



Purple Air Data Management Webinar

July 6, 2021

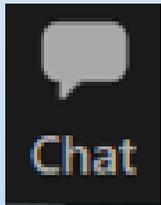
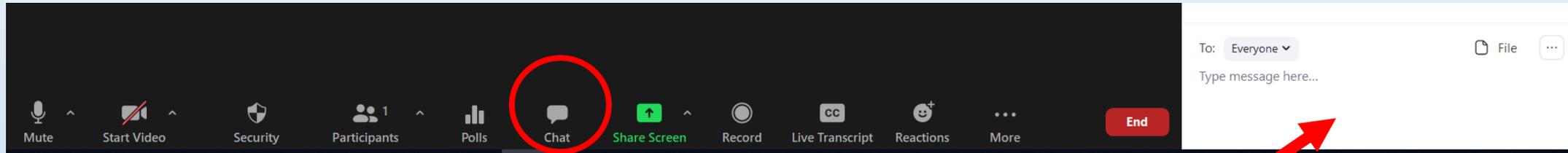
Tribal Air Monitoring



Support Center

NAU NORTHERN ARIZONA
UNIVERSITY

Webinar Logistics



Click on the “Chat” icon to submit questions in the “Chat” pane

Click raise “Hand” icon if you would like to be unmuted

This webinar is being recorded – URL for the recording will be posted webinar email



Presented by the Institute for Tribal Environmental Professionals
American Indian Air Quality Training Program
Questions? Contact Christal.Black@nau.edu



Polling Questions

Poll Question 1



- Which of the following best describes your role?
 - Environmental Staff
 - Community or Tribal Leader
 - Federal or State Partner
 - Other

Poll Question 2



- How many years have you worked in Air Quality?
 - Less than a year
 - 1-3 years
 - 3-5 years
 - 5-10 years
 - Over 10 years

Presenter



Michael King
NAU ITEP TAMS Center



Michael King is the Technical Training Analyst with NAU ITEP's Tribal Air Monitoring Support (TAMS) Center. Mike started working for ITEP in 2019 where he provides technical air monitoring assistance and data management for tribes throughout Indian Country. Before working with ITEP, he worked in tribal air programs for over ten years providing technical air quality management for the Southern Ute Indian Tribe, Ute Mountain Ute Tribe, and Navajo Nation.

Mike received his BS degree in Environmental Science from Haskell Indian Nations University in 2005 and a MS degree from Purdue University in 2013. Mike can be reached by e-mail at Michael.King@nau.edu

Webinar Overview



- What is a Purple Air Sensor
- Installation and Connectivity to WiFi
- Data Download and Basic Interpretation of Data
- Correcting Time Stamp and Charting Data
- Pros and Cons of the Purple Air Sensor

Poll Question 3



- Do you currently operate a Purple Air Sensor or other Air Quality Sensor?
 - Yes
 - No
 - Unsure

What is a Purple Air Sensor

- A low-cost air sensor to measure particulate matter (PM), temperature and relative humidity
- Laser particle counter to measure PM₁, PM_{2.5} and PM₁₀ in units of micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) of air as well as particle counts in units of microns per deciliter ($\mu\text{m}/\text{dl}$) of air
- PurpleAir sensors are easy to install and only require a power outlet and WiFi. They use WiFi to report in real time to the PurpleAir map: <https://www2.purpleair.com/>



