

ADEC's Community-Based Air Sensor Network

Quarterly Call – March 10, 2026, 10:00am AKST



Lydia Johnson, lydia.johnson@alaska.gov

Simeon Ng, simeon.ng@alaska.gov

Kelly Ireland, kelly.ireland@alaska.gov

Ayla Crosby, ayla.crosby@alaska.gov

Grace Carico, grace.carico@alaska.gov

Isaac Van Flein, isaac.vanflein@alaska.gov

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! June 9th 10-11am

Agenda

Welcome!

Sensor network overview and progress

Data findings

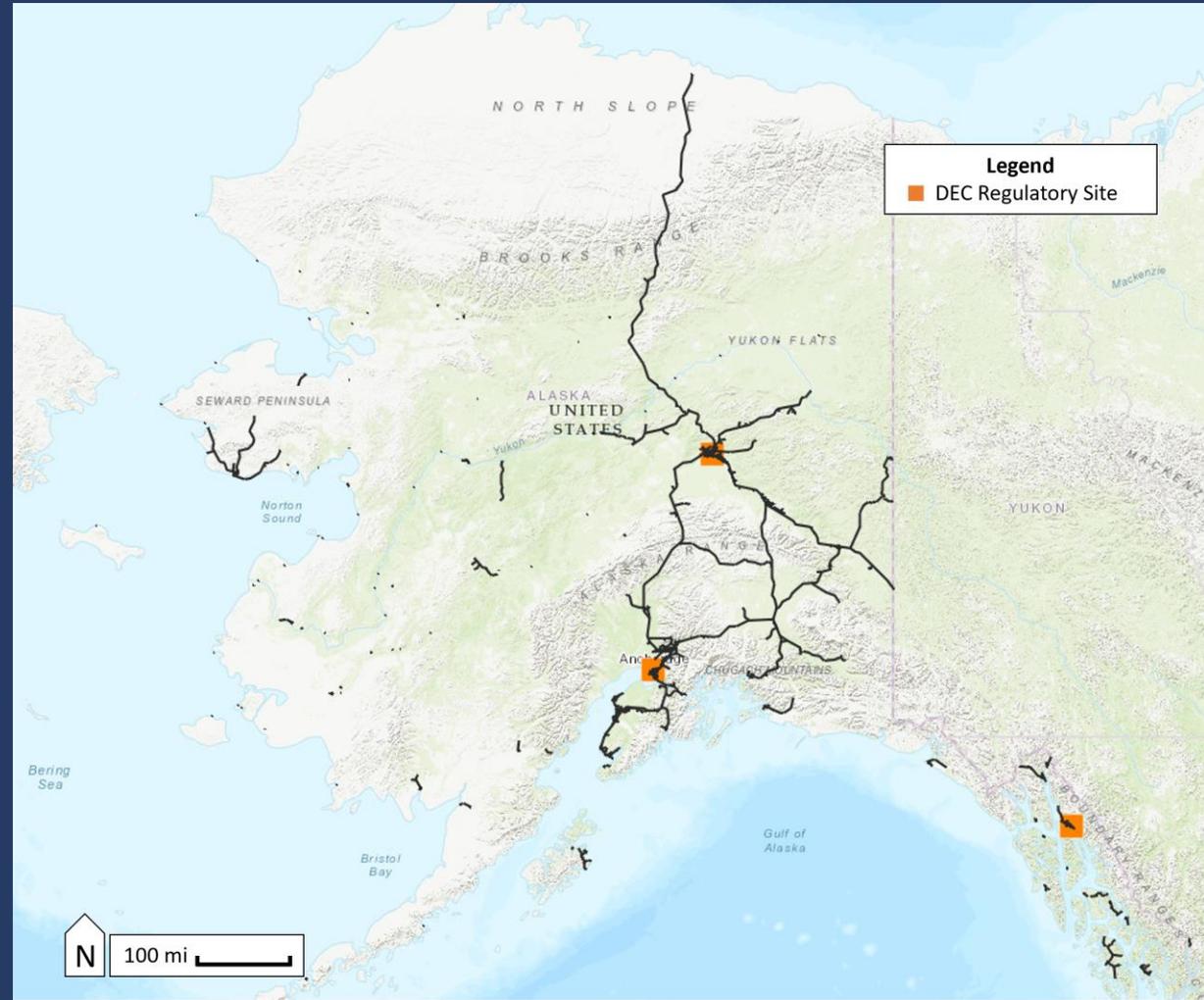
Next steps

Questions and discussion



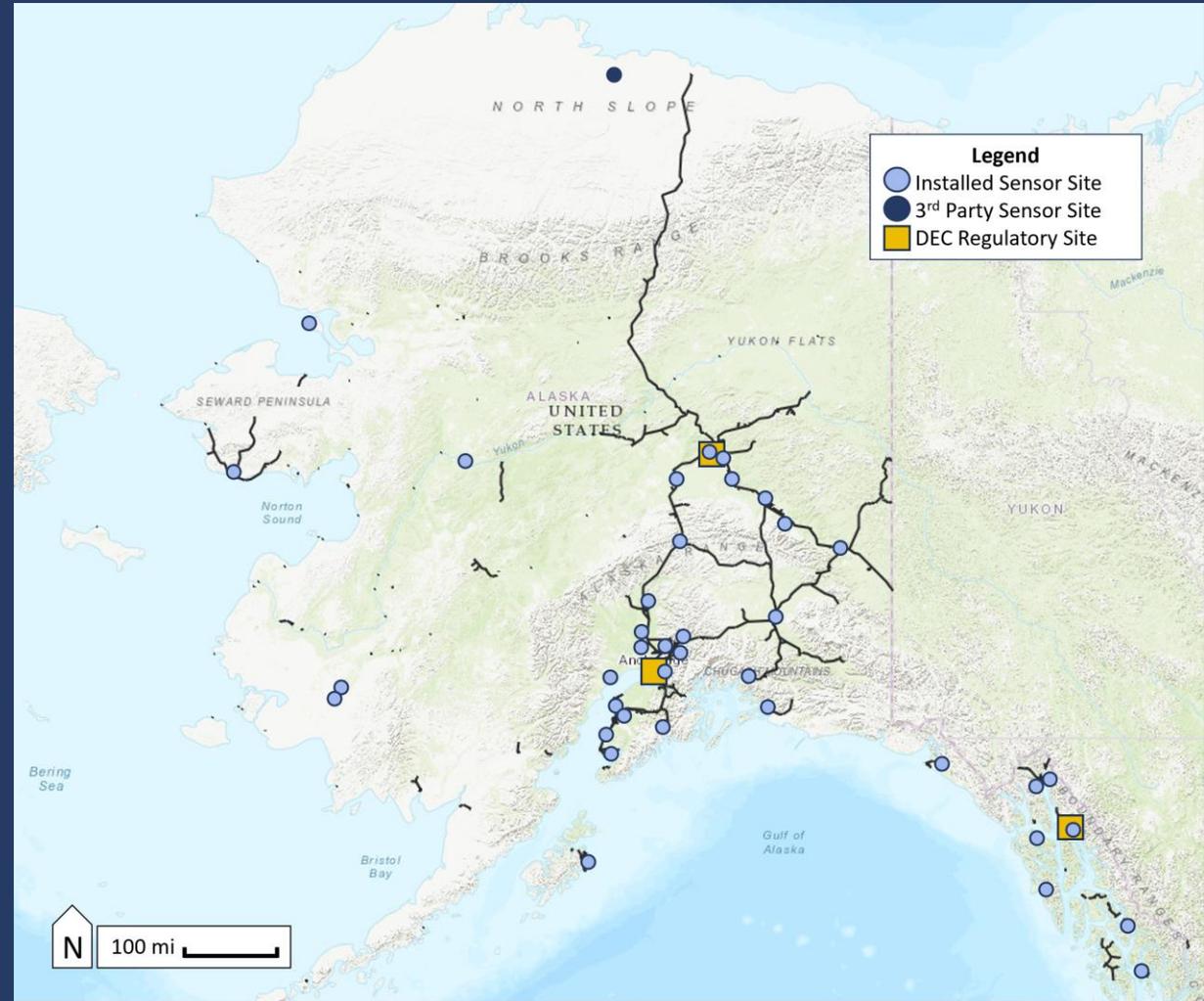
DEC's Regulatory Network

- 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}, PM₁₀)
 - Gases:
 - Carbon monoxide (CO)
 - Nitrogen dioxide (NO₂)
 - Ozone (O₃)
 - Sulfur dioxide (SO₂)



