

Exploring Near-Road Data with the Near-Road Dashboard

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Outline

- Near-Road (NR) Network
- NR Dashboard
 - Overview
 - Tabs
- Network-Wide Tabs
 - Pollutant Summary, Increment Calculator, Network Completeness, etc.
- Site-Specific Tabs
 - Site and Method Summary, Pollution Roses, etc.

Near-Road Network

- Higher population living near major roadways and an increase in vehicle miles traveled lead to an increased potential for human exposure to air pollution and subsequent negative health outcomes
- U.S. Environmental Protection Agency (EPA) mandated the Near-Road Network as part of the 2010 review of the National Ambient Air Quality Standard (NAAQS) for NO₂
- NR stations were placed to capture the elevated ambient air pollution concentrations expected to be observed from on-road mobile sources
- Designed to represent the most intense exposure in a near-road environment

Near-Road Network

- Site locations are chosen based on several factors that influence pollution exposure (e.g., meteorology, traffic volume)
- 84 active, inactive, or planned NR stations
 - Across 56 core based statistical areas (CBSAs) and 35 states and territories
- NR stations required to measure NO_2 and CO .^{*} Many measure $\text{PM}_{2.5}$, NO_x , NO , volatile organic compounds (VOCs), meteorology, and more
- **Data visualization is key**

^{*}required in every CBSA with a population of at least 1 million



*"Street View," Google Maps
(<http://www.googlemaps.com>), 2022*

Near-Road Dashboard; Overview

- Coded in an R environment; displayed using the Shiny package
- Back-end code compiles all NR data via Air Quality System (AQS) API (2016–present)
- Most recent two years updated weekly; data before that updated every quarter
- Designed to summarize large amounts of information in a quick and concise way
- Features visualizations of particular interest to the NR Network (e.g., increment calculator)
- Users can see a full characterization of a specific NR station

Near-Road Dashboard; Overview

Other features include an associated ReadMe document, tab categorization, and interactive tables:

The screenshot shows a data table with the following columns: State, County, City, PQAQ, Site Name, AQS Site Code, Latitude, Longitude, Setting, Target Road, Distance to Travel Feature (m), Distance to Mainline (m), AADT (2016), FE AADT (2016), and Multiple Pollutants. The table contains five rows of data. Annotations include: a 'Download Table' button in the top left; a search bar in the top right; a 'Downloadable table' callout pointing to the 'Download Table' button; a 'Sortable columns' callout pointing to the 'Site Name' column header; a 'Searchable table' callout pointing to the search bar; and a 'Navigability within table' callout pointing to the pagination controls at the bottom right. The pagination controls show 'Previous', '1', '2', '3', '4', '5', '...', '16', and 'Next'.

State	County	City	PQAQ	Site Name	AQS Site Code	Latitude	Longitude	Setting	Target Road	Distance to Travel Feature (m)	Distance to Mainline (m)	AADT (2016)	FE AADT (2016)	Multiple Pollutants
Alabama	Jefferson	Birmingham	Jefferson County, AL Department Of Health	Arkadelphia/Near Road	010732059	33.521427	-86.844112	Urban	I-20		25	126,670	193,362	Multiple Pollutants
Arizona	Maricopa	Tempe	Maricopa County Air Quality	Diablo	040134013	33.39023	-111.90799	Urban	I-10	13	13	267,488	521,640	Multiple Pollutants
Arizona	Maricopa	Phoenix	Maricopa County Air Quality	Thirty-Third	040134020	33.46173	-112.12796	Urban	I-10	17	17	250,030	471,769	Multiple Pollutants
California	Alameda	Oakland	Bay Area Air Quality Management District	Laney College	060010012	37.79362	-122.26911	Urban	I-80	19	24	225,000	441,675	Multiple Pollutants
California	Alameda	Not in a City	Bay Area Air Quality Management District	Berkeley Aquatic Park	060010013	37.864767	-122.302741	Urban	I-80	13	19	267,000	382,108	Multiple Pollutants

Showing 1 to 5 of 79 entries

Near-Road Dashboard; Tabs



Near Road Dashboard

Near Road Network

Pollutant Summary

Near Road Increment Calculator

Trends

Network Completeness

CBSA

Site and Method Summary

Time Series Investigation

Summary Statistics

Pollution Roses

- Network level assessments
 - Network-wide quality indicators
 - Intra-site comparison
- Specific site-level assessments
 - Site-specific quality indicators and analysis tools
 - Site selection necessary for tabs to populate with data (except CBSA)
 - Site metadata, including instrumentation

Network-Wide Tabs; Near-Road Network

- Interactive map
- Shows all active and inactive sites
- Sites designated as “NO₂-only” and “Multiple Pollutants”
- Selection on map interacts with the site-specific tabs
 - Selected site metadata table appears on every site-specific tab
- Metadata table below map

Find information on the Near Road Network and the most recent Near Road site list [here](#)

Choose sites to display on map
 Active Sites Inactive Sites

Click a circle on the map to select a site

Download Table ▾ Search:

