

EDF Permian Basin Methane Campaign

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EDF U.S. Oil & Gas CH₄ Studies

PRODUCTION GATHERING/PROCESSING TRANSMISSION/STORAGE LOCAL DISTRIBUTION TRUCKS AND STATIONS

**NOAA
Denver-Julesburg**

**Barnett
Coordinated
Campaign**

12 campaign papers
Barnett synthesis
Barnett component

**UT Phase 1
UT Phase 2**
• Pneumatics
• Liquids Unloading
HARC/EPA

CSU Study
• Methods
• Measurements
• National Scale-up

CSU Study
• Measurements
• National Scale-up

Methane Mapping
• Boston Study
• WSU Multi-City
• Indianapolis

WVU Study
• Measuring
• Modeling

Pilot Projects

Gap Filling

- Abandoned wells
- Helicopter IR Survey

Synthesis Projects

- NETL LCA
- Synthesis



EDF's Methane Research



Rigorous Science

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



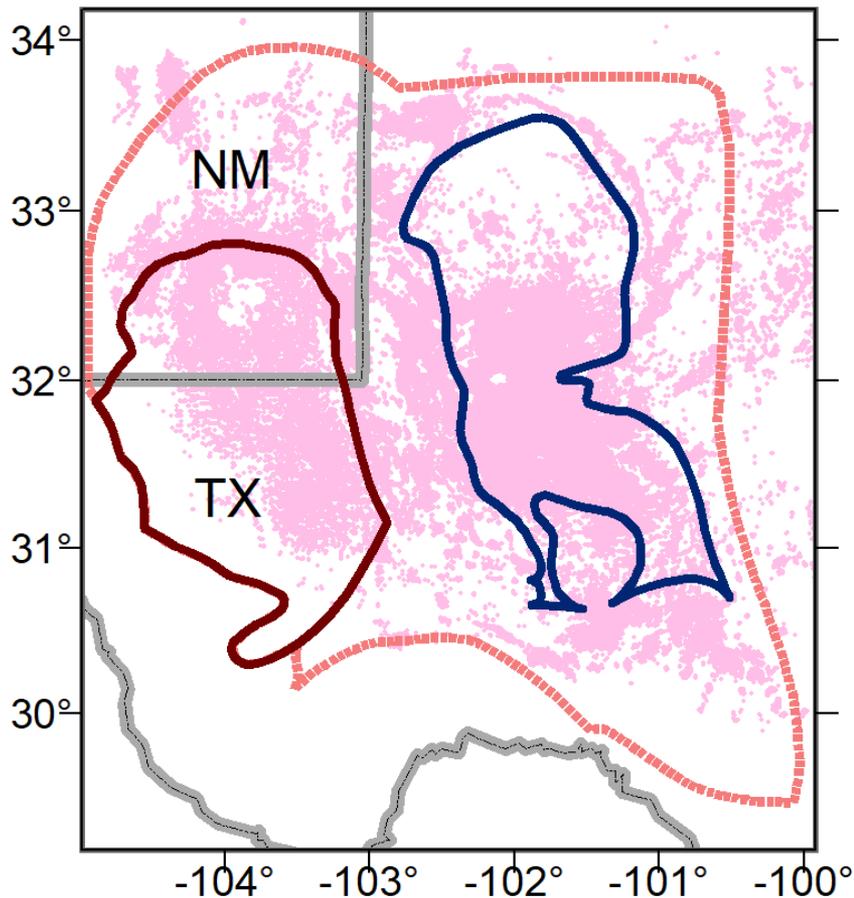
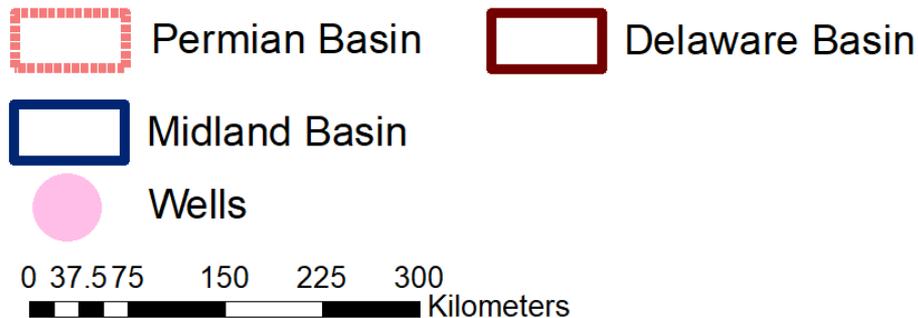
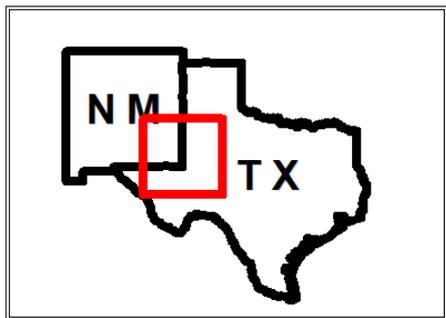
Broad Collaboration

