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Innovation Locks and the Use of Emerging Technologies for Environmental Enforcement

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State of the Art

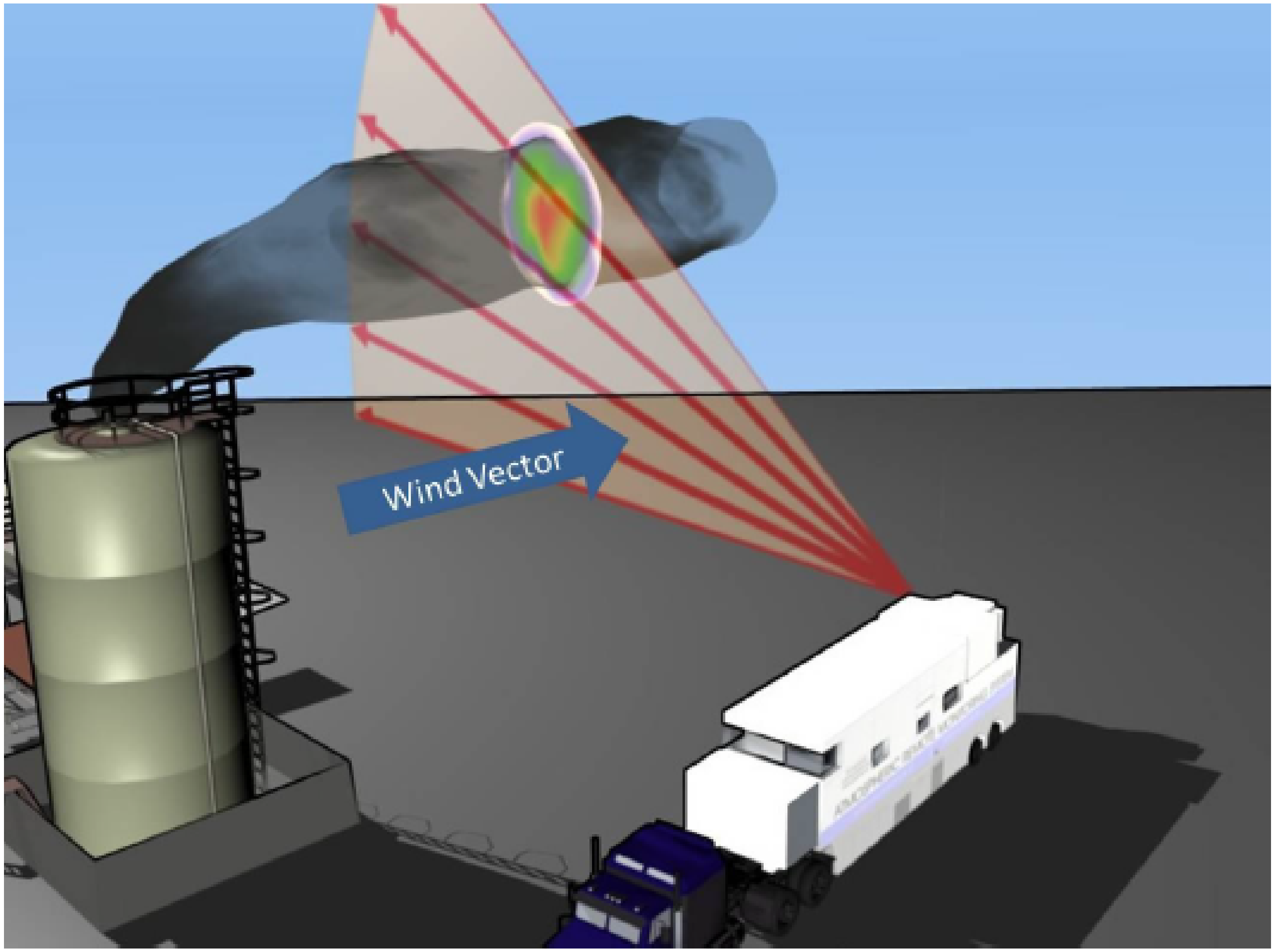
- New technologies now emerge rapidly for environmental detection, monitoring, control and remediation at an accelerating pace

- Examples:
  - Nanoscale materials and technology for environmental remediation and detection
  - Genetically modified organisms used for detection and modification for environmental purposes (Cry9C detection)
  - Drones and UAVs
  - Remote sensing – DIAL, SOF and IR

- One reason – new technologies enable other technologies, leading to a cumulative or even exponential effect

