Air Sensor Dataset

How an AQ Agency and Community Groups can use over 4,700 Air Sensors in the San Francisco Bay

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1. TD Environmental Services, LLC
2. Bay Area Air Quality Management District

TDEnviro

Bay Air Center

- TD Enviro works with SLTs and Community groups
- Working with Bay Area communities through Bay Air Center
  - Bay Area Air Quality Management District (BAAQMD)
  - AQ Technical guidance, materials, and training resource
- Large network of air sensors in area already exists
  - PurpleAir, Clarity, Aeroqual
- Assemble and QC data for use by community groups, the air district, and others

BAY AIR CENTER

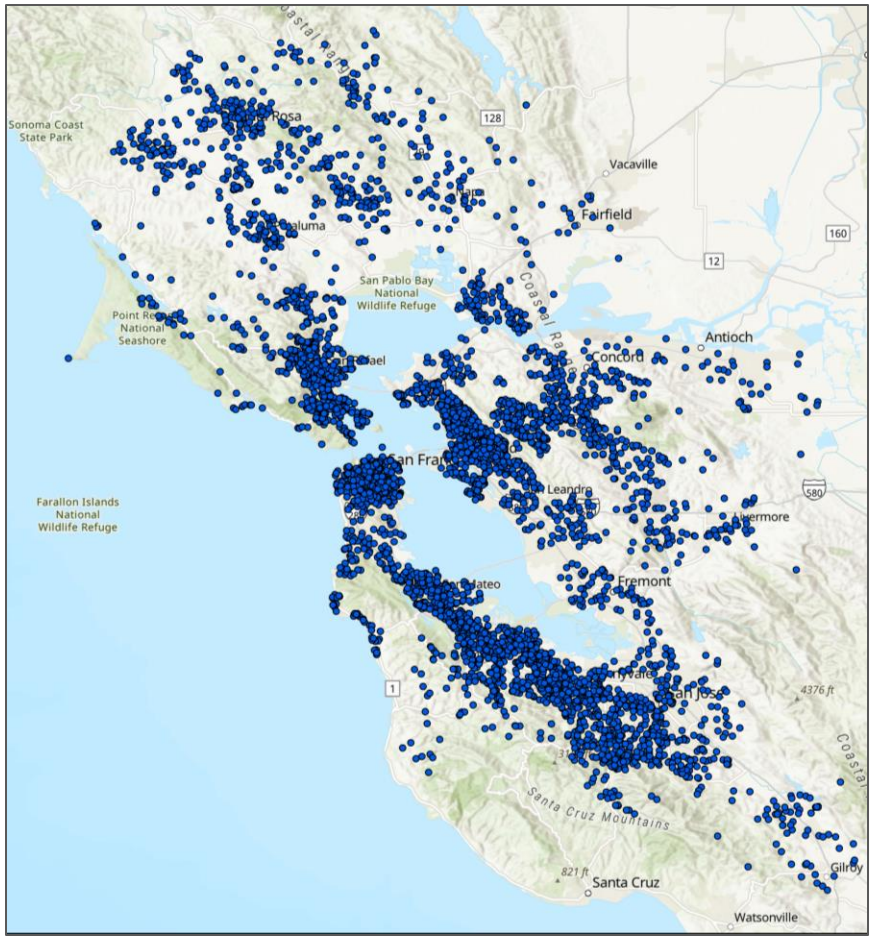
Working Together for Clean Air

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

What is the Air Sensor Dataset?

An extensive resource for local air sensor data

- Quality-controlled fine particulate matter ($PM_{2.5}$) PurpleAir data spanning nine counties of the San Francisco-Oakland-San Jose areas
- Hourly and daily averaged data
- Across over 4,700 sites
- From 2018 to 2023
- Includes metadata (site name, location, etc.)
- Potential to grow across other pollutants and devices

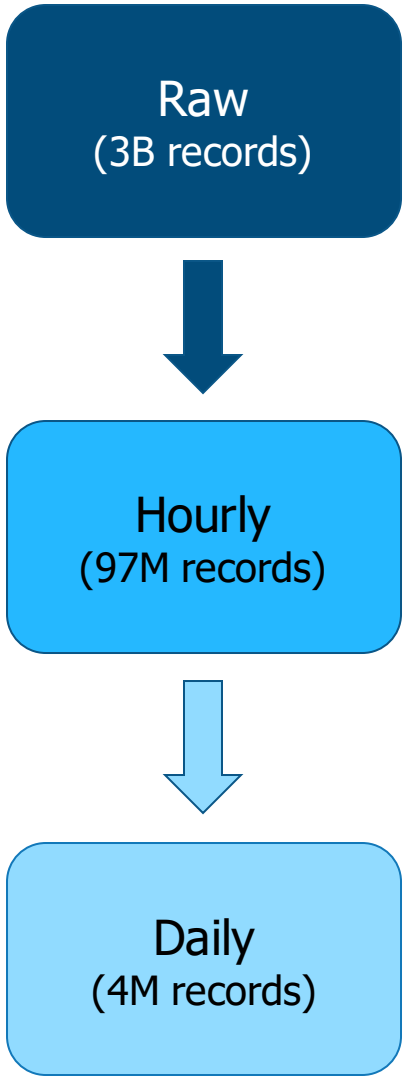


Air Sensor Dataset coverage in 2023
(16 $PM_{2.5}$ regulatory monitors in area)

Data Wrangling and Quality Control

Applied established QC protocols and novel checks

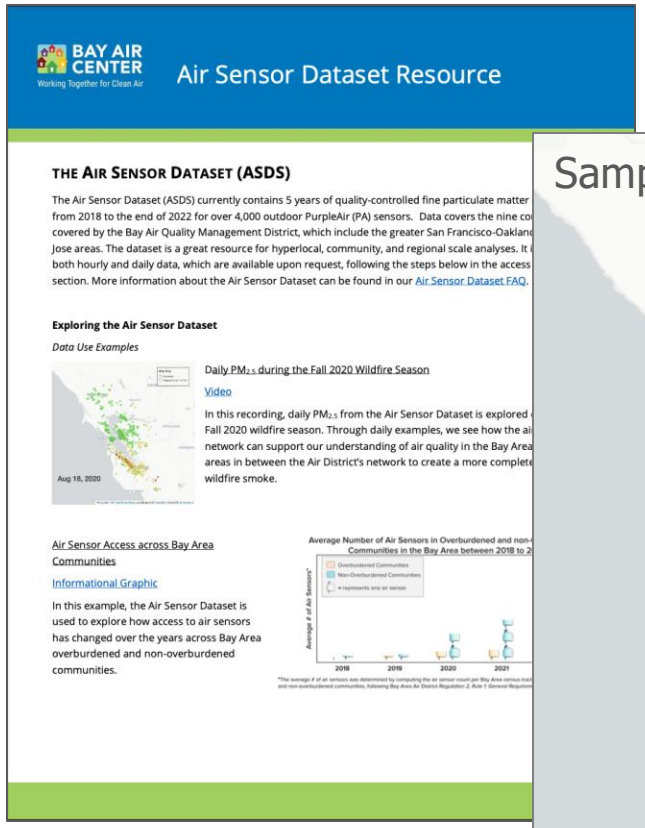
- **Leveraged methods from**
  - PA degradation paper (deSouza, Barkjohn, 2022)
  - AirNow Fire and Smoke Map
  - AirNow QC
  - EPA CFR completeness criteria
  - Applied PA wildfire smoke correction (Barkjohn, et al. 2021)
- **Designed protocols to meet large dataset needs**
  - Removed first 24 hours of data from each site (Early data showed anomalous $PM_{2.5}$ spikes)
  - Removed high likelihood indoor sites based on $PM_{2.5}$ and temp trends
  - Identified imposter PAs (lower detection limit) in metadata
- **Still more QC to do!**



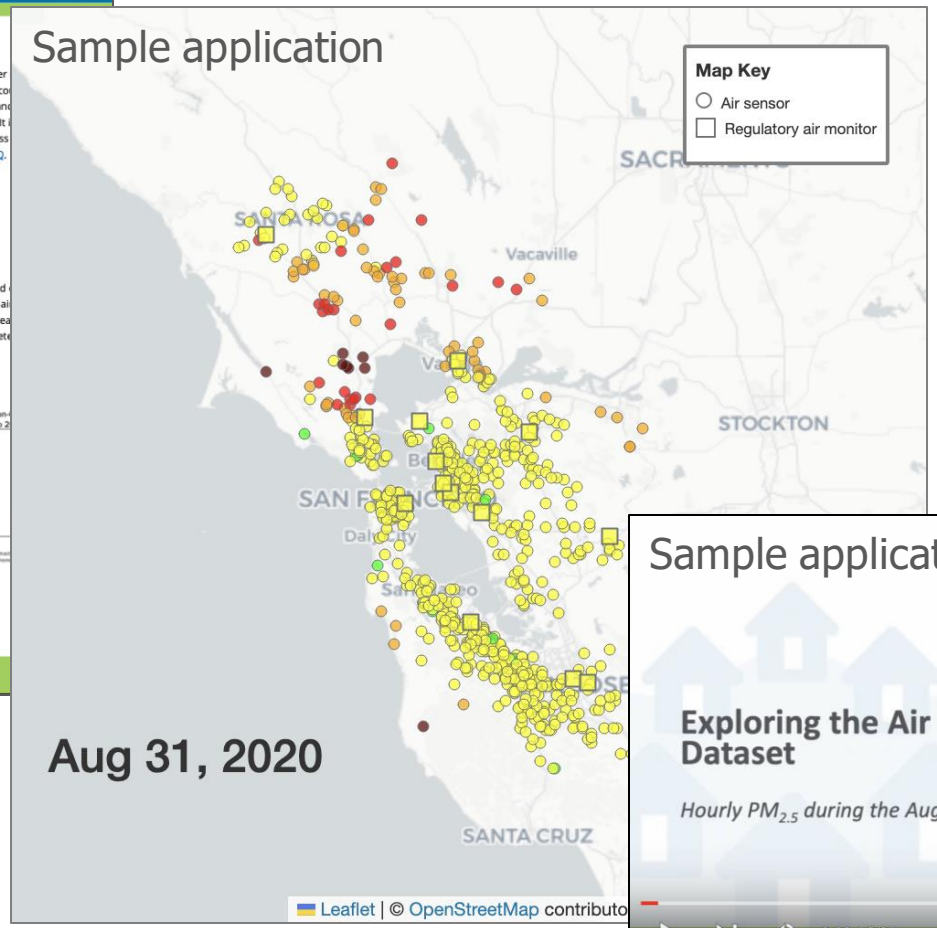
TDEnviro

Six Applications

1) Making data available to community groups



Publicizing data and increasing data availability

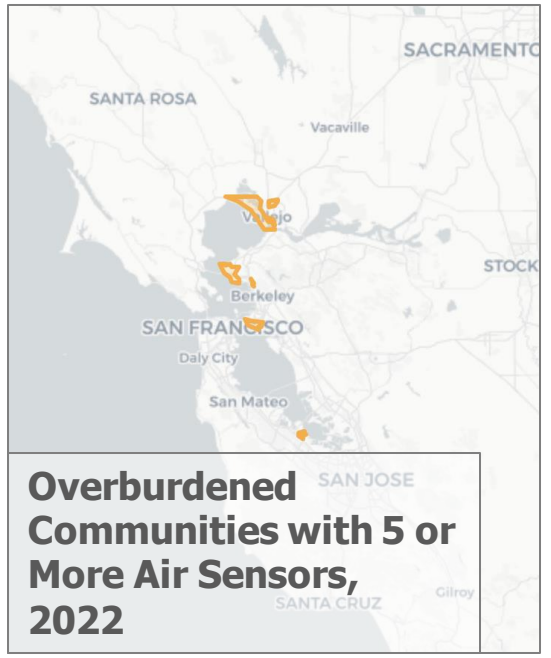


Creating illustrative examples of how the air sensor network can support our understanding of air quality in the Bay Area

