



Tammy Thompson, Ph.D.
Senior Air Quality Scientist
Environmental Defense Fund
tthompson@edf.org

EDF and Google Earth Outreach showed that air pollution can vary by up to 8x on a city block

Explore: Interactive map and points of interest

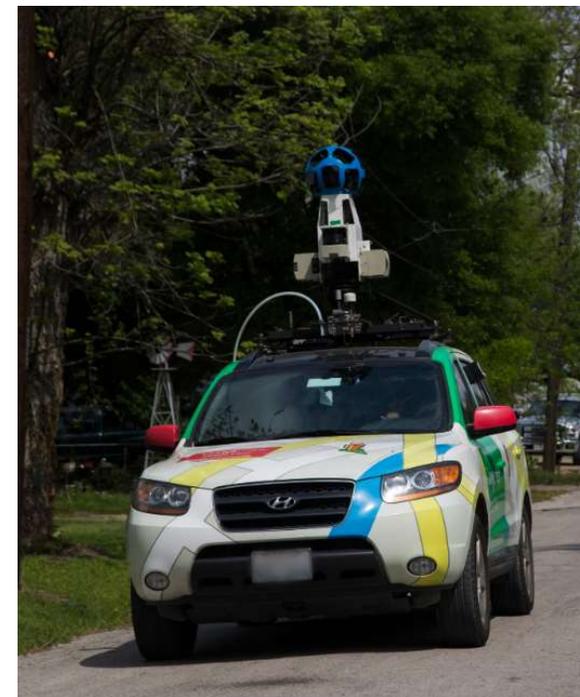
Black carbon Nitric oxide Nitrogen dioxide

Black carbon particles come from burning fuel, especially diesel, wood and coal. High exposure is associated with heart attacks, stroke and some forms of cancer.



Air quality data from Google/Aclima; analysis by [Apte et al](#) / EDF. Colors on the map do not correlate to colors on the Air Quality Index.

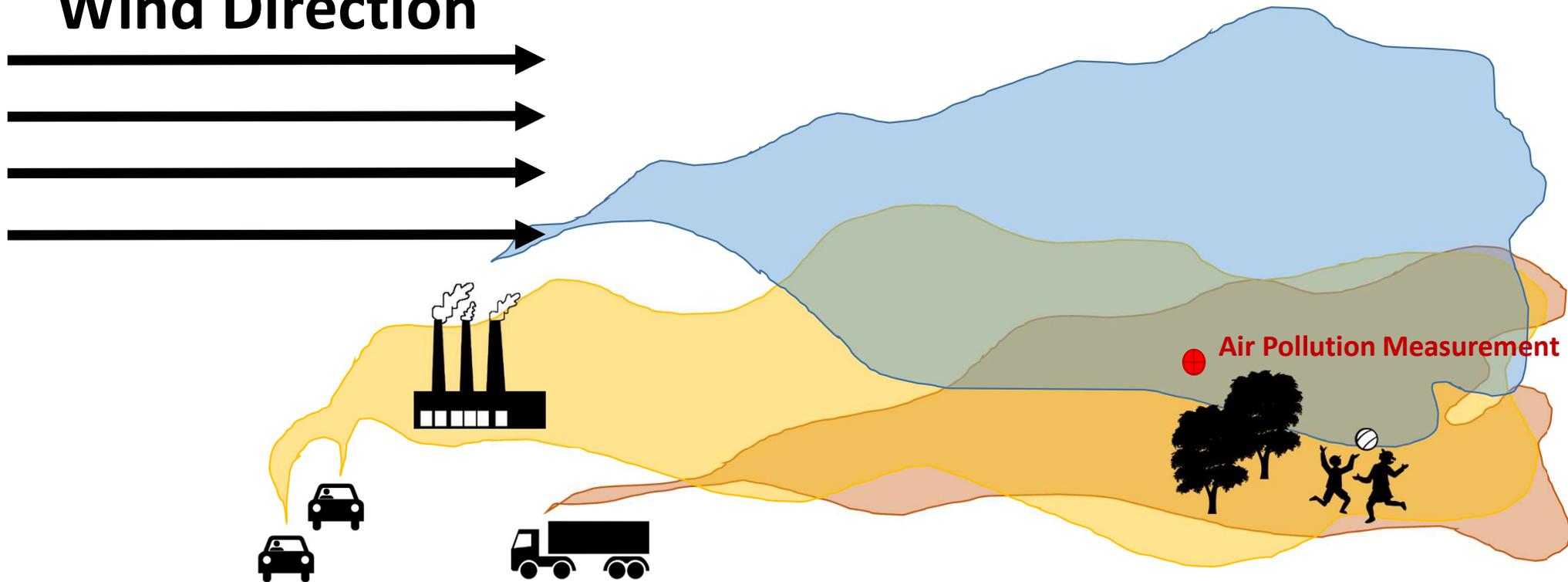
A mobile monitoring platform drove the streets of West Oakland an average of 30x each.



