excel.

The screenshot shows the 'San Bernardino/Muscoy Monitoring' dashboard. A red box highlights the filter controls on the left, including a sensor dropdown menu (currently set to 'Aloma'), date range selectors (From Date: 2021-05-26, To Date: 2021-05-02), and a time average dropdown (set to '10 Min'). Below these are 'View Data' and 'Download' buttons. A red arrow points from the 'View Data' button to the data table. Text annotations state: **“View Data”: updates preview** and **“Download”: save a copy of data**. The data table has columns for Date/Time, SensorID, SensorTitle, Latitude, Longitude, AverageType, O3, NO2, PM2.5, PM10, Temp, Humidity, DewPoint, and QC. The table contains 15 rows of data for the date 7/27/2021.

use these options to change the sensor, dates, and/or time averaging period shown

Date/Time (Local Time)	SensorID	SensorTitle	Latitude	Longitude	AverageType	O3 (ppb)	NO2 (ppb)	PM2.5 (ug/m ³)	PM10 (ug/m ³)	Temp (F)	Humidity (%)	DewPoint (C)	QC Comments
7/27/2021 5:00:00 PM	ADY BD-1112	SNBO AMS (AQY)	34	-117	10min	59.9	49.9	15.8	33.3	95.8	29.2	15.3	
7/27/2021 5:30:00 PM	ADY BD-1112	SNBO AMS (AQY)	34	-117	10min	54.6	39.3	13.4	25.8	85.2	26.9	13.3	
7/27/2021 6:00:00 PM	ADY BD-1112	SNBO AMS (AQY)	34	-117	10min	55.2	35.6	12.6	23.6	95.1	25.8	12.5	
7/27/2021 6:30:00 PM	ADY BD-1112	SNBO AMS (AQY)	34	-117	10min	51.9	33.5	12.1	22.1	94.7	25.1	11.9	
7/27/2021 7:00:00 PM	ADY BD-1112	SNBO AMS (AQY)	34	-117	10min	49.6	32.6	11.6	20.8	94.5	24.8	11.7	
7/27/2021 7:30:00 PM	ADY BD-1112	SNBO AMS (AQY)	34	-117	10min	47.5	31.1	11.3	20.9	94.4	24.6	11.5	
7/27/2021 8:00:00 PM	ADY BD-1112	SNBO AMS (AQY)	34	-117	10min	48.9	29.5	11.2	20.9	93.6	25.6	11.7	
7/27/2021 8:30:00 PM	ADY BD-1112	SNBO AMS (AQY)	34	-117	10min	45.2	29	11.6	20.0	88	26	10.9	
7/27/2021 8:40:00 PM	ADY BD-1112	SNBO AMS (AQY)	34	-117	10min	46	28.7	11.5	20.3	93.1	25.9	11.6	
7/27/2021 8:50:00 PM	ADY BD-1112	SNBO AMS (AQY)	34	-117	10min	43.4	28.7	10.9	20.9	92.4	25.6	11.2	
7/27/2021 7:00:00 PM	ADY BD-1112	SNBO AMS (AQY)	34	-117	10min	40.8	26.3	10.5	19.1	92	25.8	11.1	
7/27/2021 7:10:00 PM	ADY BD-1112	SNBO AMS (AQY)	34	-117	10min	41.3	24.8	10.9	19.3	91.5	26.9	11.5	
7/27/2021 7:20:00 PM	ADY BD-1112	SNBO AMS (AQY)	34	-117	10min	43.7	24.4	11.4	19.6	90.8	27.1	11.8	

Observations

The Observations page is where more advanced analysis completed by South Coast AQMD staff will be posted. In addition, a mechanism for community members to share feedback or observations regarding sensor data will be added.

About

The About page contains useful contextual information, similar to what is shared in the Background section of this User Guide with more specific information to the community dashboard currently in view.

Additional Information

References

For more information on the calibration approach used to improve data quality for this network, take a look at the following publications:

Weissert, L., Miles, E., Miskell, G., Alberti, K., Feenstra, B., Henshaw, G.S., Papapostolou, V., Patel, H., Polidori, A., Salmond, J.A. and Williams, D.E., 2020. Hierarchical network design for nitrogen dioxide measurement in urban environments. *Atmospheric Environment*, 228, p.117428.

Miskell, G., Alberti, K., Feenstra, B., Henshaw, G.S., Papapostolou, V., Patel, H., Polidori, A., Salmond, J.A., Weissert, L. and Williams, D.E., 2019. Reliable data from low cost ozone sensors in a hierarchical network. *Atmospheric Environment*, 214, p.116870.

Miskell, G., Salmond, J., Alavi-Shoshtari, M., Bart, M., Ainslie, B., Grange, S., McKendry, I.G., Henshaw, G.S. and Williams, D.E., 2016. Data verification tools for minimizing management costs of dense air-quality monitoring networks. *Environmental science & technology*, 50(2), pp.835-846.

Disclaimer

The AQY v1.0 sensor network and related tools are intended to be used for educational and informational purposes. Furthermore, the code used to build these tools, the data processing steps, and the different features of these tools may be subject to revision depending on the needs of the project. The data collected by the AQY v1.0 sensor network is from low-cost air quality sensors that are processed and calibrated to improve the accuracy of the sensors. These sensors are not regulatory-grade instruments and should be used for informational purposes only.

Contact

Please feel free to reach out to the AQ-SPEC group at the South Coast AQMD with questions or comments related to the San Bernardino AQY sensor network or the Map and Dashboard Tool.

<http://www.aqmd.gov/aq-spec/contact>

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