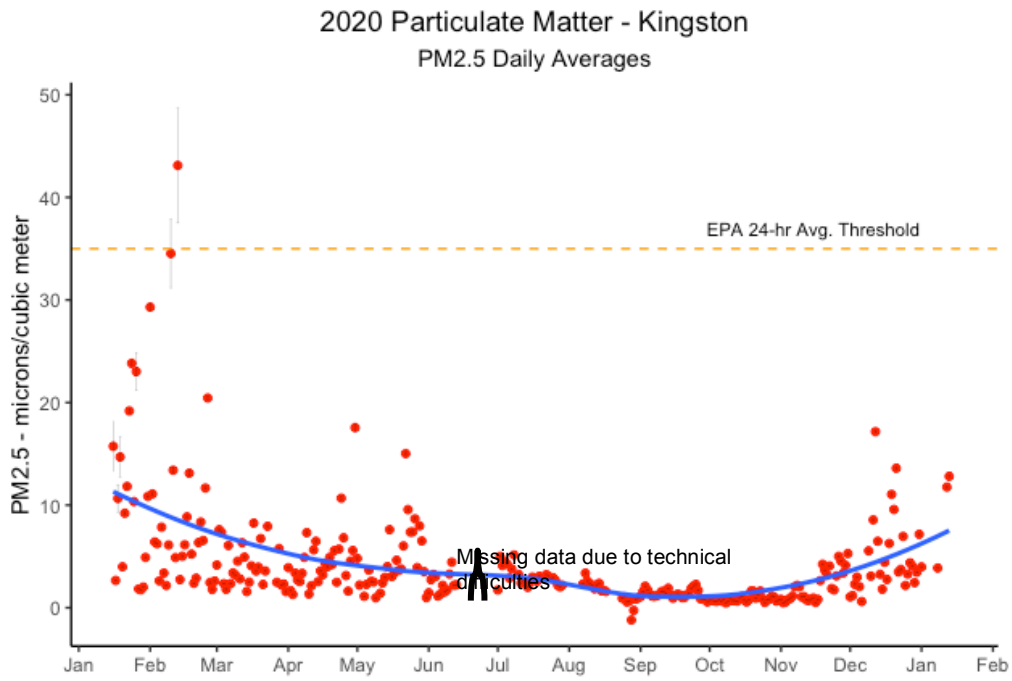
Bard

Data from the Center for the Study of Land, Air, and Water at Bard College
Air Quality Research in Kingston, New York
Dataset 1