DEC's Low-Cost Sensor Network

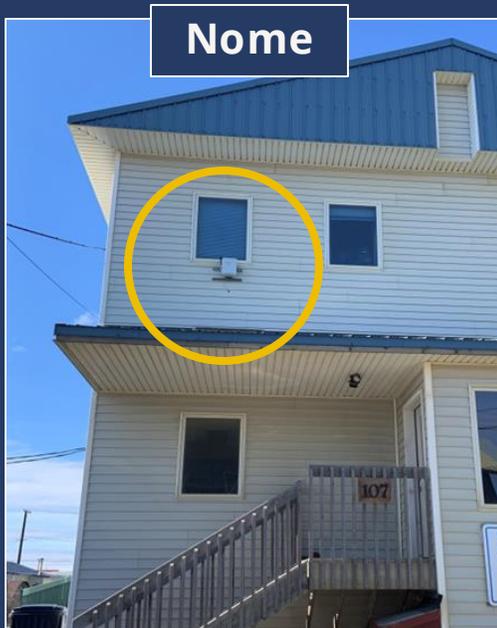
- Over 40 sensors currently deployed in 38 communities
- QuantAQ Modulair™ sensors:
 - PM₁₀ and PM_{2.5}, CO, NO, NO₂, O₃, temp, relative humidity
- Non-regulatory data
 - Trend analysis
- Cellular Network Coverage Limitations
 - Plans for expansion



Kotzebue



Nome



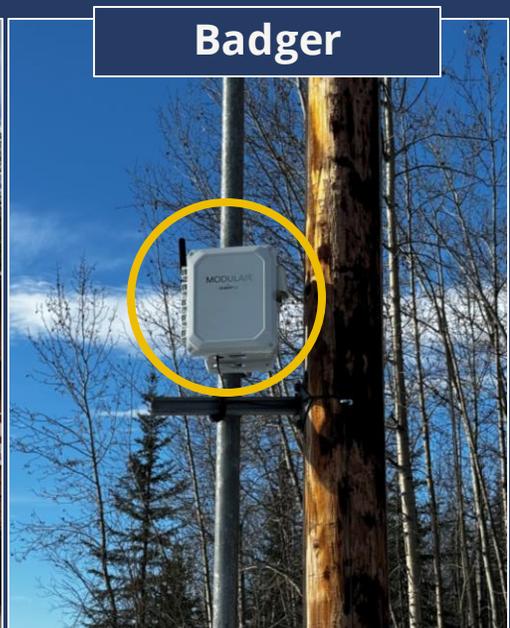
Nenana



Goldstream



Badger



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

Galena



Denali



Salcha



Delta Junction



Tok



Juneau



Alaska State Museum



Skagway



Haines



Hoonah



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Cordova



Yakutat



Sitka



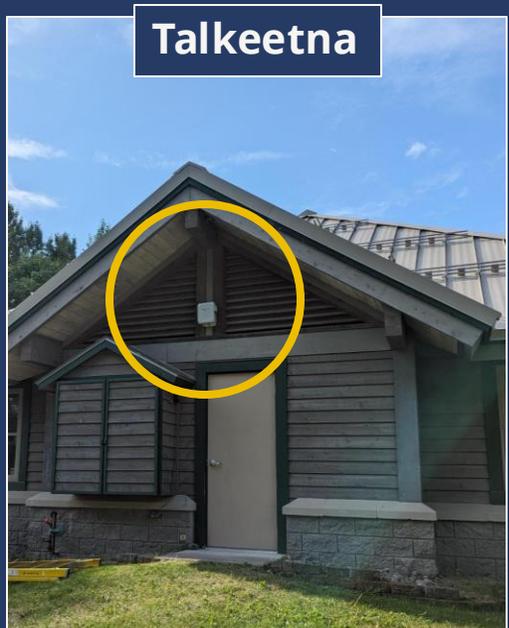
Wrangell



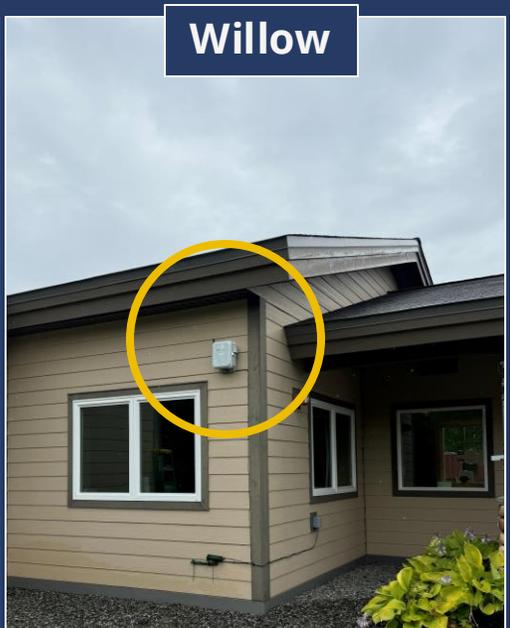
Ketchikan



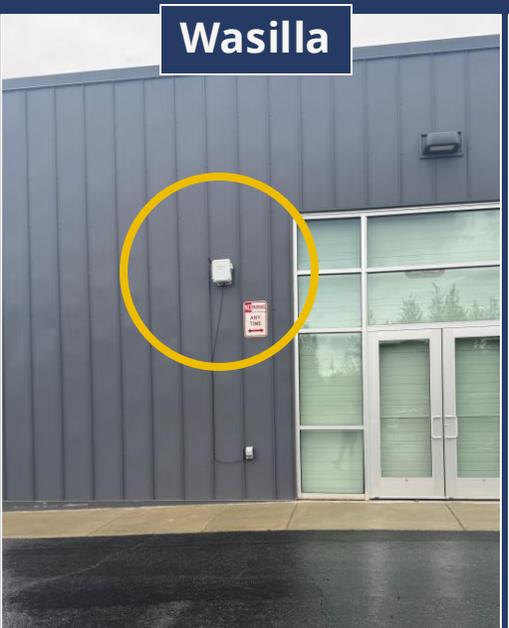
Talkeetna



Willow



Wasilla



Palmer



Chickaloon



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

Tyonek



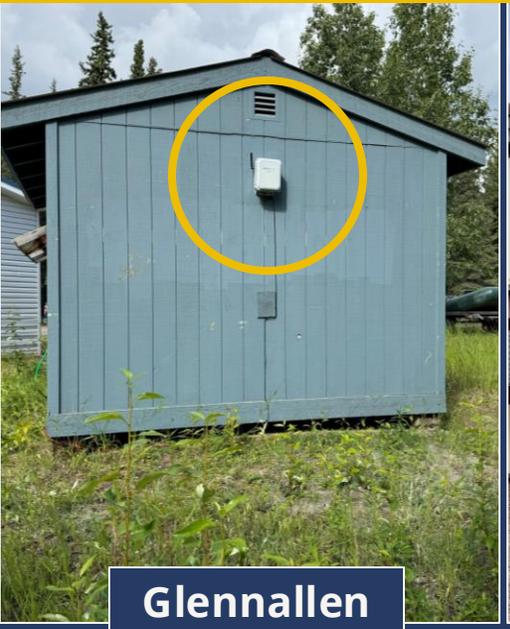
Big Lake



Campbell Creek Science Center



Glennallen



Valdez



Kenai



Soldotna



Seward



Gerstle River



Bethel



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

Ninilchik



Homer



Kodiak



Napaskiak



Anne Wien Elementary School



New sensor installs

- QuantAQ Modulair™ sensor installed 12/9/2025 at **Anne Wien Elementary School, Fairbanks**



Sensor Audits

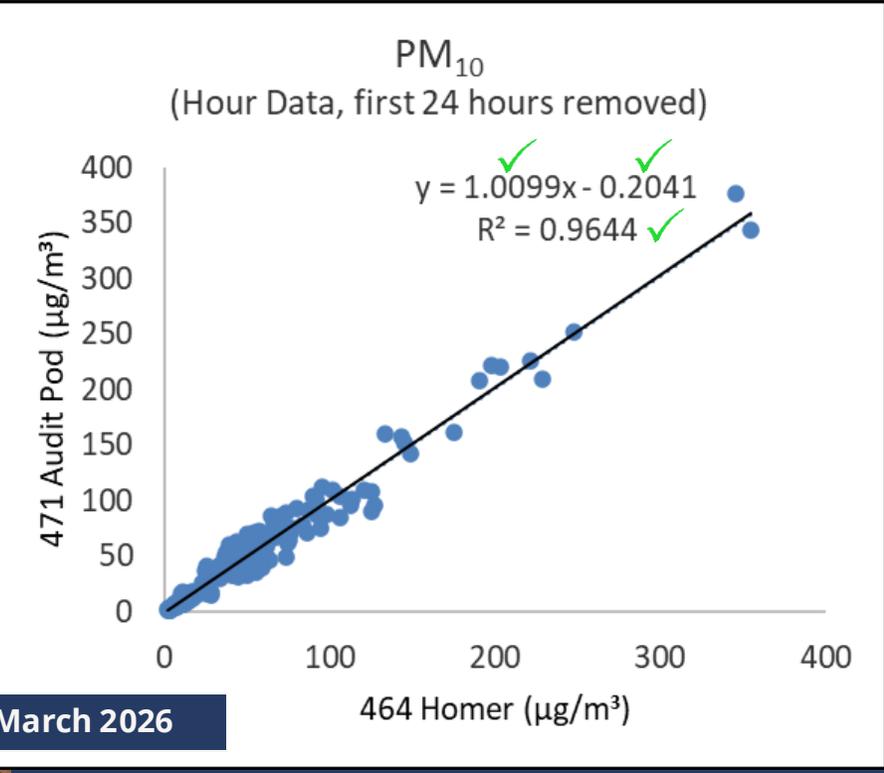
- Upcoming audits in Southcentral and Southeast regions
- Audit pod from nearest regulatory site (Anchorage, Fairbanks, or Juneau), is temporarily installed for ~1 week next to local pod to:
 - Assess sensor performance
 - Ensure data validity
- Determine sensor agreement using regression analysis and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

