How to Download Purple Air Data and Interpret Data

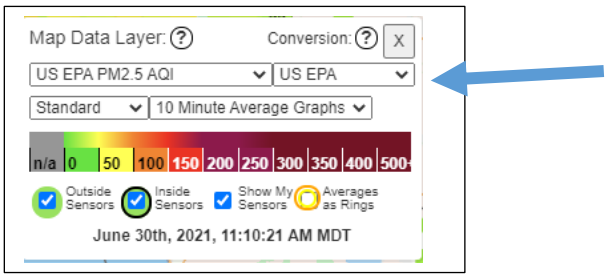
1. Go to the Purple Air website: https://www2.purpleair.com/

Click on View the Map to get to the Purple Air Map. Or you can click on the link below as well.

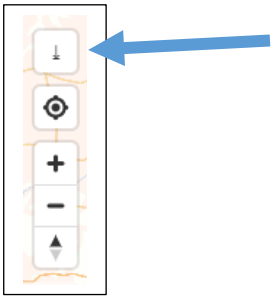
Map: https://www.purpleair.com/map?opt=1/mAQI/a10/cC0#4.58/34.72/-111.09

2. Select a sensor location and click on it.

3. Go to Map Data Layer. The Map Data Layer can be found on the lower left hand side of the map where you will see the color-coded US EPA PM2.5 Air Quality Index as default. Under conversion, select US EPA conversion factor/correction equation.



4. Next, navigate to the right hand side of the screen and click on the download icon which will take you to the **Sensor Data Download Tool** website.

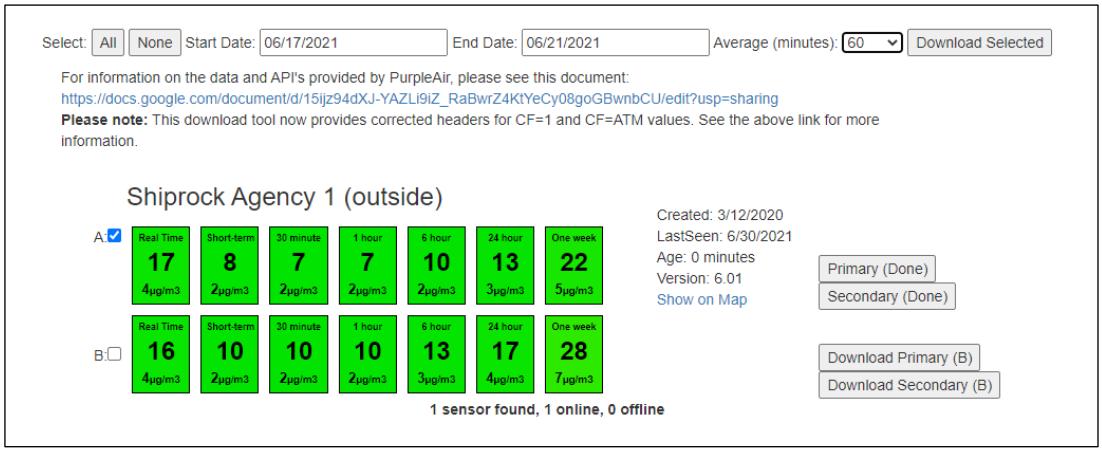


The Sensor Data Download tool will allow you to download data from the sensor's Channel A and Channel B measurements. It will also allow you to view Primary data and Secondary data. Primary Data is where you will find PM (PM_1, $PM_{2.5}$, PM_{10}) sample values as well as Temperature and Relative Humidity sample values. **Keep in mind that CF-1 values correspond to correction factor for indoor measurements and ATM corresponds to atmospheric or outdoor measurements in units of micrograms per cubic meter (µg/m^3) of air**. Secondary Data is where you will find particle counts in units of microns (micrometer) per deciliter of air as well as outdoor measurements for PM_1 and PM_{10} in units of µg/m^3.

The UptimeMinutes column tells you how long the sensor has been in operation and the RSSI_dbm corresponds to "Received Signal Strength Indicator." RSSI is a measurement of how well your device can hear a signal from an access point or router. It's a value that is useful for determining if you have enough signal to get a good wireless connection. Since RSSI varies greatly a more standardized, absolute measure of signal strength is measured in decibels, or dBm on a logarithmic scale. There's a lot of math

we could get into, but basically, the closer to 0 dBm, the better the signal is. The dBm unit, which means decibels relative to the reference power 1 mW. For example, a power of 10 µW = 0.01 mW corresponds to -20 dBm (= 20dB less than 1 mW).

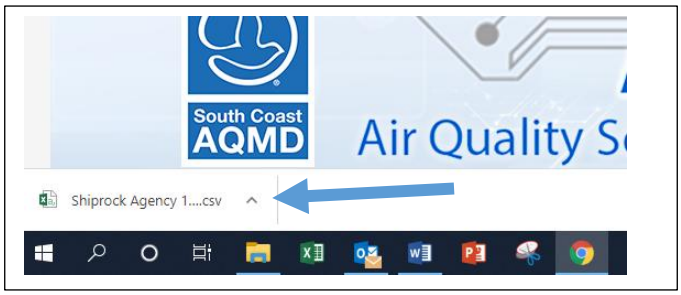
5. To begin downloading data from the Sensor Data Download Tool, first select your Start and End date. Then you want to select your averaging intervals either 10 minute, 15 minute, 30 minute, 60 minute, up to 1440 minutes which is a 24-hour average.



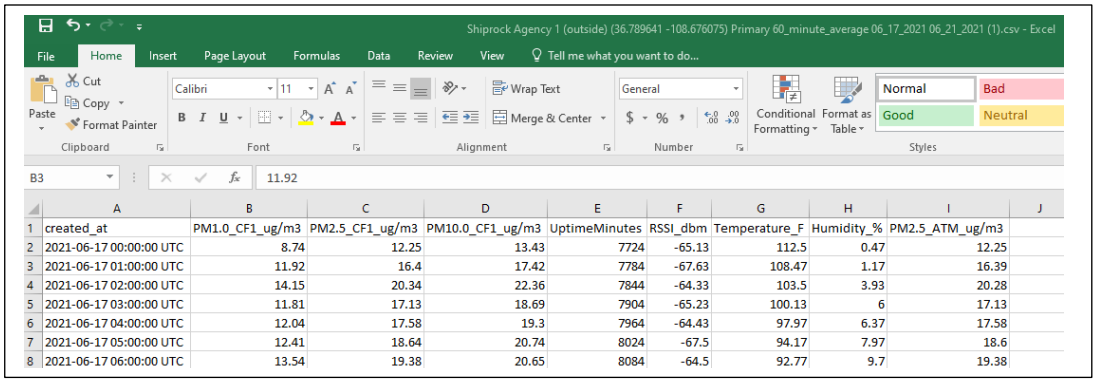
6. In the example above, the date range begins 6/17/21 and ends 6/21/21. The average interval is 60 minutes, which is basically 1-hour averages.

