Outdoor air quality in the Marshall Fire burn areas in the weeks following the event

Converge Virtual Forum
February 17, 2022

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Photo: Matt Coggon

NOAA/NASA FIREX-AQ

Extensive research efforts measuring emissions, transformations, and air quality impacts of wildfires

- Aircraft, Mobile, Ground, Laboratory & Satellites

Marshall Fire - 6,026 acres burned

Most destructive property damage in CO history

- 1085 homes destroyed; 149 damaged
- 7 commercial buildings destroyed; 30 damaged

Marshall Fire = High ratio of structures lost to acres burned compared to other recent, large U.S. fires

Burned material was mainly structures & vehicles rather than vegetation

Photo: Steve Brown

Source: Climate.gov

NOAA Chemical Sciences Laboratory Response

December 30	Marshall Fire
January 4	Local scientists (NOAA, CU, NCAR) discuss response to growing community air quality concerns; CSL communicates capacity to state and county authorities
January 10	NOAA CSL accepts request for support from Colorado Department of Public Health and Environment (CDPHE)
January 11-14	CSL drives mobile laboratory through the burn area
January 14	CSL provides data to CDPHE, Boulder County for public release
January 25	Boulder County press release: No ongoing AQ threat to community

Sampling request to measure outdoor air quality came two weeks after the fire

NOAA CSL Mobile Laboratory


Photo:Jessica GIlman

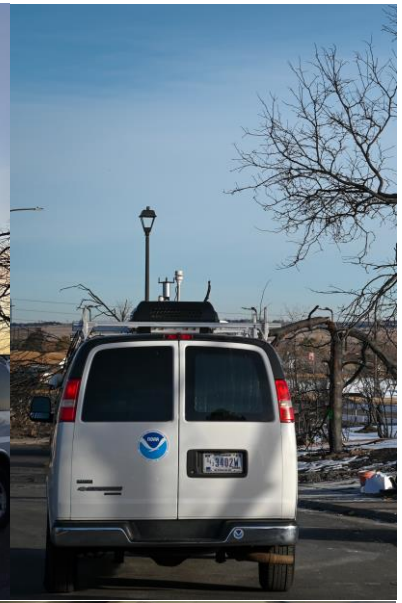



Photo: Chelsea Thompson

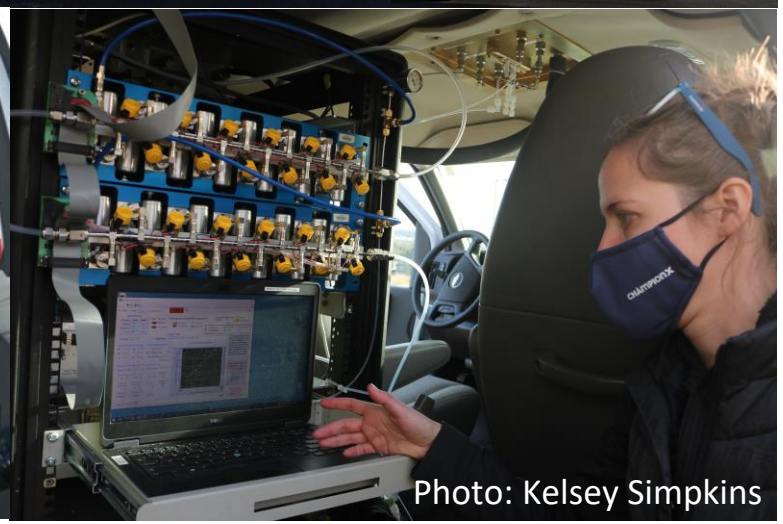


Photo: Kelsey Simpkins

Instrumentation

- Proton Transfer Reaction Mass Spectrometer (> 300 VOCs, 1 s resolution)
- Whole Air Samples (highly speciated VOCs)
- Ozone, Carbon Monoxide, Greenhouse Gases
- Particle size distribution
- Meteorological (winds) & GPS Data

Tracers

A tracer is a compound unique to specific sources that persists in the atmosphere for weeks to months

