# Standardizing Spatial Intelligence for Gridded Methane Inventories: DGGS Meets EmissionML

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CentroGeo
19°17'30"N 99°13'17"O 2489m

INEGI

# Inadequate Spatial Grids Limit Action

**We need gridded GHG inventories:**

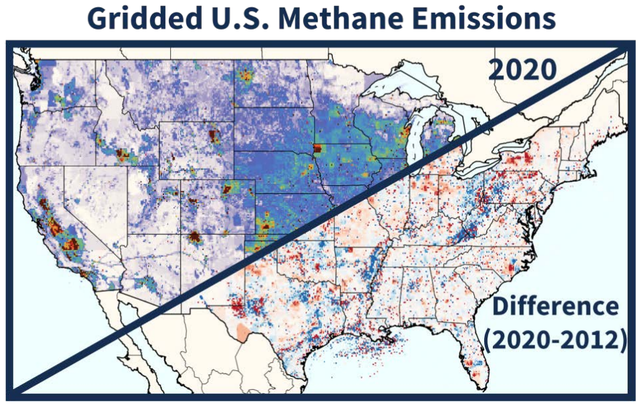
- Provide a prior estimate for inverse atmospheric analyses
- Provide baseline emission data to simulate large, short-term emission events

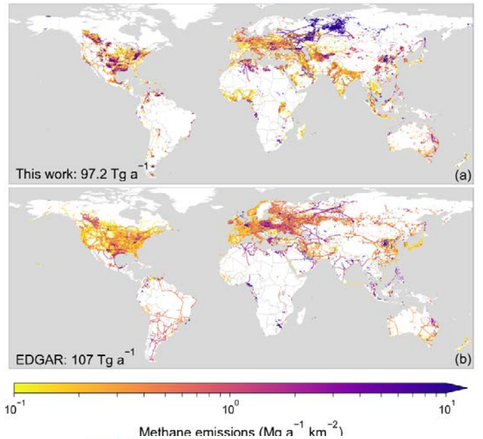
**Gridded GHG inventories often use latitude–longitude grids (graticule), where cell size and shape vary with latitude. This leads to several problems:**

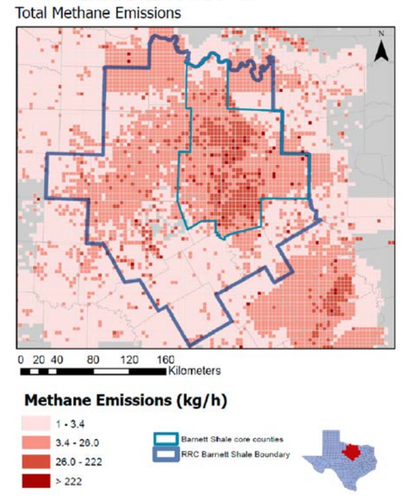
- Inflate emission densities in high-latitude regions
- Complicate direct inter-cell comparisons and integration
- Distort visualization and interpretation

**Other issues:**

- Definition of spatial scales is not clear (site/facility/urban/etc.)
- Data from multiple satellites/sensors/sources needs to be integrated




- ❖ Scarpelli et al. 2020
- ❖ EDGAR 2023
- ❖ Maasakkers et al. 2023
- ❖ Crippa et al. 2024

# A Global, Uniform Spatial Framework for GHG Data

- **What if emissions from every facility, basin, region, or country could be georeferenced to a single, equal-area, and hierarchical space-time grid?**

- **Think of it not just as a grid, but as a spatially intelligent container for all related data?**

DGGS
- Grid ID
- Resolution

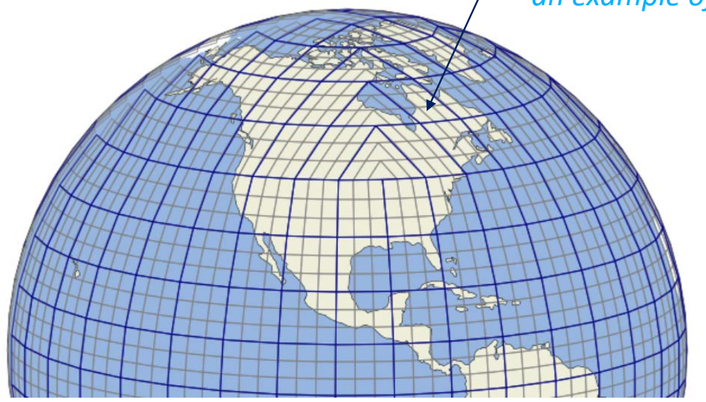
Facility
- Facility type
- Facility age
- Facility operator

