

Updating the Global Gas Flaring Tracker and Data Methodology



Webinar
January 15, 2026

GFMR 

Global Flaring and Methane Reduction Partnership



Opening Remarks

SPEAKER



Zubin Bamji
GFMR Manager
Energy Global Department
The World Bank

Updating the Global Gas Flaring Tracker Methodology

AGENDA

08:30 – 08:45

Welcome Remarks

(Zubin Bamji & Christopher Elvidge)

08:45 – 09:05

Presentation

(Mikhail Zhizhin)

09:05 – 09:15

Moderated Q&A on Presentation

09:15 – 10:00

Panel Discussion

(Christophe McGlade, Meghan Demeter, Erick Emanuel Luna Rojero, Moderator: Alexandrina Platonova-Oquab)

10:00 – 10:20

Moderated Q&A

10:20 – 10:25

Concluding Remarks

(Zubin Bamji)

10:25 – 10:30

Close

Global Gas Flaring and Methane Reduction Partnership: Overview



GFMR Webinar
January 15, 2026

GFMR 

Global Flaring and Methane Reduction Partnership

 MANAGED BY
WORLD BANK GROUP

Announced during COP28 in Dubai, UAE



Boost global efforts to end routine gas flaring and reduce methane emissions across the oil and gas value chain

Work Program

- Provide grant funding and technical assistance
- Enable policy reform and institutional strengthening
- Mobilize financing for governments and state-owned operators

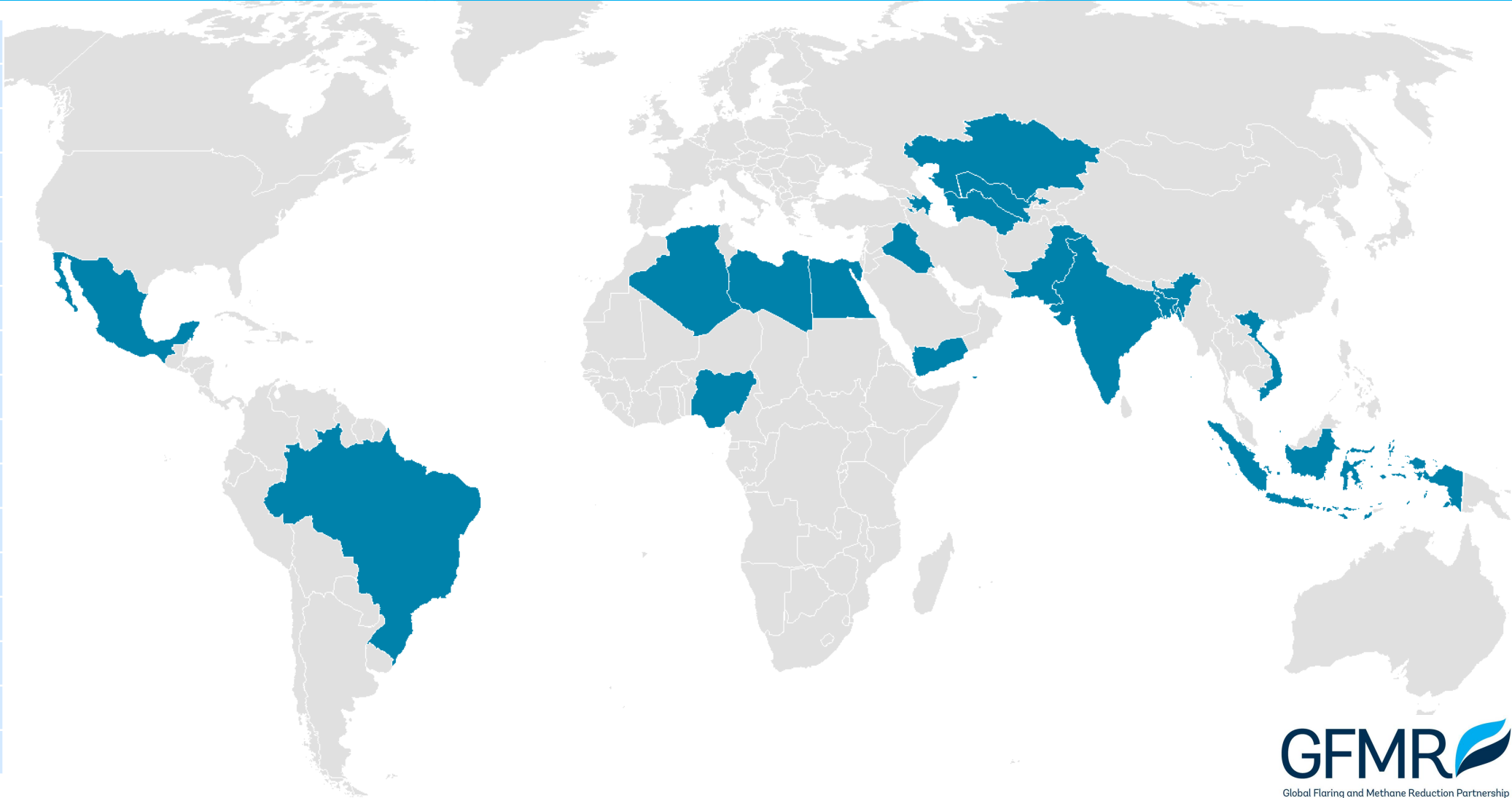


Activity Areas

- **Grant funding:** For abatement projects implemented by governments and state-owned operators
- **Project support leveraging the World Bank's convening power:** Identification, pre-feasibility, and implementation
- **Financing:** Mobilize climate and private funding
- **Knowledge sharing, building capacity:** Identify global best practices; lessons learnt
- **Data & reporting:** Collect and report flaring and methane emissions data
- **Advocacy:** Zero Routine Flaring by 2030

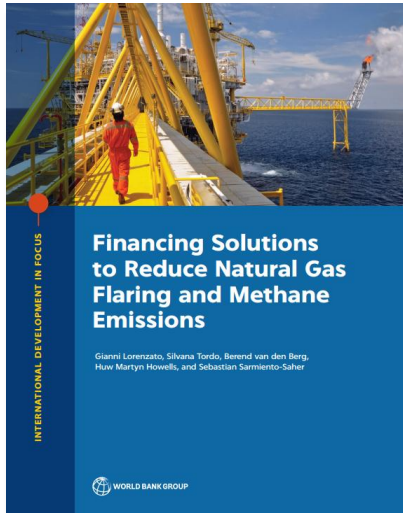
Global Work Program: 17 Countries

- Algeria
- Azerbaijan
- Bangladesh
- Brazil
- Egypt
- India
- Indonesia
- Iraq
- Kazakhstan
- Libya
- Mexico
- Nigeria
- Pakistan
- Turkmenistan
- Uzbekistan
- Vietnam
- Yemen



