Energy LCLUC hotspot: Characterizing the dynamics of energy land use and assessing environmental impacts in the Permian Basin

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NASA LCLUC Science Team Meeting, Gaithersburg, MD 04/03/2024

GLOBAL CARBON BUDGET 2023

Global Carbon Project

TOTAL EMISSIONS

40.7 (±3.4)

ATMOSPHERIC CO_2 GROWTH RATE

16.9 (±0.7)

TOTAL SINKS

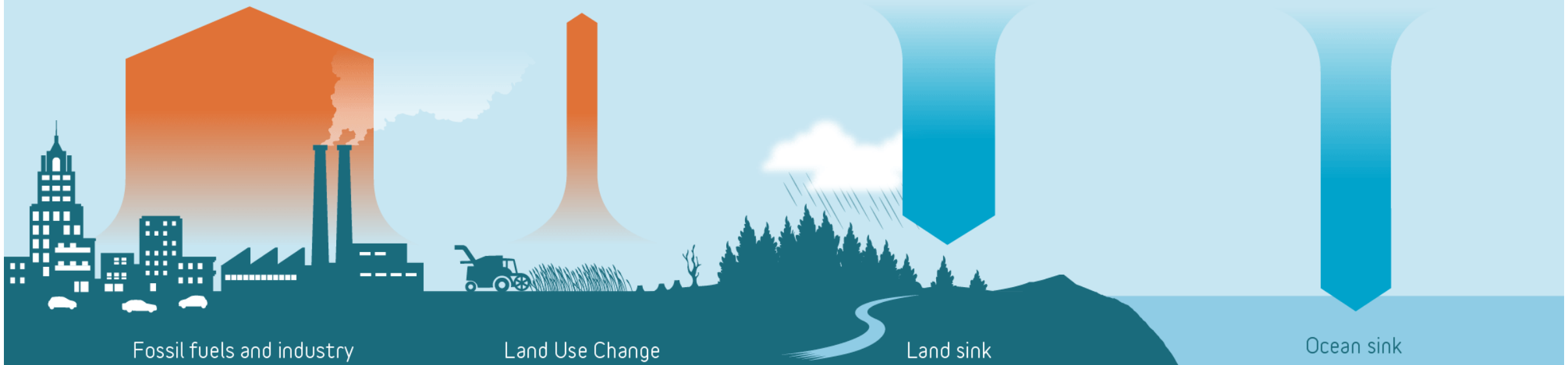
23.8 (±3.2)

36.3 (±1.8)

4.4 (±2.6)

13.5 (±2.9)

10.3 (±1.5)



Fossil fuels and industry

Land Use Change

Land sink

Ocean sink

EMISSIONS AND SINKS

In billion-tons CO_2 per year (Pg CO_2 / yr), in 2023

Anthropogenic emissions

Sinks of anthropogenic emissions

GLOBAL CARBON PROJECT

FONDATION BNP PARIBAS

GLOBAL METHANE BUDGET 2008-2017

Global Carbon Project

TOTAL EMISSIONS

Bottom-up view (BU): 737 (594-880)

Top-down view (TD): 576 (550-594)

