# How satellites can help reduce methane emissions – Super Emitters

Ilse Aben
co Principal Investigator TROPOMI


The methane hunters

Using satellites to spot industry's methane leaks

To help combat climate change

The Economist

SRON

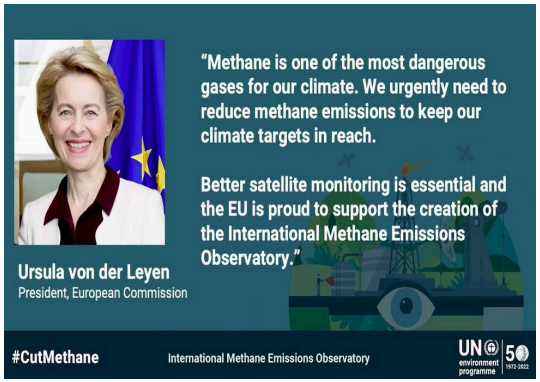
# Why is methane so 'hot' ?

- Methane ~30% of global warming
- 34x stronger GHG than $CO_2$
- Lifetime of ~ 10 years
- 25% of emission reduction at no net cost

+55% …. technically feasible *(Ocko et al., 2021)*

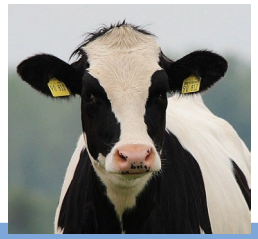
Methane important target **short term** climate mitigation









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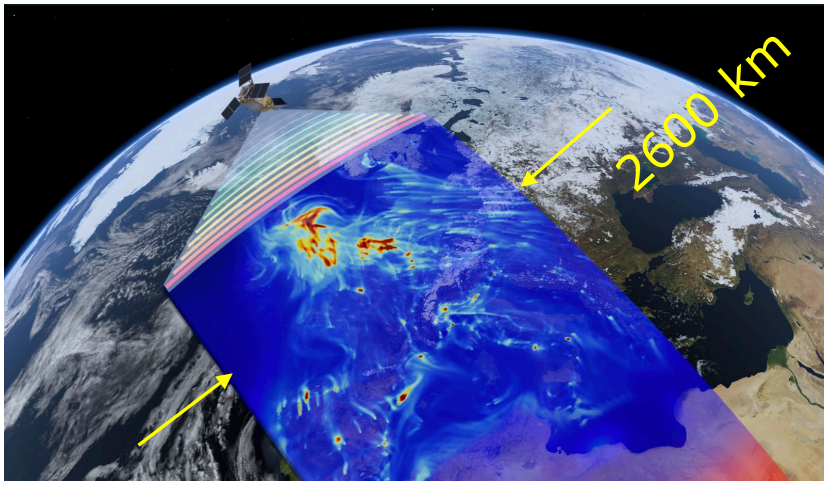
# TROPOMI on Sentinel-5 precursor : game changer

- Launched in Oct. 2017, Copernicus programme
- Measuring many atmospheric species incl. $CH_4$
- **Unique** capability : daily global coverage & 7 x 5.5 $km^2$ individual observations
- Precursor to Sentinel-5 (2024 – 2044+)