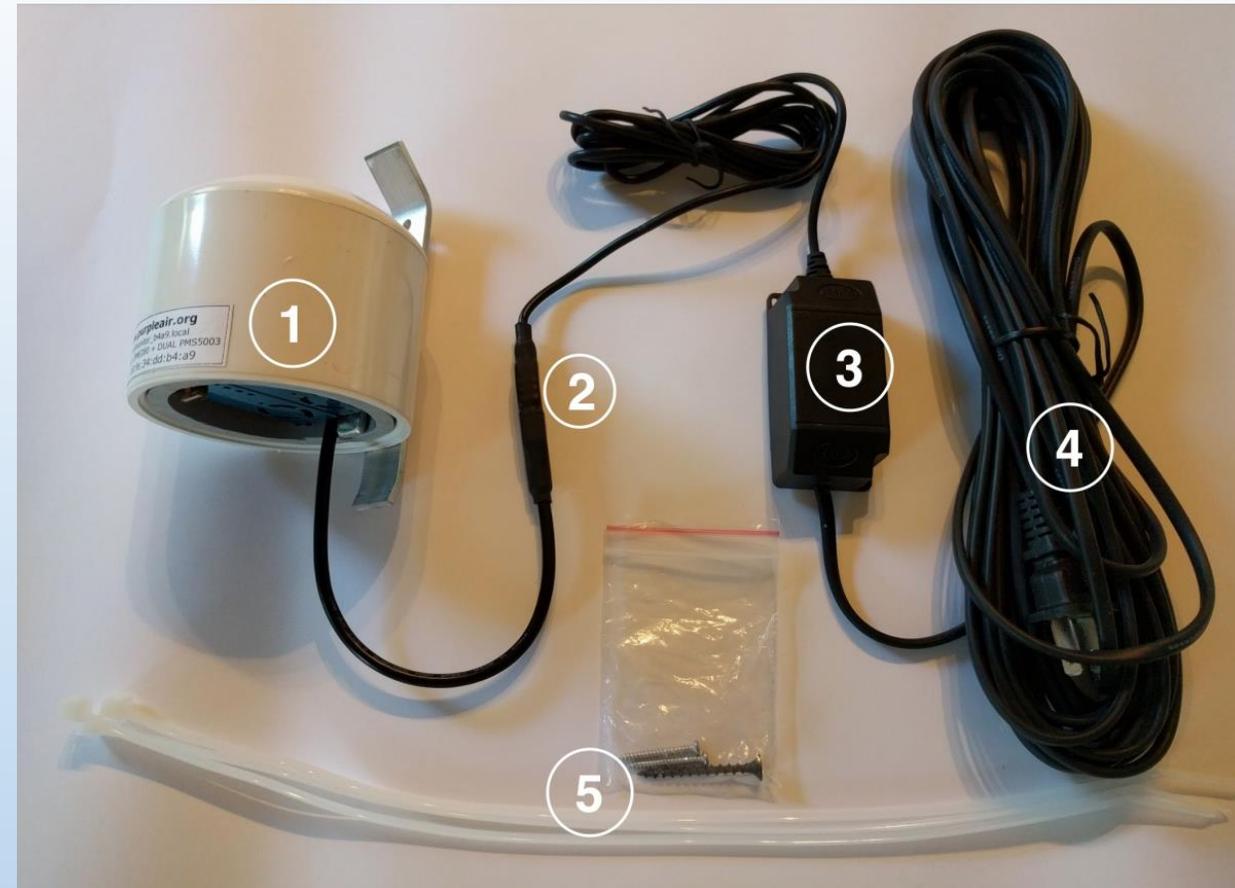
Installation of PurpleAir

In the Box

- Sensor
- Outdoor power supply
- Mounting screw
- 3 zip ties

Powering Sensor

- Plug the micro USB end of the power supply into the base of the sensor
- Plug the power supply into a wall outlet that works
- Look for dim red glow inside the sensor to confirm power



Installation of PurpleAir

- Select a location for mounting the sensor that has a solid Wi-Fi signal and is within 15 feet of a power outlet.
- Using zip ties or screws, mount the sensor under the eave of a roof or in a shady location.
- The sensor can be exposed to the elements, but it is preferable to mount the sensor in a location away from direct sunlight.



Tips on Purple Air Installation

- Choose a location that is easy to reach, power outlet is working, and within range of the WiFi network.
- Mount the sensor away from vents, local sources of direct pollution (i.e. burn barrels), and any foliage that would increase the likelihood of insects getting inside the laser counters.
- Install the sensor in the vertical position, with the open end facing toward the ground.
- Mount sensor high enough so rain water does not splash up into the underside of the sensor.
- Mount the power supply so that its does not submerge in rain water or become covered by snow.
- Use zip ties to fashion a "drip loop" to prevent water from running down the wires and into the electronics.
- Mounting the sensor in a shady spot to produce temperature readings that are not affected by direct sunlight.
- Please note that temperature readings are already elevated by as much as 10 degrees Fahrenheit due to heat generated by the WiFi module inside the sensor.
- Connect the power supply to a power outlet and tuck the wires away.

Connecting the Purple Air to WiFi

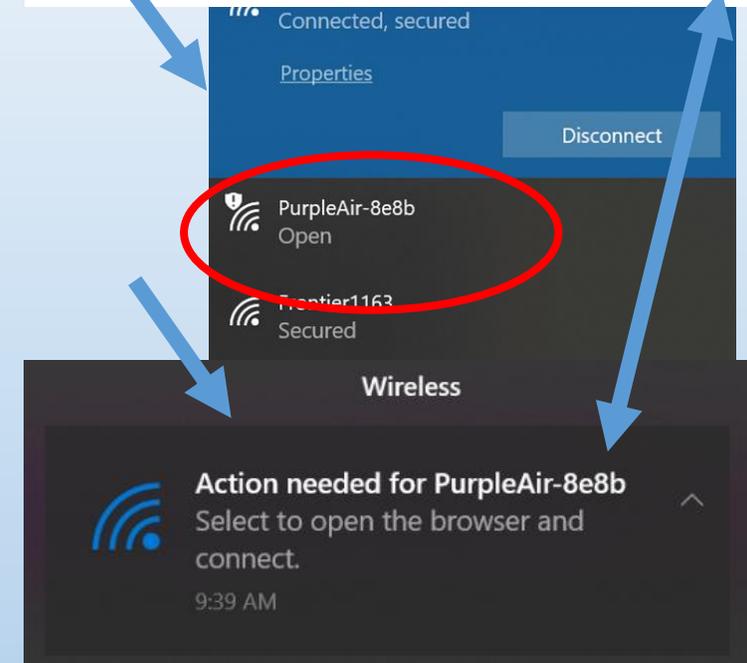
- Confirm power to sensor, go to www.purpleair.com/configure via PC, Tablet, Mobile Device
- Open the list of available WiFi networks. Click on WiFi network PurpleAir-****.
- A list of all available WiFi will show up as a pop-up on the PurpleAir configure website. If not click “Connect to Sensor”
- Choose the WiFi network you like the sensor to connect to, enter the password for that network, and click **Save**.
- The WiFi status bar will turn green once your PurpleAir sensor is connected to WiFi and transmitting data.

Configure WiFi

1. Make sure the sensor is connected to power.
2. Connect WiFi to a network called "AirMonitor_****" where **** is specific to the sensor.
3. Once WiFi is connected to the "AirMonitor_****" network, press the "Connect to sensor" button...