CHANGE IN ATMOSPHERIC ABUNDANCE

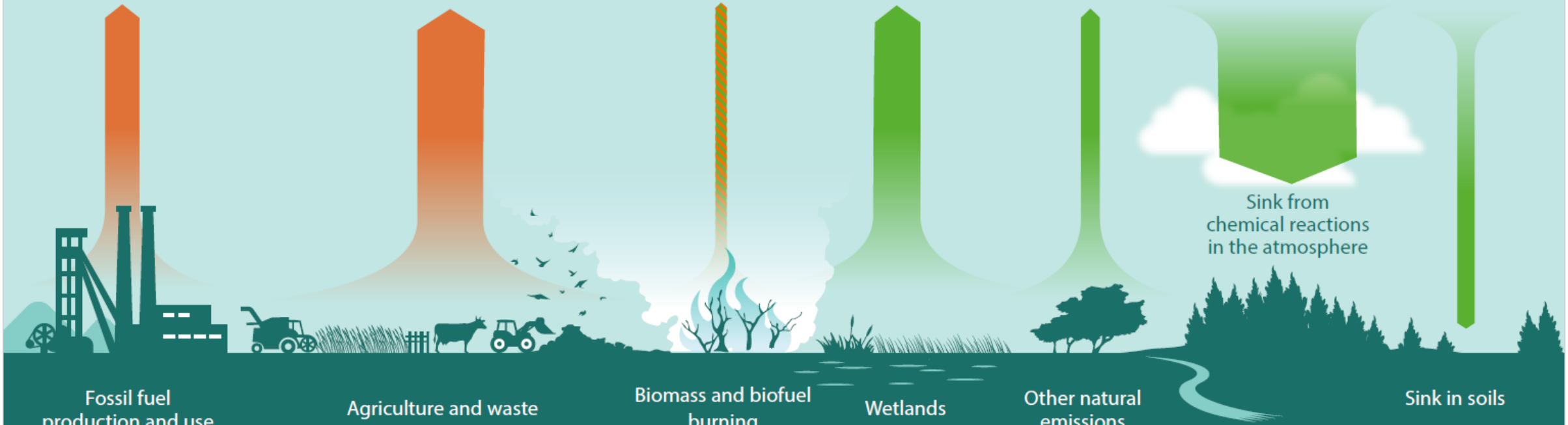
> 100

13* (0-49)

TOTAL SINKS

Bottom-up view (BU): 625 (500-798)

Top-down view (TD): 556 (501-574)



Fossil fuel production and use

Agriculture and waste

Biomass and biofuel burning

Wetlands

Other natural emissions

Inland waters, geological, oceans, termites, wild animals, permafrost, vegetation

Sink in soils

EMISSIONS AND SINKS

In teragrams of CH_4 per year (Tg CH_4 / yr) average over 2008-2017

The observed atmospheric growth rate is 18.2 (17.3-19) Tg CH_4 / yr. The difference with the TD budget imbalance reflects uncertainties in capturing the observed growth rate.

Anthropogenic fluxes

Natural fluxes

Natural and anthropogenic fluxes

GLOBAL CARBON PROJECT

RESEARCH ARTICLE | ENVIRONMENTAL STUDIES

Quantifying methane emissions from the largest oil-producing basin in the United States from space

YUZHONG ZHANG, RITESH GAUTAM, SUDHANSHU PANDEY, MARK OMARA, JOANNES D. MAASAKKERS, PANKAJ SADAVARTE, DAVID LYON, HANNAH NESSER, MELISSA P. SULPRIZIO, [...], AND DANIEL J. JACOB +8 authors Authors Info & Affiliations

