EDF Permian Basin Methane Campaign

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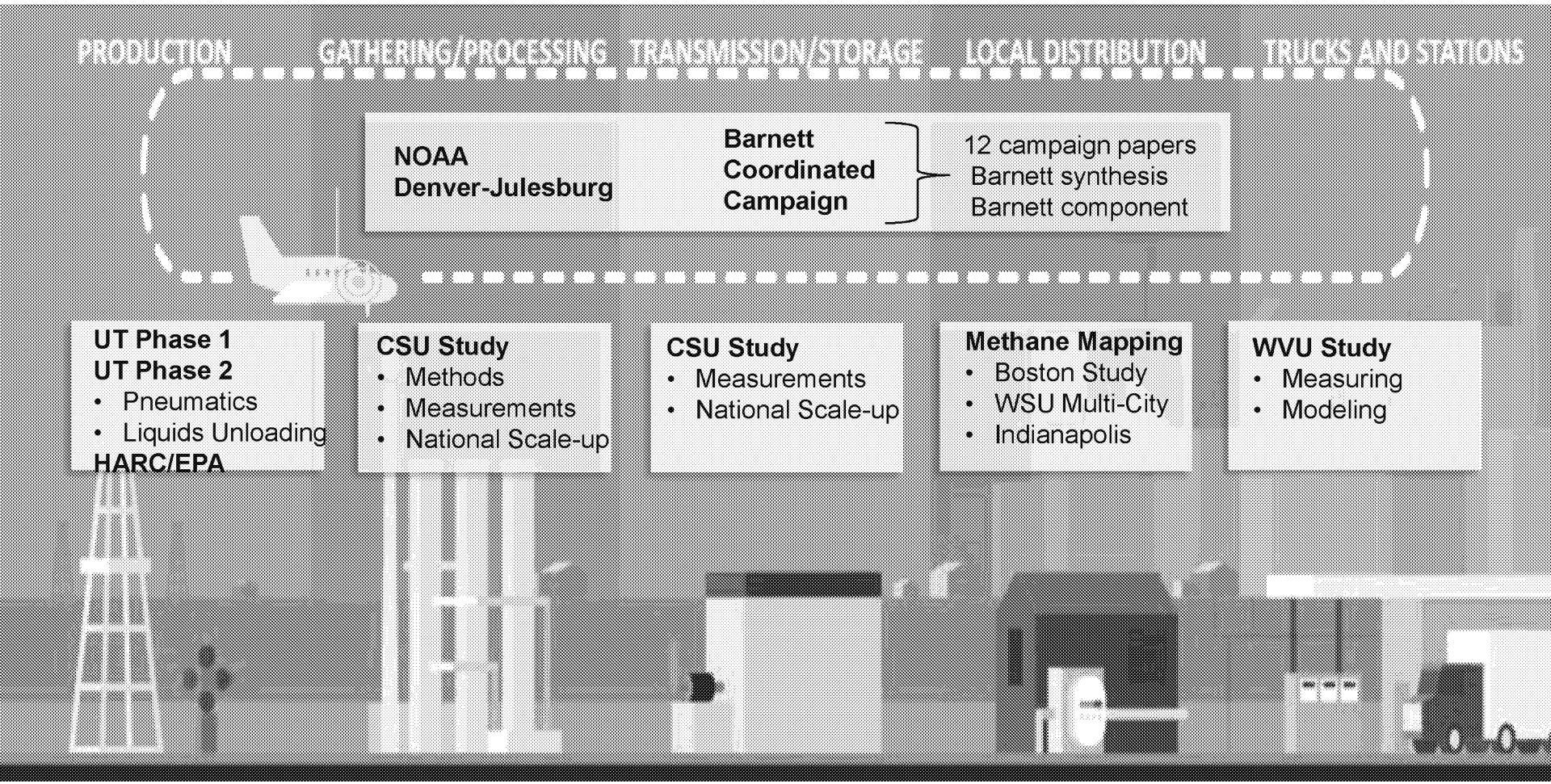
EDF
ENVIRONMENTAL DEFENSE FUND®
Finding the ways that work

EDF U.S. Oil & Gas CH_4 Studies



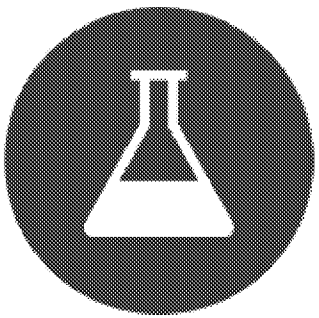
Pilot Projects

Gap Filling
- Abandoned wells
- Helicopter IR Survey

Synthesis Projects
- NETL LCA
- Synthesis

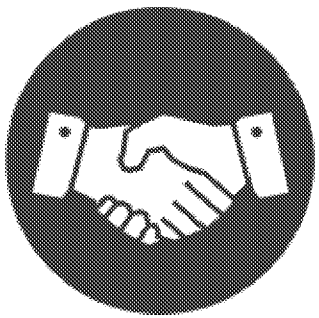
https://www.edf.org/climate/methane-research-series-16-studies

EDF's Methane Research



Rigorous Science

Studies employ independent experts and use multiple methods to measure methane emissions