R^2 ≥ 0.70	Slope 1.0 ± 0.35	Intercept $-5 \leq b \leq 5$
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Sensor Audits

- Completed since last call:
(Dec 10, 2025 - March 10, 2026)
 - Willow
 - Talkeetna
 - Ninilchik
 - Homer
 - Ketchikan
- Currently under audit:
 - Kodiak
- Upcoming audits (subject to change):
 - Southcentral – Napaskiak, Tyonek, Seward
 - Southeast – Juneau, Hoonah, Sitka, Skagway
 - Interior- Kotzebue, Nome, Tok



R^2	Slope	Intercept
≥ 0.70	1.0 ± 0.35	$-5 \leq b \leq 5$



Network Challenges

- The network is getting older! Sensors are starting to need to be sent out of state to QuantAQ service team for annual recalibrations and maintenance
 - Communities with sensors needing maintenance will receive a substitute sensor as inventory allows
- Aging PM sensors
 - Increasing frequency of PM sensor malfunctions/outages
 - Often can be fixed temporarily with a power cycle, eventually will need to be sent back for maintenance

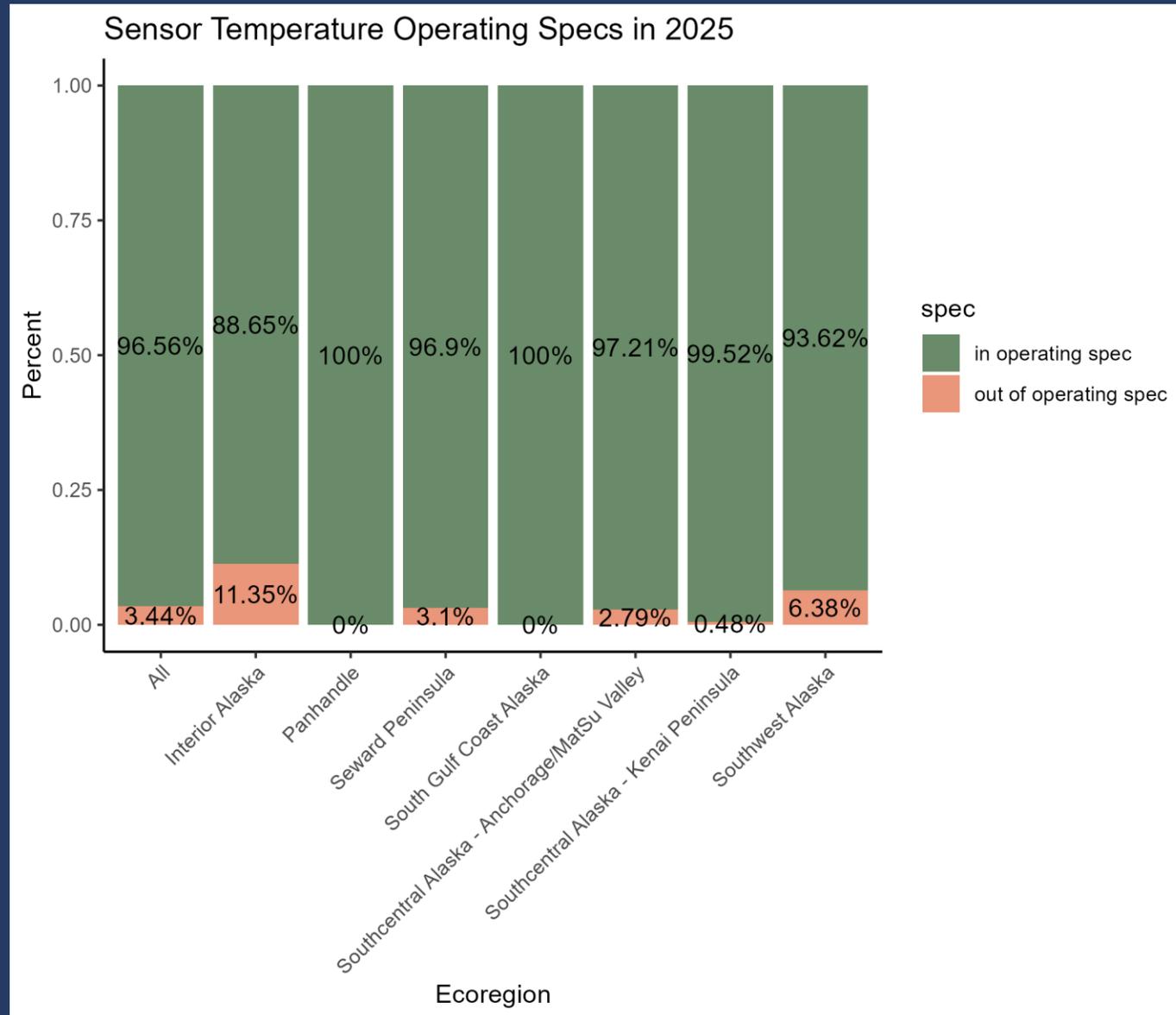


Temperature Operating Specs

- Quant sensors, unlike our regulatory network monitors, lack a heated air intake so the temp operating specs are narrower and do not produce reliable data at extremely low or high temps
 - Hygroscopic interference on PM₁₀ sensors
- QuantAQ lists the operating temperature range for Modulair™ sensors as **-20° to 45°C (-4° to 113°F)**
- Our data is shared with Quant to improve sensor performance in extreme cold
- Our sensors in the Interior, Southcentral, Southwest, and Seward Peninsula spent time outside the lower operating specs in 2025