SCIENCE ADVANCES · 22 Apr 2020 · Vol 6, Issue 17 · DOI: 10.1126/sciadv.aaz5120

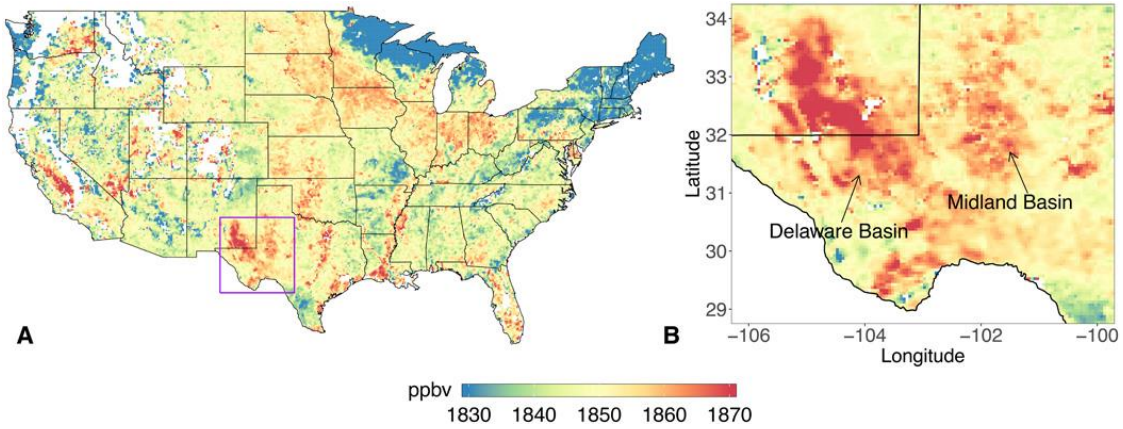


Fig. 1 Satellite observations of the Permian methane anomaly.
TROPOMI satellite data derived elevation-corrected column methane mixing ratio for (**A**) the conterminous United States and (**B**) the Permian Basin containing the Delaware and Midland sub-basins. White shading represents missing data. Purple boundary in (A) indicates the study domain encompassing the Permian Basin. Methane averages are computed from monthly means of TROPOMI measurements during May 2018 and March 2019.

RESEARCH ARTICLE | ENVIRONMENTAL STUDIES

Satellite-based survey of extreme methane emissions in the Permian basin

ITZIAR IRAKULIS-LOITXATE, LUIS GUANTER, YIN-NIAN LIU, DANIEL J. VARON, JOANNES D. MAASAKKERS, YUZHONG ZHANG, APISADA CHULAKADABBA, STEVEN C. WOFSY, ANDREW K. THORPE, [...], AND DANIEL J. JACOB +15 authors Authors Info & Affiliations