Sensor is available on: <http://192.168.4.1>

Connect to Sensor »



PurpleAir-8e8b

WiFi Connected

Looking good!

[Live](#) | [Average](#) | [WiFi Settings](#) | [Registration & Map](#)

Updated

If status looks good, [register on the map](#).

Tips on Connecting to WiFi

- It's best to configure your sensor to WiFi with the router, computer/phone/tablet, and sensor in the same room.
- PurpleAir-**** is a 2-4 character code determined by your sensor. It may take up to up to 10 minutes after the sensor is plugged in for this network to appear.
- After clicking on WiFi network PurpleAir-**** and if you receive the message “no internet connection is available,” the message can be ignored or allowed. This message is normal since the air sensor does not provide internet access to your phone, tablet or PC.
- Once the monitor successfully connects to WiFi, it will no longer appear in the list of available networks. The fact that it has disappeared means that the sensor is successfully configured to WiFi.
- The sensor data will not be displayed on the PurpleAir Map until the sensor is registered and recorded by PurpleAir.
- Once the sensor is successfully connected to your home WiFi, make sure to verify the local WiFi is connected back onto your phone, tablet or computer.

Registering Purple Air Sensor

- Go to www.purpleair.com/register
- Enter the sensor's Device-ID exactly as printed on the sensor's label
- Enter your email address and select your sensor as outside or inside.
- Enter sensor's location name and latitude and longitude coordinates
- Accept terms & conditions
- Click register and look for a green "successful registration" notice. A registration confirmation email is sent to your email.



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

If you have filled out this form in the past, it is not necessary to fill it out again unless you wish to modify the sensor.
To modify a previous registration, you will need to provide the same "Owner Email" as the first registration or the request will fail.

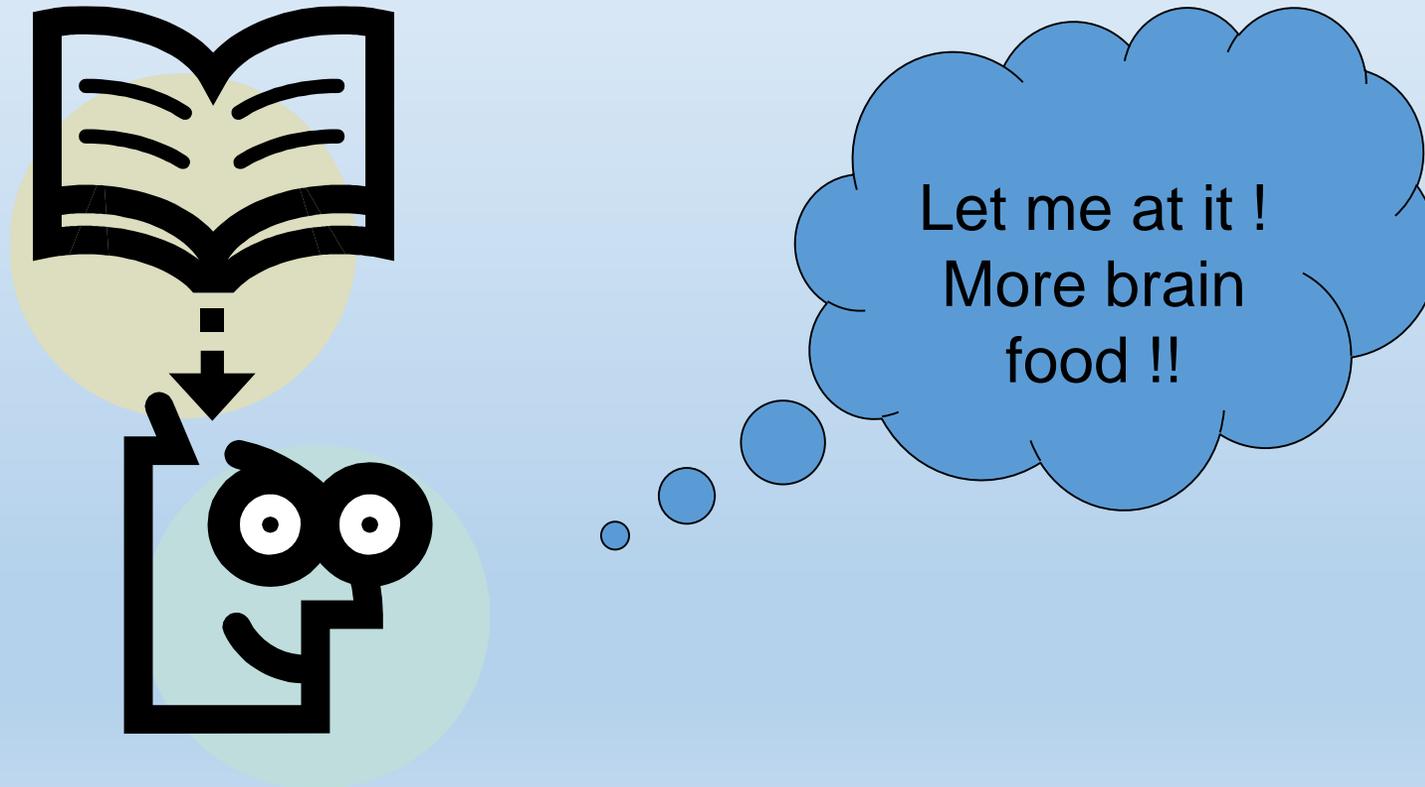
If you are moving a sensor to a new location or location type (inside / outside), please [let us know](#). We will archive the old sensor so the data stays at the original location. You will then be able to re-register it in the new location as a new sensor.