7. Next, you want to select which channel to report data into a .CSV download file. You can select a single Channel and both Primary and Secondary data. Or you can select All which will give you data from both Channel A and B to include both Primary and Secondary data. As you can see in the picture above, for this example, Channel A is selected to report both Primary and Secondary data.

8. A *.CSV file containing the data will be generated in the lower left hand side of the web browser and you should be able to click on the file and open it.

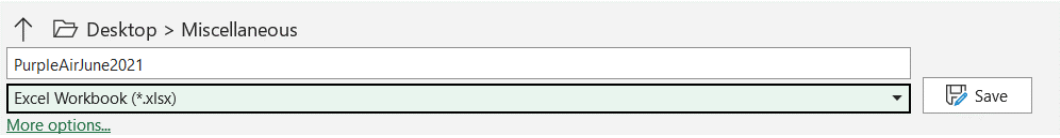


9. Click on the up arrow on the file and open the file to view the data. Data should look like this.

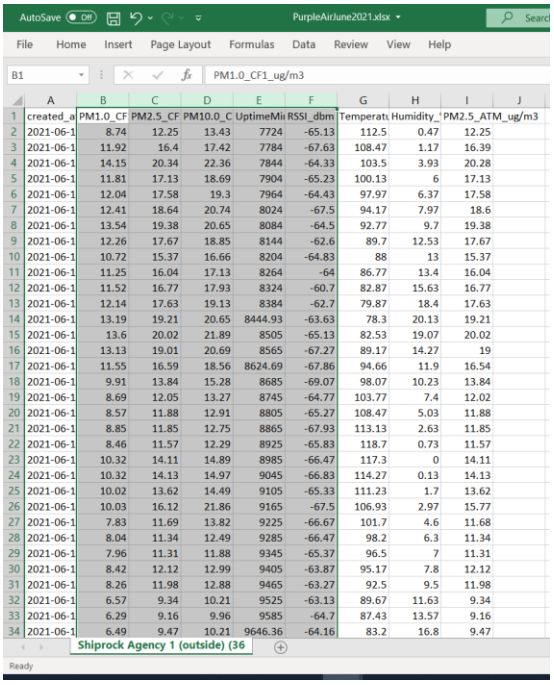


	A	B	C	D	E	F	G	H	I	J
1	created_at	PM1.0_CF1_ug/m3	PM2.5_CF1_ug/m3	PM10.0_CF1_ug/m3	UptimeMinutes	RSSI_dbm	Temperature_F	Humidity_%	PM2.5_ATM_ug/m3	
2	2021-06-17 00:00:00 UTC	8.74	12.25	13.43	7724	-65.13	112.5	0.47	12.25	
3	2021-06-17 01:00:00 UTC	11.92	16.4	17.42	7784	-67.63	108.47	1.17	16.39	
4	2021-06-17 02:00:00 UTC	14.15	20.34	22.36	7844	-64.33	103.5	3.93	20.28	
5	2021-06-17 03:00:00 UTC	11.81	17.13	18.69	7904	-65.23	100.13	6	17.13	
6	2021-06-17 04:00:00 UTC	12.04	17.58	19.3	7964	-64.43	97.97	6.37	17.58	
7	2021-06-17 05:00:00 UTC	12.41	18.64	20.74	8024	-67.5	94.17	7.97	18.6	
8	2021-06-17 06:00:00 UTC	13.54	19.38	20.65	8084	-64.5	92.77	9.7	19.38	

10. As you can see, the time stamp is in Coordinated Universal Time or UTC time. UTC time is the world time standard that regulates clocks and time. It is commonly used by the scientific community in many technical fields. For example, meteorologists, the aviation industry use this time, and it is used to synchronize time across internet networks. One way to convert the time stamp to the time in your area is to use a formula in Microsoft Excel. Begin by saving the file as an *.xlsx file by selecting File, Save As from the menu. From the file type dropdown box, select Excel Workbook (.xlsx). If you want, you can also type in a new file name. Then click on the Save icon.

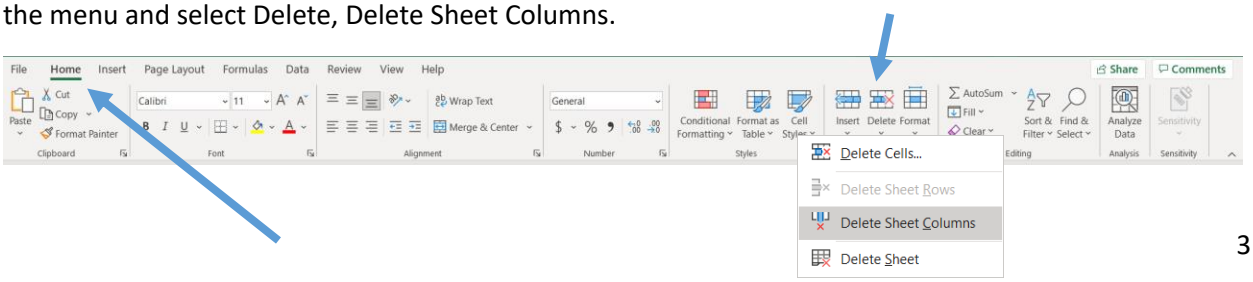


11. In this data analysis example, we are focusing on PM2.5, Temperature, and Relative Humidity data. We need to begin by removing the columns that are not necessary for this particular data analysis. From within the *.xlsx file that is now open, click and drag to highlight Column B through Column F. The five columns with the following headers should now be highlighted: PM1.0_CF1_ug/m3, PM2.5_CF1_ug/m3, PM10.0_CF1_ug/m3, UptimeMinutes, and RSSI_dbm.