Building Global Knowledge

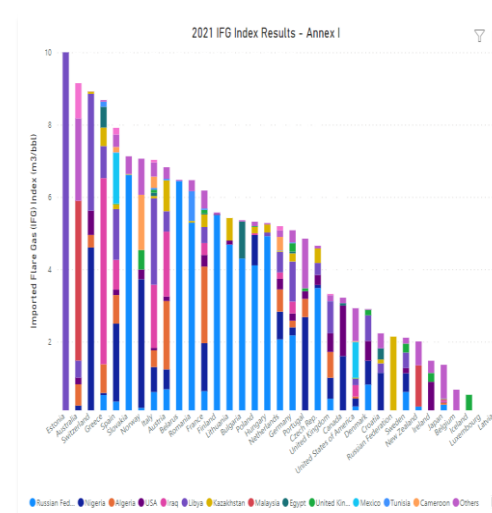
Financial Solutions



Global Regulatory Review



Imported Flare Gas Index: a new metric to infer flaring from crude oil imports

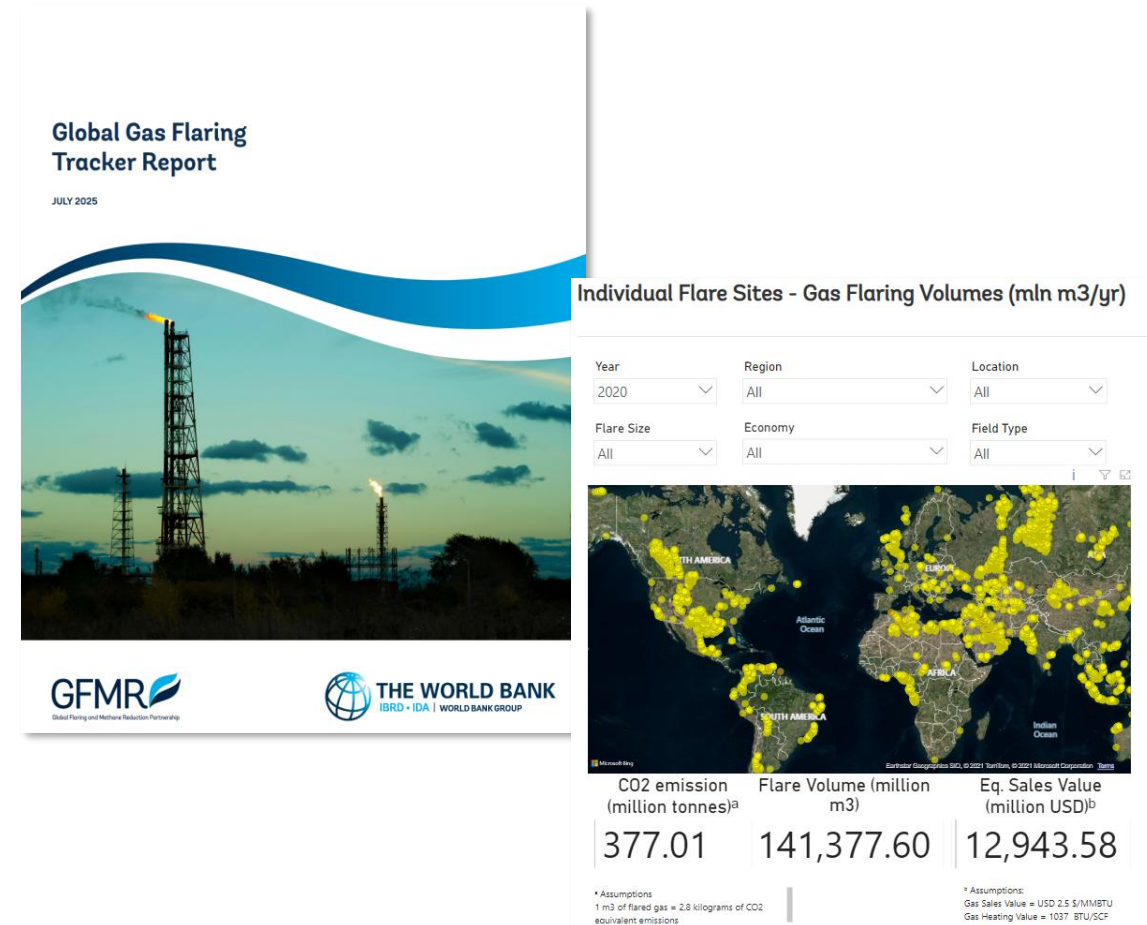


Technical Solutions



Global Gas Flaring Tracker Report and Dashboard

- Produced annually.
- Today, the Tracker Report covers time series back to 2012, while the Global Gas Flaring Dashboard provides access to flaring volumes at individual flare sites.
- Developed in collaboration with NOAA and the Payne Institute (Colorado School of Mines) using satellite-based infrared detection to estimate global flaring volumes.
- Supports global efforts to end routine flaring and reduce methane emissions, while also boosting energy security and access; enhance government revenues.



MODERATOR



Alexandrina Platonova-Oquab
GFMR Senior Energy Specialist
The World Bank

Presentation

SPEAKER



Christopher Elvidge
Director of Earth Observation Group
The Payne Institute for Public Policy
Colorado School of Mines

The Evolution of Global Flare Monitoring

Earth Observation Group (EOG)
Payne Institute for Public Policy
Colorado School of Mines
celvidge@mines.edu



The Payne Institute for Public Policy

AT COLORADO SCHOOL OF MINES

Earliest Global Monitoring of Gas Flaring: 1992-2011

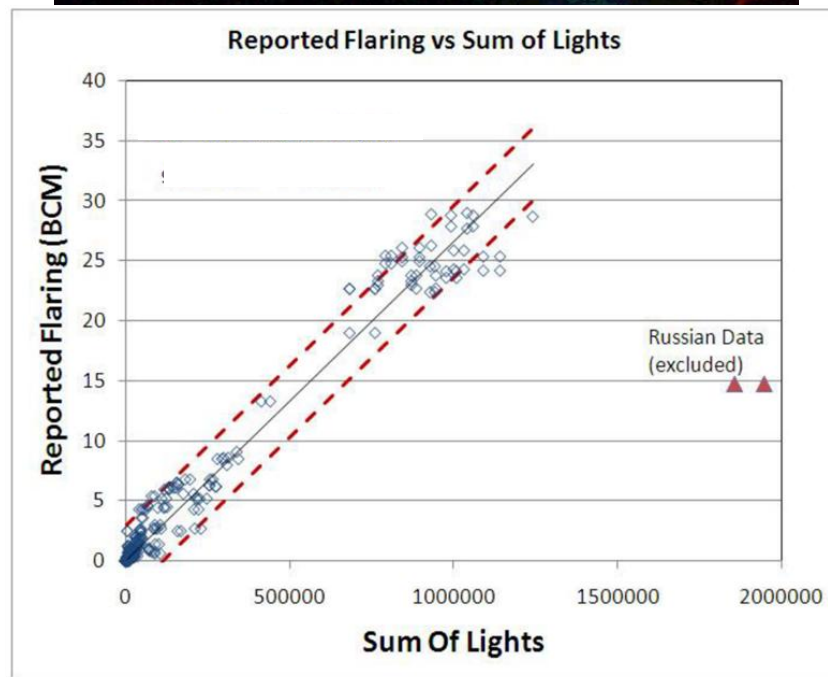
- Flaring is widely distributed and often in remote locations, so daily global satellite data are the logical choice for global flare monitoring.
- With World Bank support, the Earth Observation Group (EOG) developed methods for global flare monitoring and estimation of national flare gas volumes with nighttime lights data collected by DMSP.
- The calibration had a large uncertainty range.



**Defense Meteorological Satellite Program (DMSP)
Nighttime Light detections**

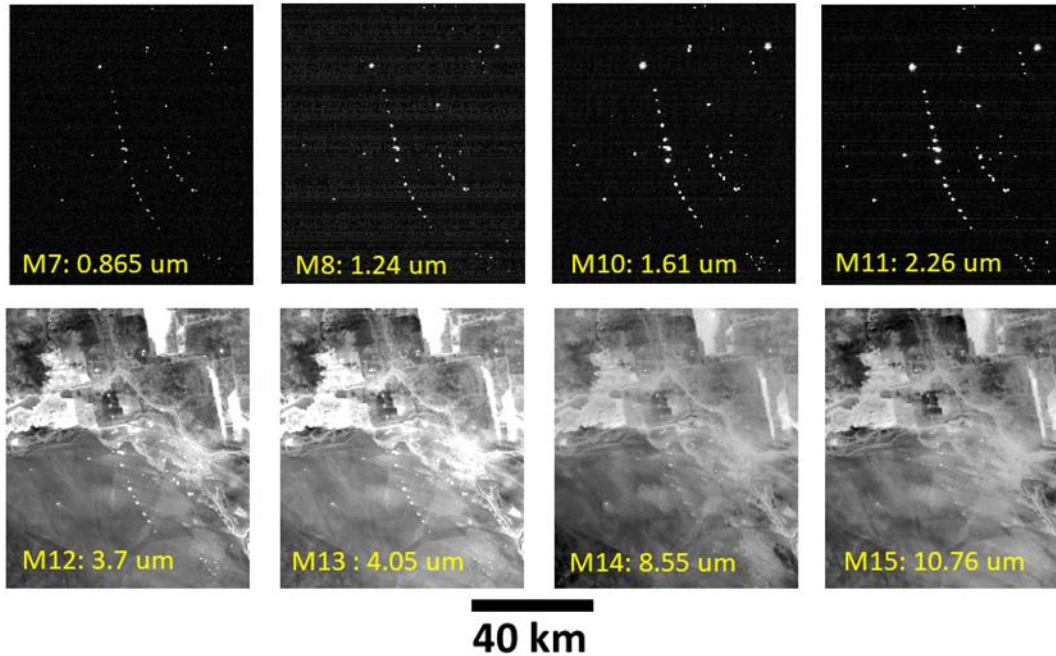
Flares show up as “fuzzy snowballs”

1992=blue
2000=green
2012=red



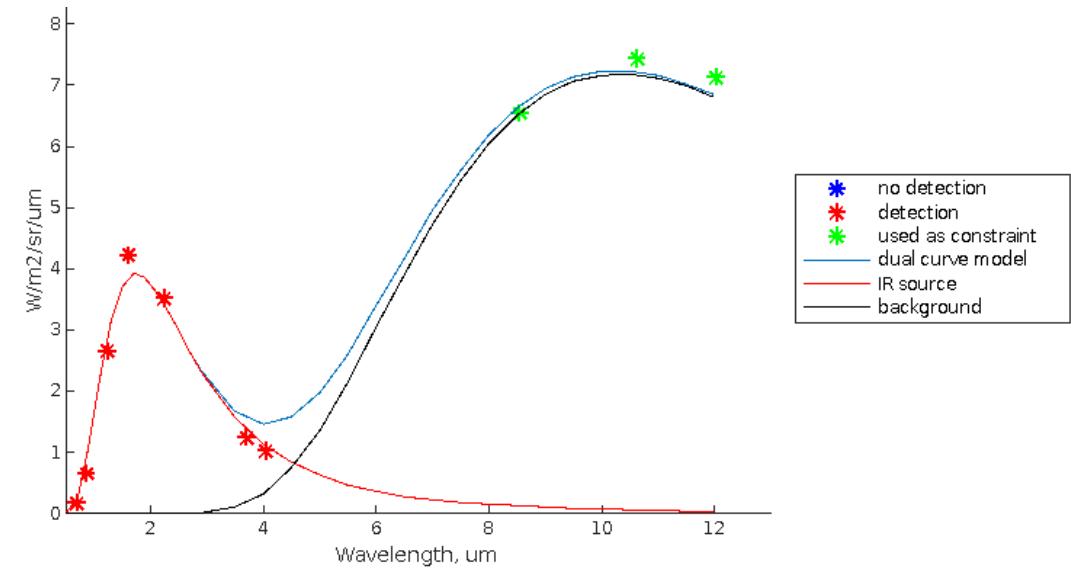
Quantitative analysis of individual flares took a leap forward with the advent of VIIRS data in 2012

SNPP VIIRS Nighttime



Advantages of VIIRS over DMSP:

- ❖ 42 times smaller pixel footprints
- ❖ Has NIR and SWIR bands collected at night
- ❖ Has in-flight radiometric calibration
- ❖ Continuity expected to 2040 and beyond



Planck curve fitting and physical laws make it possible to calculate:

- 1) Temperature in degrees Kelvin
- 2) Source area in square meters
- 3) Radiant heat in megawatts

Presentation

SPEAKER



Mikhail Zhizhin
The Payne Institute Research Associate
Colorado School of Mines

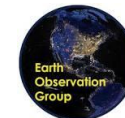


Enhancing satellite flare data for action: Methodology improvements

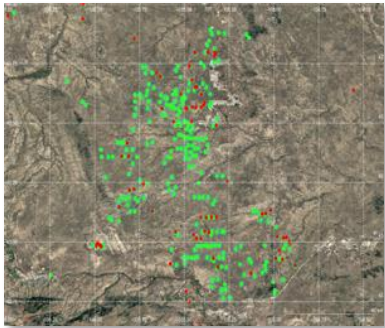
Mikhail Zhizhin

Chris Elvidge

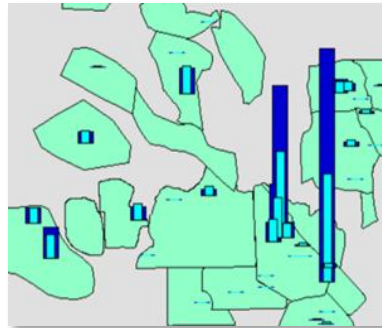
Earth Observation Group
Payne Institute for Public Policy
Colorado School of Mines



Outline



Methodology
improvements overview



Results using new
methodology



Conclusions

Major methodology improvements



1 Improved data coverage

Cross-Satellite Observations (3 Satellites)



2 Improved location of each flare

Multiyear Catalog to replace the Annual Catalog



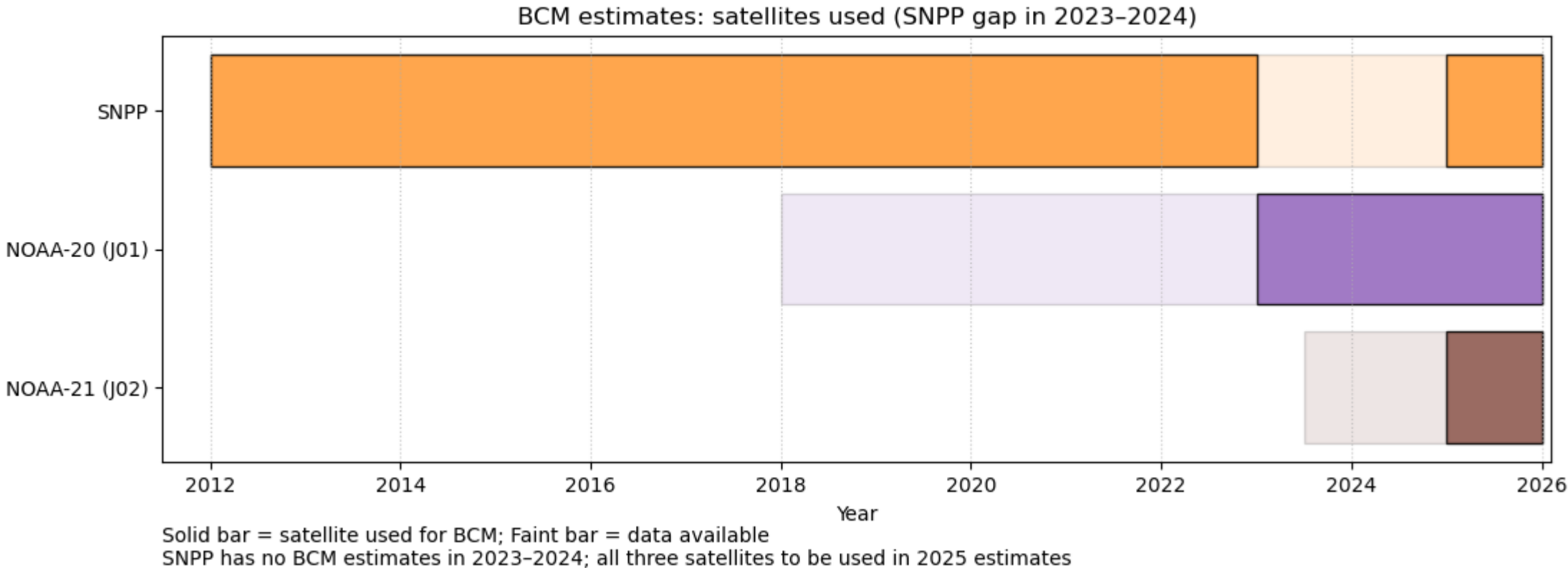
3 Improved flare volume estimates

John Zink (JZ) calibration of the satellite Radiant Heat in terms of flare volume

1

Three satellites with Visible Infrared Imaging Radiometer Suite (VIIRS)

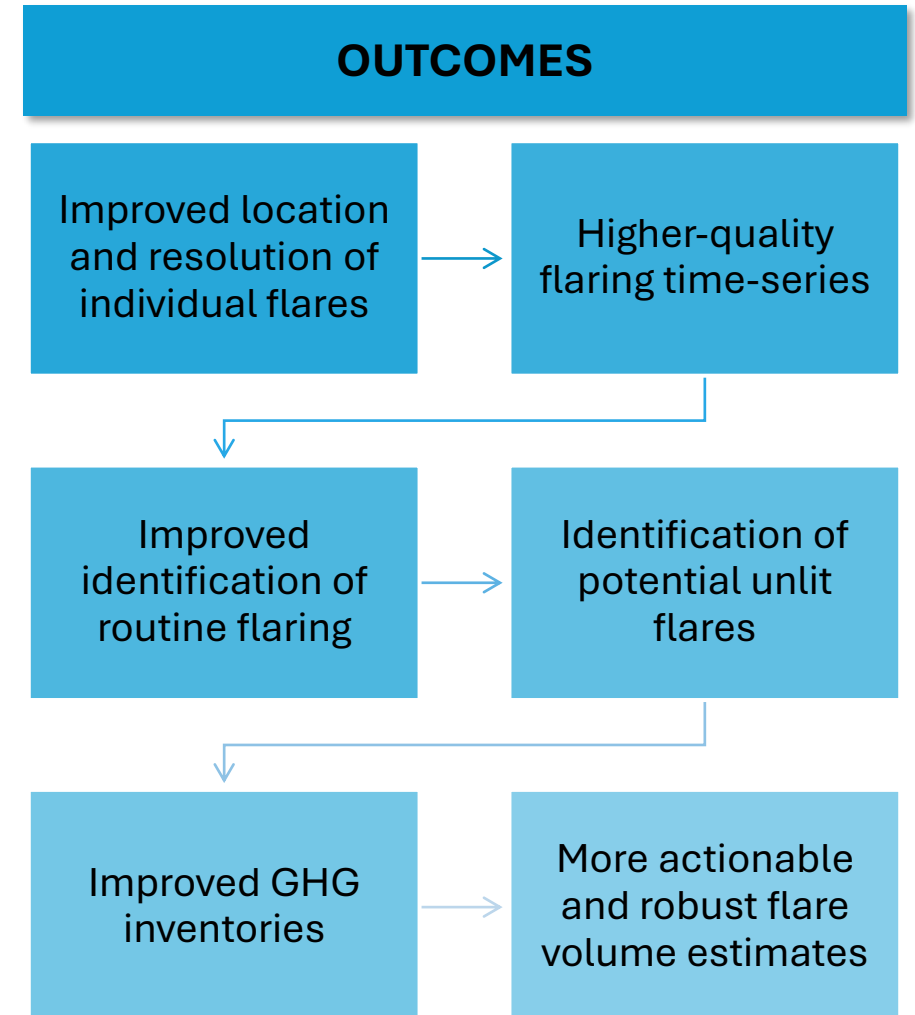
For 2025 estimates, we will use detections from three VIIRS satellites simultaneously for both flare catalog update and BCM estimates, effectively **tripling the number of observations per night**