West Oakland contains a **SINGLE** regulatory monitor for PM2.5

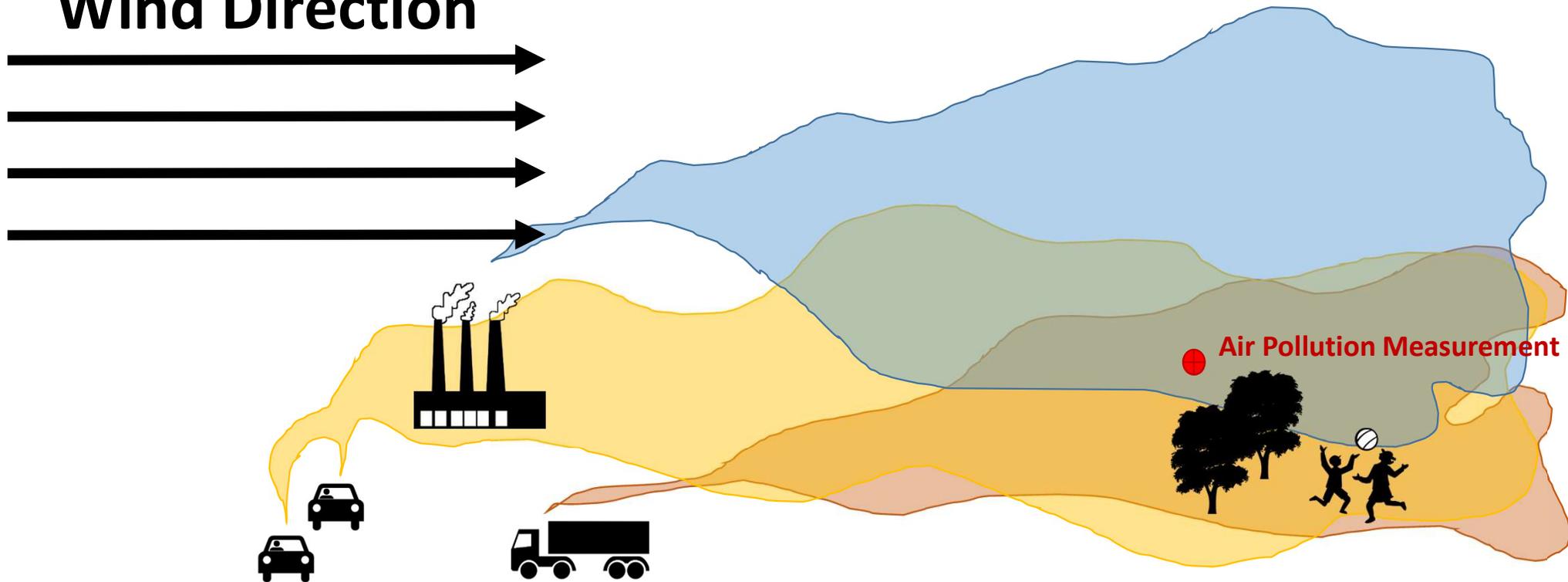
To model air pollution, you typically start at the source, and use information about emissions and weather to estimate the transport and dilution as pollutants are carried with the wind.

Wind Direction



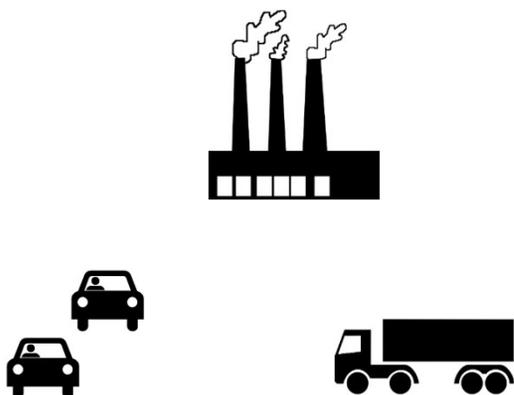
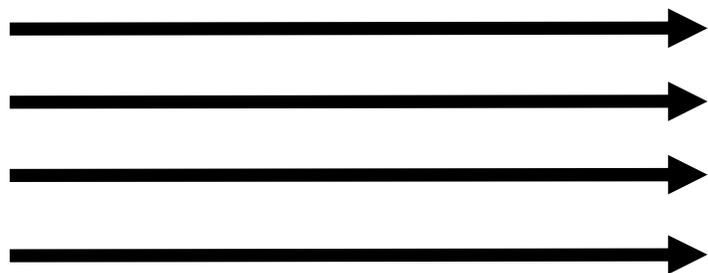
This “forward trajectory” modeling is extremely valuable to understand who is being impacted when emissions are known

