



Atmospheric CO₂ and CH₄ Monitoring

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Butterfly Photonics

Atmospheric Measurement: A Critical Component

Assets currently require atmospheric monitoring, soon more w/ IRA.

Fugitive CO₂ and CH₄ leak detection uses overlapping techniques and are proxies

Monitoring frameworks are multiscale, dynamic, and evolving



Ground Based In-Situ: Hyperlocal Point Sources

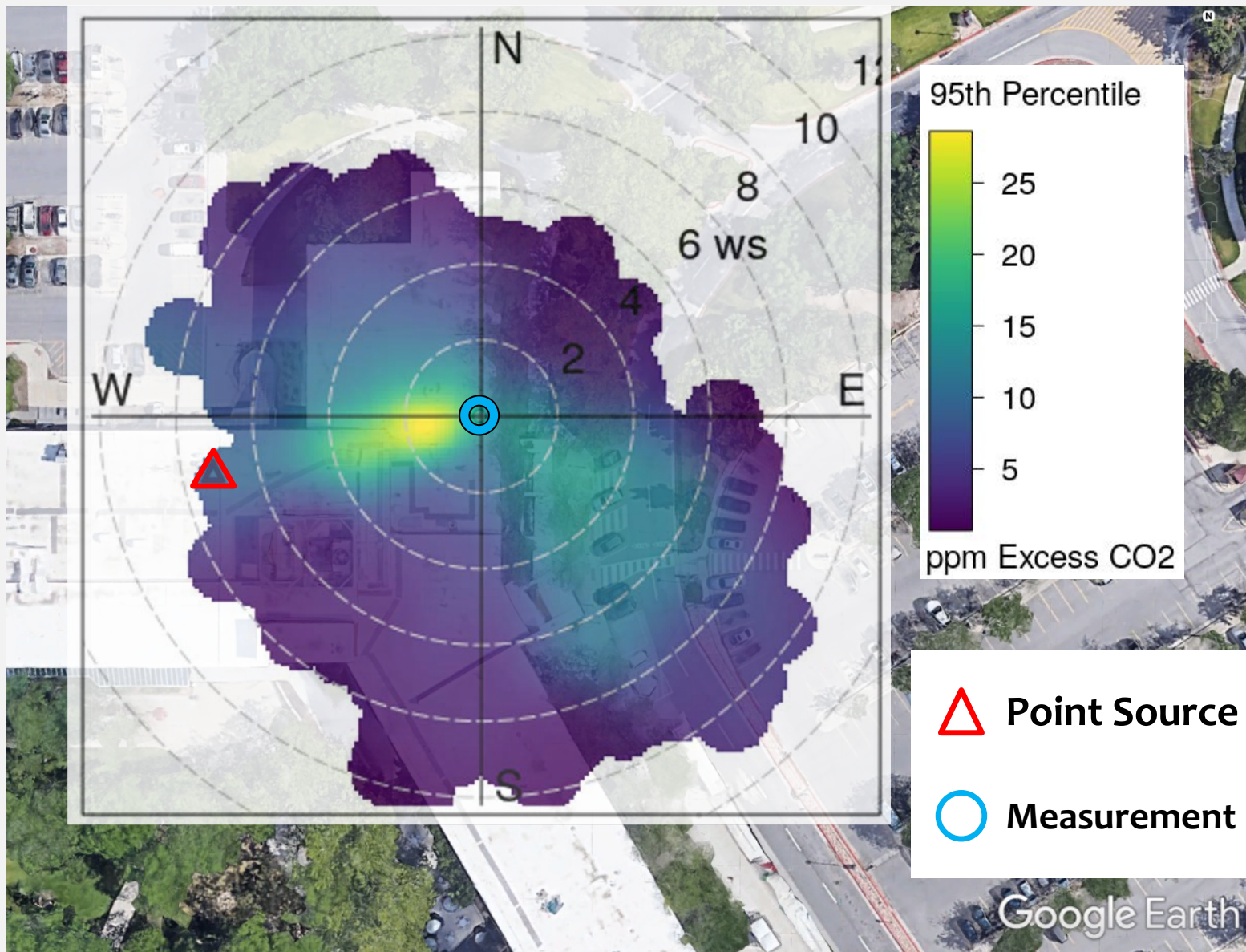


Ground Based In-Situ: Hyperlocal Point Sources

Sources measured at near scales (<100m) can be characterized

Lower cost, distributed networks provide a “smoke alarm” approach

Machine learning could improve characterization techniques



Thesis Publication (Meyer)

AGU Fall Meeting 2020 - A244-06 (Meyer et. al.)

Ground Based Mobile: Science of Signatures

Mobile platforms are complementary to airborne, remote sensing, and in-situ monitoring

“Fingerprinting” sources is possible using multi-species measurement.