Device-Id (MAC)*	Printed on the device label just above the bar code. Please include the colons (:)
	<input type="text" value="xx:xx:xx:xx:xx:xx"/>
Associated Email *	This email address would have been used in the device purchase or other communication with PurpleAir. <i>(A copy of this sensor registration will be e-mailed to this address.)</i>
	<input type="text" value="Associated email address"/>
Installed*	<input type="button" value="Outside"/> <input type="button" value="Inside"/>
Location Name*	<input type="text" value="The name that appears on the map"/>
Visibility*	<input type="button" value="Public (everyone)"/> <input type="button" value="Private (only me)"/>
	<input checked="" type="checkbox"/> Set a location on the map
Map Location*	<input type="text" value="Latitude 35.856710299999996"/>

(drag the marker to adjust)

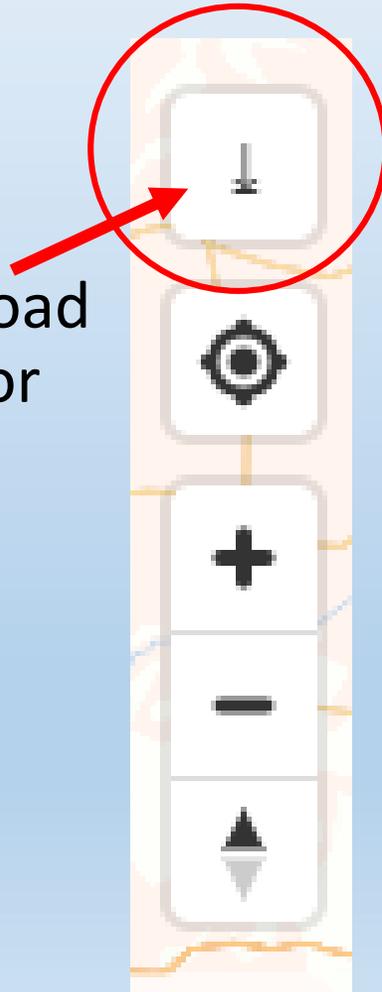
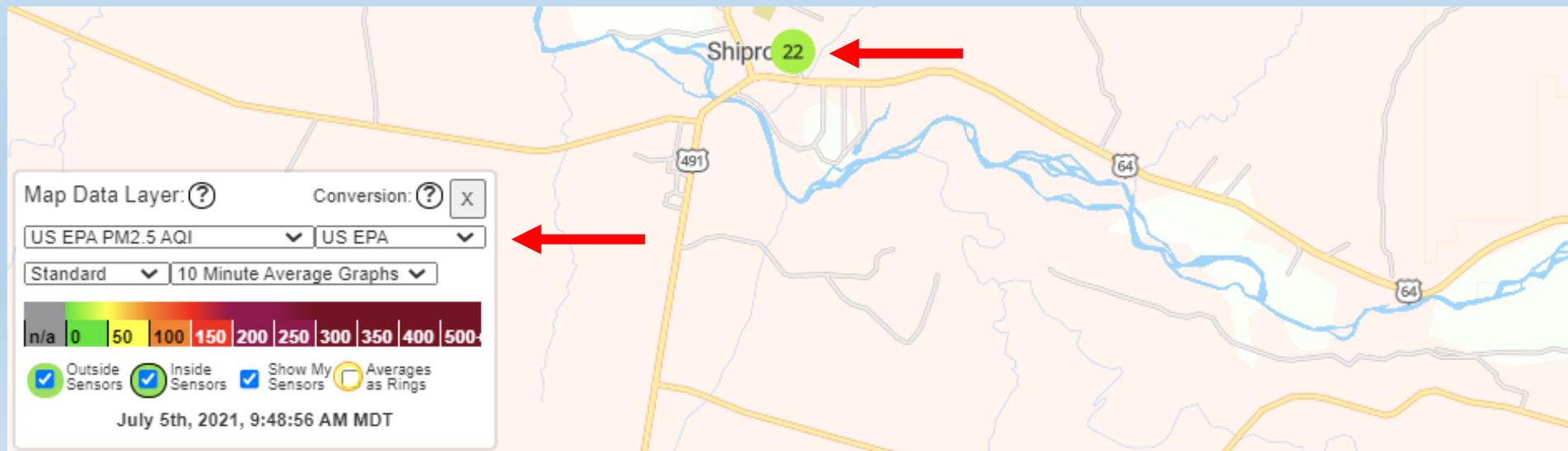
Video Demonstration of Connecting Purple Air

<https://www.youtube.com/watch?v=sfp-0uEQmaU>



How to Download Purple Air Sensor Data

- Go to the Purple Air website: <https://www2.purpleair.com/>. Click on “View the Map” to get to the Purple Air Map.
- Select a sensor location and click on it.
- Go to Map Data Layer. US EPA PM2.5 Air Quality Index set as default. Select US EPA conversion factor.
- Click on the Download icon which will take you to the Sensor Data Download Tool website. This tool allows you to download data for the selected sensor



Purple Air: Sensor Data Download Tool

- Select your Start and End date
- Select your averaging intervals: 10 min, 15 min, 30 min, 60 min, 1440 min
- Download data from the sensor's Channel A and/or Channel B measurements
- Data is downloaded into a .CSV file.

