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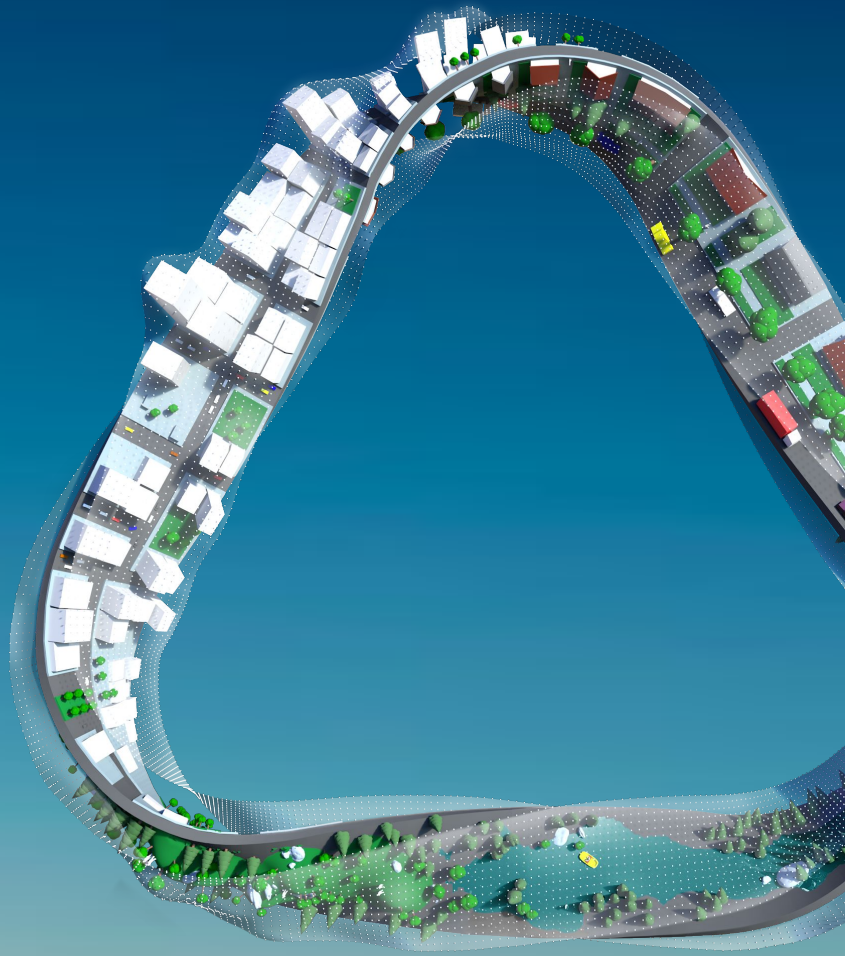
Environmental intelligence for people and the planet

November 2018 | San Diego Briefing



An opportunity to solve one of humanity's greatest challenges.

> With a trillion sensors embedded in the environment, all connected by computing systems, software and services, it will be possible to hear the heartbeat of the Earth, impacting human interaction with the globe as profoundly as the Internet has revolutionised communication.
>
> – Peter Hartwell, Former Senior Researcher, HP Labs

Data to Drive Action

Aclima delivers hyper-local air quality data and insights, at block-by-block resolution.

This new view of emissions empowers communities to understand the local causes and impacts of pollution over time, from the impacts of traffic congestion and urban planning, to gas leaks and wildfires.

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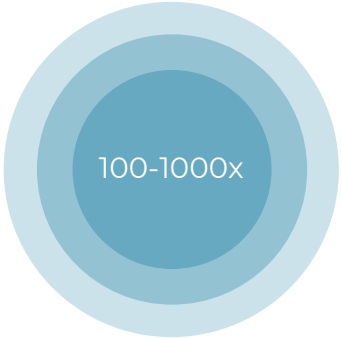
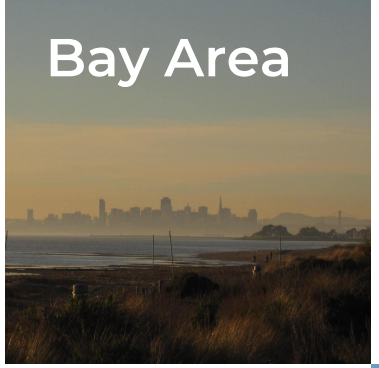
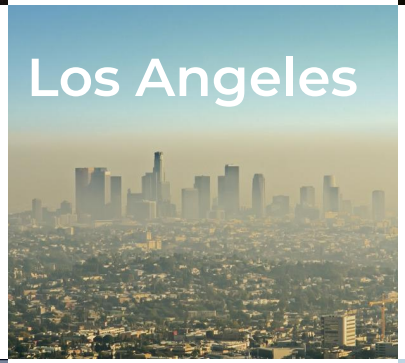


Aclima technology reduces the cost of measuring air pollutants by 100-1000x, enabling ubiquitous scale.