Source disaggregation is a valuable analysis ability

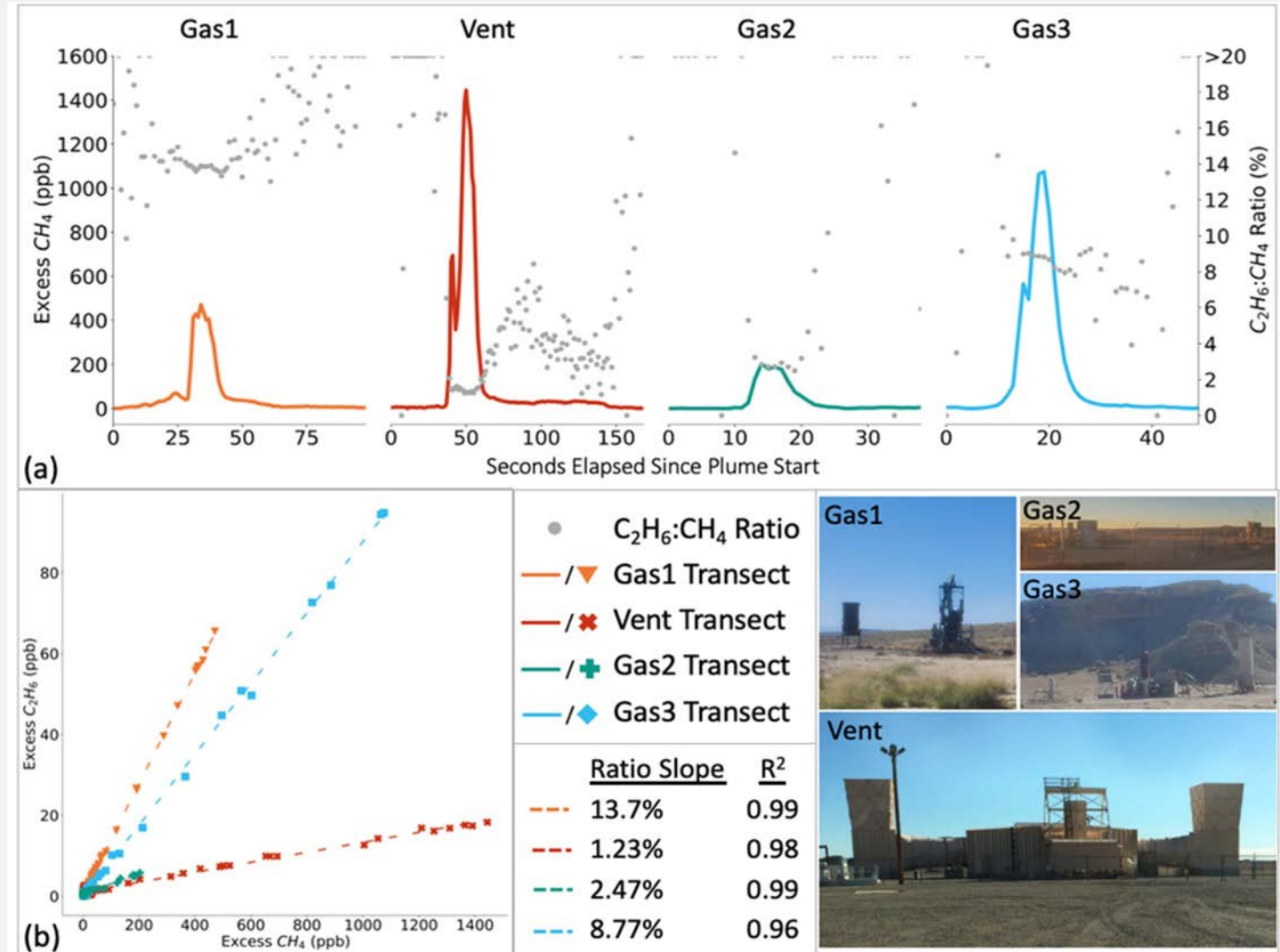


Los Alamos National Lab: Science of Signatures

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Using Multiscale Ethane/Methane Observations to Attribute Coal Mine Vent Emissions in the San Juan Basin from 2013–2021