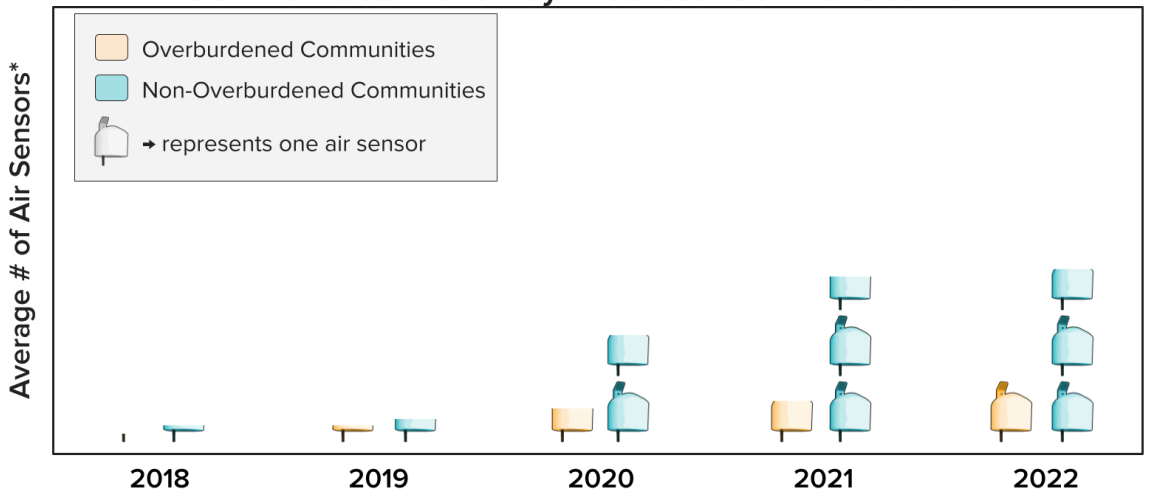
2) Evaluating the Distribution of Sensors across Communities

How has access to air sensors changed over the years across overburdened and non-overburdened Bay Area communities?

- Overall increase of sensors from 2018 to 2022, but fewer air sensors on average in overburdened communities
- Only 4% of overburdened communities had five or more air sensors in 2022, compared to 19% for non-overburdened communities

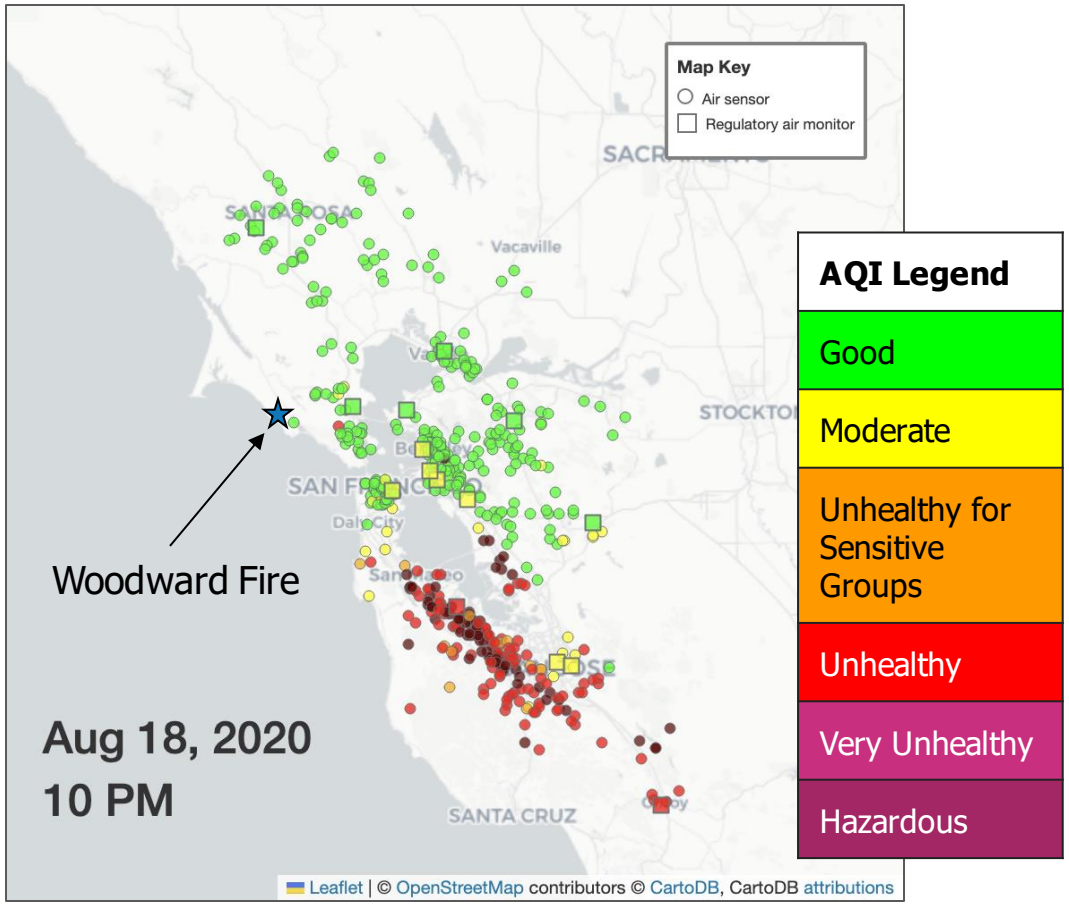


Average Number of Air Sensors in Overburdened and non-Overburdened Communities in the Bay Area between 2018 to 2022



3) Support for Technical Analyses

- Can provide spatially resolved data for wildfire exceptional events demonstrations
- Identify gaps PM monitoring for network assessment and planning
- Can inform conceptual model of PM → how does PM change spatially and temporally throughout the Bay Area
- Highlights inequities in PM exposure over annual averaging times and/or specific short-duration episodes

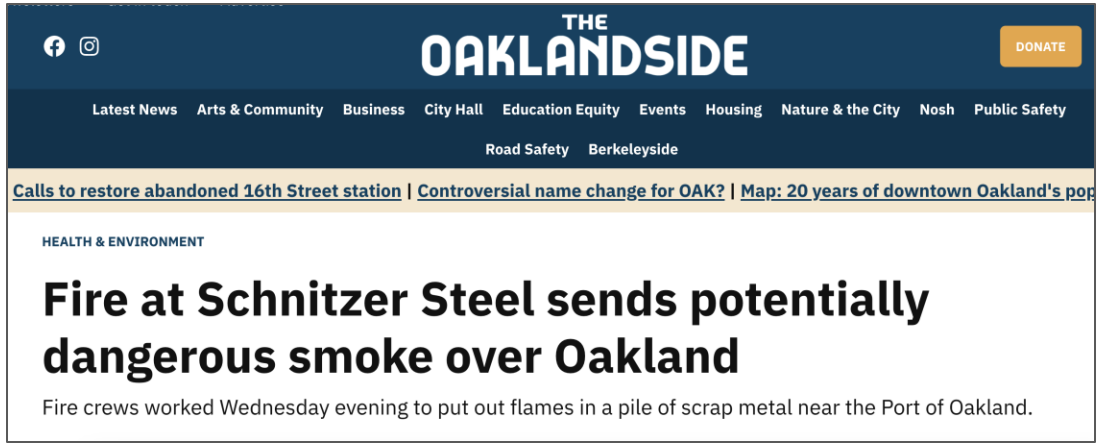


4) Characterize impacts from facility incidents

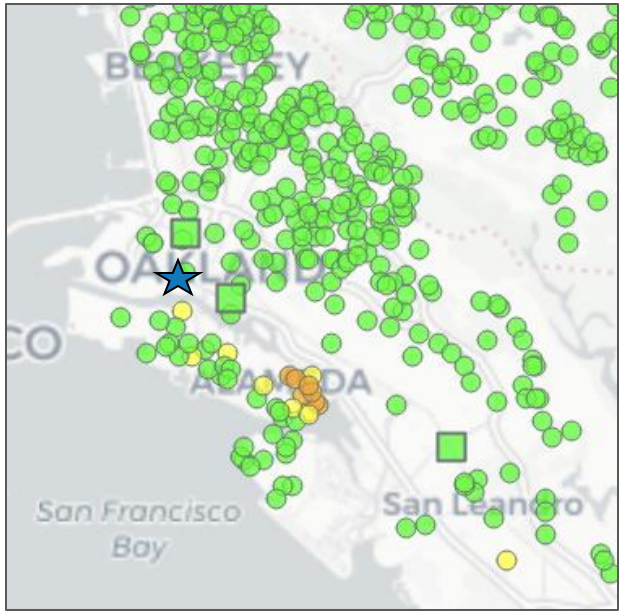
Visualize spatial patterns of PM during these events

- Air Sensor Dataset can show extent and boundary of smoke plumes, helping inform who was impacted
- *Example:* Schnitzer Fire, Aug 9 2023
  - Scrap metal fire at Schnitzer Steel Facility
  - Air quality advisory issued by BAAQMD