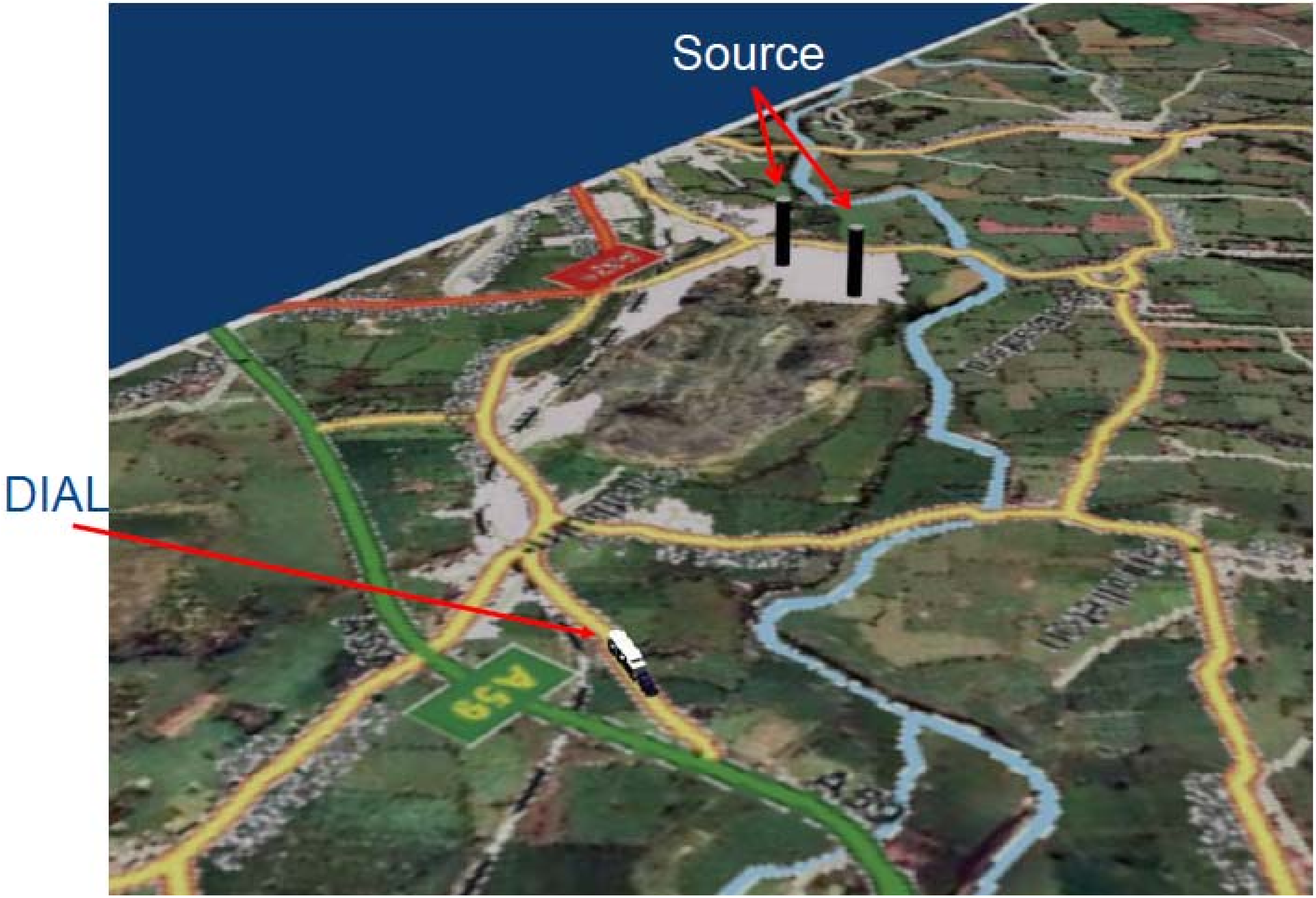
DIAL Measurement Configuration for Emission Rate (Flux) Measurement

- Vertical scans enable plume mapping and flux calculation
- Combine integrated concentration with simple wind field to give flux
- Can measure away from source



Plume Tracking

NPL National Physical Laboratory



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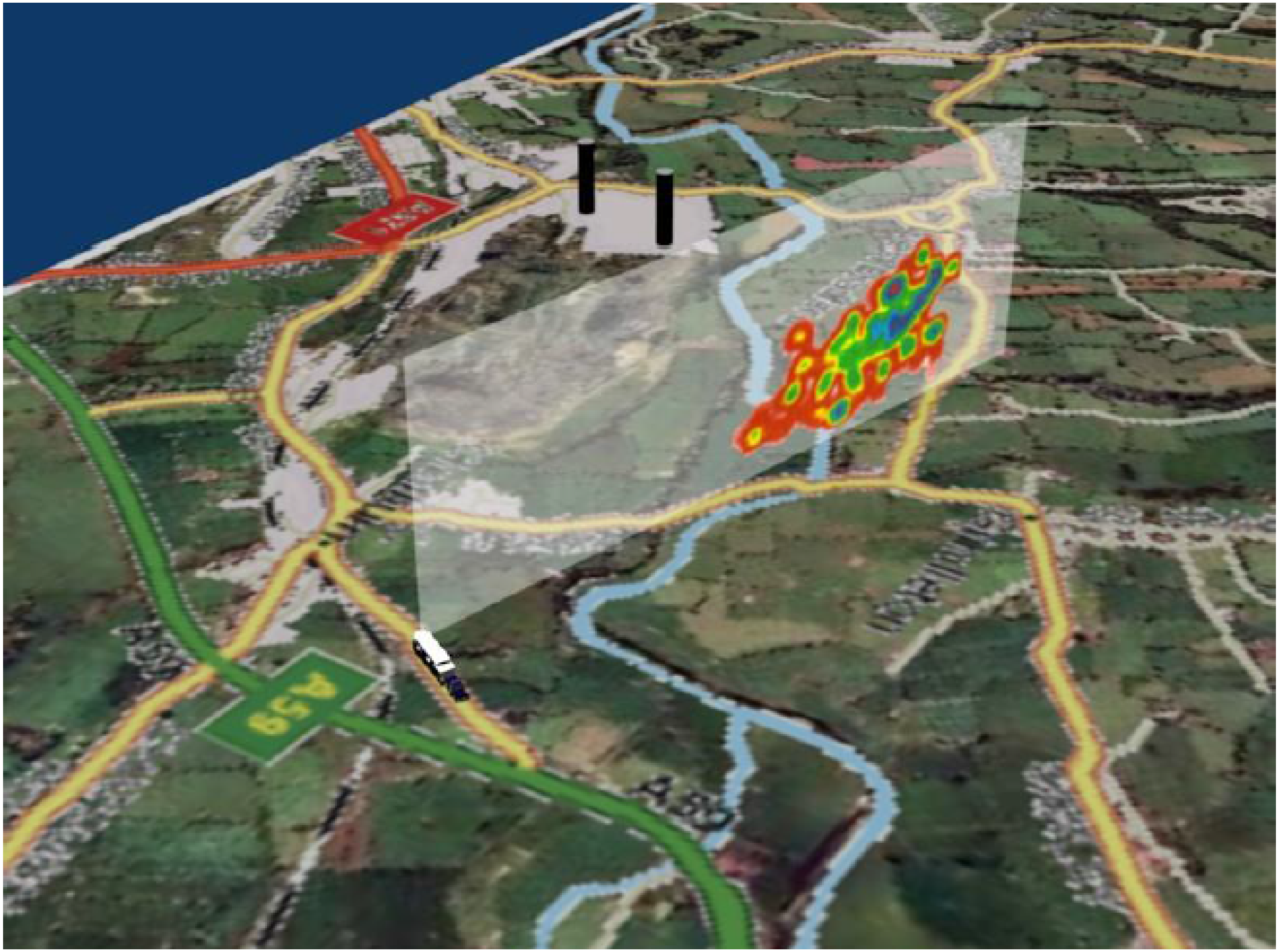