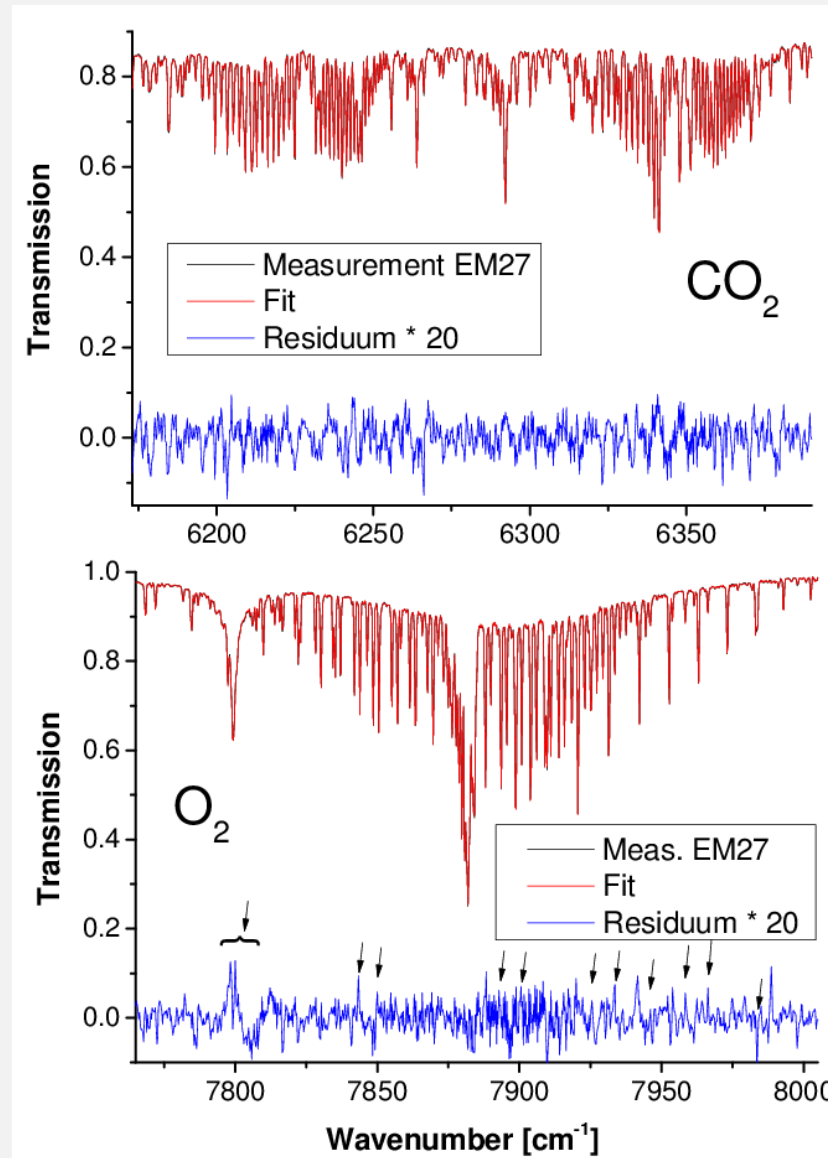
Aaron G. Meyer¹, Rodica Lindenmaier¹, Sajjan Heerah¹, Katherine B. Benedict¹, Eric A. Kort², Jeff Peischl^{3,4}, Manvendra K. Dubey¹

Basin Scale Monitoring: Total Column Measurement

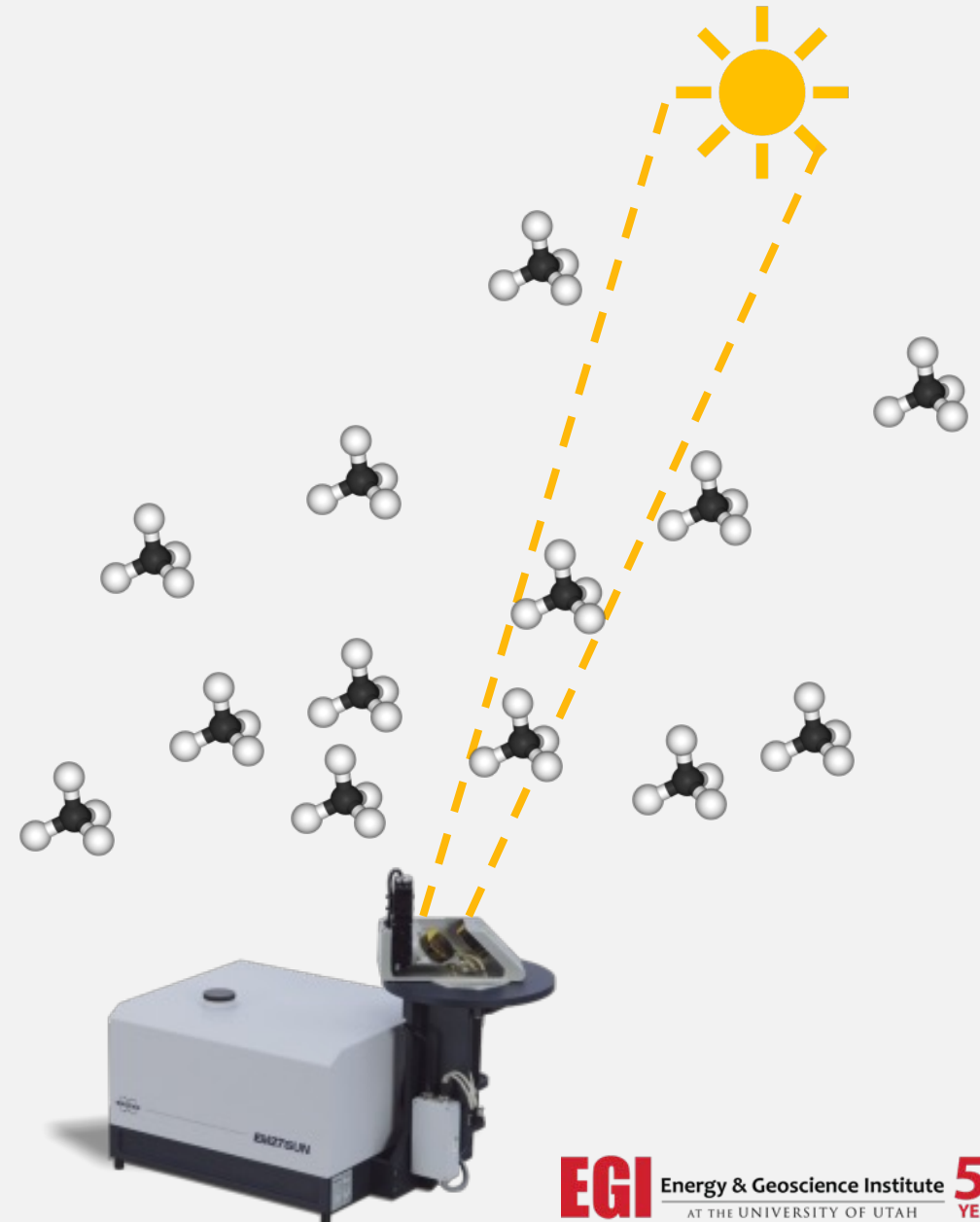
Collect direct sunlight data in ground-based sensors