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

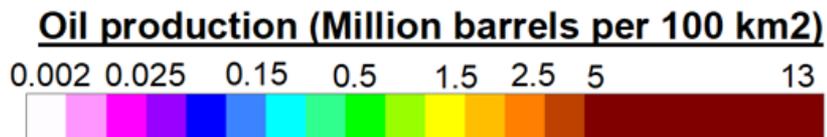
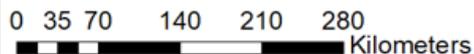


Transparent Results

38 peer-reviewed manuscripts and publicly available data



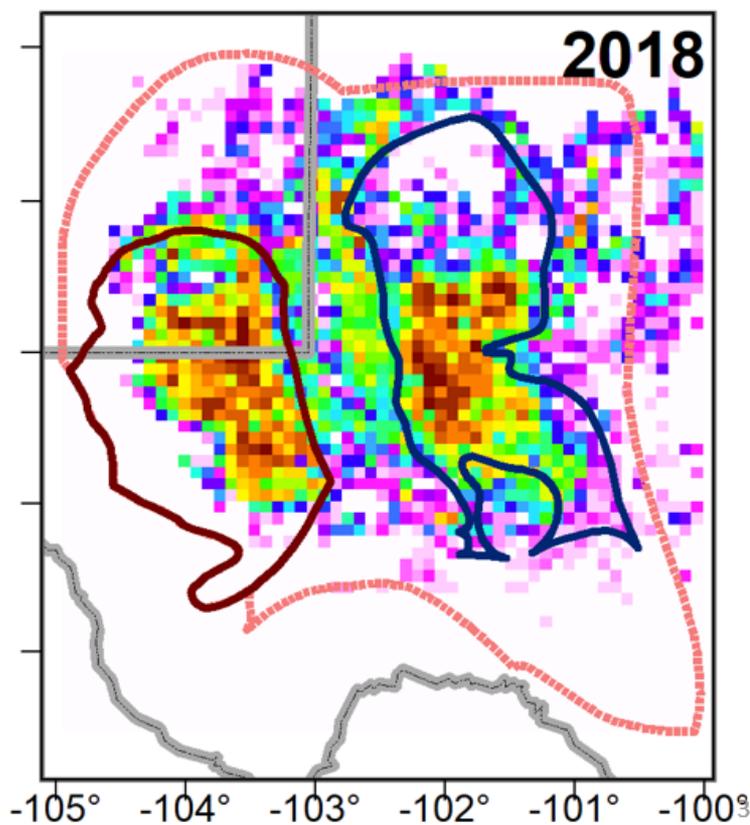
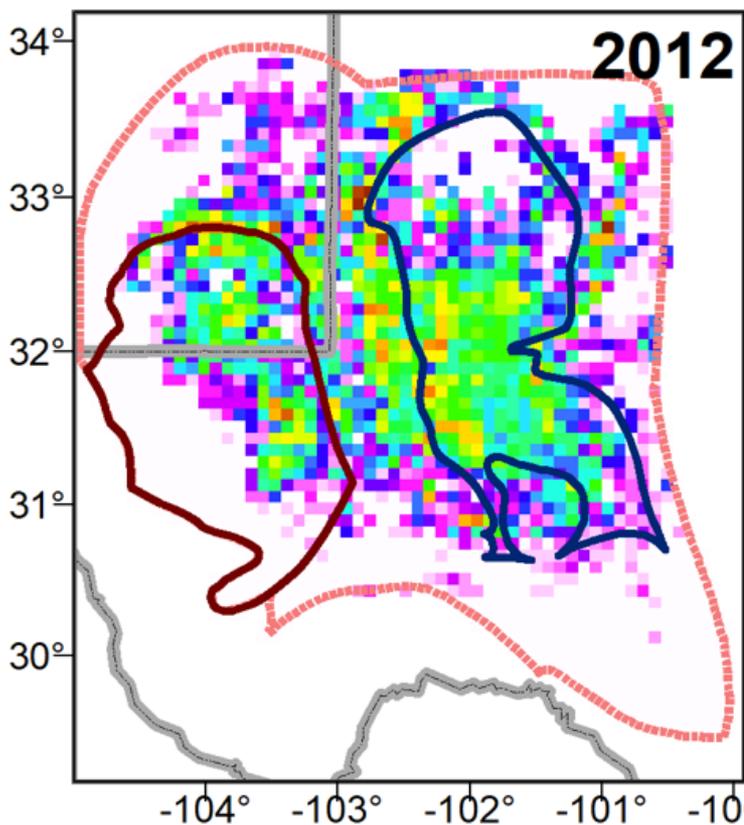
Permian Basin
includes two major
geologic basins:
Delaware and
Midland