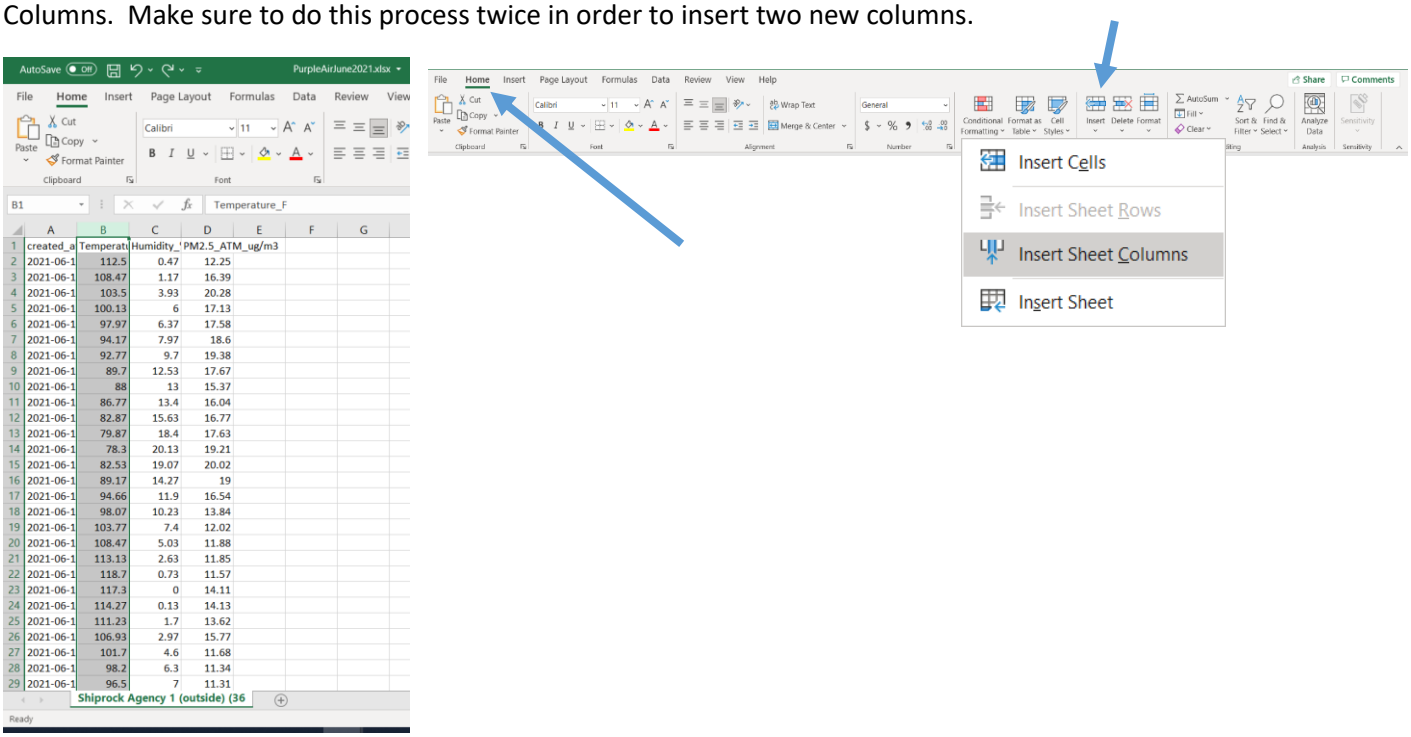


	A	B	C	D	E	F	G	H	I	J
1	created_a	PM1.0_CF	PM2.5_CF	PM10.0_C	UptimeMi	RSSI_dbm	Temperatu	Humidity_	PM2.5_ATM_ug/m3	
2	2021-06-1	8.74	12.25	13.43	7724	-65.13	112.5	0.47	12.25	
3	2021-06-1	11.92	16.4	17.42	7784	-67.63	108.47	1.17	16.39	
4	2021-06-1	14.15	20.34	22.36	7844	-64.33	103.5	3.93	20.28	
5	2021-06-1	11.81	17.13	18.69	7904	-65.23	100.13	6	17.13	
6	2021-06-1	12.04	17.58	19.3	7964	-64.43	97.97	6.37	17.58	
7	2021-06-1	12.41	18.64	20.74	8024	-67.5	94.17	7.97	18.6	
8	2021-06-1	13.54	19.38	20.65	8084	-64.5	92.77	9.7	19.38	
9	2021-06-1	12.26	17.67	18.85	8144	-62.6	89.7	12.53	17.67	
10	2021-06-1	10.72	15.37	16.66	8204	-64.83	88	13	15.37	
11	2021-06-1	11.25	16.04	17.13	8264	-64	86.77	13.4	16.04	
12	2021-06-1	11.52	16.77	17.93	8324	-60.7	82.87	15.63	16.77	
13	2021-06-1	12.14	17.63	19.13	8384	-62.7	79.87	18.4	17.63	
14	2021-06-1	13.19	19.21	20.65	8444.93	-63.63	78.3	20.13	19.21	
15	2021-06-1	13.6	20.02	21.89	8505	-65.13	82.53	19.07	20.02	
16	2021-06-1	13.13	19.01	20.69	8565	-67.27	89.17	14.27	19	
17	2021-06-1	11.55	16.59	18.56	8624.69	-67.86	94.66	11.9	16.54	
18	2021-06-1	9.91	13.84	15.28	8685	-69.07	98.07	10.23	13.84	
19	2021-06-1	8.69	12.05	13.27	8745	-64.77	103.77	7.4	12.02	
20	2021-06-1	8.57	11.88	12.91	8805	-65.27	108.47	5.03	11.88	
21	2021-06-1	8.85	11.85	12.75	8865	-67.93	113.13	2.63	11.85	
22	2021-06-1	8.46	11.57	12.29	8925	-65.83	118.7	0.73	11.57	
23	2021-06-1	10.32	14.11	14.89	8985	-66.47	117.3	0	14.11	
24	2021-06-1	10.32	14.13	14.97	9045	-66.83	114.27	0.13	14.13	
25	2021-06-1	10.02	13.62	14.49	9105	-65.33	111.23	1.7	13.62	
26	2021-06-1	10.03	16.12	21.86	9165	-67.5	106.93	2.97	15.77	
27	2021-06-1	7.83	11.69	13.82	9225	-66.67	101.7	4.6	11.68	
28	2021-06-1	8.04	11.34	12.49	9285	-66.47	98.2	6.3	11.34	
29	2021-06-1	7.96	11.31	11.88	9345	-65.37	96.5	7	11.31	
30	2021-06-1	8.42	12.12	12.99	9405	-63.87	95.17	7.8	12.12	
31	2021-06-1	8.26	11.98	12.88	9465	-63.27	92.5	9.5	11.98	
32	2021-06-1	6.57	9.34	10.21	9525	-63.13	89.67	11.63	9.34	
33	2021-06-1	6.29	9.16	9.96	9585	-64.7	87.43	13.57	9.16	
34	2021-06-1	6.49	9.47	10.21	9646.36	-64.16	83.2	16.8	9.47	