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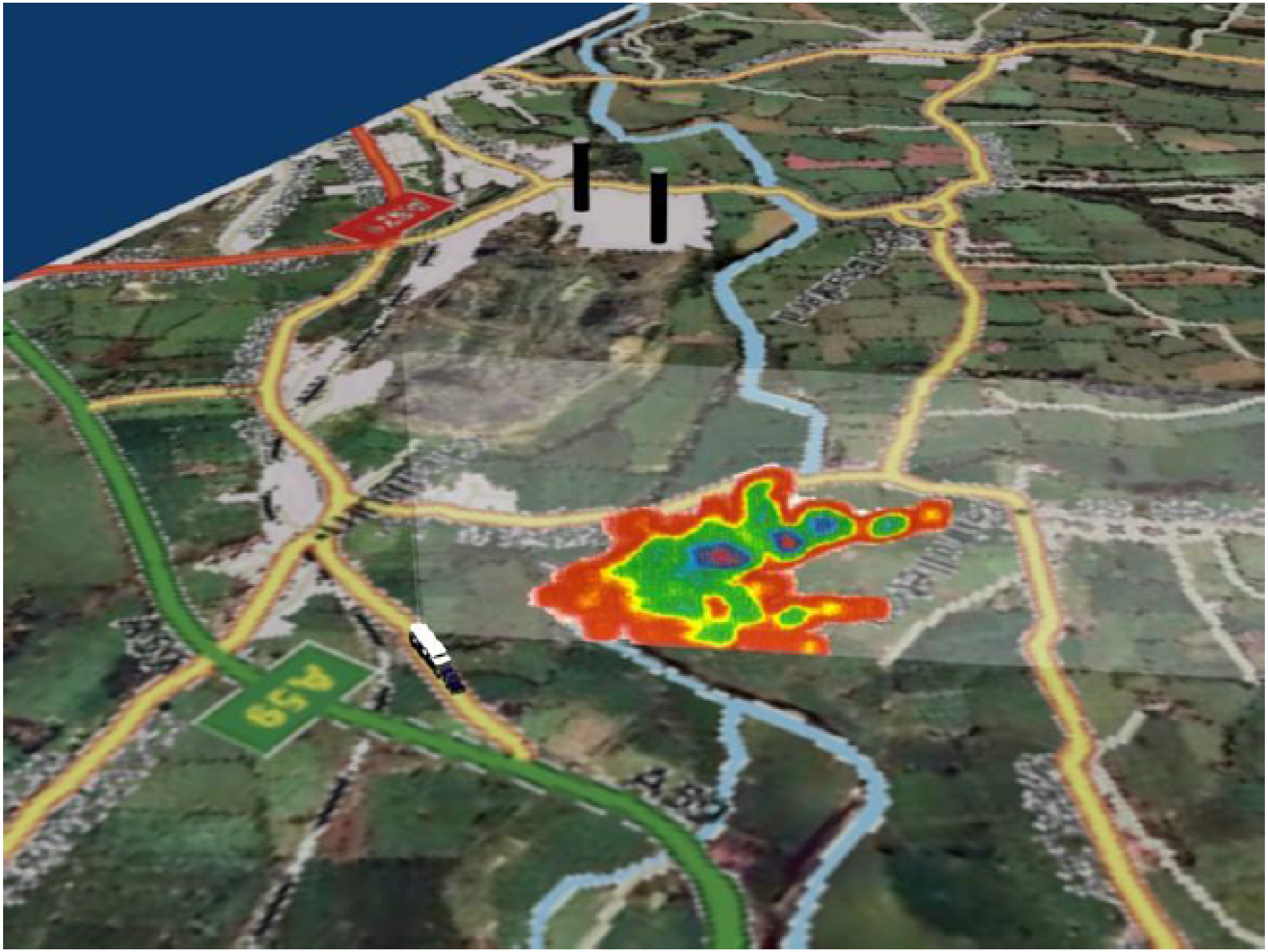