Temp operating spec

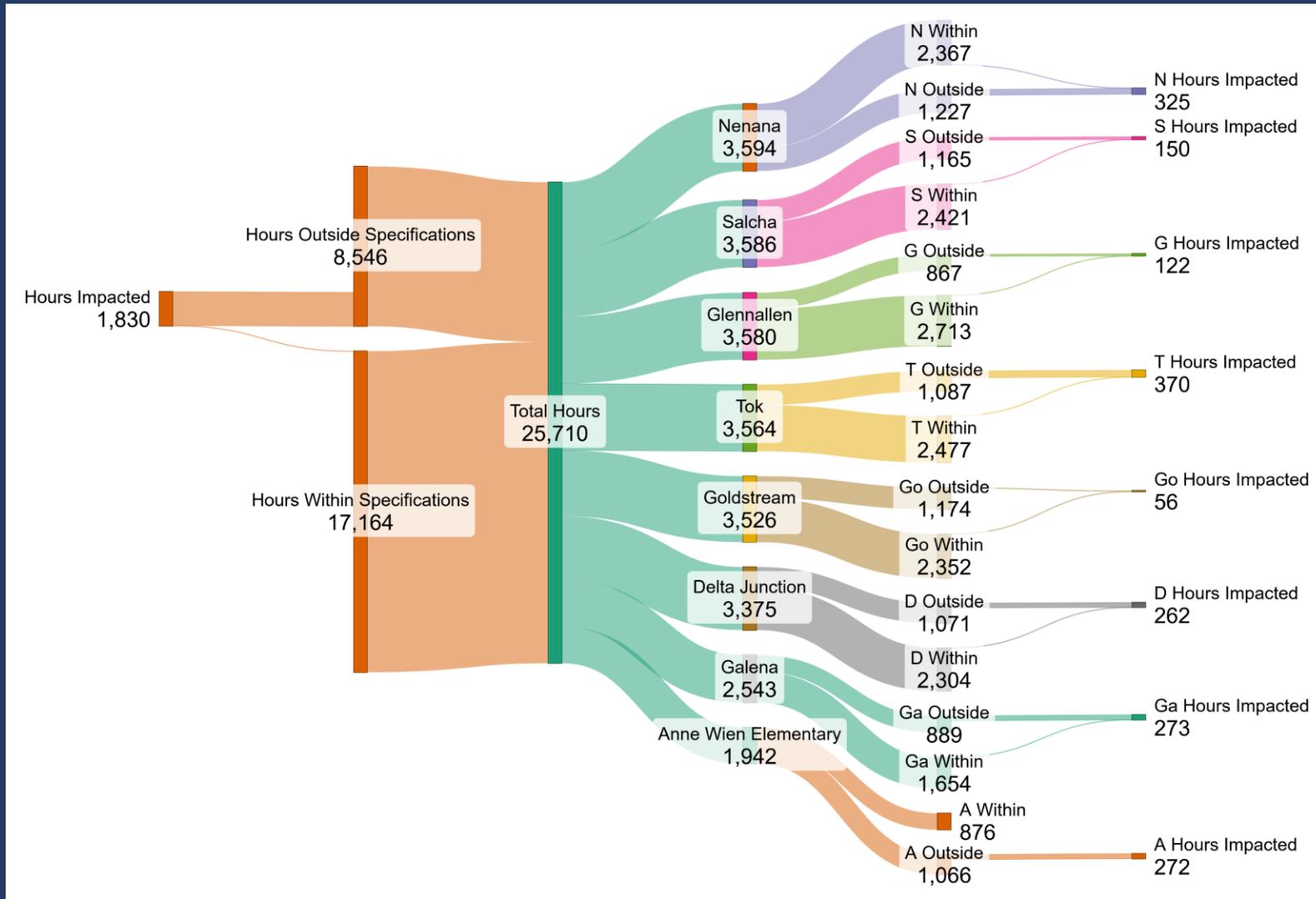


Ice Fog

- Tiny ice crystals formed by water vapor produced from urban environments
 - Typically -30°F (outside operating specs)
- QuantAQ PM₁₀ sensor – Optical Particle Counter (OPC)
 - OPC good at detecting larger particle sizes
 - Fog particles are large (up to 50µm)
- Suggested data flagging
 - Dew point spread is less than 3.75°C
 - PM_c exceeds 200 µg/m³
 - $PM_c = PM_{10} - PM_{2.5}$



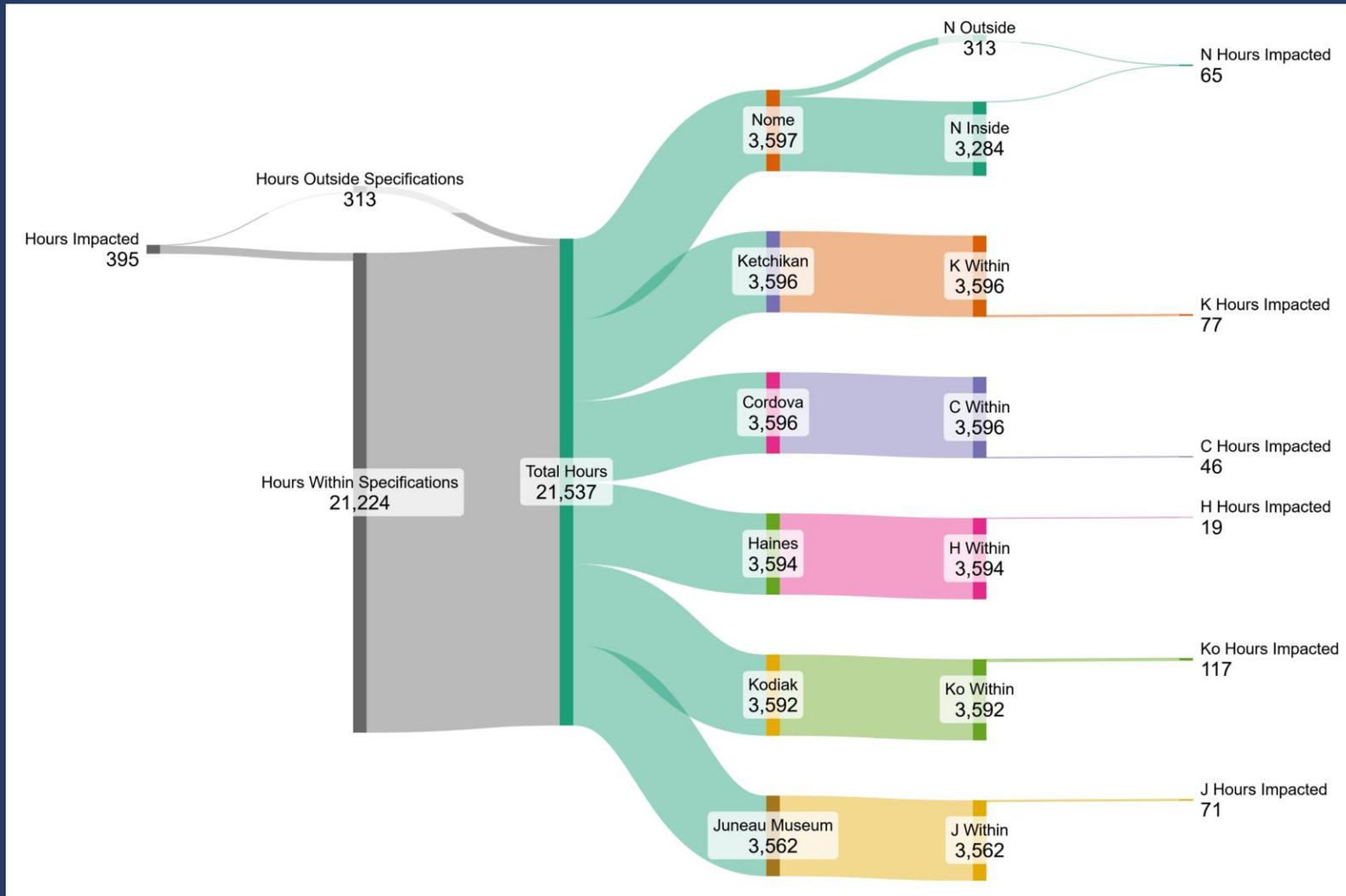
Ice Fog Impact - Interior PM₁₀



- Oct 2025 – Feb 2026
- Potential Hours:
 - 3600 hours ~ 150 days
 - AW - 1933 hours ~ 81 days
- Data Flagging:
 - High PM₁₀ readings (>1000ug/m³)
 - Outside -20°C
 - QuantAQ Fog Flagging
- 33% hours outside specs
 - 7% suspected impact by fog/ice fog
- Tok ~ 15 days impacted



Fog Impact – Southeast & Coastal PM₁₀



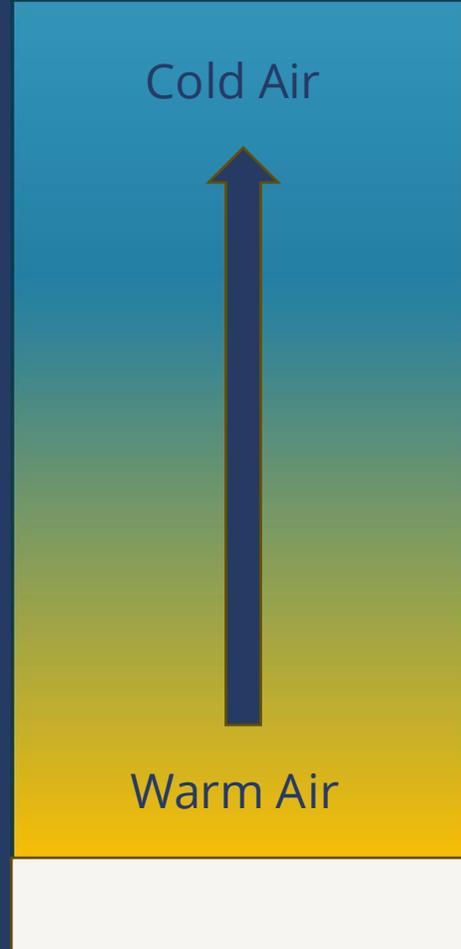
- Oct 2025 – Feb 2026
- 3600 Potential Hours ~ 150 Days
- Data Flagging:
 - QuantAQ Fog Flagging
- Operating mostly within spec
 - 1.8% suspected impact by fog
- Kodiak ~ 4.8 days impacted



What is an Inversion?

Normal Temperature Gradient

- Surface level air is warm
- Air temperature cools at higher altitudes
- Direct, simple gradient
- Good mixing of air



Inversion Temperature Gradient

- Surface level air is cold
- High altitude air is cold
- Middle layer air is warm
- Complex gradient
- Poor mixing of air



What creates an Inversion?



