Air Quality Data Sources Explained

Bay Area Air Quality Management District

Why different sites show different readings

For the past month, Bay Area residents have been living through the longest streak of poor air quality in history, which began with the dry lightning storm on August 17 that sparked 367 fires in the greater Bay Area. Now massive fires in Oregon and Washington are adding smoke to our already saturated skies. Having access to accurate air quality data is crucial to protecting ourselves from wildfire smoke, particularly in these times of the pandemic when our respiratory health is even more crucial.

Some may have noticed that a significant variation in readings can be found between different websites with air quality information, including the Air District site, AirNow Fire & Smoke Map, and sensor-specific websites like the PurpleAir map.

Which site is the most accurate and why are they so different?

The Air District air quality map sources data from our 17 stationary $PM_{2.5}$ monitors, which are sited based on specific EPA requirements driven by population density, meteorology, topography, and nearby pollution sources, and operated and maintained consistently. The Air District's $PM_{2.5}$ monitors collect a sample for 50 to 52 minutes, which is then analyzed for eight minutes. Preliminary data quality checks are also performed before it is shown on the website. For instance, the 9 a.m. measurement reflects data gathered between 9 and 10 a.m. Data is displayed in standard time, not daylight savings, so it appears to have an extra hour lag time, so that the 9 a.m. PST data point reflects data gathered between 10 and 11 a.m. PDT.

However, in areas where there is not a nearby Air District site, a denser network of low-cost sensors can provide helpful information as well. Low-cost PM sensors typically use a laser to count particles in the air and are not as accurate and typically read higher than the Air District's monitors, especially during wildfire smoke episodes.

These low-cost sensors are not only susceptible to differences in how each user deploys or maintains them, but each sensor can have different responses to the same levels of PM due to changes in humidity, temperature and the type of particulate matter in the air (wildfire smoke vs. typical PM pollution). Even so, while the exact level of air pollution shown might not be as accurate, the density of data means they can provide a different type of information about real-time air quality on a neighborhood-by-neighborhood basis.

For example, they can tell us how the air quality is changing throughout the day or from place to place, i.e., *Are concentrations generally increasing or decreasing? Is my neighborhood being impacted by wildfire smoke?* This can be especially valuable when air quality is bad and highly variable, like during a wildfire smoke event.

Some low-cost sensor manufacturers provide their own maps that show the air quality readings of all publicly available sensors. The PurpleAir map only shows data from low-cost PurpleAir sensors and

readings are updated every 10 minutes. This map gives the user the option to select different time averages or data correction factors.

Similarly, Clarity OpenMap shows hourly average data from Clarity sensors, but with different data processing and additional calculations to compensate for inaccuracies in the sensors. The Clarity OpenMap also uses the same conversion from concentration to AQI as the Air District and AirNow websites. Data is collected on 5 to 15-minute intervals, a site-specific correction factor is used to adjust the data, and then the data is posted to the website map on an hourly basis.

Further information on PurpleAir and Clarity sensor data can be found at the PurpleAir FAQ and the Clarity blog. Data from the PurpleAir or Clarity sensors should always be viewed cautiously and in conjunction with the Air District's stationary monitors.

AirNow Fire & Smoke Map displays hourly $PM_{2.5}$ data nationally from stationary and temporary monitors deployed by regulatory agencies, as well as low-cost sensors from PurpleAir. The PurpleAir Data is adjusted by an algorithm that compensates for some of the inaccuracies of these sensors. Data is updated hourly and has the highest density of data points due to the additional data from the low-cost monitors, which fills in the geographic gaps between stationary monitor locations. The map's user guide contains very helpful information on how to understand and use the map.

The AirNow Fire & Smoke Map can be particularly helpful since it displays data from the Air District's monitors, California Air Resources Board temporary monitors and PurpleAir sensors on one map. However, the other websites can be useful backup resources under certain circumstances.