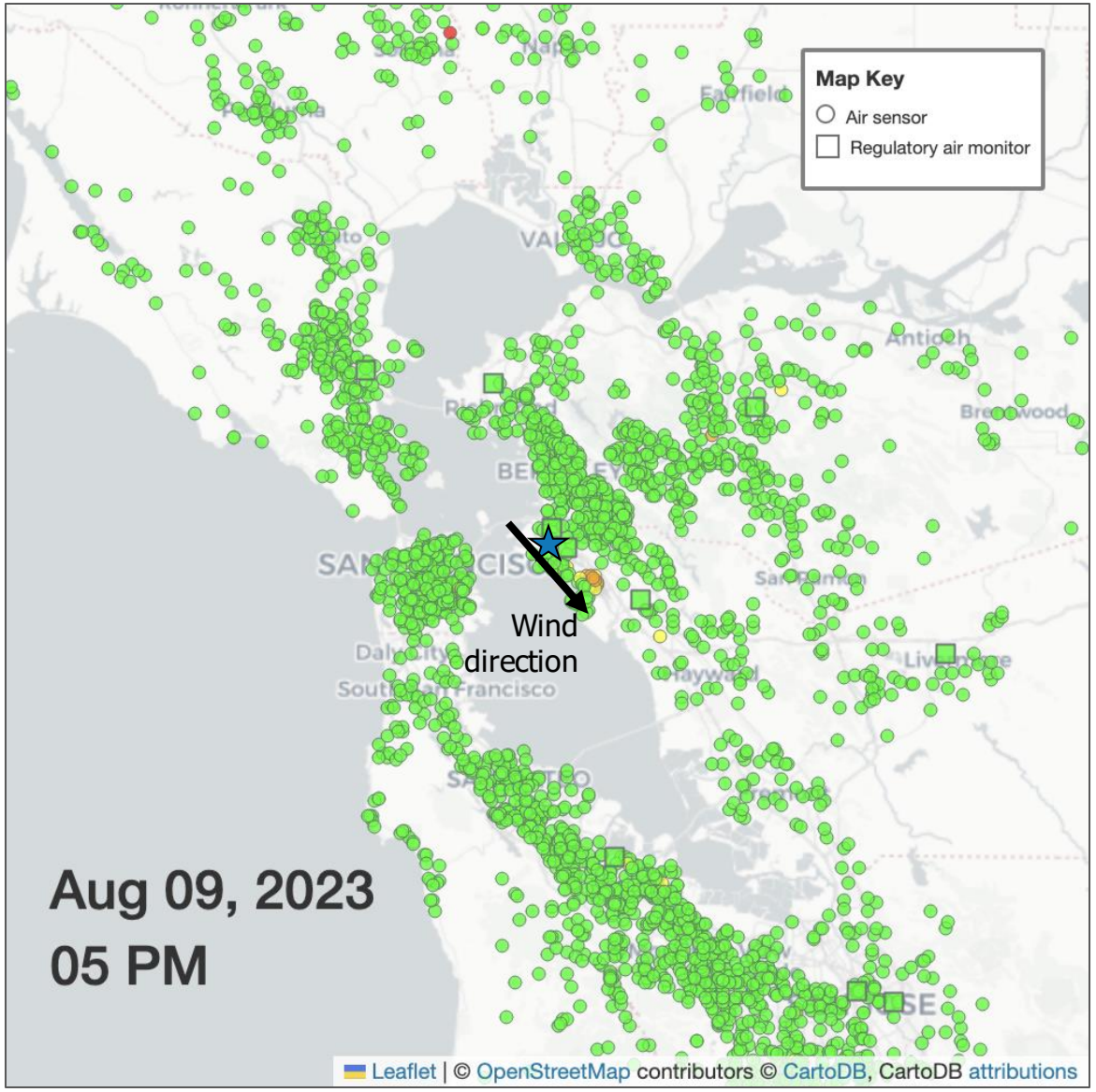
Source: ABC7 News



Source: The Oaklandside

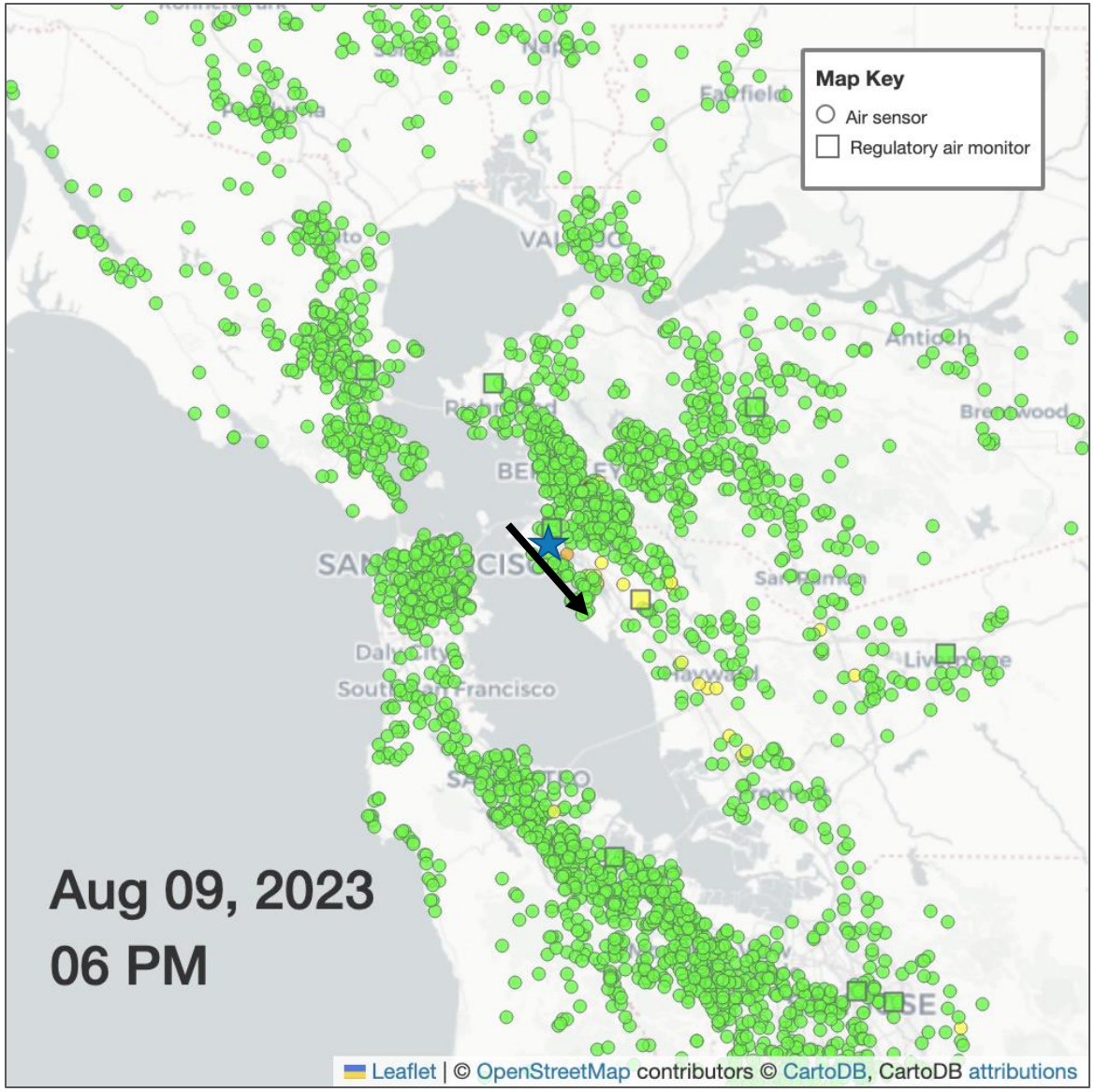


Zoomed in map on Schnitzer Steel Facility



Hourly NowCast AQI

Good
Moderate
Unhealthy for Sensitive Groups
Unhealthy
Very Unhealthy
Hazardous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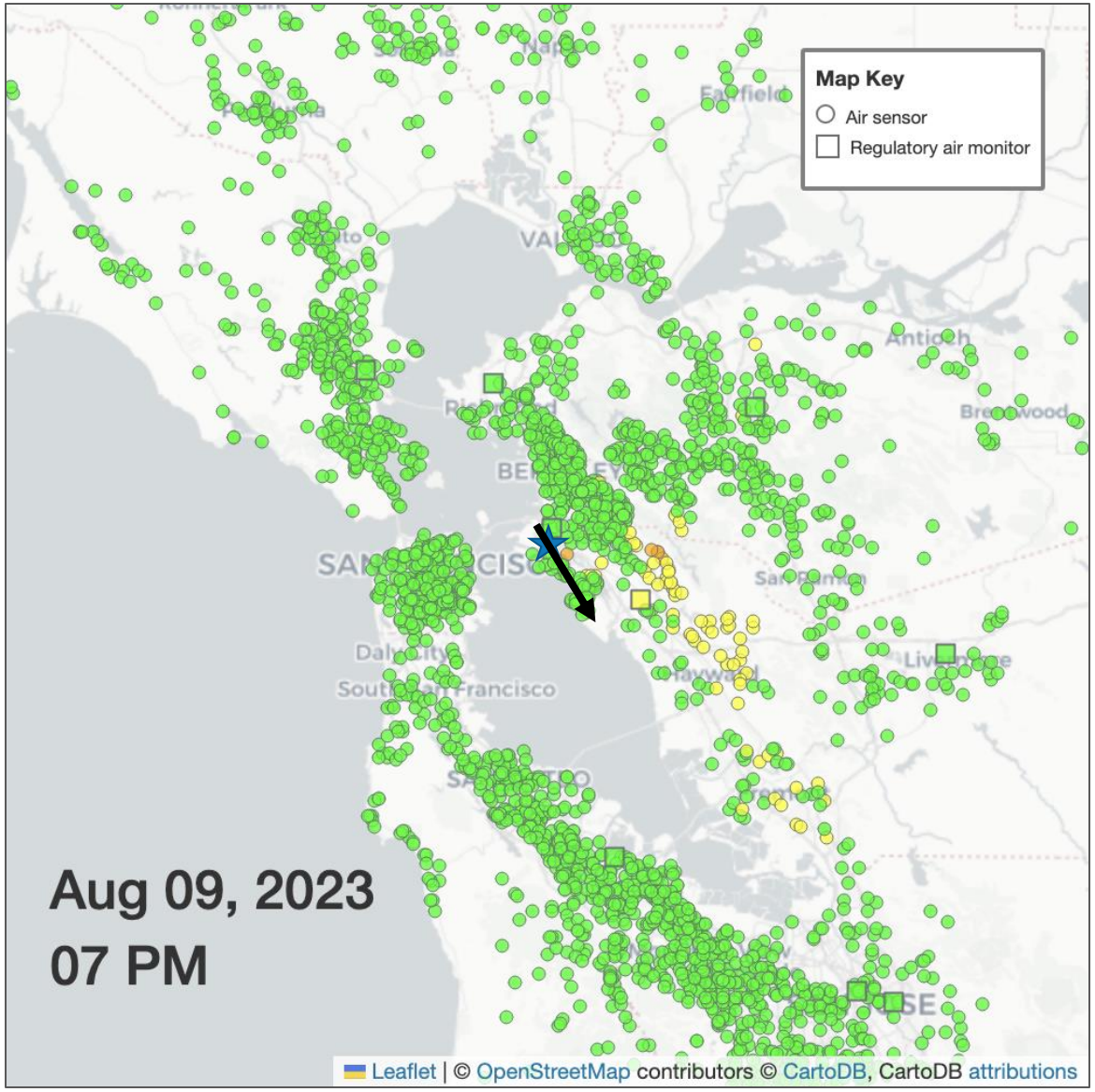