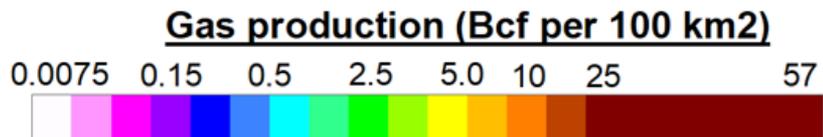
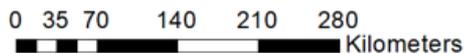


PERMIAN

Oil 2018:
1.26 billion barrels

➔ **190% increase**
From 2012

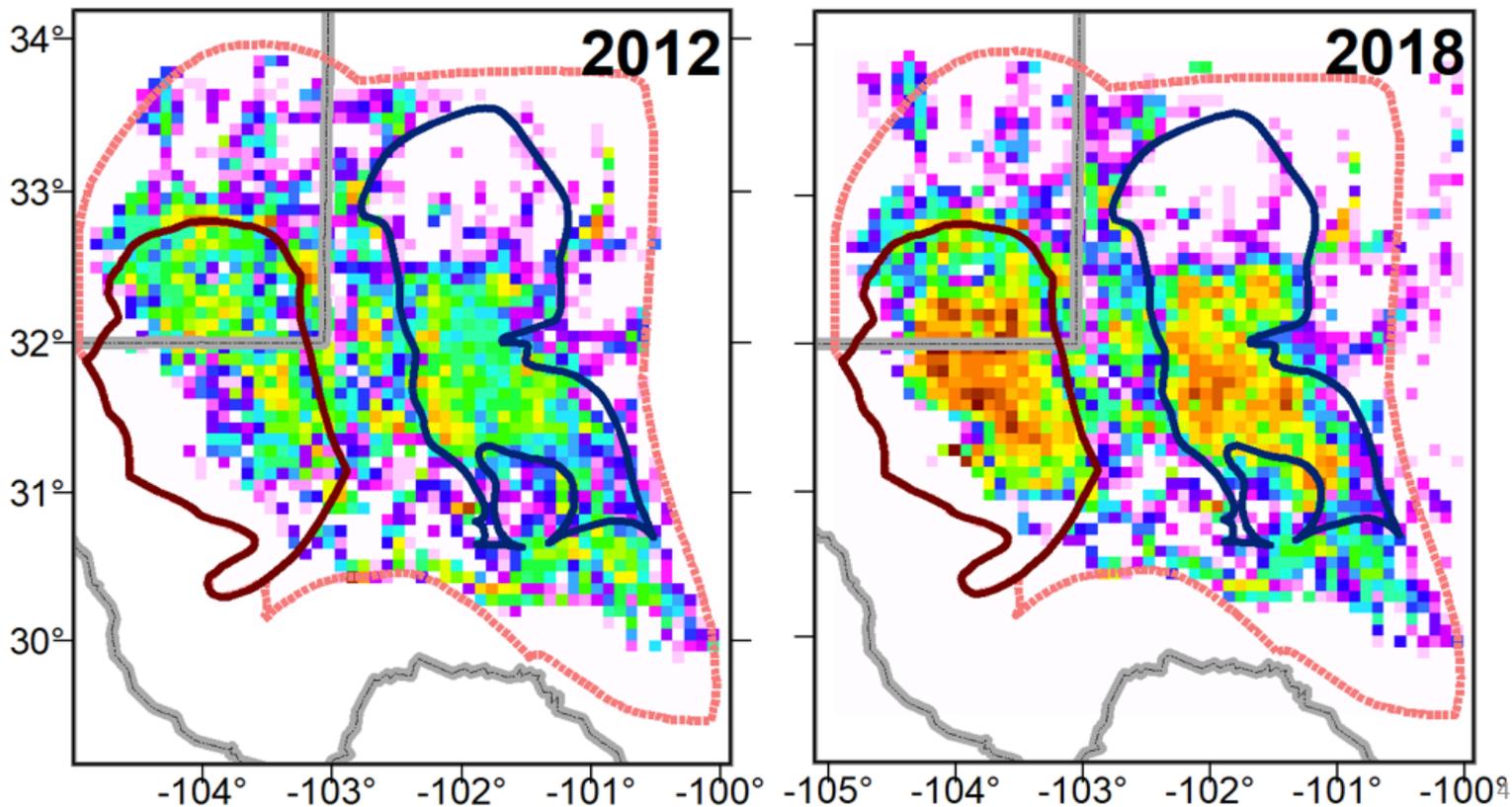




PERMIAN

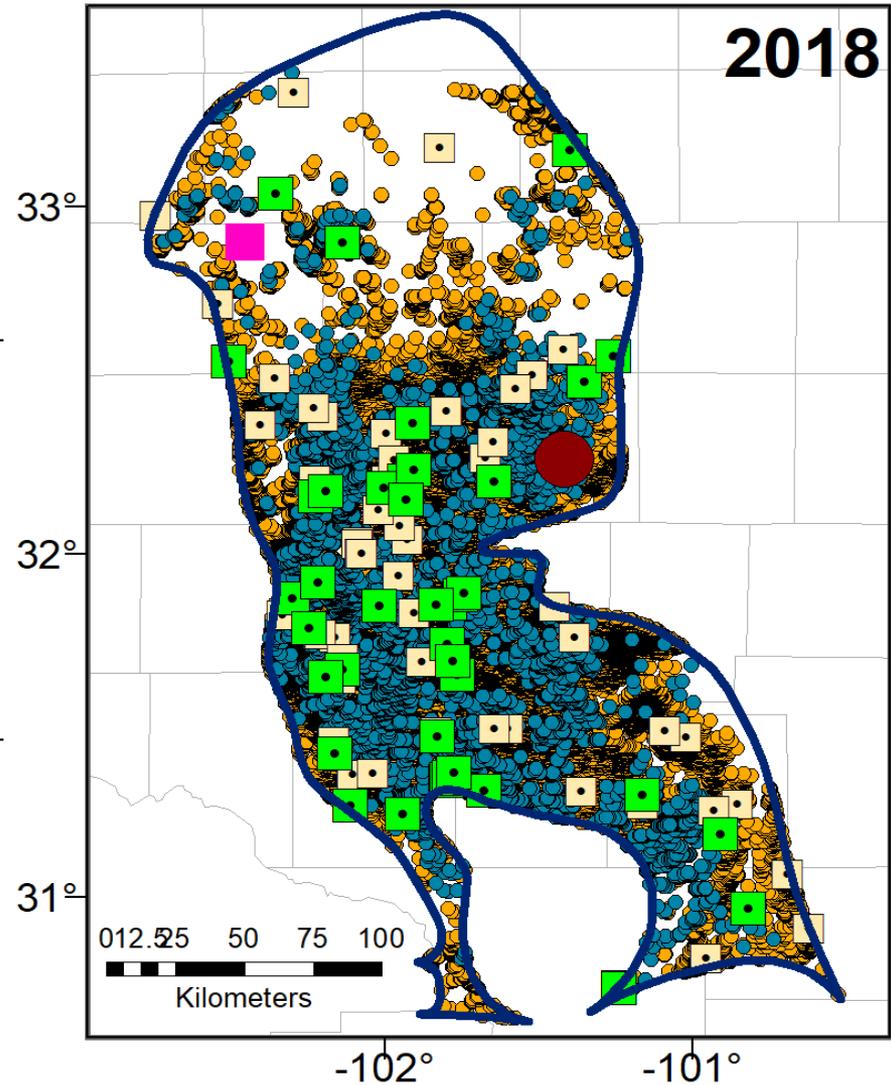
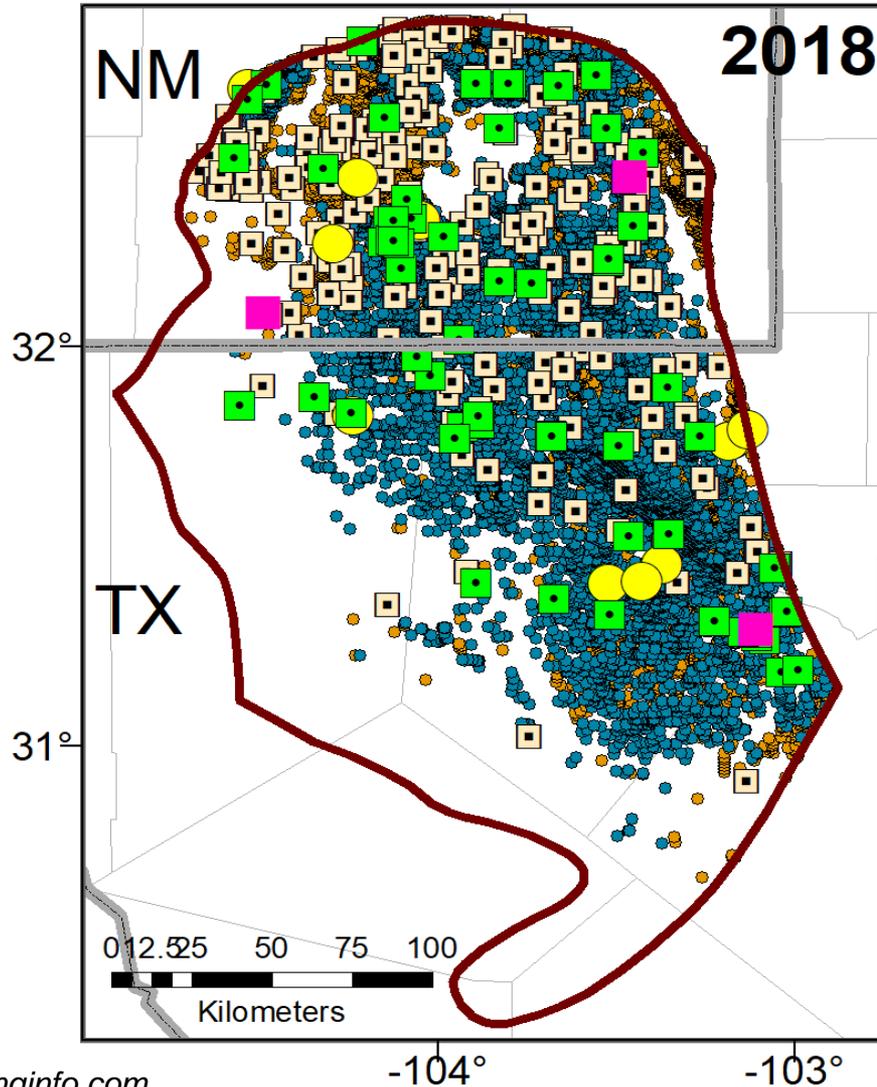
Gas 2018:
4.17 Tcf