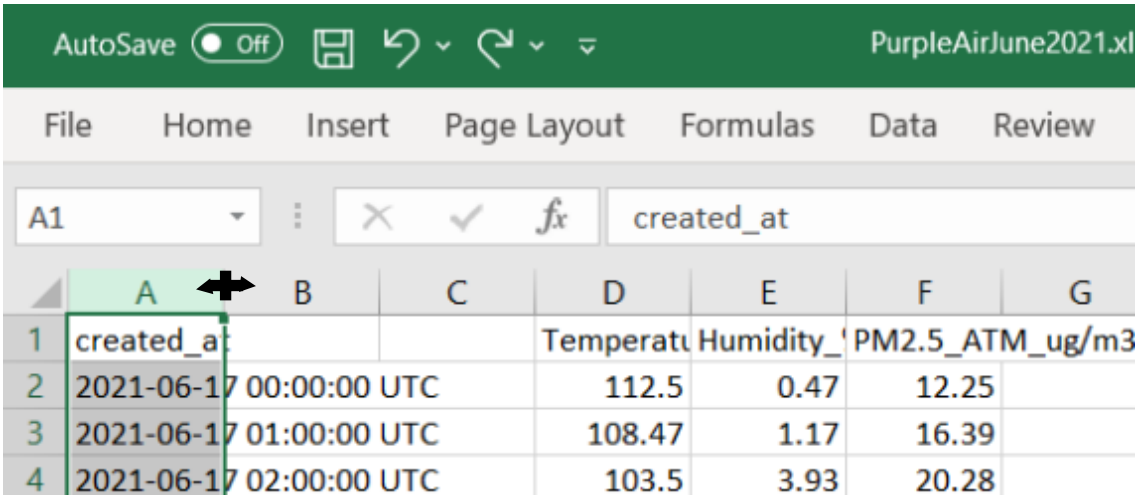
Right-click anywhere within the highlighted area and select Delete. Alternately, you can go to Home in the menu and select Delete, Delete Sheet Columns.



12. Insert two new columns to the left of Column B. You do this by first clicking on Column B to highlight it. Then right-click anywhere within the highlighted area and select Insert. Repeat this process to insert two new blank columns. Alternately, you can go to Home in the menu and select Insert, Insert Sheet Columns. Make sure to do this process twice in order to insert two new columns.



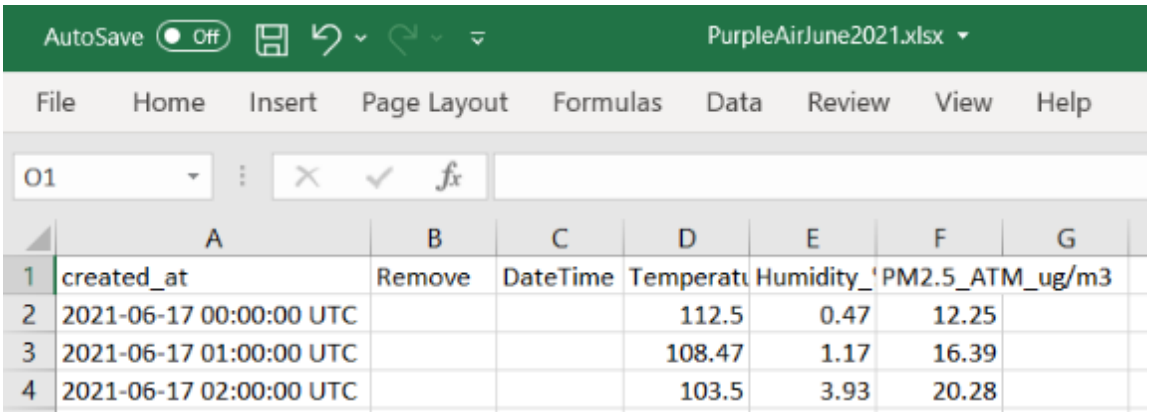
13. Increase the column size of Column A. To do this, click on Column A to highlight it. Then hover your mouse on the vertical line between Column A and B until the icon turns to two-sided arrow. Then double-click.



14. Type in the following new column headers for the new columns.

Column B: Remove

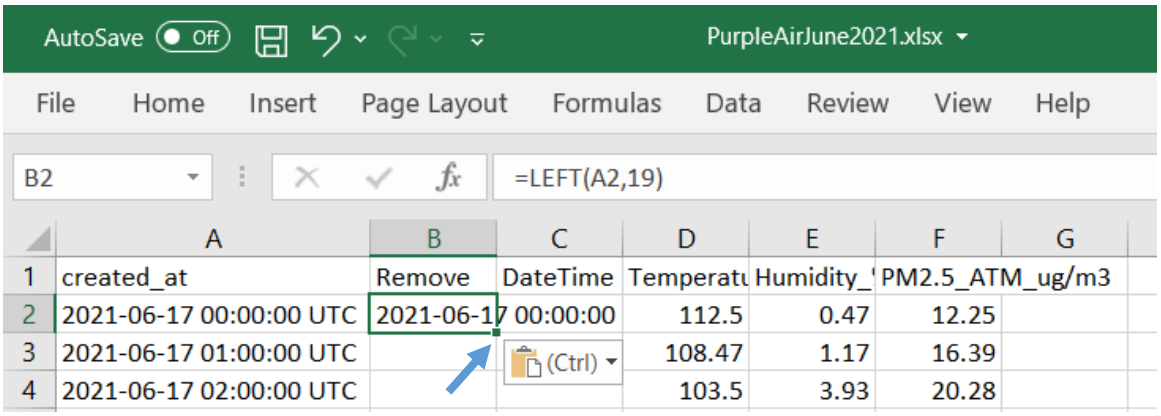
Column C: DateTime



	A	B	C	D	E	F	G
1	created_at	Remove	DateTime	Temperatu	Humidity_'	PM2.5_ATM_ug/m3	
2	2021-06-17 00:00:00 UTC			112.5	0.47	12.25	
3	2021-06-17 01:00:00 UTC			108.47	1.17	16.39	
4	2021-06-17 02:00:00 UTC			103.5	3.93	20.28	