Wind Direction



Often, events go unreported, or unknown by sources

Wind Direction

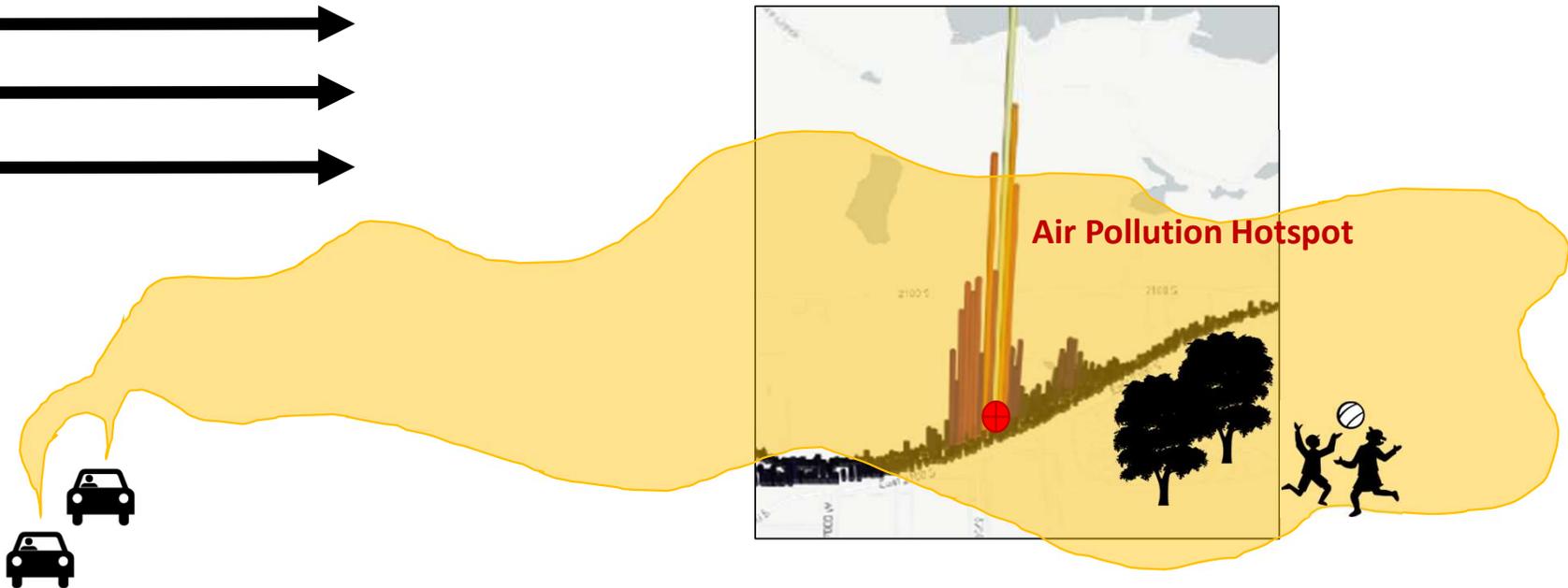
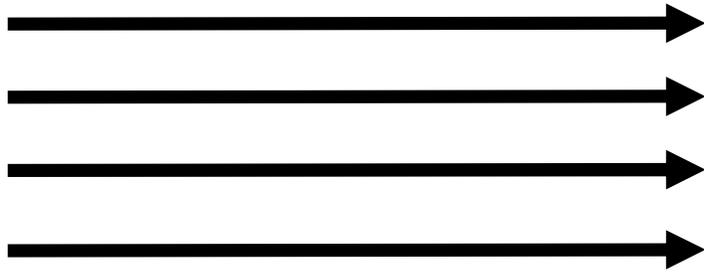


EDF “Air Tracker” starts at a location of interest and works backwards, or “upwind” to find the source of air pollution affecting that location.



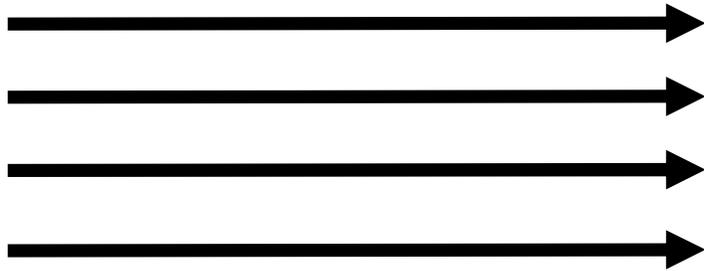
When a monitor measures a high concentration of pollution, higher than nearby concentrations (a “hotspot”), it likely means that monitor is measuring a plume from a near-by source.

Wind Direction

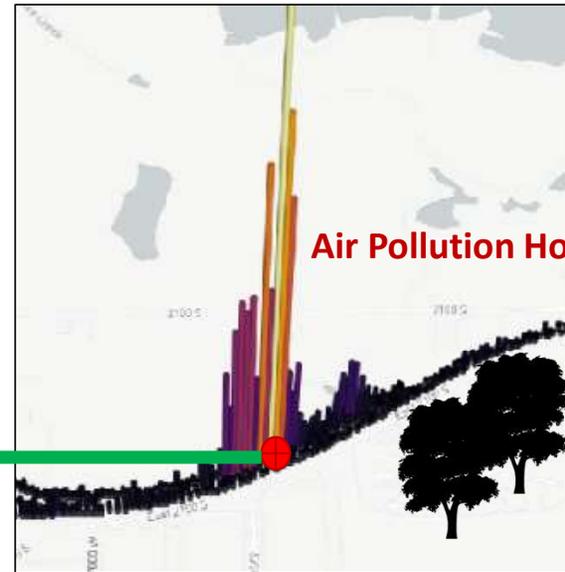


Air Tracker uses a weather model, stepping backwards in time, to see where that air (carrying the plume), came from.

