Field Use of Air Monitoring Technologies

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Geospatial Measurement of Air Pollution (GMAP)

4WD Utility van with various instruments.

GMAP Exterior Instruments

Meteorological Sensors:
- Motion-compensated anemometer
- 3-D sonic anemometer
- Turkey feather on a string

Position Sensors:
- High precision GPS

Air Sampling:
- Rotating, 4-port air inlet

Exterior instruments are mounted on an extendable boom

GMAP Interior Instruments

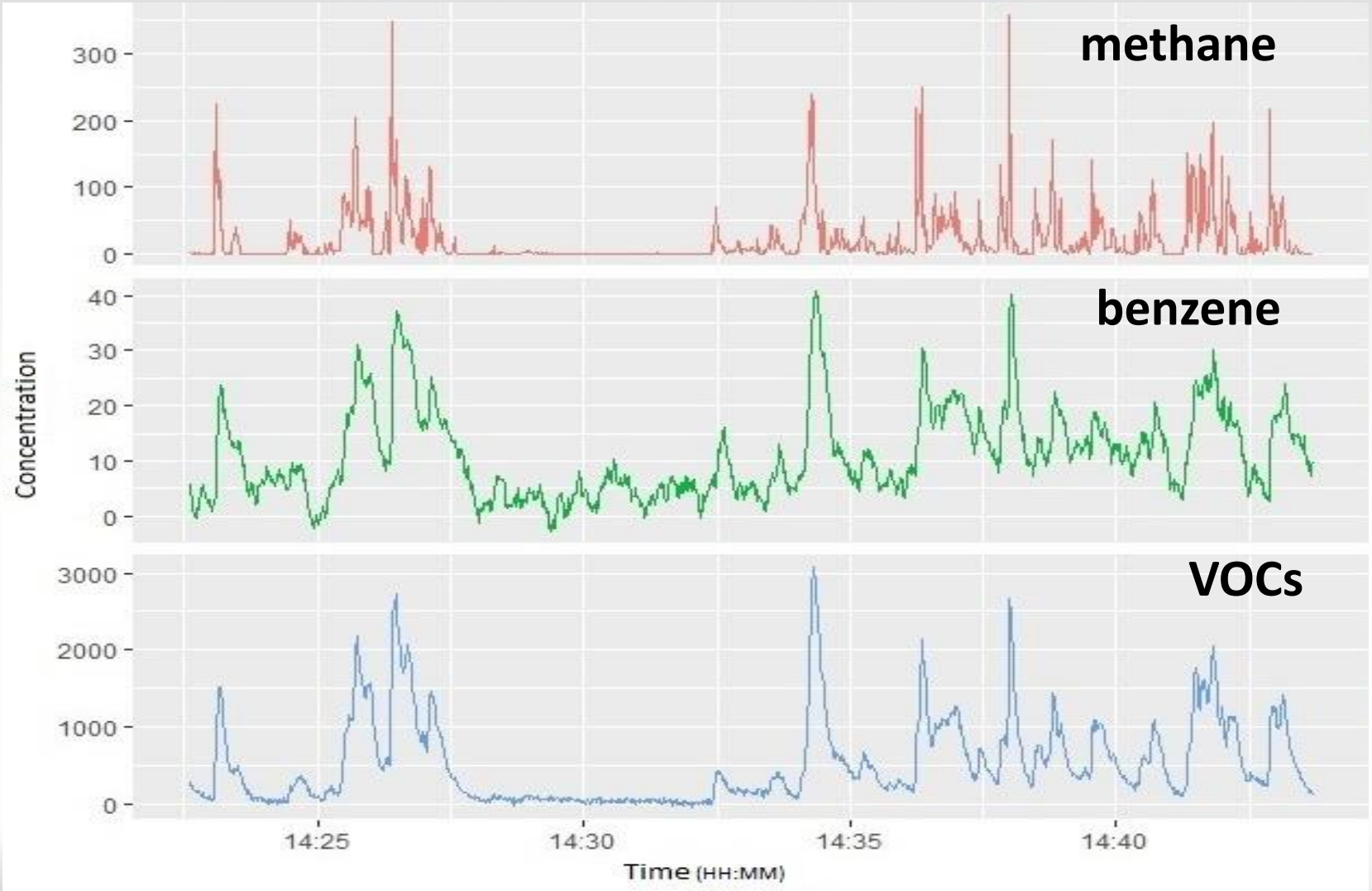
Chemical Sensors:

- Differential Ultra-Violet Absorption Spectrometer (DUVAS) – benzene, toluene, ethylbenzene, xylene isomers, sulfur dioxide, ammonia, others
- Picarro Cavity Ring-Down Spectrometer – methane, hydrogen sulfide, carbon dioxide
- Photoionization Detector (PID)– volatile organic compounds (VOCs)

Computer Hardware/Software:

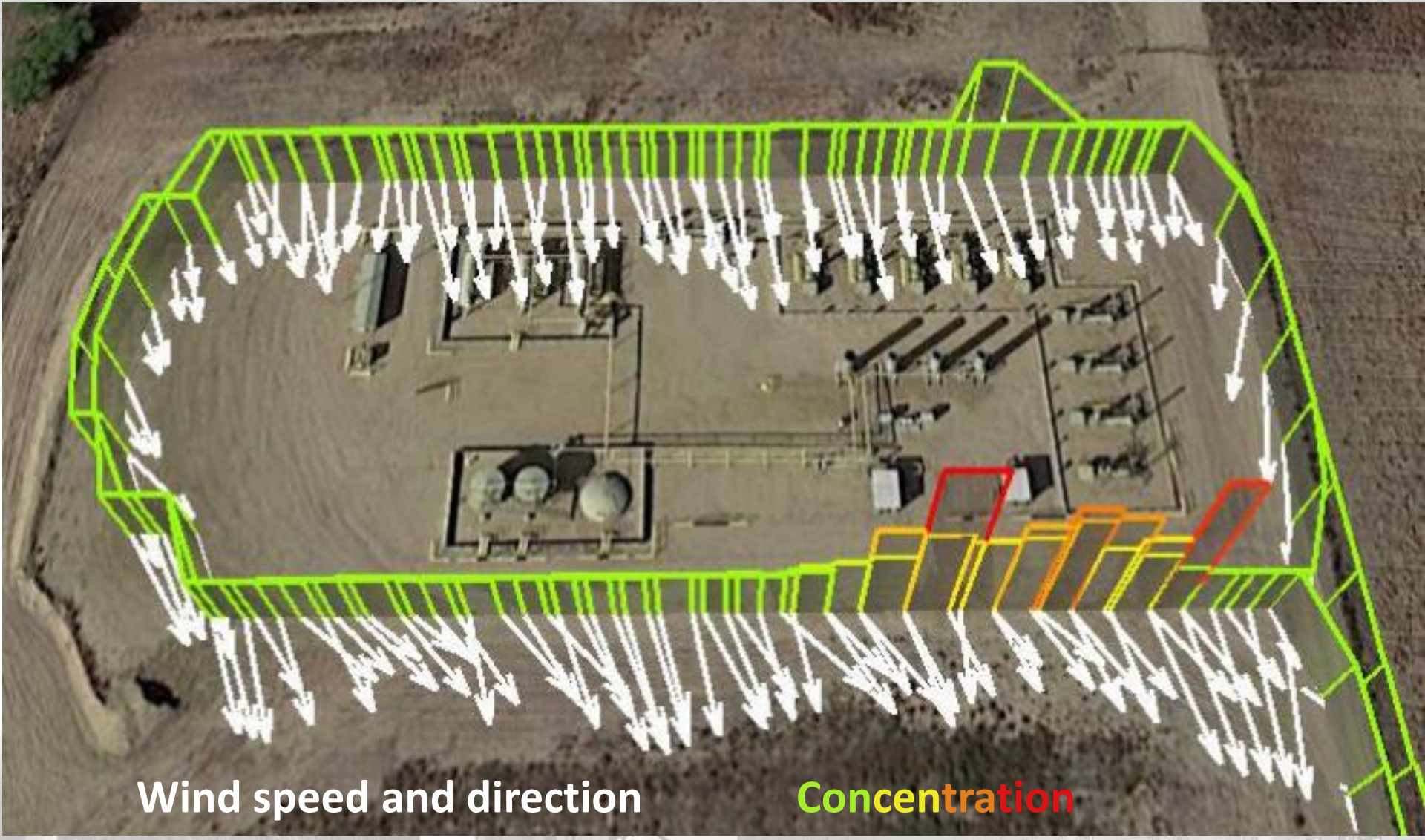
- Rack mount PC control and custom data acquisition software
- Remote into PC with laptop from passenger seat

GMAP Real-Time Data



Concentrations shown in real time and recorded approx. every second

Mapping Data Example



Visualization of data allows for high accuracy leak detection.