Analyze spectra for total column concentration

Less sensitive to local fluxes



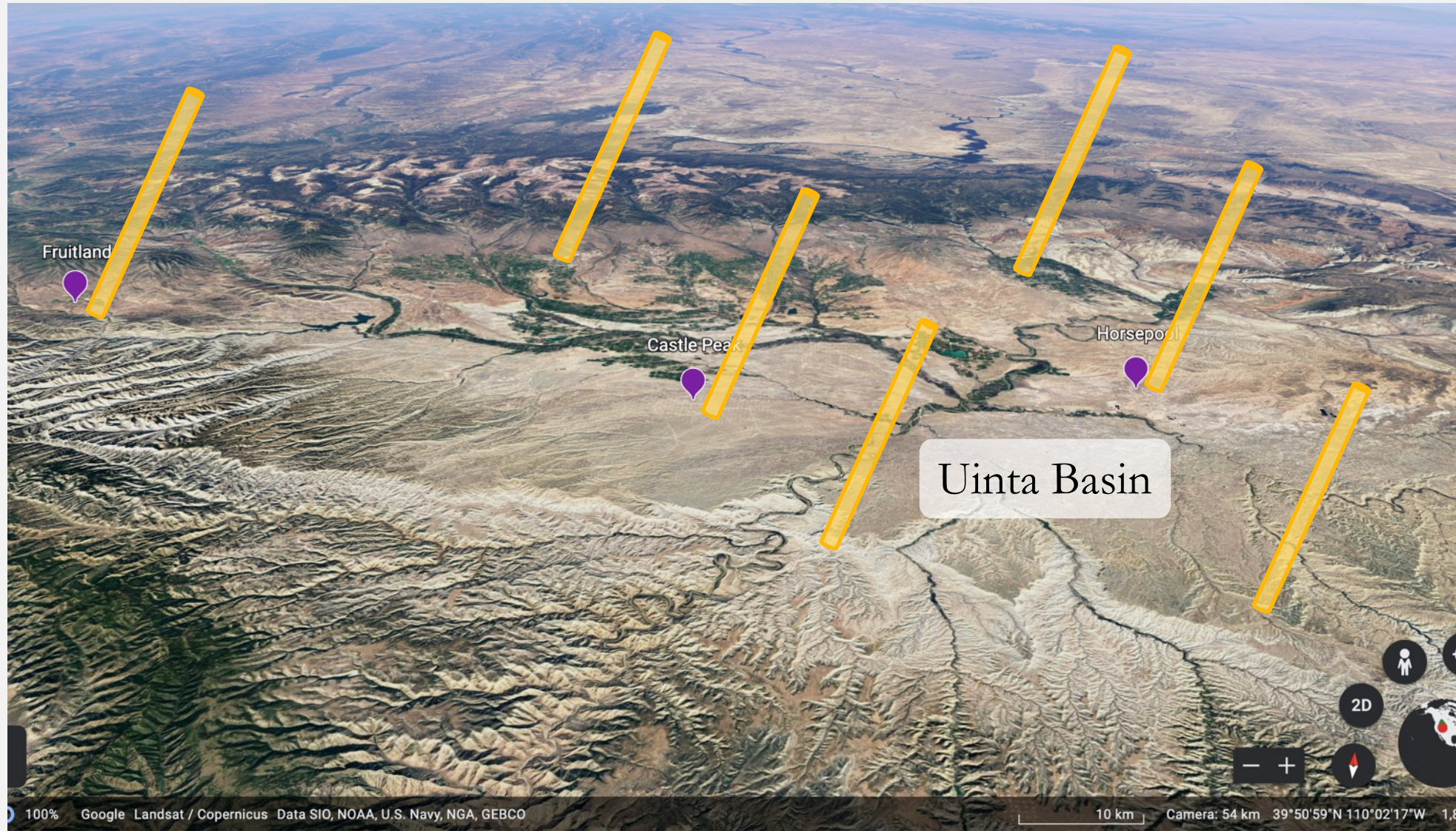
Gisi et al, 2012



Basin Scale Monitoring: Total Column Measurement