- The surface rapidly cools, releasing heat
- Warm air layer is trapped between cold surface air and colder high-altitude air

Contributing factors

- Long winter nights
- Snow cover
- No cloud cover
- Dry air near ground
- Low wind speed

Mitigating factors

- Warm air temps
- Warm ground temps
- Rainfall
- Wet air near ground
- High wind speed



What's the problem with an Inversion?

- Warm air layer acts like a blanket
 - Pollutants are trapped and concentrated
 - Reduced visibility
- Reduced movement of air
 - Less mixing, less dispersal
- Alters weather conditions at the surface
 - Reduced likelihood of rain
 - Reduced sunlight

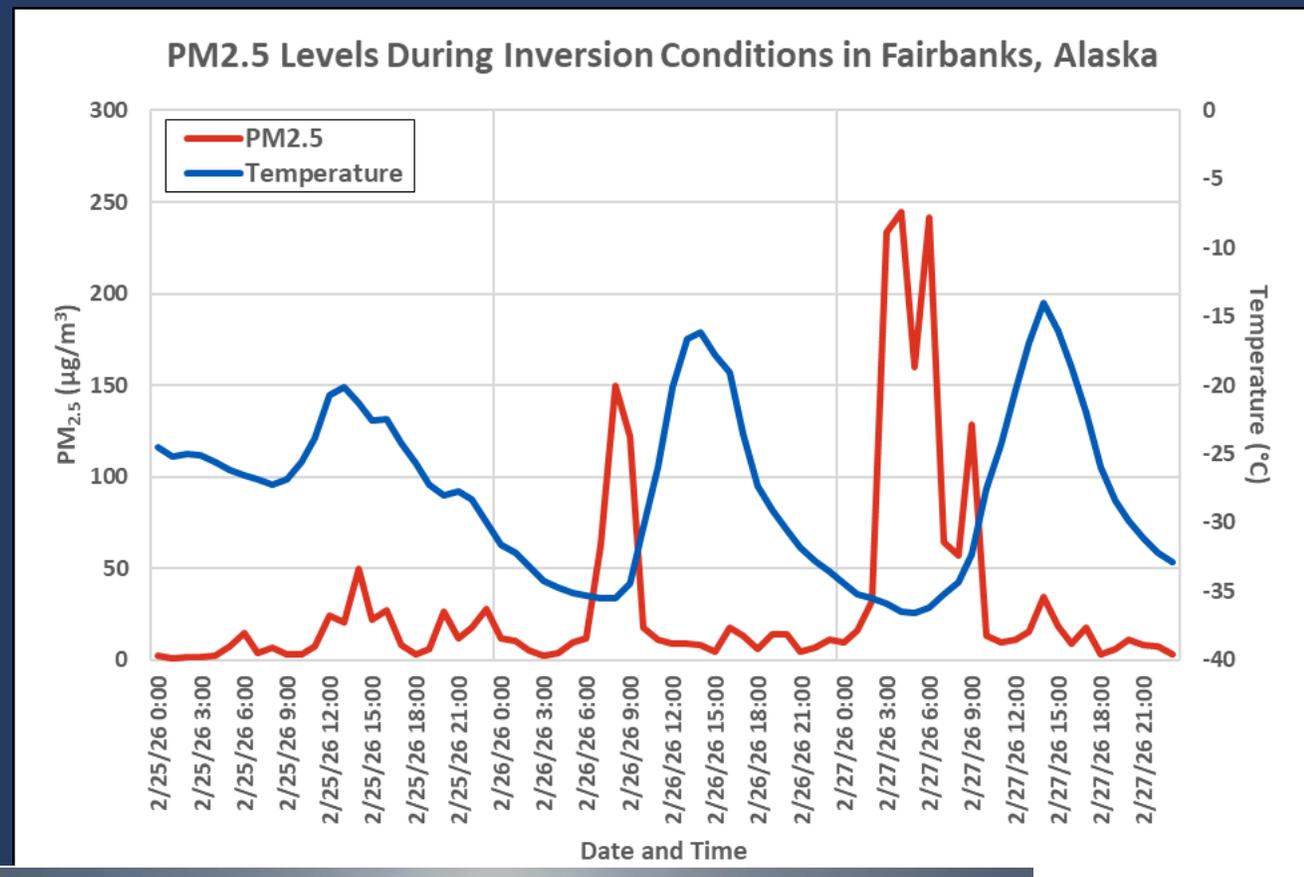


Inversion conditions in Salt Lake Valley, Utah.
Photo credit: NASA



Interior Inversions

- Interior communities experienced multiple inversion events in Dec '25 – Feb '26
 - Extreme and prolonged cold spells
 - Severe ice fog
 - Very high PM readings
 - Low visibility
 - Traffic hazards
- Fairbanks during end of February
 - Temperature falls below -30
 - Daily pattern
 - PM rises in morning with early activity
 - Inversion collapses with mid-day warming



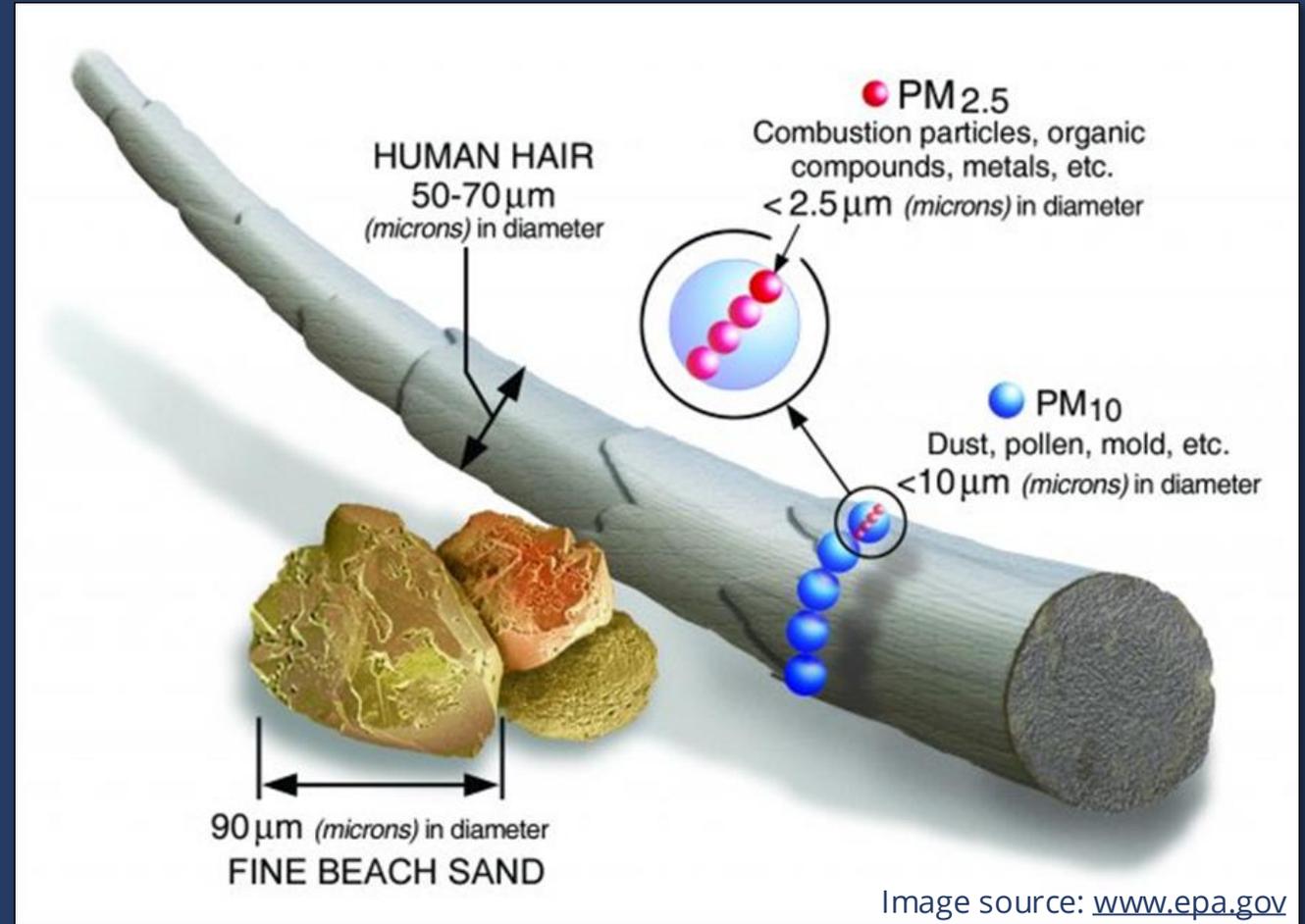
Inversion conditions in Fairbanks, Alaska, as seen from roof of Akasofu building. Photo credit: Isaac Van Flein