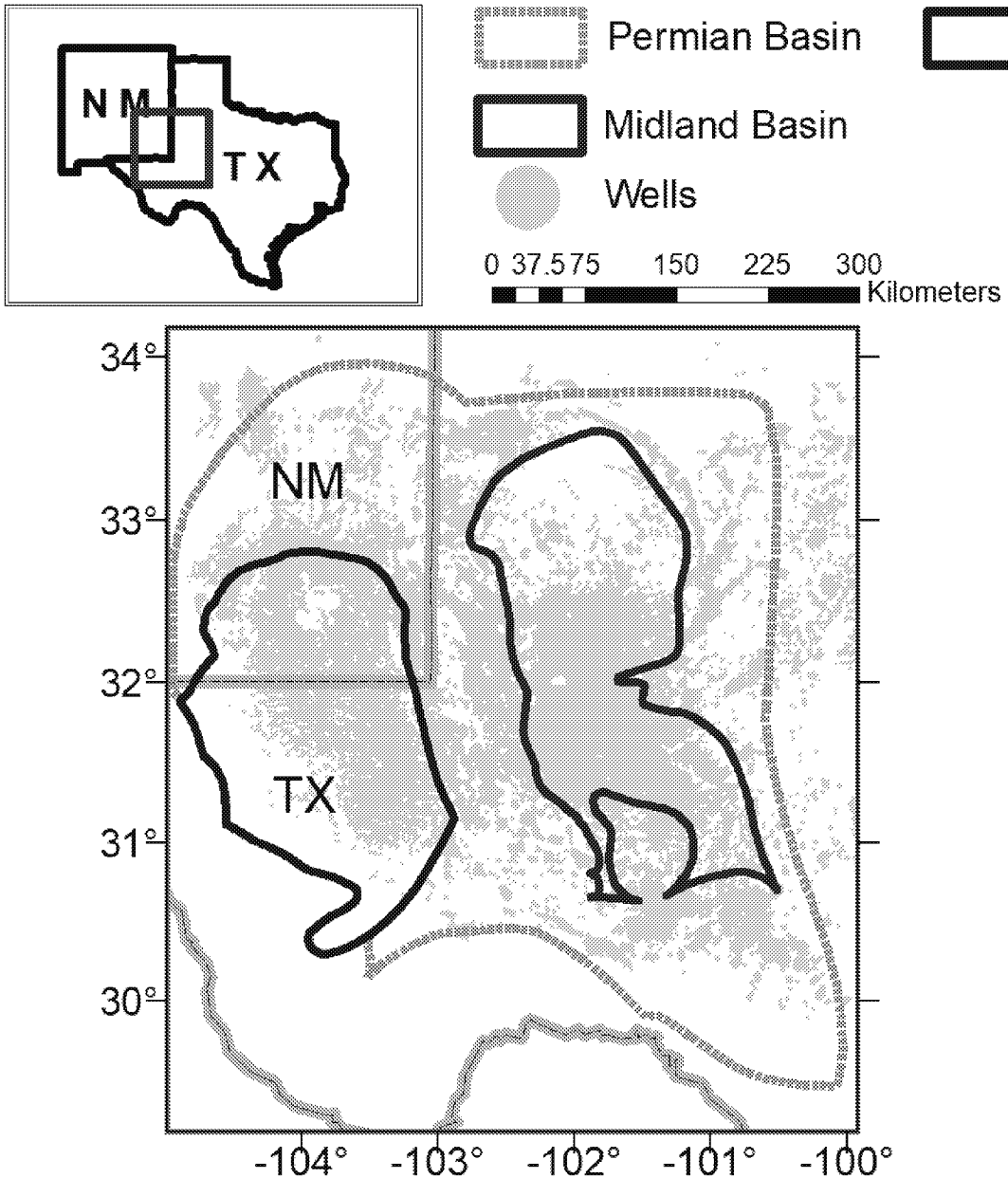


Broad Collaboration

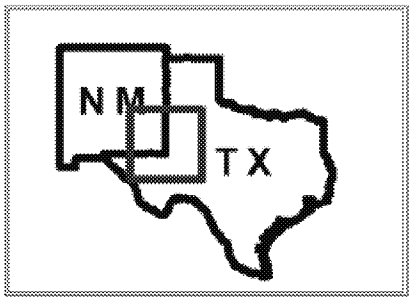
More than 130 co-authors from 50 research institutions and 50 O&G companies

Transparent Results

38 peer-reviewed manuscripts and publicly available data



Permian Basin includes two major geologic basins: Delaware and Midland



Permian Basin

Delaware Basin

Midland Basin

Oil production (Million barrels per 100 km2)

