ADEC's Community-Based Air Sensor Network

Quarterly Call
December 9, 2025
10:00 AM AKST

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Housekeeping Items

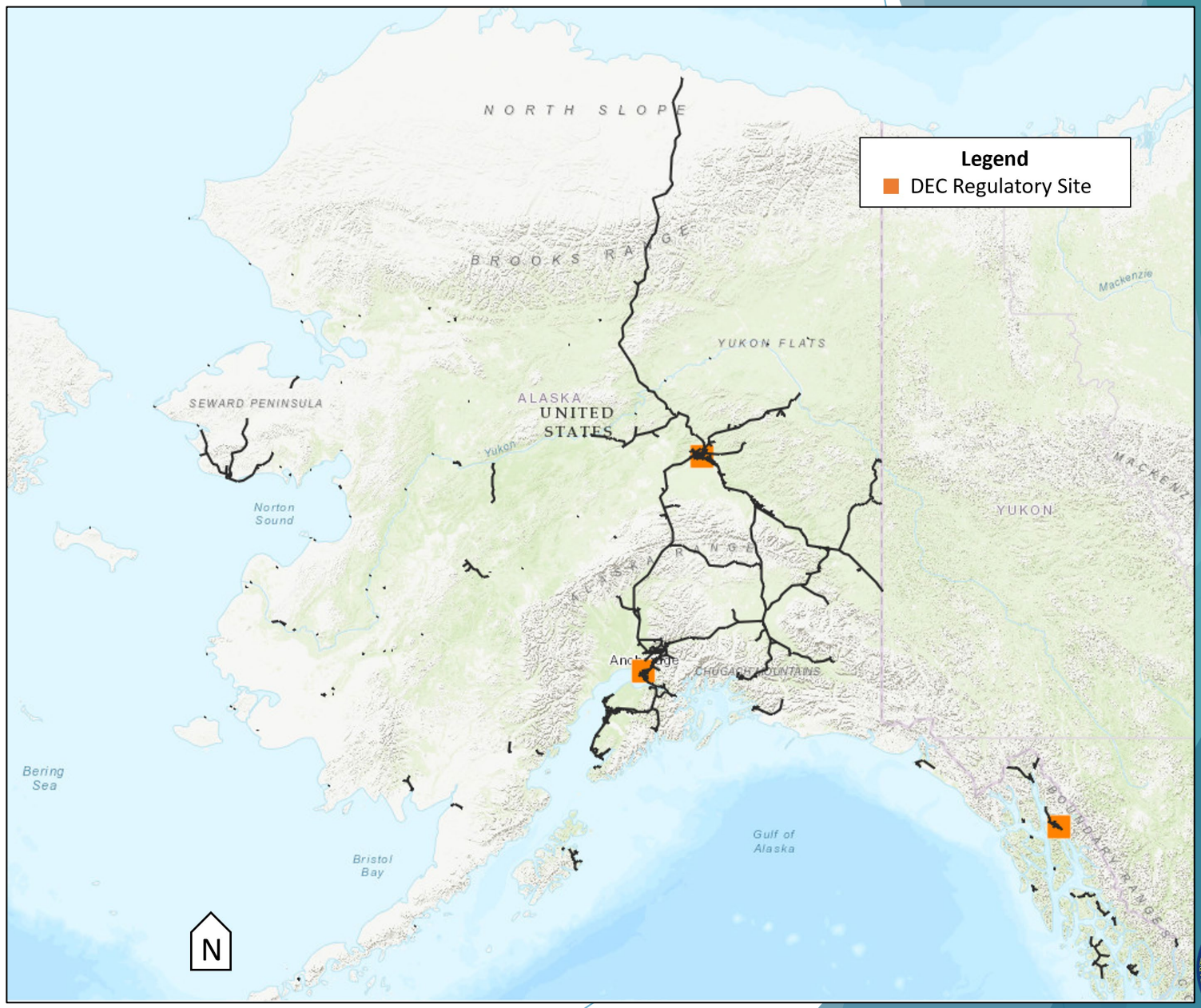
- Mute – Please mute yourself for presentations.
- Please use chat during presentation as you have questions/comments.
- 20-30 minutes of planned discussion time at end
- Mark your calendar for next call! March 10th 10-11am

Agenda

- Welcome!
- Sensor network overview and progress
- Data findings
- Next steps
- Questions and discussion

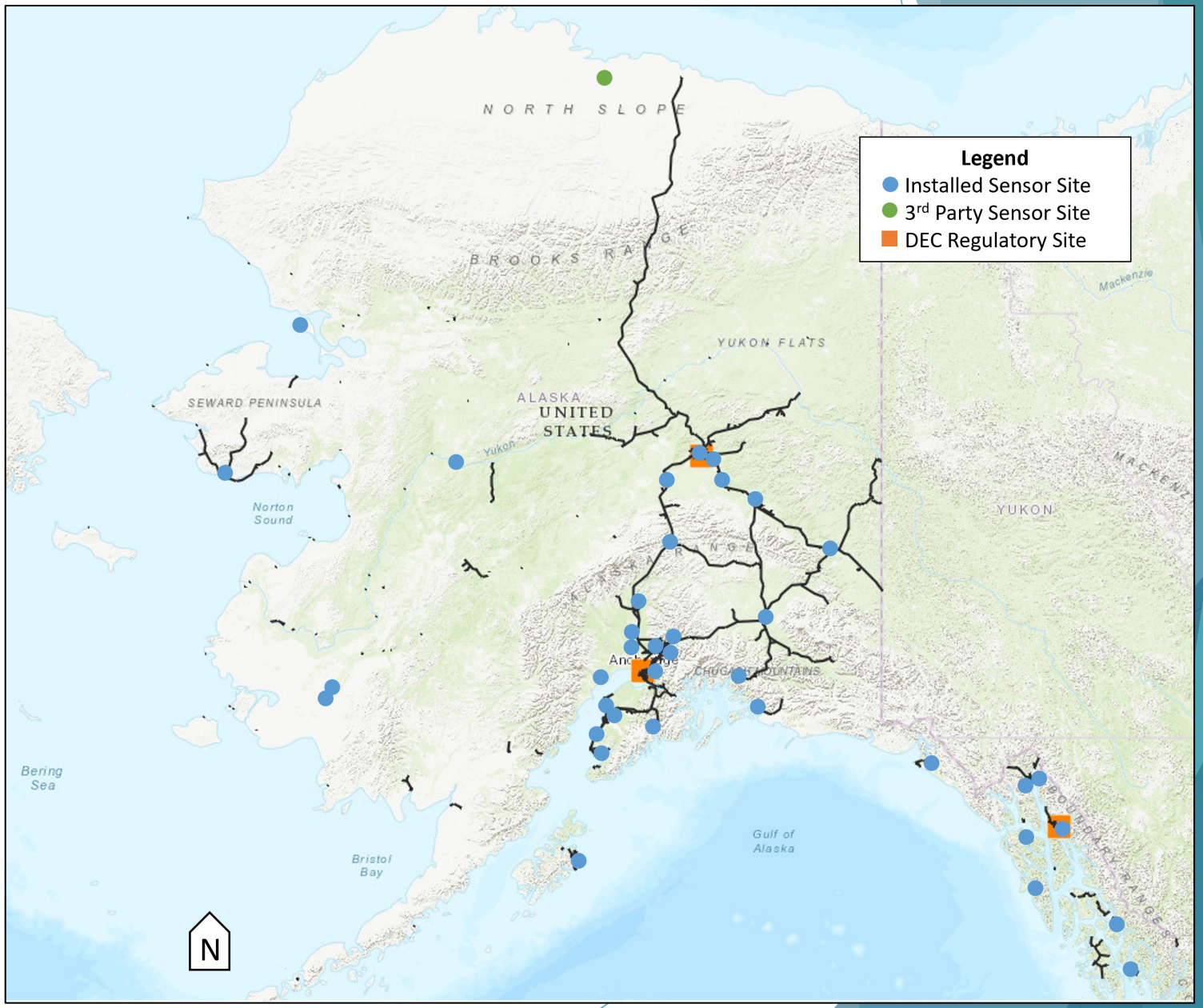
DEC's Regulatory Network

- Regulatory stations in 3 Metropolitan Statistical Areas (MSAs)
  - Anchorage / Mat-Su (4 sites)
  - Fairbanks (3 sites)
  - Juneau (1 site)
- Monitor criteria pollutants:
  - Particulate matter ($PM_{2.5}$ and PM_{10})
  - Gases:
    - Carbon monoxide (CO)
    - Nitrogen dioxide (NO_2)
    - Ozone (O_3)
    - Sulfur dioxide (SO_2)

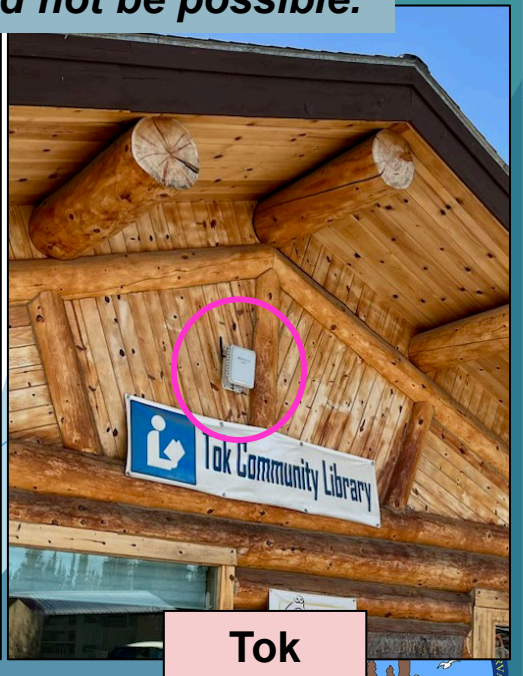


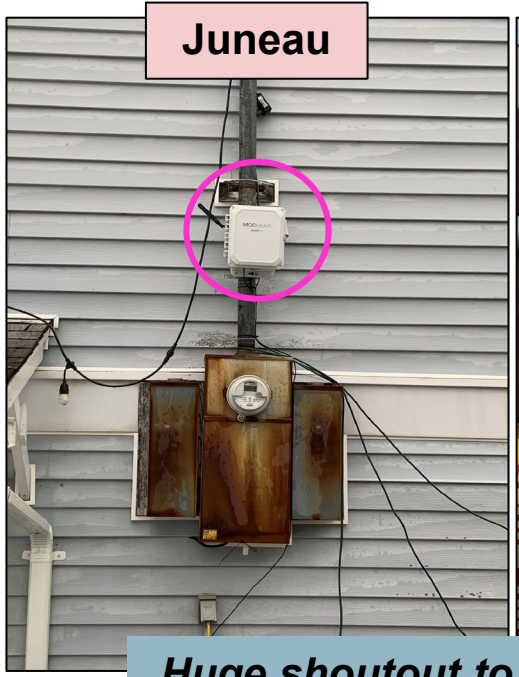
DEC's Low-Cost Sensor Network

- Over 40 sensors currently deployed in 38 communities
- QuantAQ Modulair sensors:
  - PM_{10} and $PM_{2.5}$, CO, NO, NO_2, O_3, temp, relative humidity
- Non-regulatory data
  - Trend analysis
- Cellular Network Coverage Limitations
  - Plans for expansion



Huge shoutout to our partners in communities across Alaska! Without you, this project would not be possible.