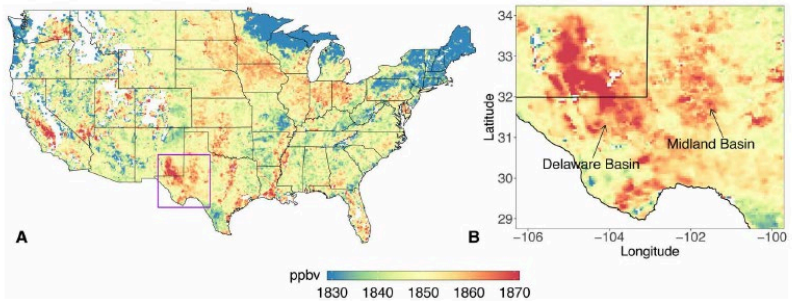
# Permian basin $CH_4$ emissions

SCIENCE ADVANCES | RESEARCH ARTICLE

ENVIRONMENTAL STUDIES

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

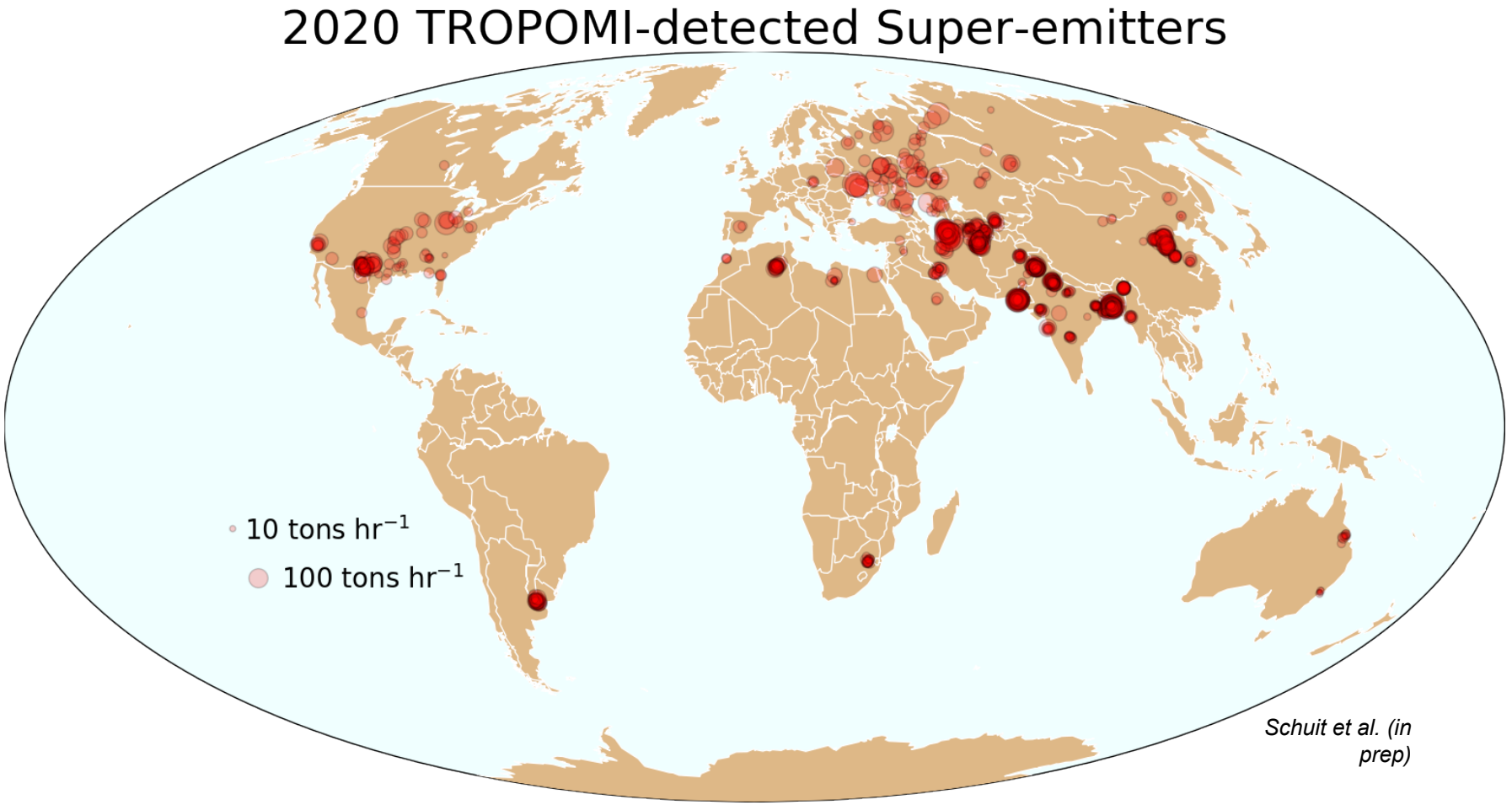
Yuzhong Zhang[1,2,3,4]*, Ritesh Gautam[2]*, Sudhanshu Pandey[5], Mark Omara[2], Joannes D. Maasakkers[5], Pankaj Sadavarte[5,6], David Lyon[2], Hannah Nesser[1], Melissa P. Sulprizio[1], Daniel J. Varon[1], Ruixiong Zhang[7,8], Sander Houweling[5,9], Daniel Zavala-Araiza[2,10], Ramon A. Alvarez[2], Alba Lorente[5], Steven P. Hamburg[2], Ilse Aben[5], Daniel J. Jacob[1]




**MAIN RESULT**
Emissions more than 2x
bottom-up inventory estimates

Showing the importance of atmospheric measurements to verify inventory estimates (Paris agreement)

# TROPOMI detection methane Super emitters




What are the exact sources responsible for these super emitter signals ?