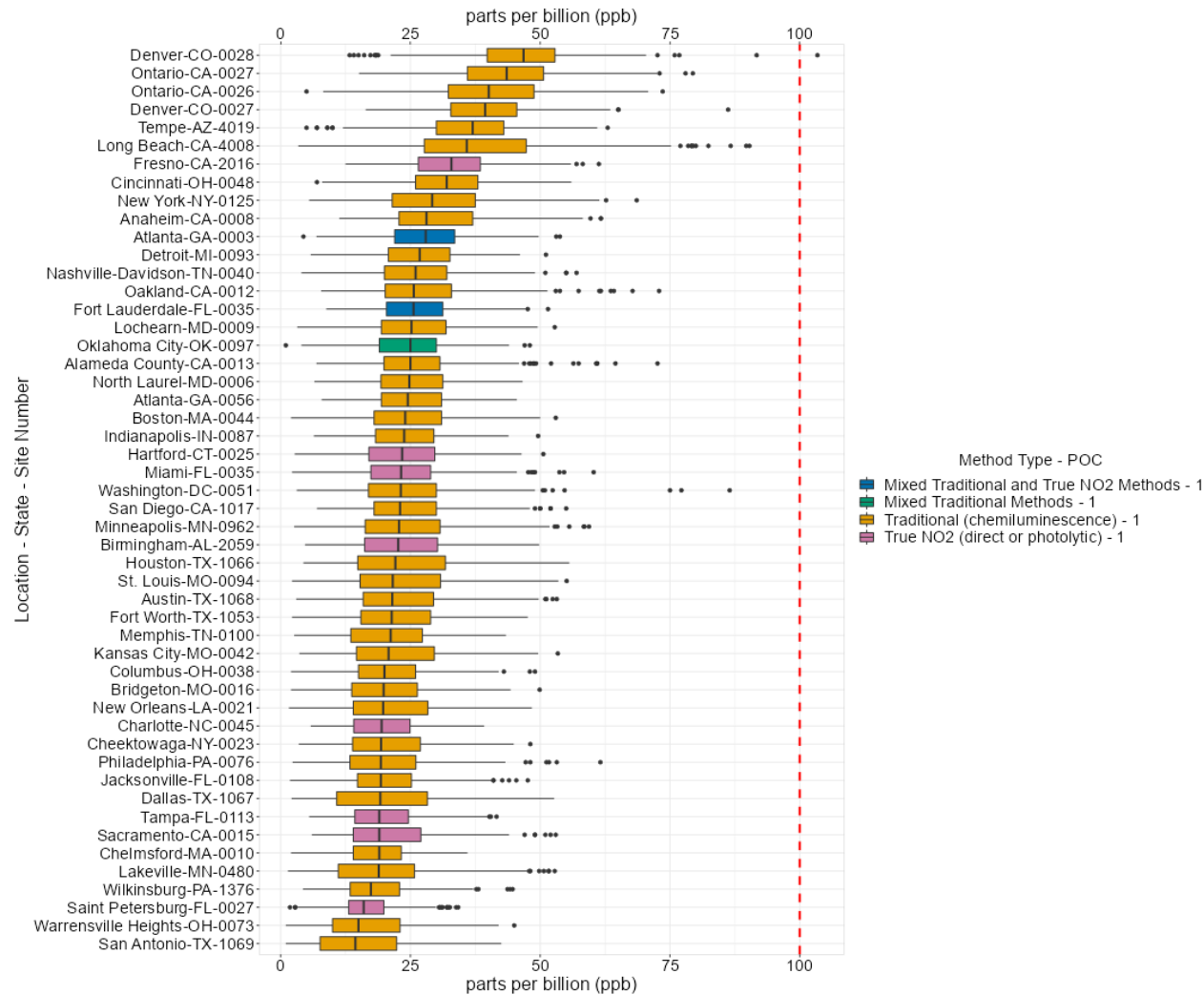
State	County	City	PQAO	Site Name	AQS Site Code	Latitude	Longitude	Setting	Target Road	Distance to Travel Feature (m)	Distance to Mainline (m)	AADT (2016)	FE AADT (2016)	Multiple Pollutants
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California	Alameda	Oakland	Bay Area Air Quality Management District	Laney College	060010012	37.793624	-122.263376	Urban	I-880	19	24	225,000	441,675	Multiple Pollutants
California	Alameda	Not in a City	Bay Area Air Quality Management District	Berkeley Aquatic Park	060010013	37.864767	-122.302741	Urban	I-80	13	19	267,000	382,108	Multiple Pollutants

Showing 1 to 5 of 77 entries

Previous **1** 2 3 4 5 ... 16 Next

Network-Wide Tabs; Pollutant Summary

- Customizable graphical display of NO₂, CO, and PM_{2.5} annual and sub-annual data
- Selectable year, sample duration, and site(s)
- Turn on/off outliers and NAAQS threshold
- Arrange by concentration or alphabetical order of state
- Sample duration methodology dropdown
- Metadata table below figure



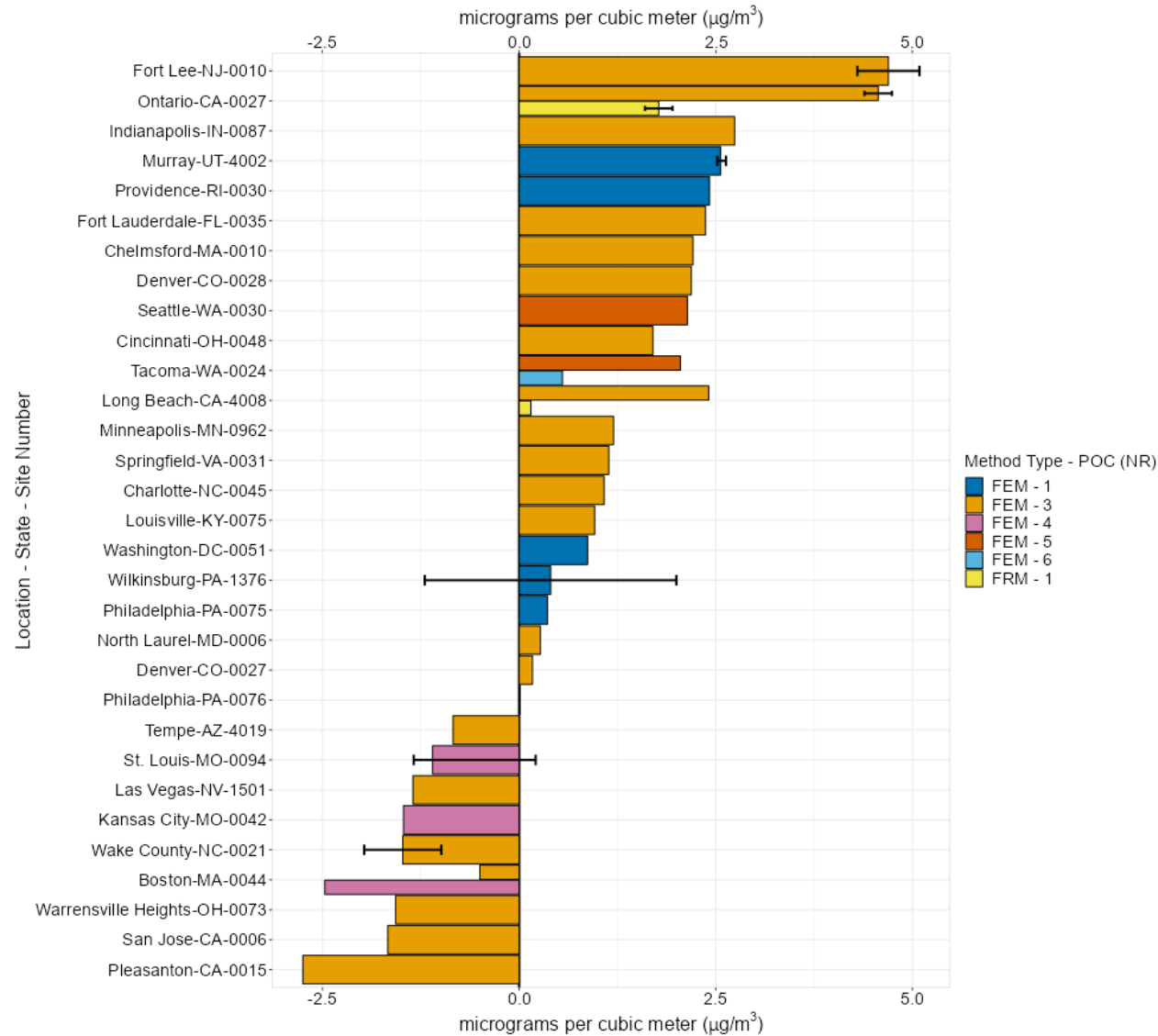
Network-Wide Tabs; Pollutant Summary

No annual completeness requirements for display.