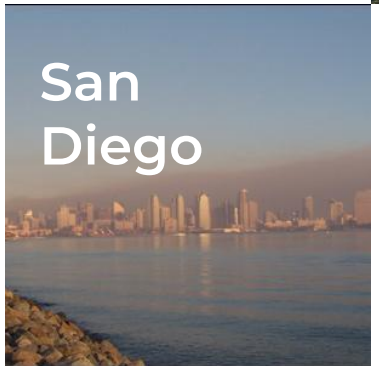


CONGESTION

WEATHER



TOPOGRAPHY



DENSITY

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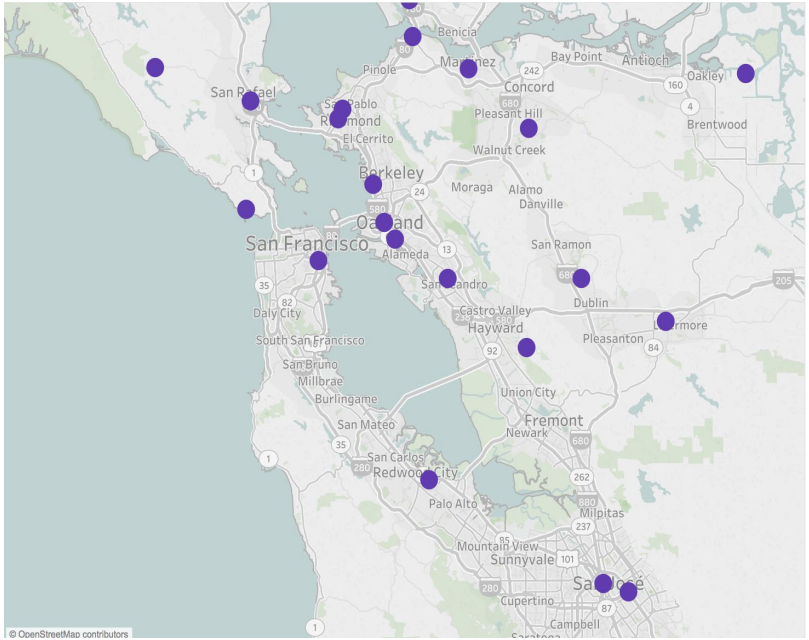
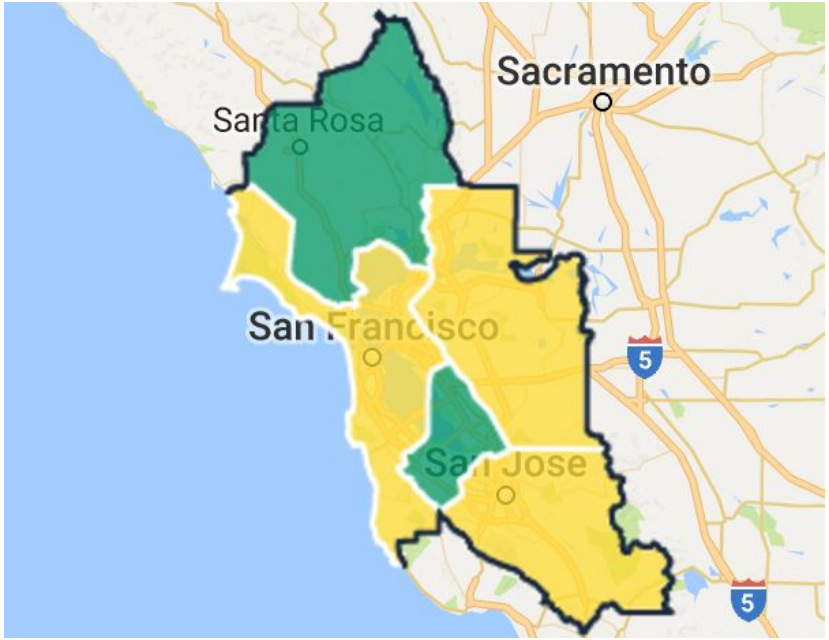
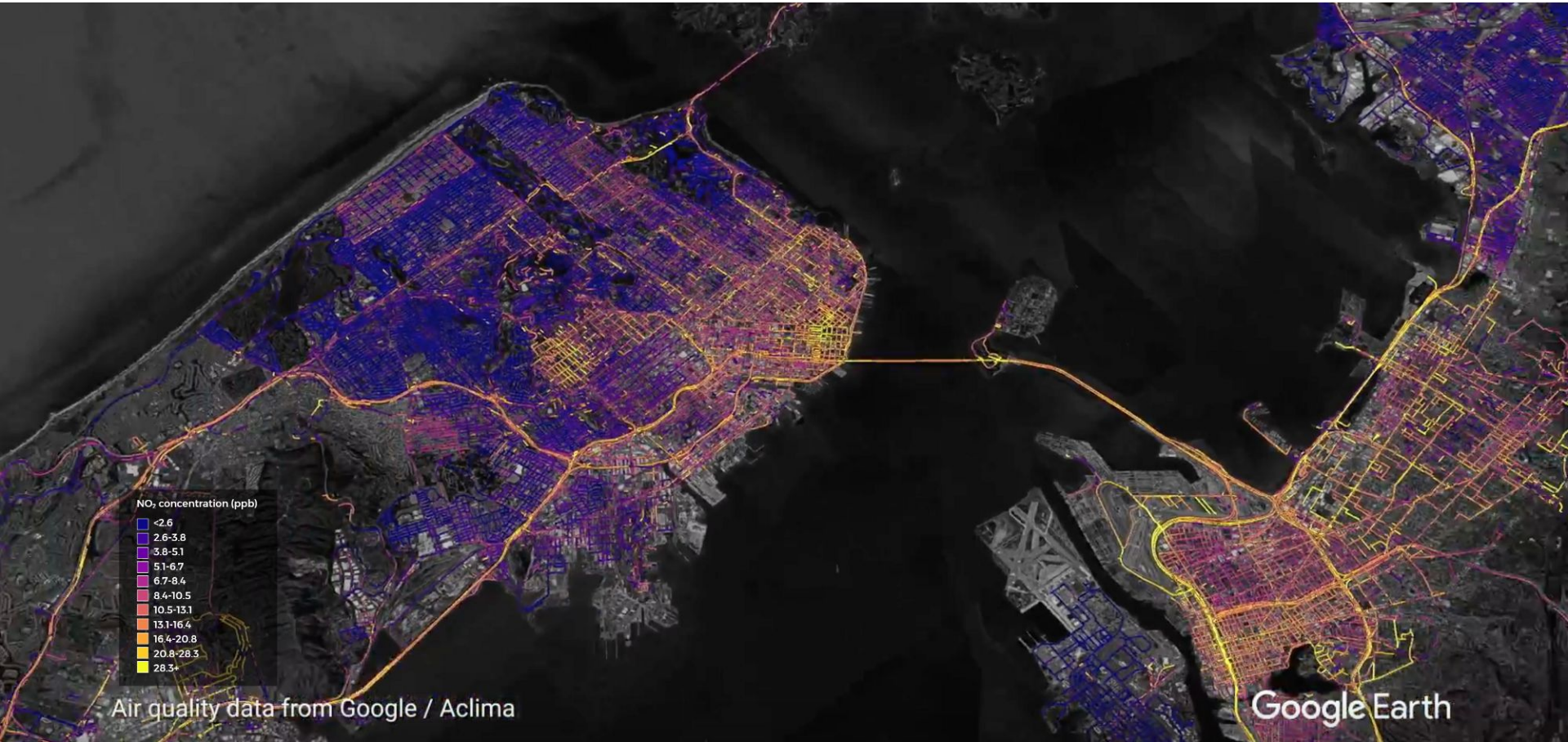
Current: Regional resolution