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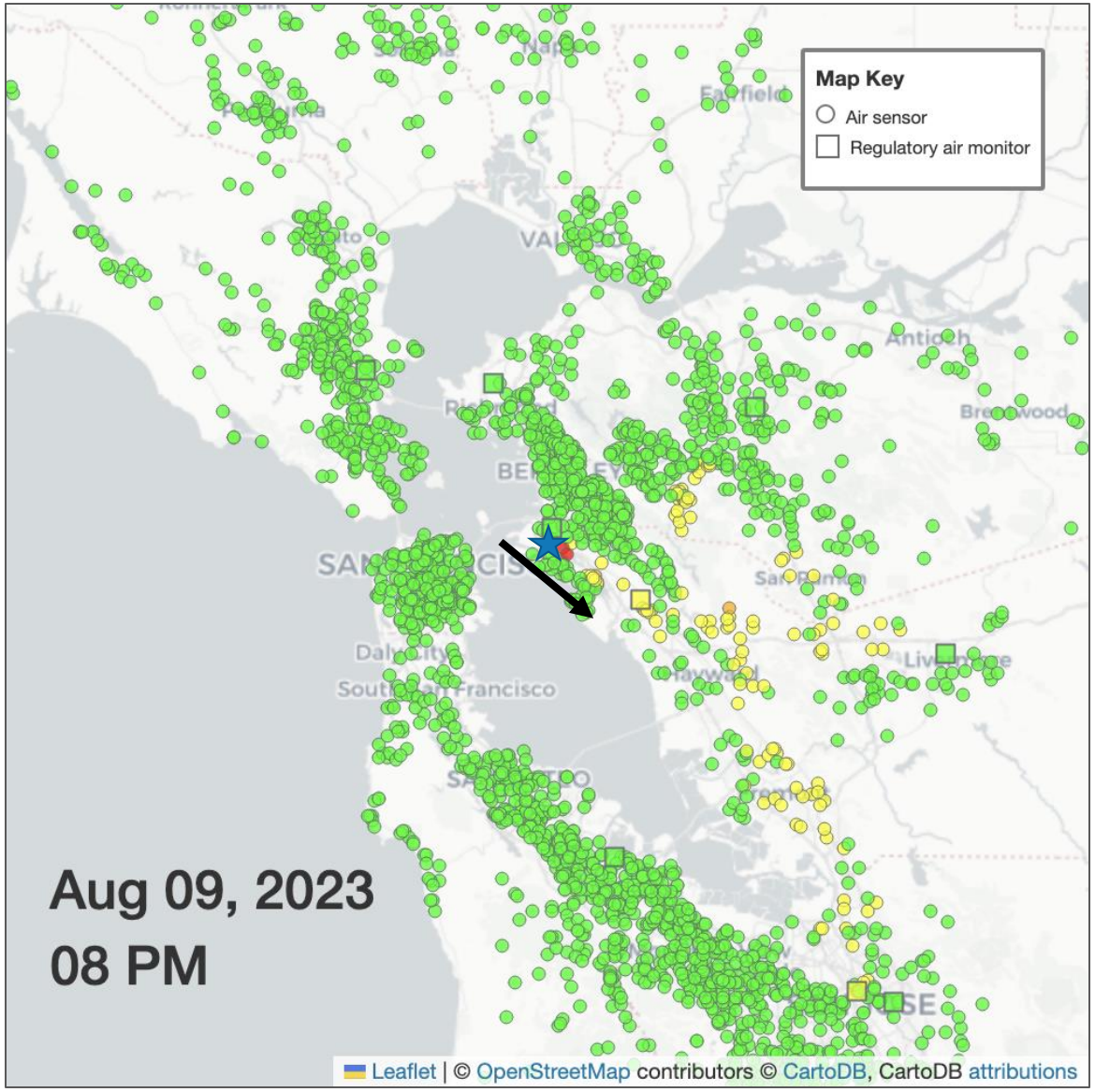
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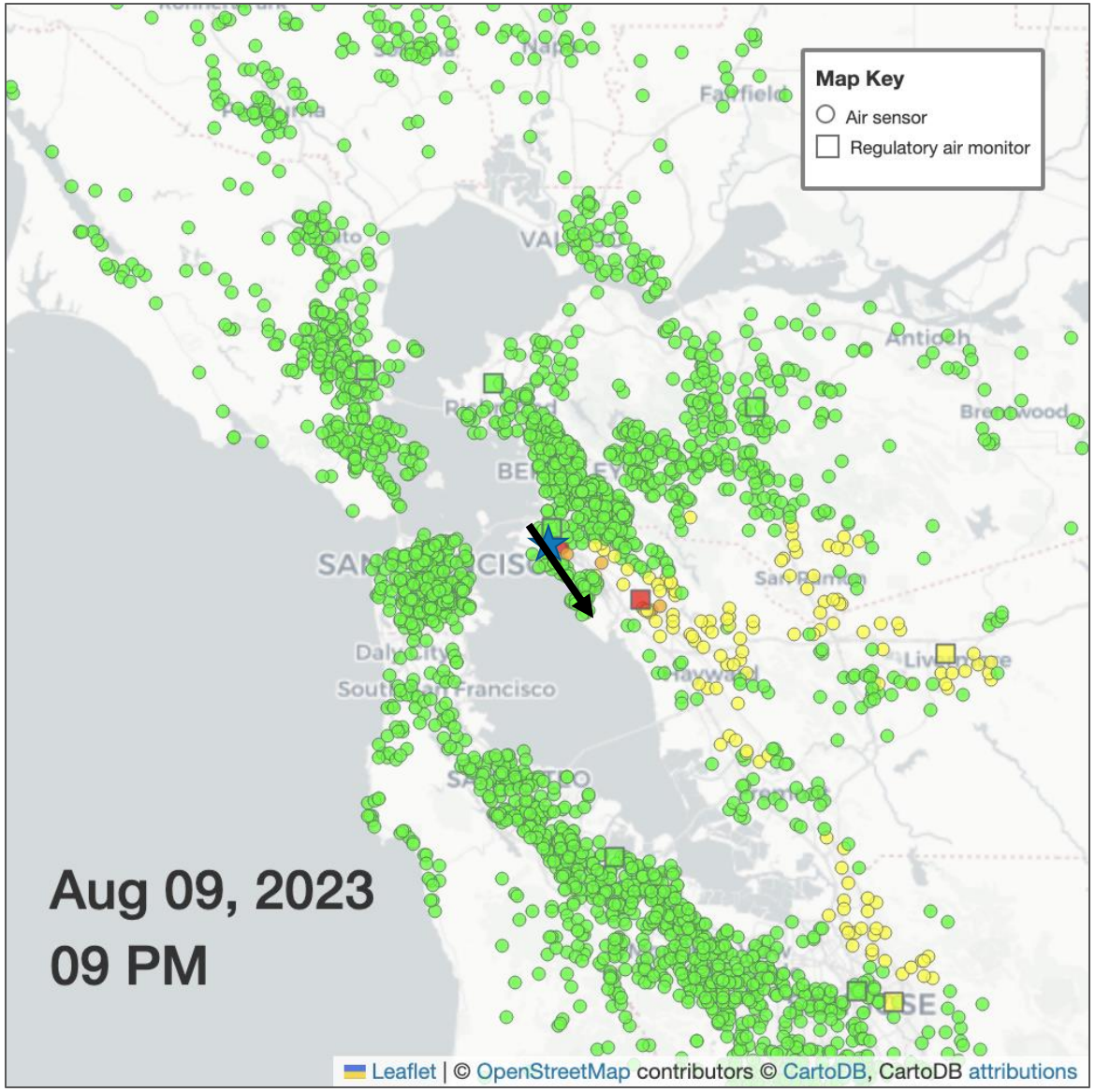
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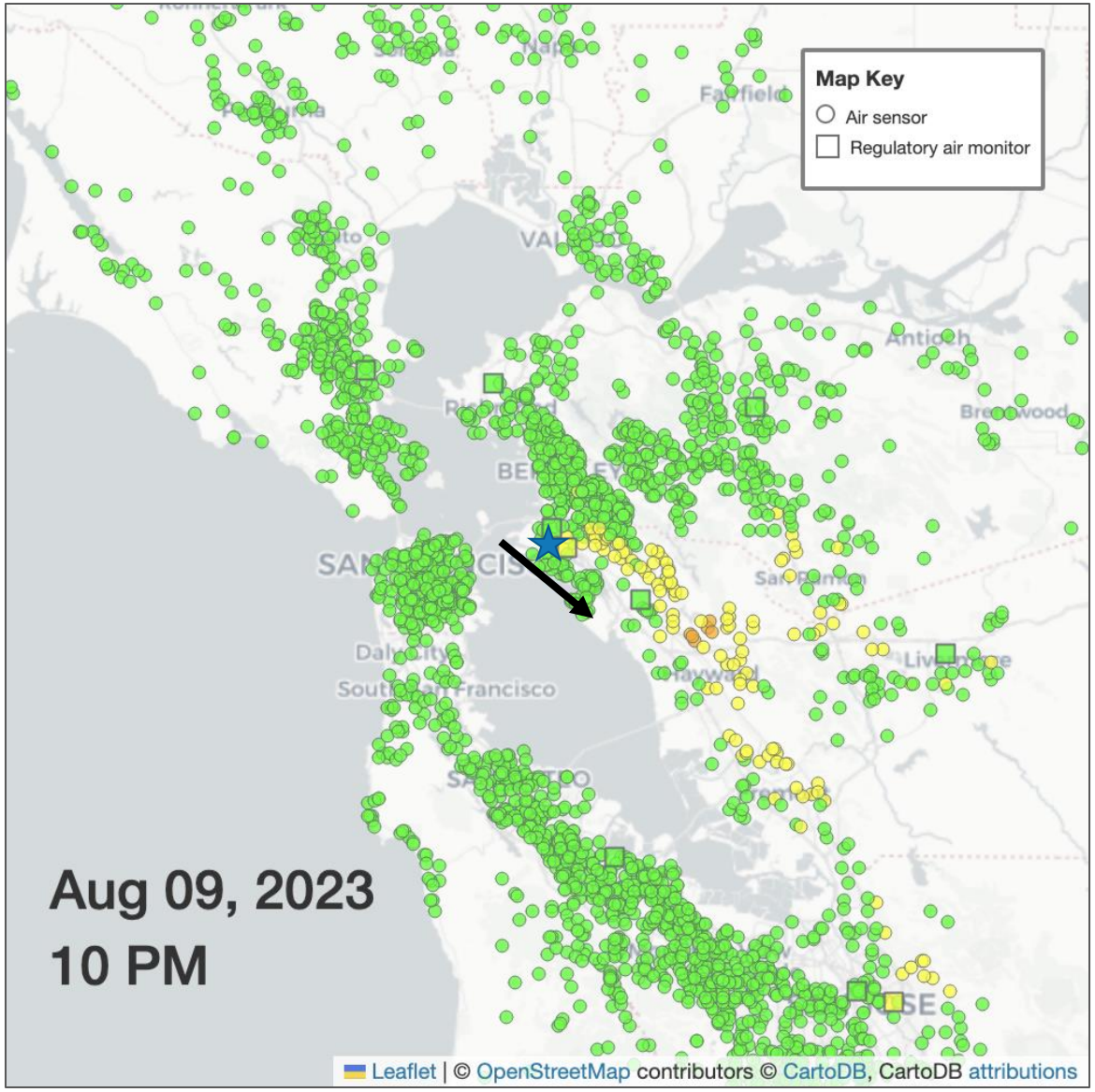