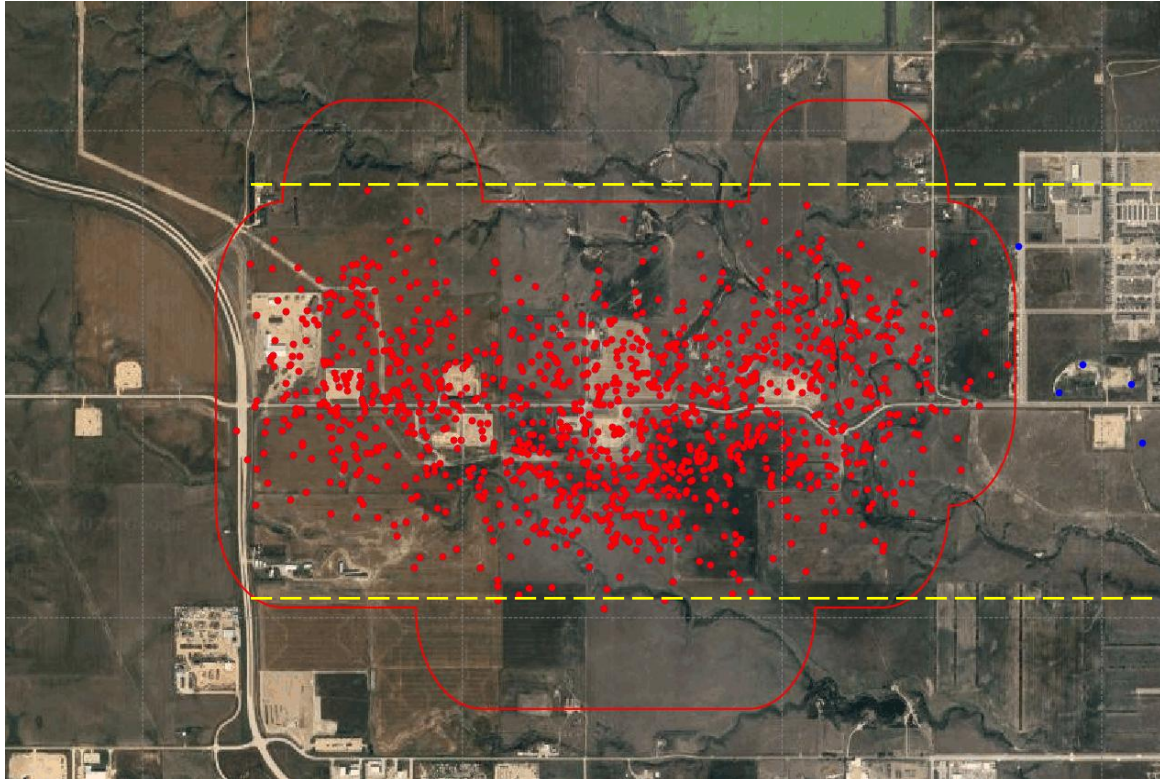
This reduces under-sampling by increasing the number of independent observations, without changing the underlying measurement approach

Enhanced flare locations and resolution

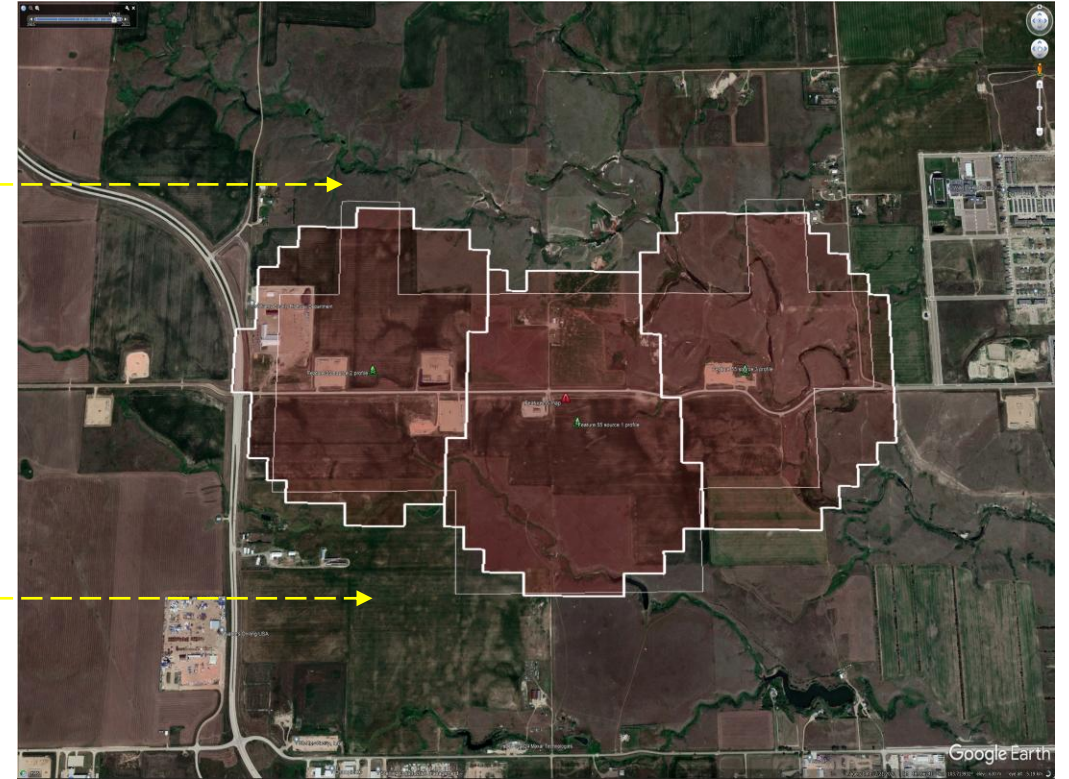
- **Flare location identification:**
 - Aggregating flare detections from 2012 to 2025 from all three satellites into a Multiyear Catalog for more consistent flare tracking
 - Previously, flare locations identified separately each year
- **Multiyear Catalog features:**
 - “Instant” individual satellite detections resolved into precise single flare features
 - Data “clustered” over multiple years help better identify intermittent flare locations
 - “False” flare detections removed (improved quality control) and more small flares detected (improved sensitivity)



2 More precise location and recognition of individual flare stacks



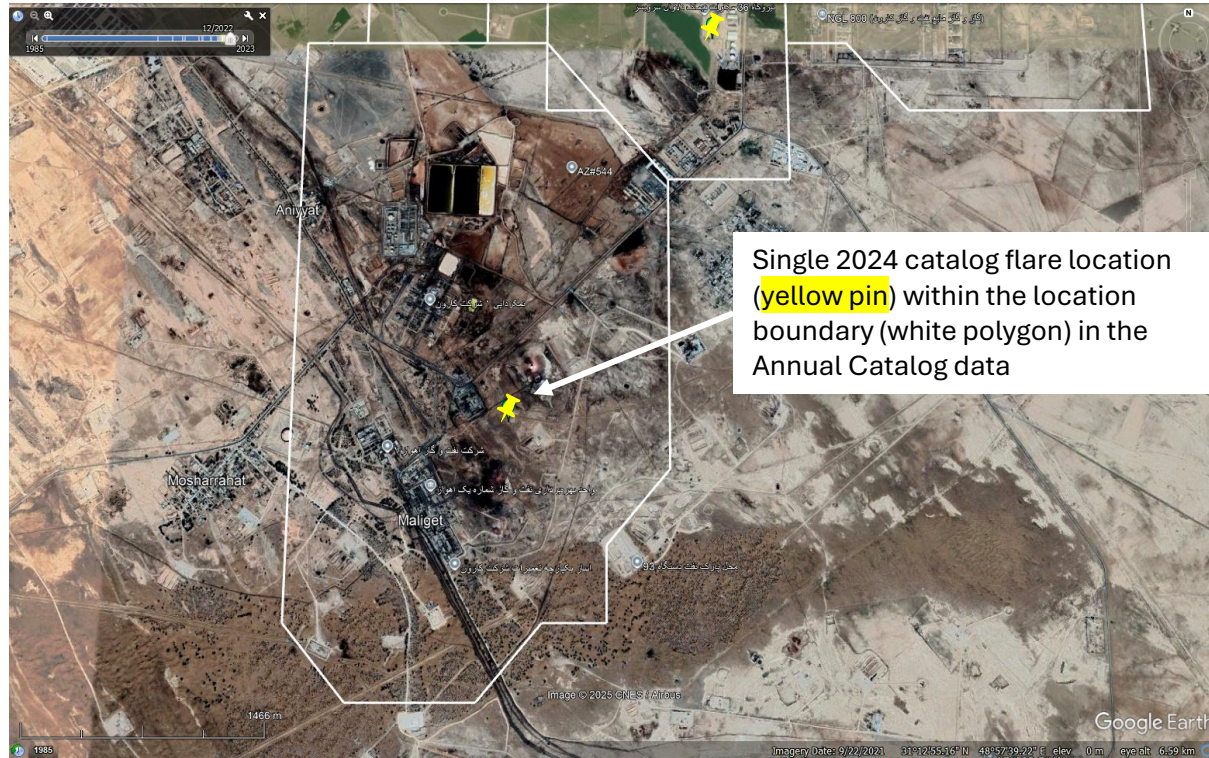
Annual Catalogs: individual stacks are hard to distinguish when activity changes year-to-year (flare detections are **red dots**)



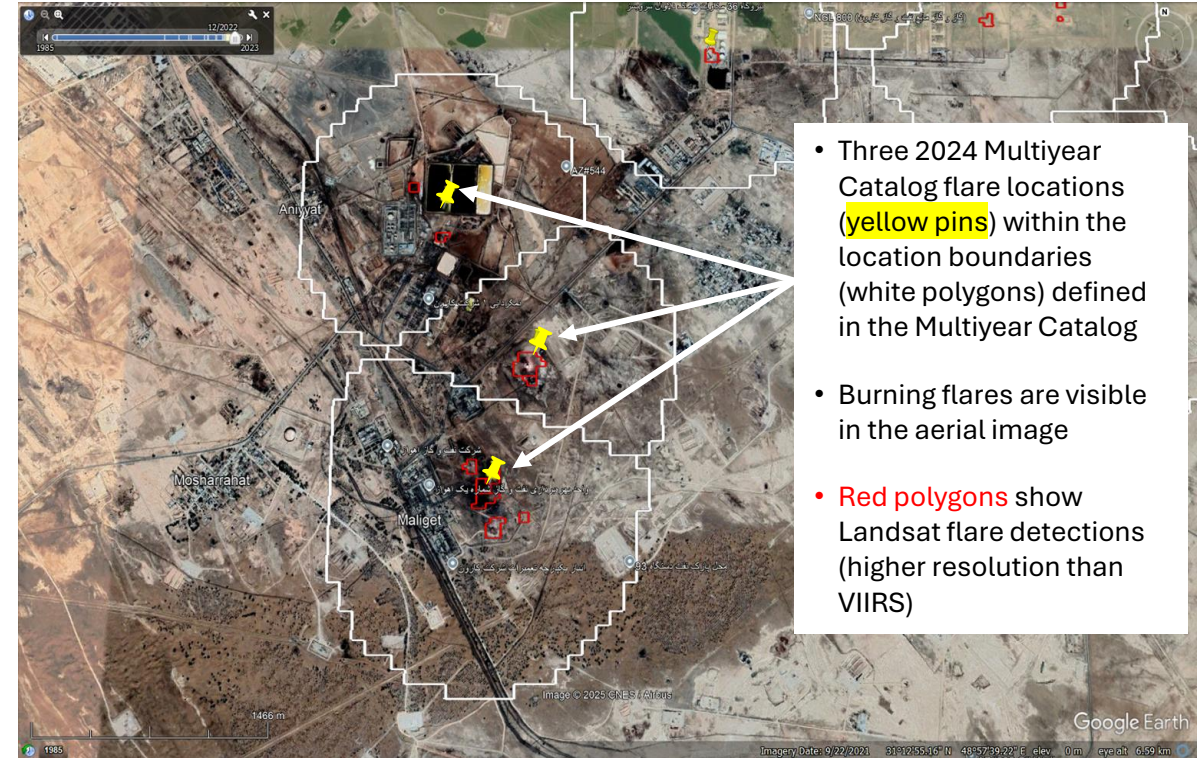
Multi-year Catalog: resolves individual detections into stable polygons plus precise stack locations (**green dots**)

