

AirNow Fire & Smoke Map: Building Trust in Air Quality Sensors ASIC May 2024

Building Public and Government Agency Familiarity & Trust in Air Quality Sensors

- A decade ago, air quality sensors did not have much of a track record and there were many questions about their potential
- Now, the AirNow Fire & Smoke Map (FASM) has nearly 15,000 PM_{2.5} air quality sensors
 - They provide additional PM_{2.5} air quality information for the public to use to protect their health during wildfire and smoke events in near-real time
 - For this non-regulatory purpose, we treat them as being supplemental sources of air quality information to permanent monitors for the public to use
- The number of PM_{2.5} sensors reporting data on FASM has nearly doubled since its release in August 2020

Review purpose of AirNow Fire and Smoke Map

- Two primary goals:
 - Provide additional PM_{2.5} air quality information for the public to use to protect their health during fire and smoke events in near-real time
 - Provide greater spatial coverage of observations by including data from permanent monitors, temporary monitors, and sensors in a consistent, scientifically-based format ("apples-to-apples" comparison)

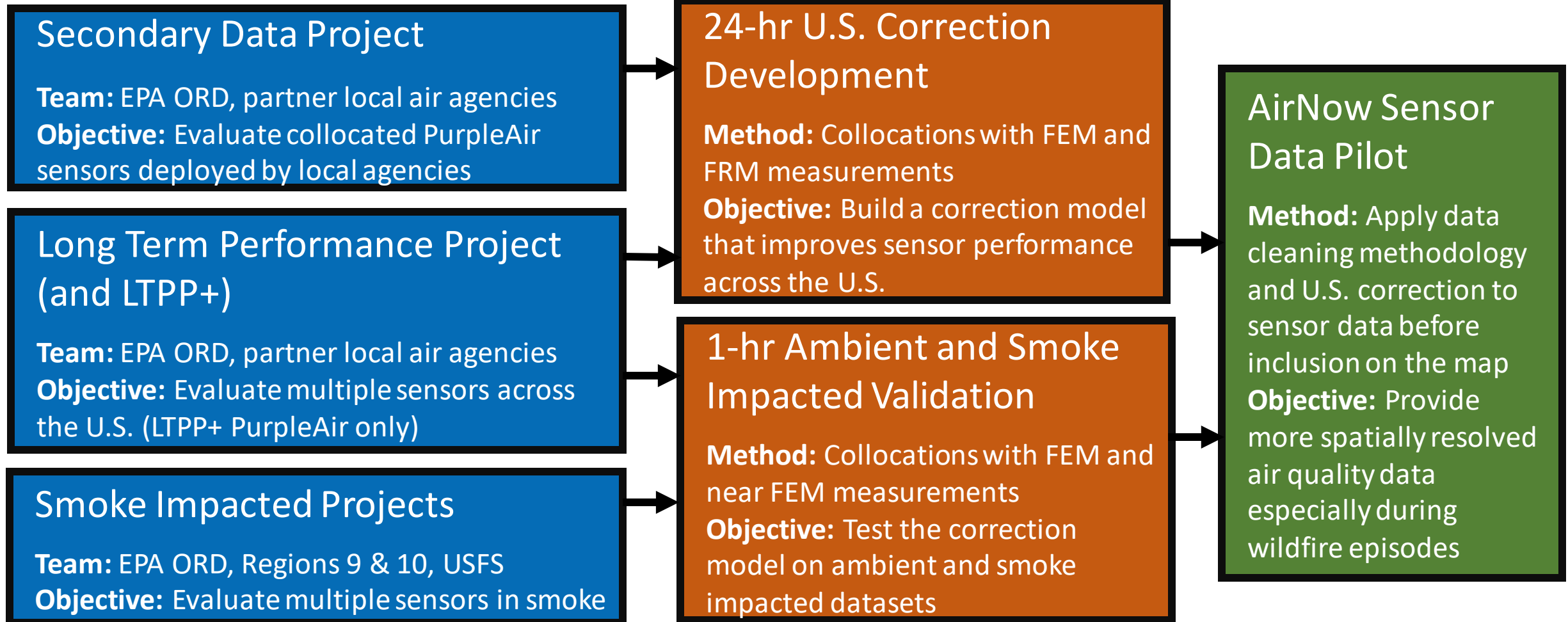
Usage since release in August 2020

- Heavy usage
 - Nearly 50 million page views since initial release
 - Roughly 8 to 10% viewed on AirNow app
 - Over 13 million June through August 2023
- Significant increase in number of sensors
 - Roughly 7,500 for initial release
 - Nearly 15,000 currently
- Spanish version released in September 2022, plan to increase outreach with release of Version 4

Building familiarity and trust is a process

- Key design principle:
 - Provide greater spatial coverage of air quality observations by including data from permanent monitors, temporary monitors, and sensors in a consistent, scientifically-based format ("apples-to-apples" comparison)
- Before release of the map:
 - EPA ORD worked with air agency partners to collocate sensors for performance testing and to develop a data correction approach
 - EPA ORD established a collaborative agreement with PurpleAir to support Agency use of public-facing data for research and applications
 - EPA and USFS worked closely with State, Local and Tribal agencies to provide them with the time to review and provide comments on the design of FASM

Research Efforts enabling the sensor data correction AirNow sensor data pilot



FEM=Federal Equivalent Method
FRM=Federal Reference Method

Prior to sensor data appearing on FASM several QA steps happen

- FASM team gets sensor manufacturer QA'ed data stream via a PurpleAir API
- Prior to the data appearing on FASM, it goes thru several cleaning steps

Cleaning steps

1. Only outdoor sensors selected
2. Average PurpleAir PM_{2.5} and Relative Humidity (RH) data to 1-hour
3. Clean the data; Remove data when channels differ by $\geq \pm 5 \mu\text{g m}^{-3}$ and $\geq \pm 70\%$
4. Average A & B channels
5. RH removed if outside 0-100%, if removed or missing replace with 50%
6. Apply U.S.-wide correction equation to 1-hr data (has been updated since initial FASM release)

FASM has been updated and upgraded since 2020

- We released FASM as a pilot in August 2020, not knowing what the acceptance would be.
- As previously indicated, it is recognized as the go to resource for the public for wildfire smoke air quality information and recommendations on how to protect their health based on the EPA Air Quality Index (AQI) and AirNow program
- Over the past few years, we have released 2 other FASM versions, each time improving the clarity and quality of the air sensor data. For example:
 - A few updates to the correction equation
 - Improvements to the user interface
 - Adding a Spanish language version
 - Adding a color assist button to improve the readability of the map for color-blind individuals