Satellite scale
measurement
at lower cost

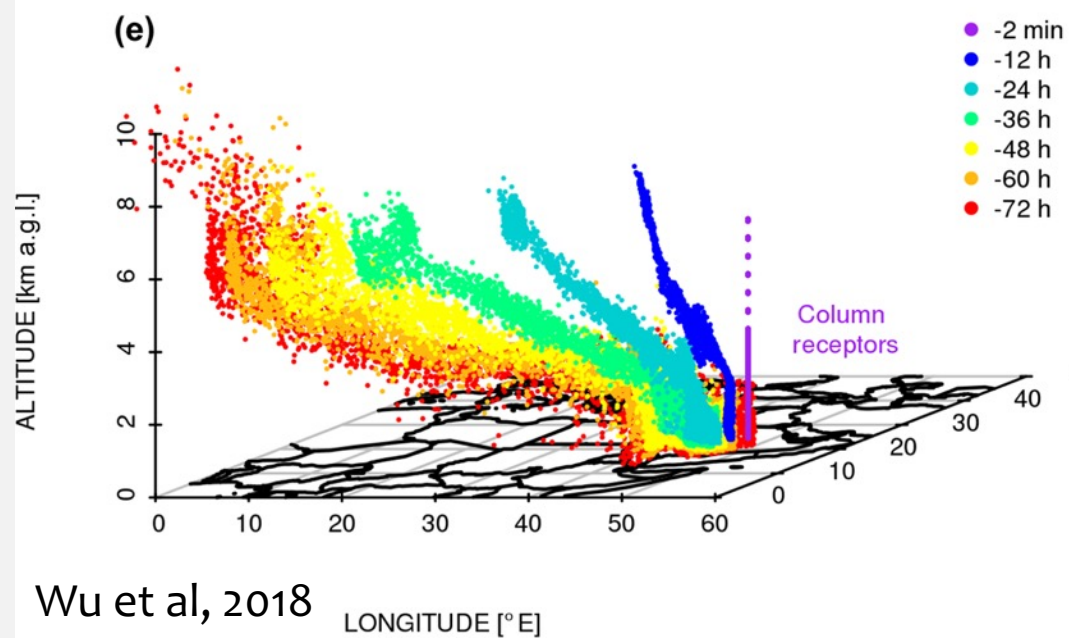
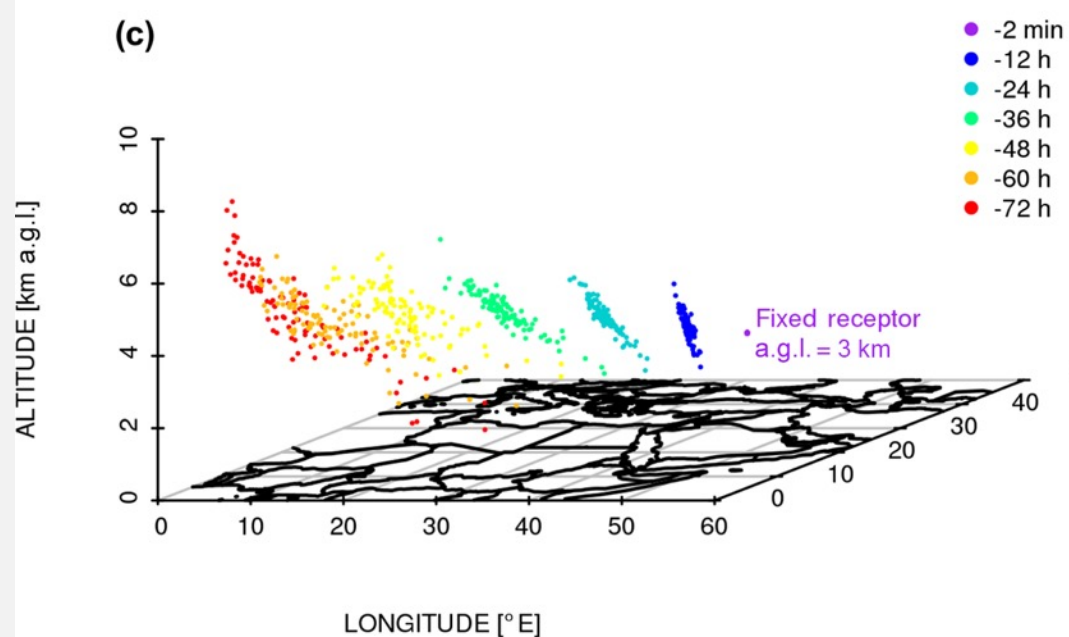
Broader spatial
footprint fills
measurement
gaps