Benzene Max: 33.6 ppb (05/10/17 11:01:21)
© 2017 Google
Google Earth

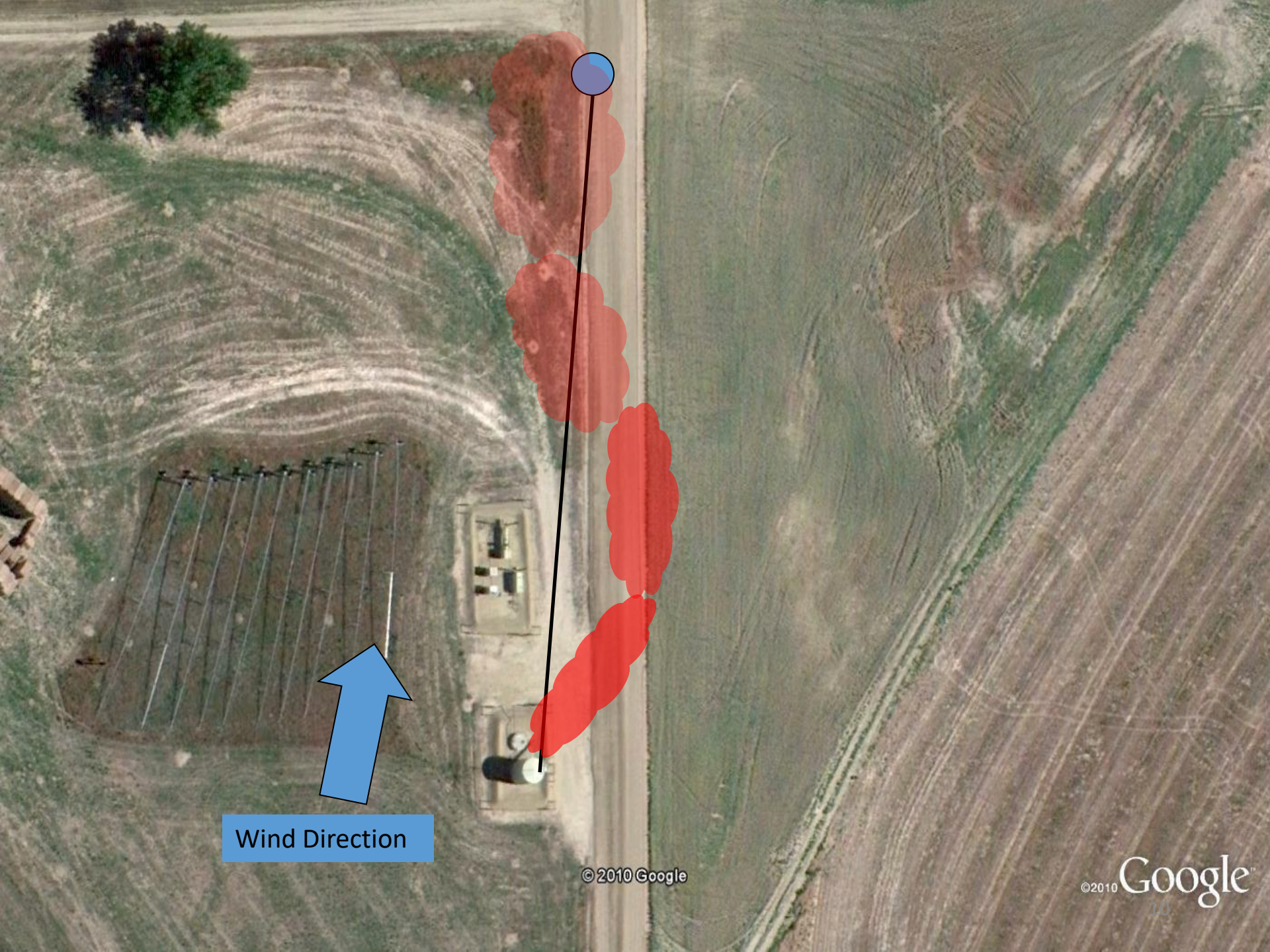
GMAP Limitations

- Emissions must be close to the ground
- Must be some wind

Emission Rate Quantification Using GMAP

- Vehicle parked within the plume
- 20 minute data collection per measurement
- 3-dimensional wind vector and concentration
- No to very light precipitation
- Wind speed between approx. 2 mph and 25 mph
- Distance to source approx. 25 to 100 meters