0.002 0.025 0.15 0.5 1.5 2.5 5 13

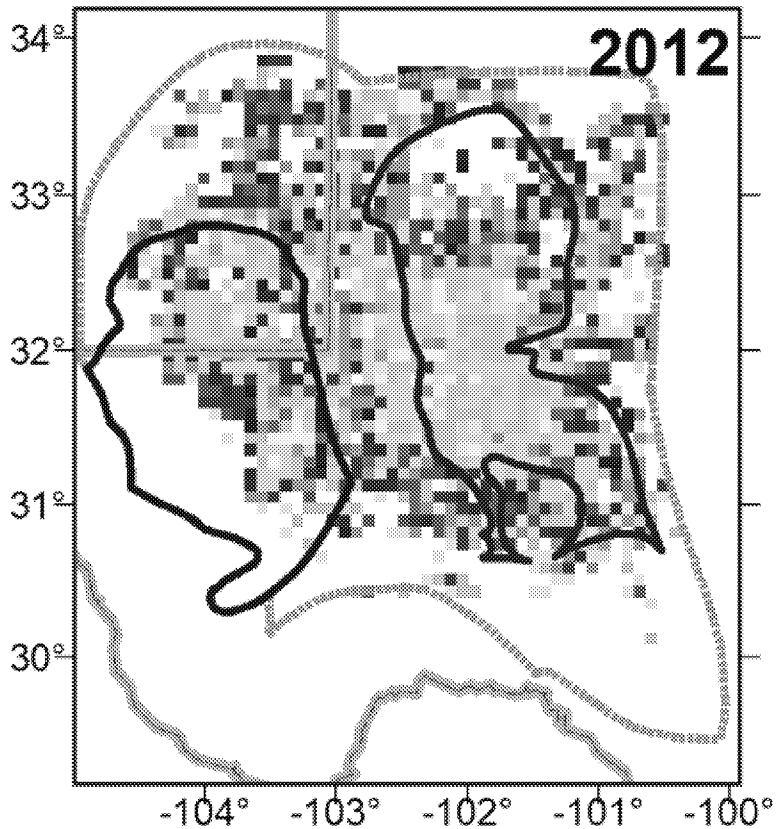
0 35 70 140 210 280 Kilometers

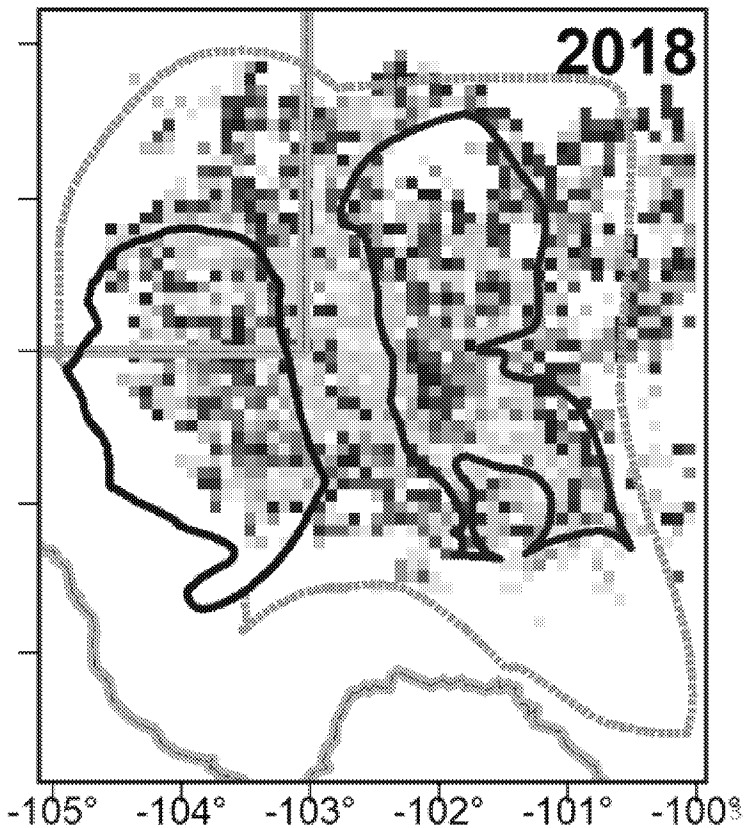
PERMIAN

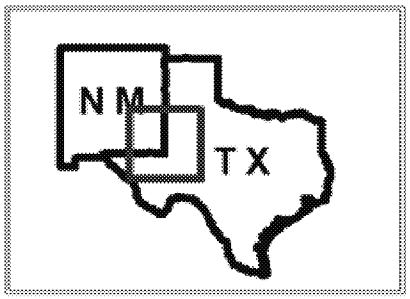
Oil 2018:

1.26 billion barrels

190% increase From 2012







Permian Basin

Delaware Basin

Midland Basin

Gas production (Bcf per 100 km2)