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# TROPOMI detection methane Super emitters

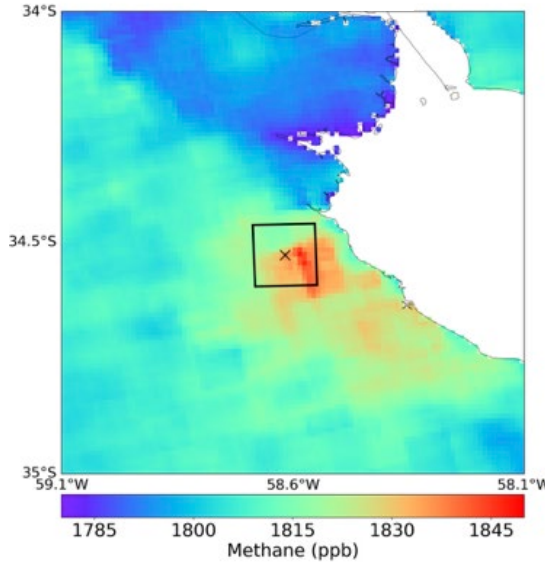
*Schuit et al. (in prep)*




**GHGSat**
**Facility scale (20 m) resolution**
**Candidate ESA 3rd party mission**

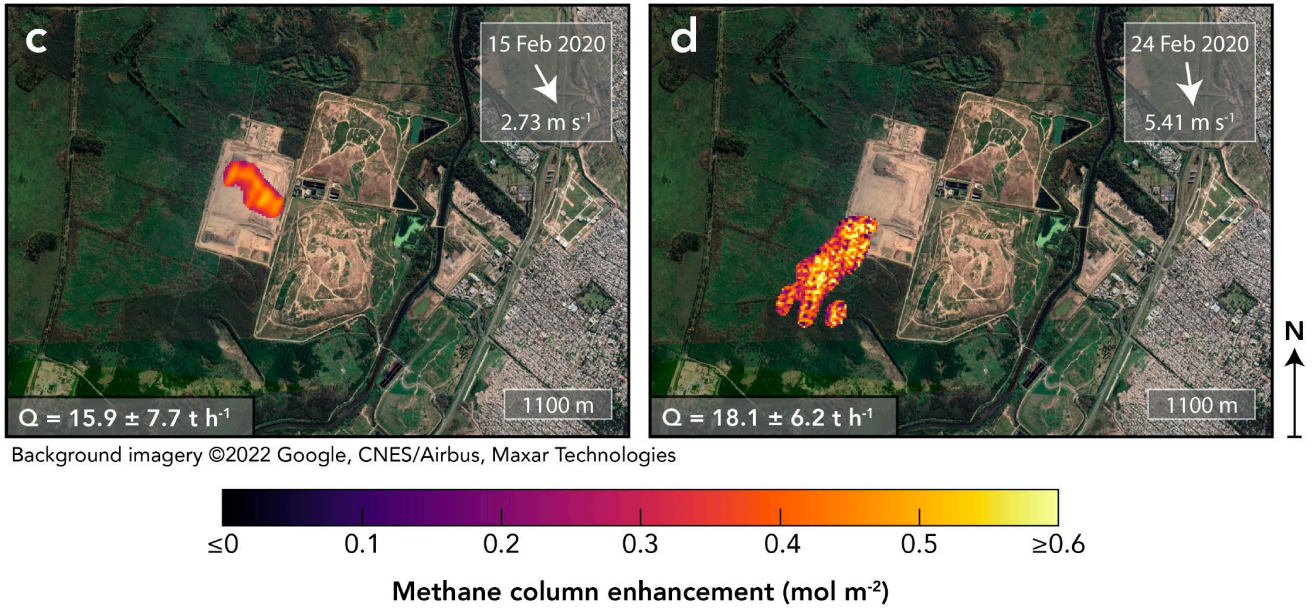
# Methane emissions from landfill in Buenos Aires