Select: Start Date: End Date: Average (minutes):

For information on the data and API's provided by PurpleAir, please see this document:

https://docs.google.com/document/d/15ijz94dXJ-YAZLi9iZ_RaBwrZ4KtYeCy08goGBwnbCU/edit?usp=sharing

Please note: This download tool now provides corrected headers for CF=1 and CF=ATM values. See the above link for more information.

Shiprock Agency 1 (outside)

A: <input checked="" type="checkbox"/>	Real Time 17 4µg/m ³	Short-term 8 2µg/m ³	30 minute 7 2µg/m ³	1 hour 7 2µg/m ³	6 hour 10 2µg/m ³	24 hour 13 3µg/m ³	One week 22 5µg/m ³
B: <input type="checkbox"/>	Real Time 16 4µg/m ³	Short-term 10 2µg/m ³	30 minute 10 2µg/m ³	1 hour 10 2µg/m ³	6 hour 13 3µg/m ³	24 hour 17 4µg/m ³	One week 28 7µg/m ³

1 sensor found, 1 online, 0 offline

AQI Value with corresponding Concentration

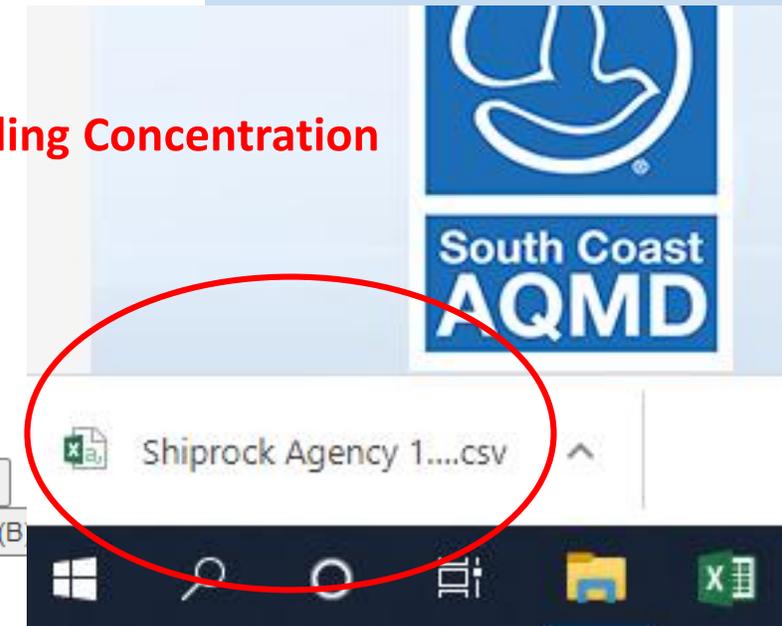
Created: 3/12/2020
LastSeen: 6/30/2021
Age: 0 minutes
Version: 6.01
[Show on Map](#)

Primary (Done)

Secondary (Done)

Download Primary (B)

Download Secondary (B)



Purple Air: Data Interpretation

- Time stamp = Coordinated Universal Time or UTC time
- Primary Data file: Outdoor PM₁, PM_{2.5}, PM₁₀, Temp, RH measurements.
- Secondary Data file: Outdoor particle counts (PM_{0.3}, PM_{0.5}, PM₁, PM_{2.5}, PM₅, PM₁₀) and Outdoor PM₁ & PM₁₀ measurements
- Particle Count units = microns per deciliter (µm/dl) of air
PM Outdoor units = micrograms per cubic meter (µg/m³) of air.
- CF-1 values = correction factor for indoor measurements
ATM = atmospheric or outdoor measurements
- UptimeMinutes = sensor operation time
RSSI_dbm = Received Signal Strength Indicator

>=0.3um/dl	>=0.5um/dl	>1.0um/dl	>=2.5um/dl	>=5.0um/dl	>=10.0um/dl	PM1.0_ATM _ug/m3	PM10_ATM _ug/m3
1731.72	477.98	67.19	6.29	1.76	0.38	8.74	13.43
2242.45	621.57	86.61	7.1	1.46	0.26	11.92	17.42

	A	B	C	D	E	F	G	H	I
1	created_at	PM1.0_CF1_ug/m3	PM2.5_CF1_ug/m3	PM10.0_CF1_ug/m3	UptimeMinutes	RSSI_dbm	Temperature_F	Humidity_%	PM2.5_ATM_ug/m3
2	2021-06-17 00:00:00 UTC	8.74	12.25	13.43	7724	-65.13	112.5	0.47	12.25
3	2021-06-17 01:00:00 UTC	11.92	16.4	17.42	7784	-67.63	108.47	1.17	16.39

Purple Air: SD Card Data Interpretation

- Time stamp = Coordinated Universal Time or UTC time
- Same parameters but 2 minute average intervals (large data sets)
- .CSV file created for each day of sampling
- Need tweezers to insert/remove SD card
- Useful if WiFi connection is lost or unavailable
- Data not reported to PurpleAir Map in real-time