0.0075 0.15 0.5 2.5 5.0 10 25 57

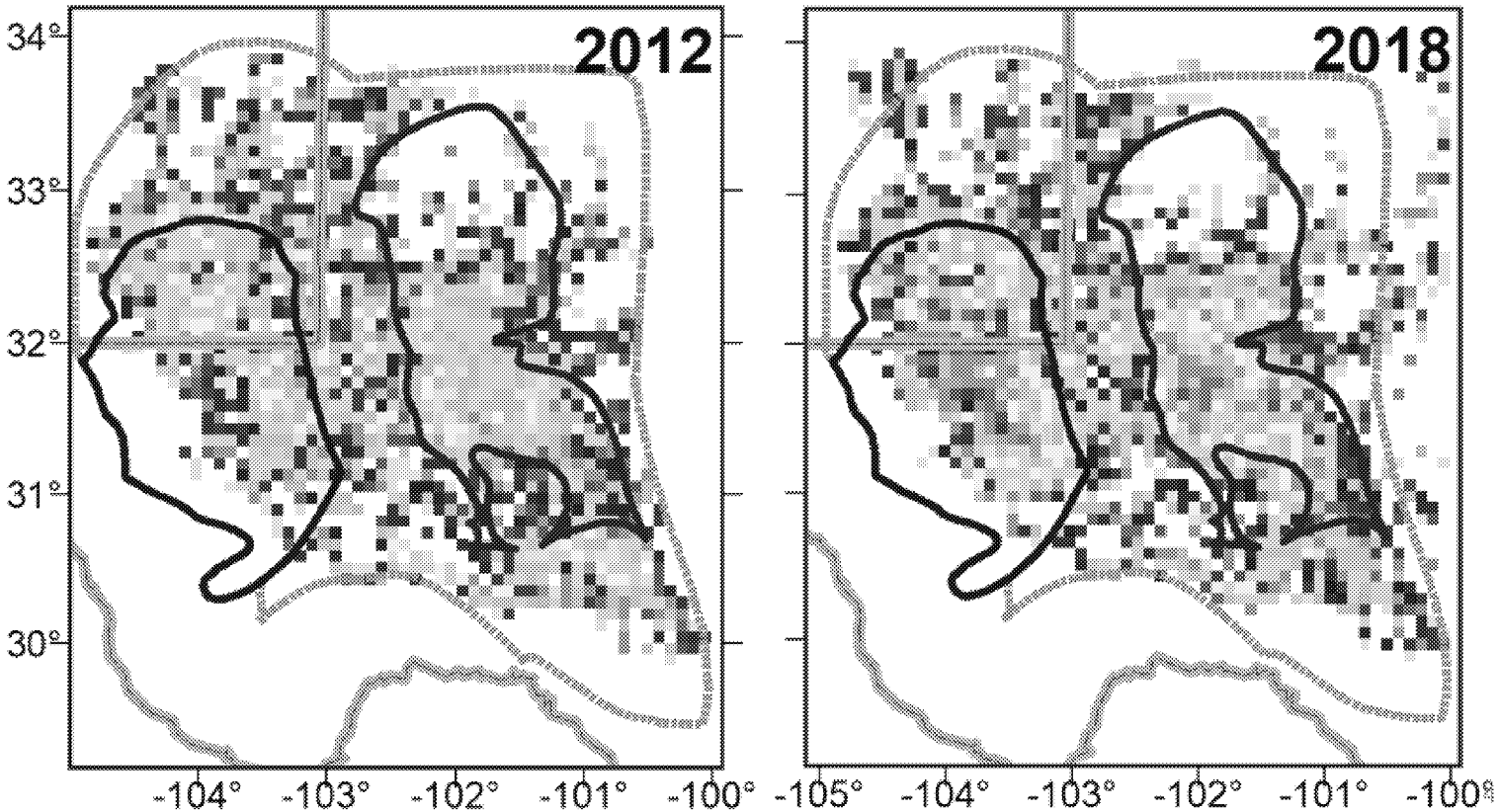
0 35 70 140 210 280 Kilometers

PERMIAN

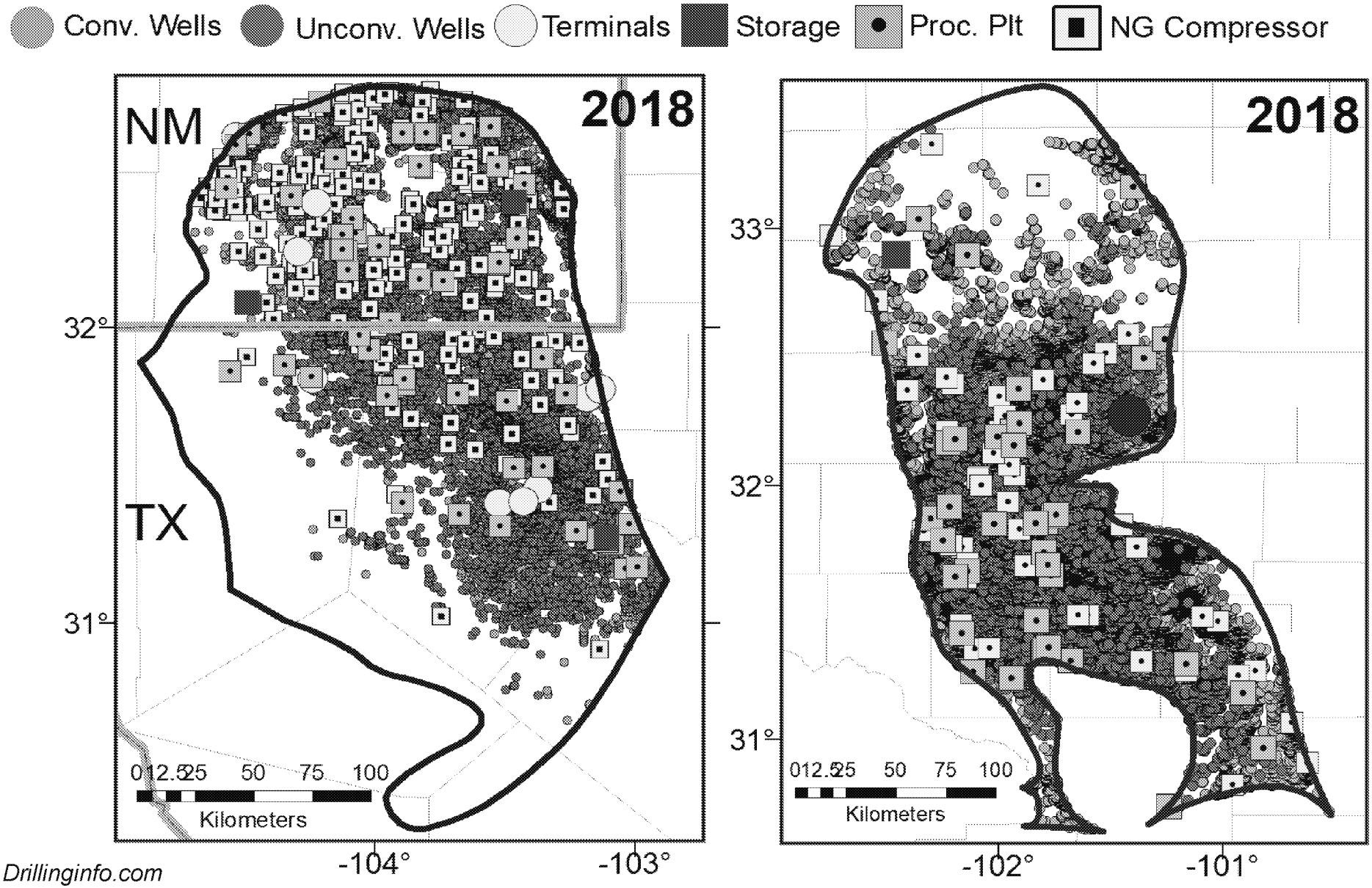
Gas 2018:

4.17 Tcf

→ **157% increase From 2012**



Delaware and Midland Basins include over 67,000 wells and 500 midstream sites



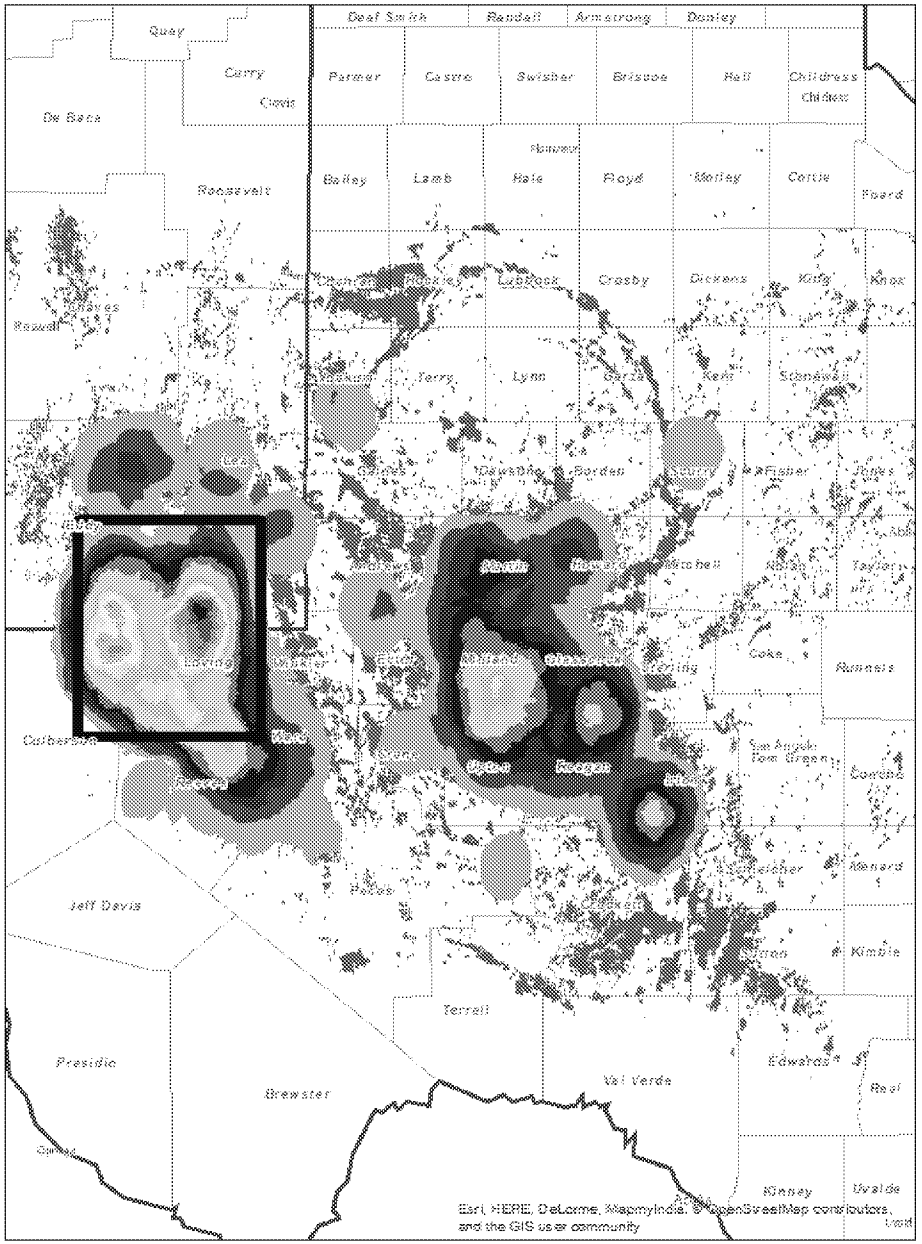
Drillinginfo.com

Permian Basin Campaign

- Twelve month campaign with science and advocacy goals
- Uses multiple, peer-reviewed methods to detect and quantify methane emissions
- Operators & regulators will be notified immediately if imminently hazardous emissions are detected
- Emissions data including site identities will be published frequently on a public website prior to submitting for peer-review

Campaign will focus on Delaware Basin core production area in TX and NM but measurements may also occur in Midland Basin

Permian gas production -heatmap



Number of sites in box = 7,900 (or 5.5% of Permian sites)
Gas production in box = 3.7 bcfd (or 37% of Permian gas prod.)
Oil production in box = 880 kb/day (or 28% of Permian oil prod.)