Juneau

Alaska State Museum


Skagway


Haines

Hoonah

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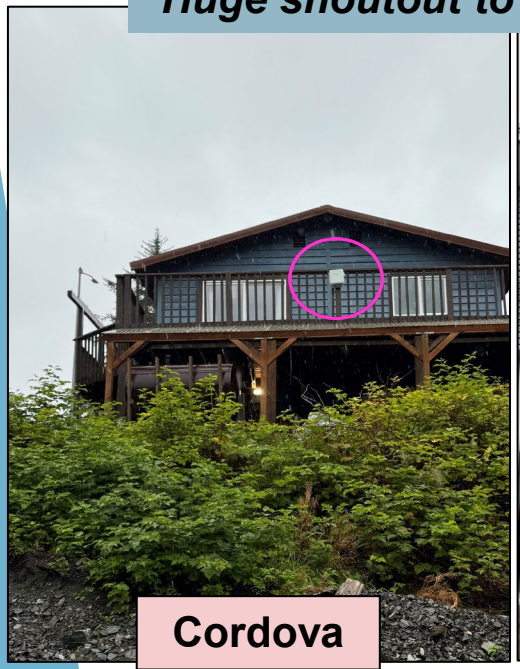
Cordova

Yakutat


Sitka


Wrangell


Ketchikan

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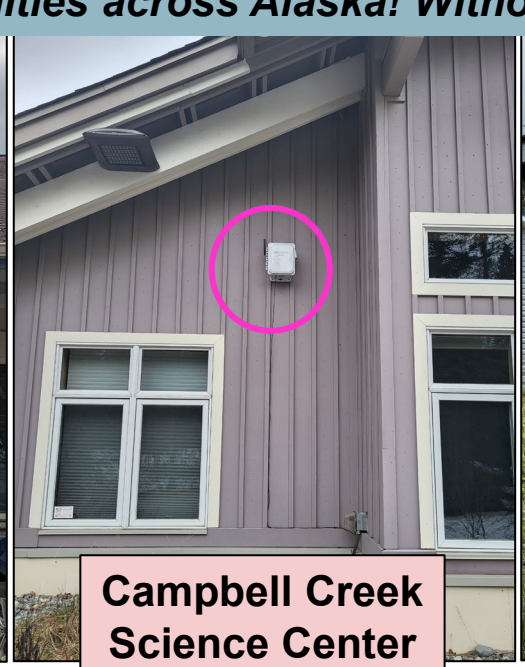

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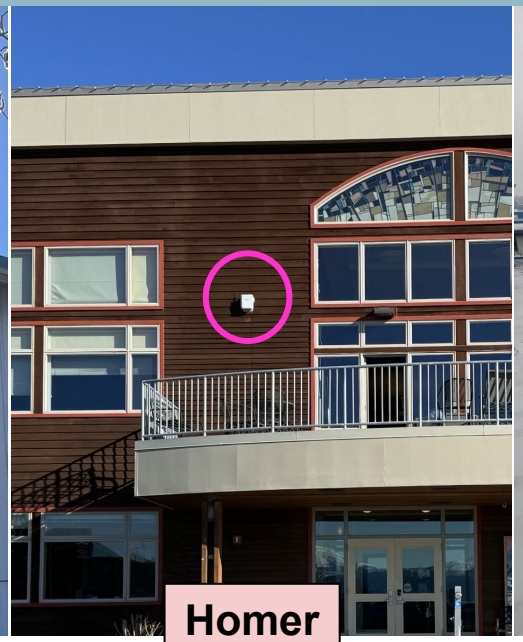
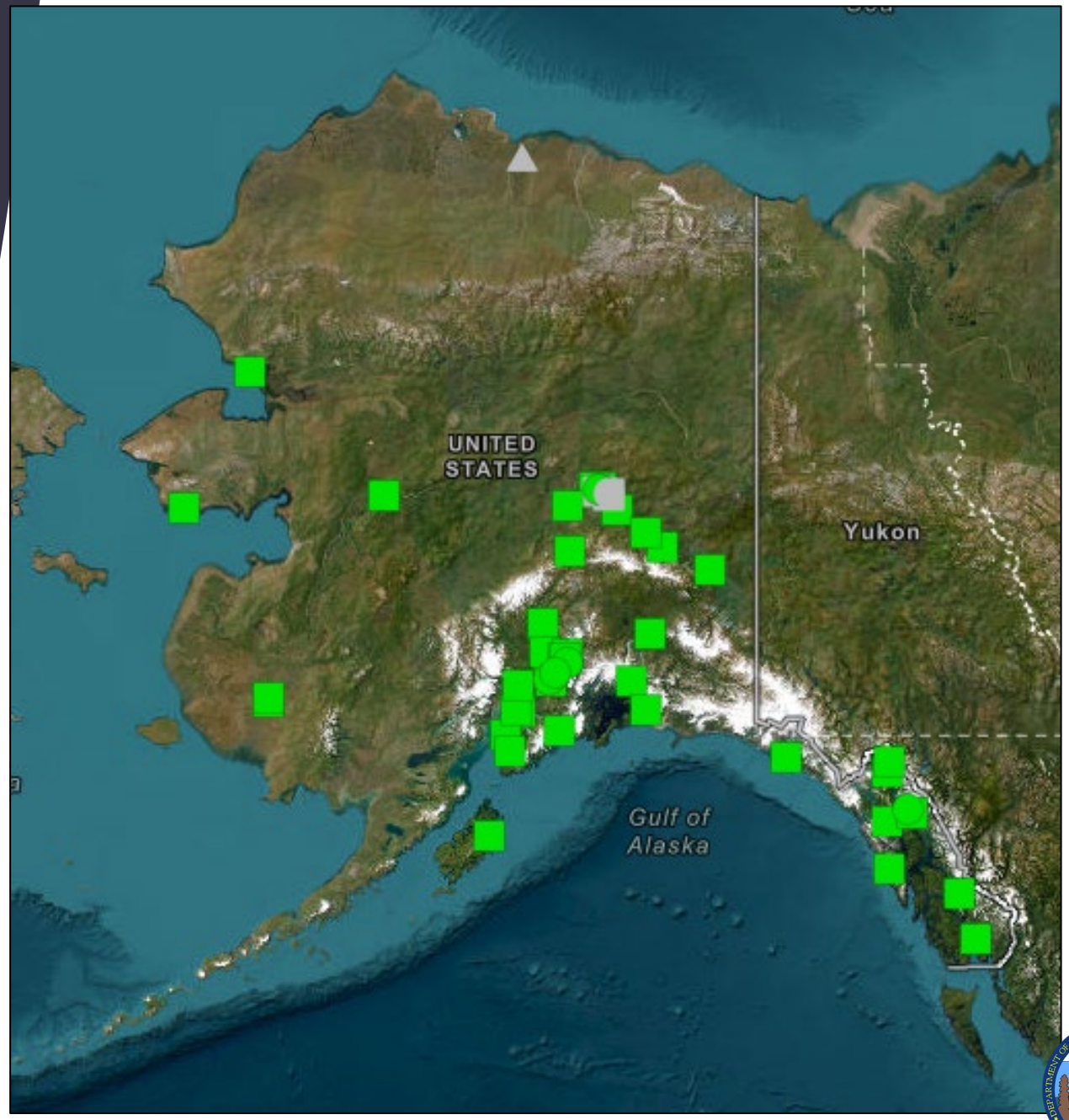


We are growing!

- Map as of December 2025
  - Continued expansion as we…
  - Deploy sensors with Wi-Fi capabilities
  - Develop sub-networks
    - Interior wildfire monitoring network
    - Municipality of Anchorage network



New sensor installs

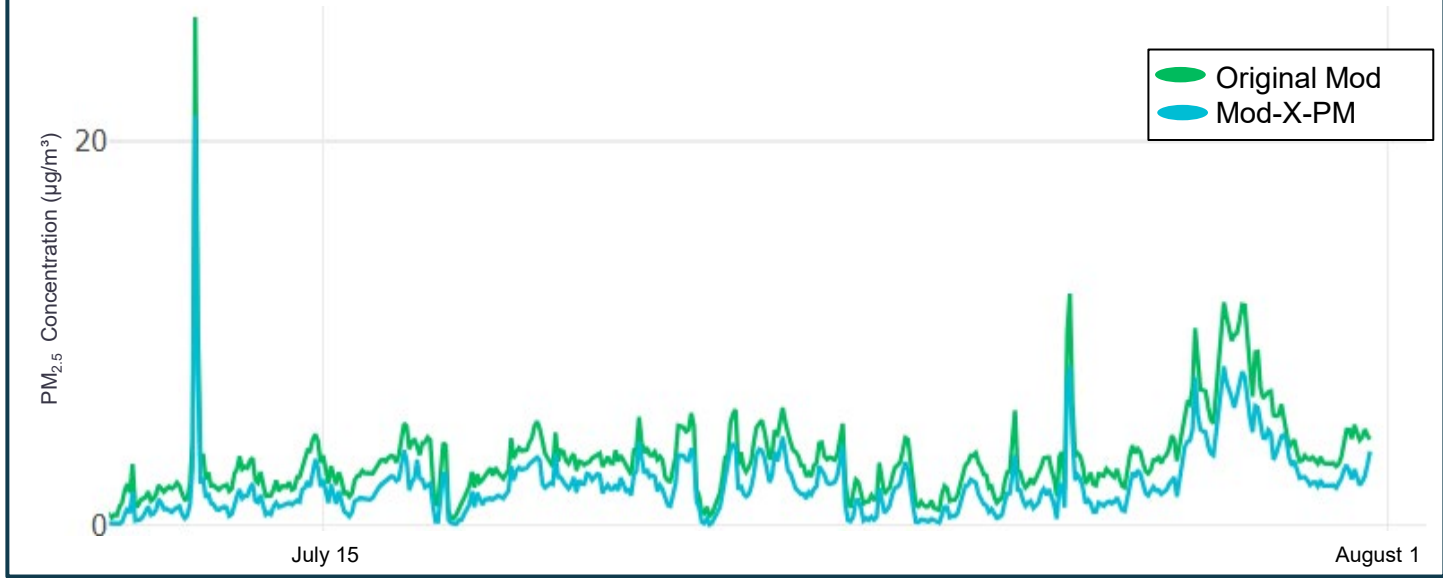
- Gerstle River area
  - Thank you to Cara Lehman, Josiah Kober, and Jana Lee for letting us use the AT&T tower to host the air monitor!
  - Fills a monitoring gap for residential neighborhoods, ranches, and farms between Delta Junction and Tok.

New Wi-Fi Sensors

- Compared several sensor models in collocation study throughout summer 2025
  - Goal to determine optimal model to integrate into Community Sensor Network to reach areas of Alaska without adequate cell service
- The accuracy and precision of each sensor was determined by its agreement with data from the Garden permanent QuantAQ Modulair™ pod
  - In the regression analysis plots shown, the linear line of best fit and corresponding statistical values infer how well the sensors agree with each other.

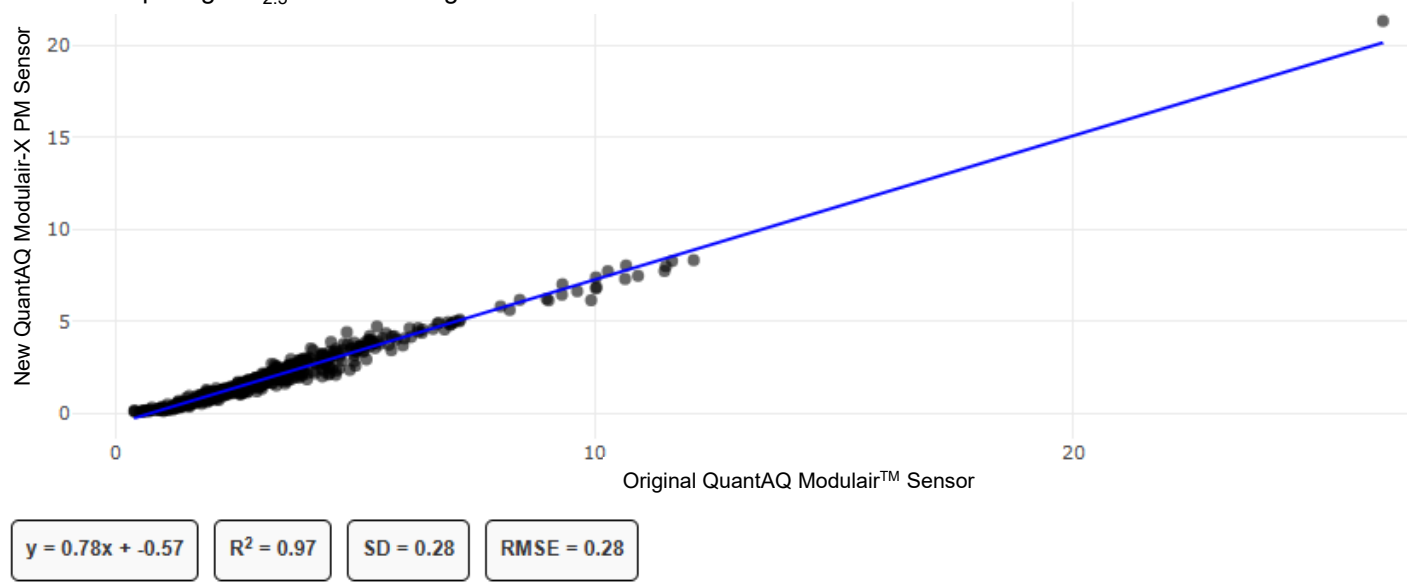
$PM_{2.5}$ Timeseries Plot

– Comparing $PM_{2.5}$ data from original Modulair™ and new Modulair-X-PM sensors