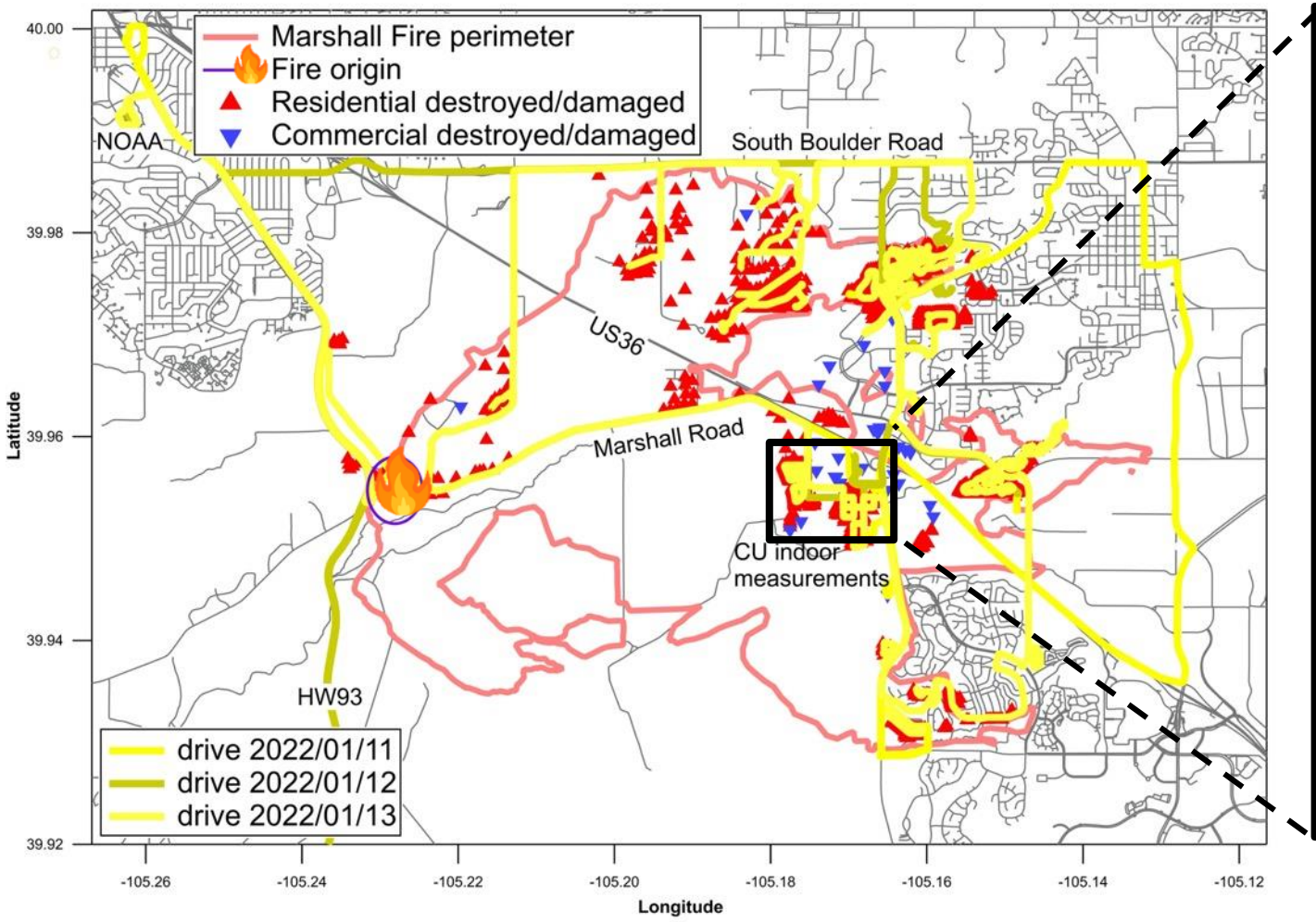
- Urban/Traffic: benzene, toluene
- Fire: acetonitrile, pyrrole, benzene
- Personal care products: D5 siloxane