15. In the first cell of Column B, cell B2, copy and paste the following formula: =LEFT(A2,19)

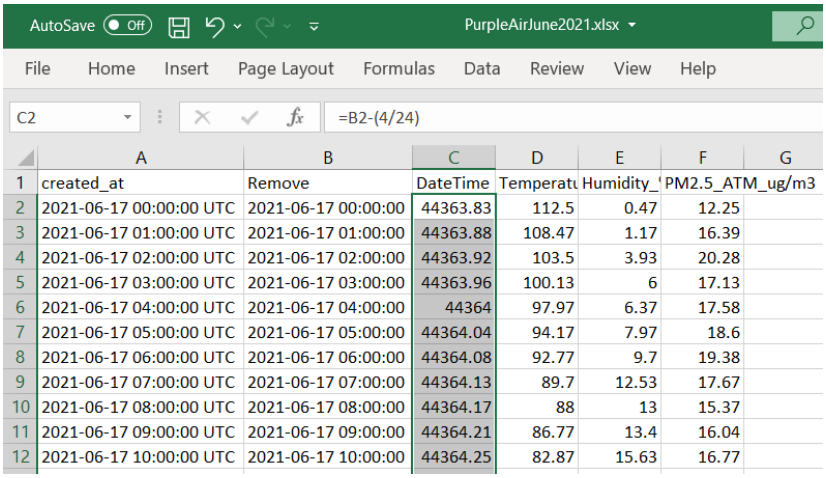
Then, double click on the bottom right corner of the cell (there is a little box shown there), to fill the formula down the entire column. Then increase the size of Column B just like you did for Column A.



	A	B	C	D	E	F	G
1	created_at	Remove	DateTime	Temperatu	Humidity_'	PM2.5_ATM_ug/m3	
2	2021-06-17 00:00:00 UTC	2021-06-17 00:00:00		112.5	0.47	12.25	
3	2021-06-17 01:00:00 UTC			108.47	1.17	16.39	
4	2021-06-17 02:00:00 UTC			103.5	3.93	20.28	

16. For this example, the Purple Air sensor is located in Mountain Daylight Time (MDT) zone, so UTC is 6 hours ahead of MDT. We convert the timestamp in UTC to MDT by subtracting 6 hours using a formula. In the first cell of Column C, cell C2, copy and paste the following formula: =B2-(6/24)

Then, double click on the bottom right corner of the cell (there is a little box shown there), to fill the formula down the entire column. Your screen should now look similar to this.



	A	B	C	D	E	F	G
1	created_at	Remove	DateTime	Temperatu	Humidity_'	PM2.5_ATM_ug/m3	
2	2021-06-17 00:00:00 UTC	2021-06-17 00:00:00	44363.83	112.5	0.47	12.25	
3	2021-06-17 01:00:00 UTC	2021-06-17 01:00:00	44363.88	108.47	1.17	16.39	
4	2021-06-17 02:00:00 UTC	2021-06-17 02:00:00	44363.92	103.5	3.93	20.28	
5	2021-06-17 03:00:00 UTC	2021-06-17 03:00:00	44363.96	100.13	6	17.13	
6	2021-06-17 04:00:00 UTC	2021-06-17 04:00:00	44364	97.97	6.37	17.58	
7	2021-06-17 05:00:00 UTC	2021-06-17 05:00:00	44364.04	94.17	7.97	18.6	
8	2021-06-17 06:00:00 UTC	2021-06-17 06:00:00	44364.08	92.77	9.7	19.38	
9	2021-06-17 07:00:00 UTC	2021-06-17 07:00:00	44364.13	89.7	12.53	17.67	
10	2021-06-17 08:00:00 UTC	2021-06-17 08:00:00	44364.17	88	13	15.37	
11	2021-06-17 09:00:00 UTC	2021-06-17 09:00:00	44364.21	86.77	13.4	16.04	
12	2021-06-17 10:00:00 UTC	2021-06-17 10:00:00	44364.25	82.87	15.63	16.77	

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

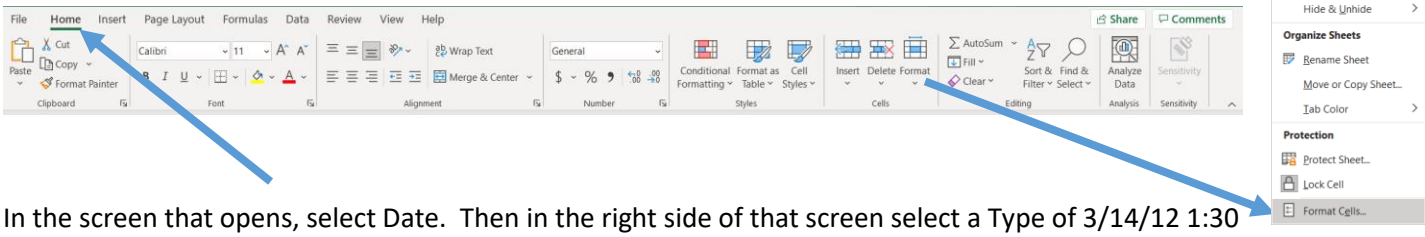
Eastern Daylight Time: =B2-(4/24)
Central Daylight Time: =B2-(5/24)
Mountain Daylight Time: =B2-(6/24)
Pacific Daylight Time: =B2-(7/24)
Alaska Daylight Time: =B2-(8/24)

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)

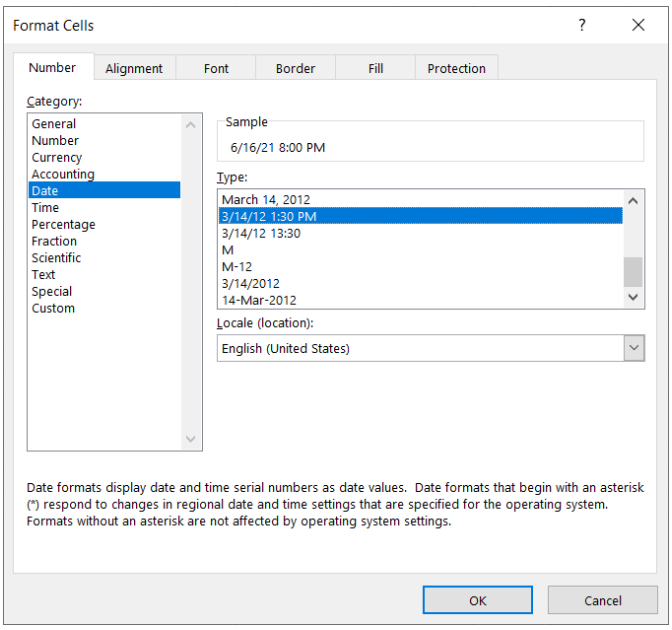
To find what your time zone is in UTC and vice versa, here is a link to a UTC converter:
https://savvytime.com/converter/utc-to-pdt