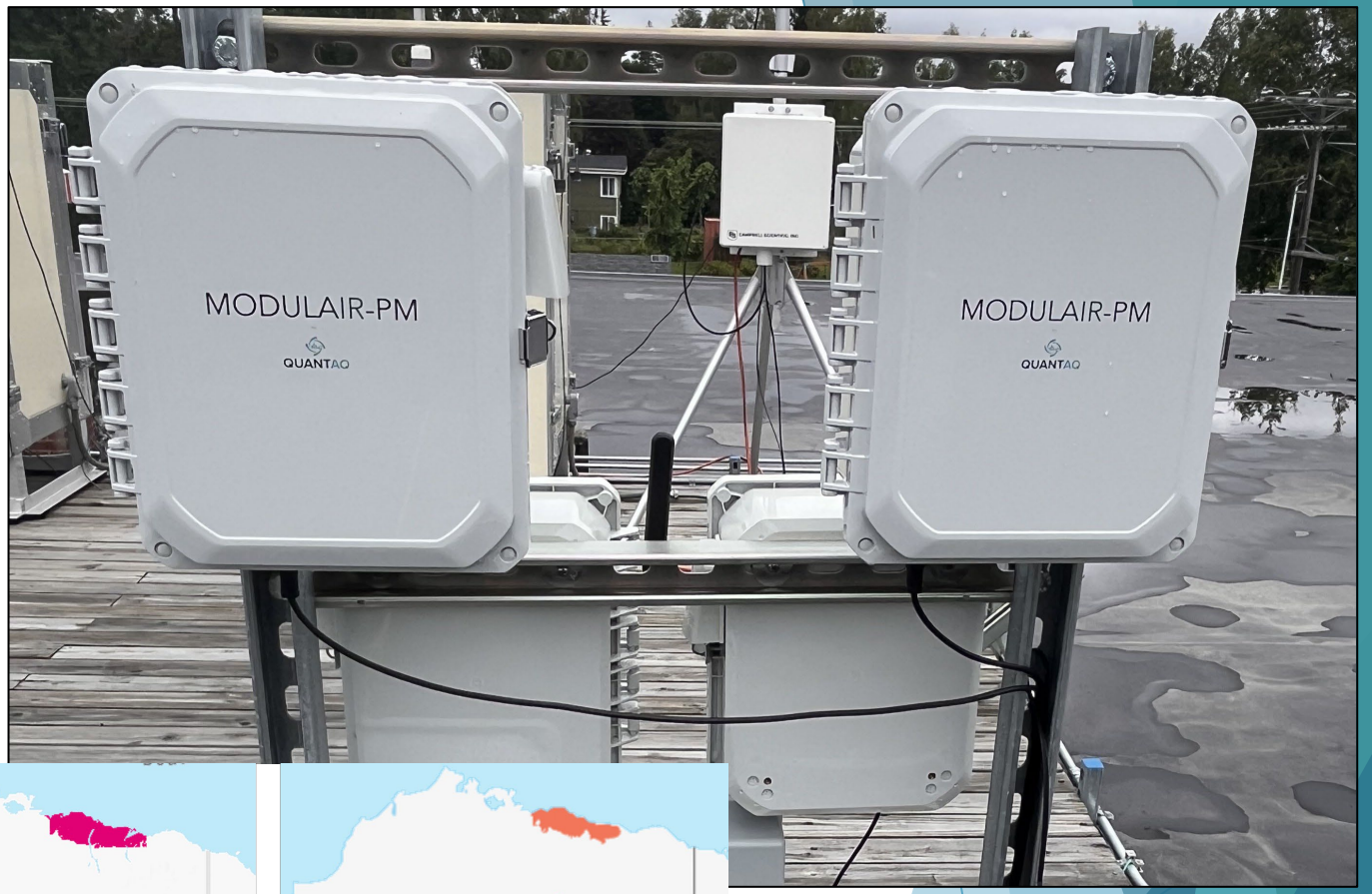
$PM_{2.5}$ Regression Plot

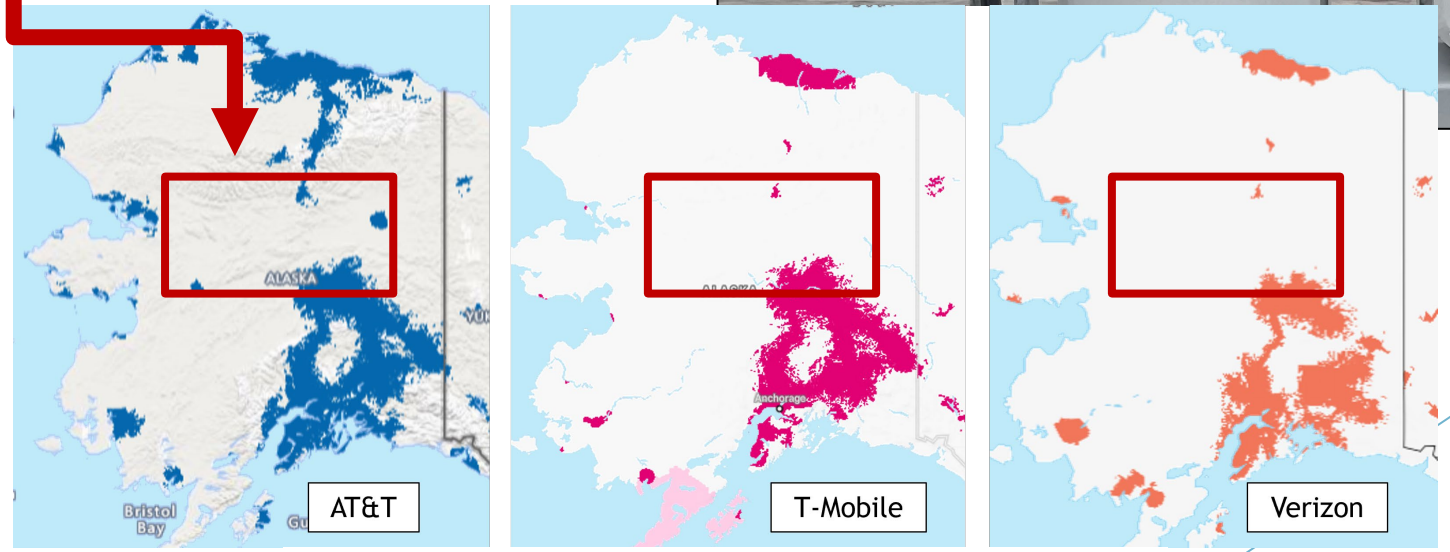
– Comparing $PM_{2.5}$ data from original Modulair™ and new Modulair-X-PM sensors



New Wi-Fi Sensors

- QuantAQ Modulair™ – PM sensors are equipped with both Wi-Fi and cellular network connection capabilities
- Currently in sensor-acquisition process
  - Aiming to install to establish host sites and install new Wi-Fi sensors in interior Alaska to monitor wildfire smoke in the coming year.





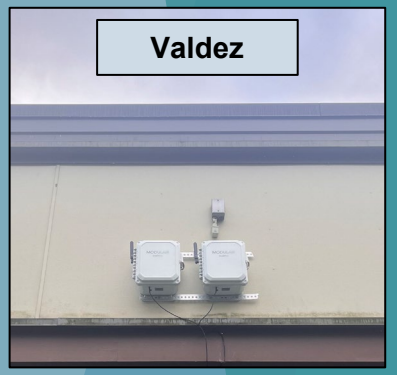
Distribution of currently available networks for sensor connections.

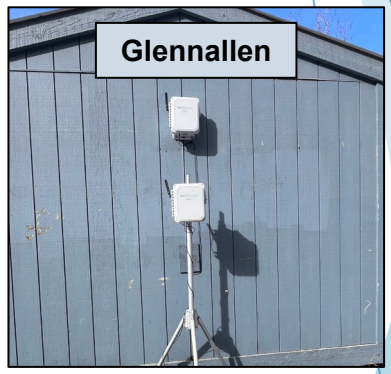
Sensor Audits

- As of December 2025, audits have been completed in Glennallen, Badger, Bethel, Galena, Nenana, Haines, Valdez, Yakutat, Cordova, Goldstream, and Wrangell
- Upcoming audits in Southcentral and Interior regions

- Audit pod from nearest regulatory site (Anchorage, Fairbanks, or Juneau), is temporarily installed for 1 week next to local pod to:
  - Assess sensor performance
  - Ensure data validity
- Determine sensor agreement using regression analysis and **project objectives:**

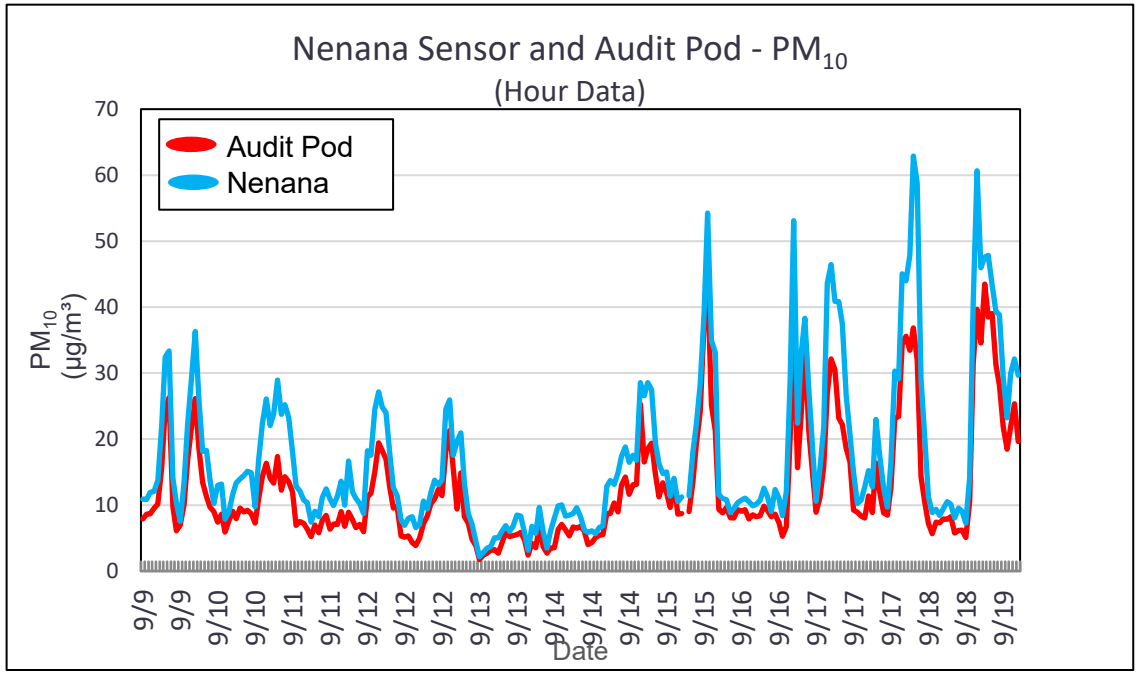
R^2	Slope	Intercept
≥ 0.70	1.0 ± 0.35	-5 ≤ b ≤ 5