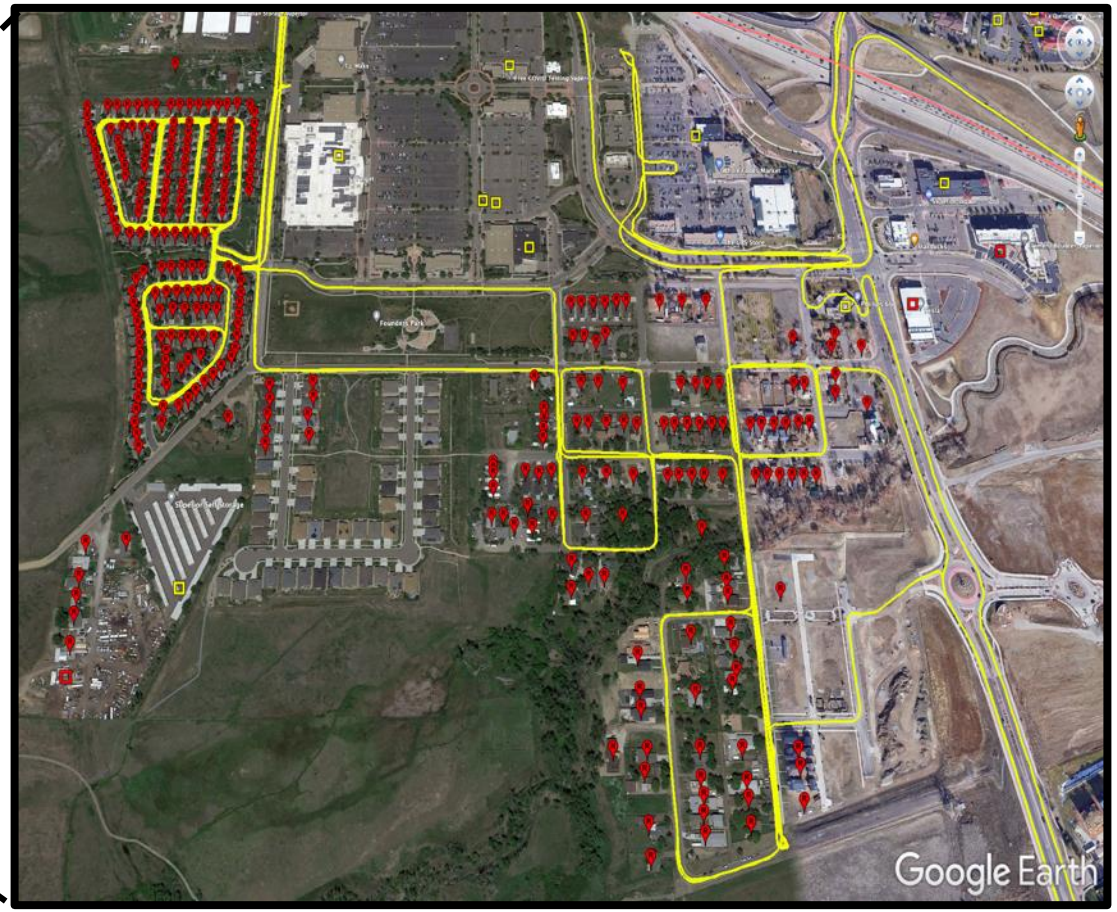
Hazardous Air Pollutants

- BTEX, acrolein, + many more

Rapidly measure hundreds of gaseous pollutants at low detection limits

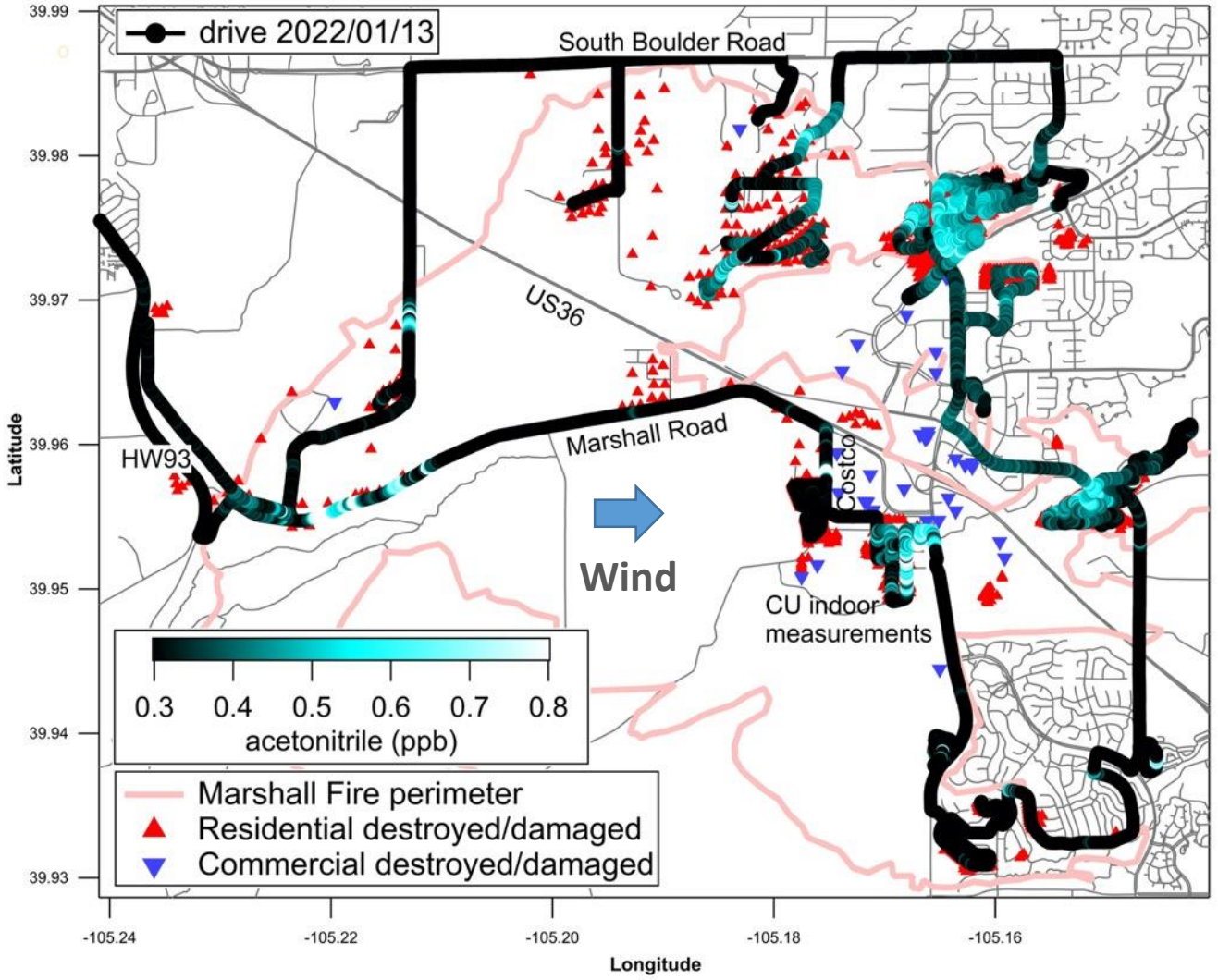