To convert 24 hour time to standard time and vice versa, see link below:
https://www.calculatehours.com/Military_Time_Converter.html

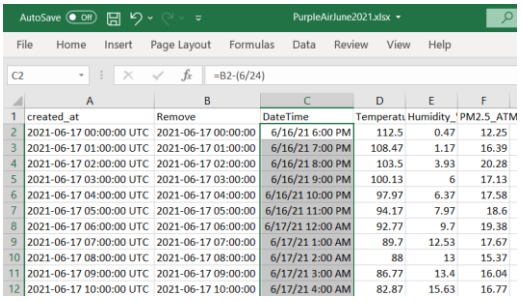
17. The date/times are in number format. We need to change that to date/time format. While the DateTime column (Column C) is still highlighted, right-click anywhere in the highlighted area and select Format Cells. Alternately, you can go to Home in the menu and select Format, Format Cells.



In the screen that opens, select Date. Then in the right side of that screen select a Type of 3/14/12 1:30 PM.

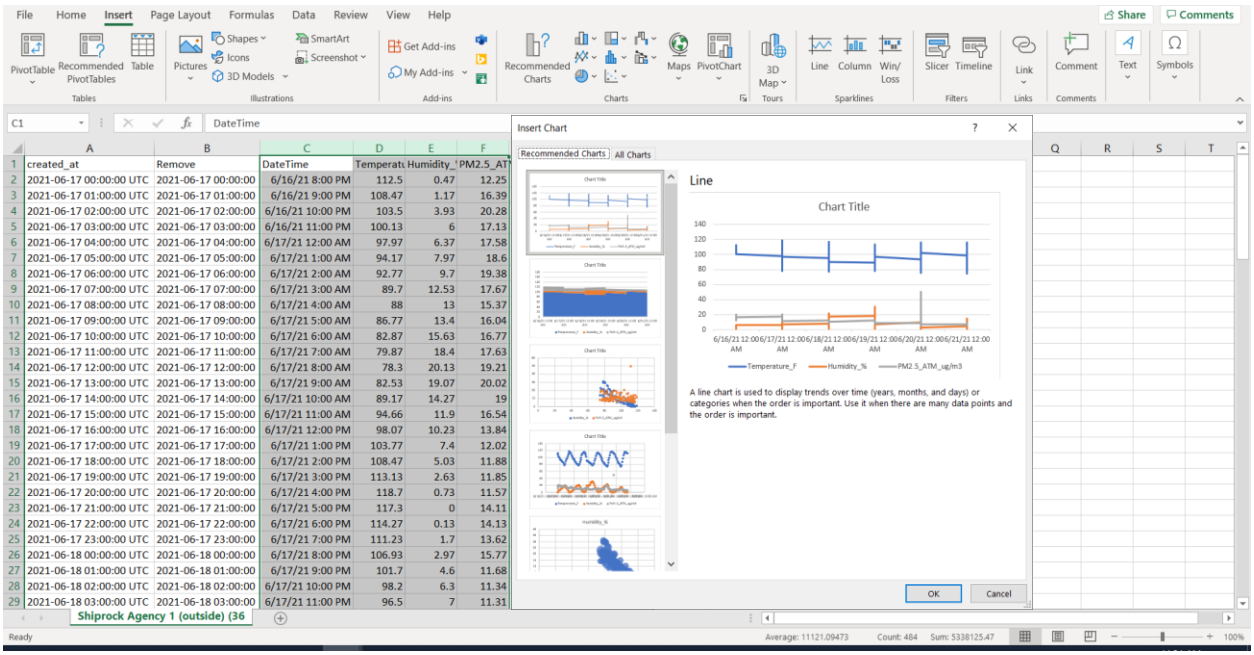


Then click the OK button.



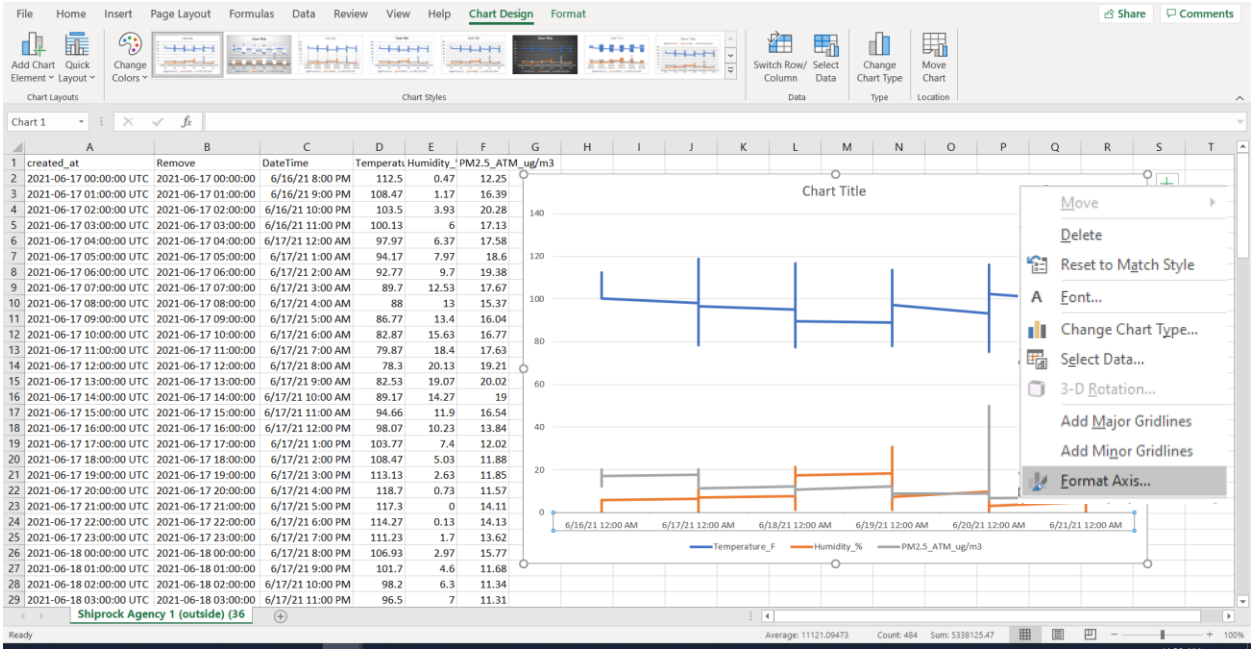
	A	B	C	D	E	F
1	created_at	Remove	DateTime	Temperatu	Humidity_%	PM2.5_ATM
2	2021-06-17 00:00:00 UTC	2021-06-17 00:00:00	6/16/21 6:00 PM	112.5	0.47	12.25
3	2021-06-17 01:00:00 UTC	2021-06-17 01:00:00	6/16/21 7:00 PM	108.47	1.17	16.39
4	2021-06-17 02:00:00 UTC	2021-06-17 02:00:00	6/16/21 8:00 PM	103.5	3.93	20.28
5	2021-06-17 03:00:00 UTC	2021-06-17 03:00:00	6/16/21 9:00 PM	100.13	6	17.13
6	2021-06-17 04:00:00 UTC	2021-06-17 04:00:00	6/16/21 10:00 PM	97.97	6.37	17.58
7	2021-06-17 05:00:00 UTC	2021-06-17 05:00:00	6/16/21 11:00 PM	94.17	7.97	18.6
8	2021-06-17 06:00:00 UTC	2021-06-17 06:00:00	6/17/21 12:00 AM	92.77	9.7	19.38
9	2021-06-17 07:00:00 UTC	2021-06-17 07:00:00	6/17/21 1:00 AM	89.7	12.53	17.67
10	2021-06-17 08:00:00 UTC	2021-06-17 08:00:00	6/17/21 2:00 AM	88	13	15.37
11	2021-06-17 09:00:00 UTC	2021-06-17 09:00:00	6/17/21 3:00 AM	86.77	13.4	16.04
12	2021-06-17 10:00:00 UTC	2021-06-17 10:00:00	6/17/21 4:00 AM	82.87	15.63	16.77