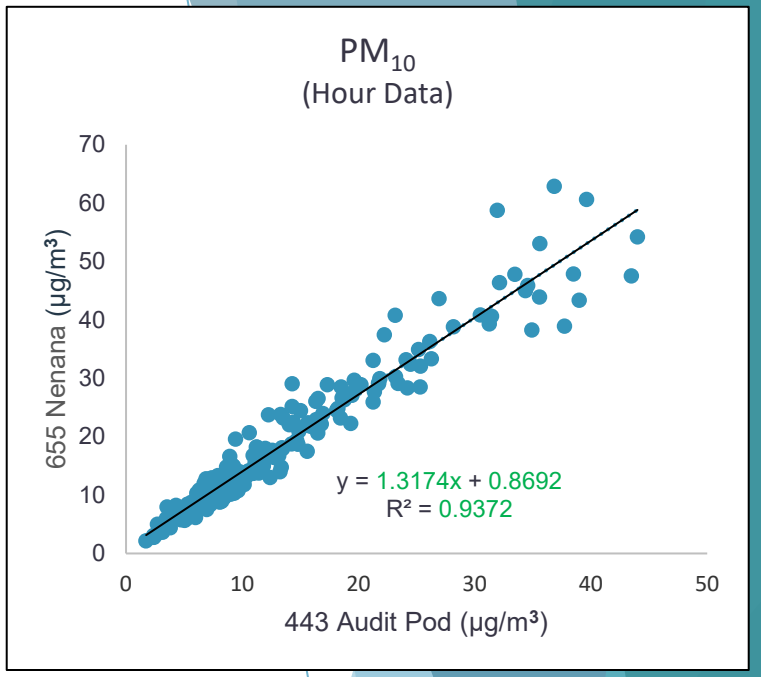


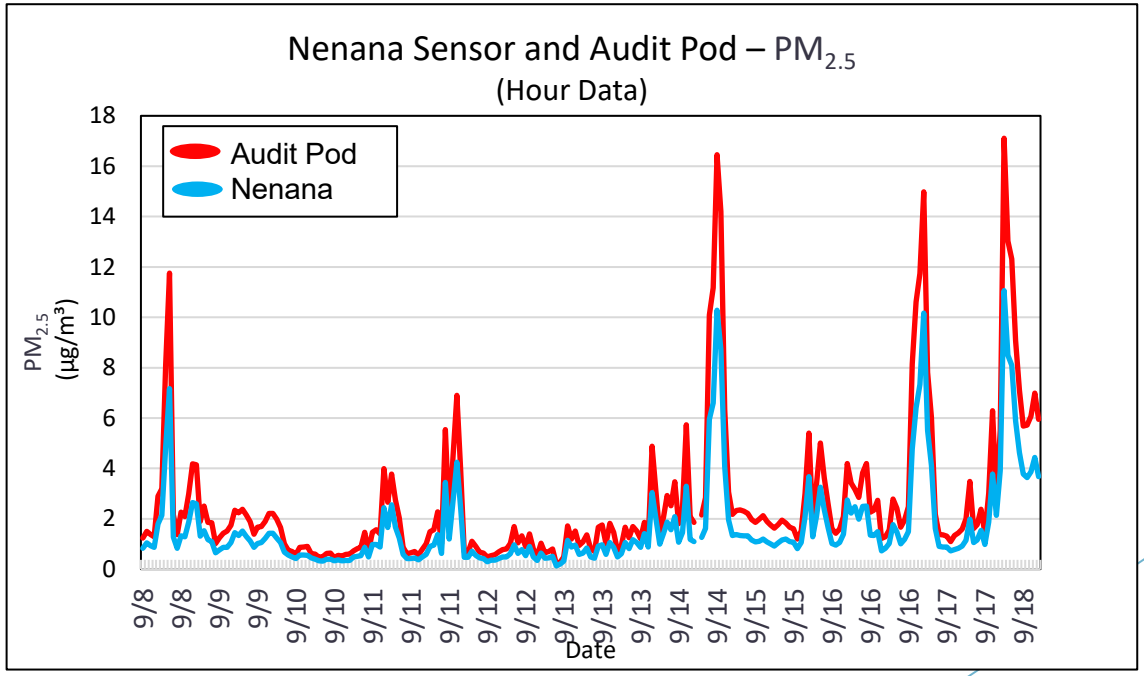


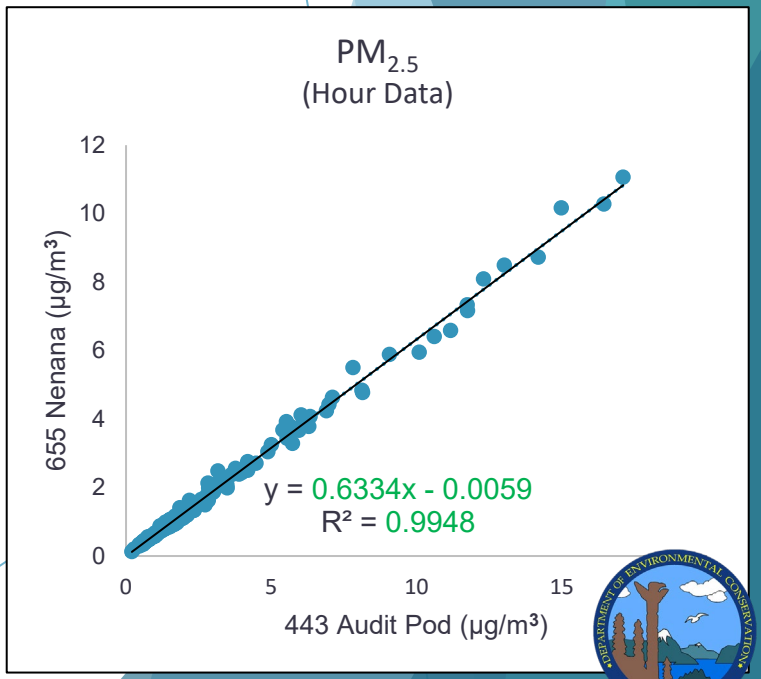
Nenana Audit

Project Objectives		
R^2	**Slope**	**Intercept**
≥ 0.70	1.0 ± 0.35	-5 ≤ b ≤ 5



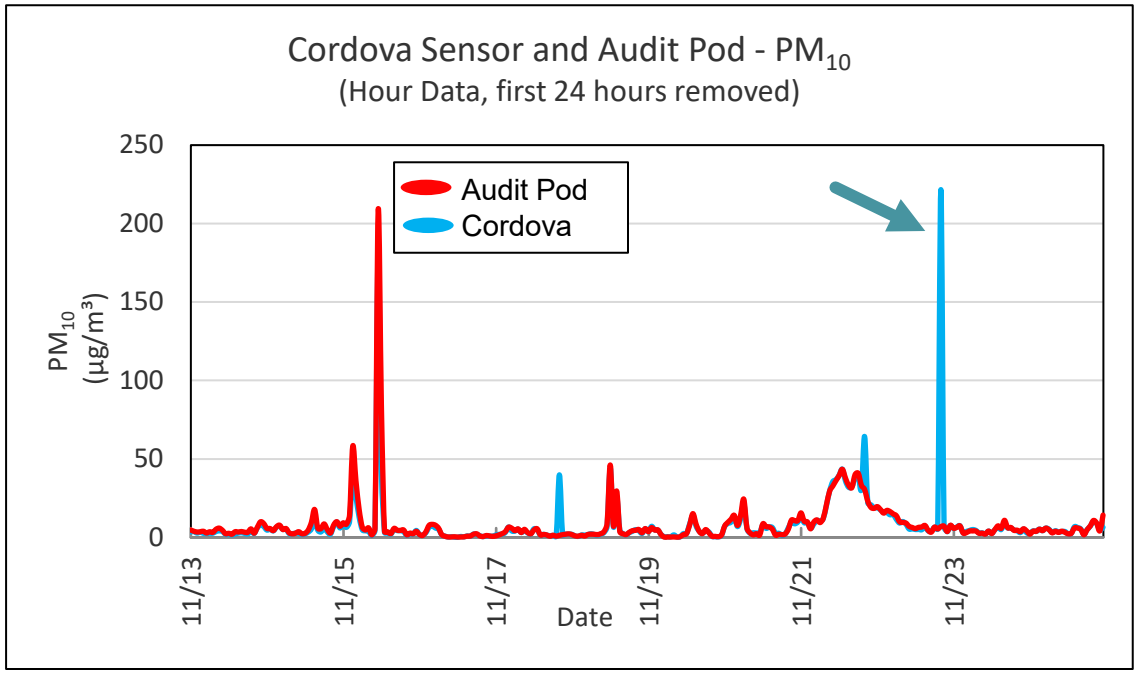


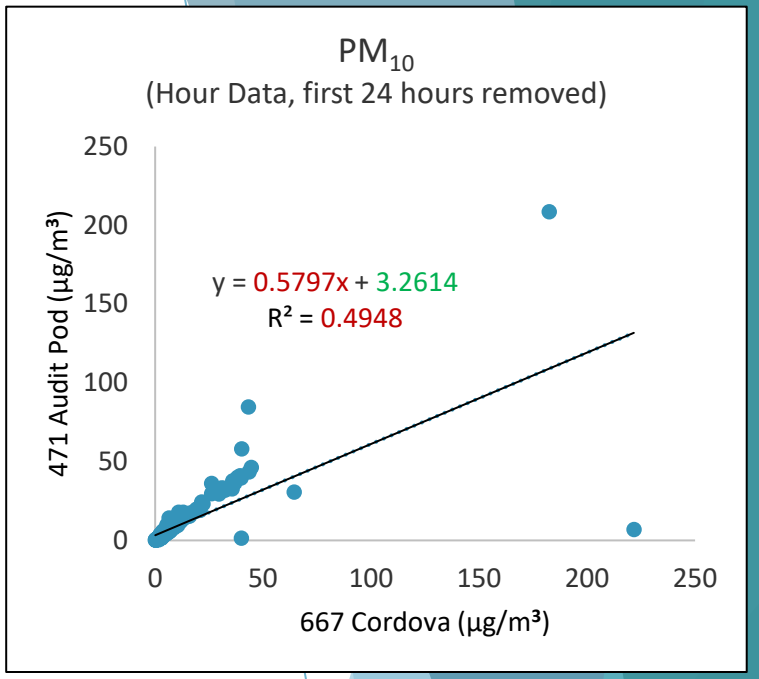


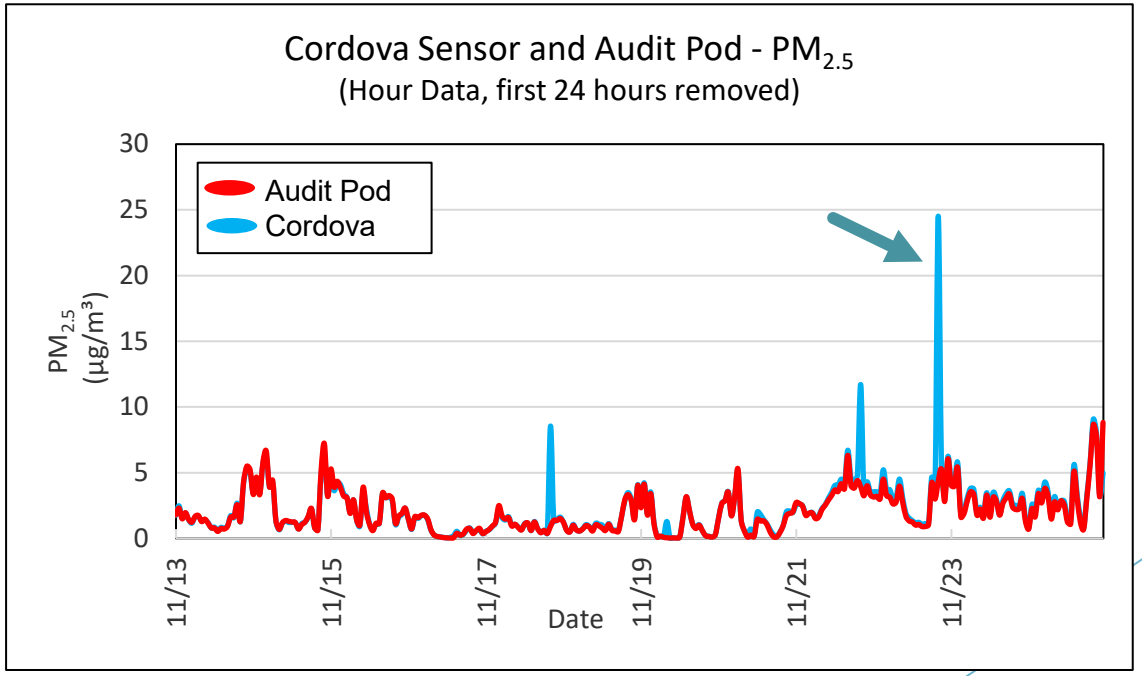


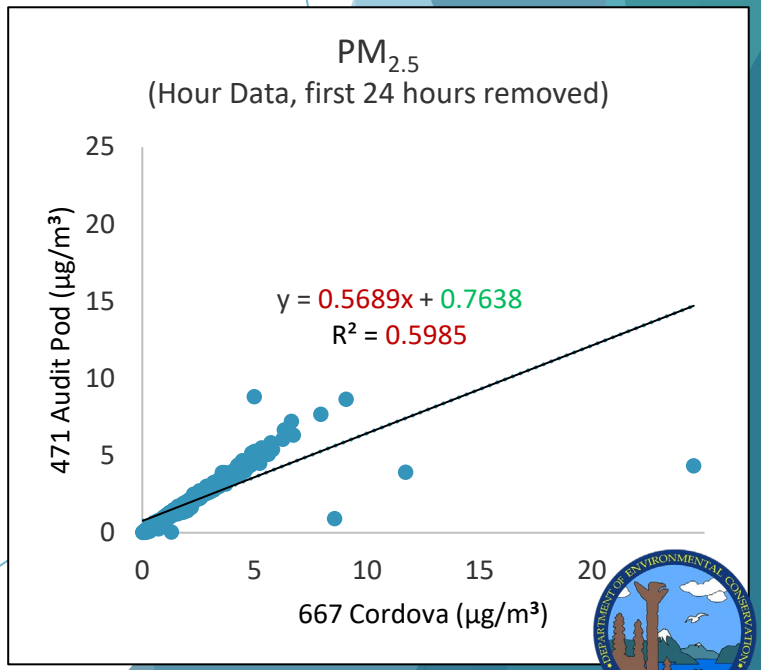
Cordova Audit

Project Objectives		
R^2	**Slope**	**Intercept**
≥ 0.70	1.0 ± 0.35	-5 ≤ b ≤ 5

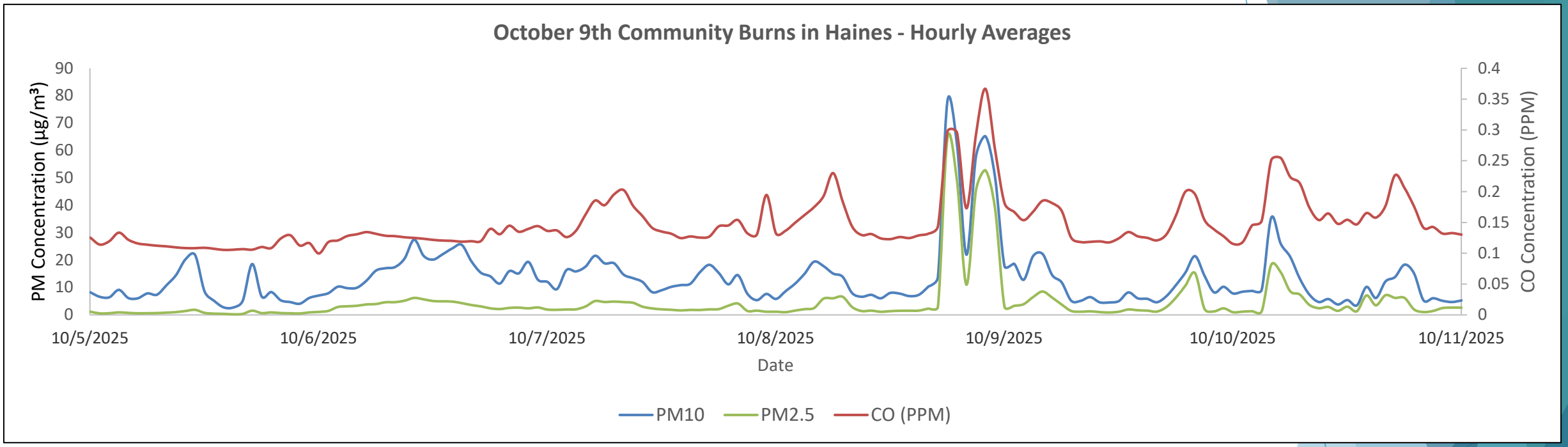








Haines – Community Burns Effect on PM, CO

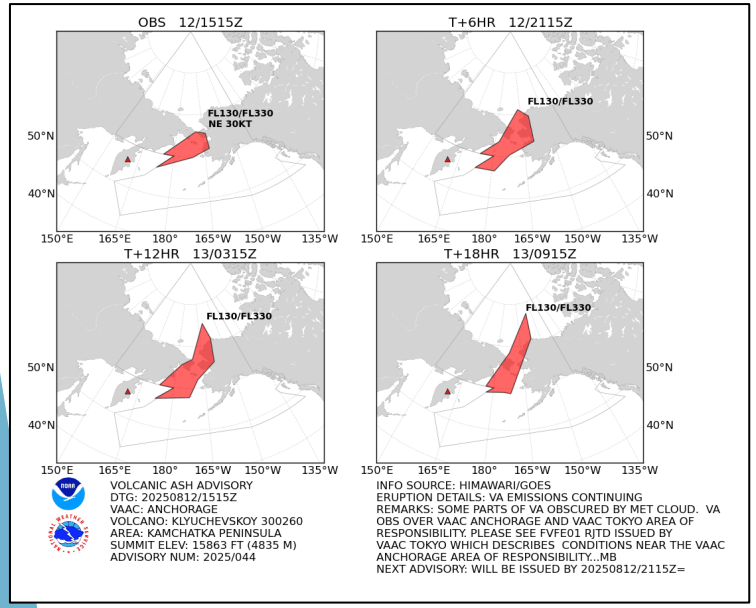


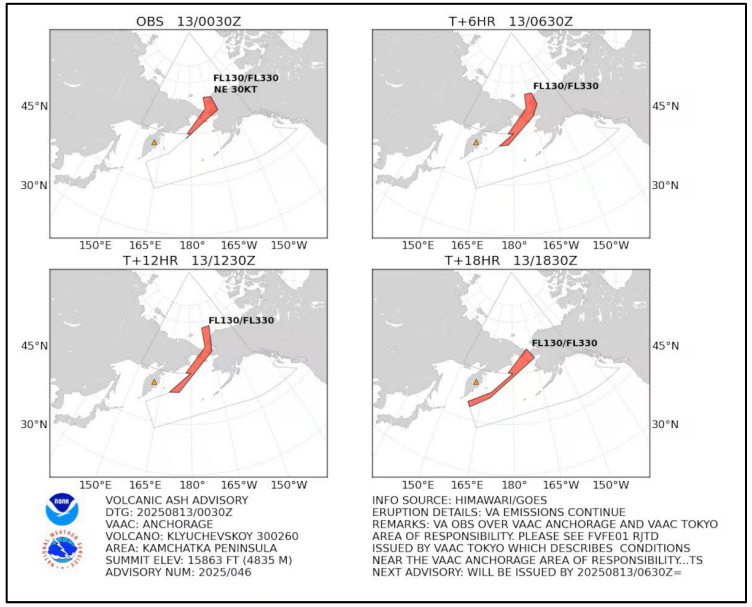
- Observed elevated PM and CO concentrations throughout morning of October 9th
- Reached out to community contact for additional insight:
  - They noted several active brush and burn piles and “there wasn't any wind and there was some moisture, so it was a popular day for burning around here.”

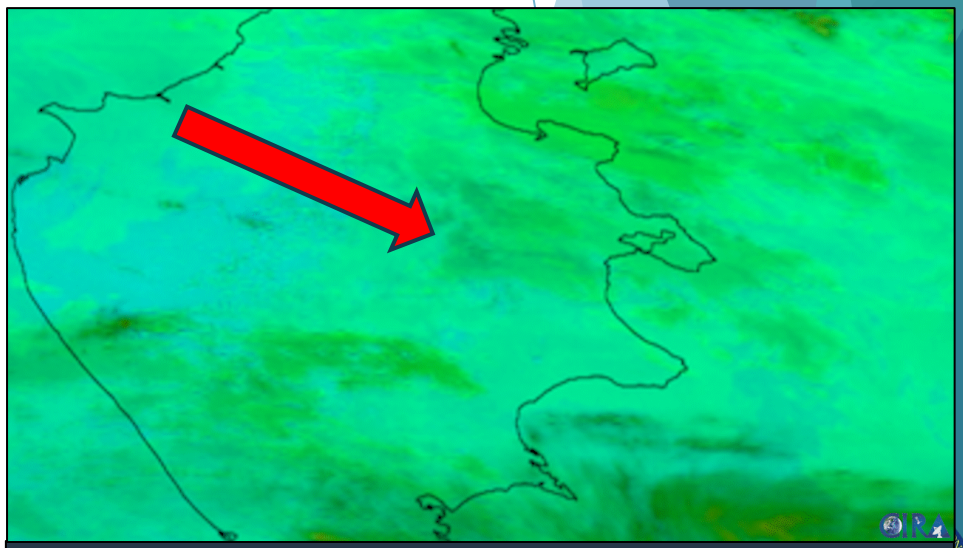
Kamchatka Volcano Event

- July 29 – Magnitude 8.8 earthquake hits off the southeast coast of Kamchatka
- Russian Academy of Sciences reports 7 volcanoes in the Kamchatka peninsula began erupting
  - Klyuchevskoy Volcano – Tallest (4.75 km) active volcano in Eurasia
- Japanese observatory reported volcanic emissions going east at 30-70 mph

Klyuchevskoy Volcano erupting on Aug 4, 2025
Credit: Russian Academy of Sciences' Vulcanology Institute



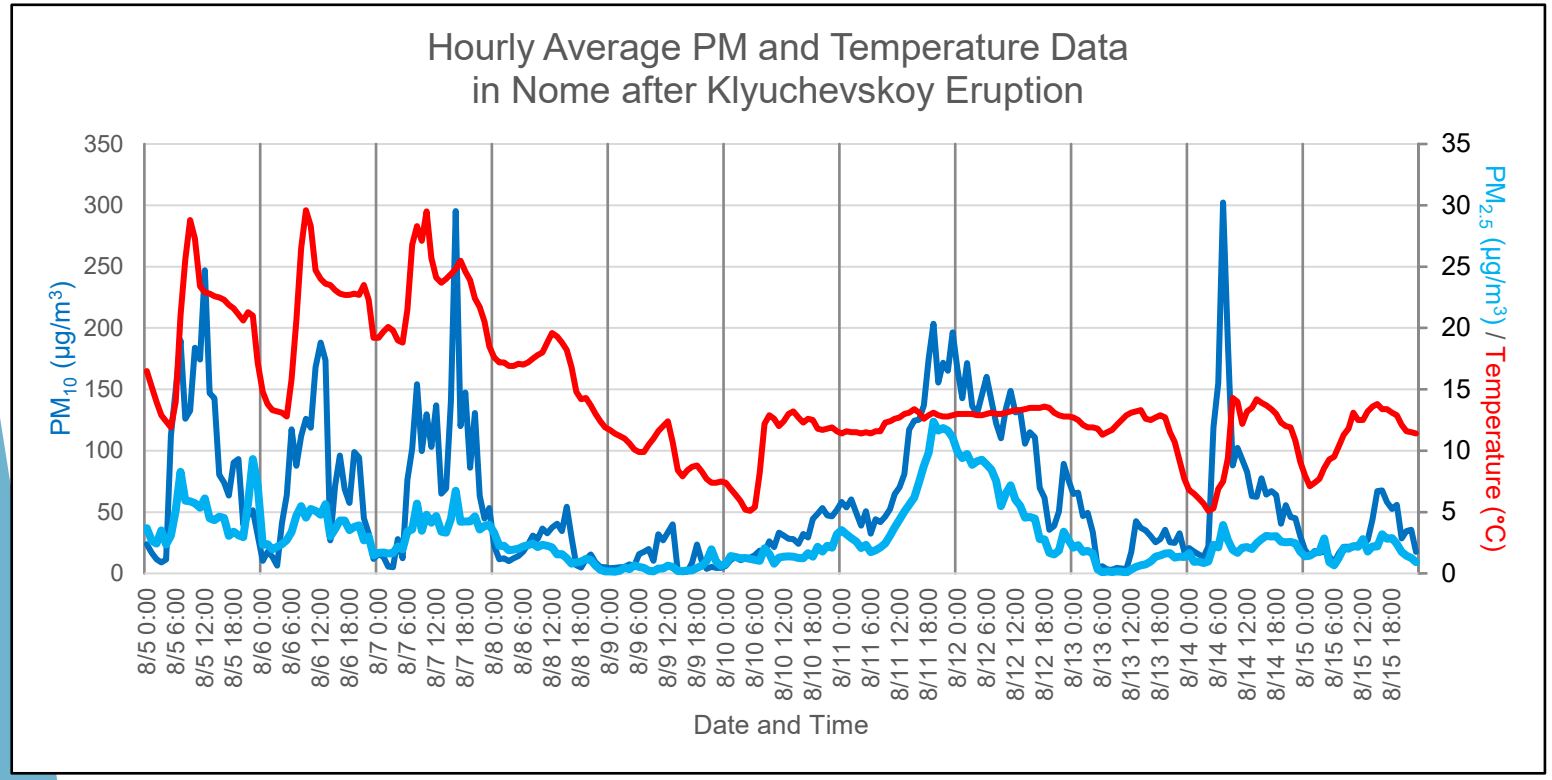




Klyuchevskoy Volcano erupting from July 29-30, 2025
Credit: Himawari-9 Satellite - Japanese Meteorological Society