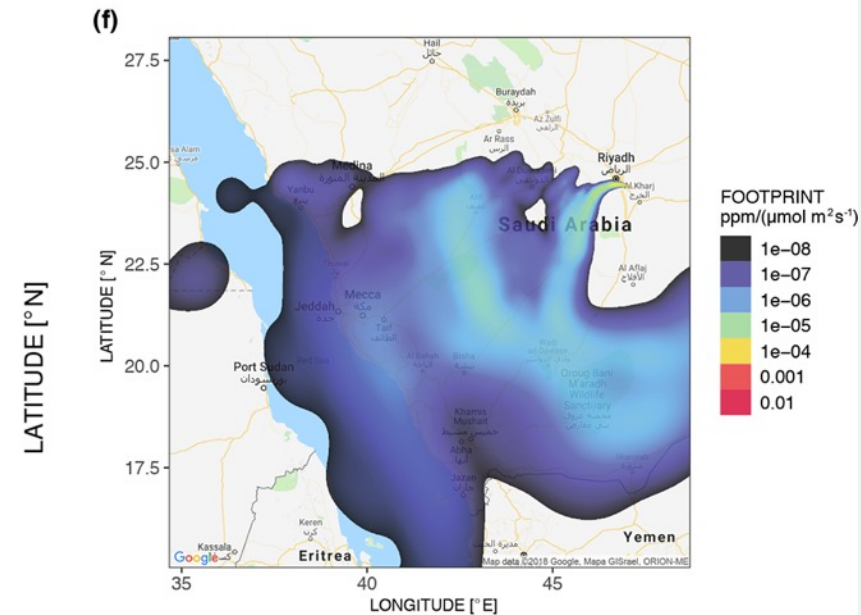
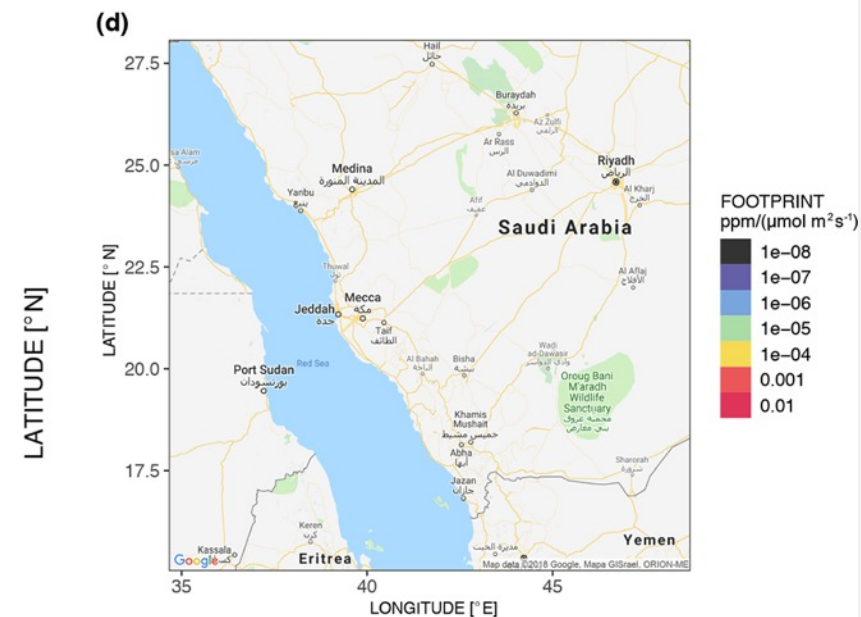
STILT Back-trajectories Identify Source Footprint/Influence

Particles released on “slant columns”