2 Super-resolution improves the location accuracy of flare stacks: Example of flare detection at a Middle Eastern oil field

Previous Annual Catalog



New Multiyear Catalog

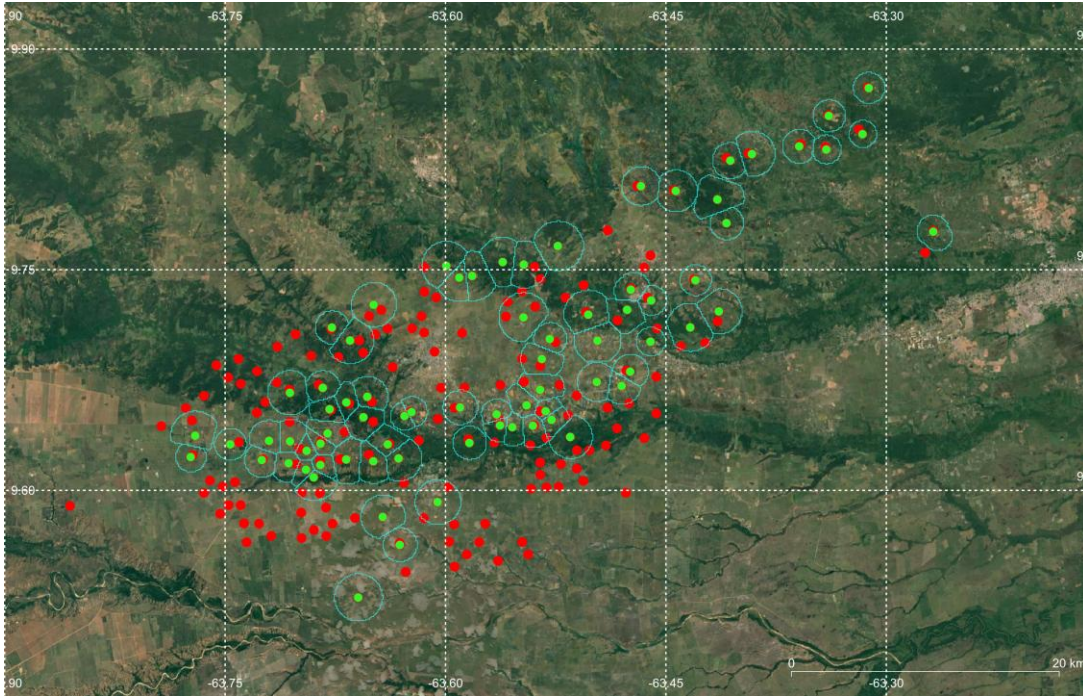


In Multiyear Catalog, super-resolution uses repeated satellite passes and statistical modeling to localize flare sources at scales finer than the native pixel size, allowing nearby flare stacks to be distinguished

2

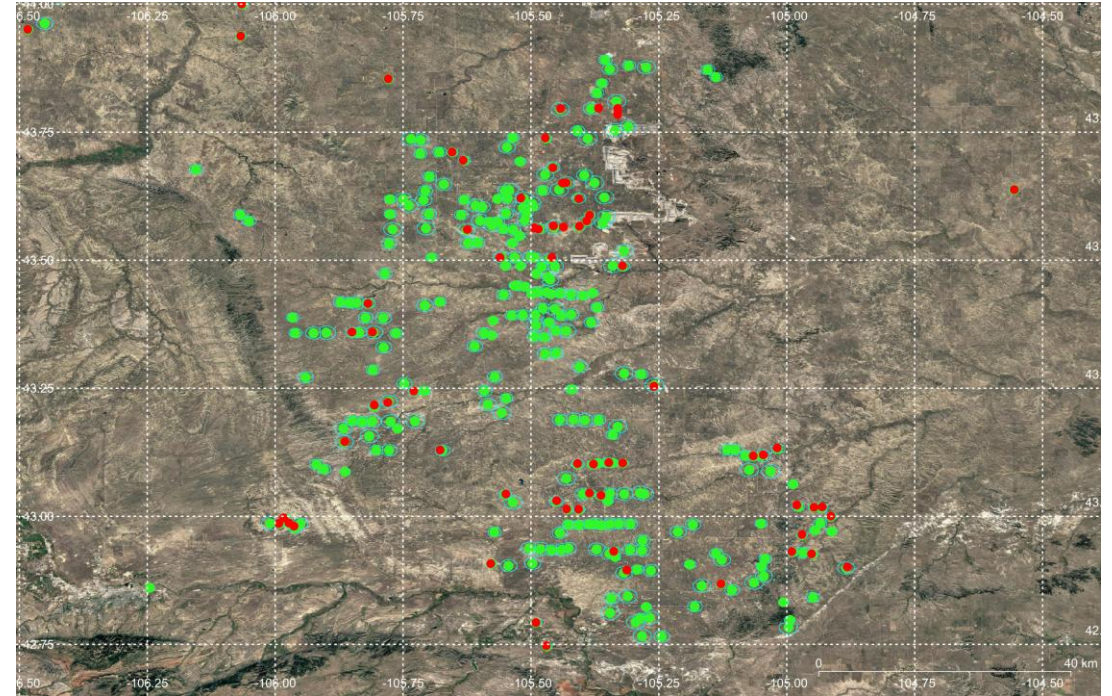
More accurate location data: additional advantages

Improved Quality Control – Removal of “false” flares



Green: Flare detections in the 2012-2025 Multiyear Catalog
Red: “False” flare detections in the 2024 Annual Catalog

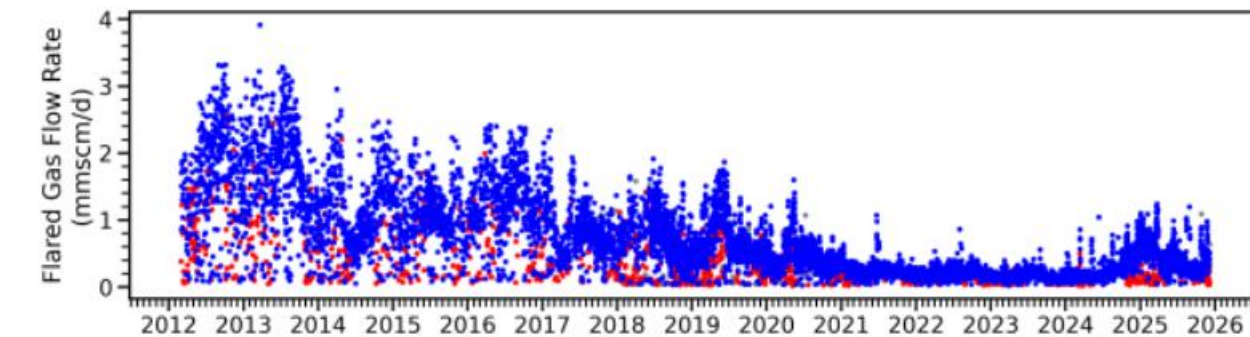
Improved Sensitivity – Detection of small/infrequent flares



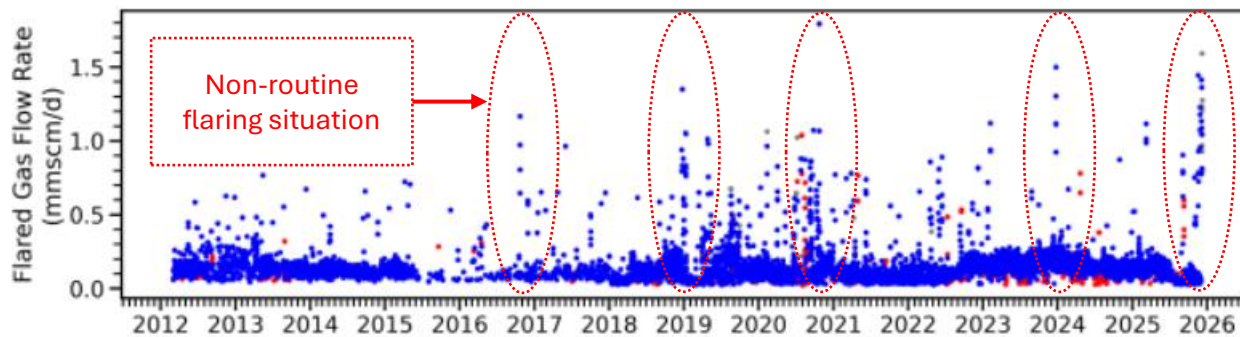
Green: Flare detections in the 2012-2025 Multiyear Catalog
Red: Flare detections in the 2024 Annual Catalog