Wind Direction

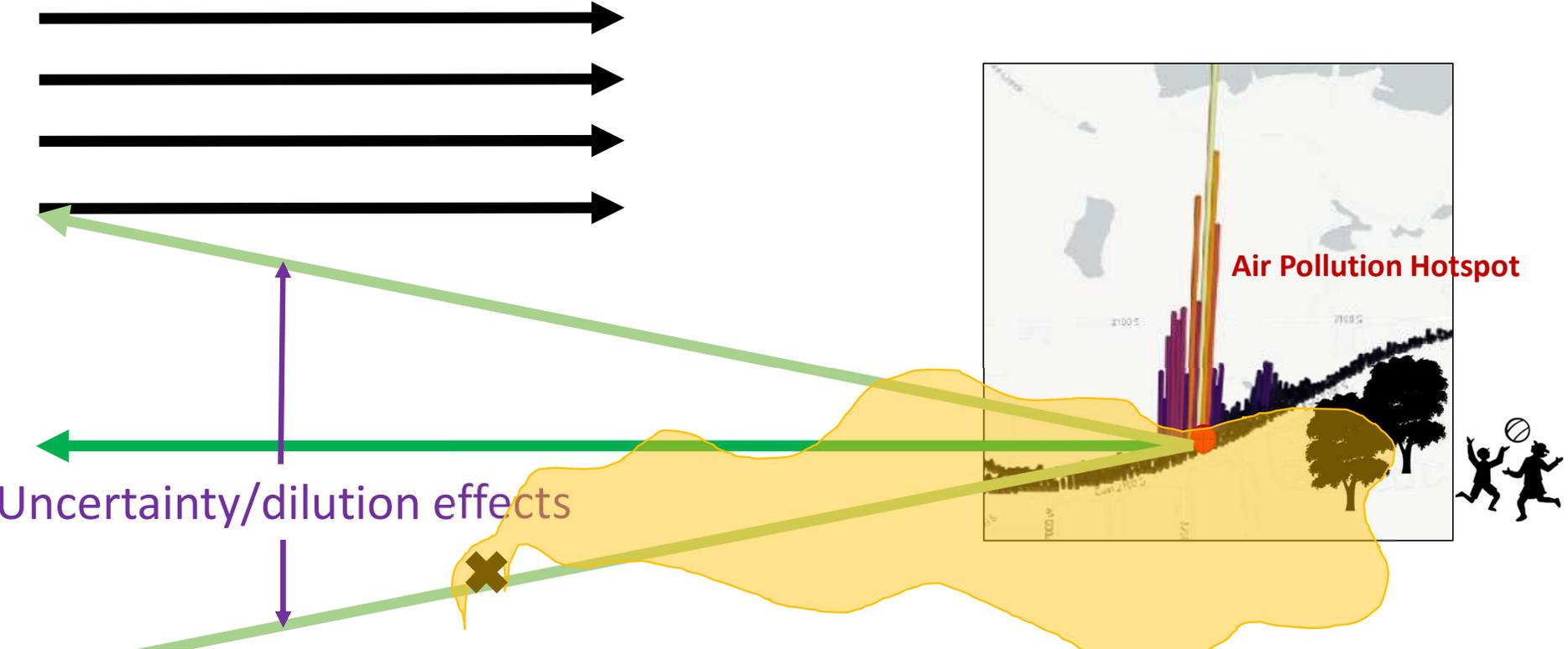


The Air Tracker moves backwards in time, or upwind, to find the source



Air Tracker “maps” the area upwind of a hotspot using a backwards trajectory model. The source of that hotspot is likely in the back trajectory outlined by Air Tracker.