0 10 20 40 60 80 Miles

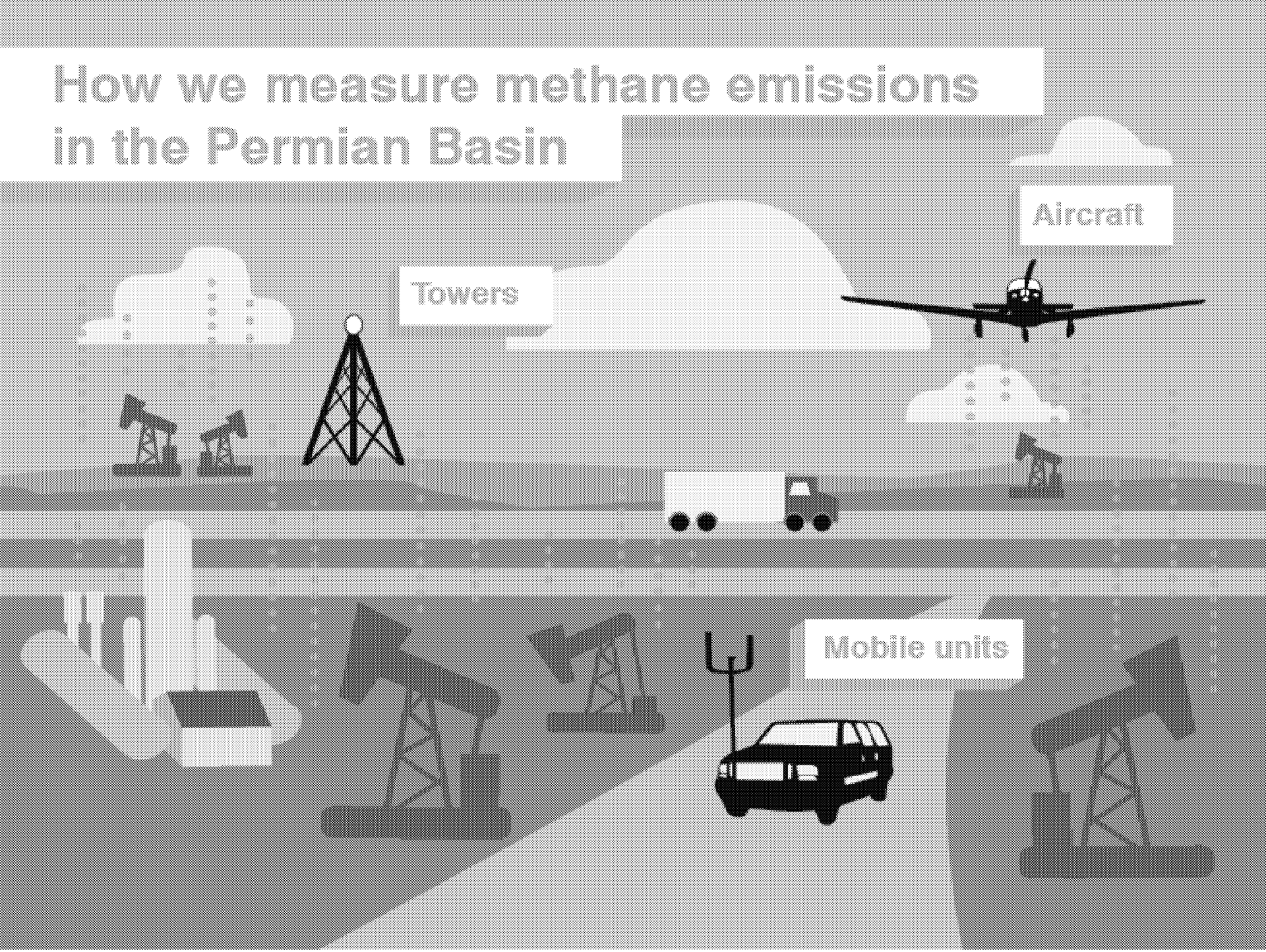
Permian Campaign: Science

- Three primary quantification approaches:
  - Towers: Ken Davis (Penn State U.)
  - Aircraft: Steve Conley (Scientific Aviation)
  - Vehicles: Shane Murphy & Dana Caulton (U. Wyoming)
- Aircraft measurements started October 2019
- Scientific Advisory Panel
  - Adam Brandt (Stanford)
  - Eric Kort (U. Michigan)
  - Mary Kang (McGill)
  - Anthony Marchese (Colorado State U.)

Permian Campaign: Science

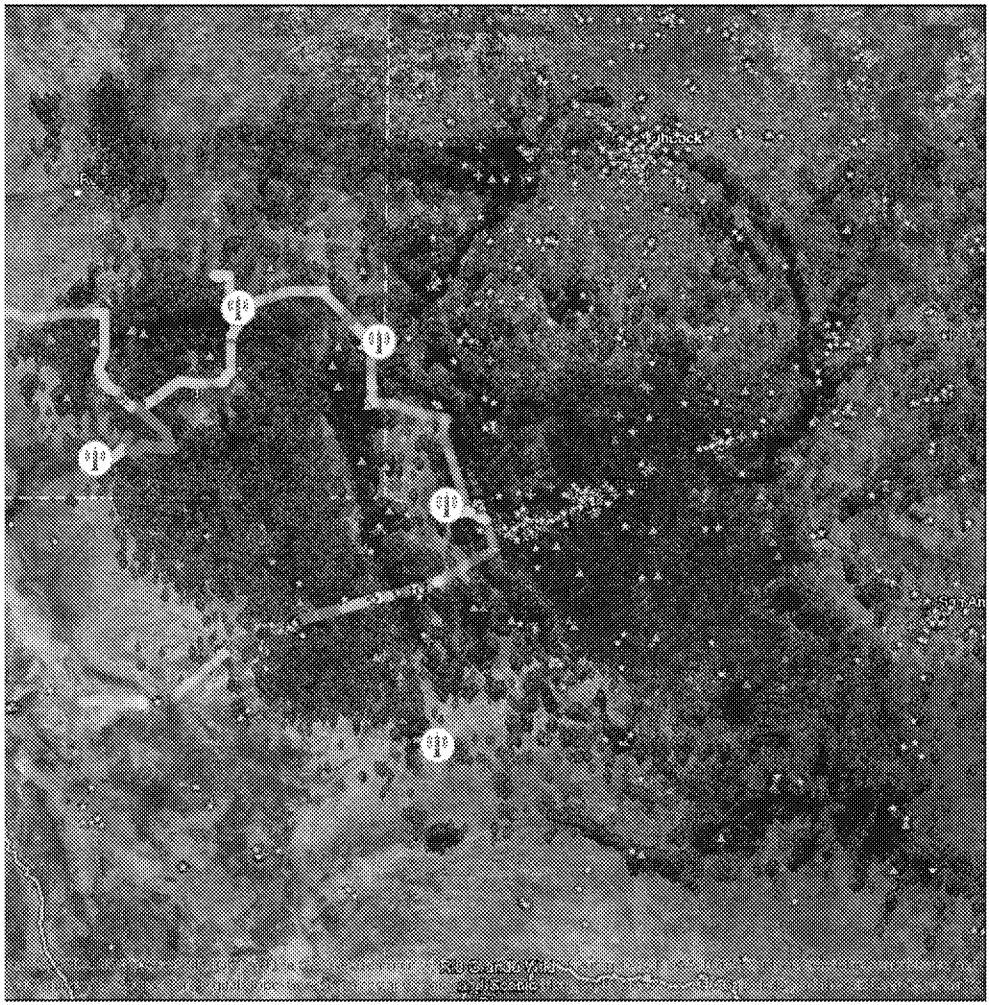
- Research questions include:
  - What are the total methane emissions from O&G sources in the Delaware basin?
  - What is the statistical and spatial distribution of site-level methane emissions?
  - How do emissions change over the 12 month campaign?
  - How long do high emissions persist at sites?
  - Which factors affect emissions, such as production, age, operator, and field?