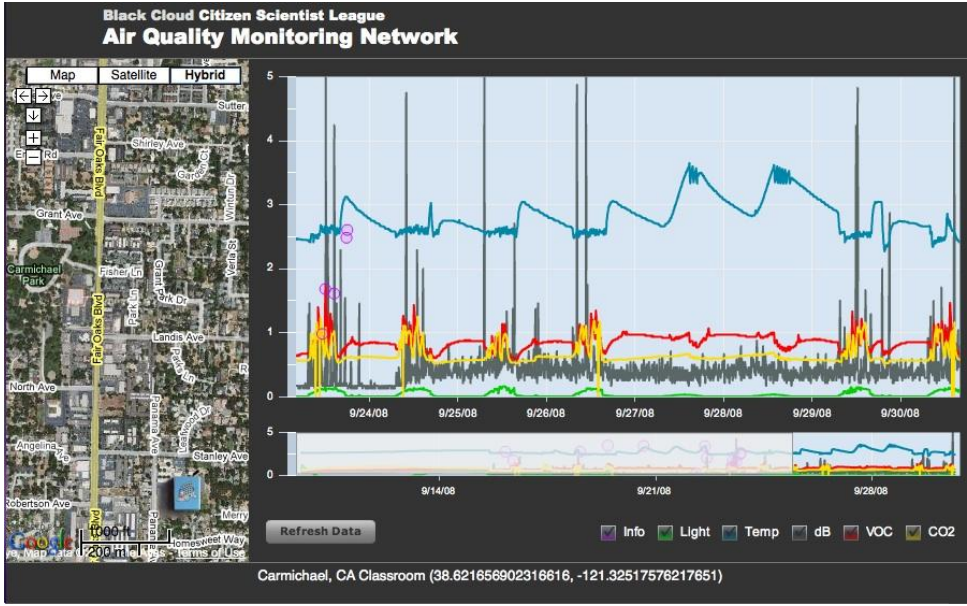
Future: Hyper-local, high-resolution



Aclima's University Origins: 2007 - 2010

UC San Diego

Berkeley
UNIVERSITY OF CALIFORNIA



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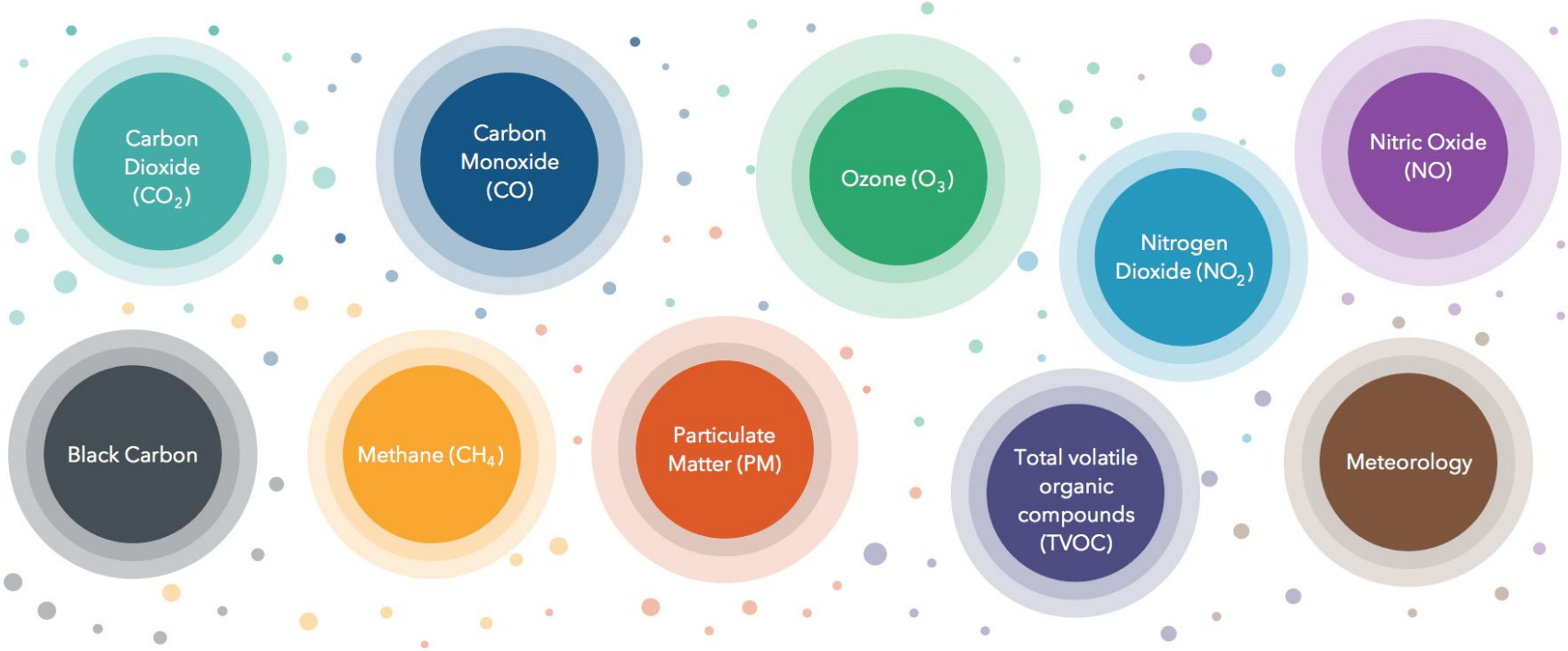
aclima™ | Technology + Science

Aclima Technology

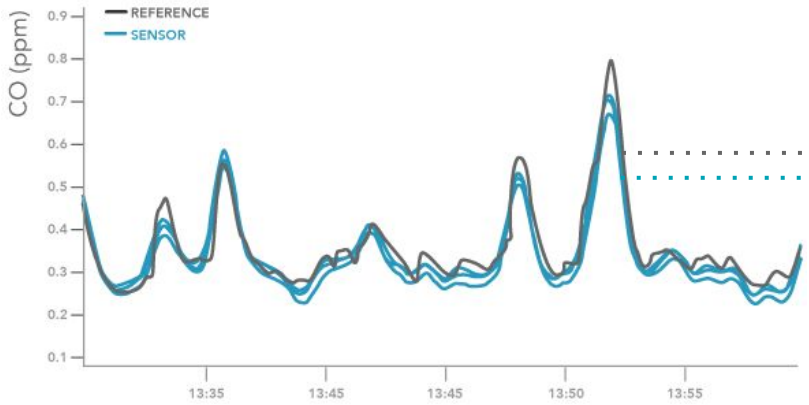
What we measure

All major air pollutants and GHGs



Best-in-Class Performance

Equivalent Performance



REFERENCE
High-Cost, Low-Density

SENSOR
Low-Cost, High-Density

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Aclima Mobile Sensing Devices

For block-by-block resolution, at scale

Mobile

- Active R&D since 2013
- For deployment via moving vehicles to generate high-resolution maps of pollution and GHG emissions at the city-scale.

2018 Mobile Node in Passenger Vehicle

2018 Production Mobile Node

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Google Announces Global Scaling with Aclima

09.12.18 | WORLD CHANGING IDEAS

Google Street View cars are now mapping pollution around the world

Pollution can vary block to block–and now Google is helping track that info in cities like Houston and Mexico City.

Screenshot

[Image: Google]

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Unprecedented Mapping Capabilities

This is direct measurement at unprecedented hyperlocal resolution, NOT modeled output.

