WRAP Meeting – June 12th 2023

Wildfire Smoke Air Monitoring Response Technology (WSMART) Pilot

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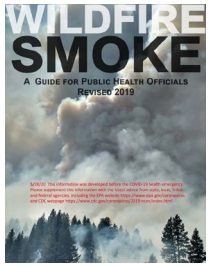
Office of Research and Development (ORD)

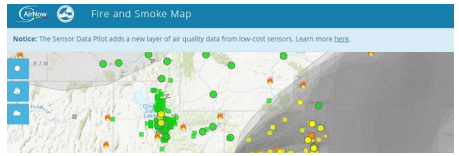
Center for Environmental Measurement and Modeling

Wildfire Smoke: Long-standing EPA ORD research, expansion to emergency response

Continuing areas of R&D: Studying source emissions to health and ecosystem impacts; methods development in modeling, monitoring, data visualization, and risk communication

Bench to field: ORD support to wildfire air quality response:





…with many partners inside and outside of EPA

Images: John Iiames (EPA) deployed as Air Resource Advisor to the Summit Trail fire in July 2021

Ongoing research effort: Wildfire Smoke Air Monitoring Response Technology (WSMART)

BRIEFING ROOM

FACT SHEET: The Biden-Harris Administration Acts to Address the Growing Wildfire Threat

JUNE 30, 2021 • STATEMENTS AND RELEASES

- Initiated in 2021 to support White House and EPA Administrator goals
- Continued in 2022 and in 2023 under the EPA ORD Air, Climate and Energy Program

WSMART technology loans

Air monitors for supplemental smoke monitoring:

- Stationary sensors: PurpleAir ($PM_{2.5}$); Multipollutant model ($PM_{2.5}$, CO, CO_2, TVOCs)
- Vehicle Add-on Mobile Monitoring Systems (VAMMS): ORD developed mobile $PM_{2.5}$ sensor package

- **Partnering with EPA Regions and Office of Air and Radiation (OAR)**
  - Loan on request to **state, tribal, and local air organizations** to meet their supplemental monitoring needs
  - Loans initiate via a webform request: https://www.epa.gov/air-sensor-toolbox/wildfire-smoke-air-monitoring-response-technology-wsmart-pilot
- **Partnering with the Interagency Wildland Fire Air Quality Response Program (IWFAQRP)**
  - Provided supplemental $PM_{2.5}$ sensors direct to the USFS Rocky Mountain Cache.
  - Multipollutant & VAMMS technologies sent to incident through direct request by Air Resource Advisors (ARAs) deployed to incident management teams

$PM_{2.5}$ – fine particles; CO – carbon monoxide, CO_2 – carbon dioxide; TVOCs – total volatile organic compounds

State, Tribal and Local requests go through an EPA website

https://www.epa.gov/air-sensor-toolbox/wildfire-smoke-air-monitoring-response-technology-wsmart-pilot

Wildfire Smoke Air Monitoring R...

epa.gov/air-sensor-toolbox/wildfire-smoke-air-monitoring-response-technolo...

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Air Sensor Toolbox

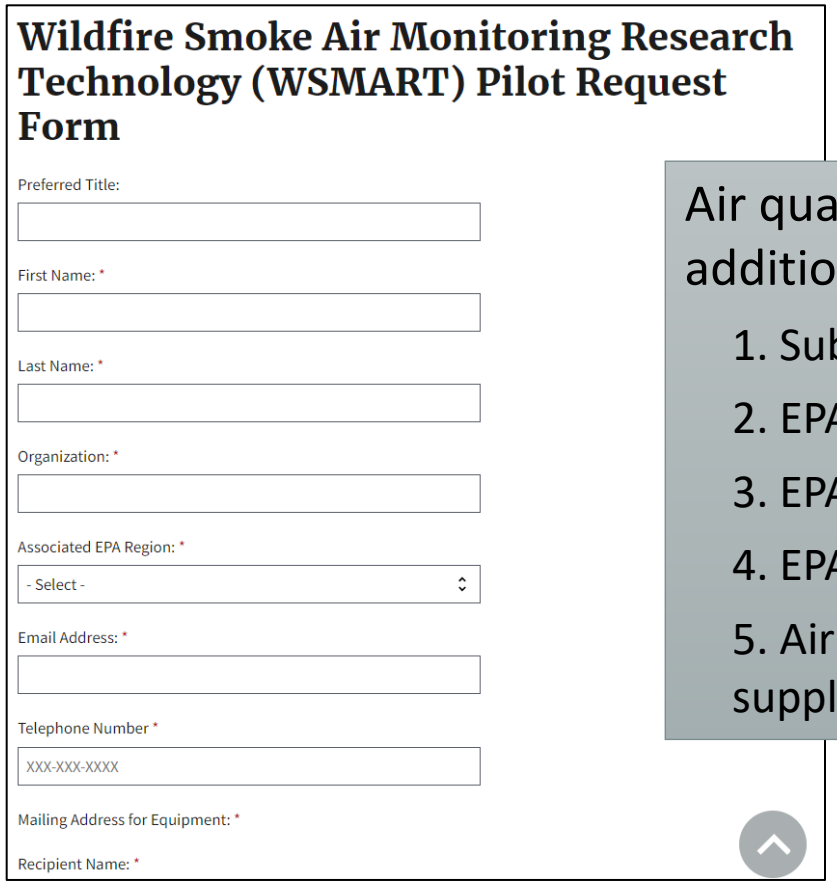
CONTACT US

Wildfire Smoke Air Monitoring Response Technology (WSMART) Pilot

EPA's Office of Research and Development has three different air monitoring technologies available for loan to state, local, and tribal air organizations to support supplemental air monitoring in areas affected by wildfire smoke and with observational data coverage gaps.