How we measure methane emissions in the Permian Basin



Towers: Penn State

- 5 tower-based monitors continuously measure methane concentrations at ~100 meter height
- Located at existing cell phone towers and Carlsbad National Park
- Atmospheric transport models used to estimate regional CH_4 emissions on quarterly basis

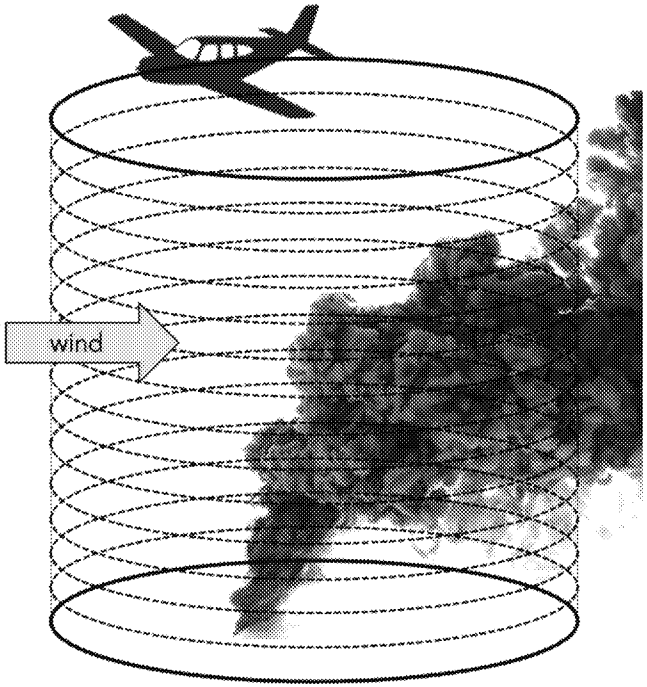


nents

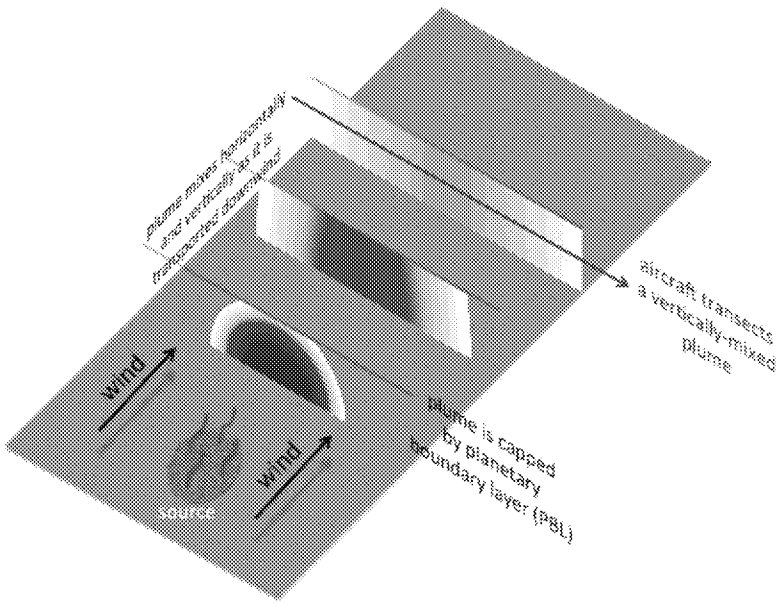
0 34 68 136 204 272 Kilometers

N

Aircraft: Scientific Aviation



Aircraft will fly ~100 days to repeatedly survey sites for high emissions and quantify emissions with a spiraling, mass balance approach.



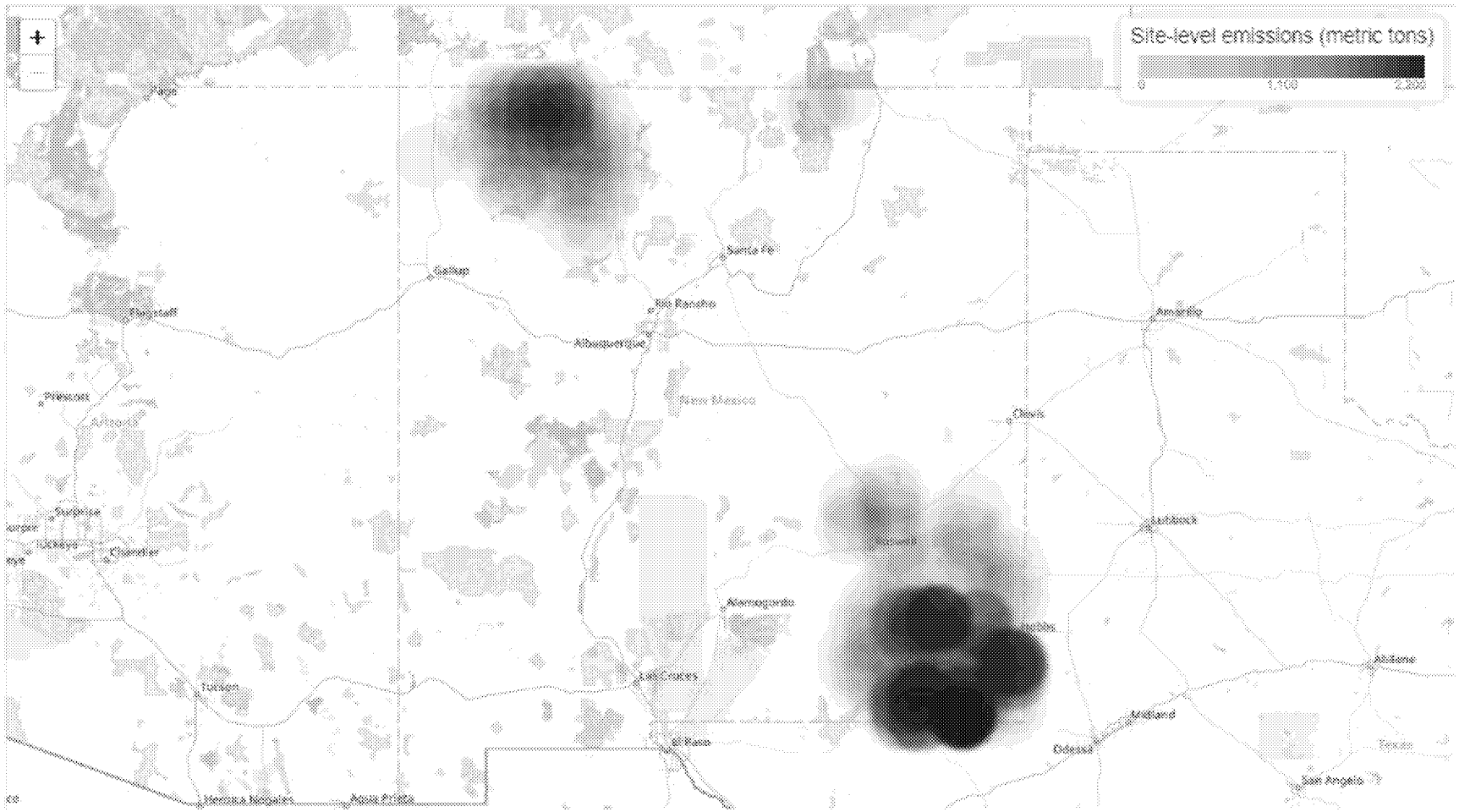
https://www.scientificaviation.com/methods/