Pollutant	Sample Durations
NO ₂	1 hour, daily 1 hour max, annual mean of 1 hour
CO	1 hour, 8-hour average, second highest mean of 8-hour average, second highest mean of 1 hour
PM _{2.5}	1 hour, 24-hour, annual mean of 24 hour

Network-Wide Tabs; Increment Calculator

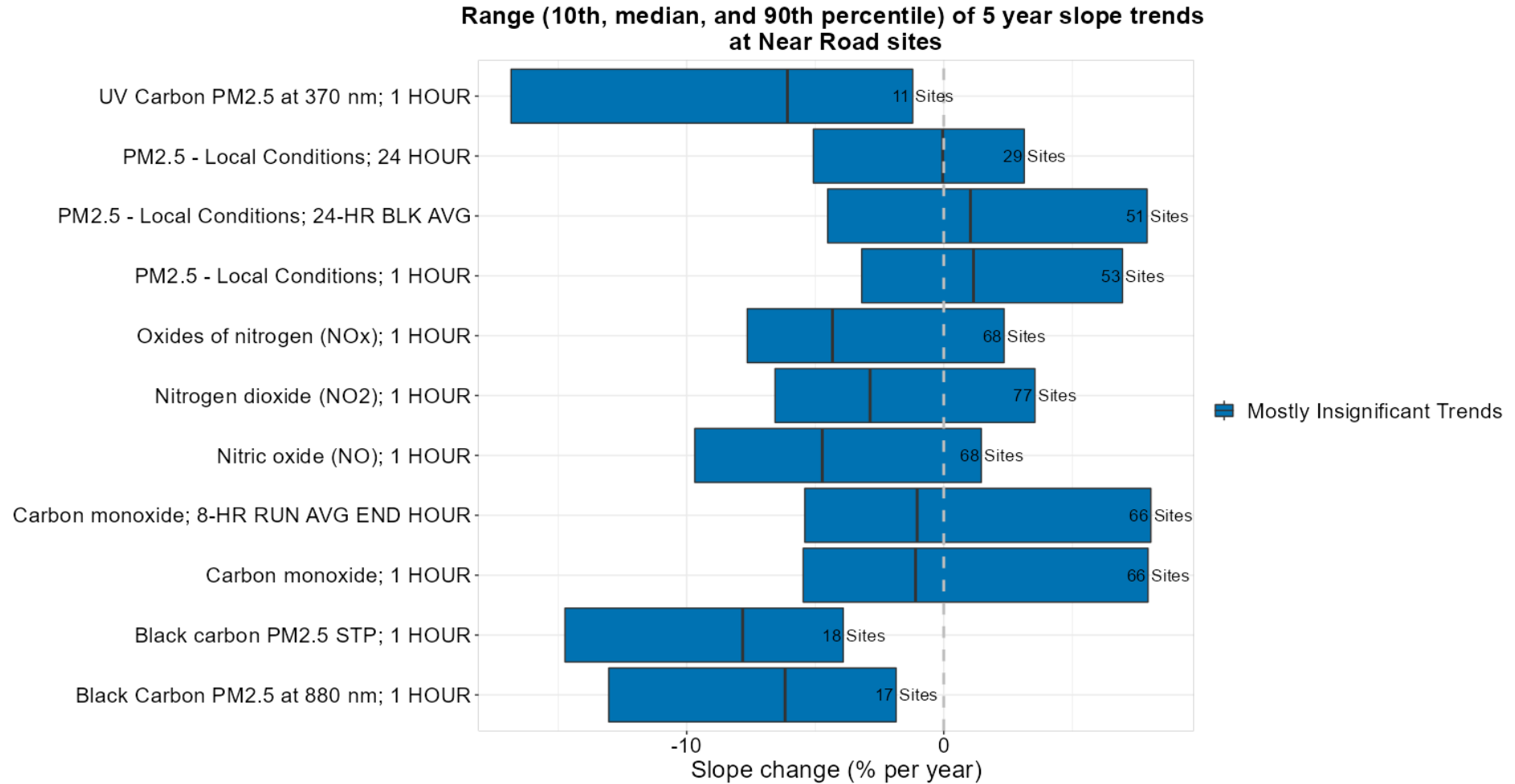
- Customizable graphical display of NO₂, CO, and PM_{2.5} annual and sub-annual increments
- Selectable year, increment duration, and site(s)
- Increment calculation method
- Sorting options
- Matching/non-matching methods
- Increment completeness and duration methodology dropdown
- Metadata table below figure



Network-Wide Tabs; Trends

- Annual trends for NR monitoring pollutants
- Boxplot (top): distribution of slopes across the NR network over the past 5 years
 - Left end: 10th percentile slope
 - Right end: 90th percentile slope
 - Color coded: f-test values of individual trends statistically significant at the 95% confidence level at more than 50% of available trends
- Line plot (bottom): annual percent change in concentration

Network-Wide Tabs; Trends



Network-Wide Tabs; Network Completeness

- Percent annual completeness of pollutant parameters by site and year
- Only sites with the selected parameter(s) will display
- Rank-ordered based on annual completeness of the selected parameter(s)
 - Rank order is recalculated after a parameter has been added/taken away
- Selectable figure; click, drag, and select to highlight sites to see metadata displayed in a table below

Select a complete year

2017

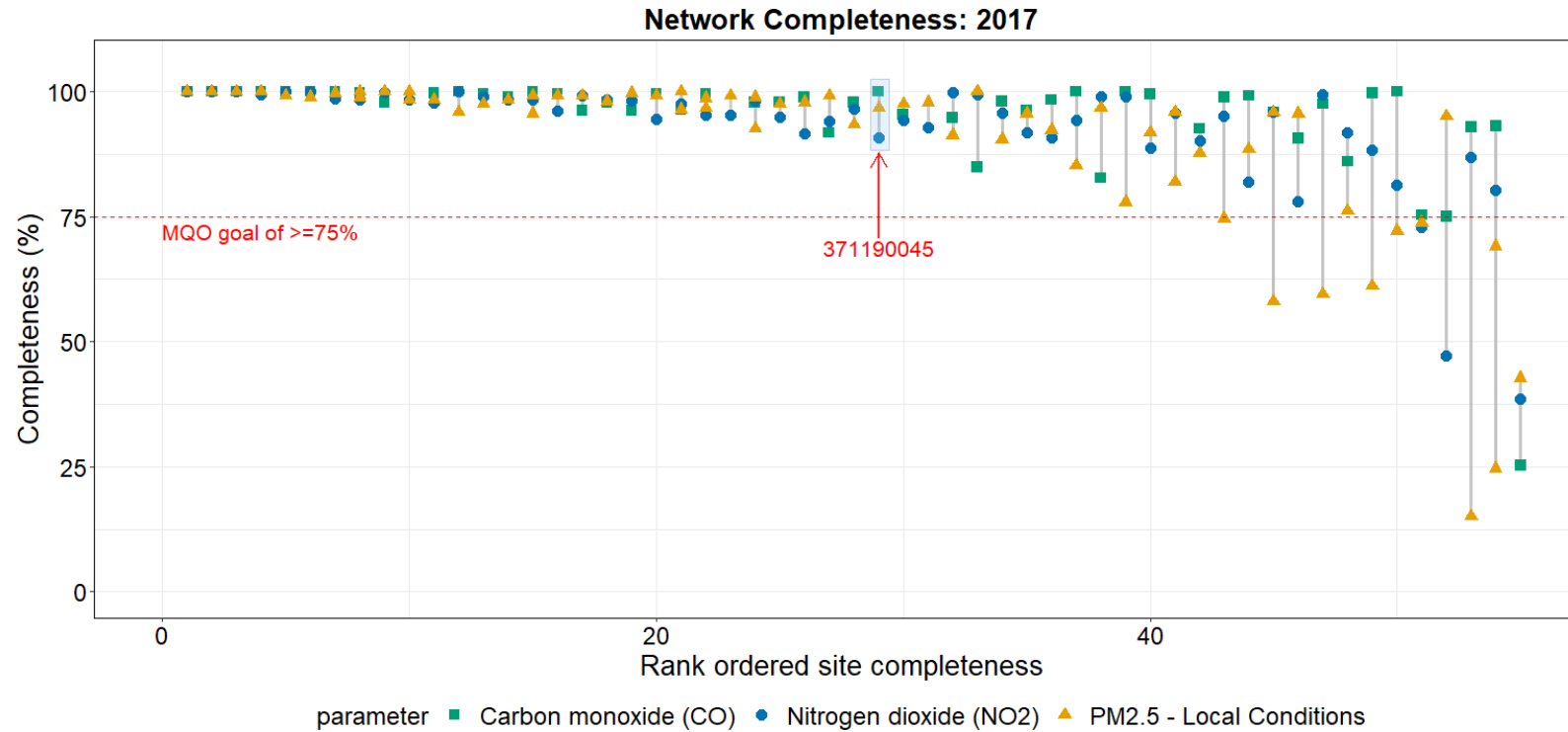
Select parameter(s)