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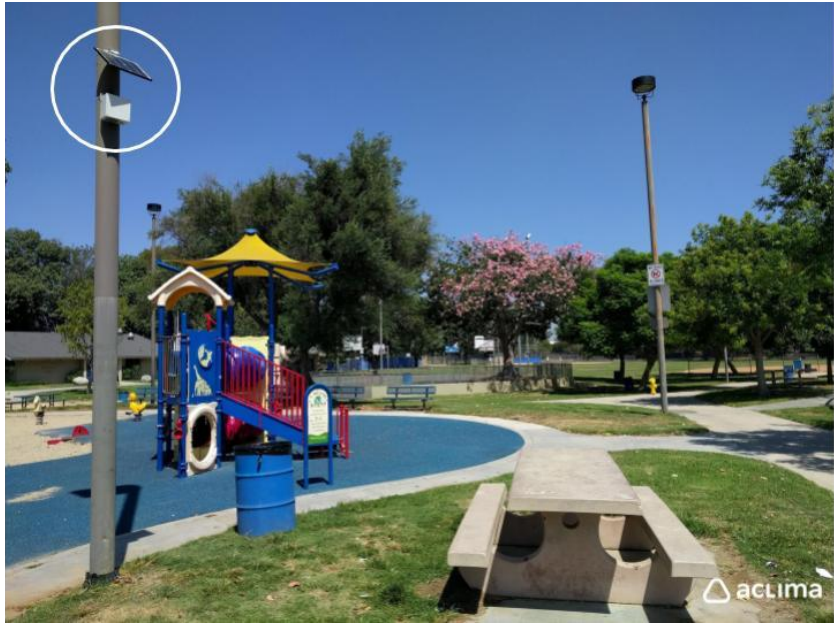
Aclima Stationary Sensing Devices

For real-time sensing in hotspots and fencelines

Outdoor

- Active R&D since 2013
- For long-term stationary deployments in outdoor locations, in urban and industrial settings, powering real-time information products.



Science

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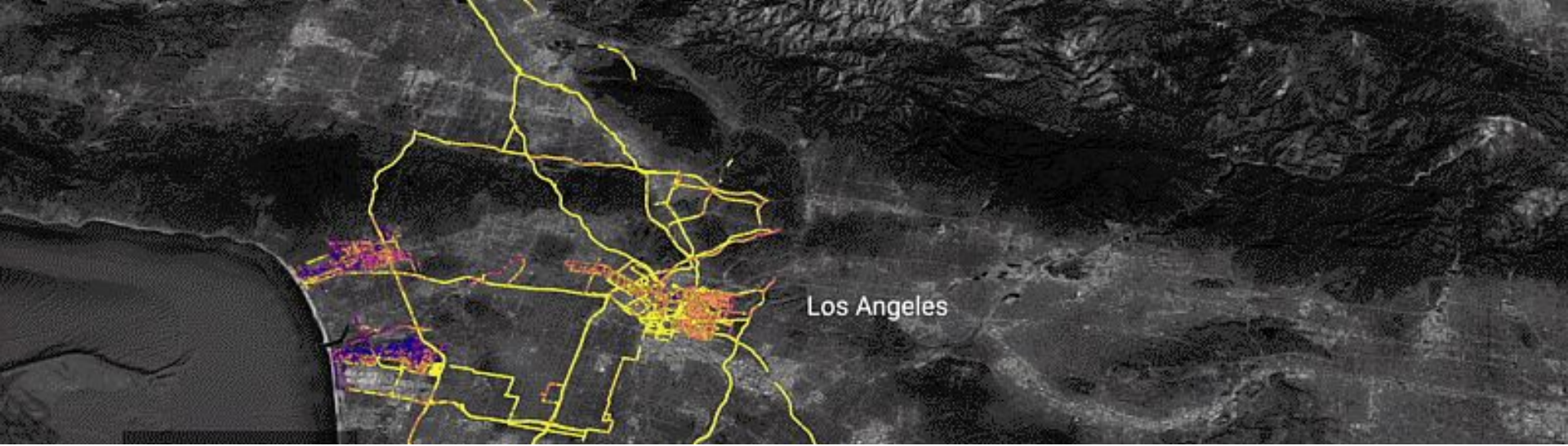

Example air quality map based on data collected in Los Angeles, CA.
Visit blog.aclima.io/data stories to see our insights.