Vehicles: U. Wyoming

U. WY will quantify site-level emissions with their mobile laboratory using EPA Other Test Method 33a.

https://pubs.acs.org/doi/abs/10.1021/acs.est.7b00571

EDF New Mexico Project based on similar U. WY measurements at 90 sites in 2018



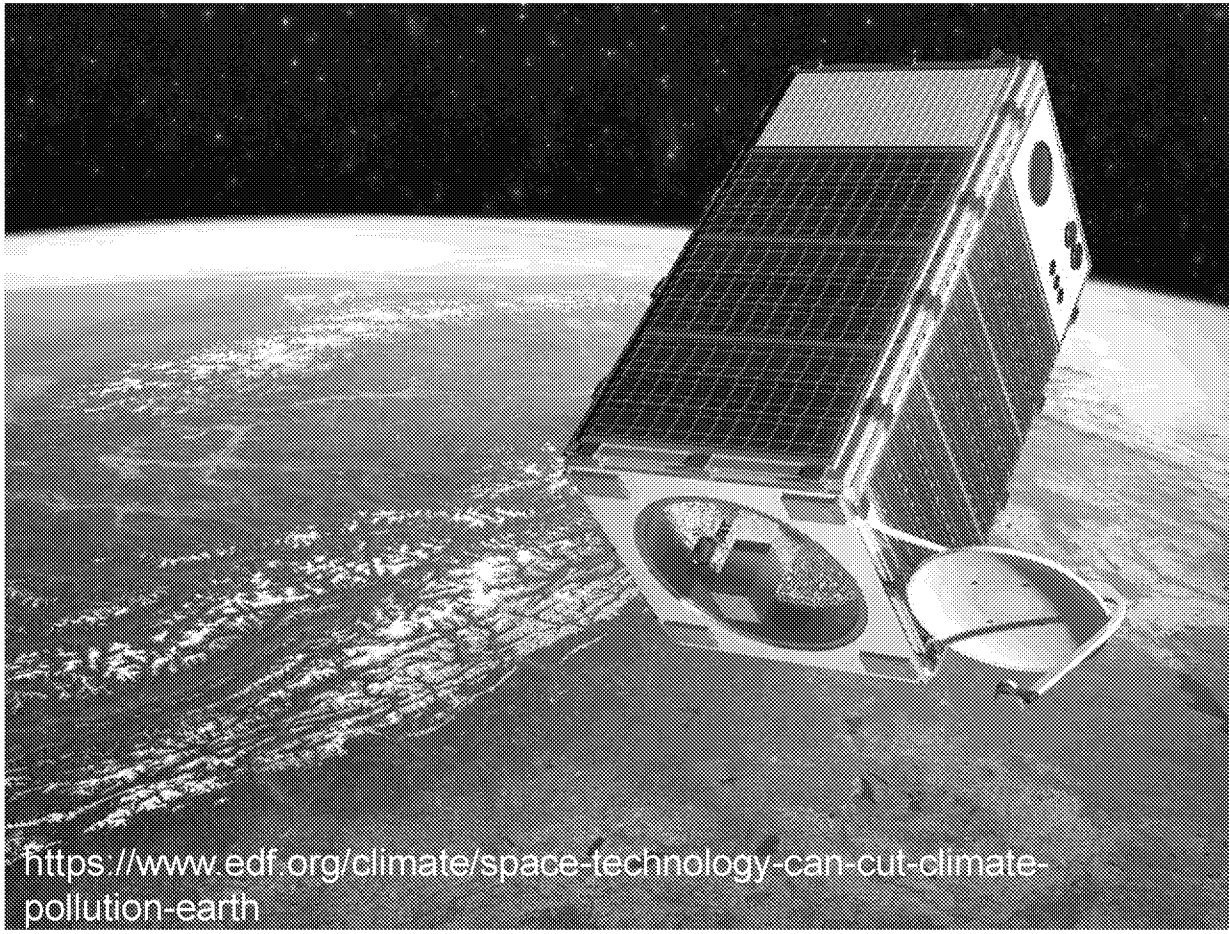
Methane emissions density across New Mexico

Source: see methodology

https://www.edf.org/energy/explore-new-mexicos-oil-and-gas-pollution

EDF is coordinating with other groups including NASA JPL and Harvard to incorporate remote sensing data.

Data will be used to test approaches for MethaneSAT.



https://www.edf.org/climate/space-technology-can-cut-climate-pollution-earth

Permian Campaign: Advocacy

- Inform regulators and other stakeholders on the scale of methane emissions
- Rapidly provide scientifically-rigorous, actionable data on a policy and mitigation relevant time frame
- Provide operator-specific data to both inform stakeholders and incentivize mitigation
- Contextualize data to facilitate operator action and recognize efforts that reduce emissions
- Test and socialize innovative approaches to detect and quantify emissions

Permian Campaign: Data Platform

- Public website will provide free data access
- User interface will show when sites were surveyed, if emissions were detected, estimated emission rate, and operator ID
- Query function will allow users to view and download data by key parameters
- Target audiences: engaged public including media & communities, state & federal regulators, and industry
- Tentative launch date of January 2020 with initial data; regular updates with new measurement data.

Permian Campaign: Stakeholder Engagement

Questions?

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