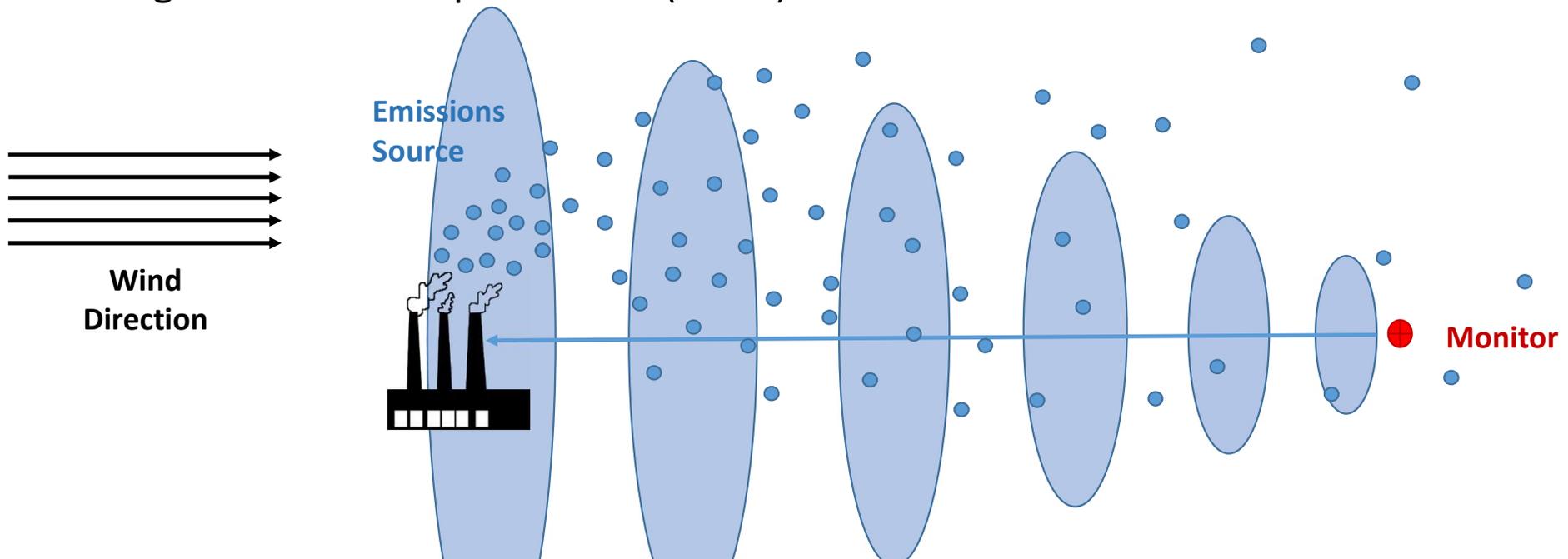
Wind Direction



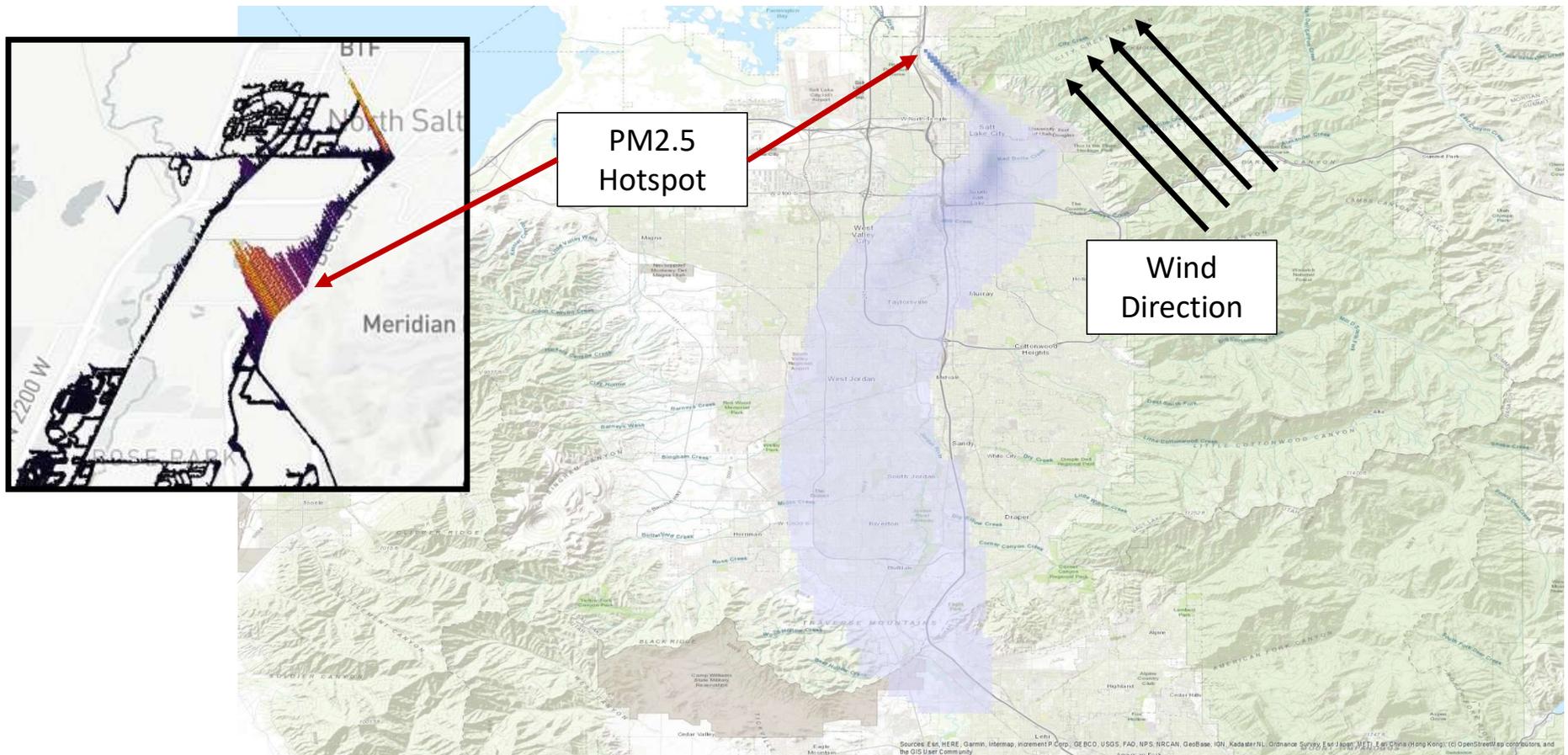
Receptor-Based Source Apportionment: Inverse Dispersion Modeling

Dispersion processes can be calculated in reverse to look upwind and estimate the most likely area the contributing source(s) was/were located.