Kamchatka Volcano Event

- Reports of incoming ash led to flight cancellations in Nome, Kotzebue, and Utqiagvik on August 12
  - Cancellations delayed grocery deliveries for residents
- Sensor in Nome potentially picked up some of the emissions
- Travel advisory was confined to 15k-35k feet, but more flights were canceled out of caution
  - Ex: Bering Air canceled 20 flights, including those at 10k feet



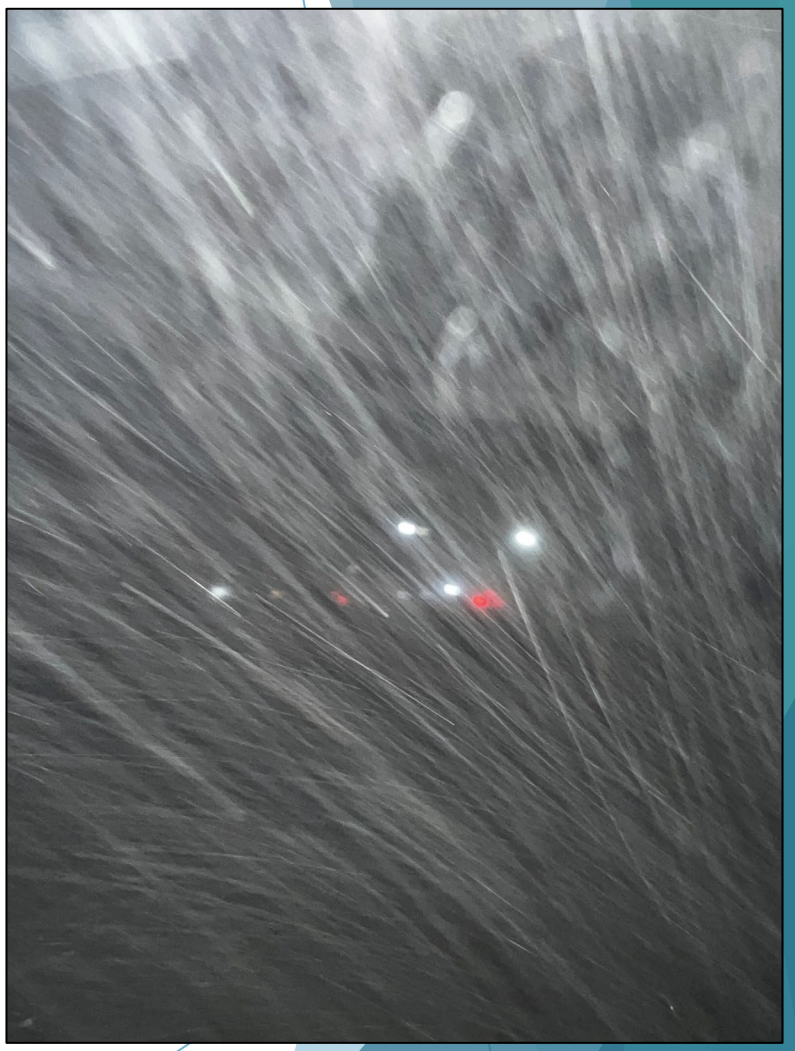
Timeline

- **August 1-7**: Clear skies, normal weather.
- **August 8**: Clouds roll in, bringing cooler temps and light rain that will last until August 13. Rain tamps down on dust, lower PM_{10} for a few days.
- **August 10-11**: Observed CO spikes, possibly from volcanic gasses passing over Nome.
- **August 11**: Observed rise and gradual fall of $PM_{2.5}$ / PM_{10} concentration, possibly from Klyuchevskoy's volcanic ash emissions.
- **August 13**: Volcanic ash cloud dissipates, as reported by pilots and meteorologists.
- **August 14**: Clouds clear, diurnal temperature cycles continue with cooler average.

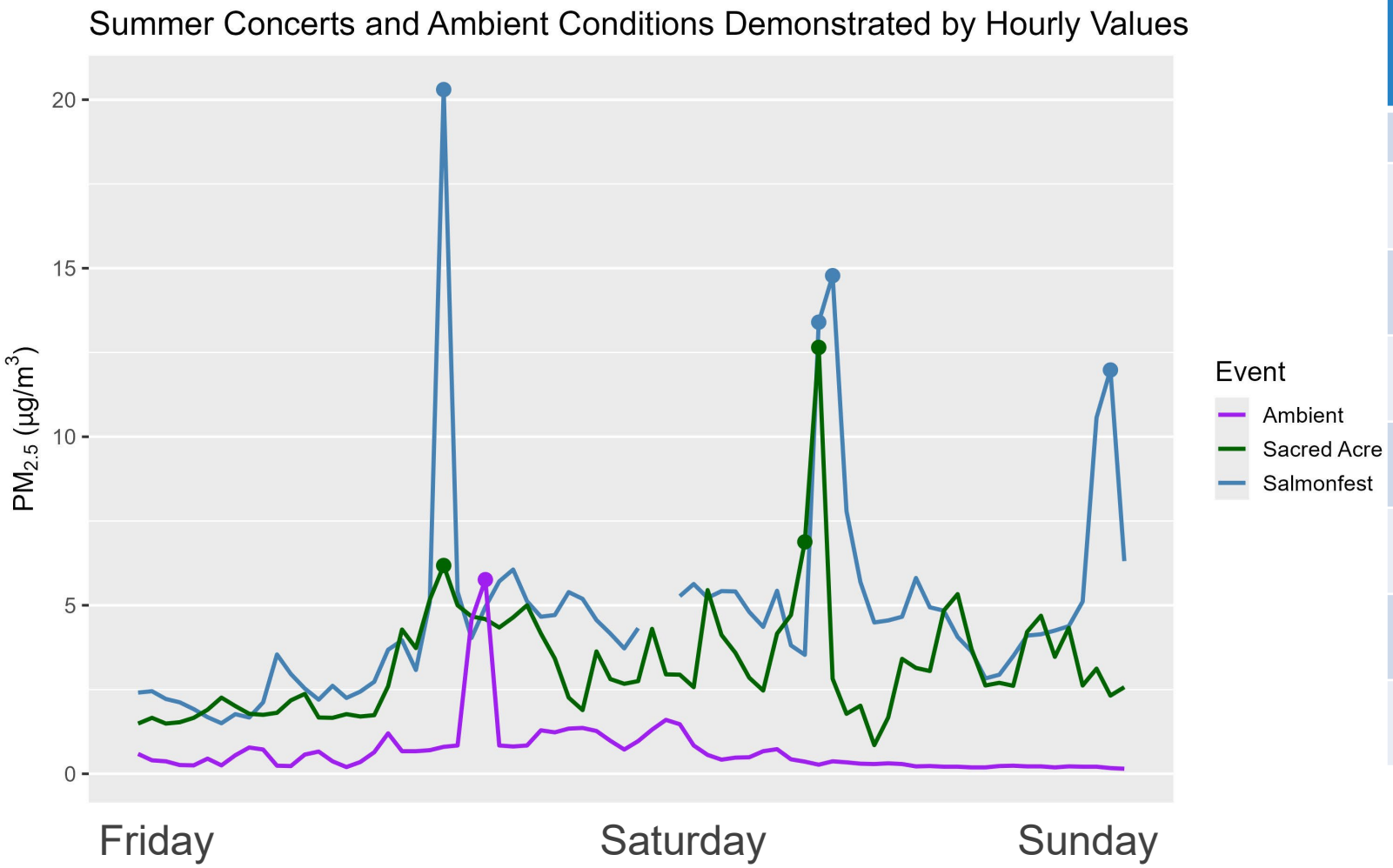
Nome Dust Activity

- In October, Nome experienced a multi-week period of dry weather characterized by several freeze-thaw cycles
  - Top layer of sediment was dried and loosened, easily picked up by wind
  - Vehicle activity picked up lots of dust that lingered around roadways
  - Late arrival of snow in Nome
- Inversion conditions set in around October 20th
  - Dust levels became concerning
  - Road dust spread out to blanket town
  - Inversion conditions prevented dust dispersal
- Norton Sound Health Corporation issued air quality PSA
  - NSHC conferred w/ DEC meteorologist
  - NSHC PSA included information on how to limit exposure to harmful dust

Nome Dust Activity

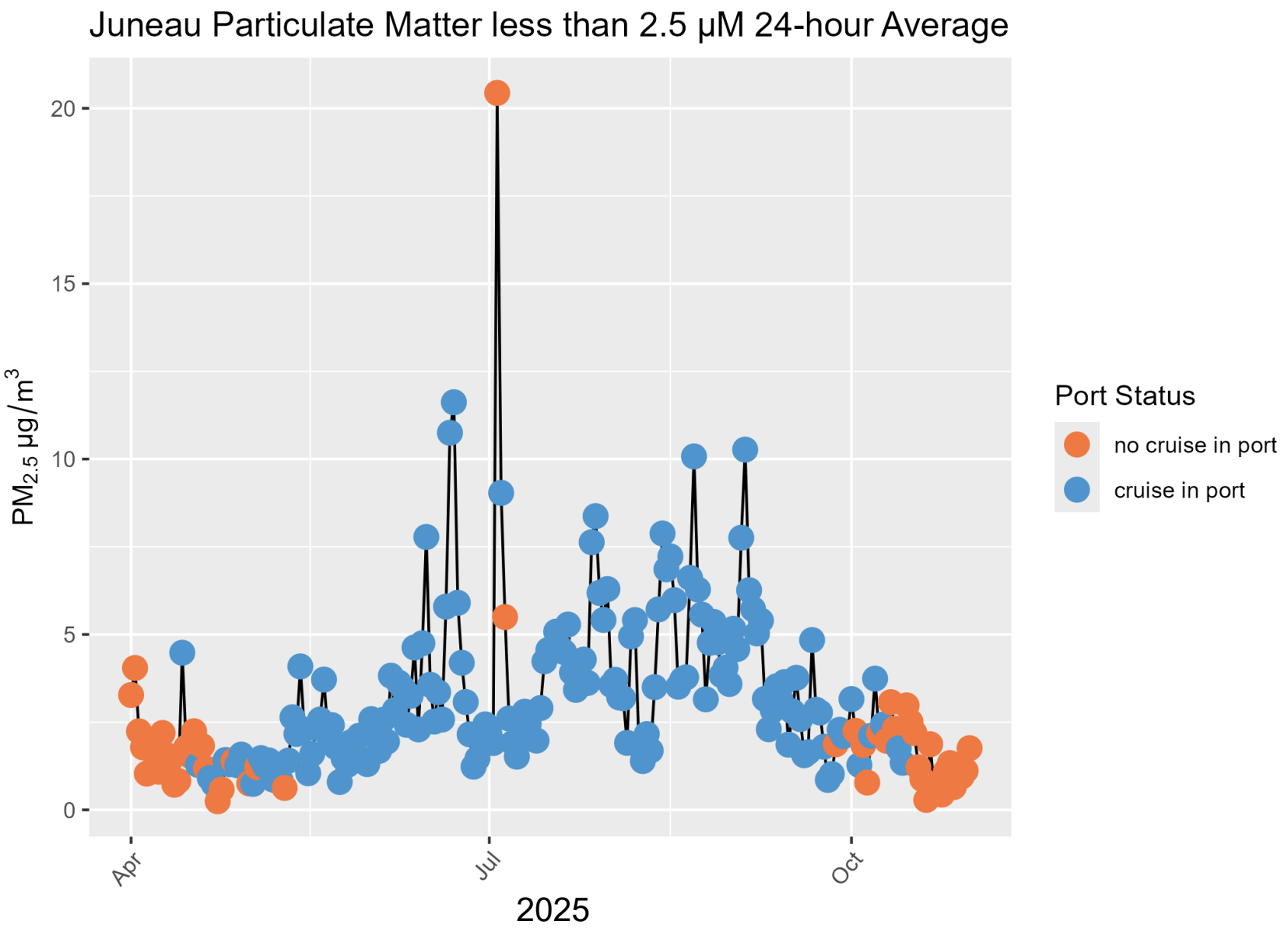


Images Credit: Tori Crawford
Environmental Coordinator at the Office of Environmental Health
Norton Sound Health Corporation



Date and Time	Max Value (µg/m³)	Event
2025-08-01 22:00:00	20.30	Salmonfest
2025-08-03 02:00:00	14.78	Salmonfest
2025-08-03 01:00:00	13.40	Salmonfest
2025-09-07 01:00:00	12.65	Sacred Acre
2025-08-03 22:00:00	11.98	Salmonfest
2025-09-07 00:00:00	6.88	Sacred Acre
2025-09-05 22:00:00	6.18	Sacred Acre
2025-11-08 01:00:00	5.76	November Ambient

- Ambient conditions are the first weekend in November.
- Hourly data that spanned over each three-day event and an ambient period.
- Ticket sales for each event – Salmonfest 8000 tickets, Sacred Acre est. 3000 tickets, Ninilchik population of 984.