Nitrogen dioxide (NO2)

Carbon monoxide (CO)

PM2.5 - Local Conditions

Drag and double-click to display details below plot. Double-click to reset.



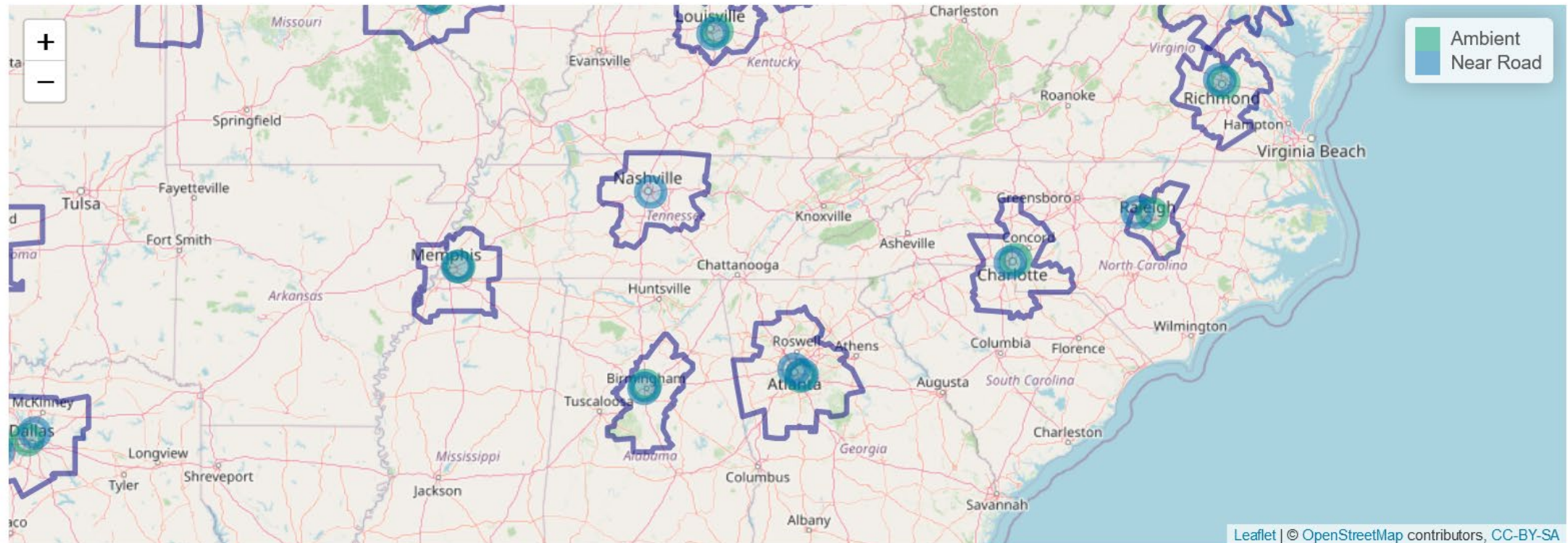
Site Rank	Site Code	Year	Parameter	POC	Method	Duration	% Annual Complete (Parameter)	% Annual Complete (Site)
29	371190045	2017	Carbon monoxide (CO)	1	INSTRUMENTAL - Gas Filter Correlation Thermo Electron 48i-TLE	1 HOUR	100.00	95.80
29	371190045	2017	Nitrogen dioxide (NO2)	1	Teledyne-API Model 200EUP or T200UP - Photolytic-Chemiluminescence	1 HOUR	90.68	95.80
29	371190045	2017	PM2.5 - Local Conditions	1	R & P Model 2025 PM-2.5 Sequential Air Sampler w/VSCC - Gravimetric	24 HOUR	96.72	95.80

Site-Specific Tabs; CBSA

- Combines elements of the Pollutant Summary and Increment Calculator tabs
- Selectable year, pollutant, and EPA region
- CBSA and selected site metadata tables
- Standalone map of NR, paired ambient sites, and CBSA boundaries
- Pollutant summary data grouped by CBSA and color-coded by EPA region
- Increment metadata table

Site-Specific Tabs; CBSA

Near Road and Paired Ambient Sites



Site-Specific Tabs; CBSA

Selected Site:

AQS Site Code	Site Designation	Site Name	City	State	CBSA
360550015	Near Road	Rochester Near-Road	Rochester	New York	Rochester, NY