2

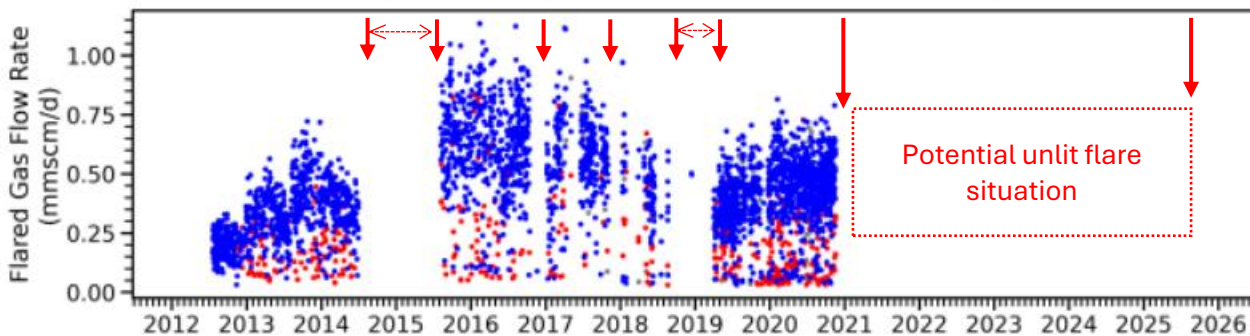
Better identification of different flaring situations: Examples of a Multiyear Catalog time series



Routine flaring



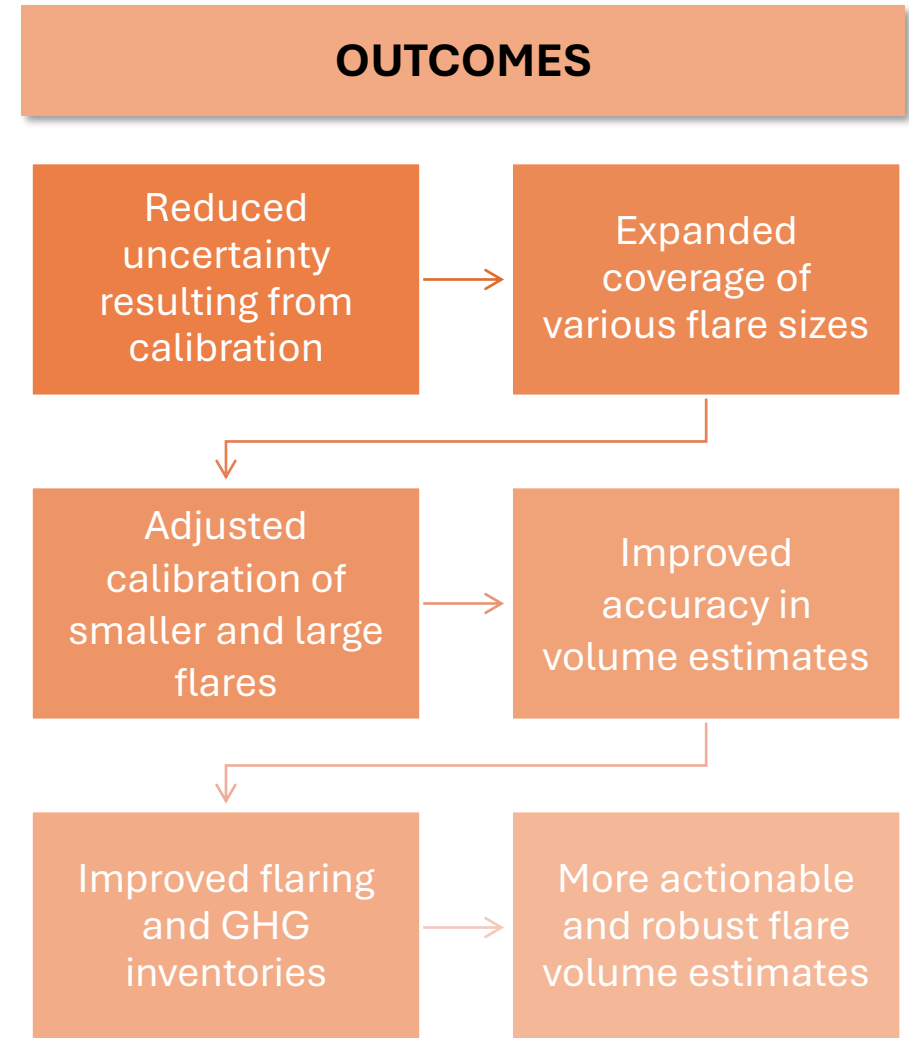
Routine flaring with occasional non-routine flaring situations



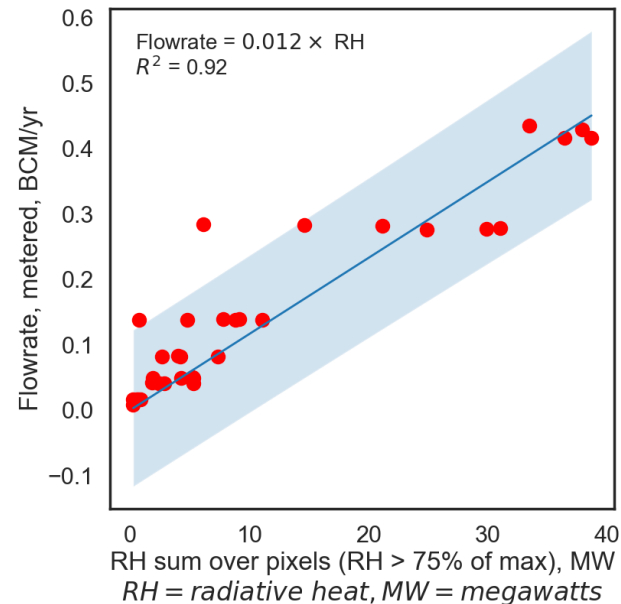
Routine flaring with periods of no flare detections, i.e., potential unlit flare situations

3 Improved calibration of flare volumes with VIIRS Radiant Heat data

- **New calibration is based on metered data from operational test flares:**
 - Compares simultaneous VIIRS satellite flare radiant heat measurements to accurately metered gas volumes at the John Zink test facility in Tulsa, Oklahoma, USA
 - Replaces previous calibration based on mixed quality country-level data provided by Cedigaz
- **New calibration supported by oil and gas operator flare data over a wide range of flare volumes:**
 - Robust representation of a variety of operational flare rates with linear calibration
 - Covers virtually the entire range of global flare sizes



Satellite-observed radiative heat sums linearly across flare stacks within a pixel and across pixels for large flares



What Was Done

- Matched satellite observations to **known gas flow rates** at the John Zink controlled test site
- Experimental setup **isolated flare signal** from background and atmospheric effects
- Covered **36 single- and dual-stack flares** with flow rates **0.004–0.4 BCM**

What We Observed

- **Strong linear relationship** between satellite-observed radiative heat (RH) and gas volume ($R^2 = 0.92$)
- **Zero-intercept behavior**, consistent with first-principles energy balance
- **Uncertainty consistent with flare physics**: regression CI comparable to intrinsic turbulent variability
- **Additivity confirmed**: signals sum **across stacks within a pixel** and **across pixels for large flares**

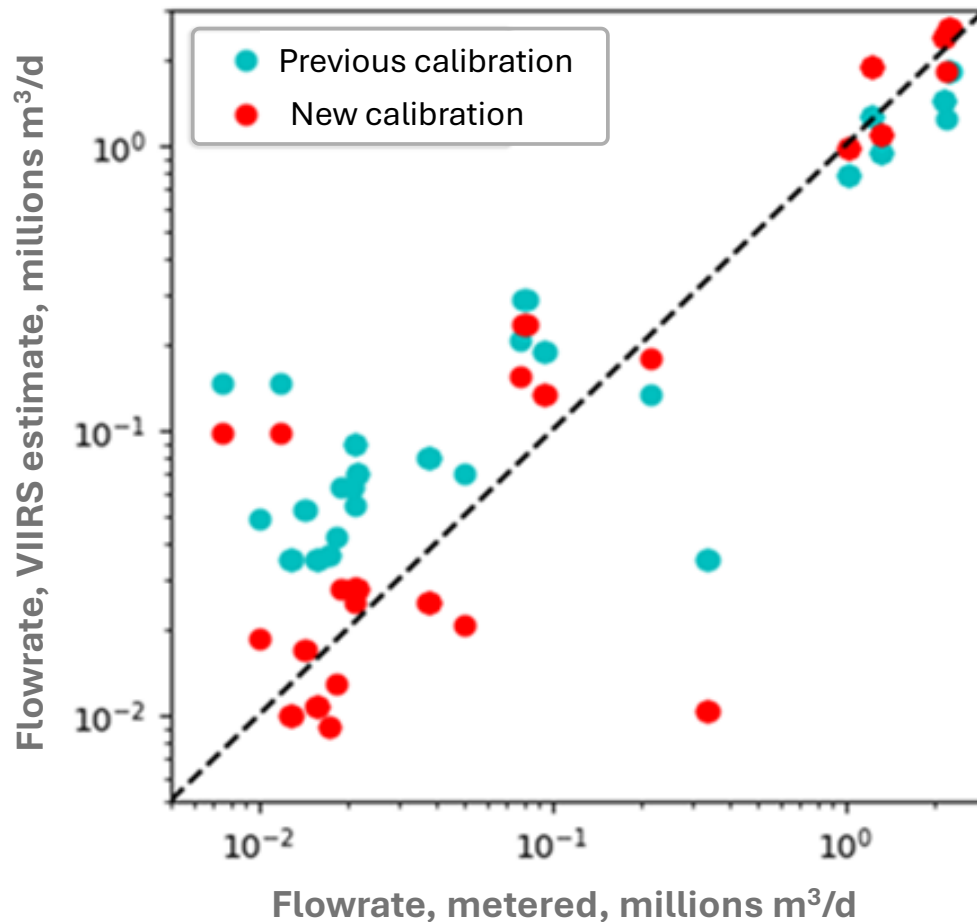
Why This Matters

- Confirms the method measures **combustion energy**, not proxy artifacts
- Demonstrates **predictive physical scaling**, not correlation alone