TROPOMI (5.5 km x 7 km)



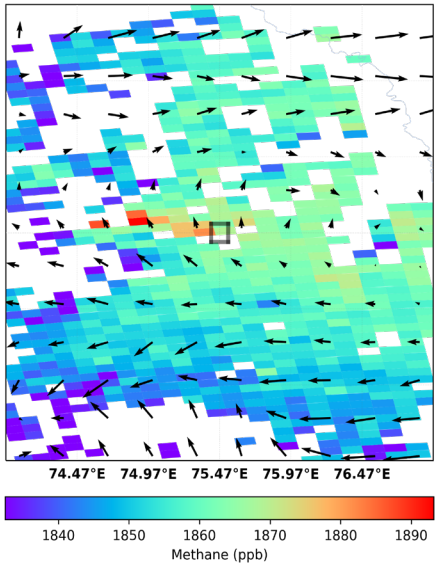

*Maasakkers et al, 2022*

GHGSat (~20 m x 20 m)



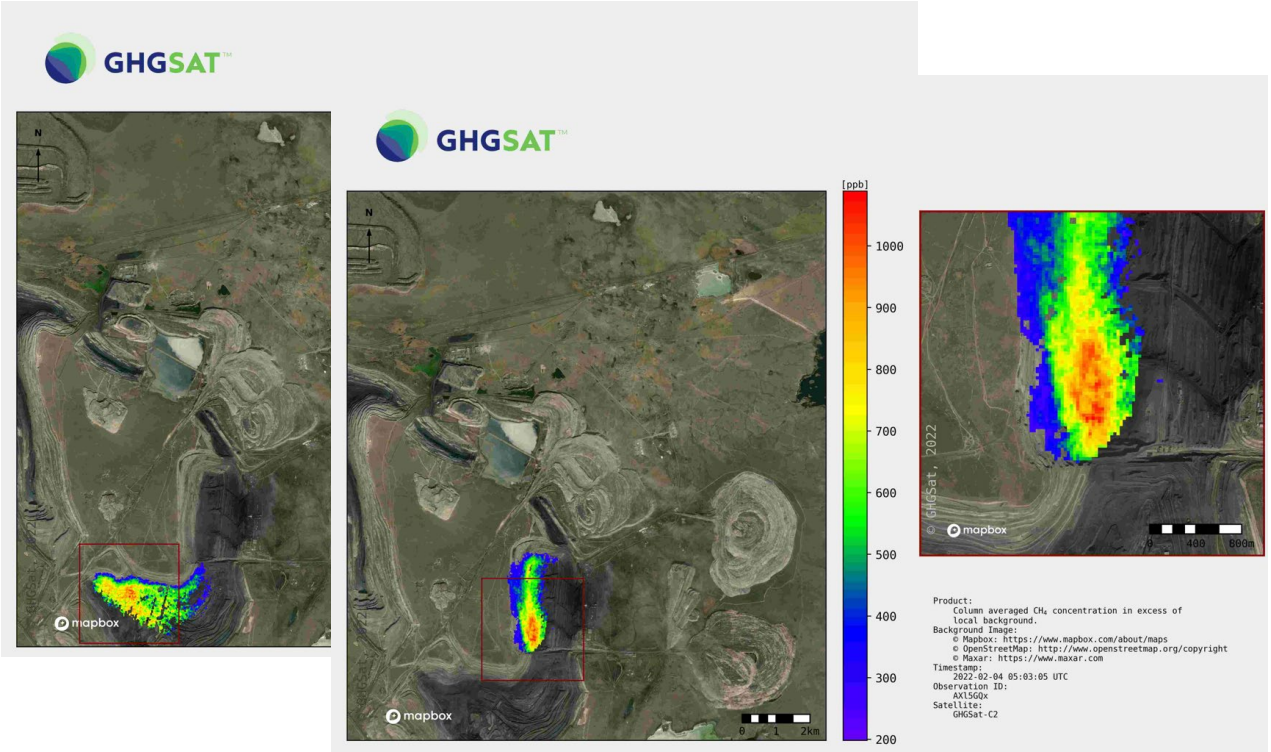

First detection from space of $CH_4$ emissions from landfills