All burn locations sampled during January 11-13th





Sampled street-by-street, house-by-house where accessible

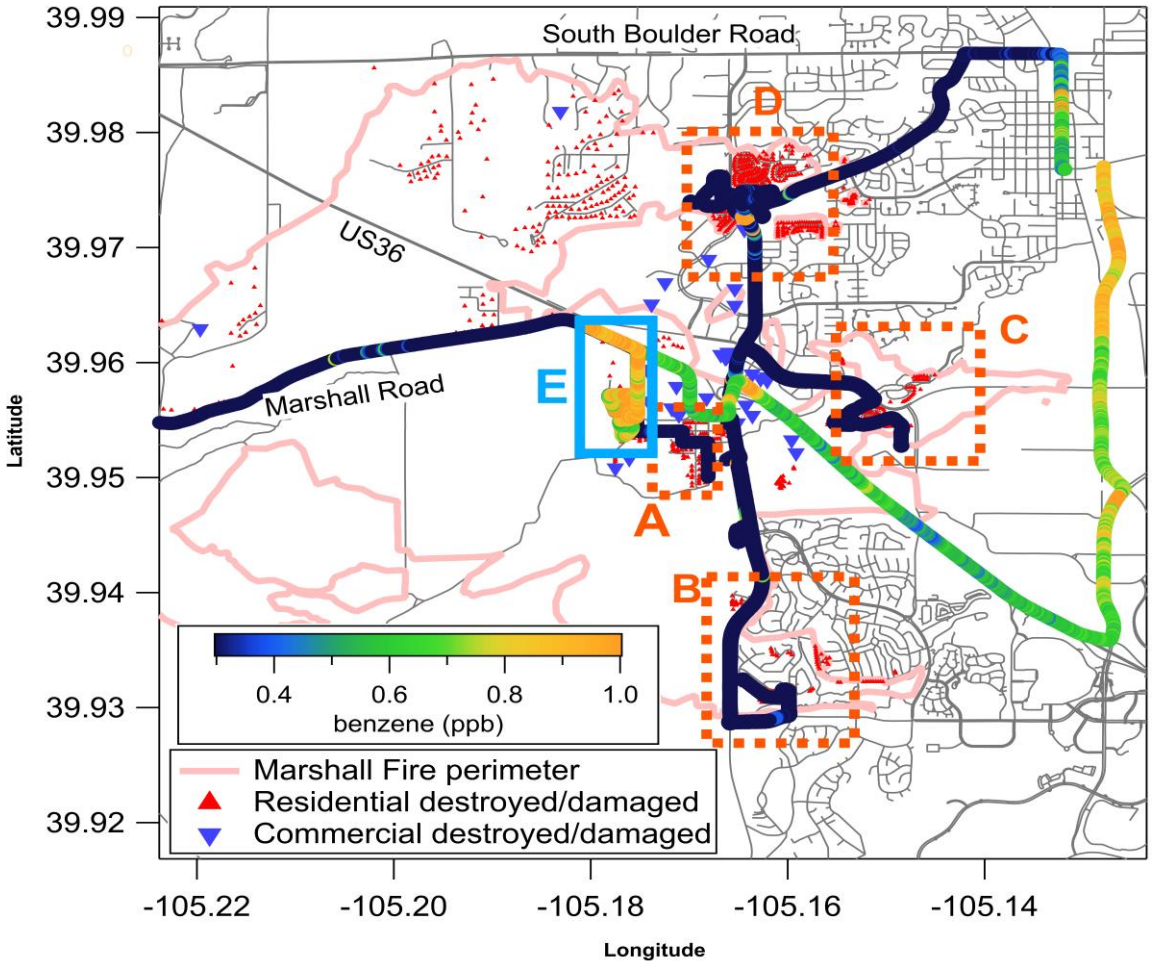
Acetonitrile – *Chemical Tracer of Fire*