Data insights from California cities

100,000 MILES

CALIFORNIA DRIVING

1+ BILLION

DATA POINTS COLLECTED

O_3 NO NO_2 BC PM2.5 CH_4

POLLUTANTS MEASURED

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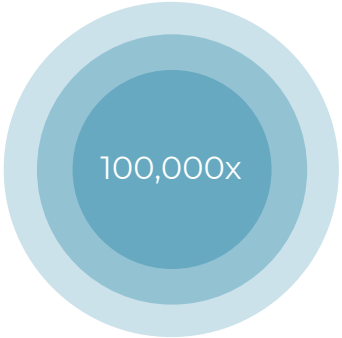
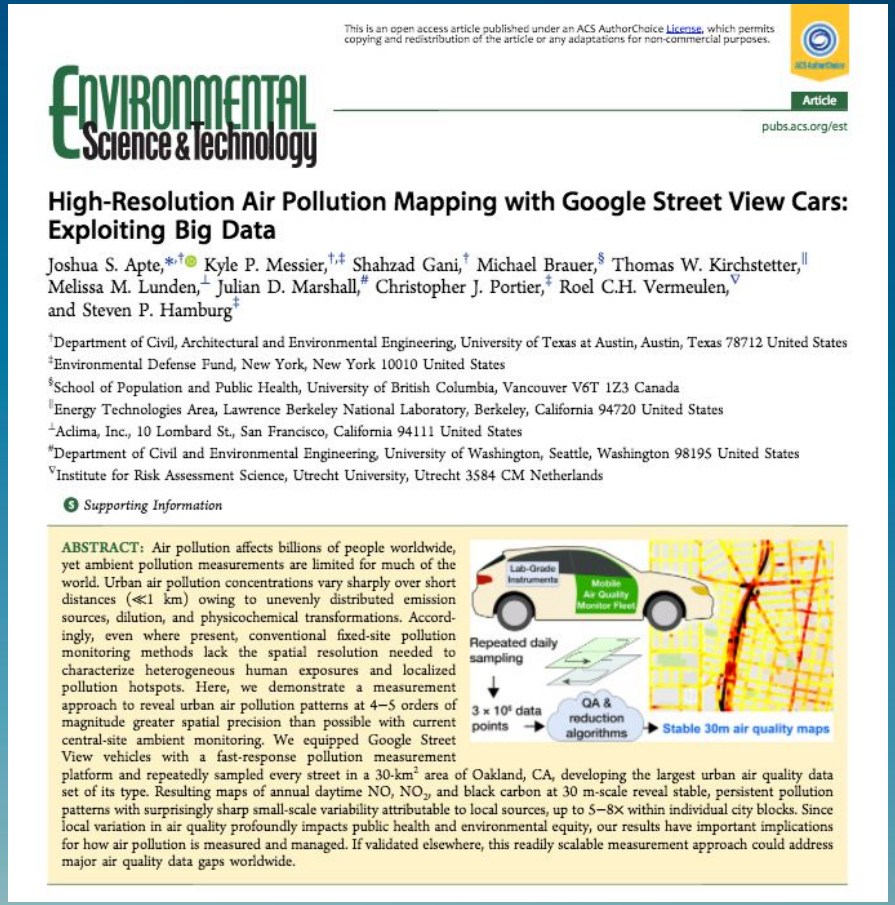
Pollution is hyperlocal

June 5, 2017: Breakthrough results of year-long mapping campaign in Oakland done by Aclima, Google, EDF and UT.

Validates mobile, high-resolution measurement methods as scientifically valid and globally scalable. Reveals that urban air pollution is more variable than previously known, with air quality changing over the course of a city block.



Aclima generates 10,000 to 100,000 times greater spatial resolution than current methods



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Environmental Science & Technology

Article

pubs.acs.org/est

High-Resolution Air Pollution Mapping with Google Street View Cars: Exploiting Big Data

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Supporting Information

ABSTRACT: Air pollution affects billions of people worldwide, yet ambient pollution measurements are limited for much of the world. Urban air pollution concentrations vary sharply over short distances (≪1 km) owing to unevenly distributed emission sources, dilution, and physicochemical transformations. Accordingly, even where present, conventional fixed-site pollution monitoring methods lack the spatial resolution needed to characterize heterogeneous human exposures and localized pollution hotspots. Here, we demonstrate a measurement approach to reveal urban air pollution patterns at 4−5 orders of magnitude greater spatial precision than possible with current central-site ambient monitoring. We equipped Google Street View vehicles with a fast-response pollution measurement platform and repeatedly sampled every street in a 30-km^2 area of Oakland, CA, developing the largest urban air quality data set of its type. Resulting maps of annual daytime NO, NO_2, and black carbon at 30 m-scale reveal stable, persistent pollution patterns with surprisingly sharp small-scale variability attributable to local sources, up to 5−8× within individual city blocks. Since local variation in air quality profoundly impacts public health and environmental equity, our results have important implications for how air pollution is measured and managed. If validated elsewhere, this readily scalable measurement approach could address major air quality data gaps worldwide.

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Air quality can change over the course of a block

Aclima data powers new science: Higher cardiovascular risk from local pollution

Alexeeff et al. Environmental Health (2018) 17:38
https://doi.org/10.1186/s12940-018-0382-1

Environmental Health

RESEARCH Open Access

High-resolution mapping of traffic related air pollution with Google street view cars and incidence of cardiovascular events within neighborhoods in Oakland, CA

Stacey E. Alexeeff[1*], Ananya Roy[2], Jun Shan[1], Xi Liu[1], Kyle Messier[2,3], Joshua S. Apte[3], Christopher Portier[2], Stephen Sidney[1] and Stephen K. Van Den Eeden[1]

Abstract

Background: Some studies have linked long-term exposure to traffic related air pollutants (TRAP) with adverse cardiovascular health outcomes; however, previous studies have not linked highly variable concentrations of TRAP measured at street-level within neighborhoods to cardiovascular health outcomes.

Methods: Long-term pollutant concentrations for nitrogen dioxide [NO_2], nitric oxide [NO], and black carbon [BC] were obtained by street-level mobile monitoring on 30 m road segments and linked to residential addresses of 41,869 adults living in Oakland during 2010 to 2015. We fit Cox proportional hazard models to estimate the relationship between air pollution exposures and time to first cardiovascular event. Secondary analyses examined effect modification by diabetes and age.

Results: Long-term pollutant concentrations [mean, (standard deviation; SD)] for NO_2, NO and BC were 9.9 ppb (SD 3.8), 4.9 ppb (SD 3.8), and 0.36 μg/m3 (0.17) respectively. A one SD increase in NO_2, NO and BC, was associated with a change in risk of a cardiovascular event of 3% (95% confidence interval [CI] -6% to 12%), 3% (95% CI -5% to 12%), and – 1% (95% CI -8% to 7%), respectively. Among the elderly (≥65 yrs), we found an increased risk of a cardiovascular event of 12% for NO_2 (95% CI: 2%, 24%), 12% for NO (95% CI: 3%, 22%), and 7% for BC (95% CI: -3%, 17%) per one SD increase. We found no effect modification by diabetes.