PM Health Impacts

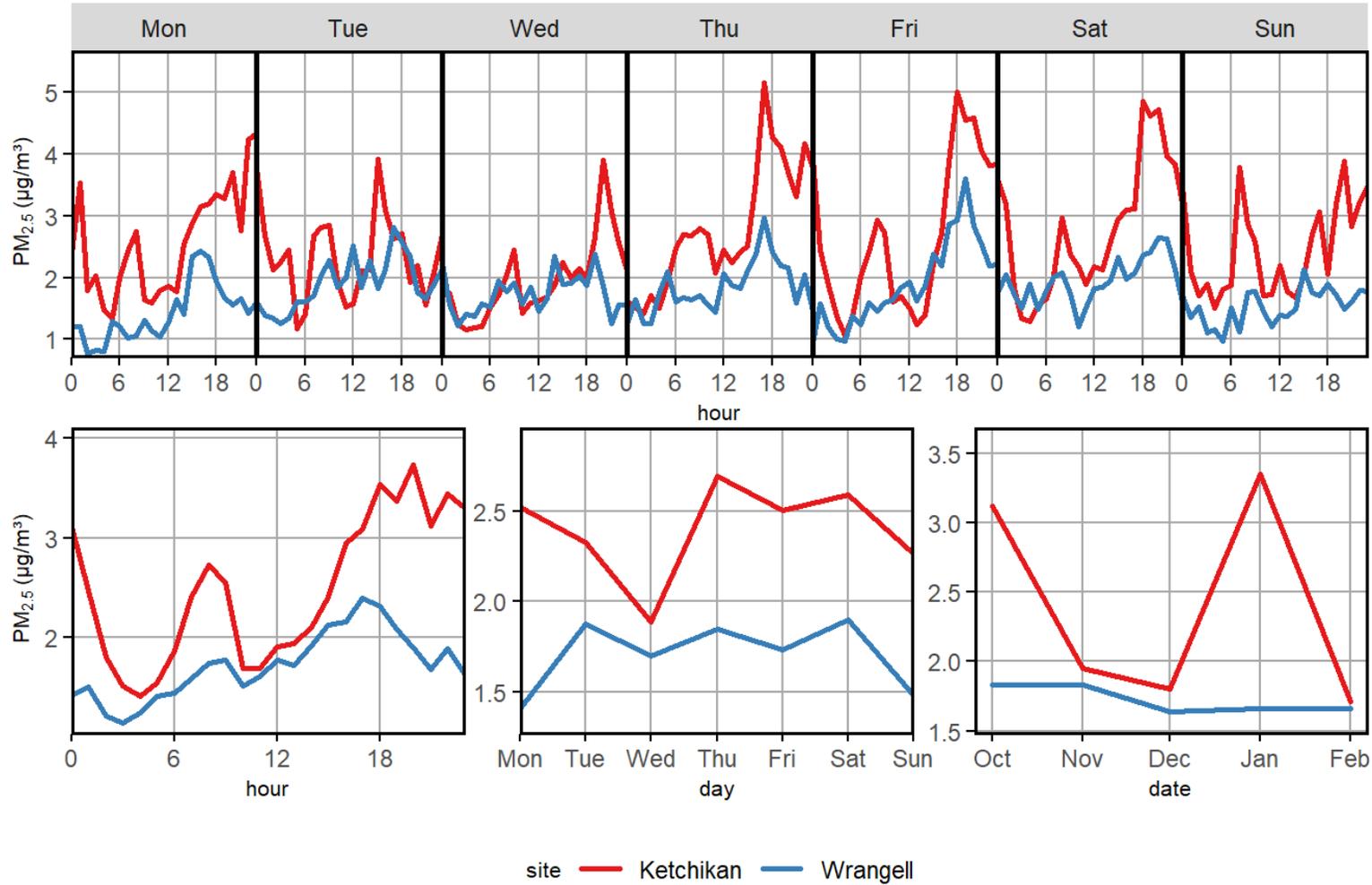
What is particulate matter (PM)?

- Particles suspended in the air
- Mixture of solid particles and liquid droplets in the air, both natural and chemical
- Small enough to be inhaled
- The smaller the particle, the farther it can imbed into your body
- Can cause excess irritation for folks with asthma or cause development of asthma.
- Prolonged exposure can increase chances for cardiovascular issues



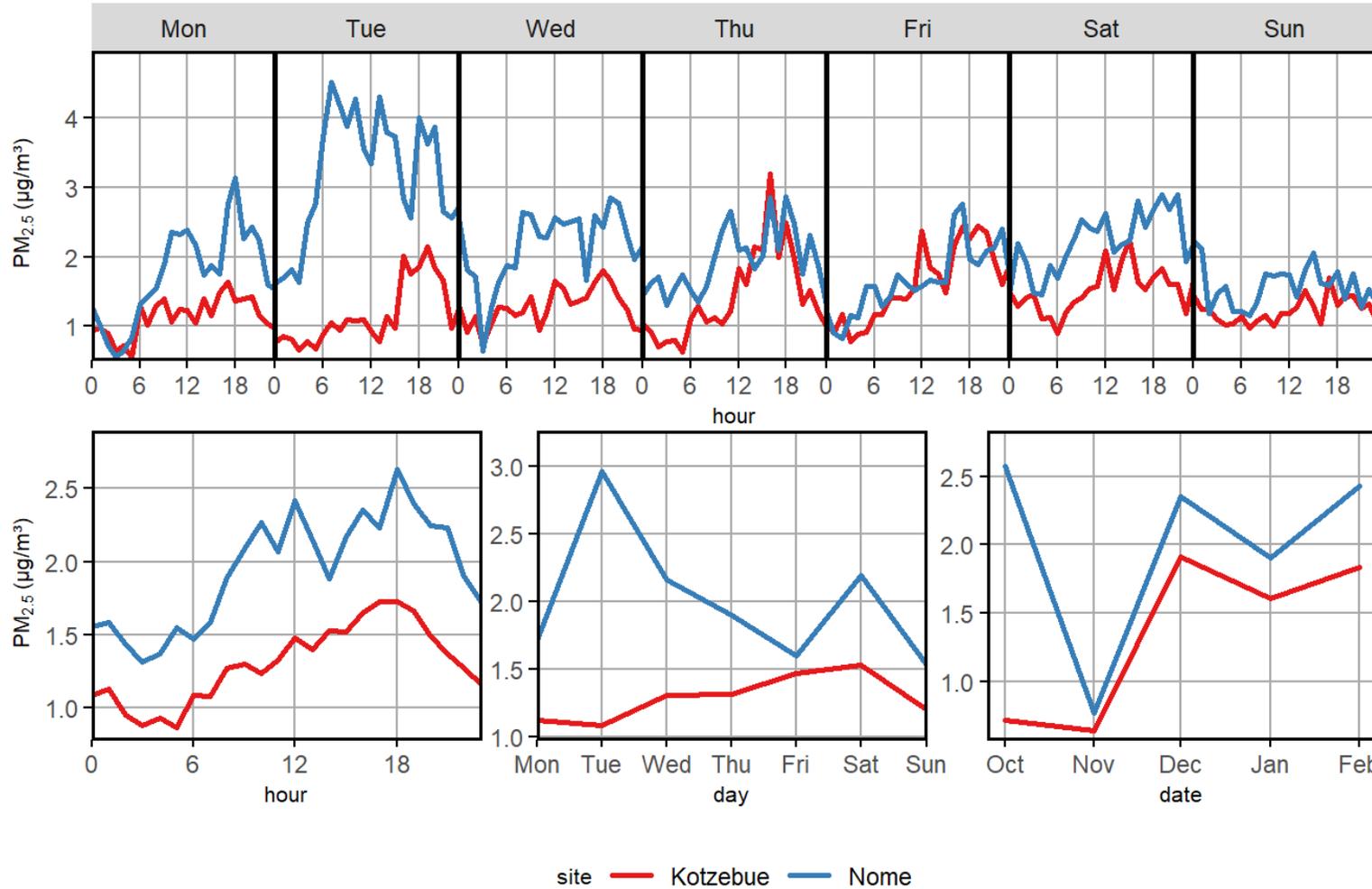
Diurnal Plots – Southern SE

Southern Southeast Alaska Quants: Median PM_{2.5} Concentrations Oct 2025 - Feb 2026