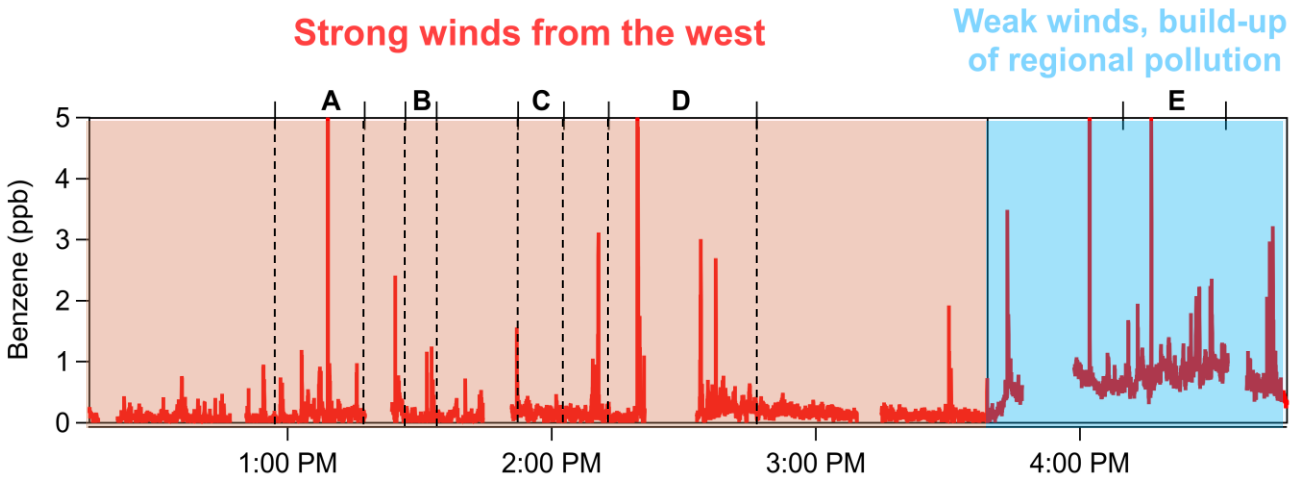


- Fires emit a complex mixture of gases and particles
- A tracer is a compound unique to specific sources that persists in the atmosphere for weeks to months; **Acetonitrile** = fire tracer
- Enhancements are primarily observed in the burn neighborhoods
- Small enhancements, as expected without continual smoldering
- 100× lower than levels observed in fresh biomass burning smoke (e.g., 2019 FIREX-AQ)