Conclusions: Street-level differences in long-term exposure to TRAP were associated with higher risk of cardiovascular events among the elderly, indicating that within-neighborhood differences in TRAP are important to cardiovascular health. Associations among the general population were consistent with results found in previous studies, though not statistically significant.

Keywords: Air pollution, Cardiovascular disease, Coronary heart disease, Mortality, Mobile monitoring

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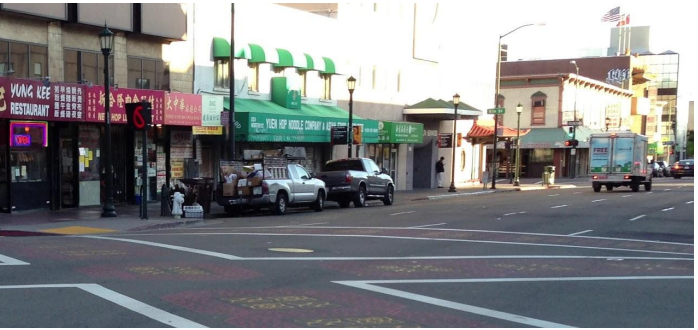
Highlighting overlooked neighborhoods

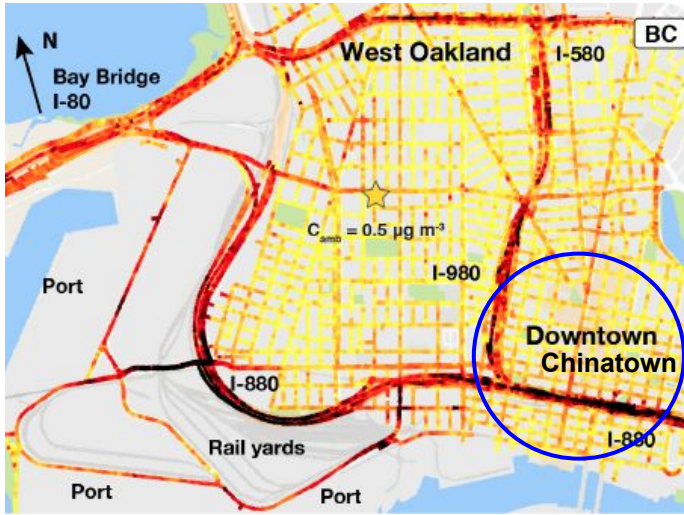
Some regions are established regions of concern

The Port of Oakland has visible and well-known emissions sources, and agencies have targeted reduction policies.



Others have been overlooked

Idling commercial vehicles loading and unloading in Chinatown create a region of elevated pollutant concentrations, and no reduction efforts in place.



Aclima for Communities

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Benefits of Hyper-local Air Monitoring

IDENTIFY EMISSIONS SOURCES

TRACK PROGRESS

INFORM THE PUBLIC

SCREEN FOR PROBLEMS

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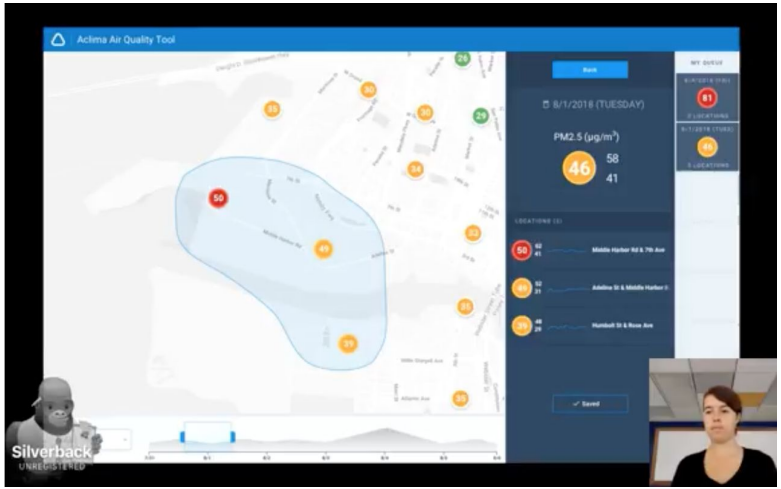
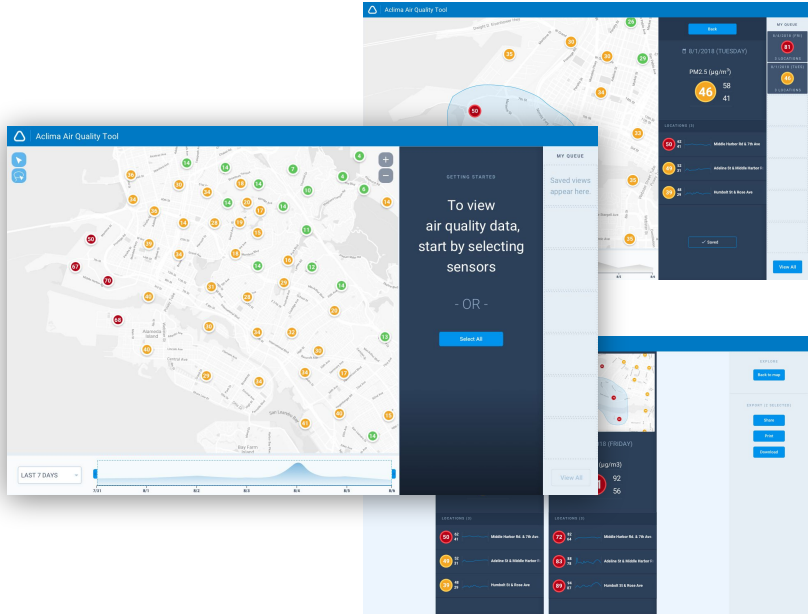
Aclima for Communities: Portal Development