Select a Year

2016 ▼

Select a Pollutant

Nitrogen dioxide (NO2) ▼

Choose EPA region(s) to display in Figure

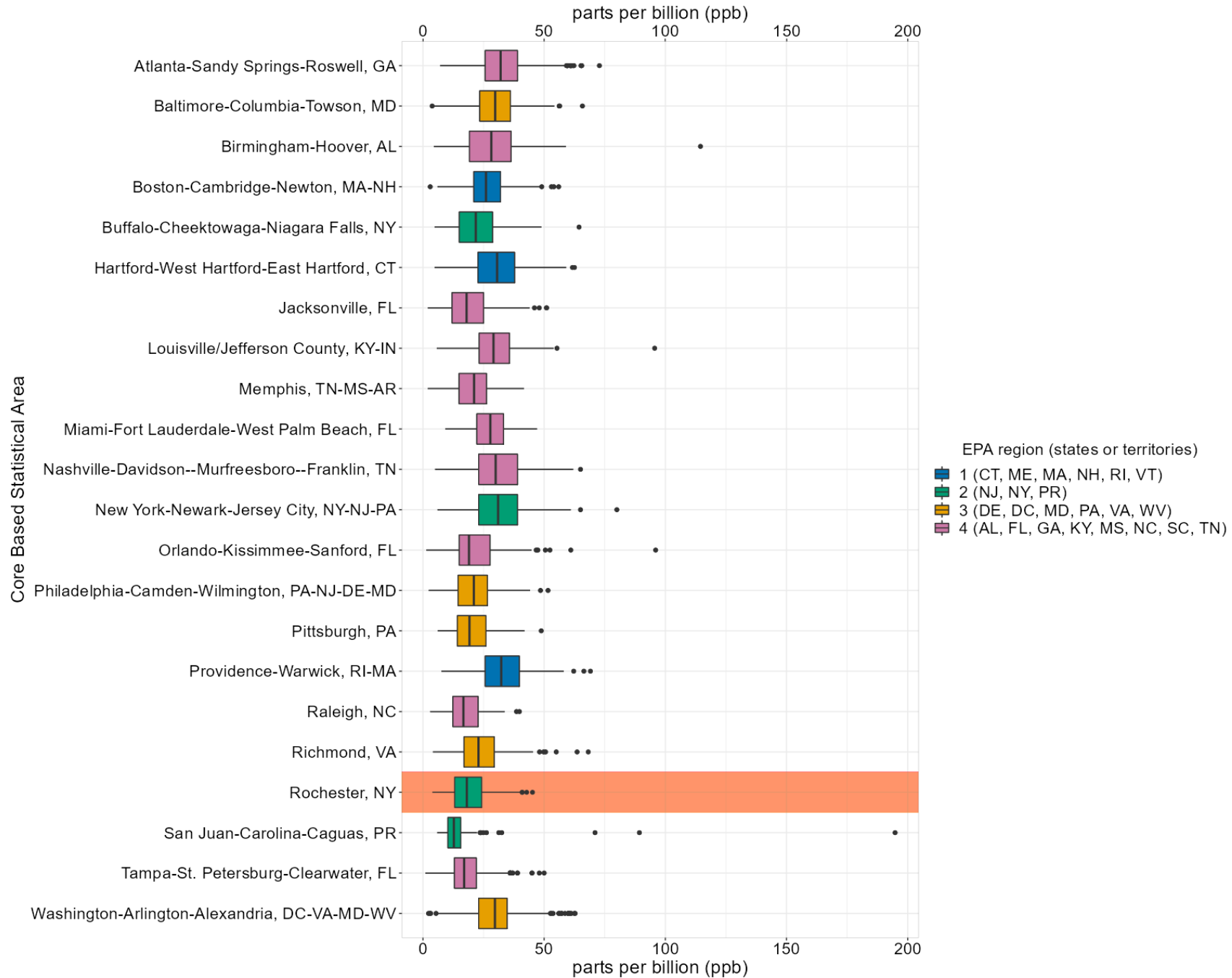
1 (CT, ME, MA, NH, RI, VT), 2 (NJ, NY, PF) ▼

Update Plot and Tables

Download Table ▼

CBSA	# of NR sites	EPA region	State(s)	# of NR sites measuring NO2	# of NR sites measuring 1-hour PM2.5	# of NR sites measuring 24-hour PM2.5	# of NR sites measuring CO
Rochester, NY	1	2 (NJ, NY, PR)	New York	1	0	1	1

1-hour daily max NO₂ Pollutant Summaries of Near Road sites



Site-Specific Tabs; Site and Method Summary

- Annually selectable set of quality indicators per parameter
- Monitor-specific information (e.g., POC, sample duration, units)
- Color-coded table based on group:
 - Required/optional gases: gas-phase measurements
 - Required/optional PM: particle-phase measurements
 - Required/optional meteorology: meteorological measurements
 - Additional supporting: optional measurements
 - Other meteorology: optional meteorological measurements

Selected Site:

AQS Site Code	Site Name	PQAO	City	State	CBSA
480291069	San Antonio Interstate 35	Texas Commission On Environmental Quality	San Antonio	Texas	San Antonio-New Braunfels, TX

Select a Year

2016 ▼

Select Group(s)

Required Gasses, Required PM, Other I ▼

Update Table

Download Table ▼

Search:

Site: 480291069

Parameter	Parameter Code	POC	Method Code	Method	Method Type	Units	Count Valid	Count > MDL	Avg. MDL	Group
Carbon monoxide	42101	1	093	INSTRUMENTAL - GAS FILTER CORRELATION CO ANALYZER	FRM	Parts per million	239	22	0.5	Required Gasses
Nitrogen dioxide (NO2)	42602	1	099	INSTRUMENTAL - GAS PHASE CHEMILUMINESCENCE	FRM	Parts per billion	7964	4888	2.7	Required Gasses
Nitric oxide (NO)	42601	1	099	INSTRUMENTAL - GAS PHASE CHEMILUMINESCENCE	FRM	Parts per billion	8066	2755	5	Required Gasses
Oxides of nitrogen (NOx)	42603	1	099	INSTRUMENTAL - GAS PHASE CHEMILUMINESCENCE	FRM	Parts per billion	8008	4273	5	Required Gasses
PM2.5 - Local Conditions	88101									Required PM
Wind Direction - Resultant	61104	1	020	INSTRUMENTAL - VECTOR SUMMATION		Degrees Compass	8447	8434	0.1	Meteorology
Wind Speed - Resultant	61103	1	020	INSTRUMENTAL - VECTOR SUMMATION		Knots	8447	8438	0.1	Meteorology
Outdoor Temperature	62101	1	040	INSTRUMENTAL - ELECTRONIC OR MACHINE AVG.		Degrees Fahrenheit	8766	8766	-60	Other Meteorology
Wind Speed - Scalar	61101	1	050	INSTRUMENTAL - ELECTRONIC OR MACHINE AVG.		Knots	8447	8406	0.6	Other Meteorology

Site-Specific Tabs; Summary Statistics

- Similar layout to Site and Method Summary tab
- Provides summary values (i.e., minimum, mean, median, maximum) for each parameter
- Additional indicators: count of valid reported samples, count of samples above the method detection limit (MDL), and percentage of samples above the MDL

Site-Specific Tabs; Time Series Investigation

- Compare two parameters, one hourly and the other hourly or daily, in a time series graph (top), pollution rose (middle), and scatter plot (bottom)
- A standalone map below the scatter plot displays the urban scale NR site
- Interactive time series graph, pollution rose, and scatter plot
 - User can zoom in to a pollutant spike, and the pollution rose and scatter plot will update accordingly
- Pollution rose will only display if there is wind speed/direction at the NR site