Diurnal Plots – Northwest

Western Alaska Quants: Median PM_{2.5} Concentrations Oct 2025 - Feb 2026



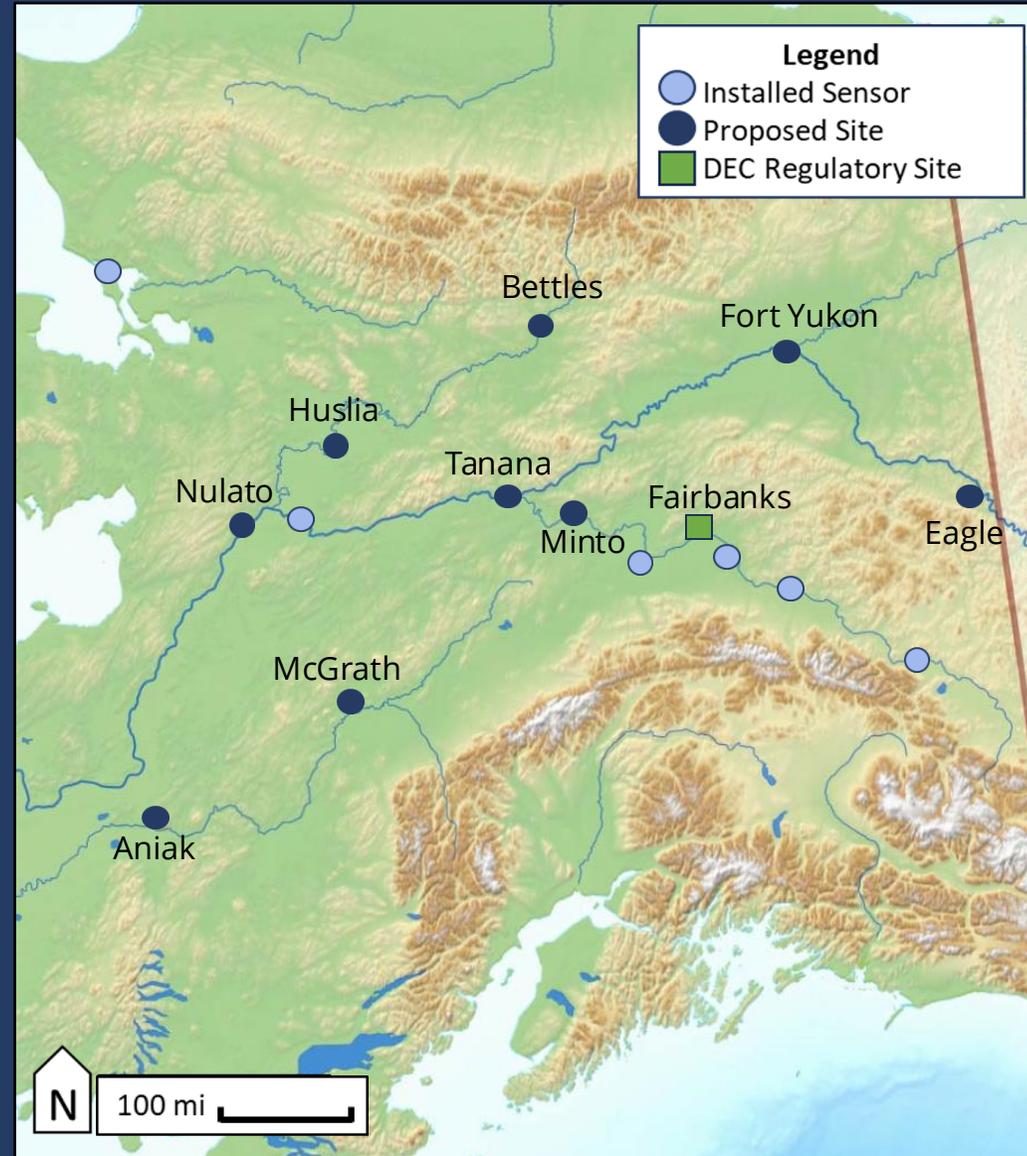
Interested about a specific sensor within a range of dates?

- [Community Sensor Network Diurnal Comparisons](#)



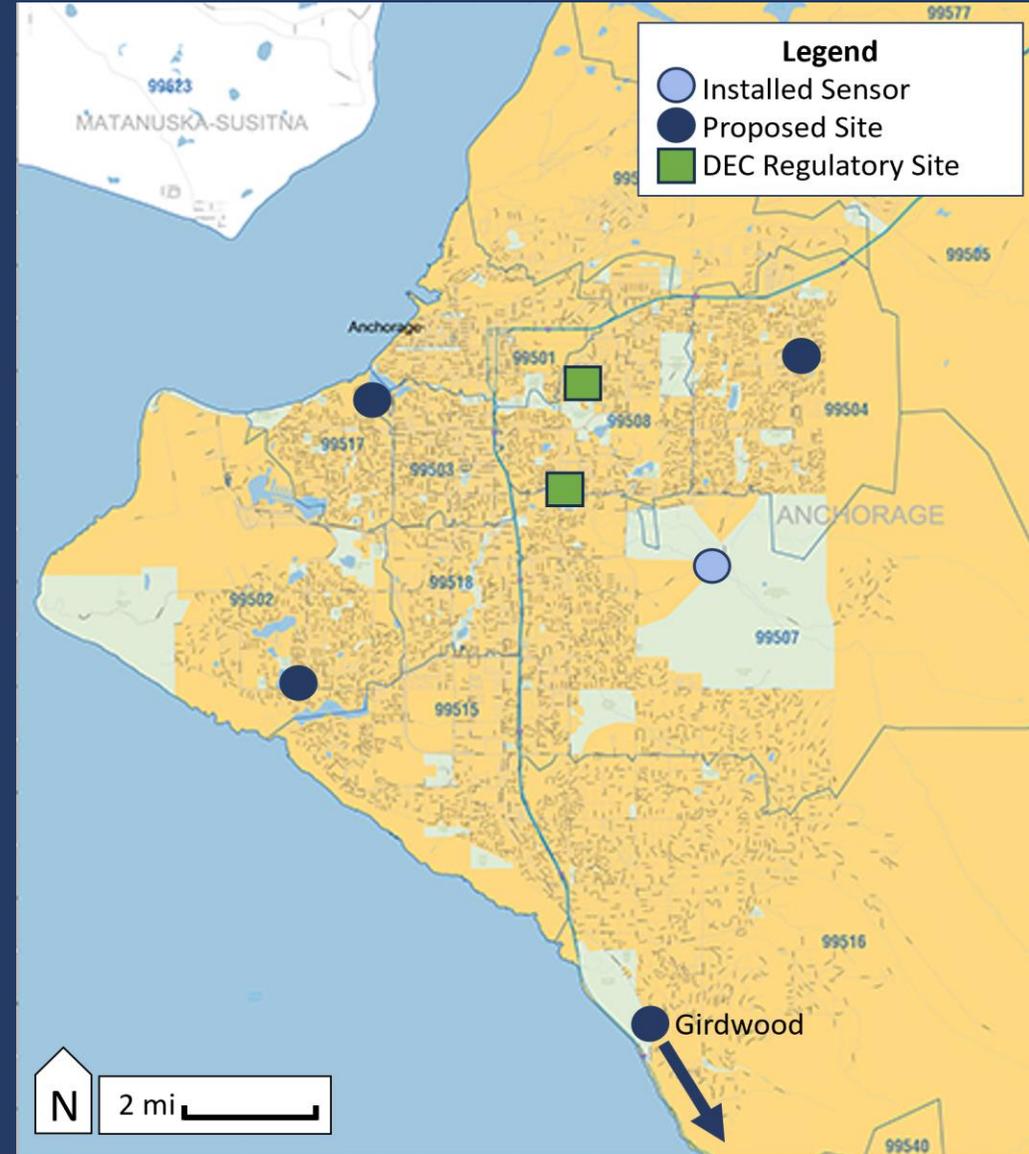
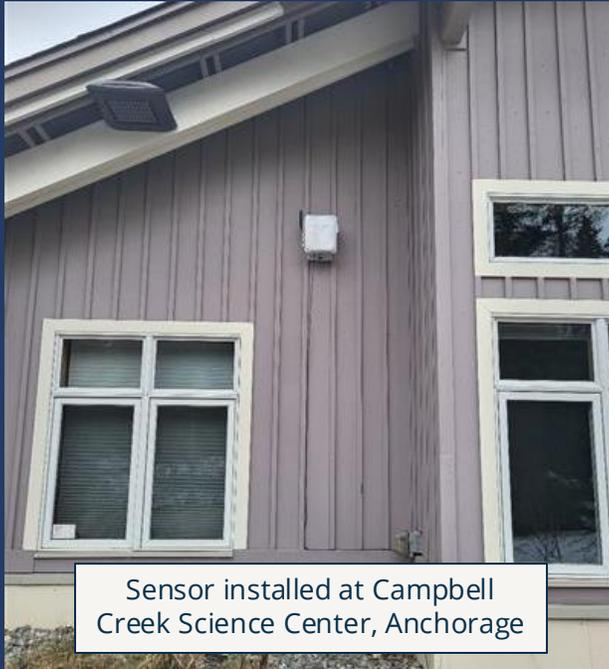
Interior Wildfire Monitoring Network