➔ 157% increase
From 2012



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

● Conv. Wells ● Unconv. Wells ● Terminals ■ Storage ● Proc. Plt ■ NG Compressor

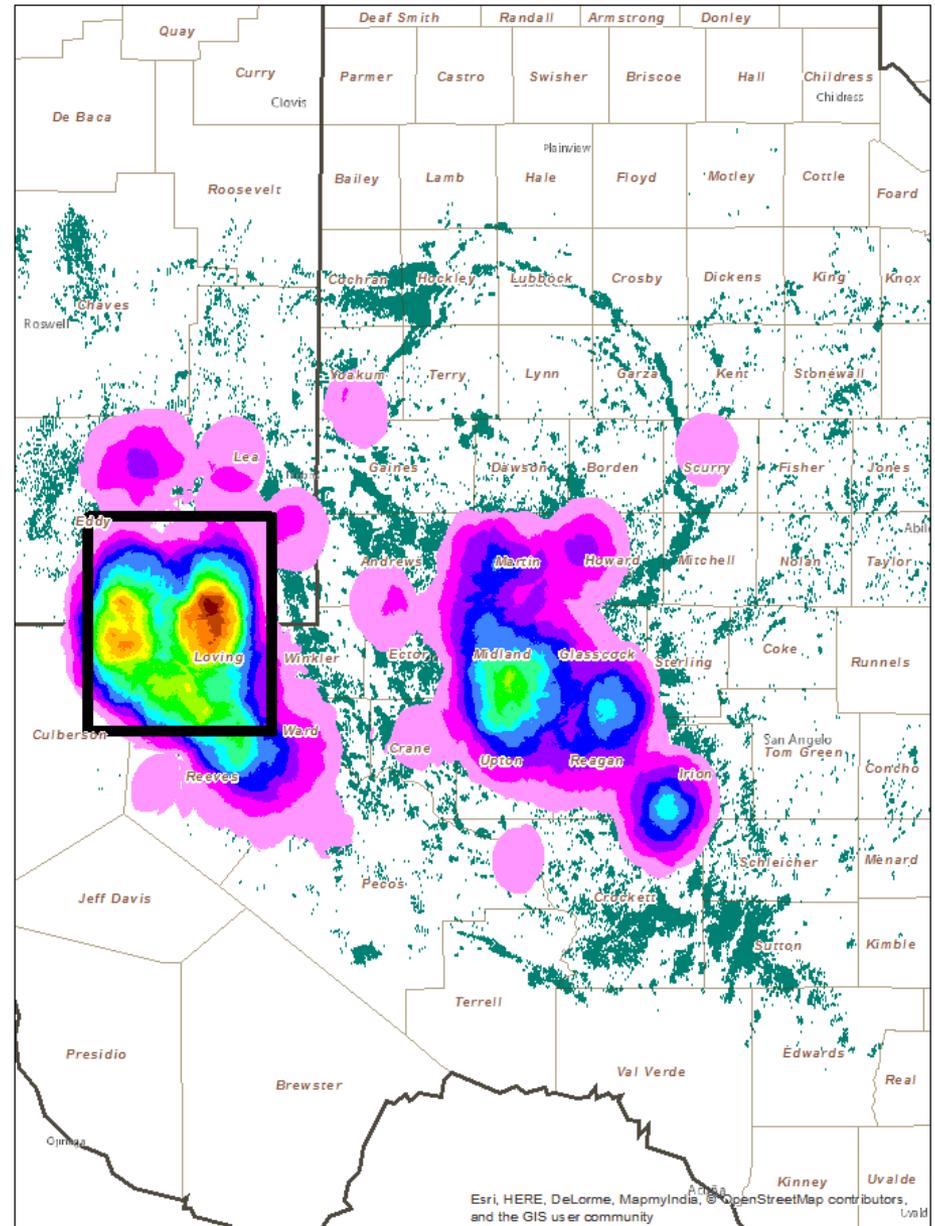


Permian Basin Campaign

- Twelve month campaign with science and advocacy goals
 - Uses multiple, peer-reviewed methods to detect and quantify methane emissions
 - Emissions data including site identities will be published frequently on a public website prior to submitting for peer-review
- 