Time spent over grid cell is proportional to potential source influence



Wu et al, 2018

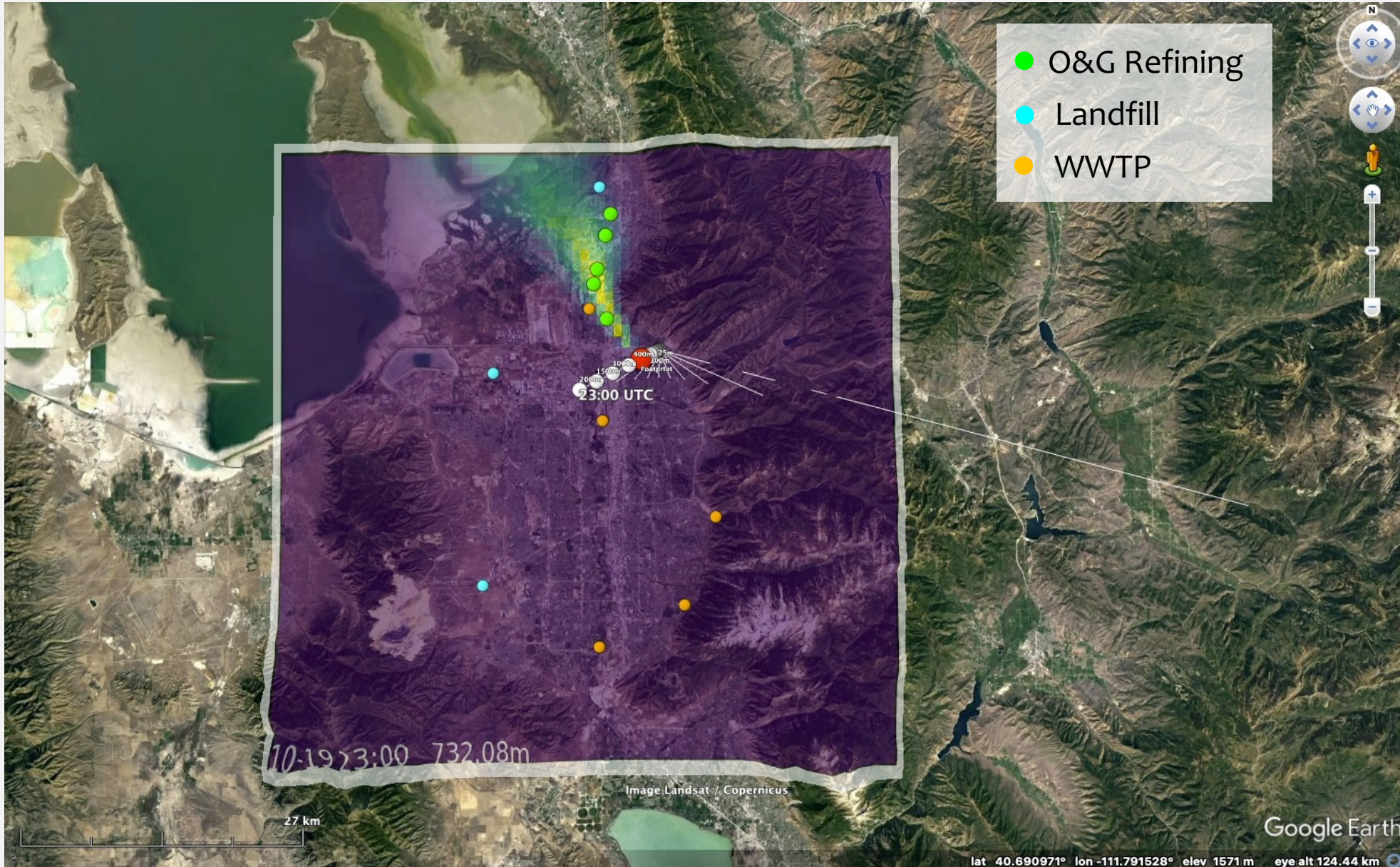


Slant Columns Identify Basin-Scale Sources for Triage



Salt Lake
Valley total
column
measurements

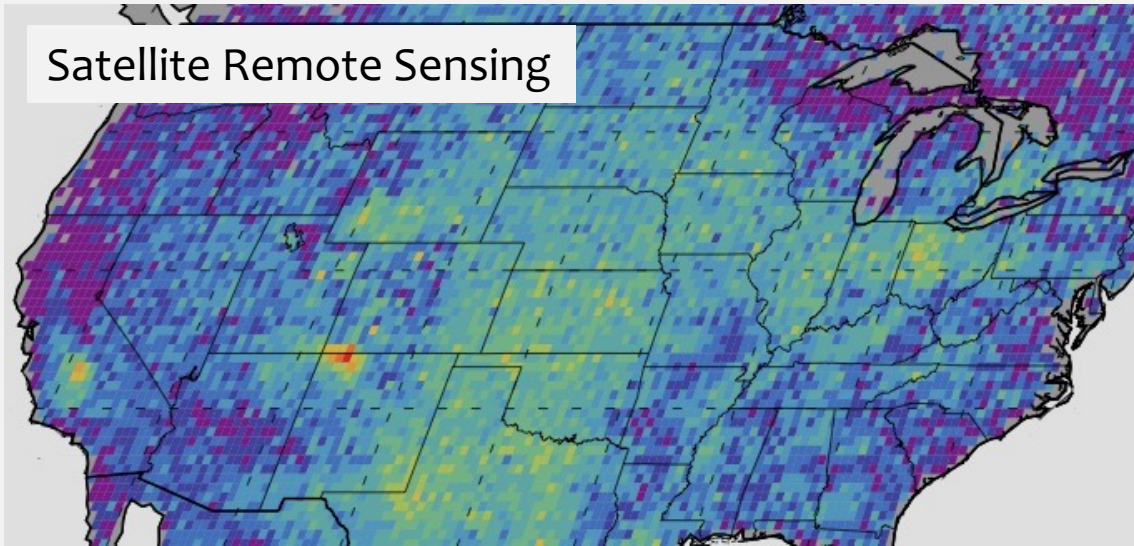
Slant Columns Identify Basin-Scale Sources for Triage



Salt Lake
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Multi-Scale Network Approach Will Provide Advanced MVA