The Wildfire Smoke Air Monitoring Response Technology (WSMART) pilot is part of a federal government response to address the growing threat of wildfires and related smoke impacts that are a public health concern in the United States. In many areas affected by wildfire smoke, air monitoring data may be limited or absent. Supplemental monitoring technologies can help air monitoring organizations gather timely data to assess smoke impacts and provide public health information.

The systems that are available upon request are two stationary sampling systems – the PurpleAir sensor and ThingyAQ sensor system – and a portable system called the Vehicle Add-On Mobile Monitoring System (VAMMS). If you are representing a state, local or tribal air agency and wish to request one or multiple air monitors, please fill



Wildfire Smoke Air Monitoring Research Technology (WSMART) Pilot Request Form

Preferred Title:

First Name: *

Last Name: *

Organization: *

Associated EPA Region: *

- Select -

Email Address: *

Telephone Number *

XXX-XXX-XXXX

Mailing Address for Equipment: *

Recipient Name: *

Air quality agencies in need of additional monitoring technology:

1. Submit information to webform
2. EPA reaches out to discuss their needs
3. EPA sends out equipment
4. EPA conducts virtual training sessions
5. Air quality agencies will set up supplemental monitoring

More information: Multipollutant monitors

2023: Canary-X

2022: Thingy AQ

Description:

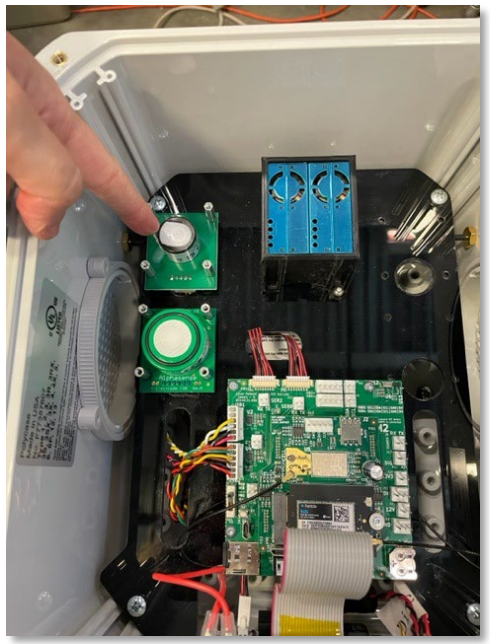
- Multipollutant packages measure $PM_{2.5}$, CO, CO_2, total VOCs via sensors continuously (minute resolution)
- Solar-battery power
- Cellular data communication sends data to cloud in real time
- Data are accessible on private access data platform

Suggested use case:

Locations with $PM_{2.5}$ and CO concerns

Locations without infrastructure

Experimental VOC sensors still need validation for smoke



Used in 2022

Canary-X in 2023

More information about the technology: VAMMS

Vehicle Add-on Mobile Monitoring System (VAMMS)

Description:

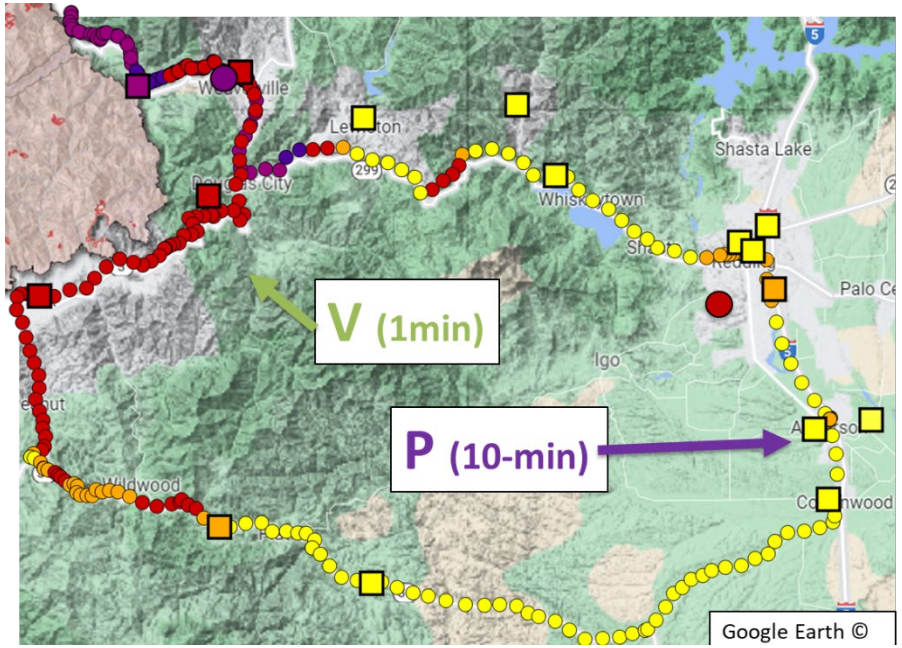
- Measures $PM_{2.5}$, RH, T, latitude, longitude, and elevation at 1-s resolution
- Compact for use in any vehicle
- Battery powered for ~8hr sample time
- Car adaptor for extended life
- Data can be uploaded, mapped, and explored with RETIGO web app (www.epa.gov/retigo)

Suggested use cases:

Identifying ideal stationary monitor site

Mapping $PM_{2.5}$ concentrations in areas without infrastructure

Measuring along transportation corridors



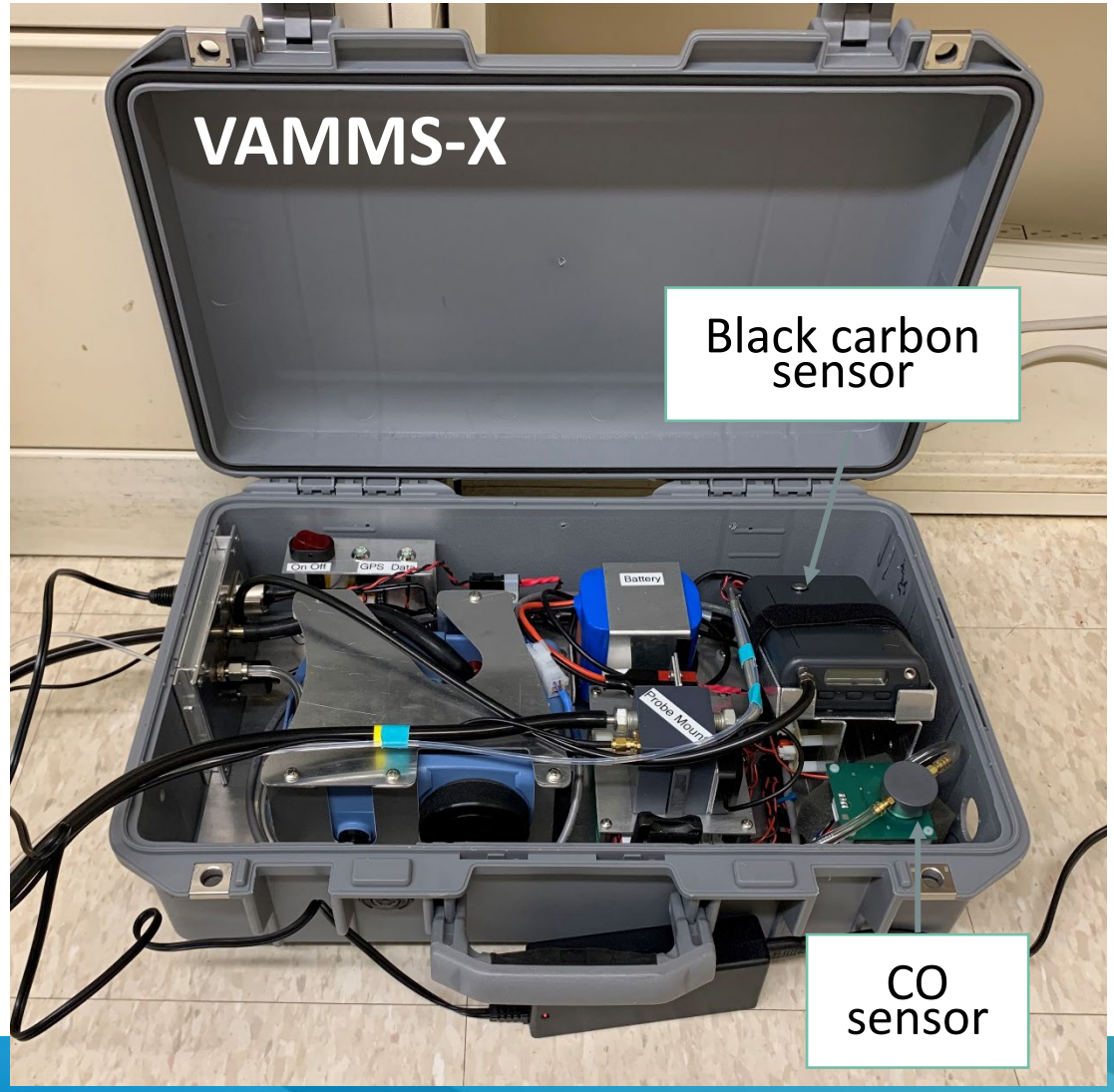
Custom built by EPA, evaluated at multiple fires in 2021 and 2022, shown to provide comparable data at high time resolution

More information about the technology: VAMMS-X

- Extended version of the VAMMS includes integrated CO and black carbon sensors
- Color changing LED based on AQI
- Data formatted for RETIGO, toggle between pollutants on map
- Limited number available (3) for beta testing loan

Suggested use case:

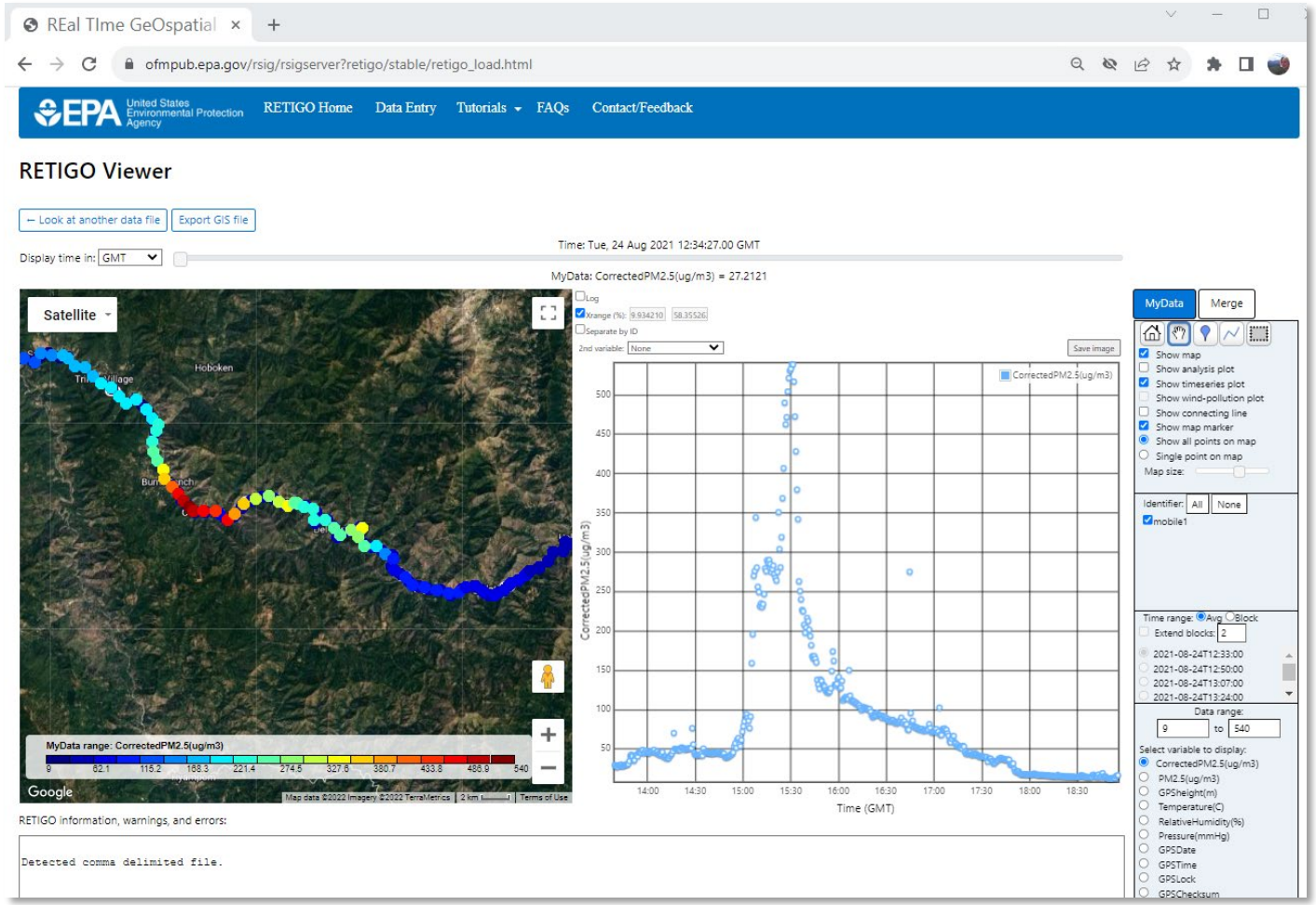
- Areas with a CO concern
- Dusty areas where PM may be from dust or smoke



More information about the technology: RETIGO

- Transfer VAMMS data using SD card
- Visualize with RETIGO (web-based app, no installation required)
- VAMMS data formatted for RETIGO
- User can:
  - Map any VAMMS data ($PM_{2.5}$, CO, Temperature, etc.)
  - Plot time series
  - Compare to other data sources (AirNow, Metar)

New version near the end of 2023 with more data sources (e.g., PurpleAir), KML export for 3D mapping in GoogleEarth



www.epa.gov/retigo

Testing partner loan option

From the project website: https://www.epa.gov/air-sensor-toolbox/wildfire-smoke-air-monitoring-response-technology-wsmart-pilot

Can I request this equipment to try out during periods of low wildfire activity?

During periods with lower wildfire activity nationwide, state, local, and tribal air organizations can request a loan of the monitors for up to a 3-month-period under an equipment testing partnership. In this arrangement, the recipient can try out the monitoring equipment and use it to collect data in other smoke measurement applications (e.g., prescribed fire). The WSMART technical team will be interested in user feedback from these partners and collected data to support ongoing research and development activities. For requests of this nature, please specify in the comments of the request form that this is an equipment testing partnership request and the preferred time window of your loan.

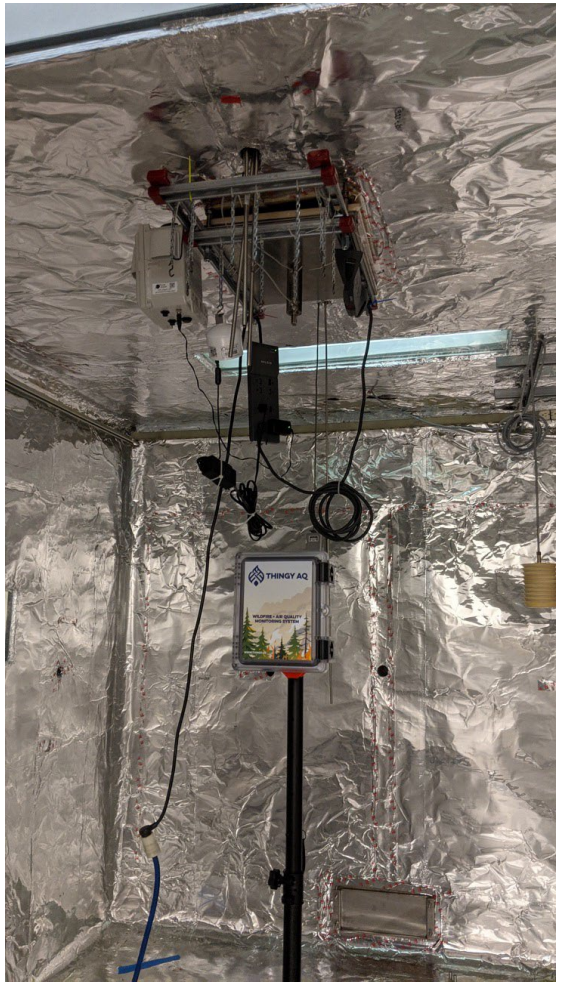
→Use the same webform to request a testing partner loan