Low levels of fire tracers present in neighborhoods two weeks post burn

Benzene – Hazardous Air Pollutant from both Fires and Traffic

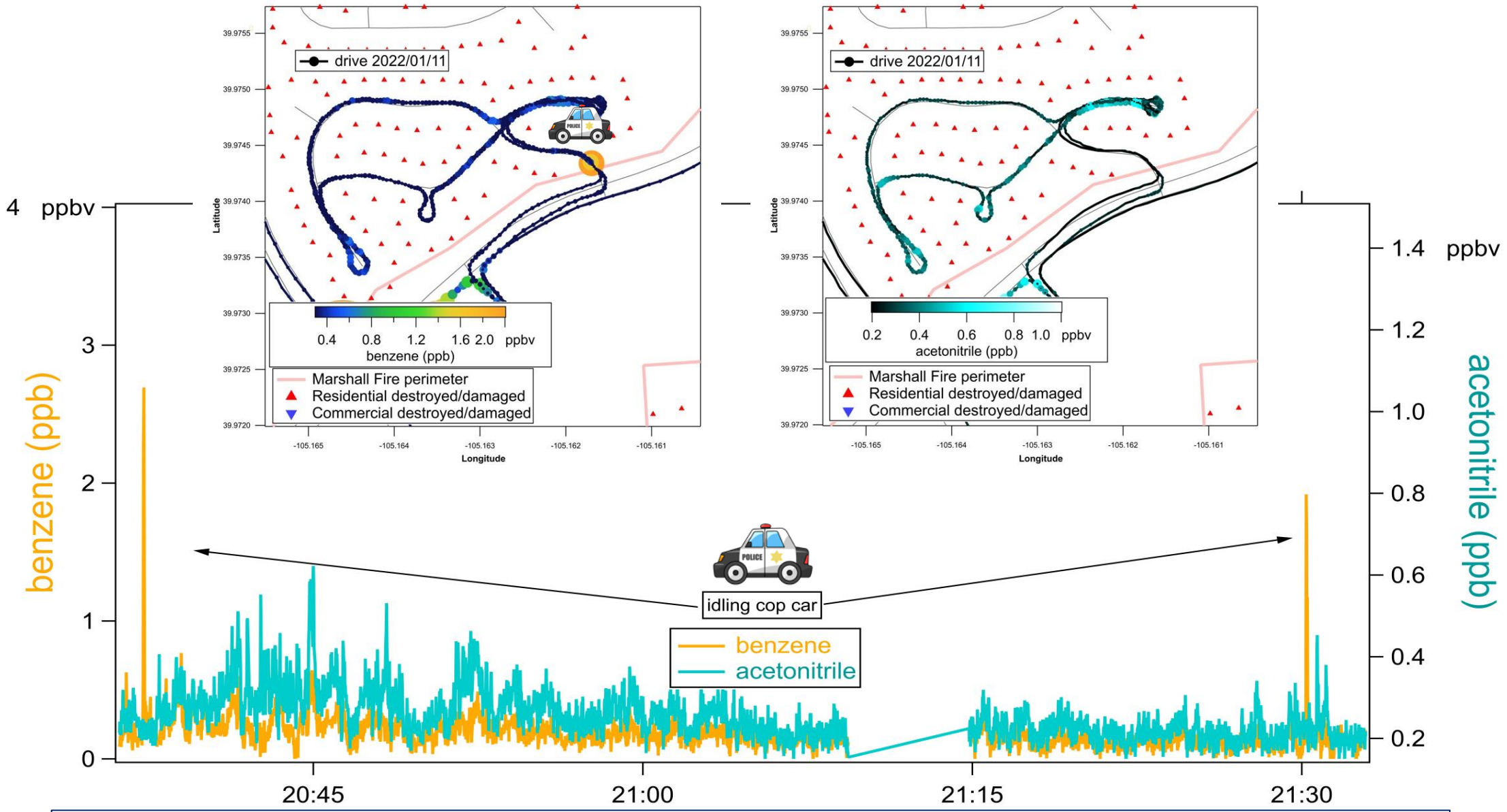




- Benzene enhanced in most neighborhoods, but at levels lower than during wildfire events
- Regional increases from other pollution sources outweigh enhancements from burned buildings
- Other aromatic compounds show similar behavior

Benzene was present in the burned area, but at levels comparable to those from normal urban pollution sources

Small enhancements of acetonitrile and benzene in burned areas



Largest enhancement of benzene was measured from idling police car

Summary and Future Plans

- ***Low levels*** of fire-related gases, including hazardous pollutants, in the burned neighborhoods
- Concentrations were likely higher immediately following the fire
- Measured ***hundreds*** of compounds: ***much*** to learn from these data !
- Unique dataset from an ***understudied***, yet increasingly common emission source
- ***2 drives*** planned within the next month during debris removal

Wildland Urban Interface (WUI) fires are increasingly common, but AQ impacts poorly understood