Site-Specific Tabs; Time Series Investigation

Select an hourly parameter

Nitric oxide (NO) ▼

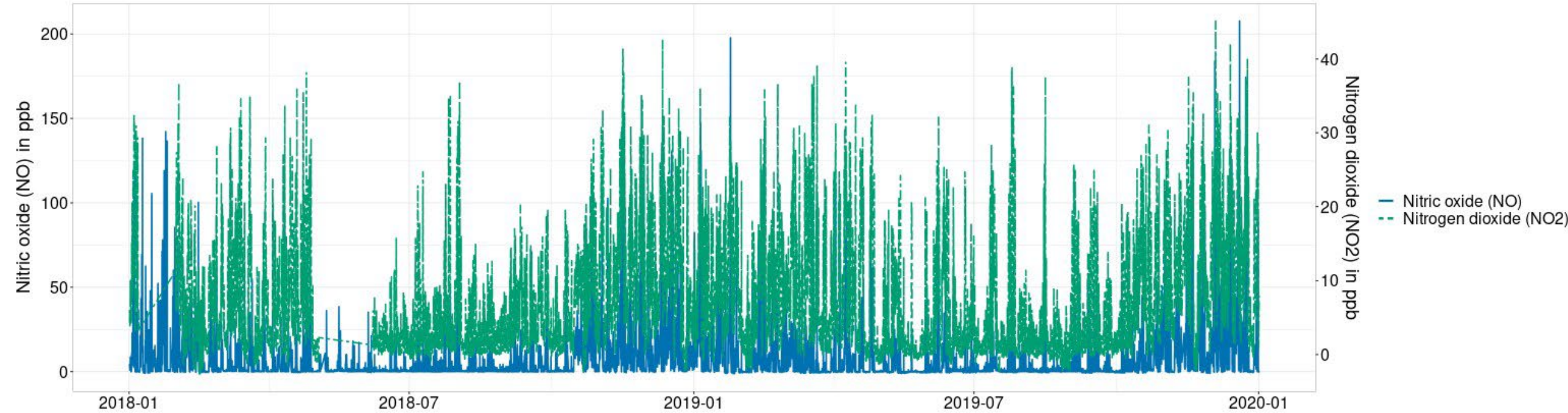
Select a second parameter

- Show 1-Hr Parameters
- Show 24-Hr Parameters
- None

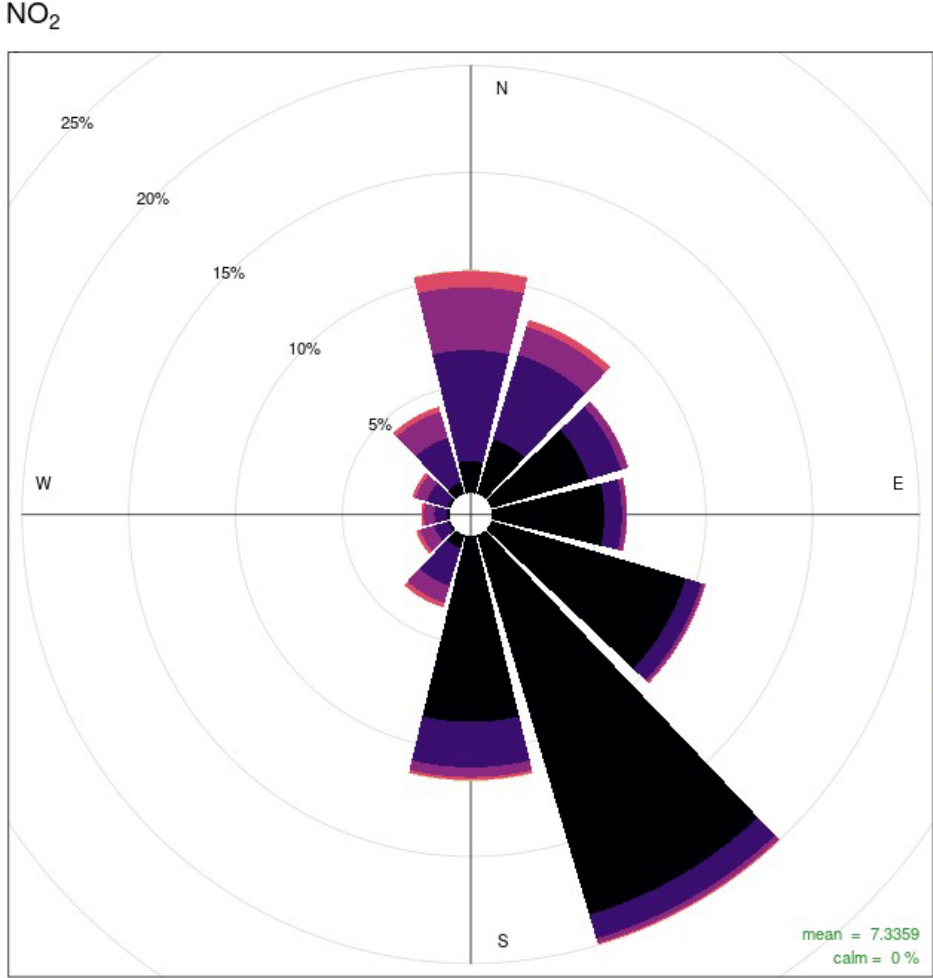
Nitrogen dioxide (NO2) ▼

Update Plots

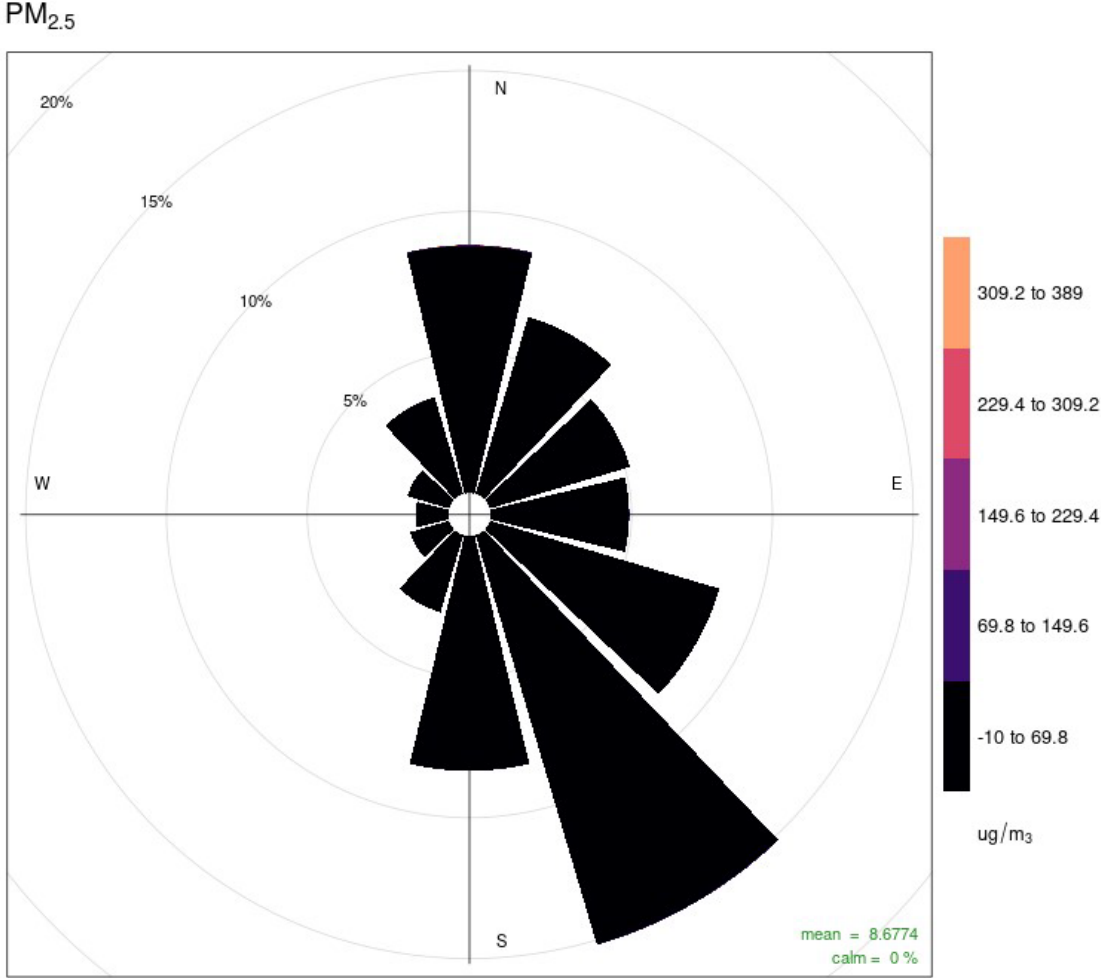
Drag across plot area and double-click to zoom. Double-click again to reset.