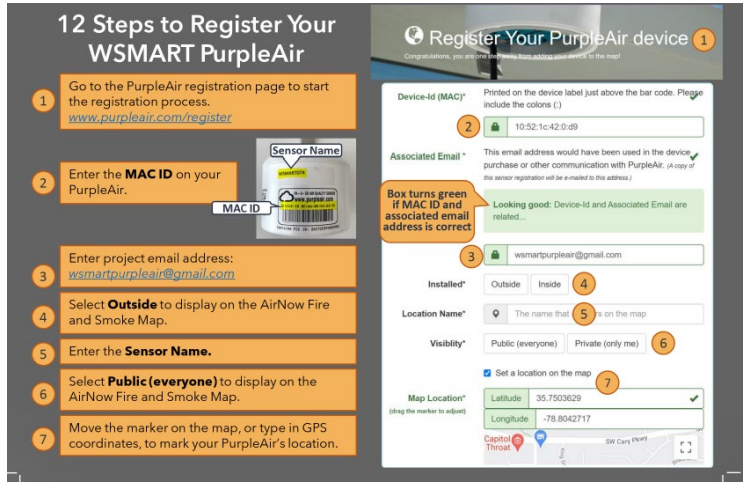
- Case by case opportunity based on availability of equipment and ORD personnel to provide off-season support.
- Expectation on the ORD side: Receiver is willing to give technical user feedback on the equipment.

Example testing partner loans:

- State, local, and tribal organizations (e.g., CDPHE, local air district in CA, Tribe in CA) requested equipment for hands-on experience.
  - *Due to wildfire occurrence, CDPHE loan shifted to a wildfire response scenario*
- State agency interested in collocation testing of multipollutant monitor based on their unique climate (AKDEC).

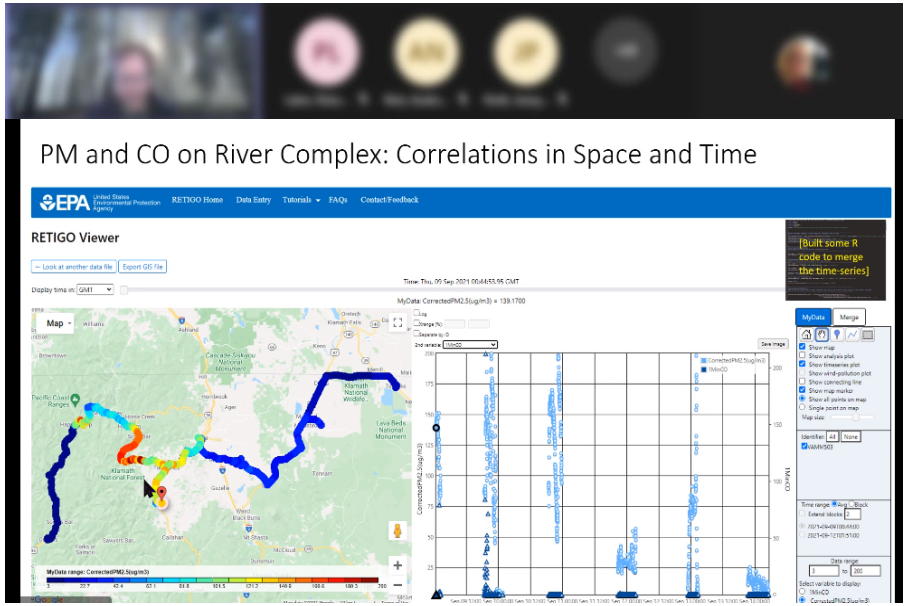
WSMART provides QA/QC, training, and user guides