18. Now highlight Columns C through F and go to the top tool menu bar and select **Insert** and **Recommended Charts** to chart the data. For this example, I selected the first recommended chart.

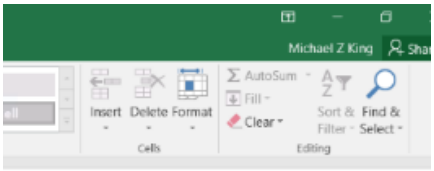


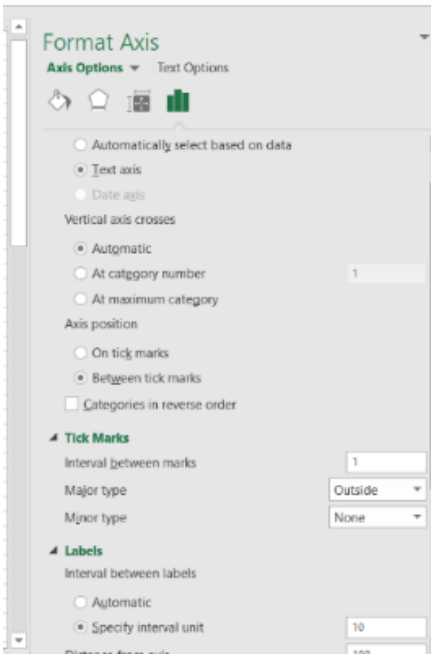
	A	B	C	D	E	F
1	created_at	Remove	DateTime	Temperatu	Humidity_%	PM2.5_AT
2	2021-06-17 00:00:00 UTC	2021-06-17 00:00:00	6/16/21 8:00 PM	112.5	0.47	12.25
3	2021-06-17 01:00:00 UTC	2021-06-17 01:00:00	6/16/21 9:00 PM	108.47	1.17	16.39
4	2021-06-17 02:00:00 UTC	2021-06-17 02:00:00	6/16/21 10:00 PM	103.5	3.93	20.28
5	2021-06-17 03:00:00 UTC	2021-06-17 03:00:00	6/16/21 11:00 PM	100.13	6	17.13
6	2021-06-17 04:00:00 UTC	2021-06-17 04:00:00	6/17/21 12:00 AM	97.97	6.37	17.58
7	2021-06-17 05:00:00 UTC	2021-06-17 05:00:00	6/17/21 1:00 AM	94.17	7.97	18.6
8	2021-06-17 06:00:00 UTC	2021-06-17 06:00:00	6/17/21 2:00 AM	92.77	9.7	19.38
9	2021-06-17 07:00:00 UTC	2021-06-17 07:00:00	6/17/21 3:00 AM	89.7	12.53	17.67
10	2021-06-17 08:00:00 UTC	2021-06-17 08:00:00	6/17/21 4:00 AM	88	13	15.37
11	2021-06-17 09:00:00 UTC	2021-06-17 09:00:00	6/17/21 5:00 AM	86.77	13.4	16.04
12	2021-06-17 10:00:00 UTC	2021-06-17 10:00:00	6/17/21 6:00 AM	82.87	15.63	16.77
13	2021-06-17 11:00:00 UTC	2021-06-17 11:00:00	6/17/21 7:00 AM	79.87	18.4	17.63
14	2021-06-17 12:00:00 UTC	2021-06-17 12:00:00	6/17/21 8:00 AM	78.3	20.13	19.21
15	2021-06-17 13:00:00 UTC	2021-06-17 13:00:00	6/17/21 9:00 AM	82.53	19.07	20.02
16	2021-06-17 14:00:00 UTC	2021-06-17 14:00:00	6/17/21 10:00 AM	89.17	14.27	19
17	2021-06-17 15:00:00 UTC	2021-06-17 15:00:00	6/17/21 11:00 AM	94.66	11.9	16.54
18	2021-06-17 16:00:00 UTC	2021-06-17 16:00:00	6/17/21 12:00 PM	98.07	10.23	13.84
19	2021-06-17 17:00:00 UTC	2021-06-17 17:00:00	6/17/21 1:00 PM	103.77	7.4	12.02
20	2021-06-17 18:00:00 UTC	2021-06-17 18:00:00	6/17/21 2:00 PM	108.47	5.03	11.88
21	2021-06-17 19:00:00 UTC	2021-06-17 19:00:00	6/17/21 3:00 PM	113.13	2.63	11.85
22	2021-06-17 20:00:00 UTC	2021-06-17 20:00:00	6/17/21 4:00 PM	118.7	0.73	11.57
23	2021-06-17 21:00:00 UTC	2021-06-17 21:00:00	6/17/21 5:00 PM	117.3	0	14.11
24	2021-06-17 22:00:00 UTC	2021-06-17 22:00:00	6/17/21 6:00 PM	114.27	0.13	14.13
25	2021-06-17 23:00:00 UTC	2021-06-17 23:00:00	6/17/21 7:00 PM	111.23	1.7	13.62
26	2021-06-18 00:00:00 UTC	2021-06-18 00:00:00	6/17/21 8:00 PM	106.93	2.97	15.77
27	2021-06-18 01:00:00 UTC	2021-06-18 01:00:00	6/17/21 9:00 PM	101.7	4.6	11.68
28	2021-06-18 02:00:00 UTC	2021-06-18 02:00:00	6/17/21 10:00 PM	98.2	6.3	11.34
29	2021-06-18 03:00:00 UTC	2021-06-18 03:00:00	6/17/21 11:00 PM	96.5	7	11.31