Site-Specific Tabs; Time Series Investigation

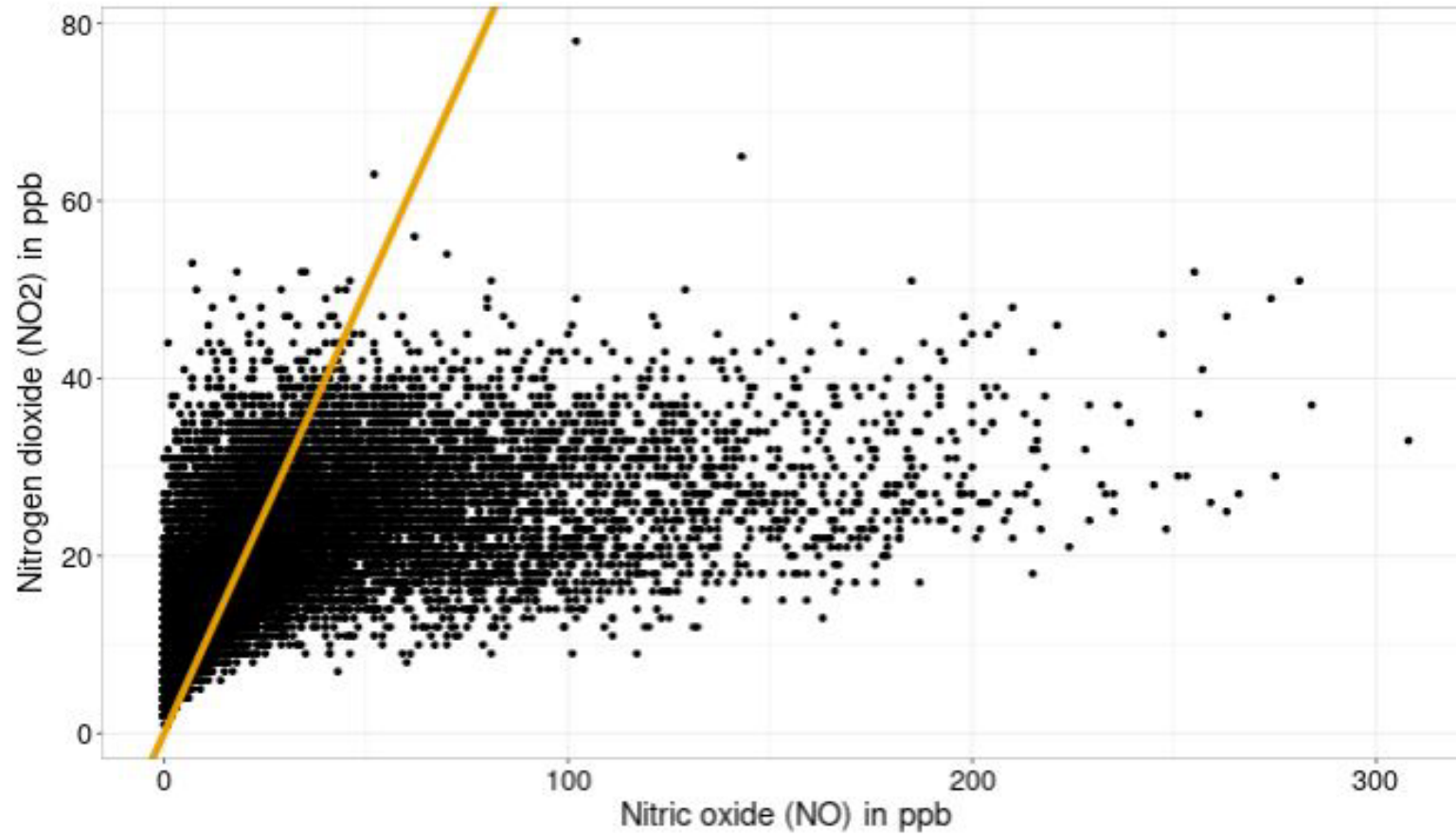


Frequency of counts by wind direction (%)



Frequency of counts by wind direction (%)

Site-Specific Tabs; Time Series Investigation



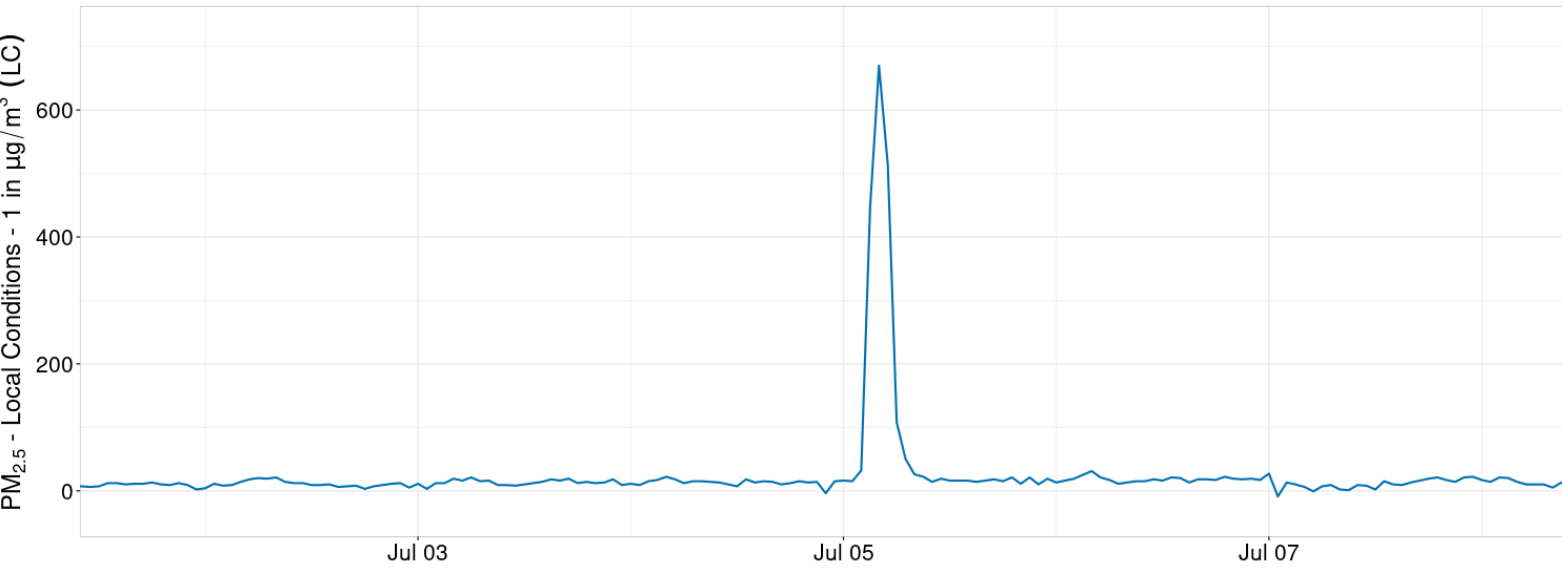
Toggle Reference Lines:

Note: one-to-one line may be outside plot limits.