3

Operator-reported data support linear satellite scaling

The John Zink calibration remains linear when applied to operator data, with uncertainty driven by real-world flare diversity



Wider operating envelope: operator-reported volumes span roughly twice the flow range of the controlled flaring experiment from **0.001** to **2.2 million m³/d**

Linear relationship preserved: satellite-derived flow rates scale linearly with operator-metered volumes across the observed range

Improved consistency: the updated calibration (red) aligns more closely with the 1:1 reference line than the earlier approach (cyan)

Scale-dependent differences: earlier calibration tend to overestimate smaller flares and underestimate larger ones

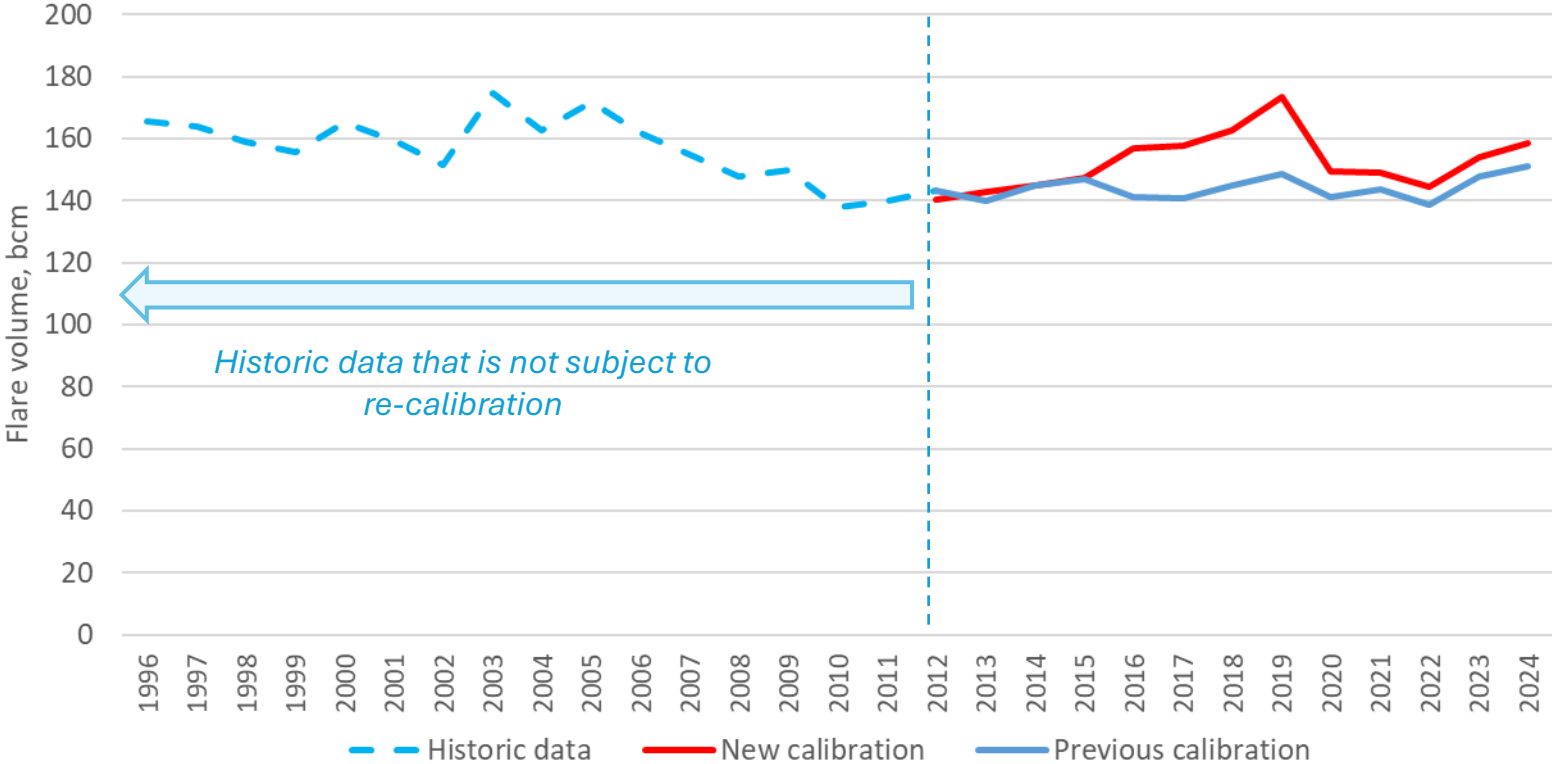
Detection threshold defined: the minimum reliably detectable flaring rate is **~0.008 millions m³/day**, setting the lower bound for quantitative comparison

Results using the improved methodology



Impact of change in methodology on global upstream flare volume trend

Minimal impact on global upstream flare volume trend



The variation is within the flare volumes variation over the entire 28-years observation period (~12%)

The new methodology captures twice the number of flares as the previous Annual Catalogs

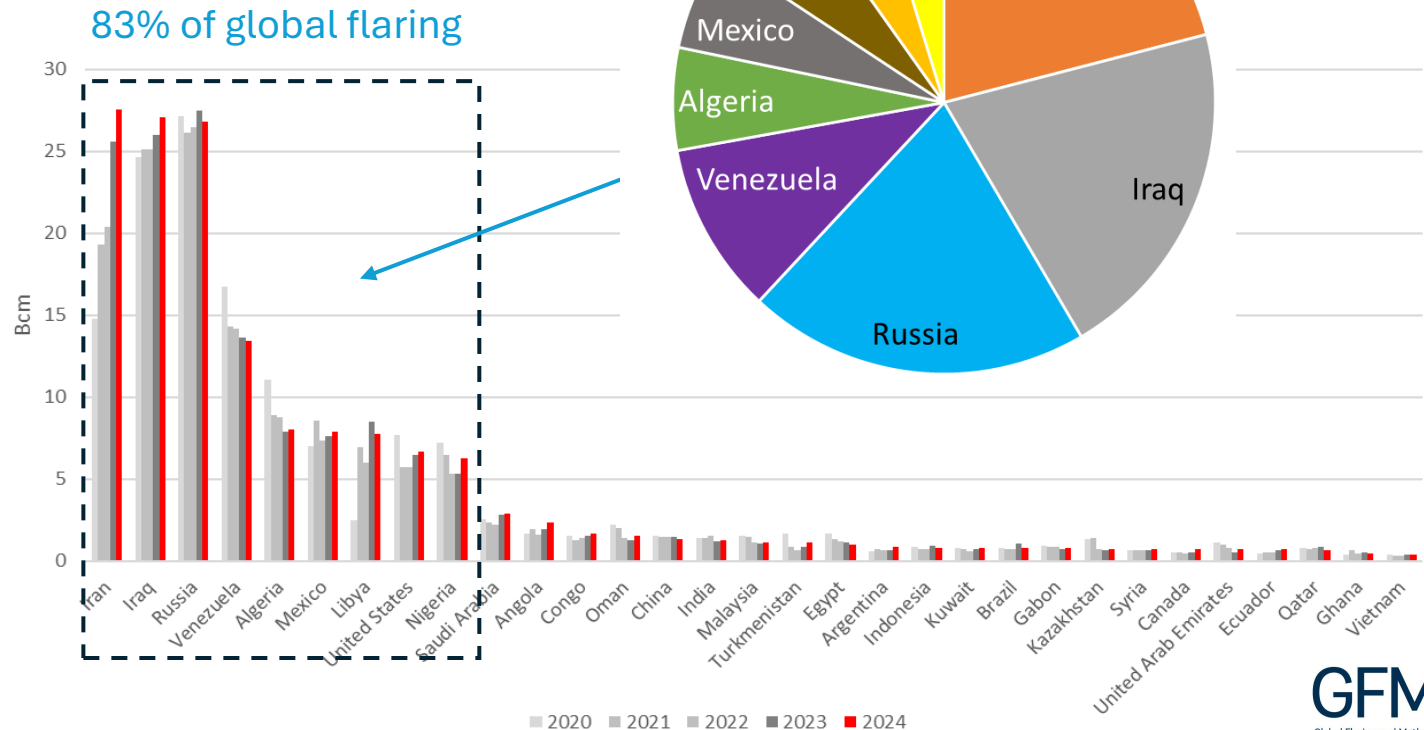
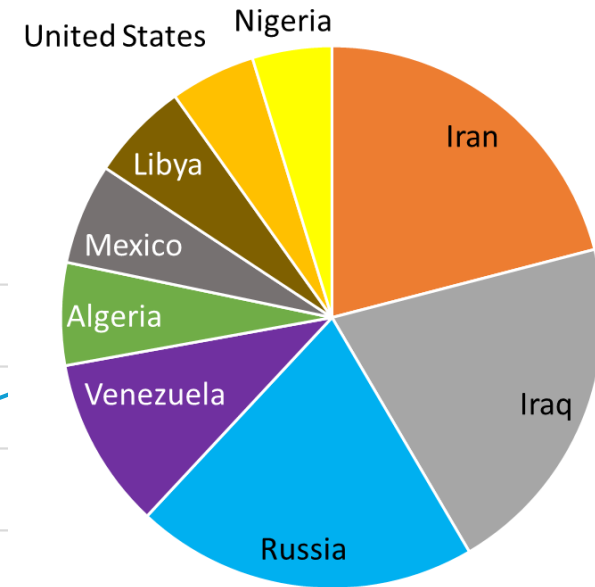
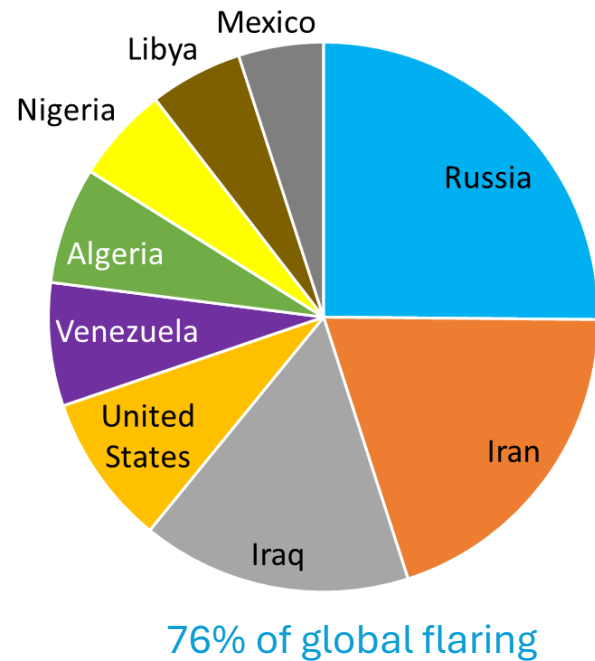
Top 30 flaring countries: impact of the new methodology