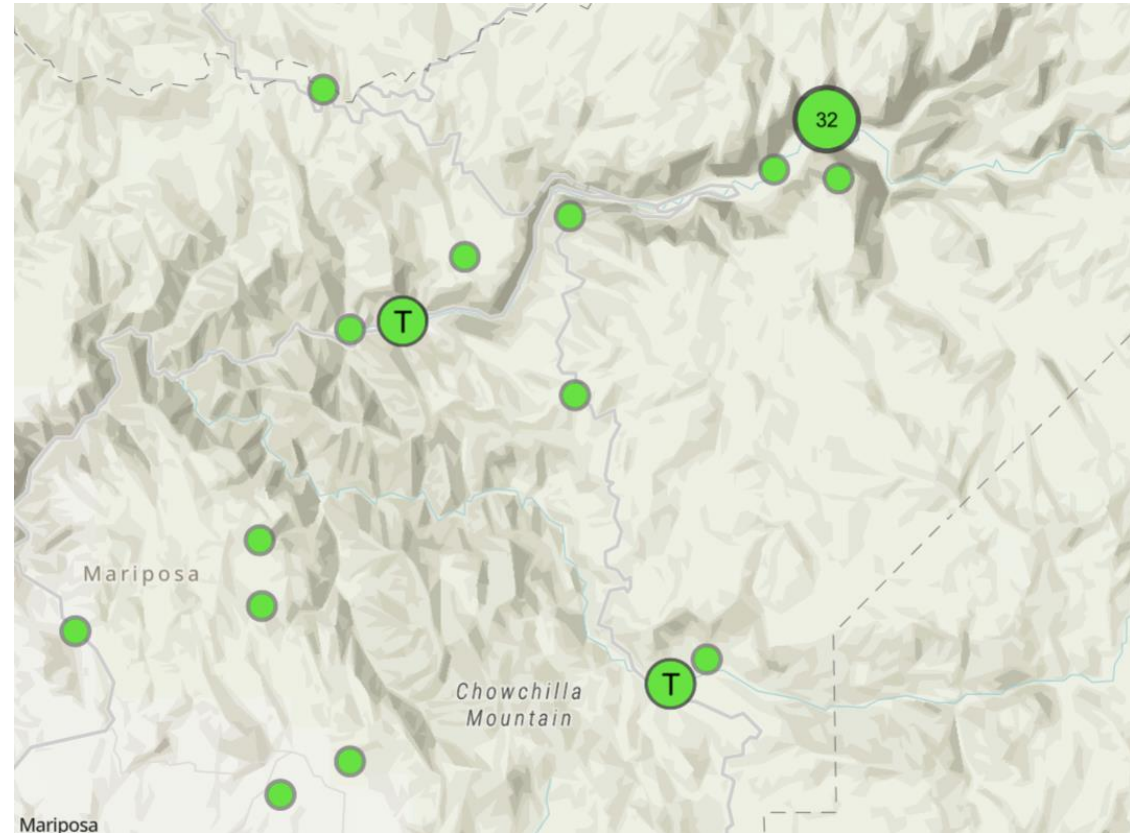
Planning to release Version 4 in May 2024

- Substantial upgrade in underlying software, initial beta test with air agency partners in August 2023
- Version 4 has an updated look and feel
- More “at a glance” information about your location
 - A consistent approach whether you are on a computer or mobile device
- Some new and updated features
 - Much faster loading
 - An indication when ozone or PM10 are the controlling pollutant
 - More explanatory information when a user digs down
 - Better fire information display
 - PurpleAir sensors located in Canada will appear on FASM using the EPA AQI consistent with the treatment of monitors already on FASM
 - New symbols for permanent monitors, temporary monitors and sensors
- Concurrent release of Spanish Version 4

Re-styled monitor and sensor symbology

Updated software
compelled a change

- 12** Permanent Monitors
- T** Temporary Monitors
- Air Sensors



Updating and Improving the quality

- Underlying science features (e.g., correction equation) remain unchanged
- Beginning in Version 3 we started including steps to remove sensors which were clearly problematic (e.g., PM_{2.5} levels remained constant over hours or days)
- Version 4 will start testing approaches to automatically detect potentially malfunctioning or mislocated sensors . However, since PM_{2.5} levels can vary significantly over a small distance we will proceed cautiously their implementation
- Will include the updated AQI breakpoints required with the changing of the PM_{2.5} National Ambient Air Quality Standard
 - <https://www.epa.gov/system/files/documents/2024-02/pm-naaqs-air-quality-index-fact-sheet.pdf>

Success in building familiarity & trust in air quality sensors

- Through a variety of ways, air quality sensors, in particular for PM_{2.5}, have gained familiarity and trust by the public and government agencies
- FASM was considered and released to provide a forum for sharing air quality sensor and monitor data side by side
- For this non-regulatory purpose, we treat them as being supplemental sources of air quality information to permanent monitors for the public to use to protect their health during wildfire smoke events
- Scientific credibility & transparency are paramount for familiarity and trust
- We will continue to update and improve FASM
 - For example, we are running a pilot process on how to qualify sensors from other manufacturers to FASM including transparent criteria and rationale



Thank you!

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