# Methane emissions from coal mines : surface mines !!

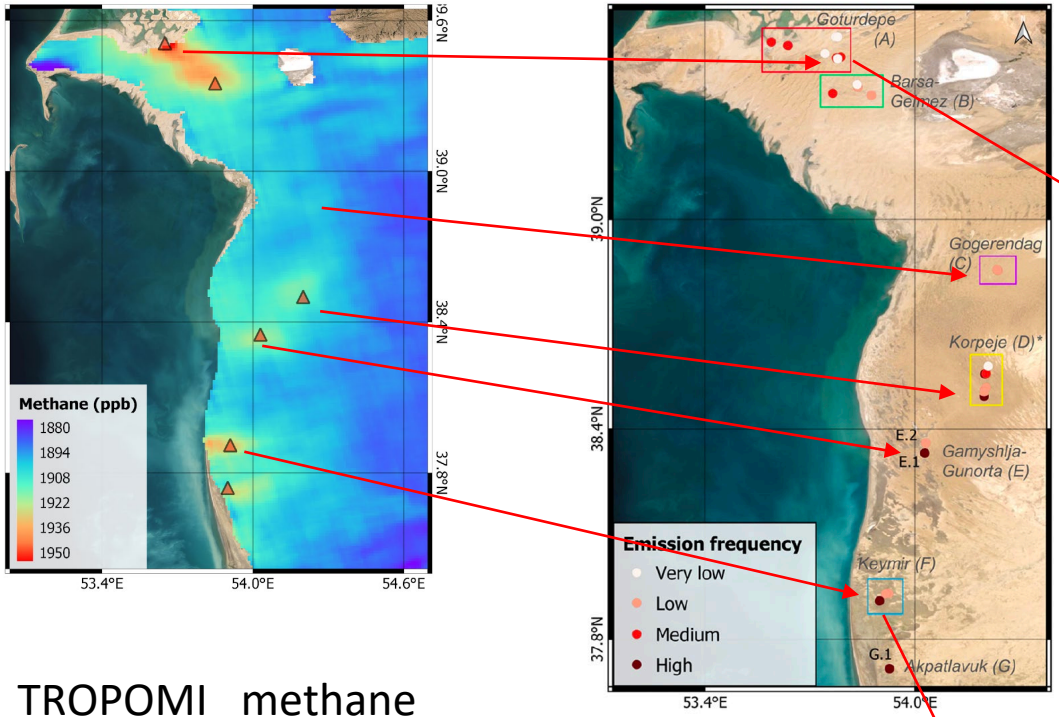



TROPOMI

Ekibastuz region
(Kazachstan)

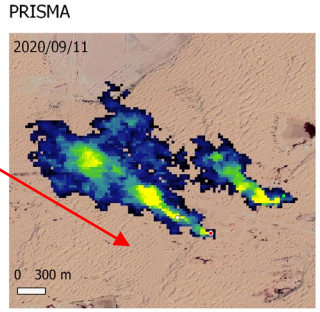


# West Turkmenistan



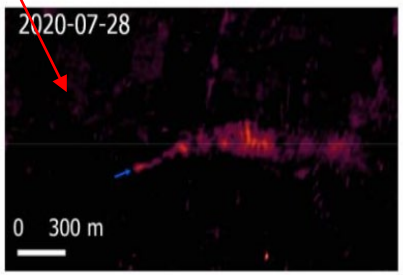

TROPOMI methane
(~5.5 km x 7 km)