Citizen-driven design process, across user types

Citizen-defined user features

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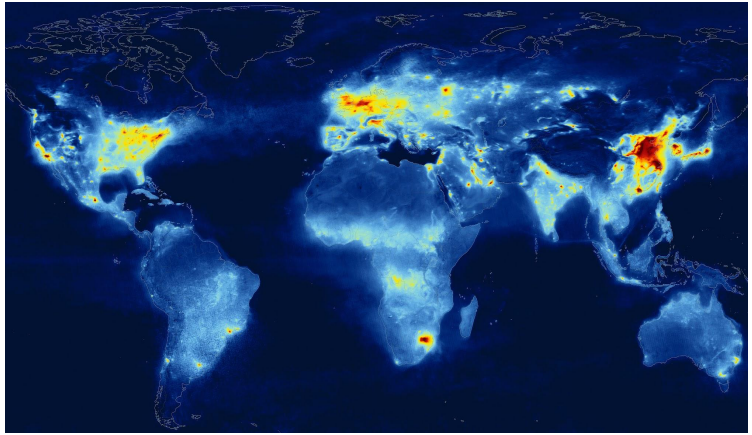
A Shared Vision

Working together for healthy communities and a healthy planet

Local Innovation...

.... Global Impact



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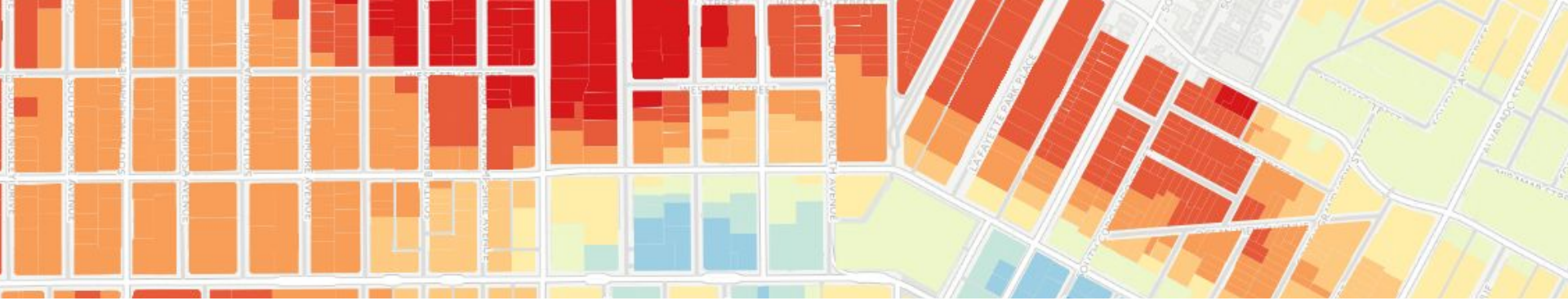
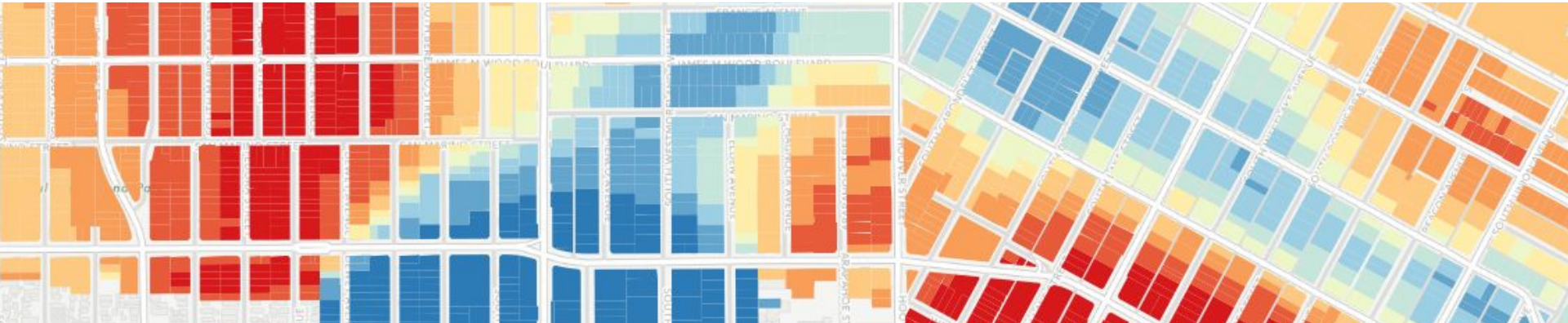
Q&A



Thank You