- Install six QuantAQ Modulair™-PM pods across Interior Alaska
- Planned deployment summer 2026
- Will provide:
 - Air monitoring capacity to communities with incompatible cell service/no service
 - Wildfire smoke monitoring



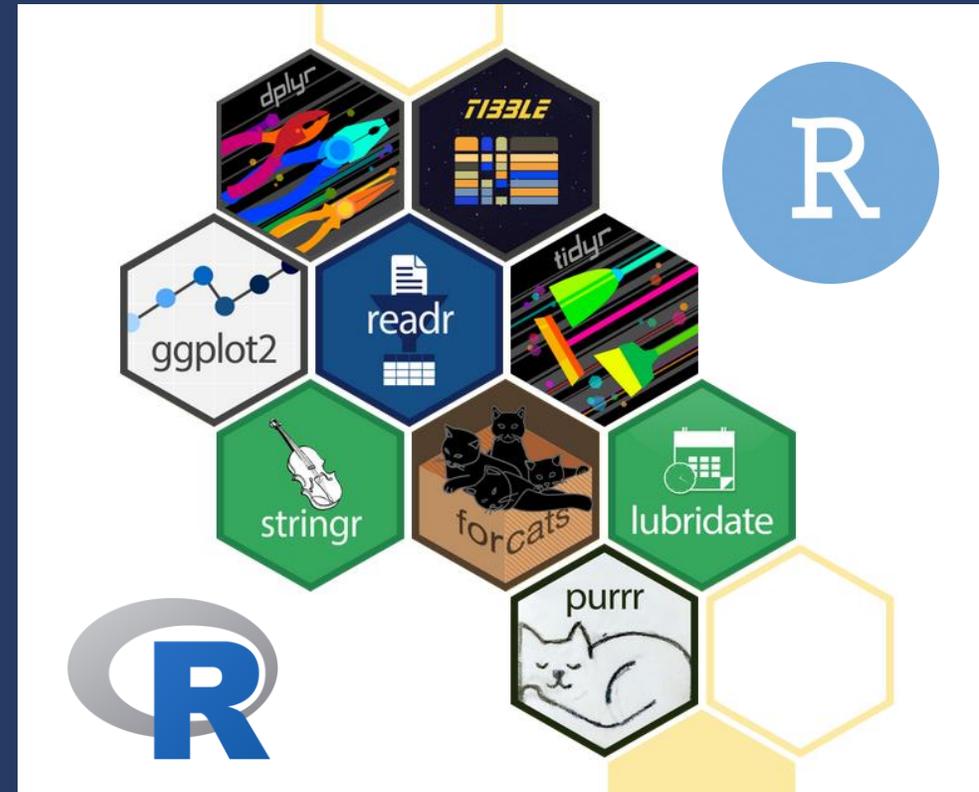
Municipality of Anchorage Network

- Install 4 additional QuantAQ Modulair™ sensors around the Municipality of Anchorage to increase intra-city PM_{2.5} monitoring.
- Planned deployment summer 2026



R Data Analysis and Visualization Workshops

- Dates TBD
- 4-5 workshops about 1-hour each
- Proposed topics
 - R and R Studio Basics
 - Tidy Data Framework
 - Data Cleaning
 - AQI Calculations
 - Tile Plots
 - Calendar Plots



Community Data Reports

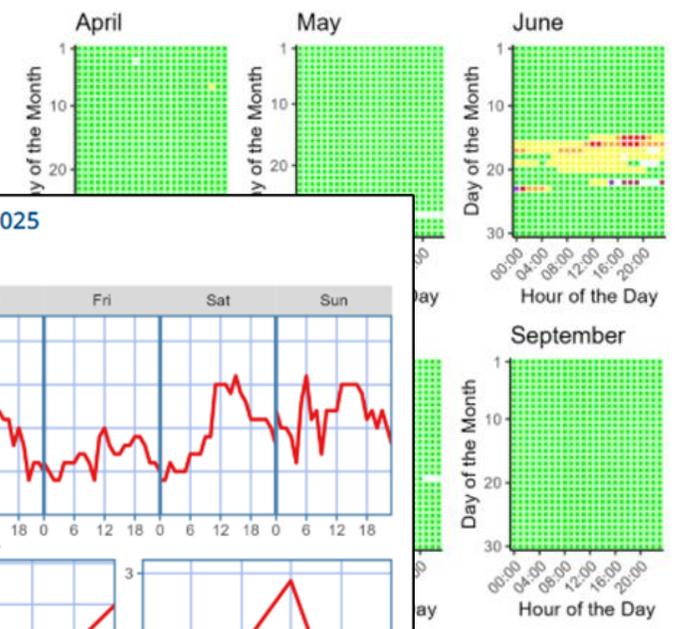
- Semi-annual reports giving overview of sensor performance, data preview, and air quality education resources
- Winter season covers October 1, 2025- March 31, 2026 – available late spring 2026!
- View all reports at <https://dec.alaska.gov/air/air-monitoring/instruments-sites/community-based-monitoring/community-data-reports/>



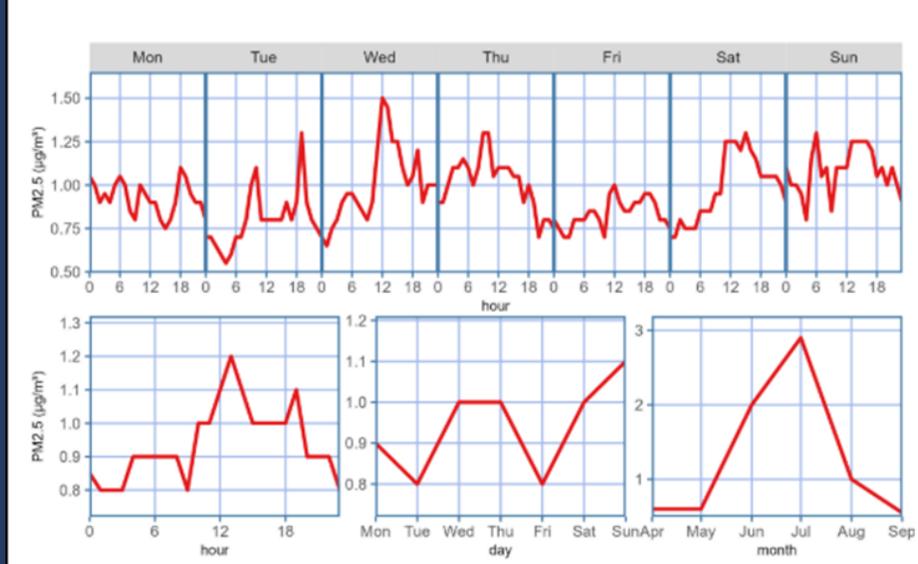
Sensor Performance

Denali's PM_{2.5} ambient air quality for the summer 2025 season fell mostly in the Good range of the Air Quality Index (AQI); more information about AQI is provided in [Resources](#) for April, May, August, and September, with notable periods of Moderate to Hazardous AQI in June and July due to wildfires across Interior Alaska. Diurnal patterns show little variation in median PM_{2.5} concentrations throughout the hour of day or day of the week, with June and July experiencing significantly higher median concentrations than other summer months.

Hourly PM_{2.5} Air Quality Index (AQI) for Summer 2025



Median PM_{2.5} Concentrations for Summer 2025



Summary Statistics of Air Pollutants

STATISTIC	1-HOUR PM _{2.5} (µg/m ³)	24-HOUR PM _{2.5} (µg/m ³)	1-HOUR PM ₁₀ (µg/m ³)	24-HOUR PM ₁₀ (µg/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? *

What time does this local condition/event start?

Date

Hour Minutes

What time does this local condition/event start?

Date

Hour Minutes

What local condition or event occurred?

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

- **DEC Sensor Network Collaboration**
 - Contact us for direct collaboration
 - Future calls and knowledge share
 - Data available at request -
 - amqa-data-requests@alaska.gov
- **Future Calls and Reporting**
 - *What data do you want to see?*



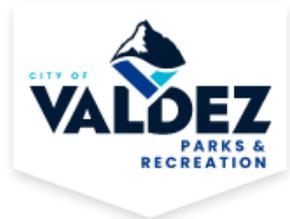
Thank you to all our community partners!



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



Chilkoot Indian Association



Questions

- Next quarterly call date: **June 9th 10:00am**. 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](https://www.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>

**DEC Air Quality
Contact Page:**