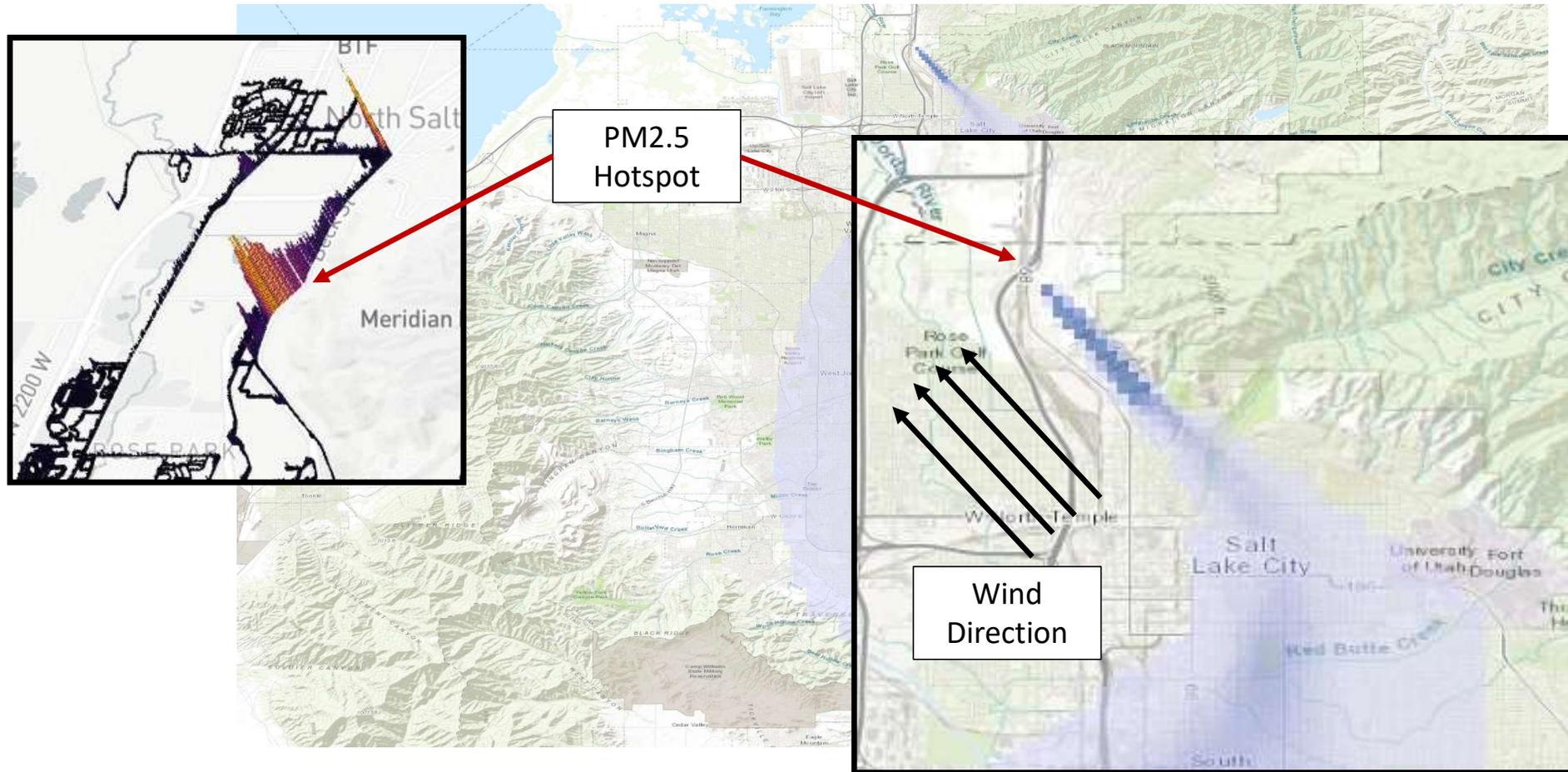
We are using the Stochastic Time-Inverted Lagrangian Transport model (STILT), driven by the High-Resolution Rapid Refresh (HRRR) weather model from NOAA.



Air Tracker Back Trace showing the area that likely influenced a measured hotspot on August 8, 2019 in SLC



Air Tracker Example: Back Trace showing the area that likely influenced a measured hotspot





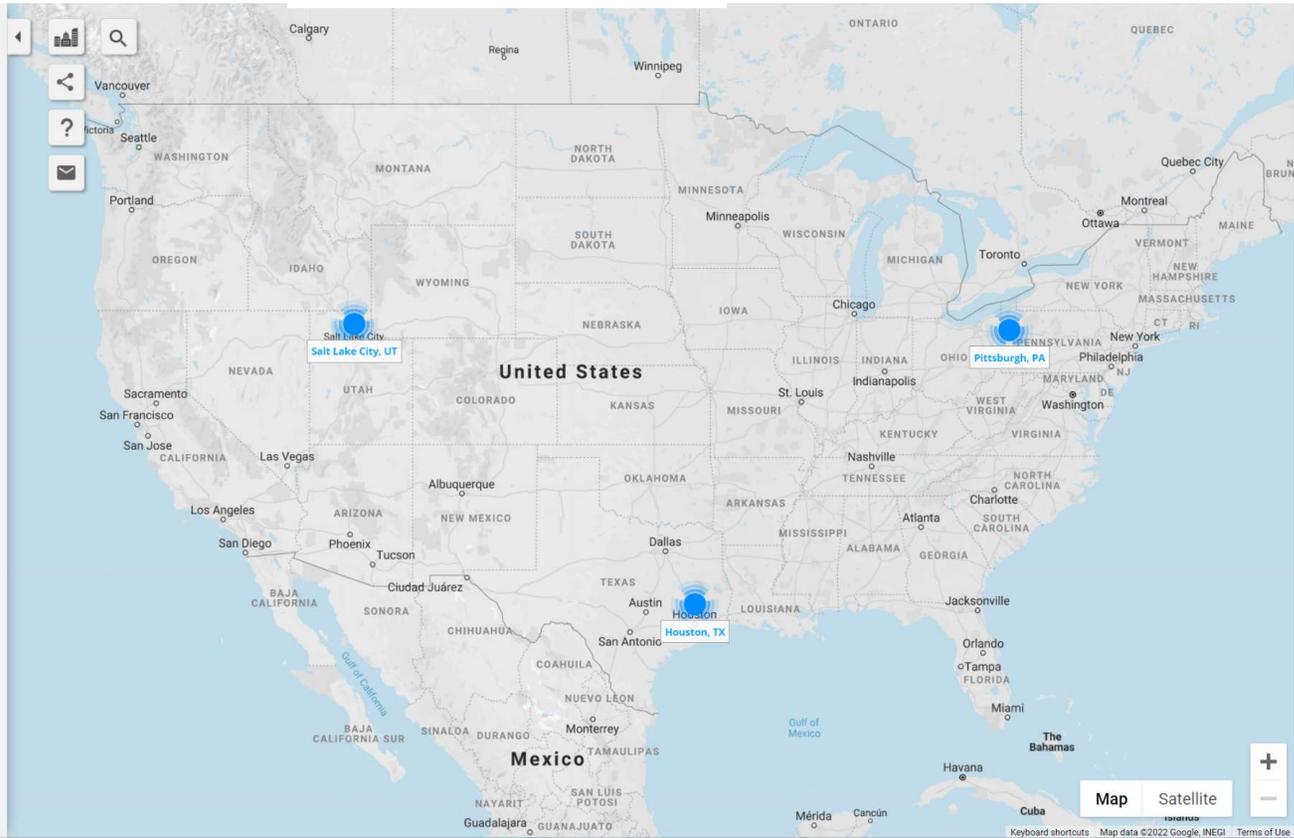
Air Tracker

That air you're breathing, where's it been?