Permian gas production -heatmap

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



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

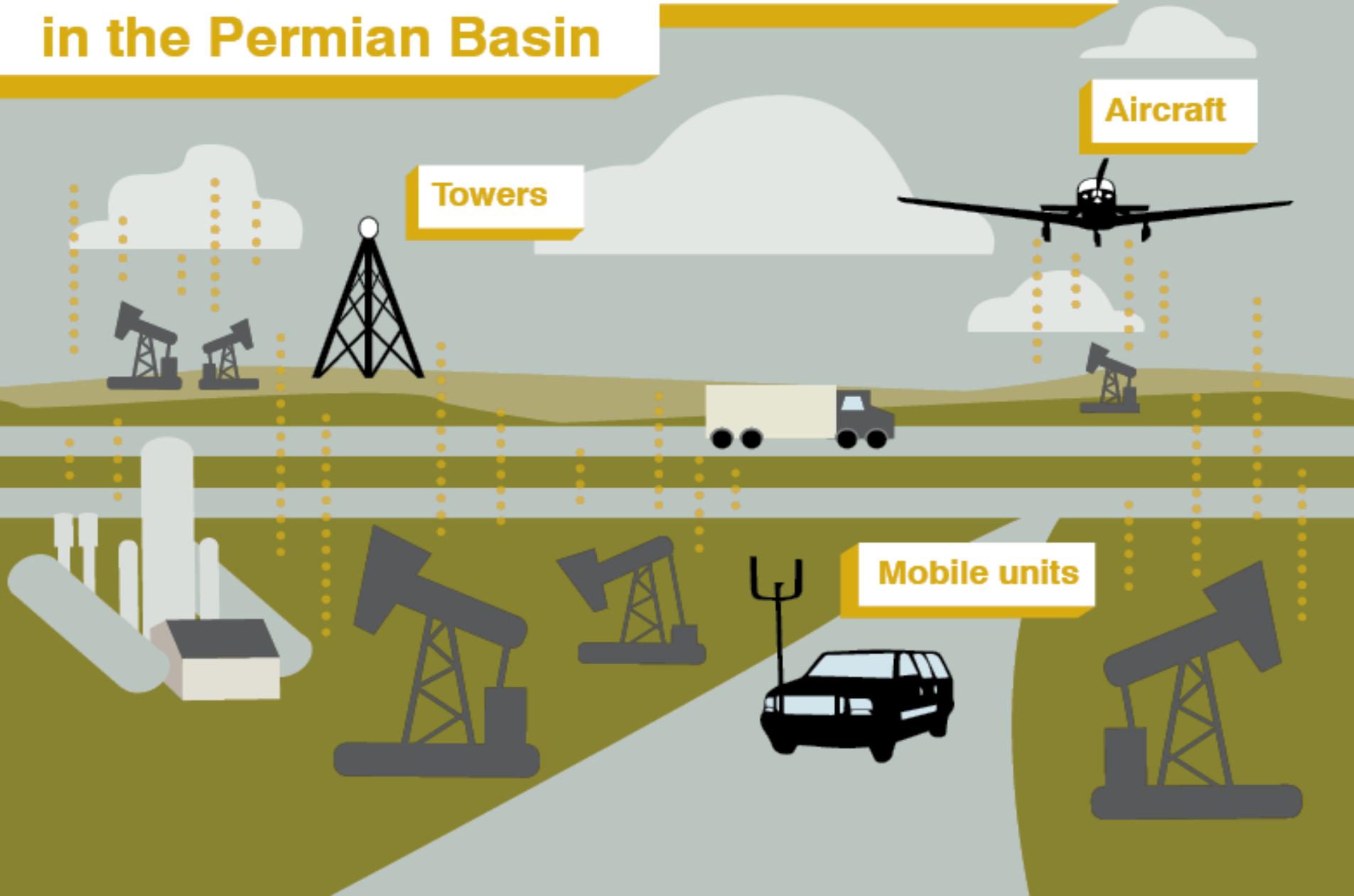
Permian Campaign: Science

- 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

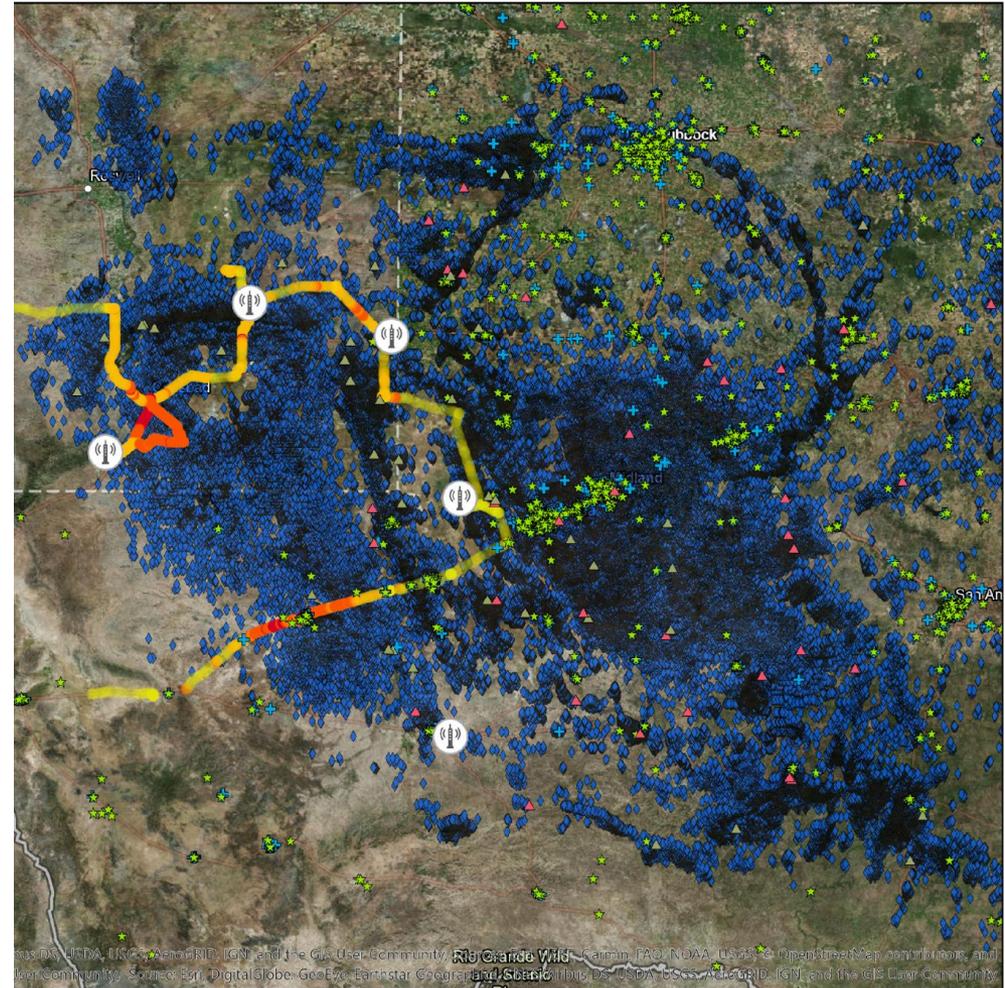
- Research questions include:
 - What are the total methane emissions from O&G sources in the Delaware basin?