SCIENCE ADVANCES · 30 Jun 2021 · Vol 7, Issue 27 · DOI: 10.1126/sciadv.abf4507

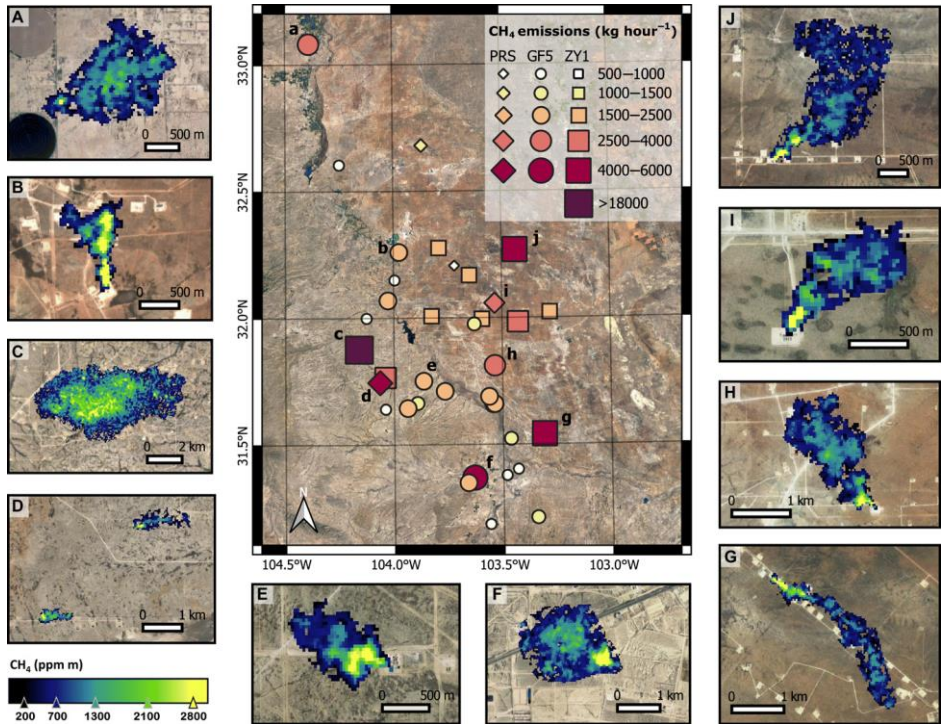