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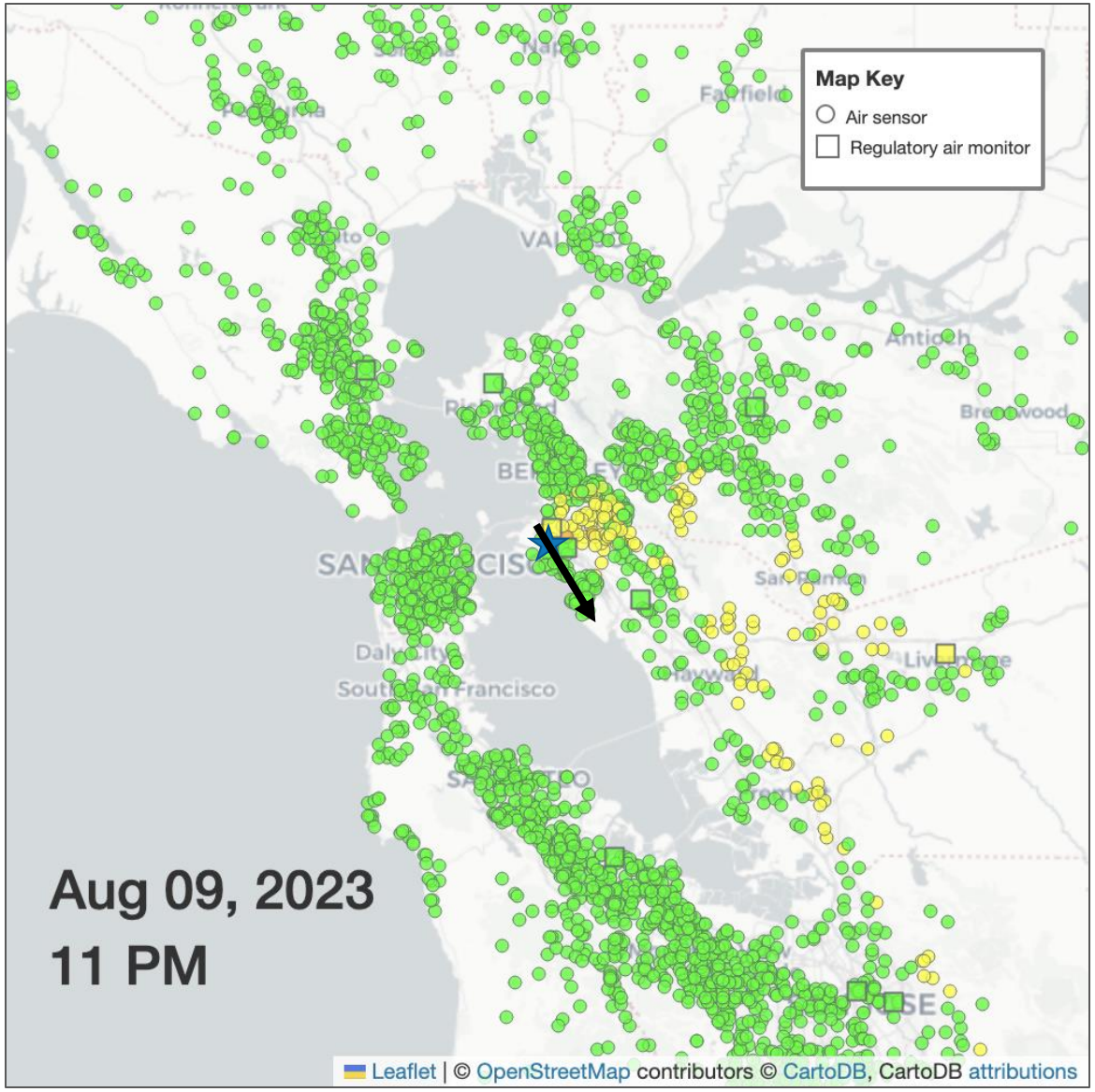
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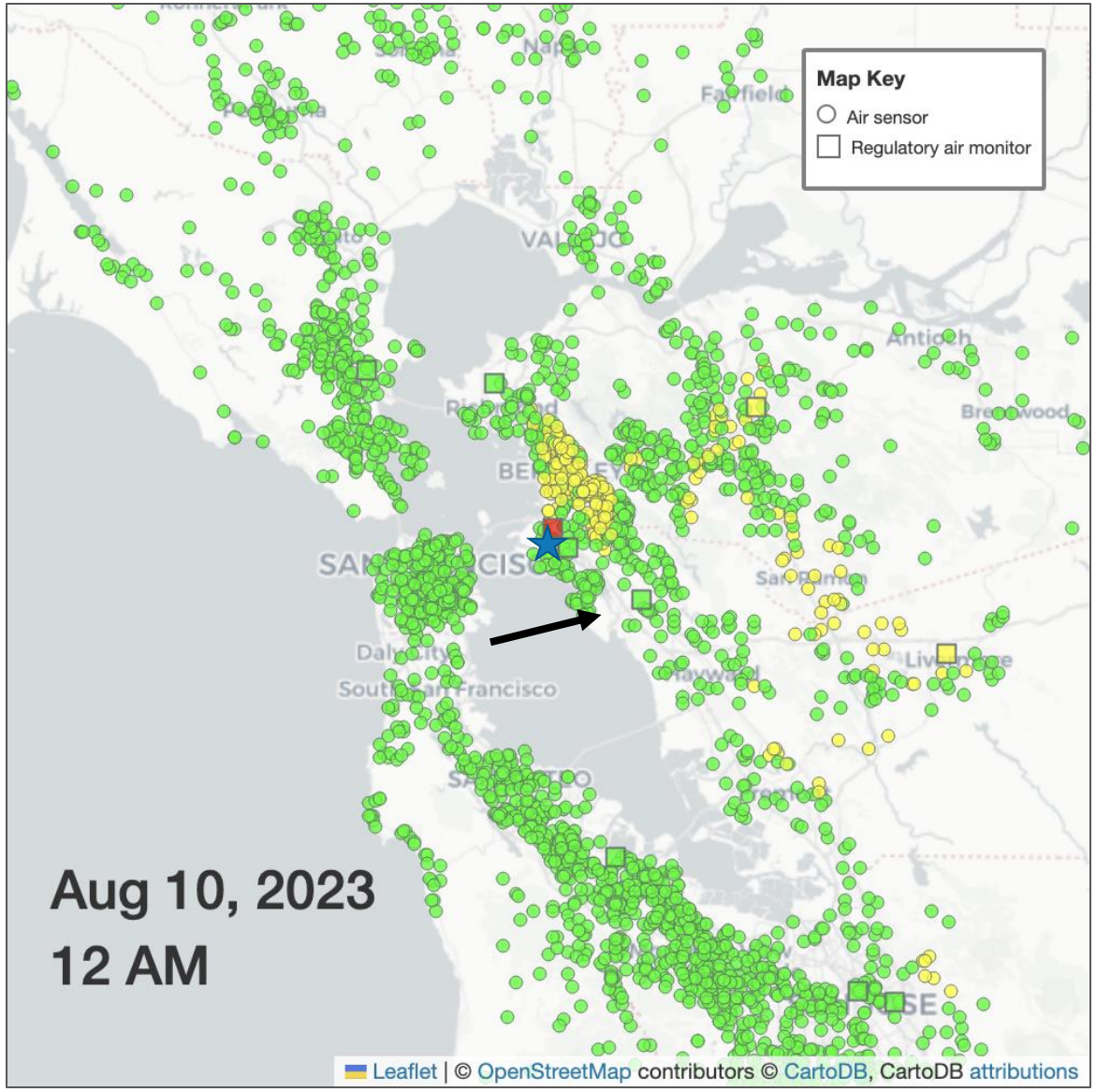
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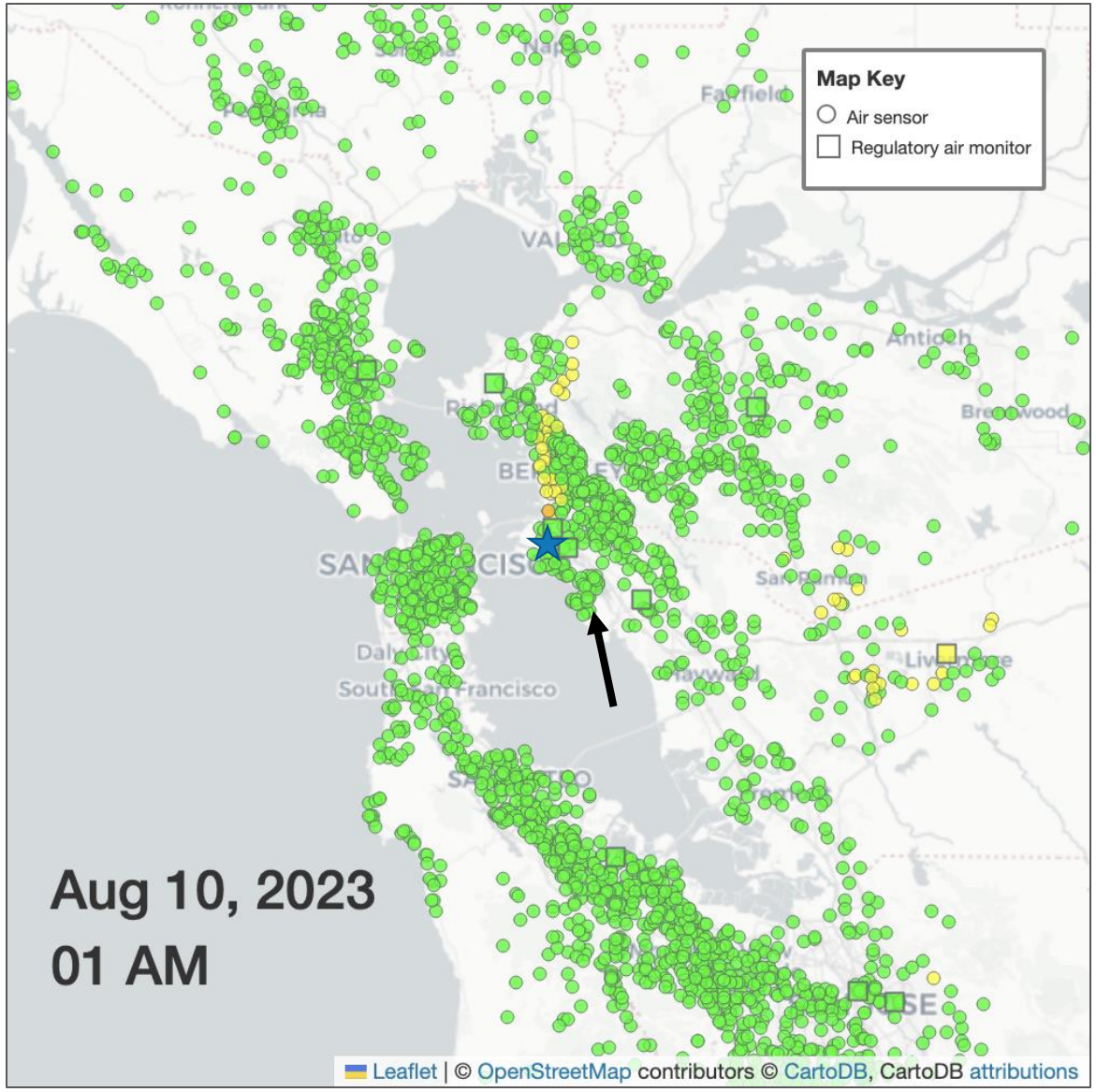
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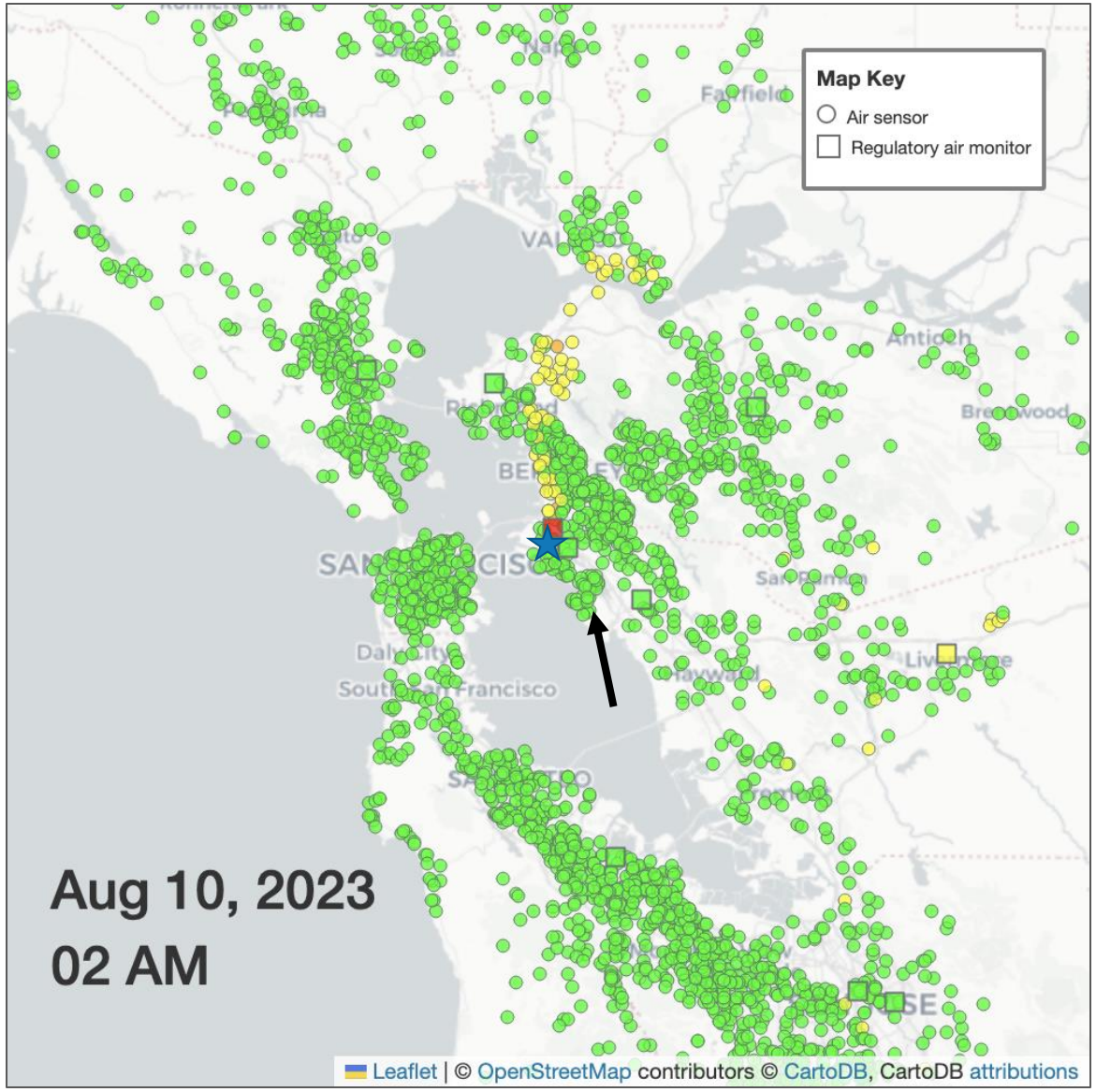