- Unobstructed wind from potential source
- Typically requires site access
- Specific chemicals identified or VOCs
- Air canisters collected for quality checks and speciation of VOCs

https://www3.epa.gov/ttnemc01/prelim/otm33a.pdf


Wind Direction
© 2010 Google
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Emission Rate Modeling

Example GMAP-REQ:

Distance = 90 m

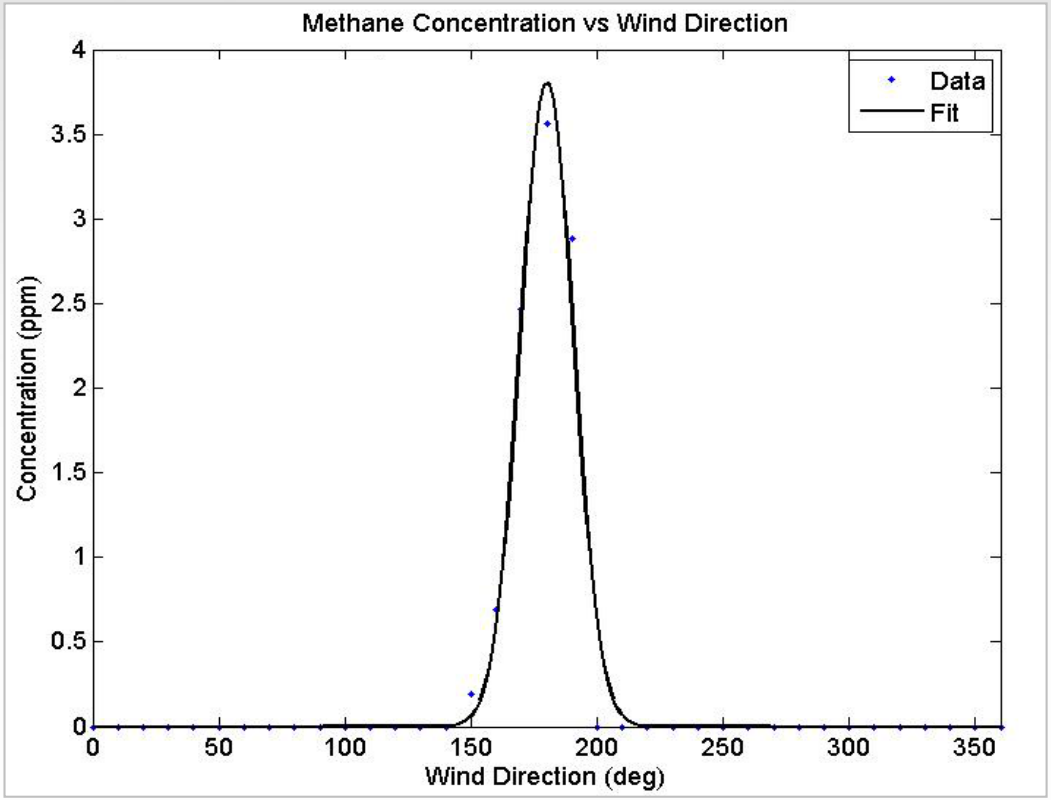
Wind speed = 6.1 m/s

CH_4 bkg. conc.= 1.78 ppm

CH_4 plume conc. = 3.81 ppm

Emission estimate:

CH_4 = 1.86 g/s

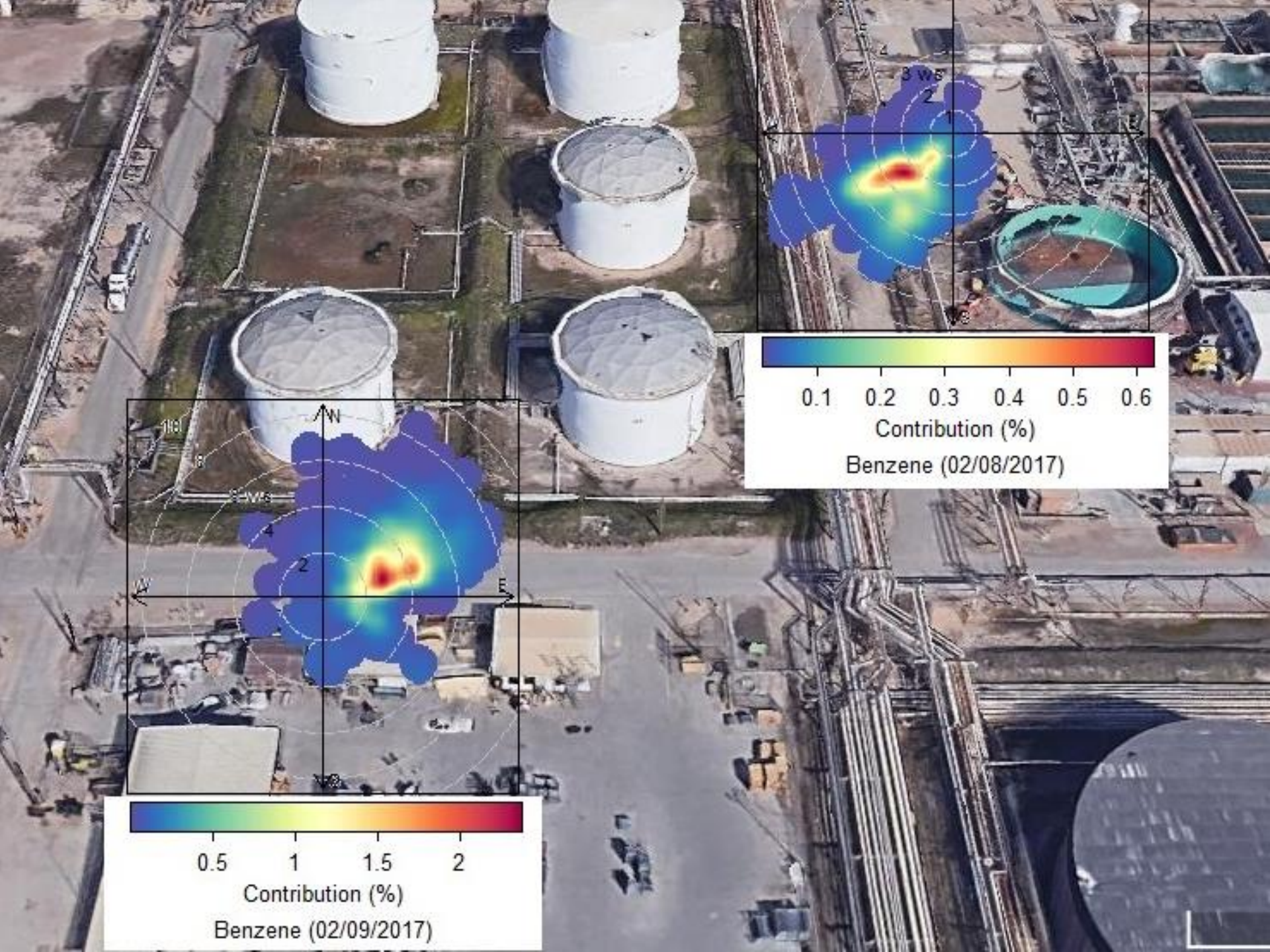


Good methane emission estimate based on Gaussian fit

Accuracy +/- 30% per run based on controlled release studies

Sensor Pods (aka: S-Pods)

- PID monitor
- Wind speed and direction
- Solar powered
- Reading every second
- Cell phone technology being tested (daily data file remotely uploaded to a server)
- Can be programmed to collect air canister sample


0.1 0.2 0.3 0.4 0.5 0.6
Contribution (%)
Benzene (02/08/2017)
0.5 1 1.5 2
Contribution (%)
Benzene (02/09/2017)

Questions?

Request NEIC field support through your regional EPA office

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