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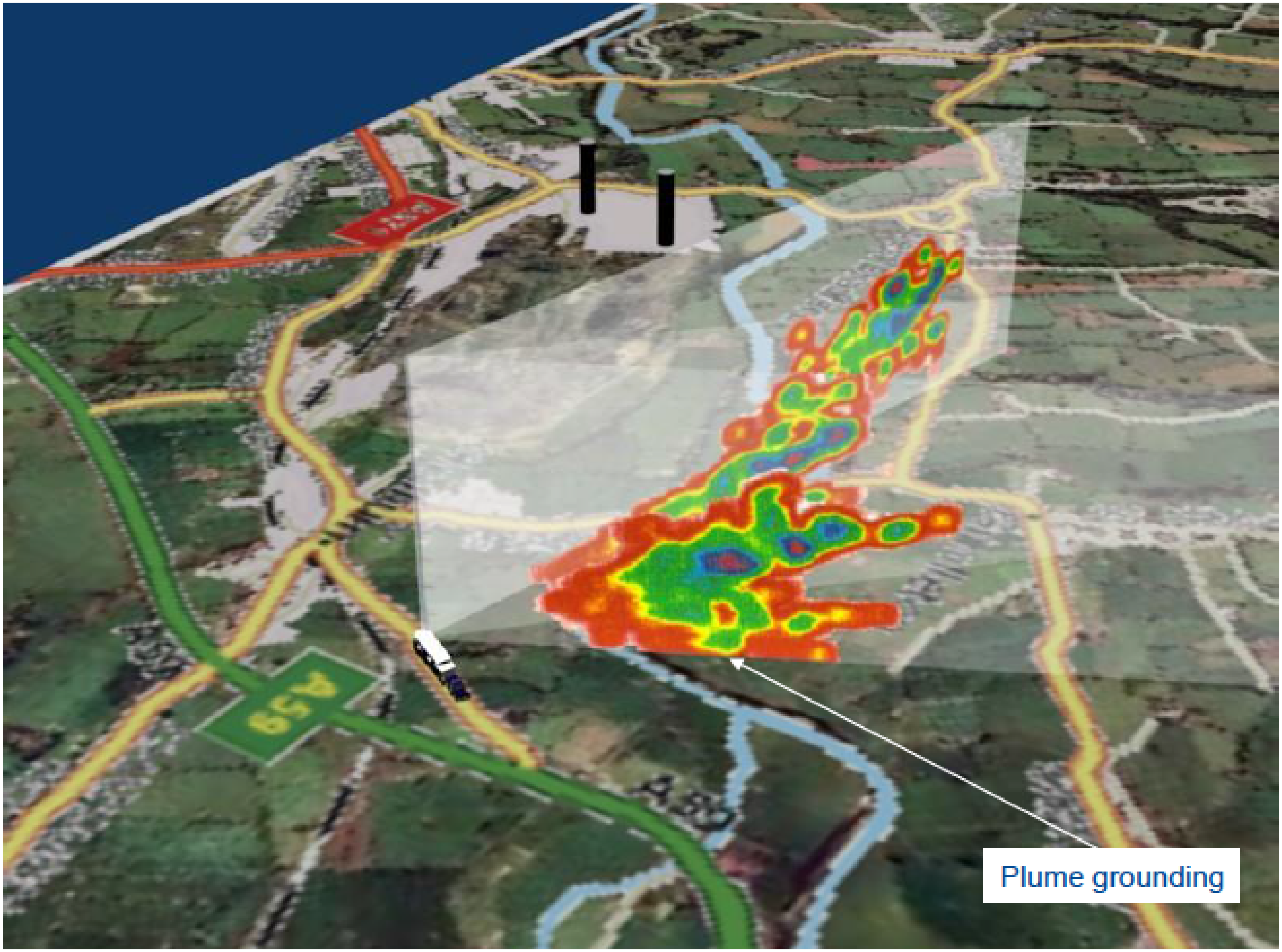


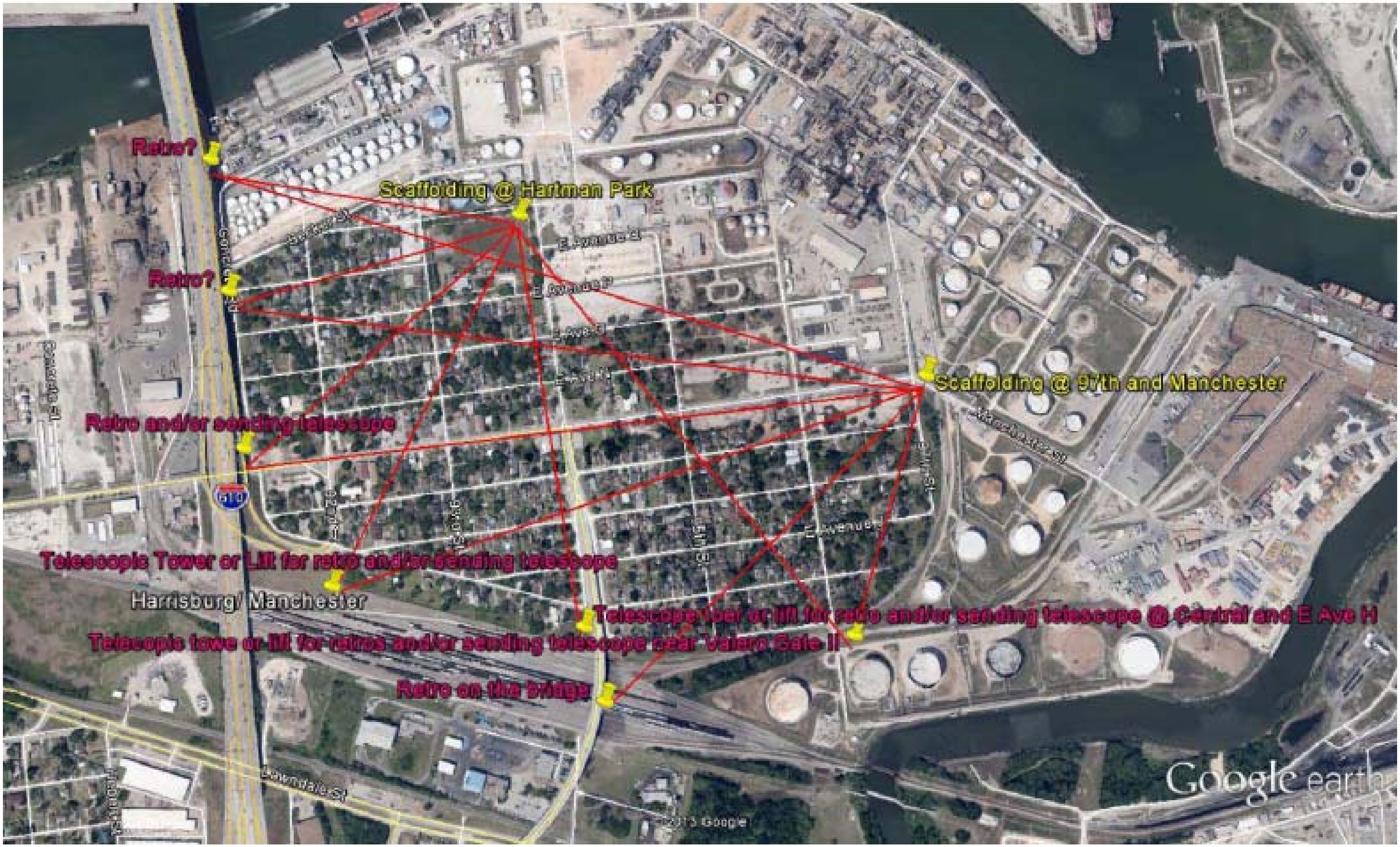
From the front lines: Open-Line Long-Path DOAS

- Measures total amount of substance over a long path using visible or UV light absorption.