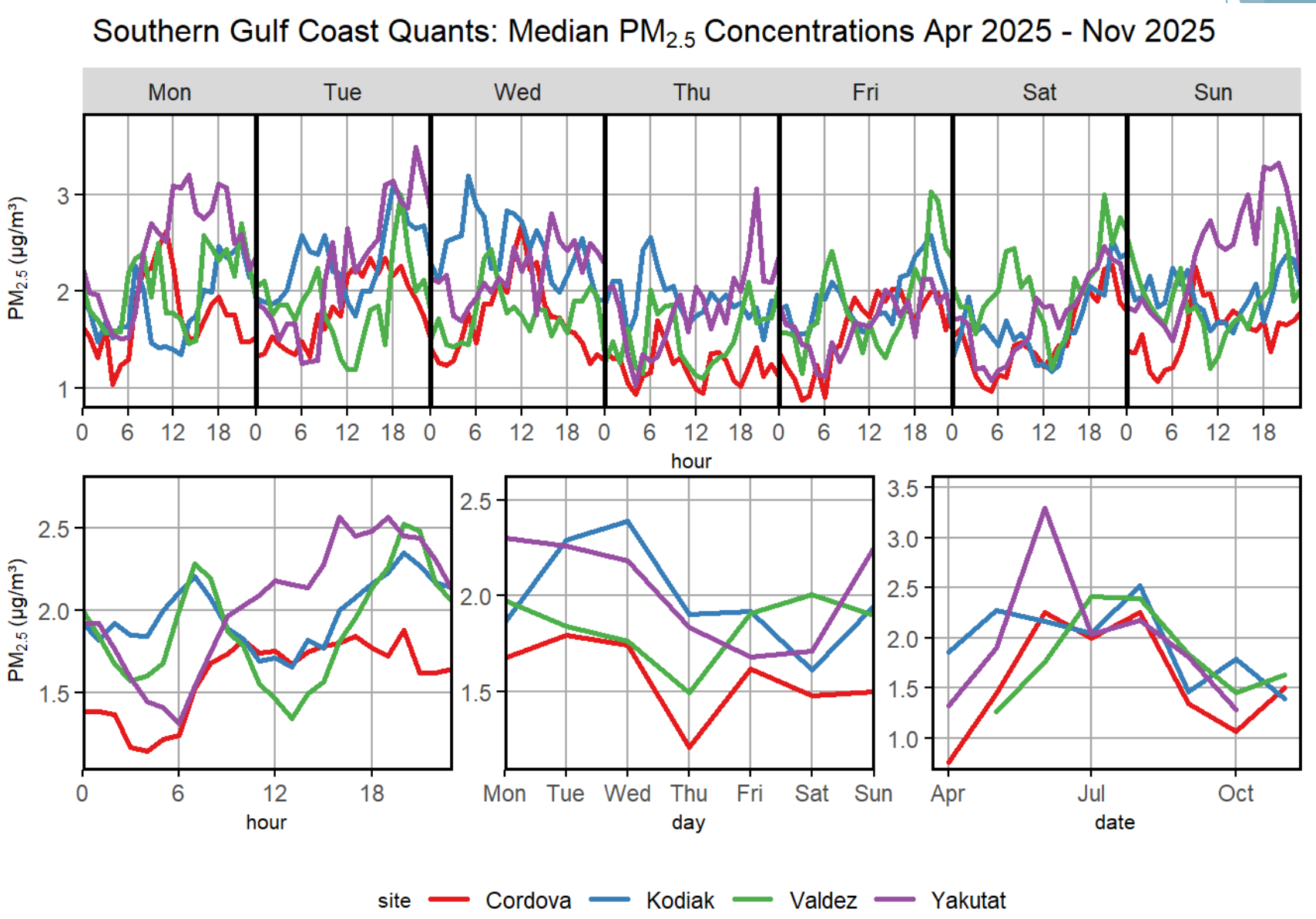


Mean $PM_{2.5}$ Hourly Concentration

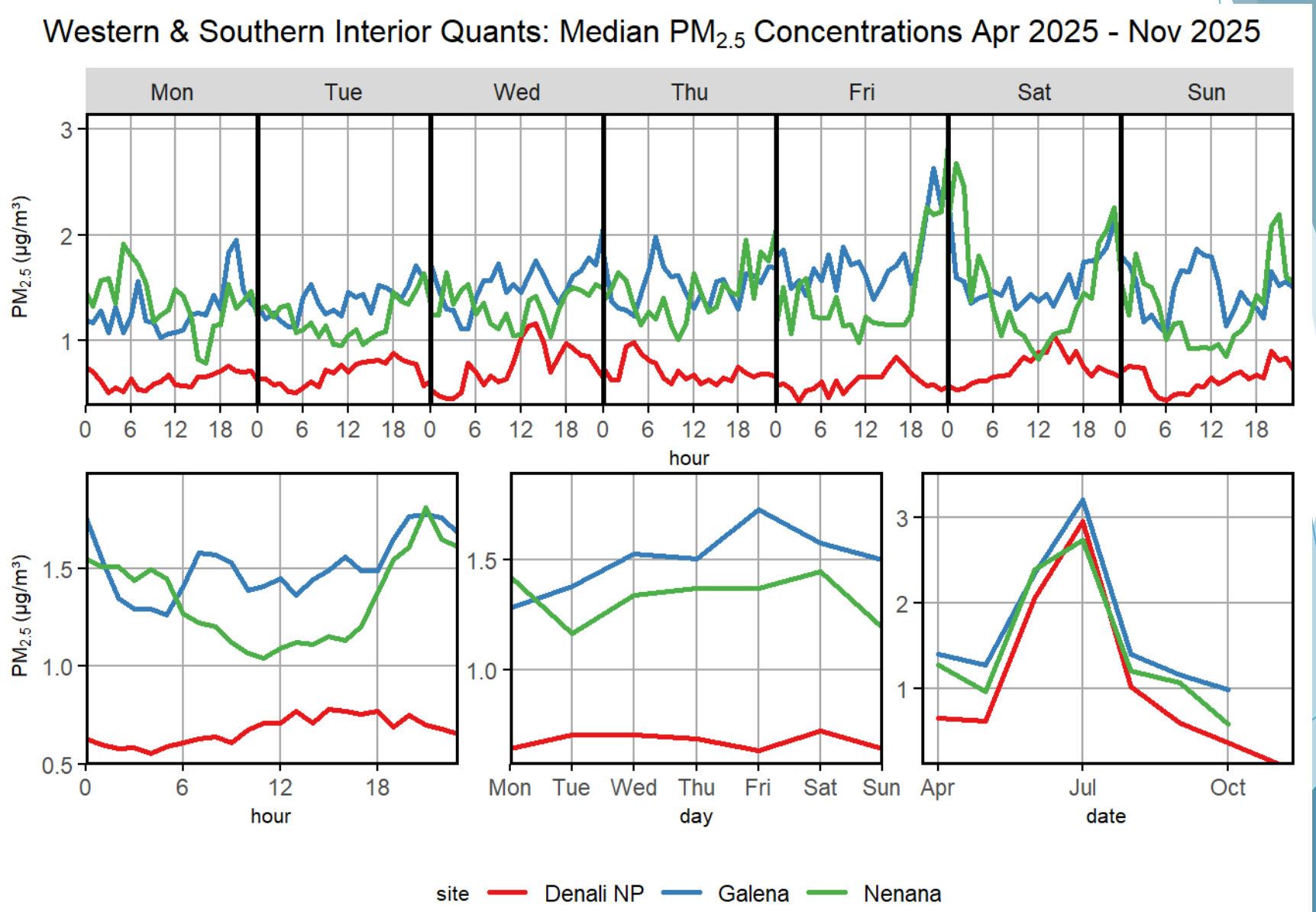
No cruise in port	Cruise in Port
2.36	3.75

There is a statistically significant difference ($p = 2x10^{-16}$) between the mean hourly $PM_{2.5}$ concentration in Juneau when there is a cruise ship versus when there is not, but both mean concentrations are within the "good" air quality index category.