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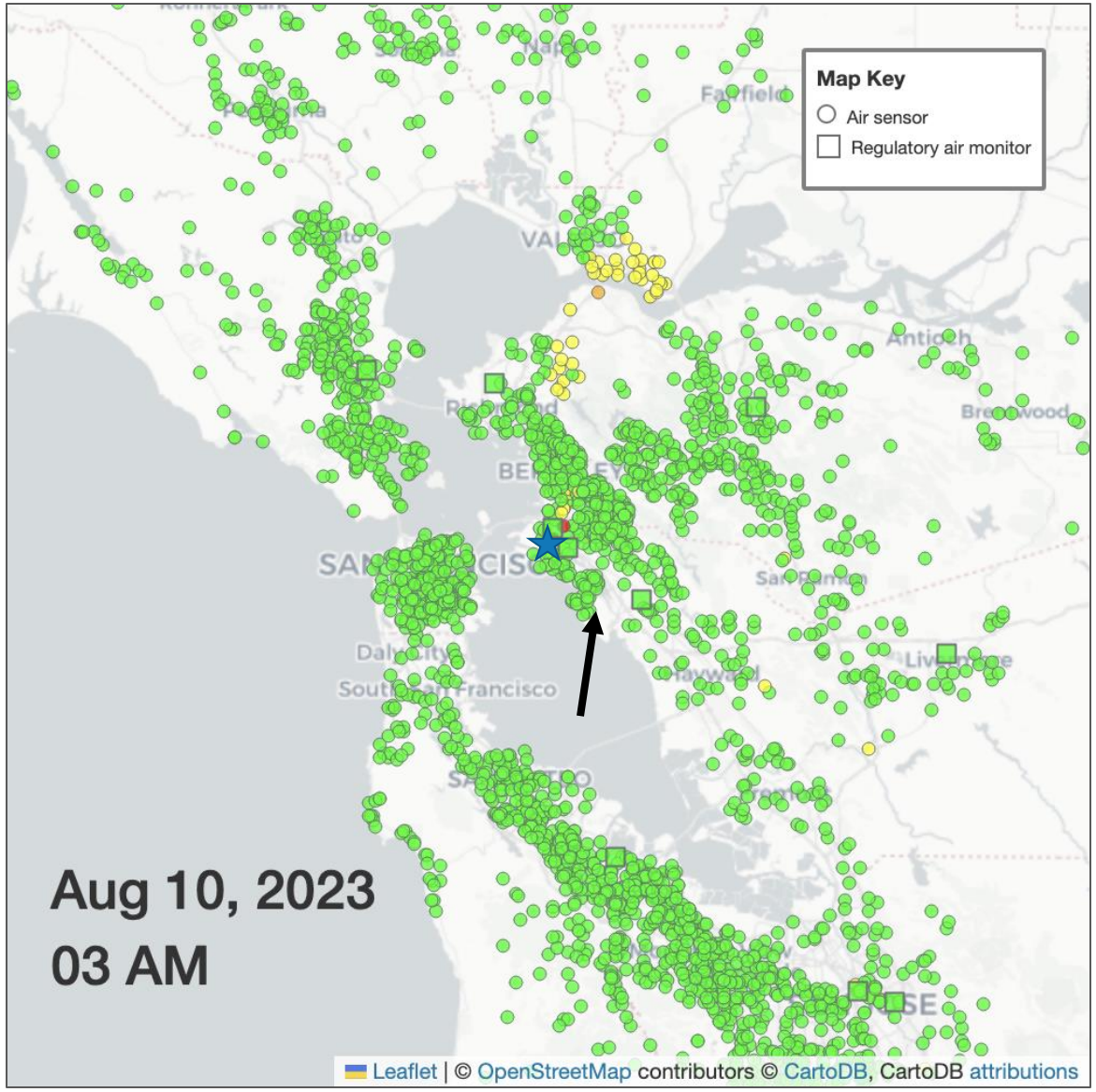
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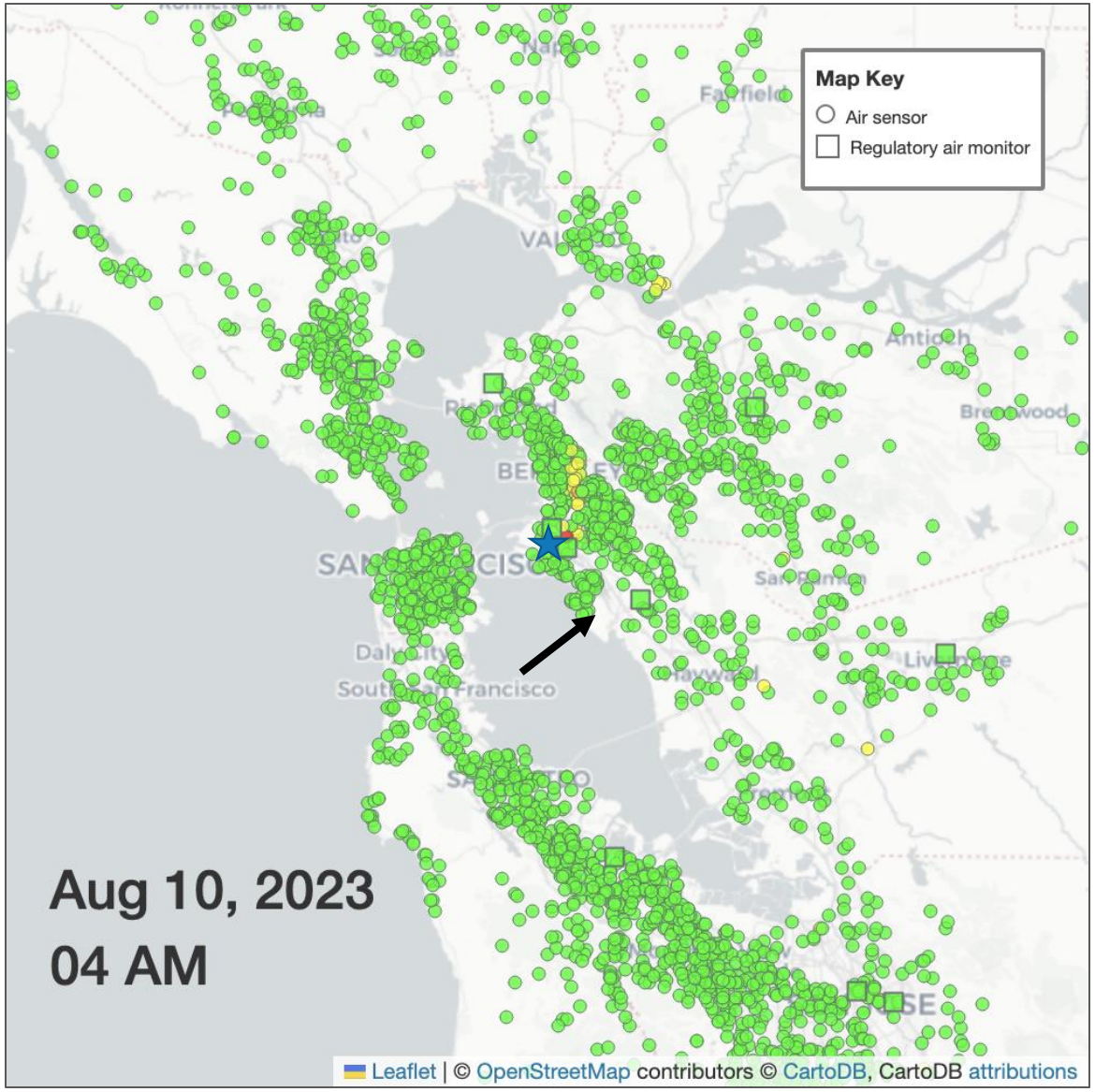
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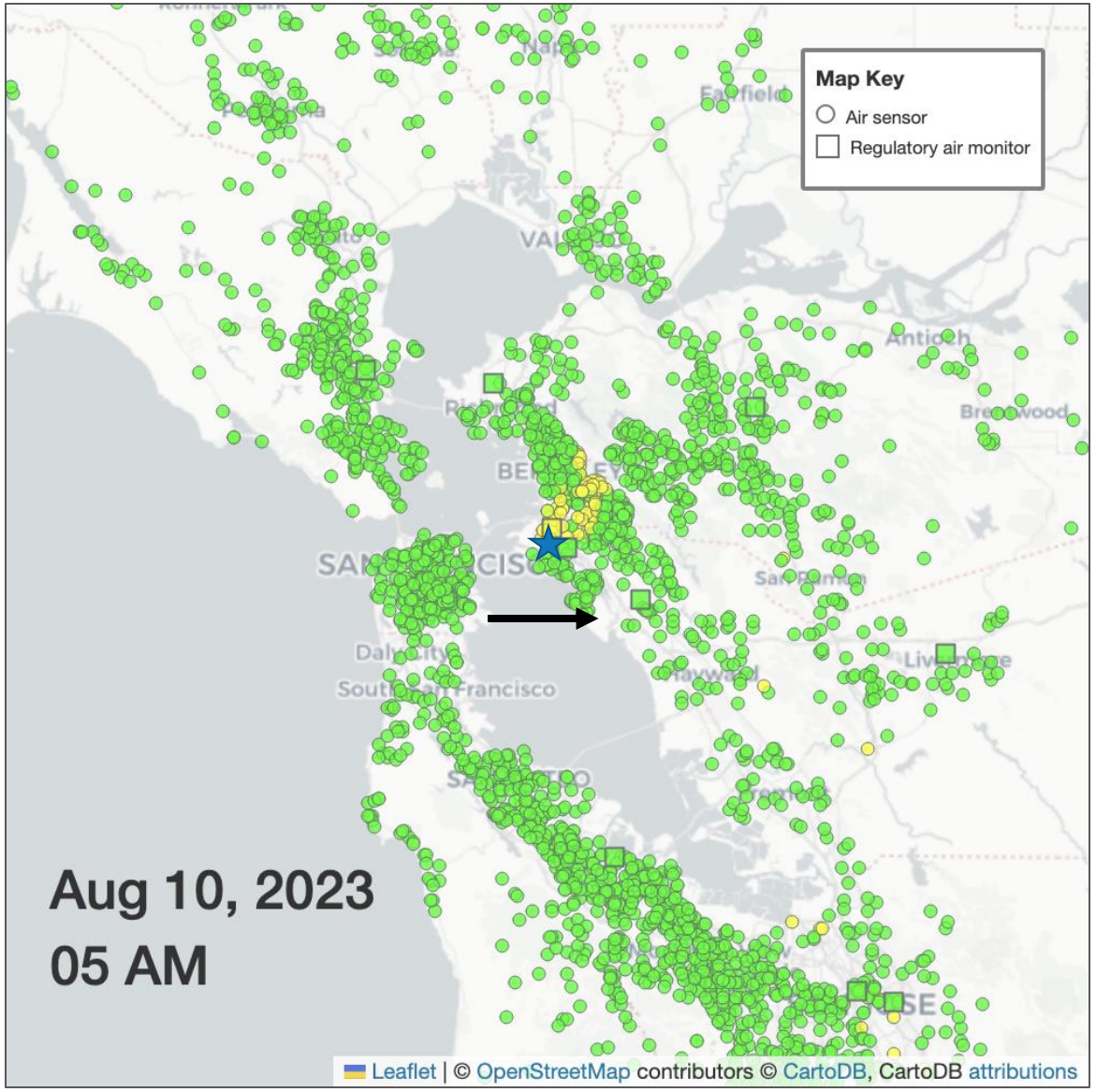
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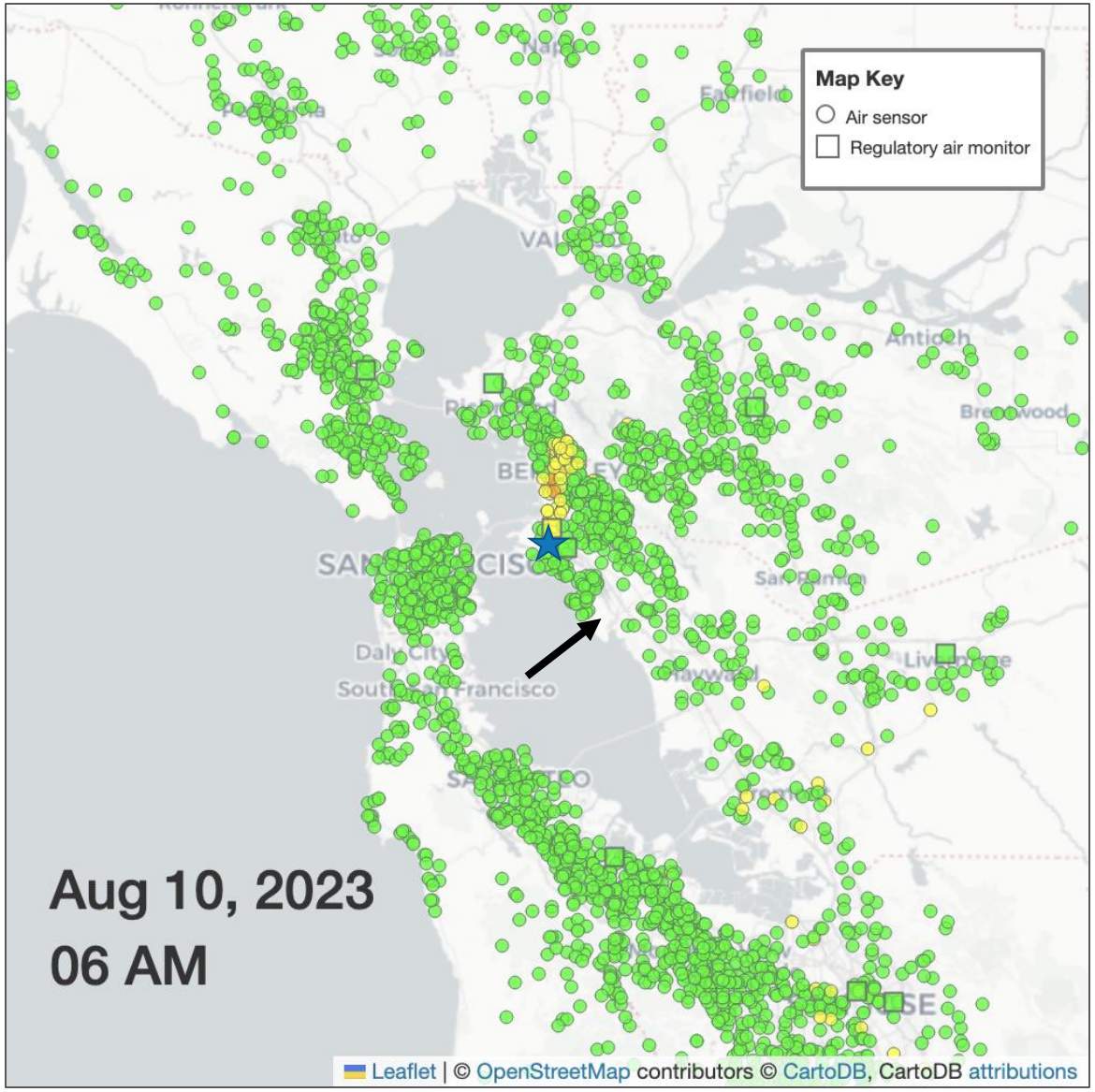