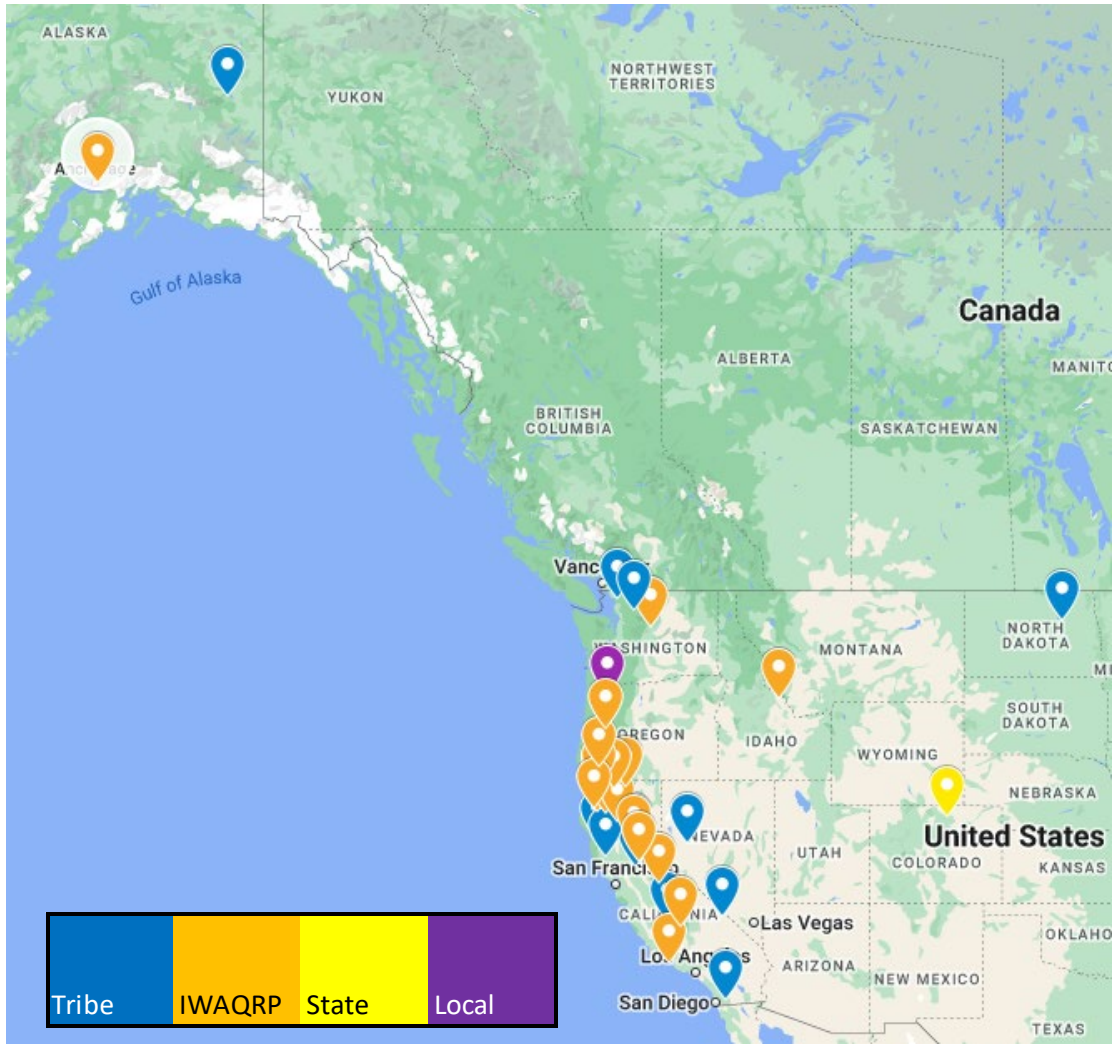
Bringing equipment from lab to field…

- Pre-deployment quality assurance and quality control (QA/QC) checks (ORD project QAPP)
- User-friendly quick start guides
- Remote coaching to quickly come up to speed
- Share common "oops" that create issues



Lab image credit: Amara Holder

WSMART Loans



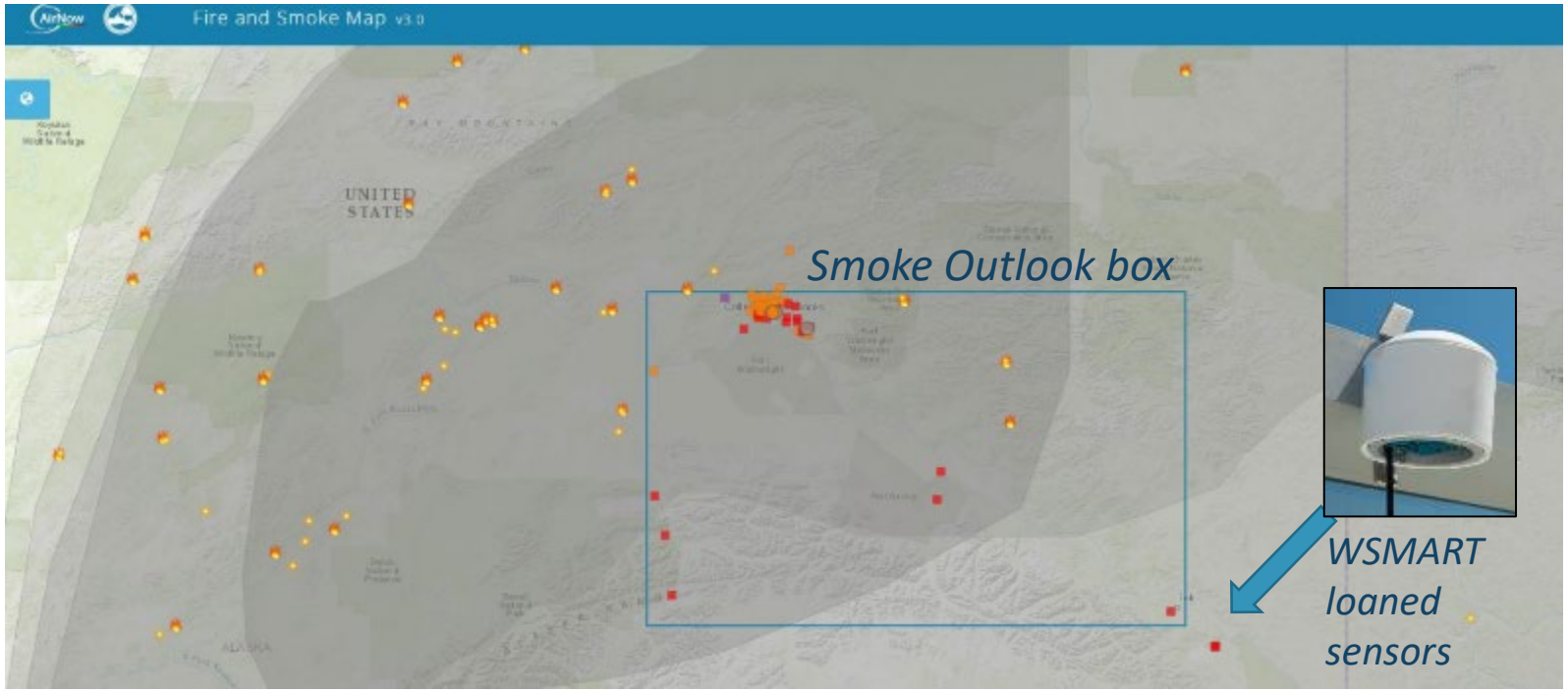
In 2022:

- 29 total loan recipients utilized WSMART equipment
  - 12 loan recipients were tribal organizations, who all requested $PM_{2.5}$ sensor units.
  - 14 loan recipients were ARAs, who all utilized a VAMMS unit, and a subset also requested a multipollutant sensor system.
  - 3 loan recipients were state and local organizations, with varying equipment requests.