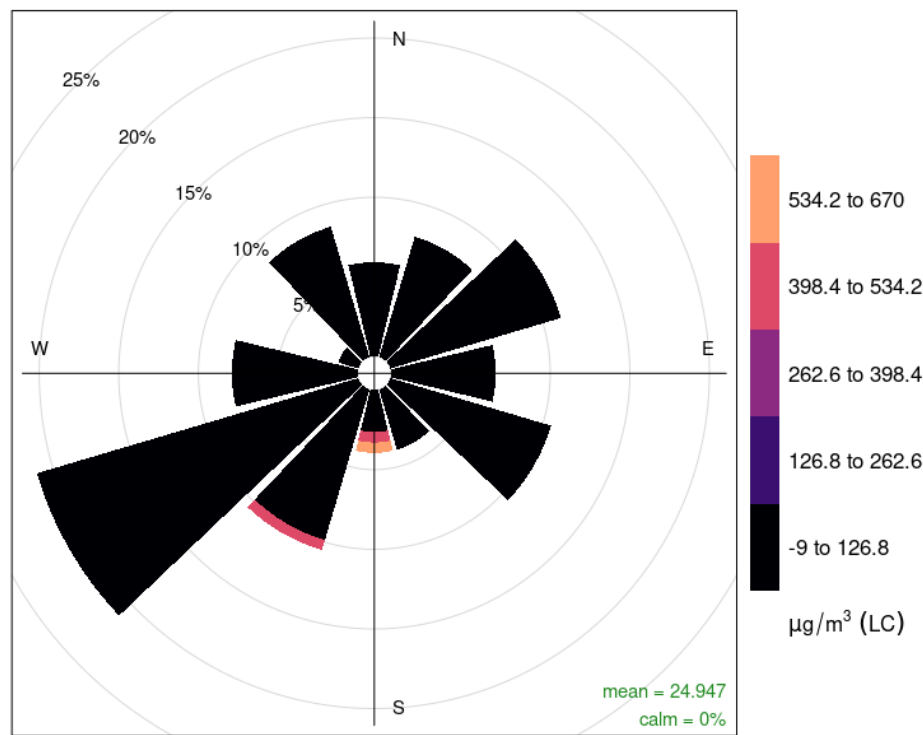
One-to-one

Linear Regression

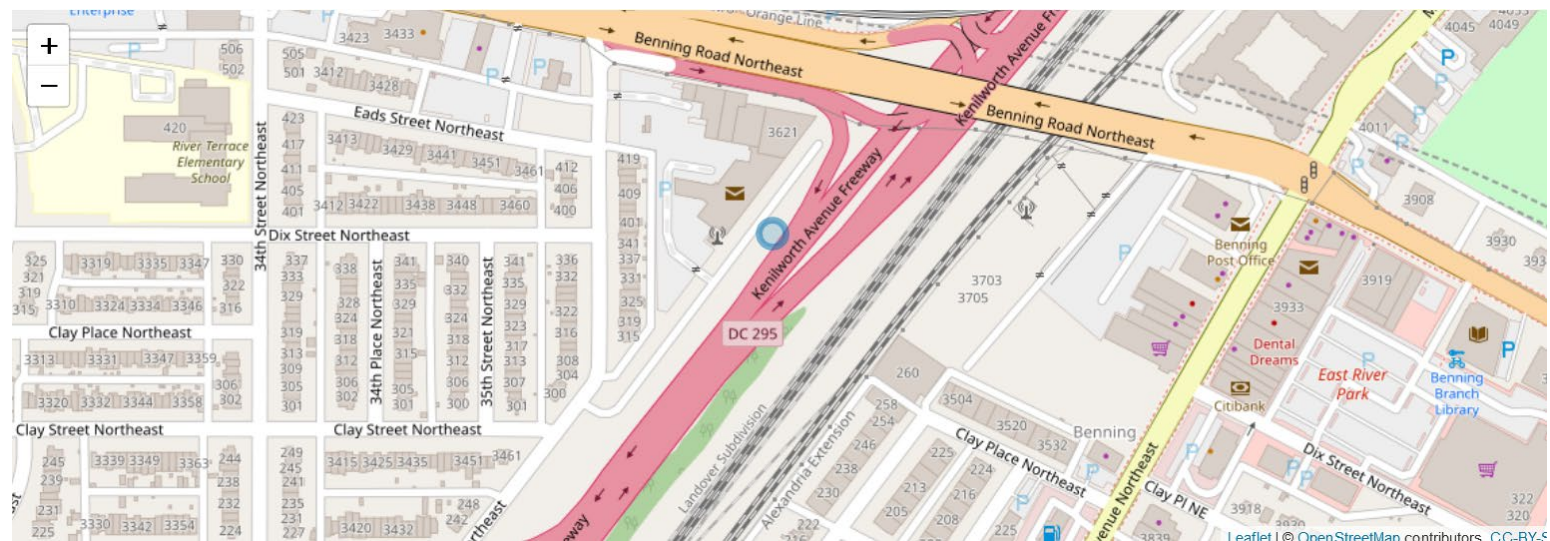
Site-Specific Tabs; Time Series Investigation



PM_{2.5} - Local Conditions - 1



Frequency of counts by wind direction (%)



Site-Specific Tabs; Pollution Rose

- Pollution roses for NO₂ and PM_{2.5}
- A standalone map below the scatter plot displays the urban scale NR site
- Selectable year and season:
 - Spring: March, April, and May
 - Summer: June, July, and August
 - Fall: September, October, and November
 - Winter: December, January, February

Near-Road Dashboard Summary

The Near-Road Dashboard:

- Compiles a large quantity of data from all Near-Road sites
- Displays data through various forms of visualization
- Allows for site-to-site comparison
- Is highly interactive and easily accessible



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From EPA: Tim Hanley, and Neelson Watkins; Legacy Team: Mike McCarthy

Questions?

Explore the **Near Road Dashboard** live at the Sonoma Technology booth!

Also check out the suite of dashboards available:

- *PAMS Dashboard*
- *NCore Dashboard*
- *FRM-FEM Comparability Dashboard*
- *Ozone, CO, NO, NO₂, NO_y, SO₂, and FRM Dashboards*