Ordered by 2024 flare volumes

Top 9 flaring countries remain the same, but their share in global flare volumes ranking has changed

Previous calibration 2024 estimates

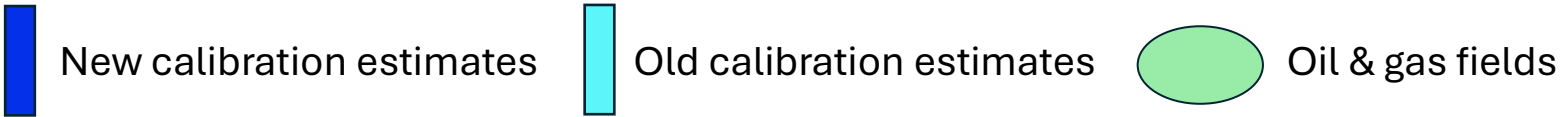
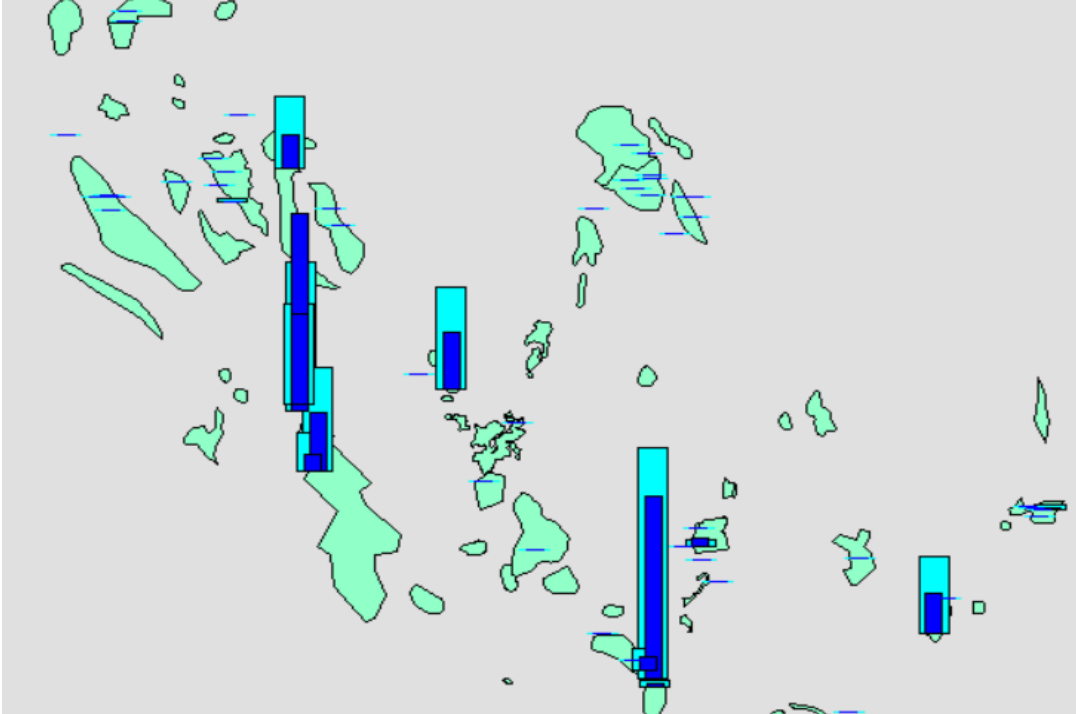
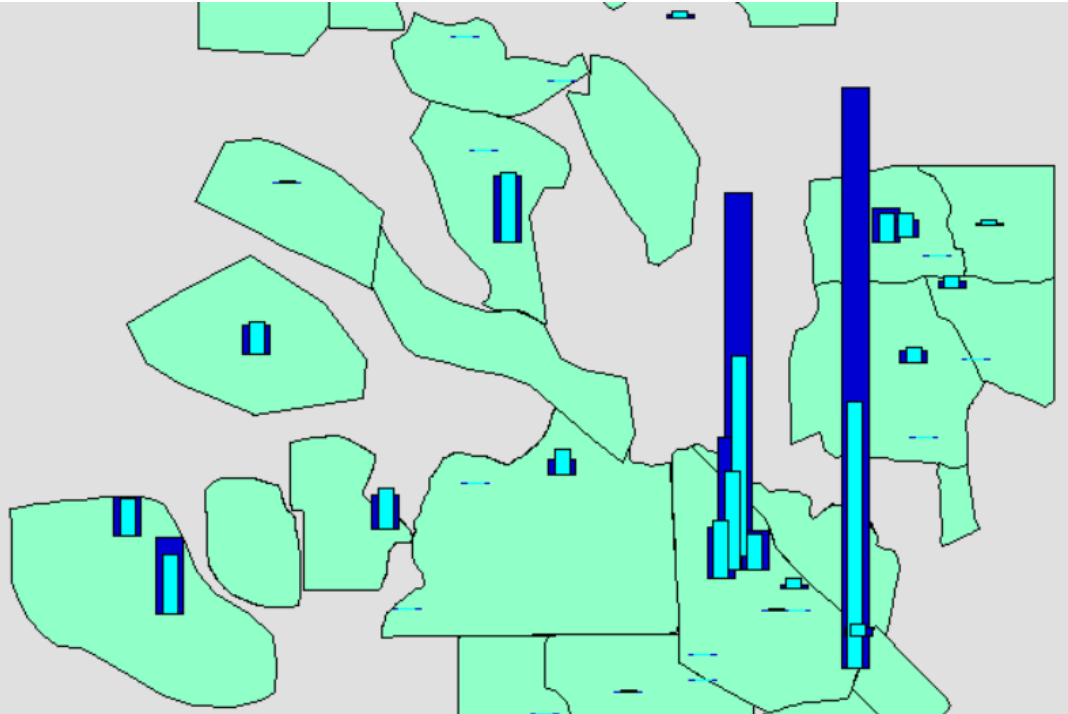
New calibration 2024 estimates



Impact of the new methodology on each region depends on the respective flare sizes

- Where flare volumes are large, the new calibration increases the volume estimate, sometimes significantly

- Where flare volumes are small, the new calibration decreases the volume estimate, sometimes significantly



Conclusions

These advances empower stakeholders to prioritize interventions, track abatement progress, and make informed investment decisions

- **New methodology has many advantages**
 - **Better location data**, which can highlight unlit flares and help assess routine versus non-routine flares
 - **Greater accuracy** allows improved satellite-based monitoring and GHG inventories, especially for unmetered flares
- **New data sets the stage for renewed action on flaring**
 - **Actionable insights:**
 - Improved flare volume estimates, better tagging the volumes of the largest flares for potential abatement
 - Facilitated identification of large abatable sources of methane associated with unlit flares
 - **Independent tracking:** Provides robust, independent data to monitor progress
 - **Supporting policies and investment** with more accurate understanding of country and global trends

Thank you!

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Chris Elvidge celvidge@mines.edu

Panel Discussion

SPEAKERS



Christophe McGlade
Senior Counselor &
Head of Energy Supply
International Energy Agency (IEA)



Meghan Demeter
MARS Program Manager
International Methane Emissions
Observatory UNEP



Erick Emanuel Luna Rojero
Head of Research Department
Mexican Petroleum Institute