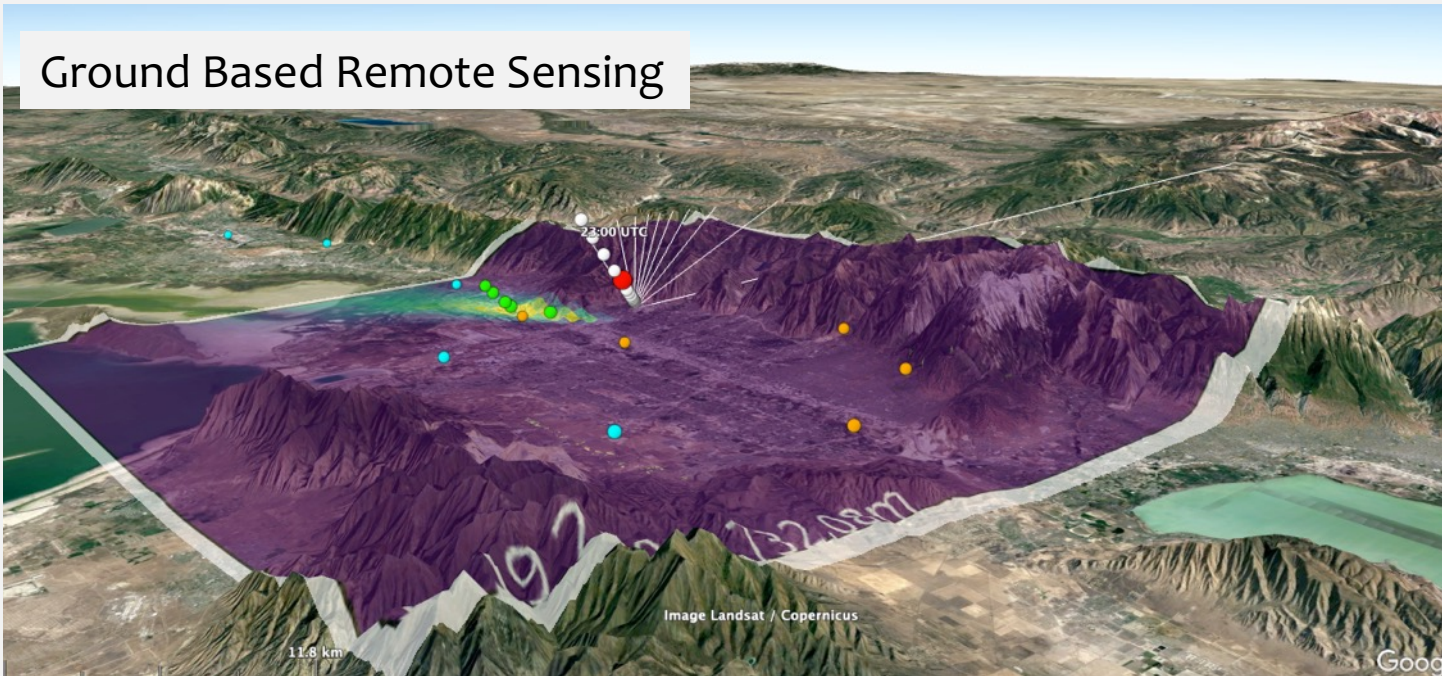
Satellite Remote Sensing



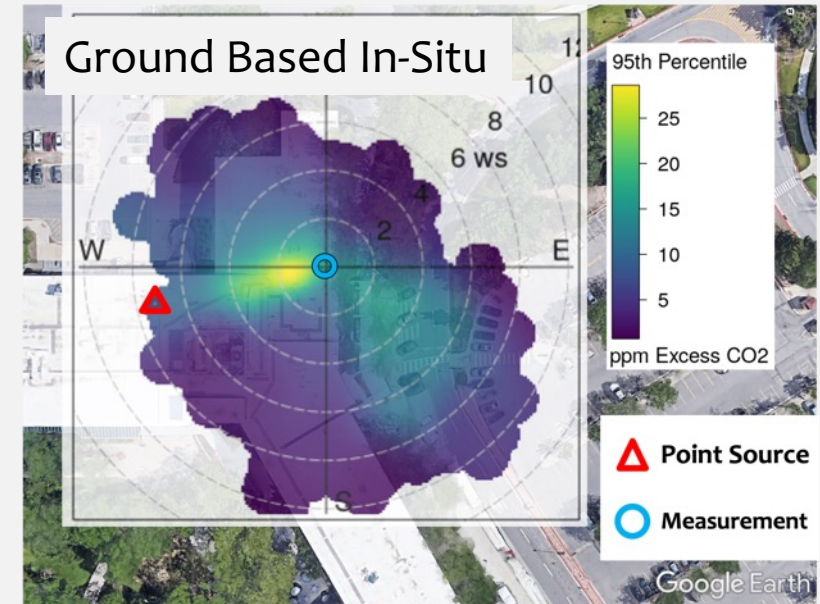
Ground Based Mobile



Ground Based Remote Sensing



Ground Based In-Situ





Energy & Geoscience Institute

1972

50

2022

YEARS

... 1972 - EGI... the science to find energy - 2022 ...