 - What is the statistical and spatial distribution of site-level methane emissions?
 - How do emissions change over the 12 month campaign?
 - How long do high emissions persist at sites?
 - 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 CH₄ emissions on quarterly basis

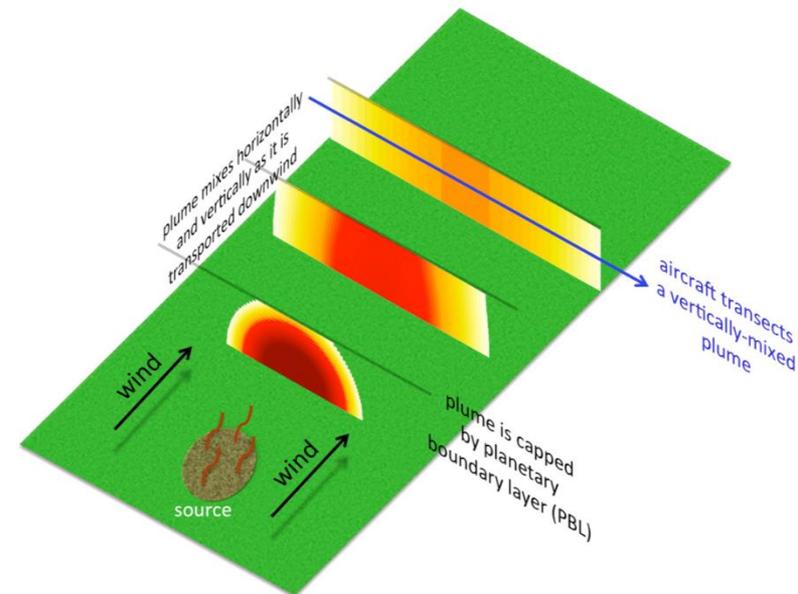
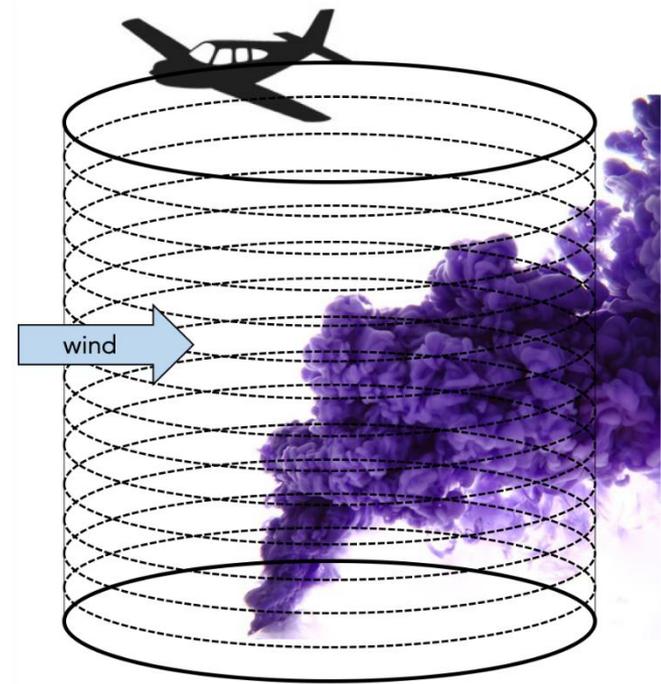