Particulate Matter 2.5

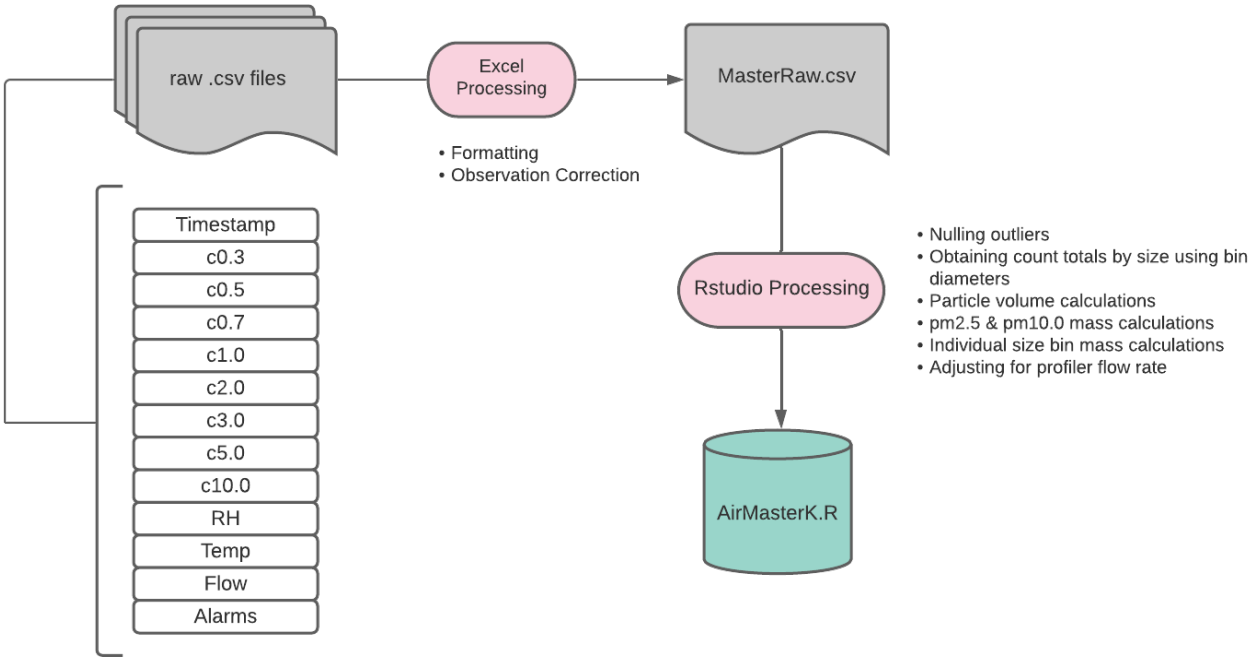


The above figure represents daily averages in **Particulate Matter 2.5** for year one of ambient monitoring in the City of Kingston. Each red point corresponds to the mean PM2.5 concentration for that day in micrograms per cubic meter (µg/m³). Particulate counts are logged on a minute-by-minute basis utilizing the MetOne Model 212 Eight Channel Particle Counter. The orange dashed line represents the U.S. Environmental Protection Agency 24-hour PM2.5 standard of 35 µg/m³. According to this documentation, an area meets the above standard if the 98th percentile of 24-hour PM2.5 concentrations in one year, averaged over a period of three years, is below 35 micrograms/cubic meter. There are limited data available regarding ambient particulate matter concentrations in the city of Kingston. As a result, it is difficult to collate these data with other regional data streams. Our monitoring program is the first of its kind in the

immediate area, and we are pleased to observe limited instances where 24-Hour PM2.5 averages throughout the year exceed the limit determined by the EPA. However, this is just year one of what must be a three-year collection period to make a more definite determination. It also must be taken into account that air quality is subject to significant change over varying spatial scales. While ambient air quality with regard to particulates appears to be quite good at our monitoring site, the story may change when we account for changes in elevation, distribution of industry and green space, as well as population density. To address this, we are expanding our neighborhood-scale monitoring effort significantly. This involves collaboration between KAQI team members and Bard undergraduates to analyze the nearly years-worth of particulate data collected on the interior and exterior of two Kingston households in different neighborhoods of the city using Air Quality Egg technology. More sensors are being deployed in a similar fashion at new residences as well using PurpleAir technology. If you are a Kingston resident and would like to participate in the expansion of our air quality network, please feel free to reach out to the Air Quality Sub Committee of the Kingston CAC at CAC@kingston-ny.gov.

