Summary of EPA's Current Work with Air Quality Sensors

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October 2020

Agenda

Update on (Select) Sensor R&D Projects

AirNow Sensor Data Pilot

Data Interpretation Efforts

Discussion Questions

Sensor R&D - RTP Evaluations
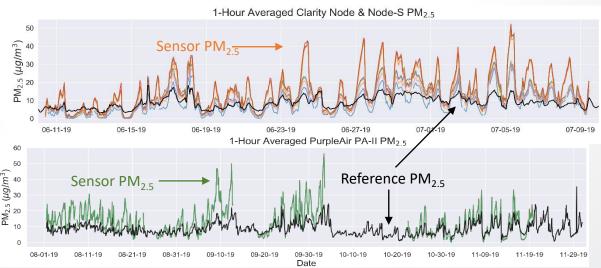
Project Lead: Andrea Clements

- **Continued effort to evaluate new sensors coming to market**
  - Focus on criteria pollutants ($PM_{2.5}$, O_3, etc.), considering other pollutants (e.g., VOCs, HAPs)
  - Especially interested in products likely to be widely adopted and/or new technologies
- **Air sensors are collocated at the AIRS research site in RTP, NC for at least 30 days**
  - Devices of the same type are tested in at least triplicate to understand sensor precision
  - Paired hourly and daily averages are compared to nearby FRM/FEM regulatory instruments (Teledyne T640x for $PM_{2.5}$, T265 for O_3) and meteorological measurements to evaluate accuracy
- **Results shared on the Air Sensor Toolbox** (www.epa.gov/air-sensor-toolbox)

AIRS Site

1-Hour Averaged Clarity Node & Node-S $PM_{2.5}$
Sensor $PM_{2.5}$

1-Hour Averaged PurpleAir PA-II $PM_{2.5}$
Sensor $PM_{2.5}$
Reference $PM_{2.5}$

Sensor R&D - Long-Term Performance Project

Project Lead: Andrea Clements

Study Design & Goal:

- Leverage partnerships with air monitoring agencies to test sensors
  - 7 air monitoring stations across the U.S. (NC, GA, DE, AZ, CO, OK, WI)
  - 1-year of measurements beginning in July 2019*
- 6 air sensors
  - Some PM only, some multipollutant
  - AQY – Aeroqual, PA-II-SD - PurpleAir, ARISense – QuantAQ, Ramp – SenSit, Maxima – Applied Particle Technology, Clarity Node – Clarify Movement Co.
- Understand sensor performance across regions and environmental conditions

Anticipated Findings:

- Will allow for a broader understanding of:
  - Air sensor performance
  - Resources needed to successfully deploy useful sensor networks

Sites across the U.S.

*ARISense deployed in second phase in 2020

EPA Sensor R&D Air Sensor Performance Targets

Project Leads: Rachelle Duvall and Andrea Clements

- **Issue**
  - Sensor data quality is highly variable, making it difficult to understand their performance
  - Consistent testing protocols, metrics, and targets have **not** been available to uniformly evaluate and compare different technologies
- **Approach**
  - EPA is developing two reports for ozone and $PM_{2.5}$ air sensors that outline testing protocols, performance metrics, and target values for those metrics
  - *Applications*: Non-regulatory supplemental and informational monitoring (NSIM) in ambient, outdoor, fixed site environments
  - *Intended audience*: testing organizations and sensor manufacturers/developers
- **Anticipated outcomes**
  - Provide standard approach to evaluate and report the performance of sensors
  - Help consumers make informed decisions on choosing sensors for NSIM applications
  - Encourage innovation and product development in the marketplace

Reports will be available in Fall 2020 on the Air Sensor Toolbox website:
https://www.epa.gov/air-sensor-toolbox/air-sensor-performance-targets-and-testing-protocols

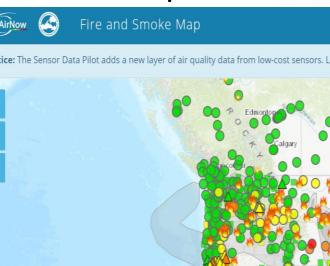# AirNow Sensor Data Pilot

EPA

Project Lead: Ron Evans

Motivation:

- Analytics show that the public wants information on their air quality, especially during fires **and** will turn to any source in their area (e.g., AirNow and PurpleAir websites crashed during 2018 CA wildfires)

- Sensors can provide air quality information where no monitors are available

- With increase use of sensors, increased potential for conflicting information and public confusion as data is displayed differently and at different time scales than on AirNow and state websites
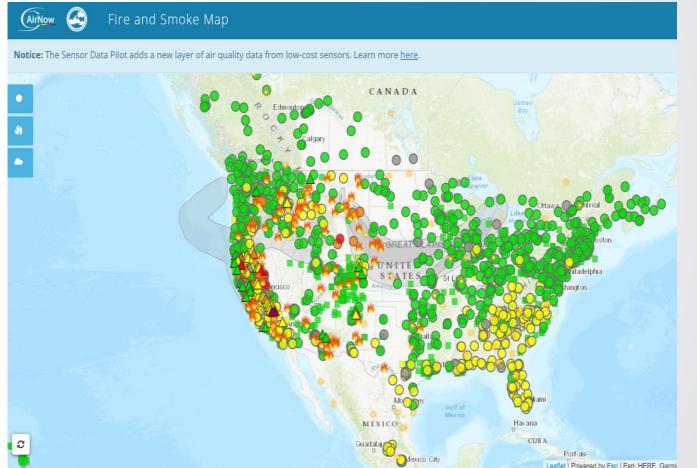
Goals:

- Provide the public with additional air quality information they can use to protect their health during wildfires

- Improve coverage where monitors do not exist

Fire and Smoke Map

AirNow Sensor Data Pilot

Project Lead: Ron Evans

Approach and Current Status:

- New sensor data layer added to existing Wildfire and Smoke Map on Airnow.gov that integrates publicly available $PM_{2.5}$ data from the PurpleAir sensors

- New map layer released on August 14th and coincided with a large number of fires in the West

- Millions of page views since became live

- Several articles and posts have appeared talking about the map availability and usefulness

- Receiving numerous helpful suggestions and positive comments from the public and air agencies

Fire and Smoke Map

Sensors: Data Interpretation Projects

- Frequently Asked Questions - Visit EPA's Air Sensor Toolbox FAQ page

- Includes what EPA means by "air sensor", how the technology is being used, common challenges experienced by users, and others

- EPA's Office of Air and Radiation addressed questions from state and local air agencies regarding EPA's position on the use of air sensor data for National Ambient Air Quality Standard (NAAQS) compliance
  - Released a memo on June 22, 2020
  - Describes steps Agency is taking to better understand the data quality, interpretation, and management of sensor data in the ambient environment
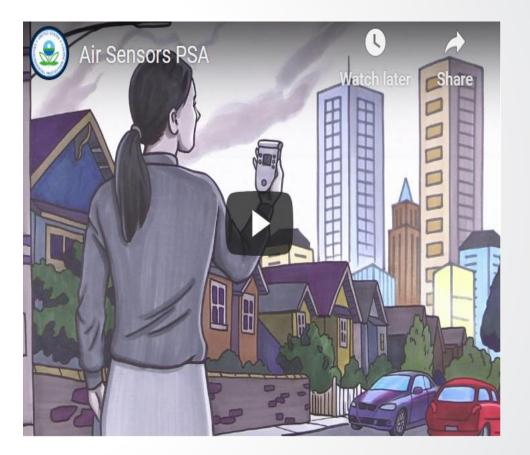
Sensors: Data Interpretation Projects

Air Sensor Public Service Announcement – PSA

Video 1: Air Sensors: Regulatory Data and Sensor Data Quality

Video 2: Air Sensors: Measurements and Your Health

Video 3: Air Sensors: Sources of Air Quality Information

Available in both English & Spanish

Sensors: Data Interpretation Projects

- Comparing Public Facing Websites: Project Goals and Objectives
  - Understand the similarities and differences among publicly available websites reporting current air quality conditions for the United States
  - Summarize each information source (technical methods, data display and messaging, data quality)
  - Conduct case studies during fire/smoke events in California to qualitatively and semi-quantitatively analyze how current air quality information reported at approximately the same time, is the same or different across websites

Sensors: Data Interpretation Projects

Air Quality (AQ) Exchange: Delivering High Value Air Quality Information to the Public

- EPA hosted participants to discuss the increasing amount of air quality information being shared by various public and private entities.
- Confusion over air quality information exists because data is being generated for different purposes, needs, and users. EPA brought together stakeholders, specifically providers and interpreters of the data, to share information about their air quality products and role and perspectives on delivering air quality information to the public, and to provide a forum for discussion.
- A workshop summary, presentation overviews, conclusions, and next steps are available here.

Discussion Question(s)

- EPA is developing two reports for ozone and $PM_{2.5}$ air sensors that outline testing protocols, performance metrics, and target values for those metrics
  - What are your thoughts on the current need to develop similar reports for NO_2, SO_2, PM_{10}, and CO? Is the need for all or some of the remaining pollutants?
- What have been your experiences with the AirNow Sensors Data Pilot?
- How are you using low cost sensors in your program now?
- What are the most pressing data quality, interpretation, and management needs for sensors now and in the next few years?
- Other?

Acknowledgments

Thanks to all contributors:

- **RTP Evaluations:** *A. Clements, S. Frederick, B. Thomas, W. Schoppman, J. Rice*

- **LTPP:** *A. Clements, K. Barkjohn, C. Johnson, B. Thomas, S. Frederick, Maricopa County AQD, Wisconsin DNR, Colorado DPHE, Oklahoma DEQ, Delaware DNR, Georgia DNR, EPA OAQPS*

- **Sensor Performance Targets:** *Sensor Performance Targets Deliberation Workgroup; ERG; TD Environmental Services*

- **PM Sensors for wildfire**: *A. Holder, B. Mitchell, A. Mebust, D. Vallano, L. Maghran, K. Stewart, R. Elleman, M. McGown, M. Arashiro*

- **U.S. correction:** *K. Barkjohn, A. Clements, B. Gantt, State of Alaska, Citizens for Clean Air, Maricopa County AQD, San Luis Obispo County APCD, Mojave Desert AQMD, CARB, Santa Barbara County APCD, Ventura County APCD, Colorado DPHE, Delaware DAQ, Sarasota County, Georgia EPD, Reg4, Iowa DNR, Kansas DHE, Missoula County, Montana DEQ, Forsyth County, Clean Air Carolina, Quapaw Nation, Oklahoma DEQ, Virginia DEQ, Vermont DEC, Puget Sound CAA, Wisconsin DNR*

- **AirNow Sensor Data Pilot:** *EPA OAR & ORD, USFS, and State, Local and Tribal partners*

- ***Public AQ Information***: *K. Benedict, A. Kaufman (videos), R. Evans, L. Shumway, A. Ingelsias (screenshot analysis)*