Equipment
- Equipment type
- Emission rate
- Pipe material

Operational history
- Maintenance record
- Blowdown event

Environmental conditions
- Wind speed
- Atmospheric pressure

*an example of O&G..*



# Our Recent Study

- Omara et al. 2024
- Raichev et al. 2020

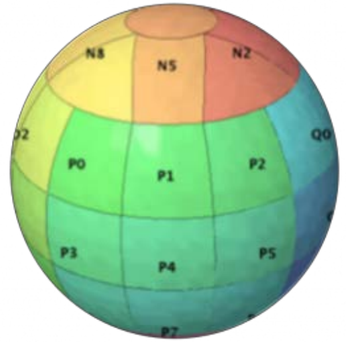
***Spatially Explicit Methane Emissions from Alberta Upstream Oil and Gas Operations with Equal-Area Grid Systems***

**What we adopt:** rHEALPix (**r**earranged **H**ierarchical **E**qual **A**rea iso**L**atitude **Pix**elization) DGGS

**What we did:** An initiative study on Alberta upstream O&G emissions

**Data we used:** 2020-2023 Petrinex Conventional Volumetric Data (Fuel, Flare, Vent)

**What we achieved:** True emission intensity comparisons across space and time; Consistent aggregation at any scale; Precise hotspot tracking and trend monitoring over time; Informed monitoring design, including optimized aerial survey and satellite observation planning




# Label, Locate, and Link Emission Sources with DGGS and EmissionML

**DGGS + EmissionML:**

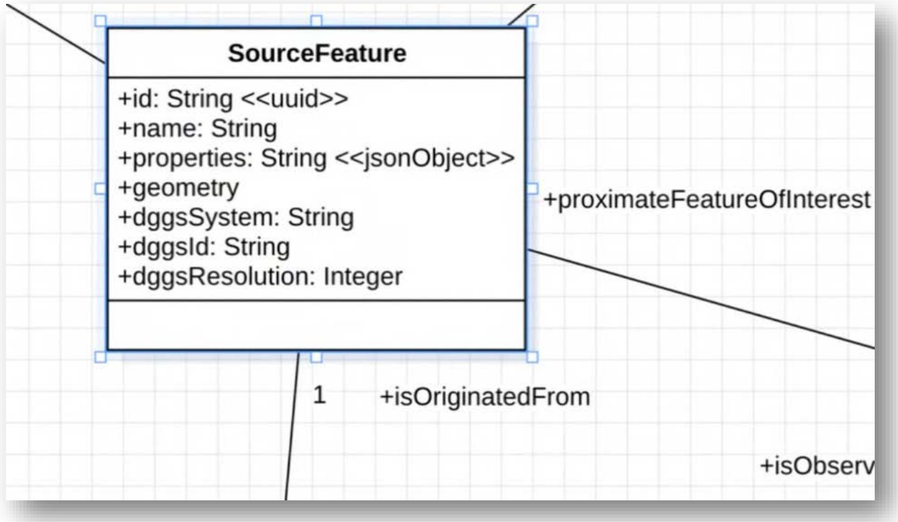
- Use the *SourceFeature* class to encode emission source locations using attributes *dggsSystem*, *dggsId*, and *dggsResolution*.
- Enable unique spatial labelling of emission sources in an equal-area, hierarchical, and global reference frame.

**Why this matters:**

- Avoid geolocation ambiguity in graticule or other arbitrary grids.
- Improve data interoperability for integrating satellite observations, ground-based measurements, and bottom-up inventories.
- Thanks to the existing OGC DGGS API, spatial operations are already standardized.

**Future applications:**

- Use DGGS-labelled SourceFeature records to simplify hotspot tracking.
- Run temporal emission trends per cell with uniform spatial granularity.
- Attach emission events to specific DGGS cells for easy spatial querying and change detection.



# THANK YOU

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