AirTracker makes visual connections between the air you are breathing and the locations of air pollution sources in your city. Users can view back traces, which show where air comes from at any time.

Key interactive features include:

- View real-time air pollution and wind measurements across your city. Click on a blue circle, indicating an available city. Once the region has loaded, click on a circle to see these sensor measurements.
- Click anywhere in the dotted region of the city to create a back trace that "looks upwind" to see where the air came from to end up at that location, at that time.
- When examining a city, explore past air pollution measurements and back traces to learn more about areas that may influence air quality in a neighborhood. Choose a day on the timeline and click the clock in the lower left to explore data within that day.



Community Robotics, Education and Technology Empowerment



Air Tracker

Clinton C403 AirNow

Backtrace:

Snapshot from model at 7:00 PM (CST)

PM_{2.5}:

17.7

ug/m3

6:30 PM (CST)

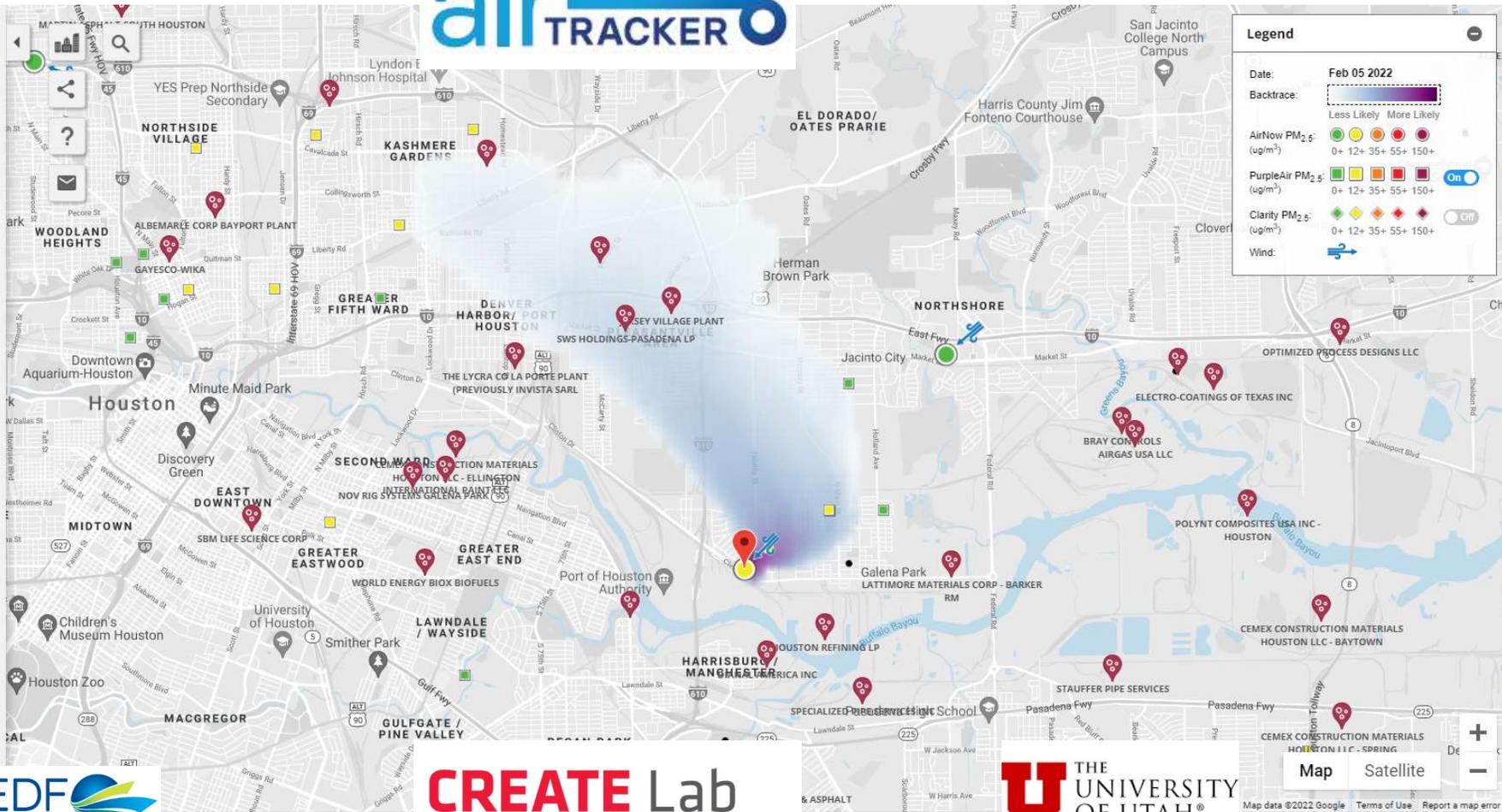
Wind:

Coming from

NE

at 1.2 mph

6:30 PM (CST)