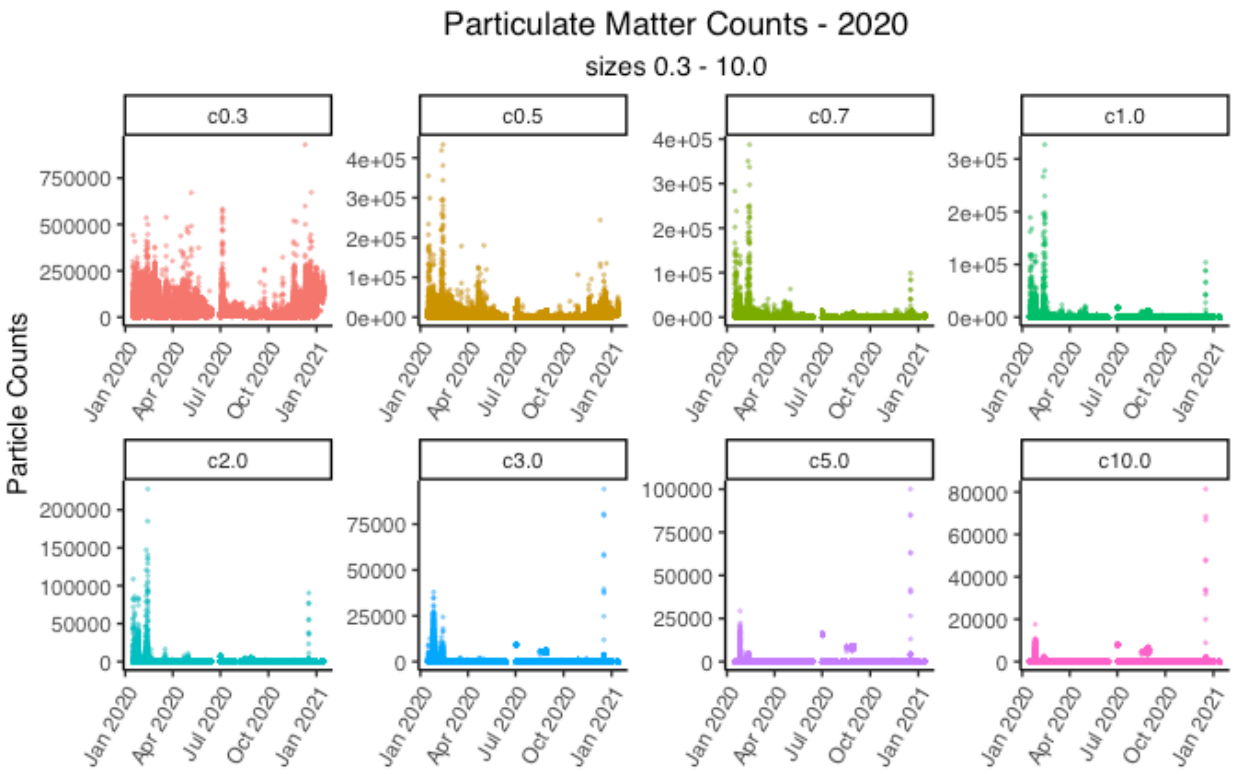
Data Conversion Methodology

The particle counter which we use to collect the above data does not produce PM2.5 mass counts in a ready-to-plot format. There is a significant processing pipeline that the data must go through in order to be prepared for analysis. The development of this pipeline has been a result of the hard work of members of the Bard CSLAW team and Kingston Community members.



The above figure summarizes this data cleaning and processing pipeline. The profiler counts particles cumulatively every minute and organizes these counts into bins. Counts data are then

written to a csv file which undergo preliminary formatting in excel before more advanced formatting in R studio.



The above figure shows all counts colored by size from January 2020 through January 2021 prior to any volume or mass conversion processing. Individual counts of the various size classes are converted to volume using the sphere volume constant for a particle at the midpoint of that size bin. Resulting cubic micron values are converted to cubic centimeters and multiplied by 1.65 to determine the weight per cubic centimeter of particle in grams (Tittarelli et al., 2008, Tuch et al., 2000, Weijers et al., 2004). This value is then converted to micrograms and the 1 liter-per-minute airflow intake of the profiler is converted to cubic meters for a final value in $\mu g/m^3$. PM2.5 and PM10.0 header columns used for analysis include mass counts for particles of those respective diameters summed with the mass counts for all particles below that diameter as well, per their definitions (outlined in the particulate matter description below). Daily averages can then be taken to show PM2.5 or PM10.0 over a several month period as is exemplified in the first figure above. See the R code used to produce the AirMasterK dataset here.