- BTEX spectra below 290 nm, so cannot use sunlight. Uses light emitting diodes (LEDs) instead.

- System tested at UCLA and at a refinery in Carson, CA.

Computer-Aided Tomography

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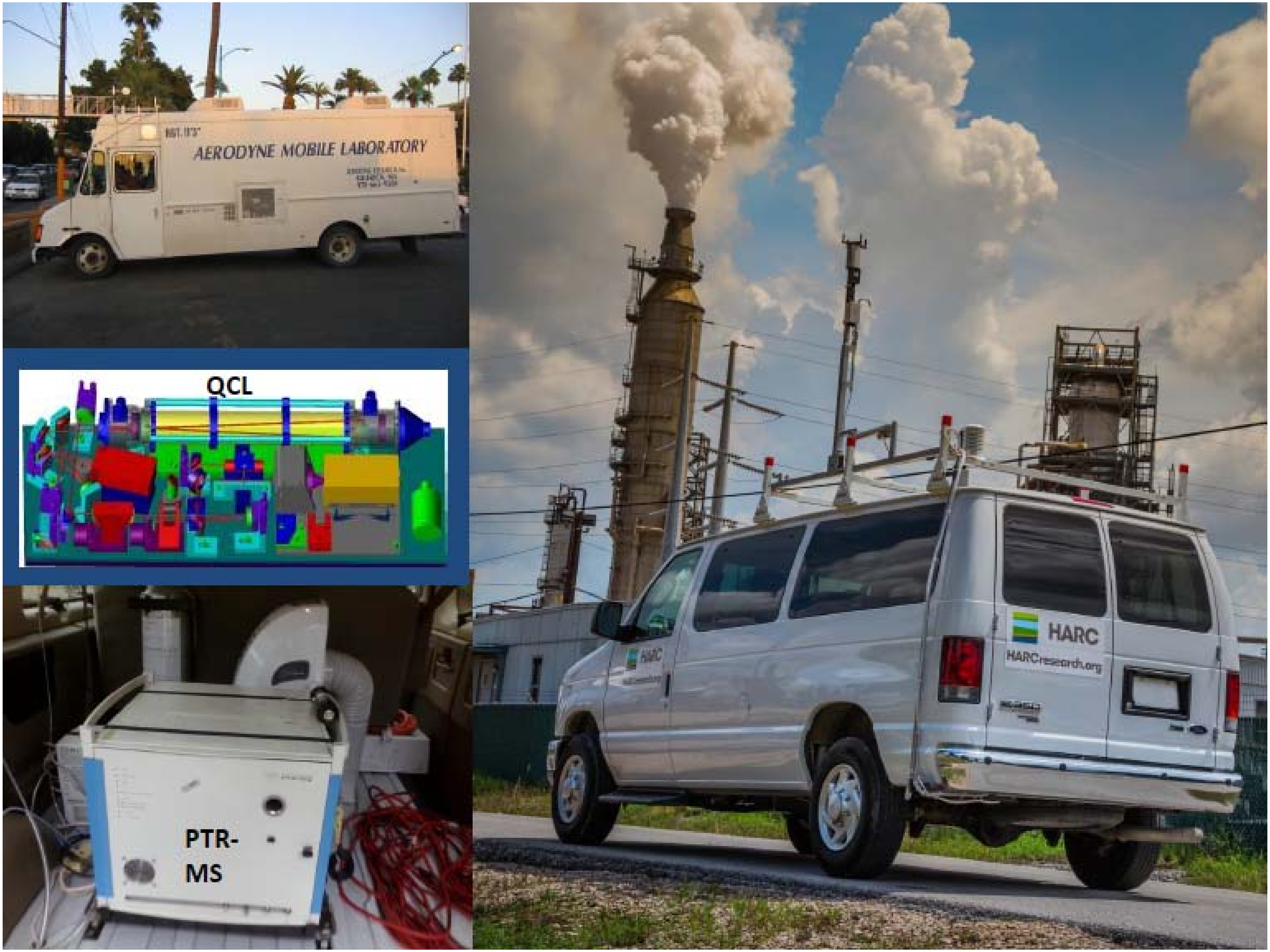
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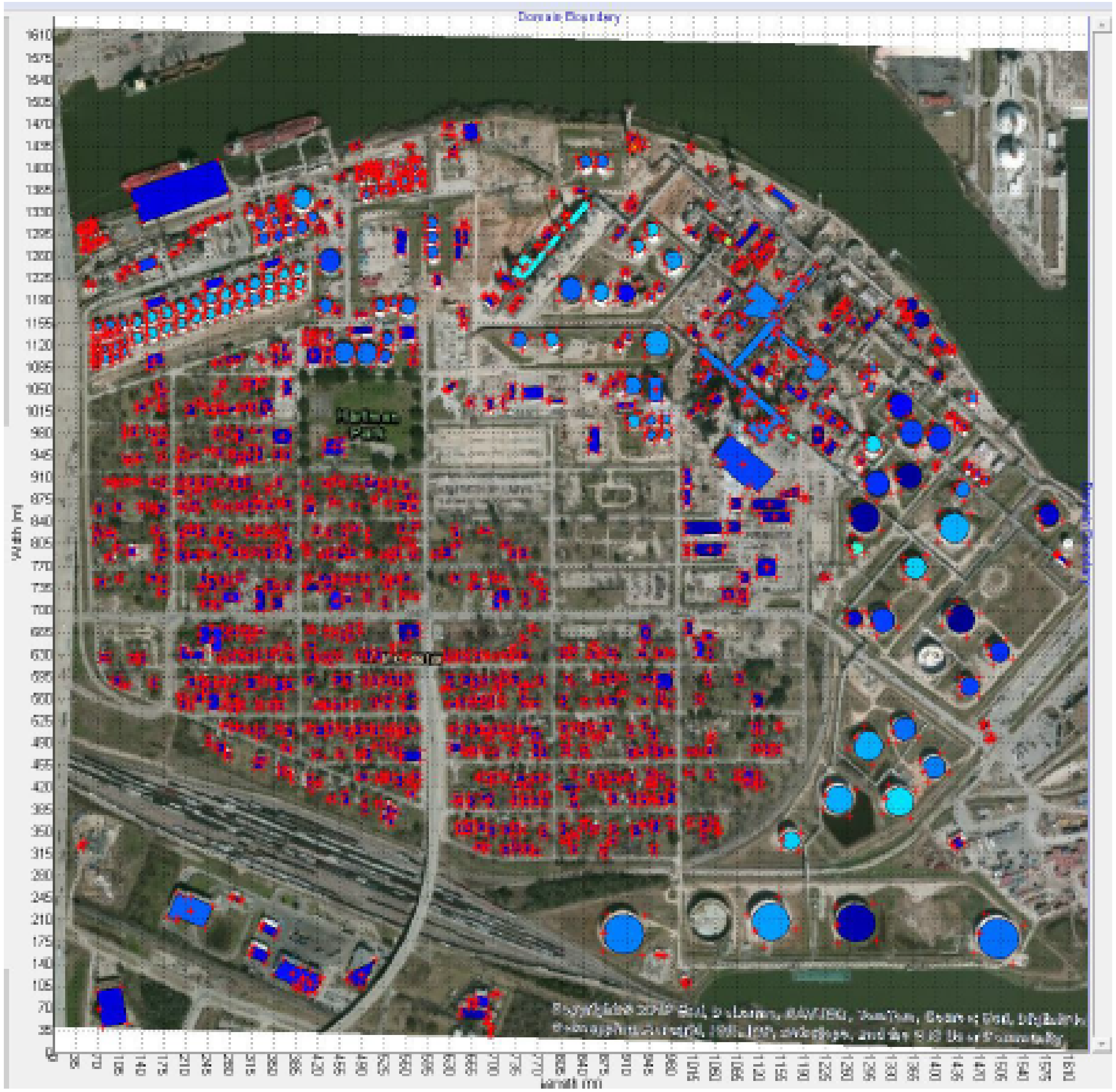
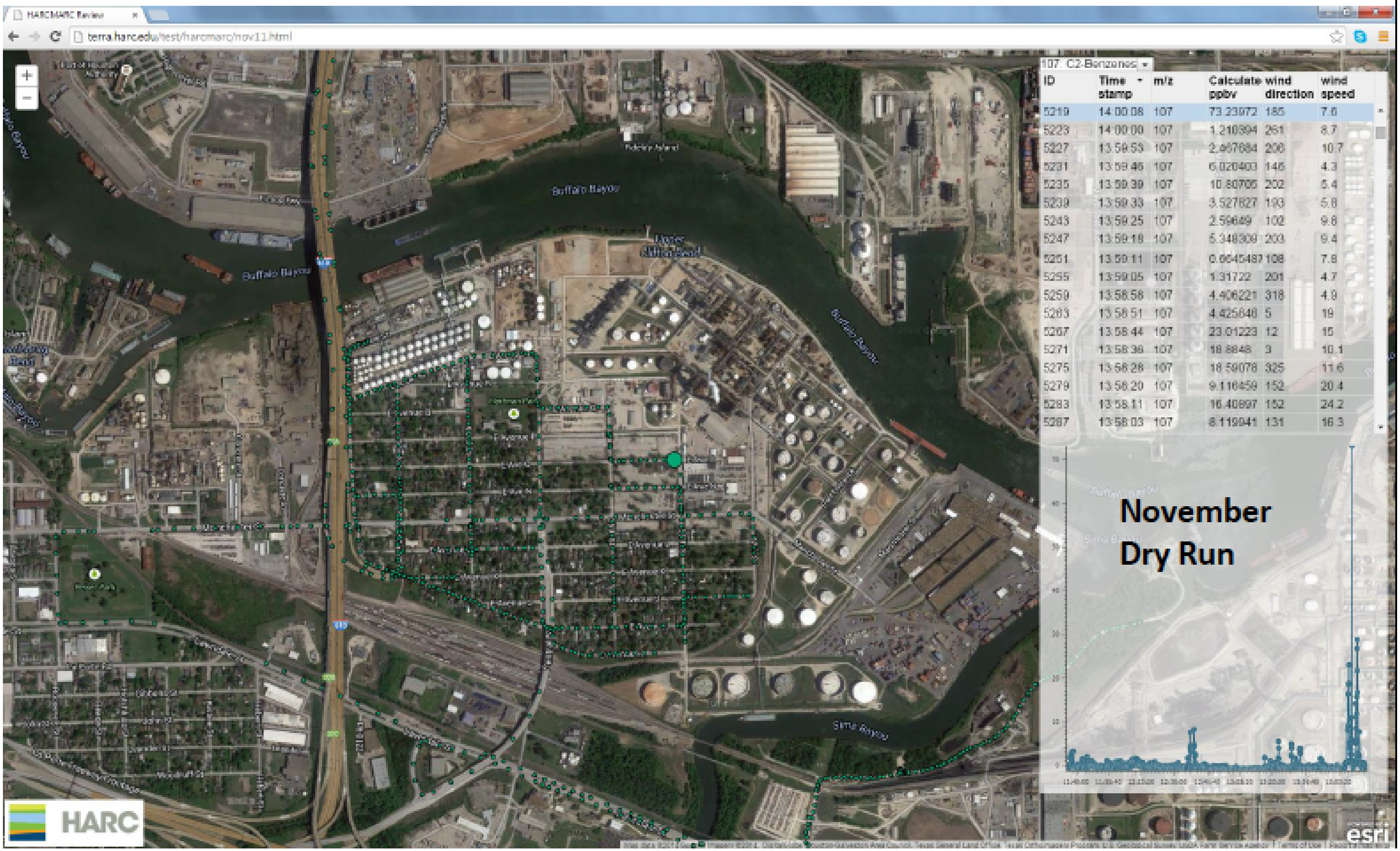
HARC 3D Micro-Scale Model