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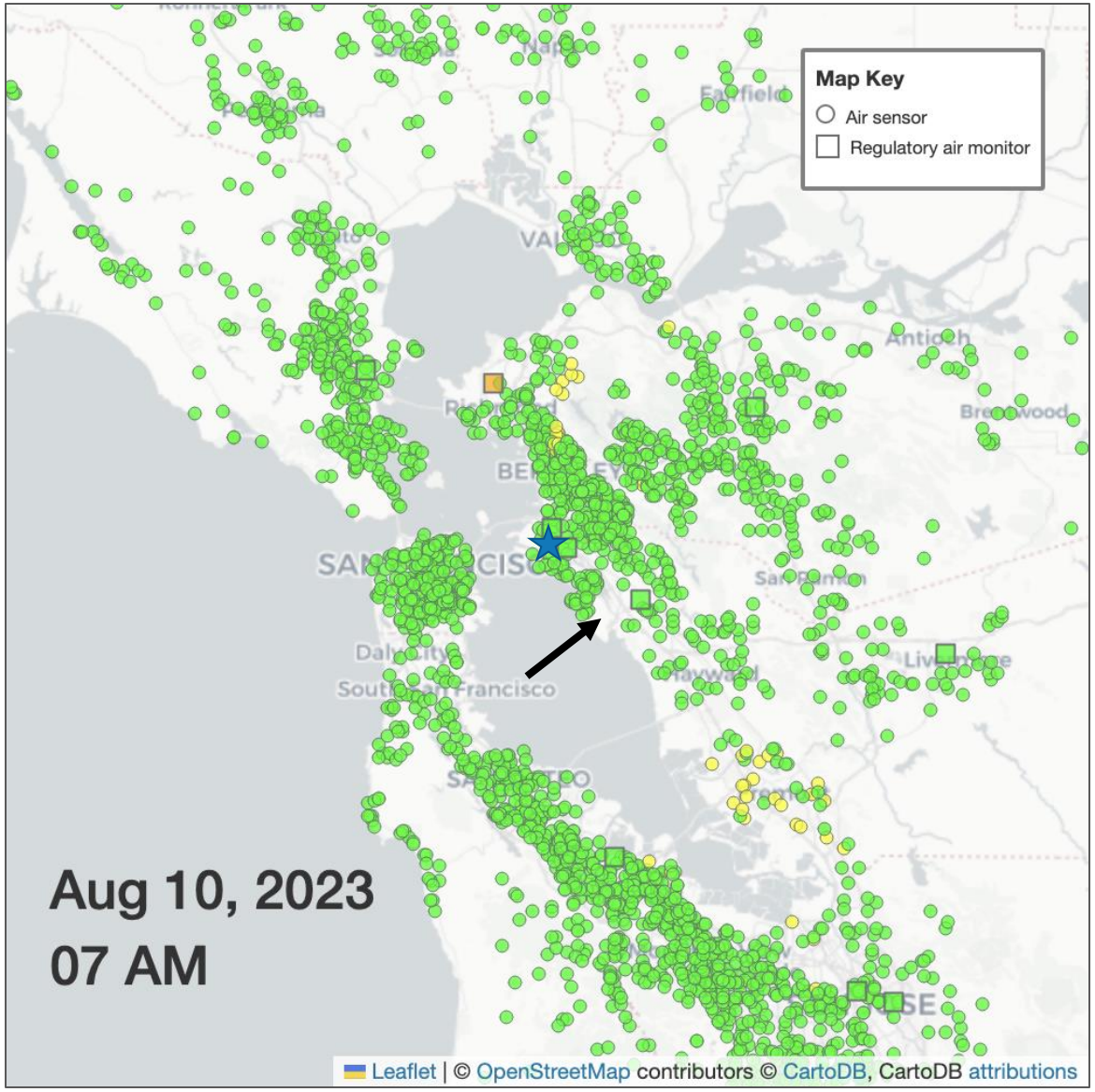
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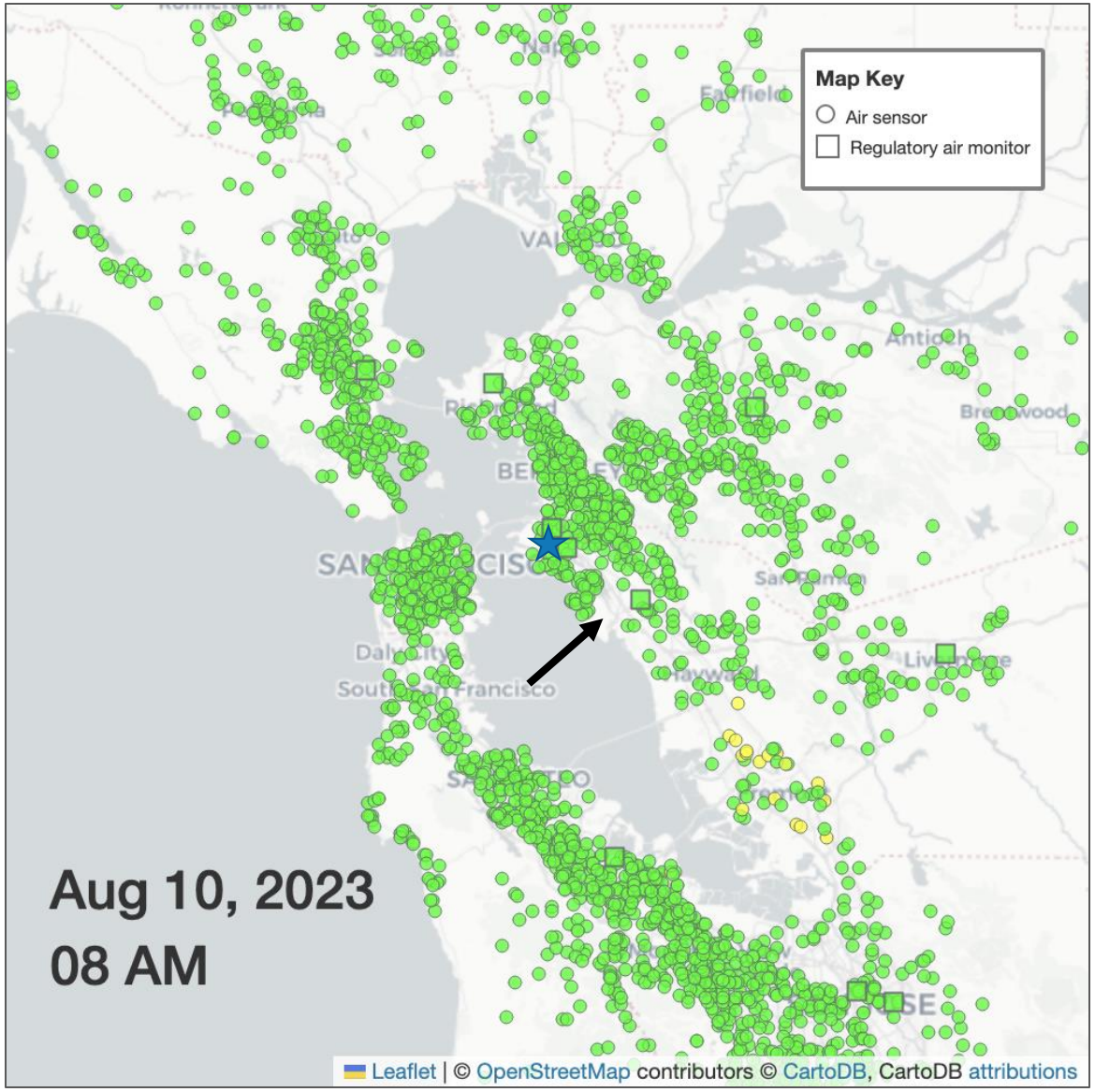
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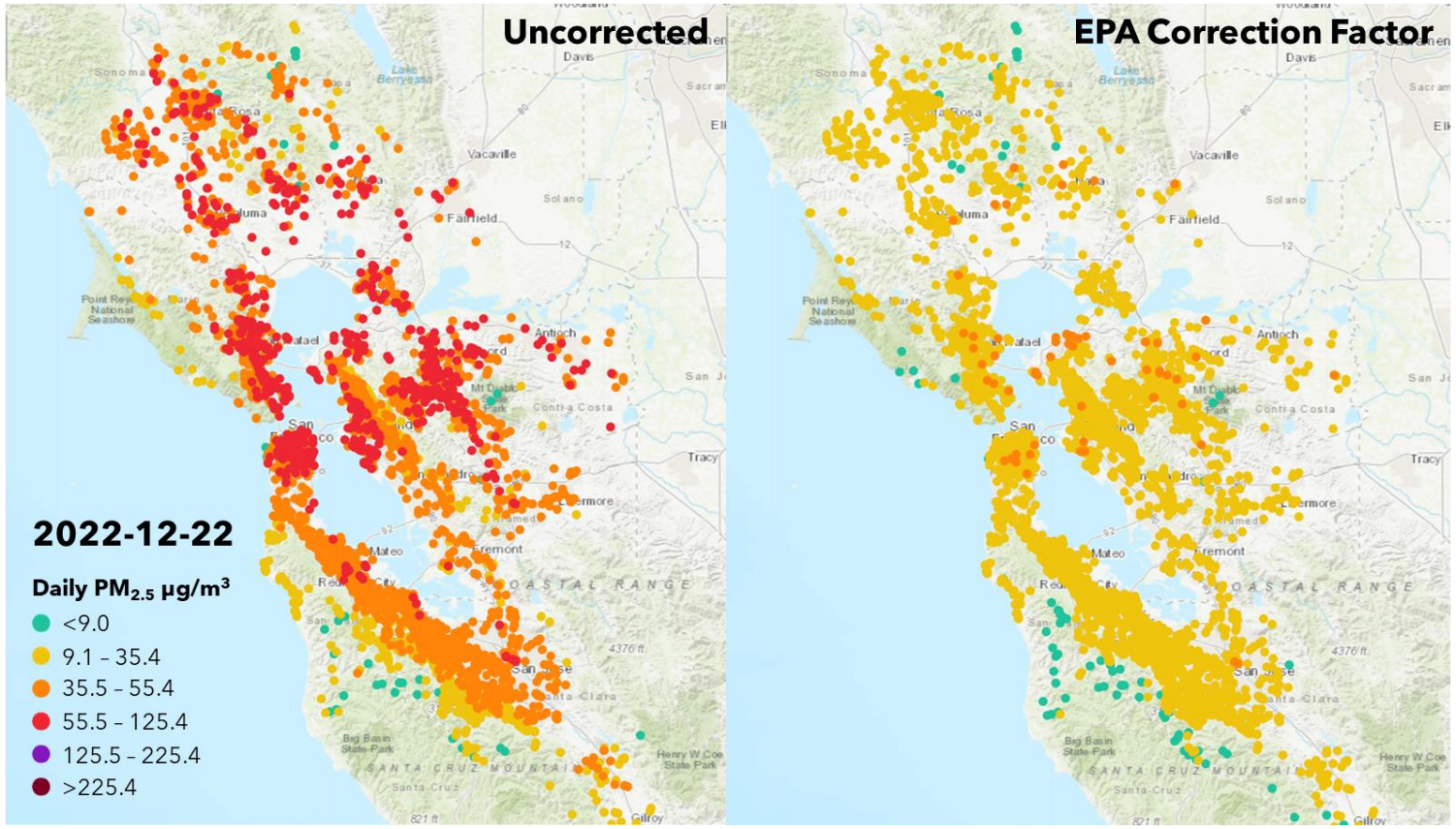
5) Characterize woodsmoke episodes