- Loan recipient locations were in 8 states: CA, OR, WA, NV, ID, CO, ND, AK

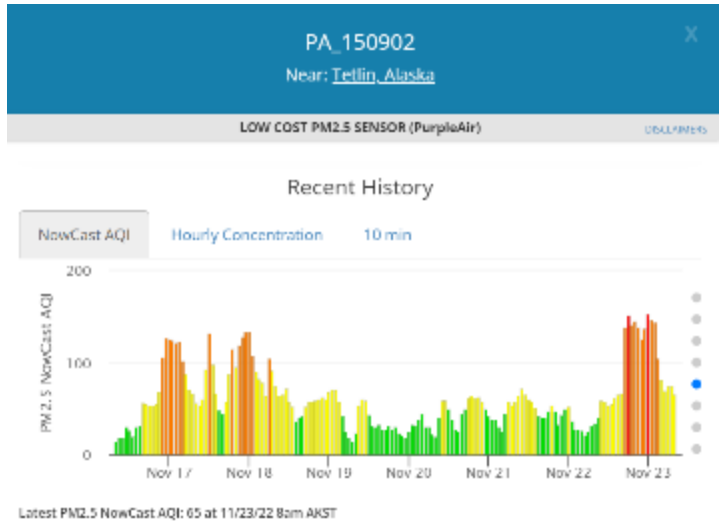
2022 case study: Tetlin Tribal Council

Tetlin Tribal Council requested WSMART loan of $PM_{2.5}$ sensors to provide observational data in their village, located in a remote area of Alaska and impacted by 2022 wildfires; ~200 miles from nearest regulatory monitor



Loan Summary:

- Used the 3 PA sensors at tribal government buildings covering the several outdoor areas
- Option to retain PA sensors for continued $PM_{2.5}$ monitoring



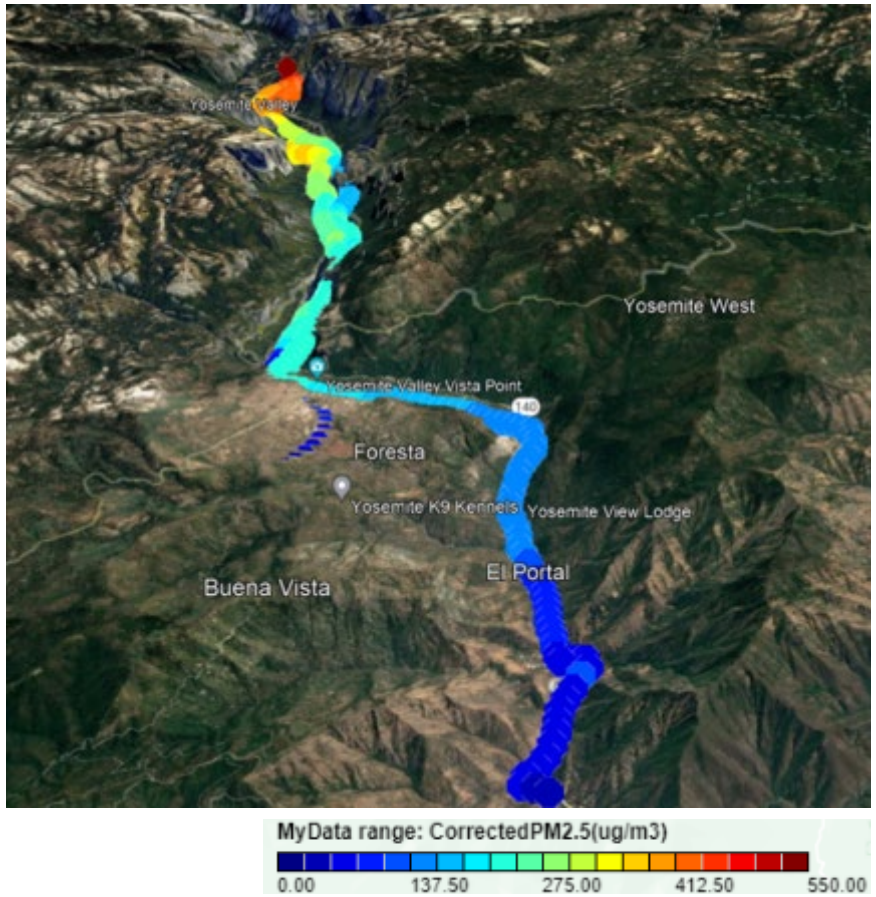
2022 ARA case study: Red & Rogers Fire

ARA serving at Red and Rogers Fire

Assigned as ARA in late August in Yosemite National Park. Fires were managed as a Type 3 incident – smaller organization, less overhead and partners.

- Substantial terrain in the area of the fires and the spike camps
- Relatively smaller fires, more localized smoke impacts
- Very few monitors in the area

Altogether, a challenging area to generate a smoke forecast.



Loan Summary:

- Used the VAMMS data with persistent weather forecast to inform smoke outlook. Used the VAMMS to identify when the inversion lifted and confirm the improvement of air quality in the valley.

- Presented data to the National Park staff to show where smoke was higher and lower in the park and how it varied throughout the day. This information allowed staff to prioritize work locations/times when air quality was optimal.