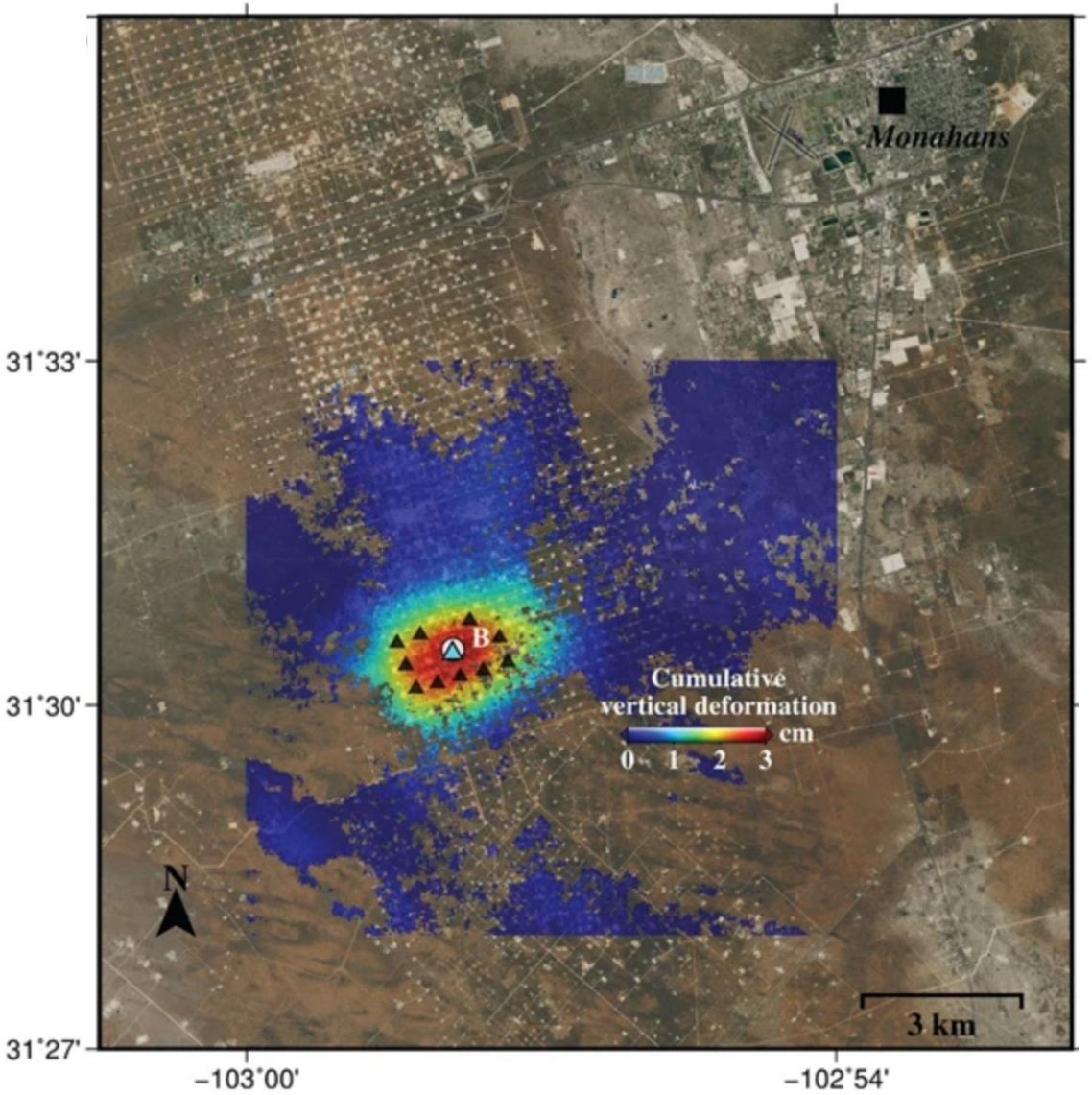
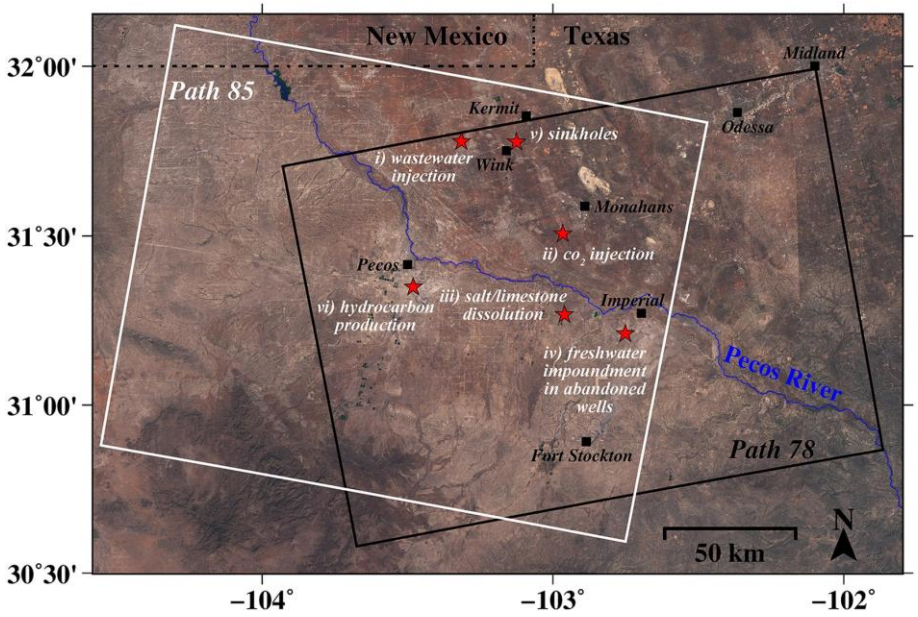
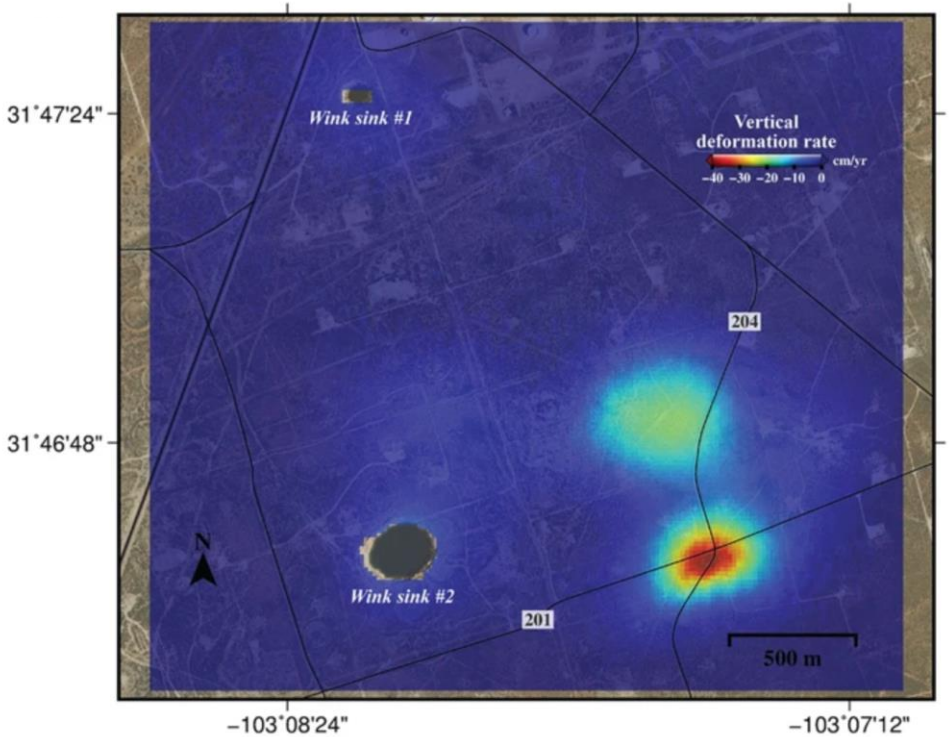