UTCDateTime																					
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
UTCDateTime	mac_addr	firmware	hardware	current_t	current_hu	current_de	pressure	adc	mem	rsi	uptime	pm1_0_cf	pm2_5_cf	pm10_0_c	pm1_0_at	pm2_5_at	pm10_0_a	pm2.5_aqi	pm2.5_aqi	p_0_3_um	p_0_5_u
2021/06/03T00:01:39z	40:f5:20:1	6.01	2.0+OPEN	85	29	50	906.4	0.05	21552	-44	37568	0	0.03	0.03	0	0.03	0.03	0	0	305.59	82.8
2021/06/03T00:03:39z	40:f5:20:1	6.01	2.0+OPEN	86	29	50	906.4	0.05	21552	-46	37688	0	0.09	0.09	0	0.09	0.09	0	0	322.76	83.2
2021/06/03T00:05:39z	40:f5:20:1	6.01	2.0+OPEN	86	29	50	906.41	0.05	21552	-45	37808	0	0	0.11	0	0	0.11	0	0	291.53	78.6
2021/06/03T00:07:39z	40:f5:20:1	6.01	2.0+OPEN	86	29	50	906.37	0.05	21552	-45	37928	0	0.16	0.16	0	0.16	0.16	1	1	326.24	86.1
2021/06/03T00:09:39z	40:f5:20:1	6.01	2.0+OPEN	86	29	50	906.34	0.05	21552	-45	38048	0	0	0	0	0	0	0	0	270.6	72.8
2021/06/03T00:11:39z	40:f5:20:1	p_0_5_um																			
2021/06/03T00:13:39z	40:f5:20:1	p_0_5_um																			
V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ
p_0_5_um	p_1_0_um	p_2_5_um	p_5_0_um	p_10_0_ur	pm1_0_cf	pm2_5_cf	pm10_0_c	pm1_0_at	pm2_5_at	pm10_0_a	pm2.5_aqi	pm2.5_aqi	p_0_3_um	p_0_5_um	p_1_0_um	p_2_5_um	p_5_0_um	p_10_0_ur	gas		
82.83	6.81	0	0	0	0.25	0.36	0.36	0.25	0.36	0.36	2	2	331.31	89.71	6.75	0	0	0			
83.22	6.86	0.21	0	0	0.26	0.57	0.57	0.26	0.57	0.57	2	2	405.1	102.79	10.21	0	0	0			
78.68	7.26	0.49	0	0	0	0.29	0.29	0	0.29	0.29	1	1	337.14	85.41	6.4	0.22	0	0			
86.11	4.76	0.4	0	0	0	0.17	0.17	0	0.17	0.17	1	1	307.97	82.9	5	0	0	0.00			
72.82	5.6	0	0	0	0.09	0.21	0.21	0.09	0.21	0.21	1	1	379.02	99.86	6.29	0	0	0			

How to Interpret the AQI Data Breakpoints

Table 4: 2015 Calculation and Breakpoints for the Air Quality Index (AQI)

Breakpoints for Criteria Pollutants							AQI Categories	
O ₃ (ppm) 8-hour ^(d)	O ₃ (ppm) 1-hour ^(a)	PM _{2.5} (µg/m ³) 24 hour	PM ₁₀ (µg/m ³) 24 hour	CO (ppm) 8 hour	SO ₂ ^(c) (ppb) 1 hour	NO ₂ (ppb) 1 hour	AQI value	Category
0.000–0.059	—	0.0–12.0	0–54	0–4.4	0–35	0–53	0–50	Good
0.060–0.075	—	12.1–35.4	55–154	4.5–9.4	36–75	54–100	51–100	Moderate
0.076–0.095	0.175–0.164	35.5–55.4	155–254	9.5–12.4	76–185	101–360	101–150	Unhealthy for sensitive groups
0.096–0.115	0.165–0.104	55.5–150.4	255–354	12.5–15.4	186–304	361–649	151–200	Unhealthy
0.116–0.374	0.205–0.404	150.5–250.4	355–424	15.5–30.4	305–604	650–1249	201–300	Very unhealthy
(b)	0.405–0.504	250.5–350.4	425–504	30.5–40.4	604–804	1250–1649	301–400	Hazardous
(b)	0.505–0.604	350.4–500.4	505–604	40.5–50.4	805–1004	1650–2049	401–500	

^(a) Areas are generally required to report the AQI based on 8-hour ozone values. However, there are a small number of areas where an AQI based on 1-hour ozone values would be safer. In these cases, in addition to calculating the 8-hour ozone value, the 1-hour ozone value may be calculated, and the greater of the two values reported.

^(b) 8-hour O₃ values do not define higher AQI values (above 300). AQI values above 300 are calculated with 1-hour O₃ concentrations.

^(c) EPA changed the SO₂ standard on June 22, 2010 to be based on an hourly maximum instead of a 24-hour and annual average.

^(d) EPA tightened the O₃ standard Oct 26, 2015 (effective 12/28/15) and new values are not reflected in this chart.

For more information on the AQI, see airnow.gov/index.cfm?action=aqibasics.aqi.

Air Quality Index (AQI)	Actions to Protect Yourself
● Good	None
● Moderate	Unusually sensitive individuals should consider limiting prolonged or heavy exertion.
● USG	People within Sensitive Groups* should reduce prolonged or heavy outdoor exertion.
● Unhealthy	People within Sensitive Groups* should avoid all physical outdoor activity.
● Very Unhealthy	Everyone should avoid prolonged or heavy exertion.
● Hazardous	Everyone should avoid any outdoor activity.