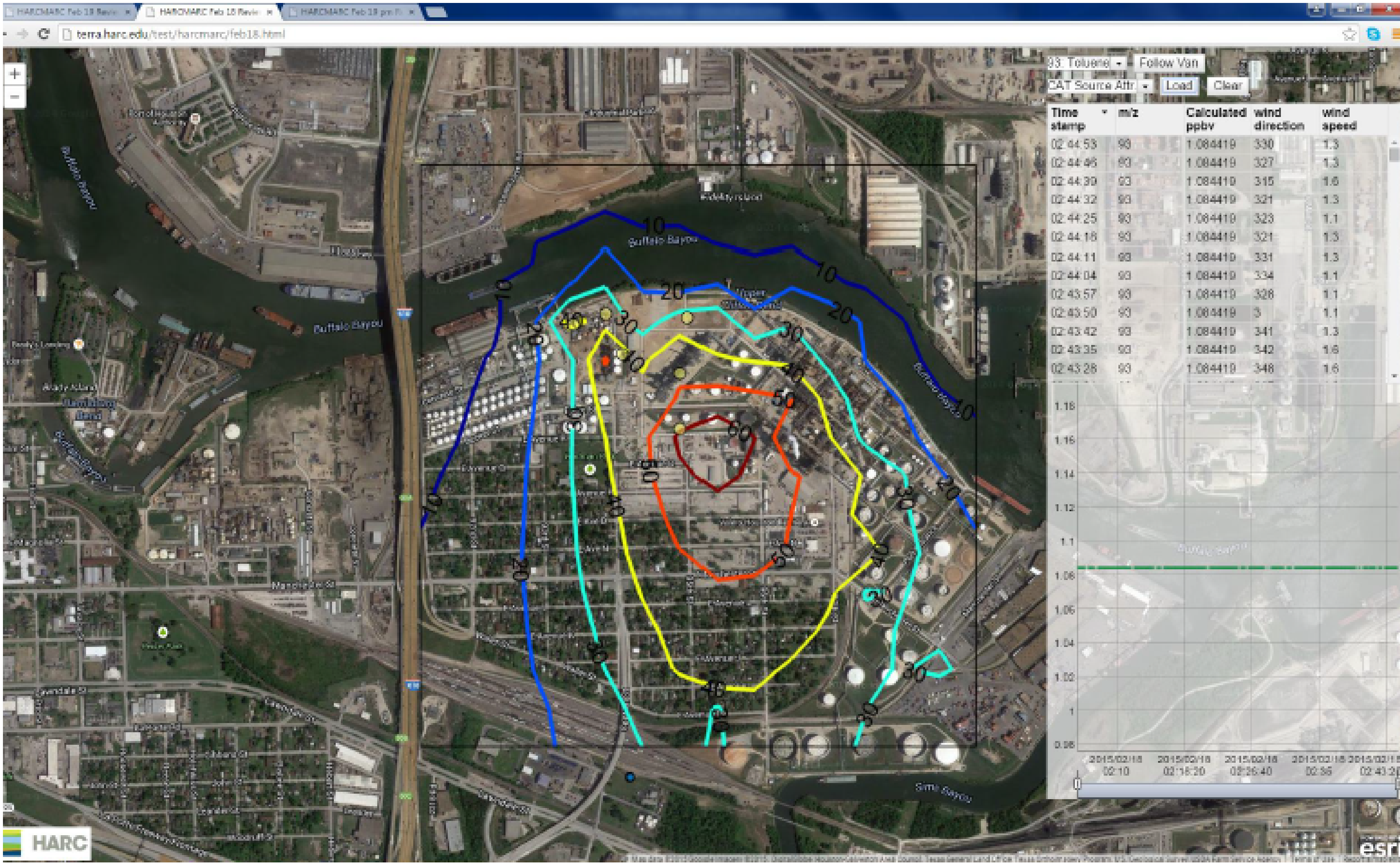
- Neighborhood scale 3D air quality model with its own chemical mechanism (47 gas phase reactions).
- Very high resolution (~20 s time, ~200 m horizontal with chemistry; even higher with passive tracers, e.g. benzene).
- Uses QUIC model and 3D LIDAR building morphology to generate winds based on sparse meteorological observations.
- Forward and inverse mode.
- Real-time source attribution and plume reconstruction (within 30 min to 1 hr of observations).