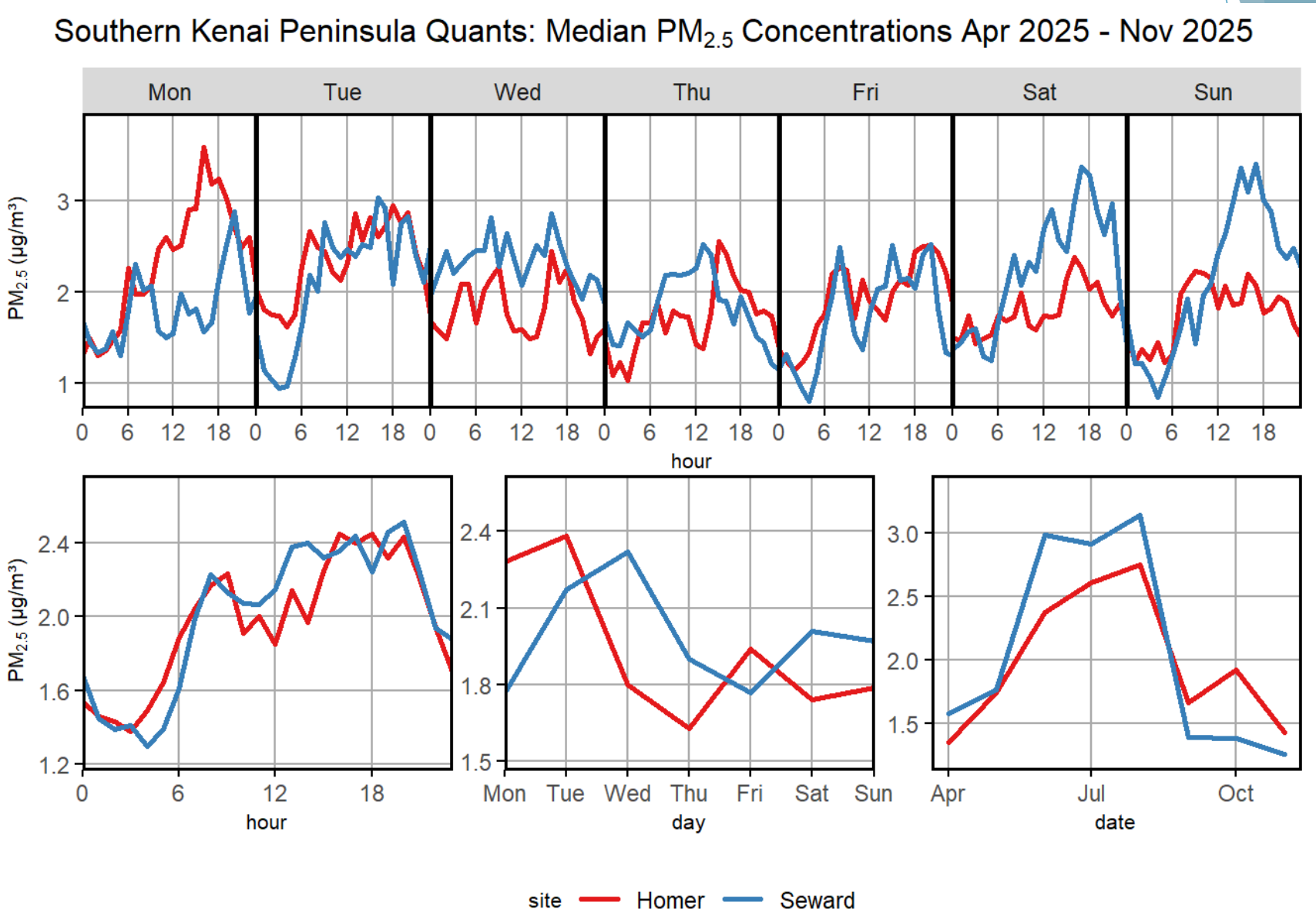
Diurnal Plots – Southern Gulf Coast



Diurnal Plots – Western & Southern Interior



Diurnal Plots – Southern Kenai Peninsula

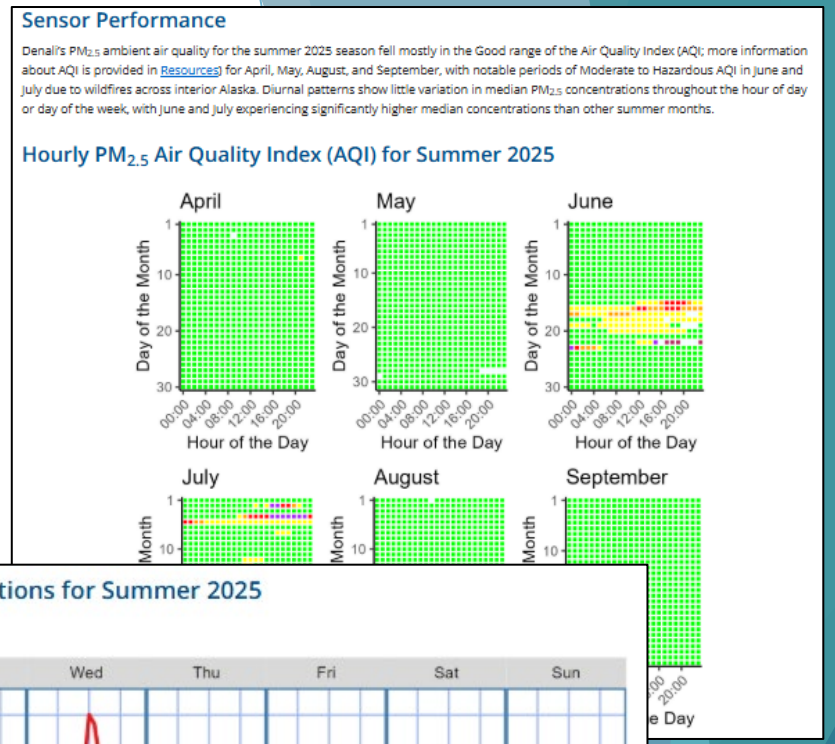


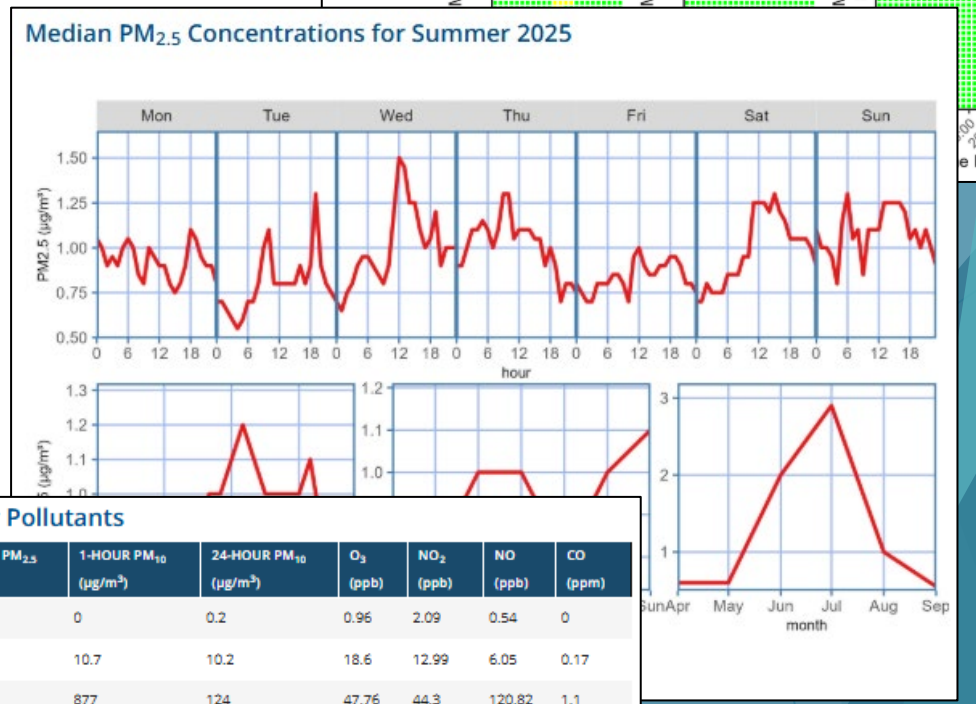
Interested about a specific sensor within a range of dates?

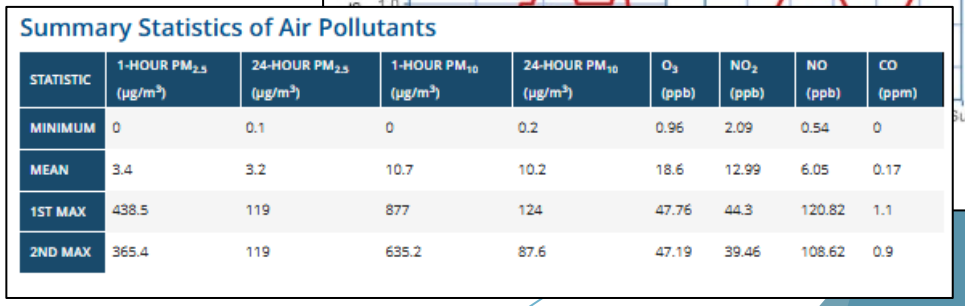
- Community Sensor Network Diurnal Comparisons

Community Data Reports

- Semi-annual reports giving overview of sensor performance, data preview, and air quality education resources
- Summer Season covers April 1, 2025 - September 30, 2025 – available now
- Winter Season covers October 1, 2025 - March 31, 2026 – available late spring 2026
- New web page format!
- View all reports at https://dec.alaska.gov/air/air-monitoring/instruments-sites/community-based-monitoring/community-data-reports/



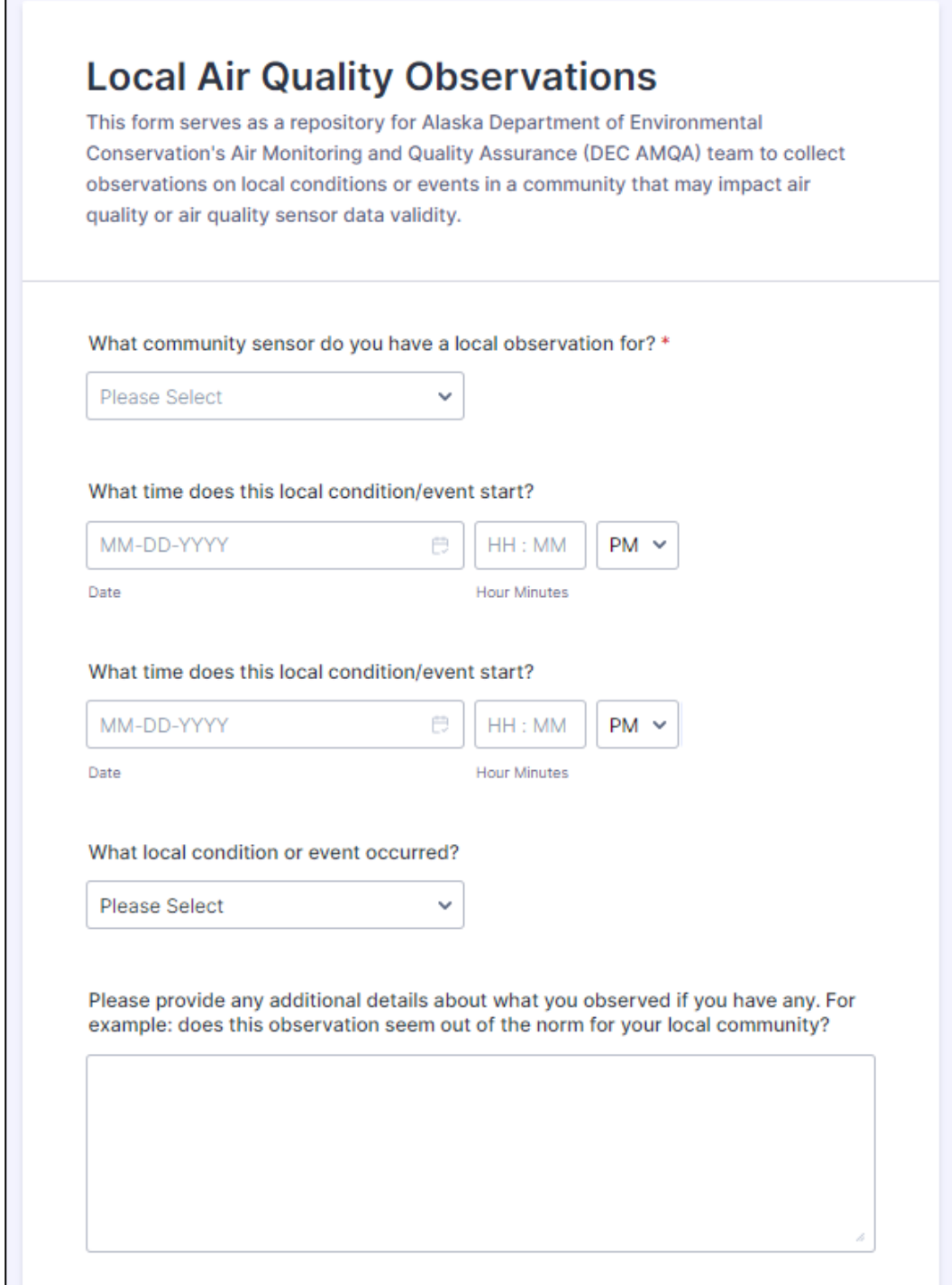




STATISTIC	1-HOUR $PM_{2.5}$ ($\mu g/m^3$)	24-HOUR $PM_{2.5}$ ($\mu g/m^3$)	1-HOUR PM_{10} ($\mu g/m^3$)	24-HOUR PM_{10} ($\mu g/m^3$)	O_3 (ppb)	NO_2 (ppb)	NO (ppb)	CO (ppm)
MINIMUM	0	0.1	0	0.2	0.96	2.09	0.54	0
MEAN	3.4	3.2	10.7	10.2	18.6	12.99	6.05	0.17
1ST MAX	438.5	119	877	124	47.76	44.3	120.82	1.1
2ND MAX	365.4	119	635.2	87.6	47.19	39.46	108.62	0.9

Local Air Quality Observations

- Local Air Quality Observations Form
  https://dec.alaska.gov/air/air-monitoring/instruments-sites/community-based-monitoring/



Local Air Quality Observations

This form serves as a repository for Alaska Department of Environmental Conservation's Air Monitoring and Quality Assurance (DEC AMQA) team to collect observations on local conditions or events in a community that may impact air quality or air quality sensor data validity.

What community sensor do you have a local observation for? *

Please Select

What time does this local condition/event start?

MM-DD-YYYY | HH : MM | PM

Date | Hour Minutes

What time does this local condition/event start?

MM-DD-YYYY | HH : MM | PM

Date | Hour Minutes

What local condition or event occurred?

Please Select

Please provide any additional details about what you observed if you have any. For example: does this observation seem out of the norm for your local community?

Rowing in the same direction

- **Sensor Network Expansion**
  - Wi-Fi sensors
  - Interior wildfire network
  - Municipality of Anchorage network
- **We want to host your air quality data on our website!**
- **DEC sensor network collaboration**
  - Contact us for direct collaboration
  - Future calls and knowledge share
  - Data available at request
  - *What data do you want to see?*

Thank you to all our community partners!

- Cathedral of the Nativity of the Blessed Virgin Mary
- Tok Community Library
- Palmer Public Library
- Big Lake Public Library
- Ninilchik Library

Contact us

Questions

- Next quarterly call date: March 10th 10-11am. Registration link will be emailed to our contact list.
- Visit our Air Quality Index Map (or Google 'Alaska air quality' and look for DEC AQI link)
- Contact info is in chat and in QR code

Resources

- Not sure what sensor to buy?
  - EPA Air Sensor Toolbox: epa.gov/air-sensor-toolbox
  - South Coast AQMD's AQ-SPEC program and evaluations: aqmd.gov/aq-spec
  - Contact us!
- ANTHC's PurpleAir program – contact ANTHC
- EPA Air Sensor Loan Program - https://www.epa.gov/air-sensor-toolbox/air-sensor-loan-programs