- Woodsmoke can be a significant contributor to elevated $PM_{2.5}$ in the Bay Area
- Use woodsmoke markers to identify specific days
  - Elevated BC and BrC
  - Elevated $PM_{2.5}$/CO enhancement ratios
- Evaluating relative differences from sensor-to-sensor for both uncorrected and adjusted datasets can be used to identify spatial patterns



Max $PM_{2.5}$ concentrations at regulatory monitoring sites: 37 µg/m^3

6) Community support

Support community-led advocacy and development of effective PM reduction strategies

- Provide a source of historical data
- Demonstrate air quality informational gaps

Example: Supporting AB-617 communities in their Community Emission Reduction Program (CERP)

- Adds to inventory of data that is available in a specific community
- Can provide insights on spatial and temporal patterns of PM
- Combined with other sources of data, including community-lived experience and knowledge, can provide supporting information for understanding air quality in overburdened communities

Interested in using the Air Sensor Dataset?

Use these steps to get access to the ASDS:

1. Read over and agree to the terms for data use.
2. Submit a data request through the general Contact Us page on the Bay Air Center website. Make sure to include "Interest in ASDS" when describing the specific support services you are interested in. Provide any additional information related to your intended use for the dataset.
3. The Bay Air Center will follow up with detailed information.

bayaircenter.org

Contact

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404-786-3556

Find me on Whova and LinkedIn!

TDEnviro

How can we help?

Reach out and we can help with any aspect of your air monitoring programs:

- Study design
- Measurements
- Data management
- Analytics
- Training & mentoring
- Community engagement
- Capacity building