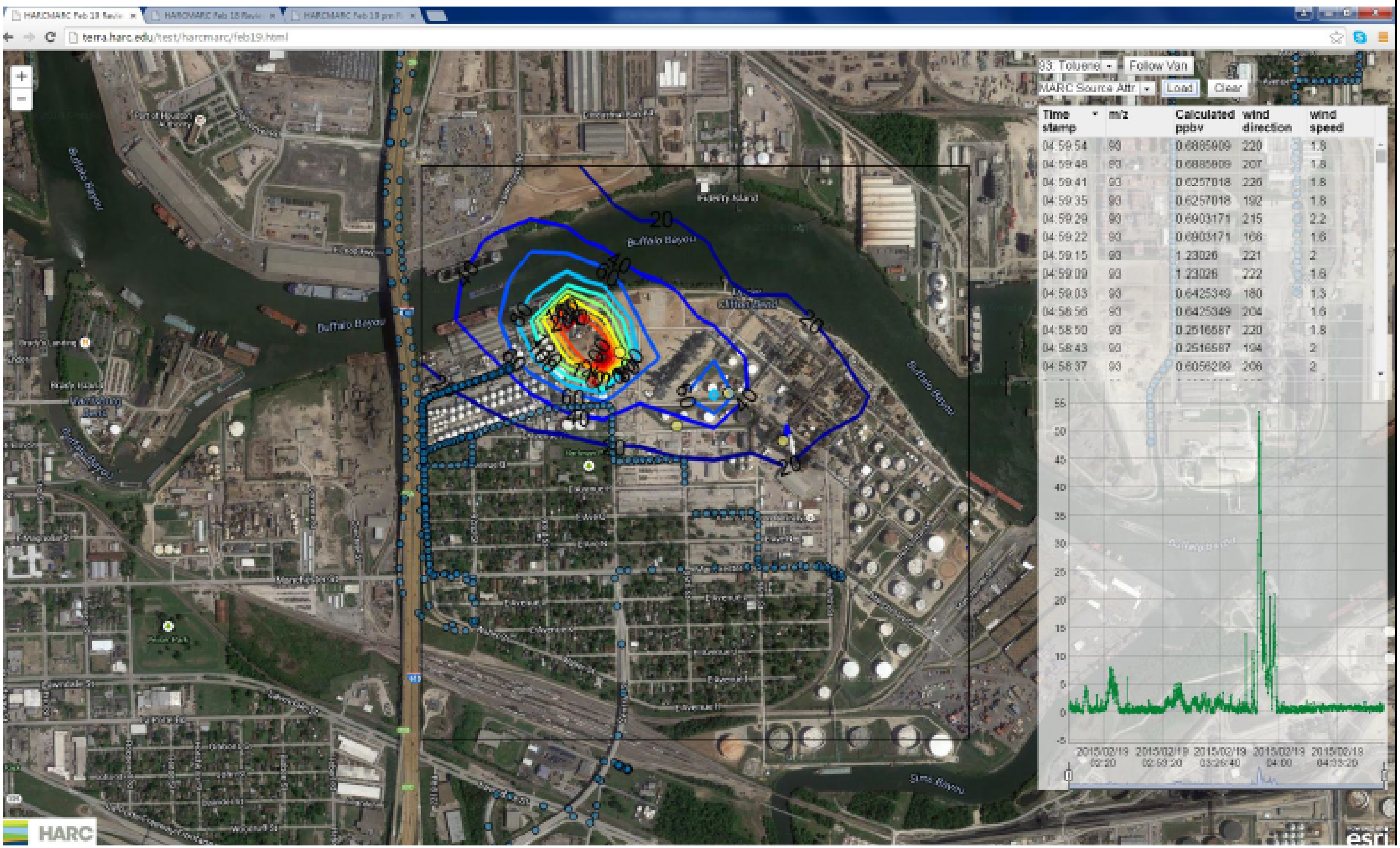
Real Time Data Broadcasting



Toluene CAT Scan, Feb 18 at ~2 am



Mobile Lab Toluene, Feb 19 at ~4 am



Cultured Human Lung Cells

- UNC deployed *in vitro* technique during the BEE-TEX campaign.
- Living lung cells were exposed to polluted air delivered across an air-liquid interface.
- Cell toxicity & inflammation measured based on releases of specific proteins and enzymes.
- Cell responses may indicate exposure to specific classes of pollutants (e.g., aldehydes).

Hypothetical case study – facility operator

- Does current system reward or discourage facility operators who might choose to use open-path DOAS to identify fugitive emissions or uncontrolled sources?
  - Historically, emission factors likely to yield lower results in many cases – so direct measurement risks discovery of significantly higher emissions than permit limits
  - For now, cost of direct sensing likely to be much higher than EFs or other simpler technologies (IR)
  - Retroactive permitting of newly discovered historical emissions

- Availability of self-assessment or audit?
  - EPA Self-Disclosure Policy – status unclear
  - State audit privilege and immunity
  - Attorney-client privilege and work product protection
  - U.S. Attorney's Manual and Sentencing Guidelines

Hypothetical case study – EPA or state agency

- Statutory authority likely sufficient to issue information requests that compel use of advanced remote sensing (*Tonawanda Coke*)

- Use in permitting – may face same difficulties as facility operators
  - Difficult to adapt typical permit emission limits based on long-term exposure amounts vs. instantaneous emission detection
  - Requires large amount of operational information to explain raw emission data

- Growing use in EPA enforcement settlements or consent decrees
  - OECA Memorandum on *Use of Next Generation Compliance Tools in Civil Settlements* (Jan. 7, 2015)
  - Regulatory adaptation – e.g., direct approval of Texas SIP revision for voluntary AWP to allow optical detection of fugitive emissions (Feb. 26, 2015)

Hypothetical case study – EPA or state agency

- Possible challenges for use in enforcement
  - Optical data may not readily translate into enforcement parameters (instantaneous, operational data requirements)
  - *Kyllo* or *Dow*?
    - *U.S. v. Jones* (2012)
    - Expectations of privacy in light of novel or emerging technology (thermal imaging vs. IR camera)
    - Possible collection of protected trade secrets or data from production facilities
  - Self-Disclosure Privilege or Protections

Hypothetical Case Study – Private Parties

- Role of Credible Evidence Rule
  - Baseline admissibility standards under Fed.R.Evid and *Daubert*

- Can use of advanced remote sensing create unanticipated tort liability issues?
  - Under state laws, permits may not preclude availability of tort actions for damages
    - *North Carolina v. TVA* (4th Cir. 2010)
    - *Bell v. Cheswick Generating Station* (3rd Cir. 2014)
  - Trespass and invasion of privacy – scan by private party?
  - Evolving standard of care to use remote sensing technologies to assure adequate emission controls, even if not required by permit or statute? (rapid acceptance of IR cameras)

Pace of Regulatory Adoption

- Bottom line: agency adoption of innovative technologies for compliance and enforcement moves at a considerably slower pace than evolution of new technologies

- Strong reasons why:
  - Difficulty of modifying underlying statutory authorization
  - Delegation to states
  - Risk of technology failure (double remedy)
  - Due Process concerns and constitutional impediments, particularly for criminal enforcement
  - Reliance and expectations of regulated community
  - Insufficient comfort and acceptance of new technology by community

Possible Solutions?

- Risk shifting – third-party certification of test methods with burden of proof remaining on permit holder
  - Need to protect transparency for public and Title V compliance purposes
  - Possible additional incentives for early adopters (Federal Technology Transfer Act of 1986?)

- Enforcement context – incorporation of new technologies via consent decrees and settlements that can move beyond bare statutory or regulatory requirements

- Role for public disclosure and reflexive regulation

Questions?

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