Purple Air: Time Stamp Correction

- How do correct to your sensor location time zone? Mountain Daylight Time (MDT) is 6 hours behind UTC...
- Save .CSV file as an .XLSX file and do the conversion using Excel formulas
 - 1st Formula =LEFT(A2,19)
 - 2nd Formul =B2-(6/24)
- The Formula = LEFT(A2, 19) takes the leftmost nineteen characters from the time stamp (cell A2). This grabs only the date/time and leaves out the text of UTC
- In this example, the Formula = B2-(6/24) subtracts 6 hours from the timestamp for MDT. You need to use the 24 because of the way Microsoft Excel stores date/time values
- For other time zones, you would enter the relevant hour into that formula. For example, if you wanted to subtract 4 hours, the formula would be B2-(4/24).

	A	B	C	D	E	F
1	created_at	Remove	DateTime (MDT)	Temperature_F	Humidity_%	PM2.5_ATM_ug/m3
2	2021-06-17 00:00:00 UTC	2021-06-17 00:00:00	6/16/21 6:00 PM	112.5	0.47	12.25
3	2021-06-17 01:00:00 UTC	2021-06-17 01:00:00	6/16/21 7:00 PM	108.47	1.17	16.39
4	2021-06-17 02:00:00 UTC	2021-06-17 02:00:00	6/16/21 8:00 PM	103.5	3.93	20.28

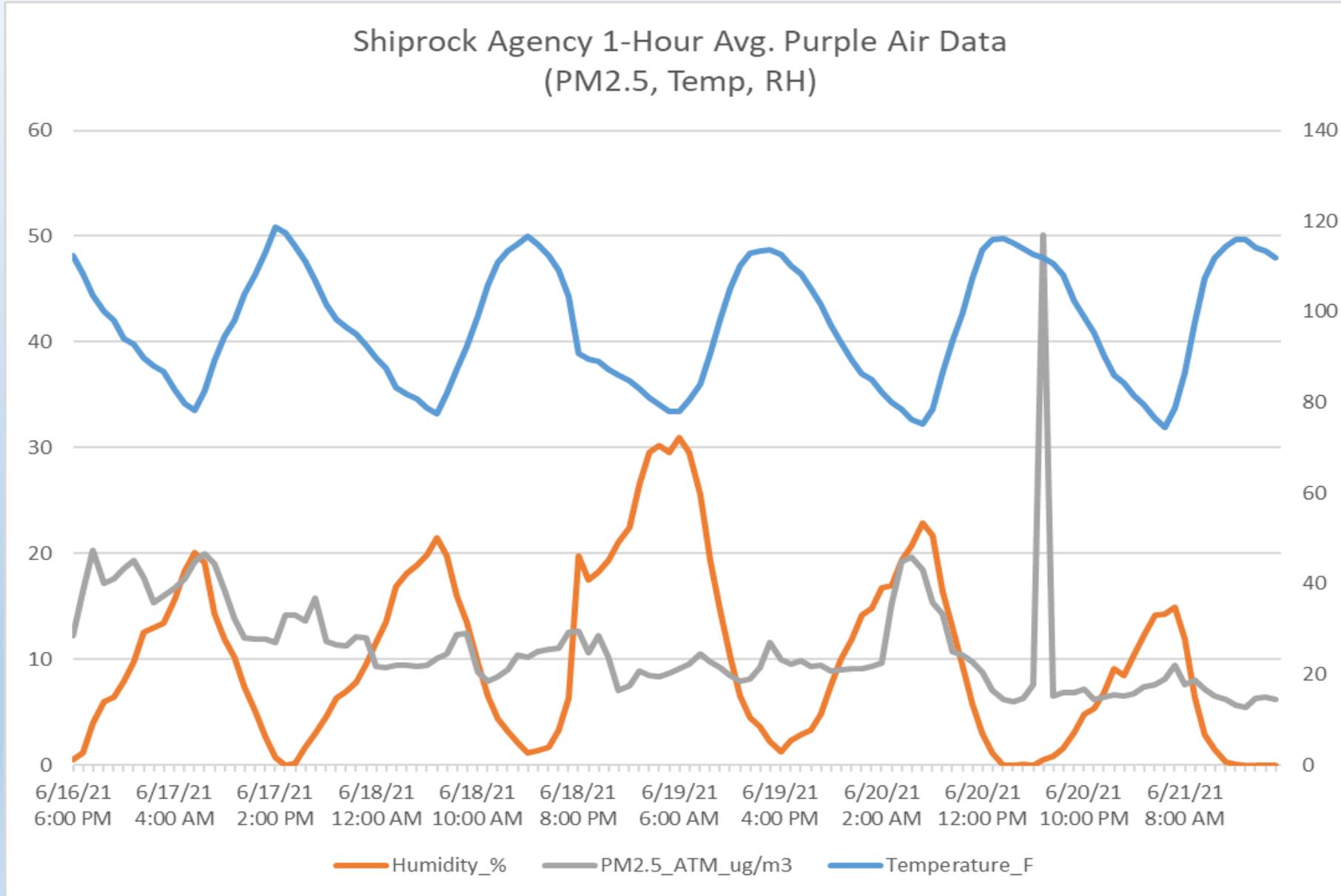
Purple Air: Time Stamp Correction

Here are formulas for other time zones that you can copy and paste into your spreadsheet