Fig. 1 Extreme methane emissions detected in the Permian basin from satellite imaging spectroscopy data.
A map with the identified methane plumes is shown in the central panel. Emissions are coded according to their flux rate and to the source of data (GF5-AHSI, GF5; ZY1-AHSI, ZY1; PRISMA, PRS). The small panels (A to J) around the main figure show examples of the detected plumes.

Localized geohazards induced by fossil fuel extraction







Kim and Lu 2018
Scientific Report

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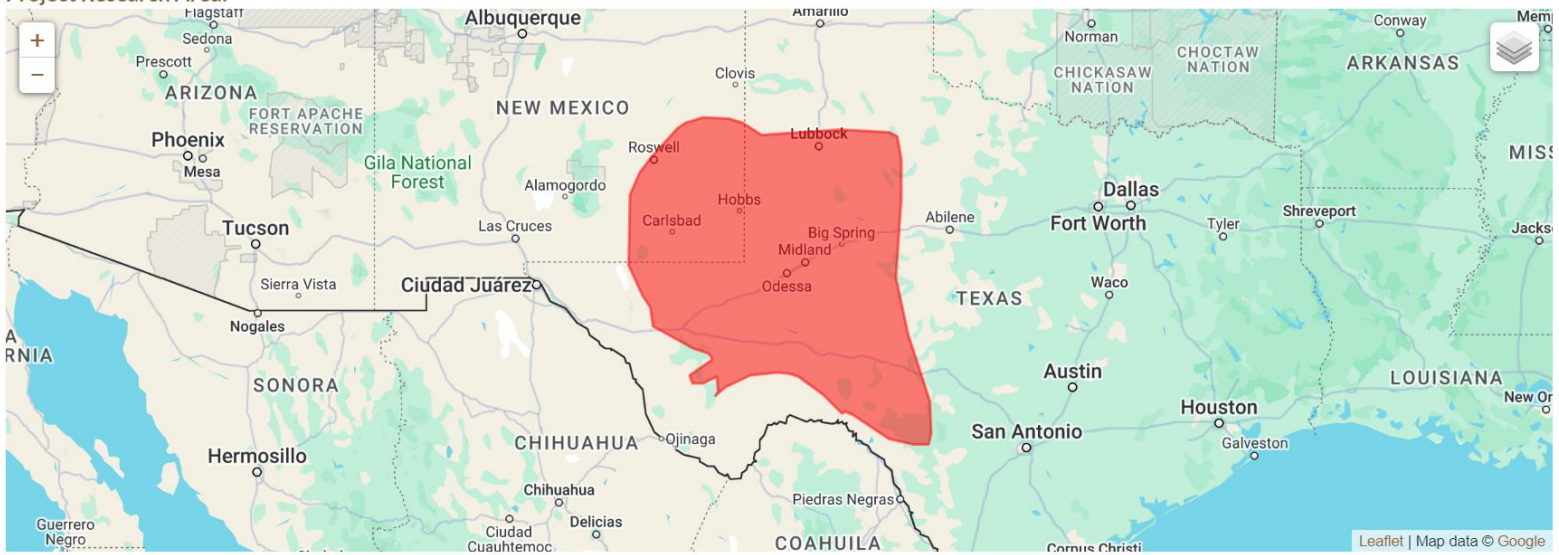
Start Date: 01/01/2023
End Date: 12/31/2025
Grant Number: 80NSSC23K0526
Science Theme:
Detection and Monitoring of LCLUC
Region: Continental U.S.
Solicitation: NNH22ZDA001N- LCLUC