Legend

Date: Feb 05 2022

Backtrace: [Color scale legend: Less Likely (lighter) to More Likely (darker)]

AirNow PM_{2.5} (ug/m³): 0+ 12+ 35+ 55+ 150+ [Color scale legend]

PurpleAir PM_{2.5} (ug/m³): 0+ 12+ 35+ 55+ 150+ [Color scale legend]

Clarity PM_{2.5} (ug/m³): 0+ 12+ 35+ 55+ 150+

Wind: [Wind direction icon]

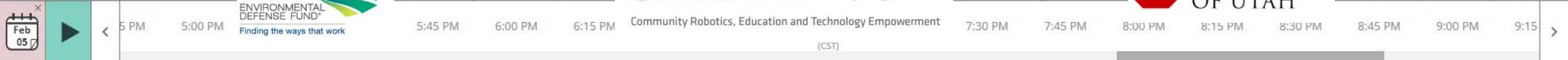


Community Robotics, Education and Technology Empowerment (CST)



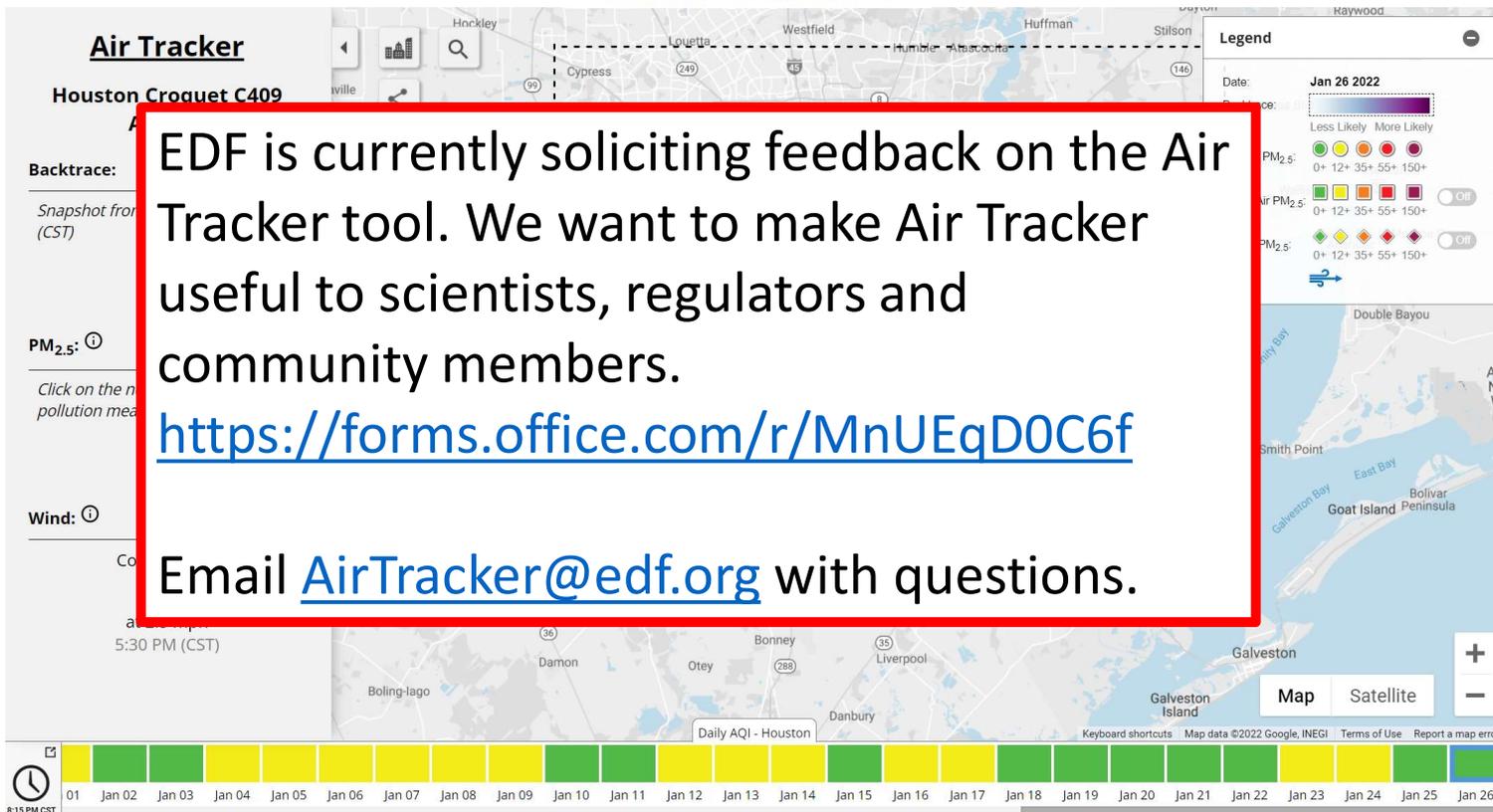
Map Satellite

Map data ©2022 Google Terms of Use Report a map error



Air Tracker: In Progress

- Improve in-tool communications/explanations of the science
- Incorporate feedback from Focus Groups and User Testing
- Work with partners in Houston to expand functionality/features and build out Use Cases
 - Benzene Alert System
 - Mobile measurement route planning
 - API access to grab static maps of single trajectories from a specific time/location
- Analysis features: 1. Heat maps, 2. Weather model performance



Community Robotics, Education and Technology Empowerment



Questions?

Tammy Thompson tthompson@edf.org

Alex Franco afranco@edf.org