nents

0 34 68 136 204 272 Kilometers

Aircraft: Scientific Aviation

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



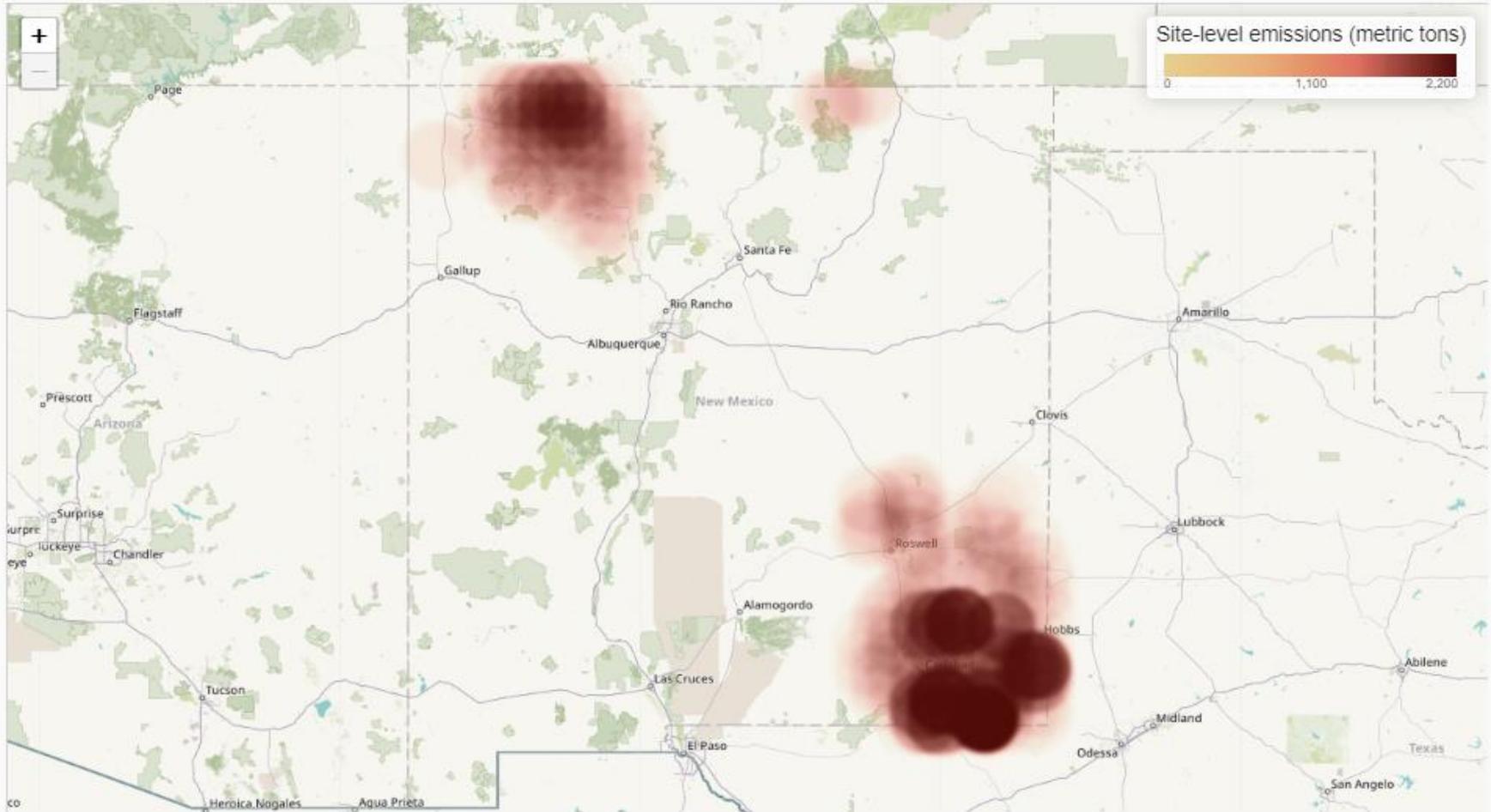
Vehicles: U. Wyoming

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, ENGO's, and the public 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
- Launch date in early 2020 with initial data; regular updates with new measurement data.

Permian Campaign: Stakeholder Engagement



Questions?

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