Project Research Area:



ect Team Members Institutions

Investigator Collaborator Postdoc Researcher
te Student Researcher Other

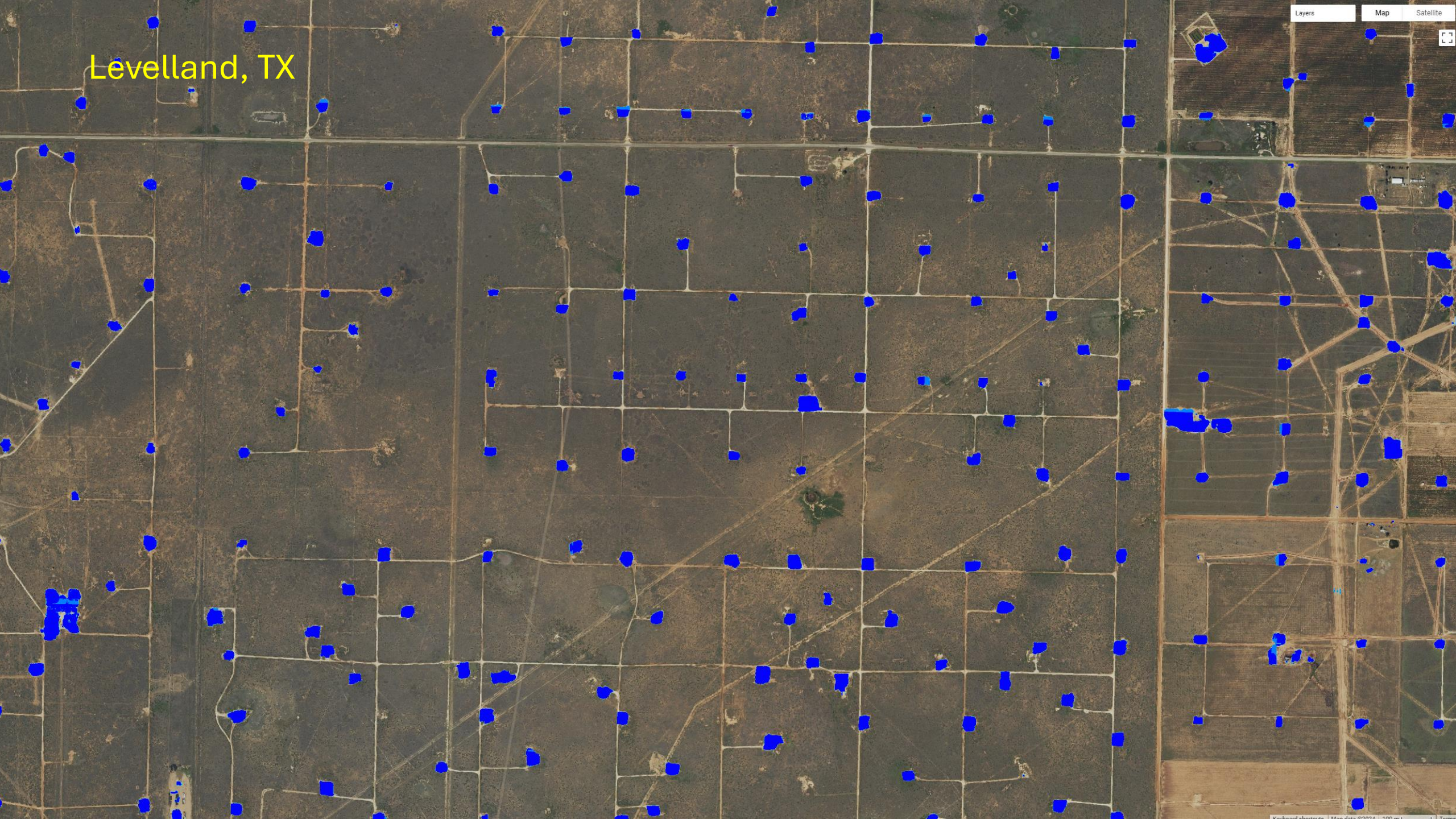
Song 2023 *International Journal of Digital Earth*
https://doi.org/10.1080/17538947.2023.2224586

Google Map of Goldsmith, TX

Google Earth Image

2 km


Levelland, TX
Layers
Map
Satellite


Levelland, TX
Layers
Map
Satellite

Thank you!

Questions?

xpsong@umd.edu