*Irakulis et al, 2022*



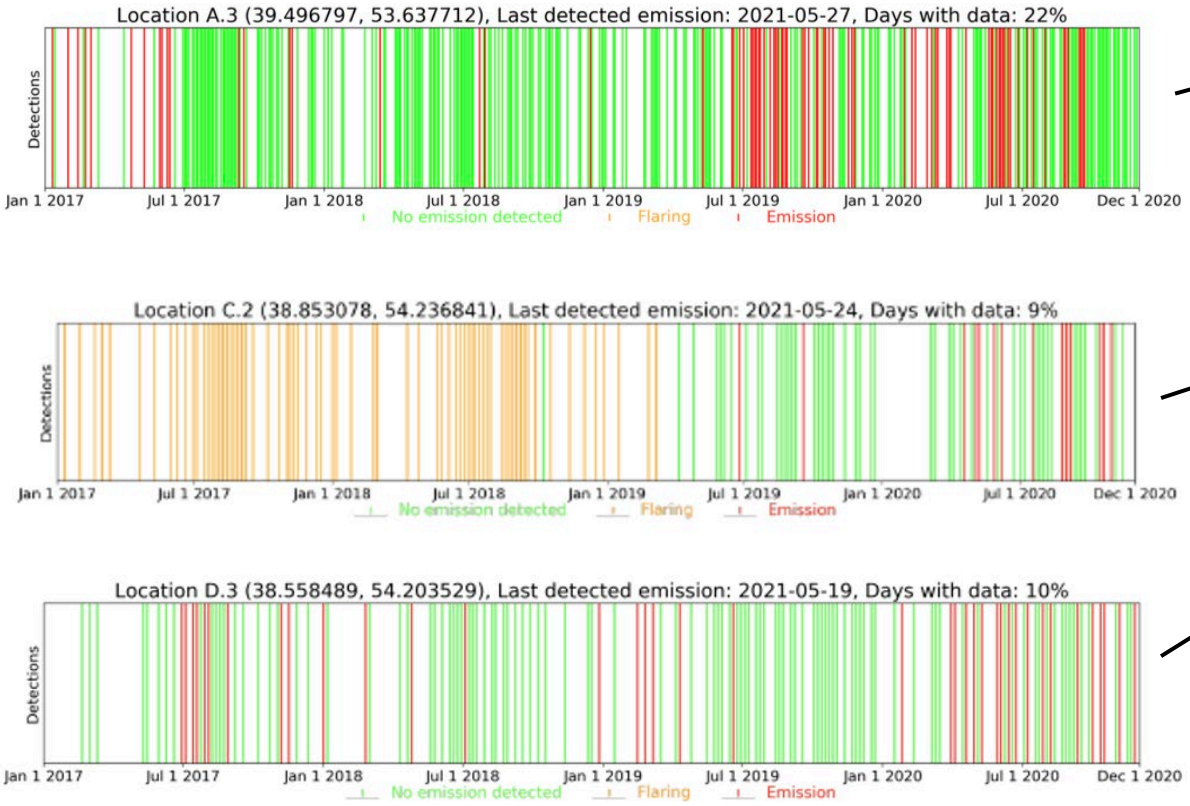

**PRISMA** methane
(~20 m,
Imager hyperspec.)

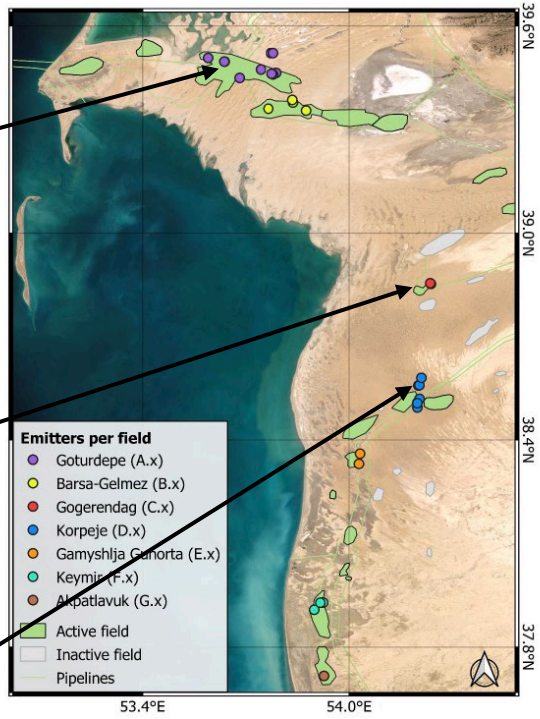
Unlit flares causing huge methane emissions




**Sentinel-2** methane
(~20 m, band imager spectrometer)

# Monitor in time with Sentinel-2




Emission
Flaring
Observation

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# Concluding :


The methane hunters

## Using satellites to spot industry's methane leaks

To help combat climate change