19. You should now see the chart in your Excel worksheet. First, we need to fix the X-Axis by right clicking on the X-axis labels and select **Format Axis.**

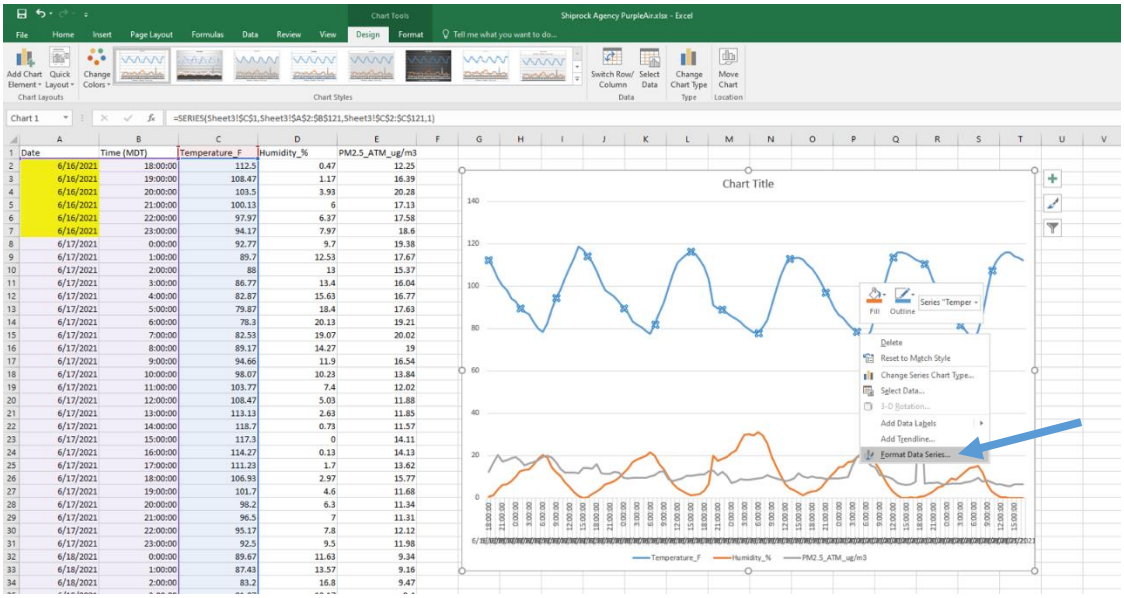


Within Format Axis under Axis Options, scroll down to Axis Type select **Text Axis**. Under Tick Marks scroll to Major Type set to **Outside**. Under Labels select **Specify Interval Unit** and set to **10**. Lastly, uncheck the box next to **Mult-level Category Labels**.

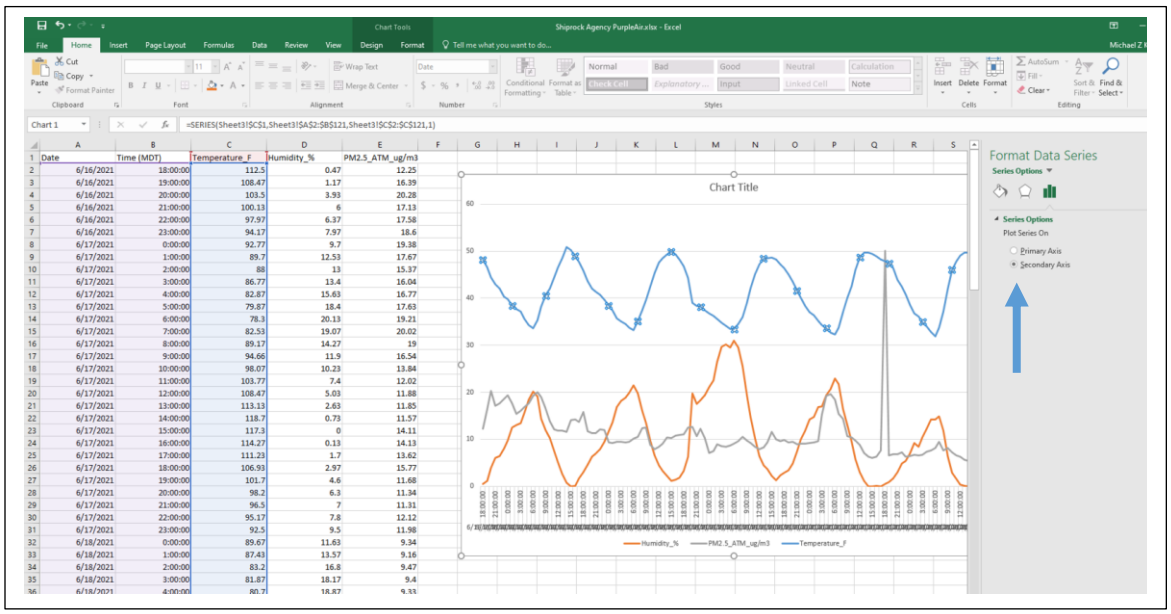




20. Notice the Temperature is plotted high on the Y-axis. You can fix this by plotting the Temperature on the secondary Y-axis. First click on the Temperature data on the chart and right click your mouse to select **Format Data Series**.



You will then select plot series on **Secondary Axis**.



21. Click on Chart Title and add a Title to your chart. Your chart should now look similar to the chart below.