
Beyond the Graticule: Spatially Explicit Methane Inventories Using Discrete Global Grids

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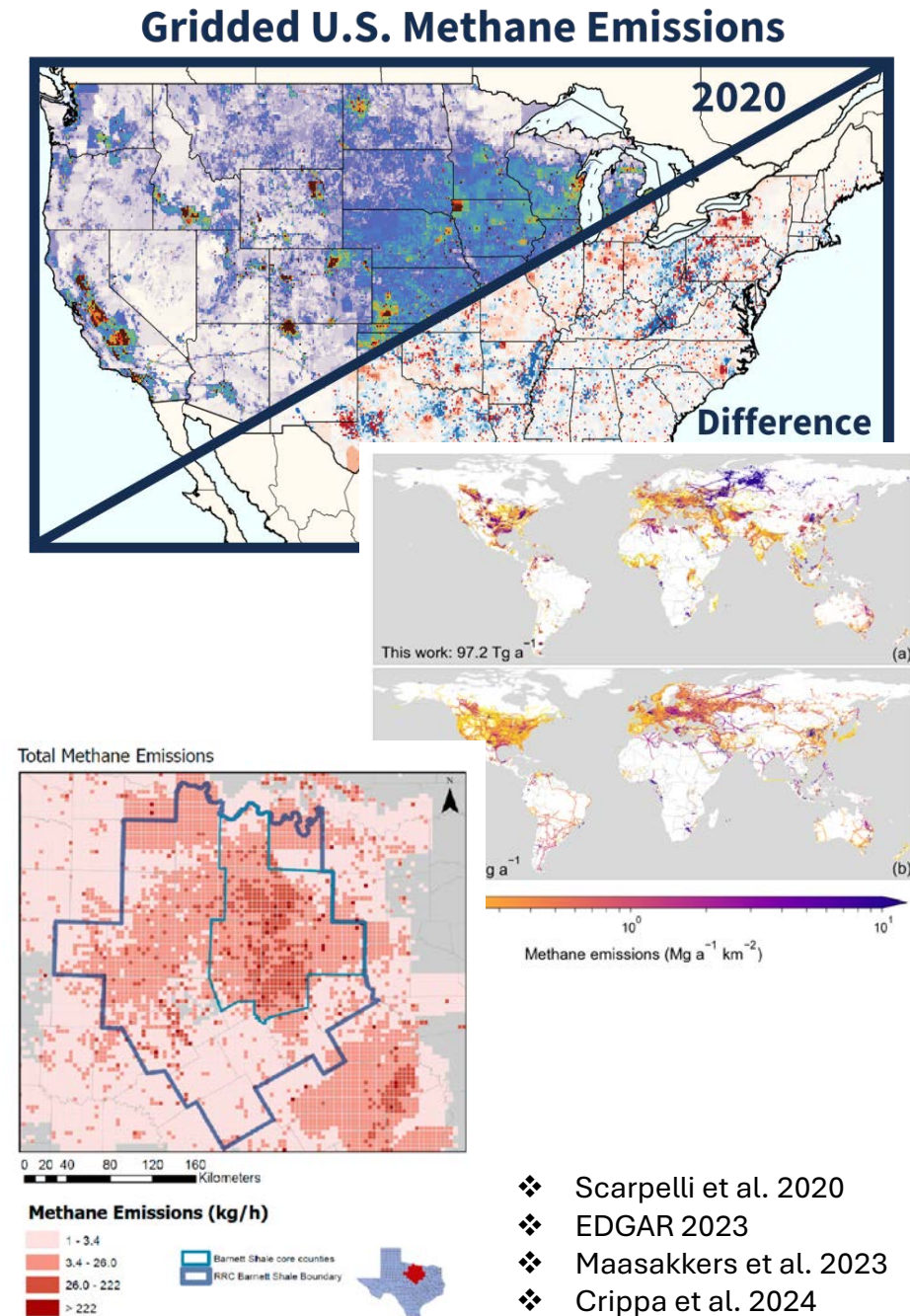


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Why do we need gridded inventories?

- **Supports Inverse Atmospheric Analyses:** Provide a prior estimate for inverse atmospheric analyses.
- **Simulates Large Emission Events:** Provide baseline emission data to simulate large, short-term emission events.
- **Enhances Local Emission Estimates:** Assists in estimating and comparing emissions for localized studies.
- **Provides Seamless Coverage:** Offers consistent data across boundaries (county, basin, province, etc.).
- **Engages Non-Technical Audiences:** Presents emissions data in an intuitive, accessible format.



Problem: Inadequate Spatial Grids Limit Action

Existing GHG inventories are

- **Spatially inconsistent**
- **Poorly georeferenced**
- **Difficult to integrate**

Gridded methane 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**

Graticule



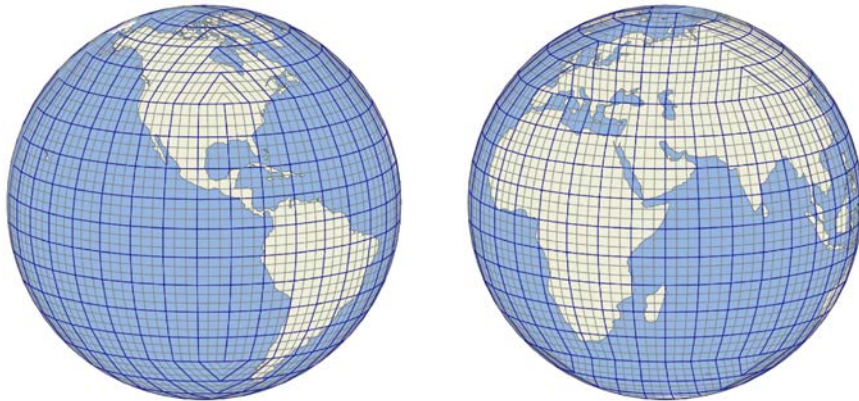
Web Mercator Tiles



Solution: A Global, Uniform, Hierarchical Spatial Framework for GHG Data

What we used: rHEALPix DGGS

What we did: An initiative study on **Alberta upstream O&G** emissions (Petrinex Conventional Volumetric Data)



rHEALPix = rearranged Hierarchical Equal Area isoLatitude Pixelization
DGGS = Discrete Global Grid Systems

What we achieved:

- True emission intensity comparisons across space and time
- Consistent aggregation at any scale (e.g., facility, basin, and national)
- Precise hotspot tracking and trend monitoring over time
- Informed monitoring design, including optimized aerial survey and satellite observation planning