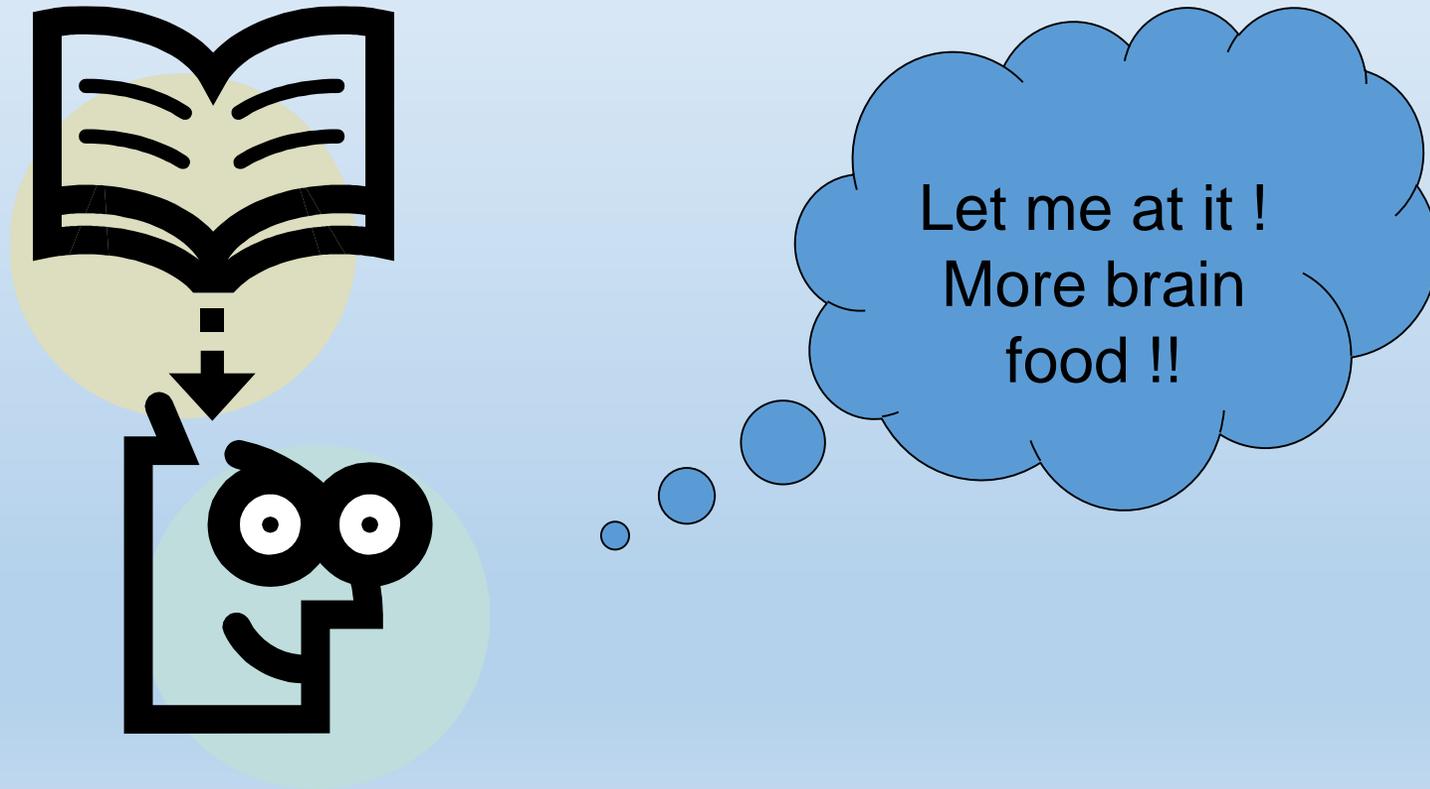
- Eastern Daylight Time: =B2-(4/24)
- Central Daylight Time: =B2-(5/24)
- Mountain Daylight Time: =B2-(6/24)
- Pacific Daylight Time: =B2-(7/24)
- Alaska Daylight Time: =B2-(8/24)
- Eastern Standard Time: =B2-(5/24)
- Central Standard Time: =B2-(6/24)
- Mountain Standard Time: =B2-(7/24)
- Pacific Standard Time: =B2-(8/24)
- Alaska Standard Time: =B2-(9/24)

To find what your time zone is in UTC and vice versa, here is a link to a UTC converter: <https://savvytime.com/converter/utc-to-pdt>

Purple Air: Chart Data



Demonstration of Data Download and Time Stamp Correction



Purple Air: Pros and Cons

Pros

- Low-cost
- Real-time measurements (indoor/outdoor)
- Good screening tool
- Community air quality awareness
- Easy to install and deploy
- PM channel correlates well with collocated FEM monitors

Cons

- Non-FEM
- Need reliable WiFi (if not use SD card)
- Lifespan is 2-3 years
- Time stamp correction needed
- QA/QC limitations (collocation necessary to use data)
 - Data verification & validation (data integrity)
 - Interferences (high RH, sensor siting)
- Cannot make NAAQS determination

Resources



Purple Air website (setup instructions)

- <https://www2.purpleair.com/>

AQI Calculator (convert concentrations to AQI value)

- <https://aqicn.org/calculator/>

Udemy online courses on MS Excel

- <https://www.udemy.com/topic/excel/>

Ideas on how to chart Purple Air Data

- <https://publiclab.org/notes/jiteovien/08-28-2018/download-analyze-your-purple-air-data>

South Coast Air Management District – Purple Air Field Evaluation

- <http://www.aqmd.gov/aq-spec/product/purpleair-pa-ii>



Thank you for joining today's webinar!