2022 ARA case study: Cedar Creek Fire

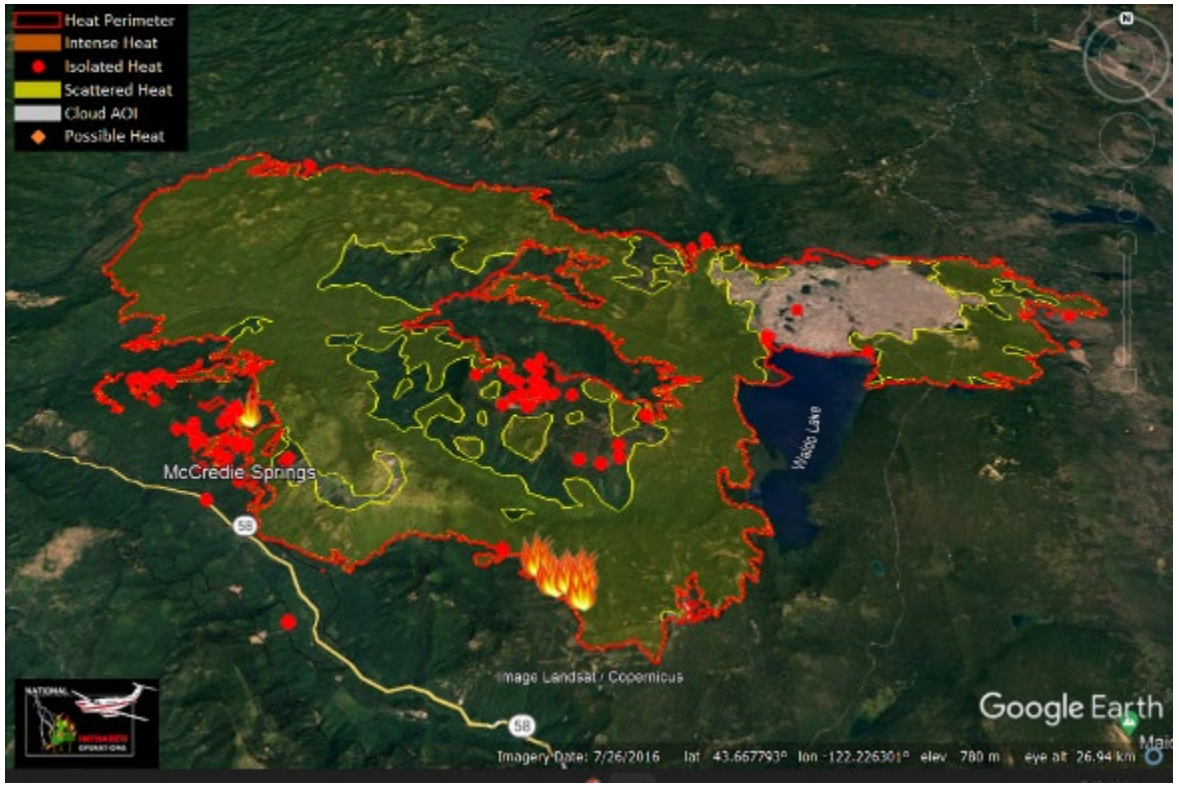
ARA serving at Cedar Creek Fire

Cedar Creek Fire Incident Command Post in an area with frequent and extreme smoke impacts

Loan Summary:

- Used stationary multipollutant sensor system to monitor for $PM_{2.5}$ and CO
- CO levels rose during dense smoke periods, but remained below any health and safety thresholds
- Data valuable to answer questions regarding smoke exposure to emergency responders at this location

Cedar Creek Fire in Oregon Fire Perimeter from 9/26/2022



Pictures from Air Resource Advisor – Gayle Hagler

WSMART next steps:

- Continue loan program in 2023 fire season
- Continue testing partner loans with state/tribal/local air agencies during the times of low wildfire
- Continue wildfire smoke monitoring technology R&D
  - Improving monitoring systems and training based on loan recipient feedback.
  - Improving connections to EPA air quality apps
    - AirNow Fire and Smoke Map incorporation of sensor data (fire.airnow.gov)
    - RETIGO data visualization platform (epa.gov/retigo)
  - Development of a VAMMS-X prototype, incorporating a CO and black carbon sensors
  - Analysis of WSMART data collected and shared back for R&D purposes
  - Publication being prepared on VAMMS development and use for smoke monitoring from wildland fires

Related resources

Resources related to emerging air monitoring technologies:

EPA Air Sensor Toolbox - https://www.epa.gov/air-sensor-toolbox

RETIGO: https://epa.gov/retigo

AirNow Fire and Smoke Map: https://fire.airnow.gov/

AQ-SPEC - http://www.aqmd.gov/aq-spec

WSMART project page: https://www.epa.gov/air-sensor-toolbox/wildfire-smoke-air-monitoring-response-technology-wsmart-pilot

Research team and Region Points of Contact (POCs)

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OAR: James Payne, Pat Childers, Amanda Kaufman, Corey Mocka, Hayden Hardie
Region 1: Michelle Coombs, Alysha Murphy, Bob Judge (retired)
Region 2: Sarah Pender
Region 3: Meighan Long
Region 4: Ryan Brown
Region 5: Robin Katz
Region 6: Mark Berry, Frances Verhalen (retired)
Region 7: Leland Grooms
Region 8: Joshua Rickard
Region 9: Shaye Hong, Amy Seeds, Dena Vallano (past POC), Anna Mebust (past POC)
Region 10: Sarah Waldo, Will Wallace

Plus – equipment loan recipients: invaluable contributors with real-world user feedback and optional provision of smoke monitoring data for research use.

Thank you!

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