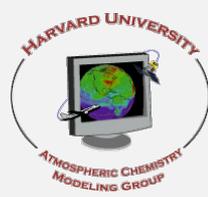


This work was funded by the NASA Carbon Monitoring System



A gridded version of the EPA national methane inventory

J.D. Maasackers

Thanks to: D.J. Jacob¹, M.P. Sulprizio¹, A.J. Turner¹, M. Weitz²,
T. Wirth², C. Hight², M. DeFigueiredo², and A.A. Bloom³

(1) Harvard University

(2) U.S. Environmental Protection Agency, Climate Change Division

(3) Jet Propulsion Laboratory/California Institute of Technology

2012 US EPA anthropogenic methane emissions



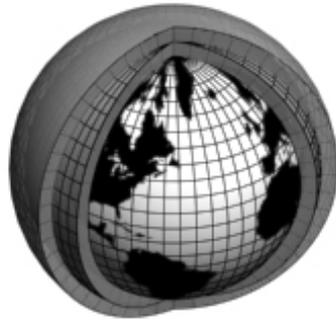
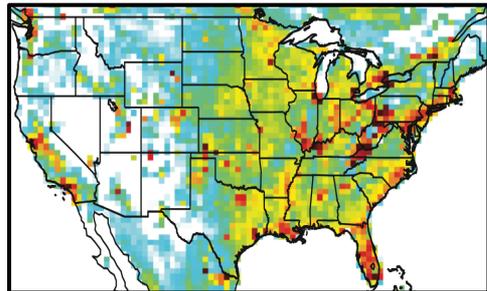
Evaluating bottom-up with atmospheric data

Inverse methods seek to optimize emissions by combining atmospheric methane observations with the bottom-up information

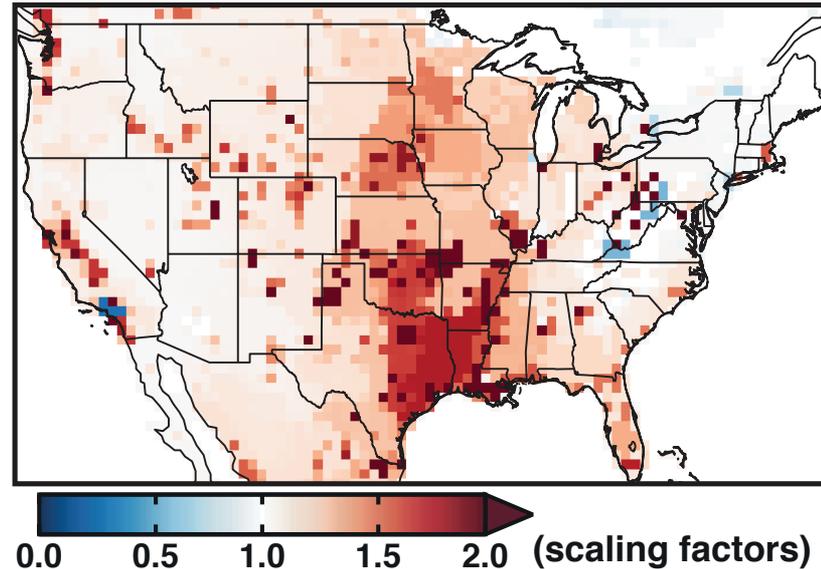
Atmospheric observations

- Satellite retrievals
- Aircraft observations
- Surface measurements

Bottom-up inventory (EDGAR)

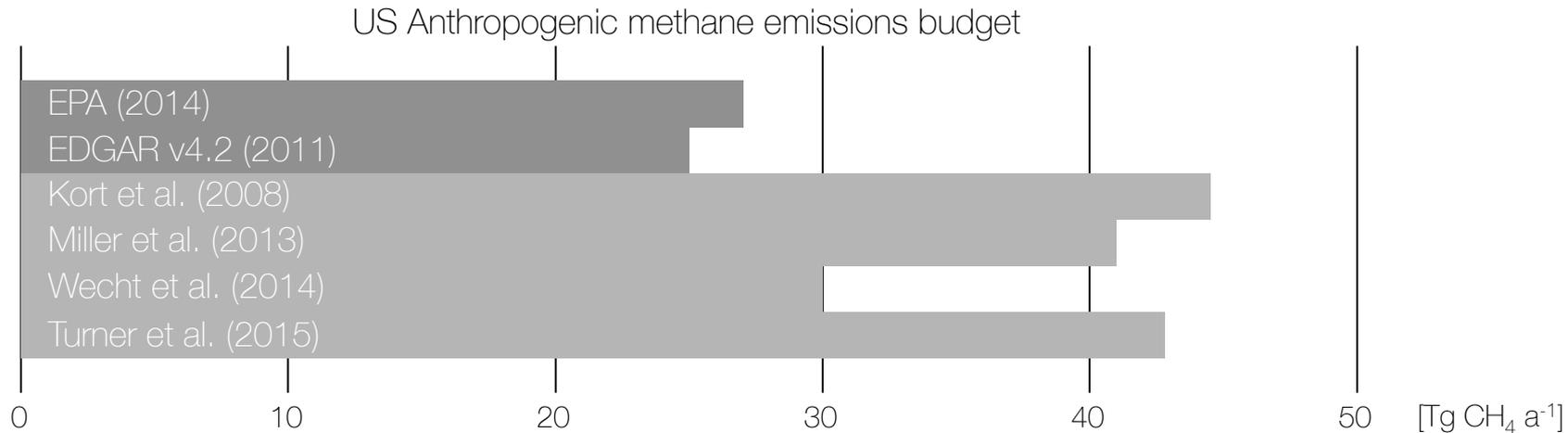


Optimal estimate emission scaling factors



Evaluating bottom-up with atmospheric data

Inverse studies rely on the EDGAR inventory as prior since gridded data is required to compare to observations



Attribution of these differences to source types requires that we start from the best prior bottom-up knowledge

This project: Create an evaluable gridded EPA inventory

Region-specific EPA emission factors

Spatial allocation on $0.1^\circ \times 0.1^\circ$ grid using national & high resolution datasets

Multiple layers of data for emissions from different processes

Monthly time resolution



6.7 Tg Enteric fermentation
2.5 Tg Manure management
0.4 Tg Rice cultivation

Agriculture

Livestock – Gridding strategy

State-level emissions from EPA



County-level emissions: USDA 2012 Census for 14 animal types

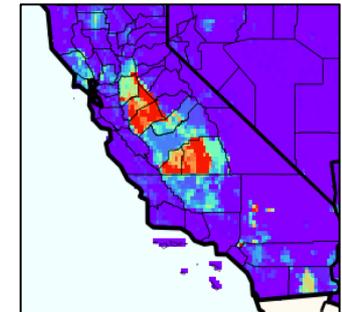
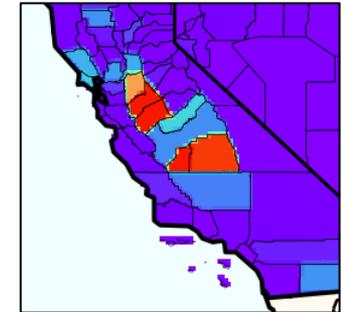


0.1° x 0.1° Grid emissions: USDA livestock occurrence probability maps for 9 animal types

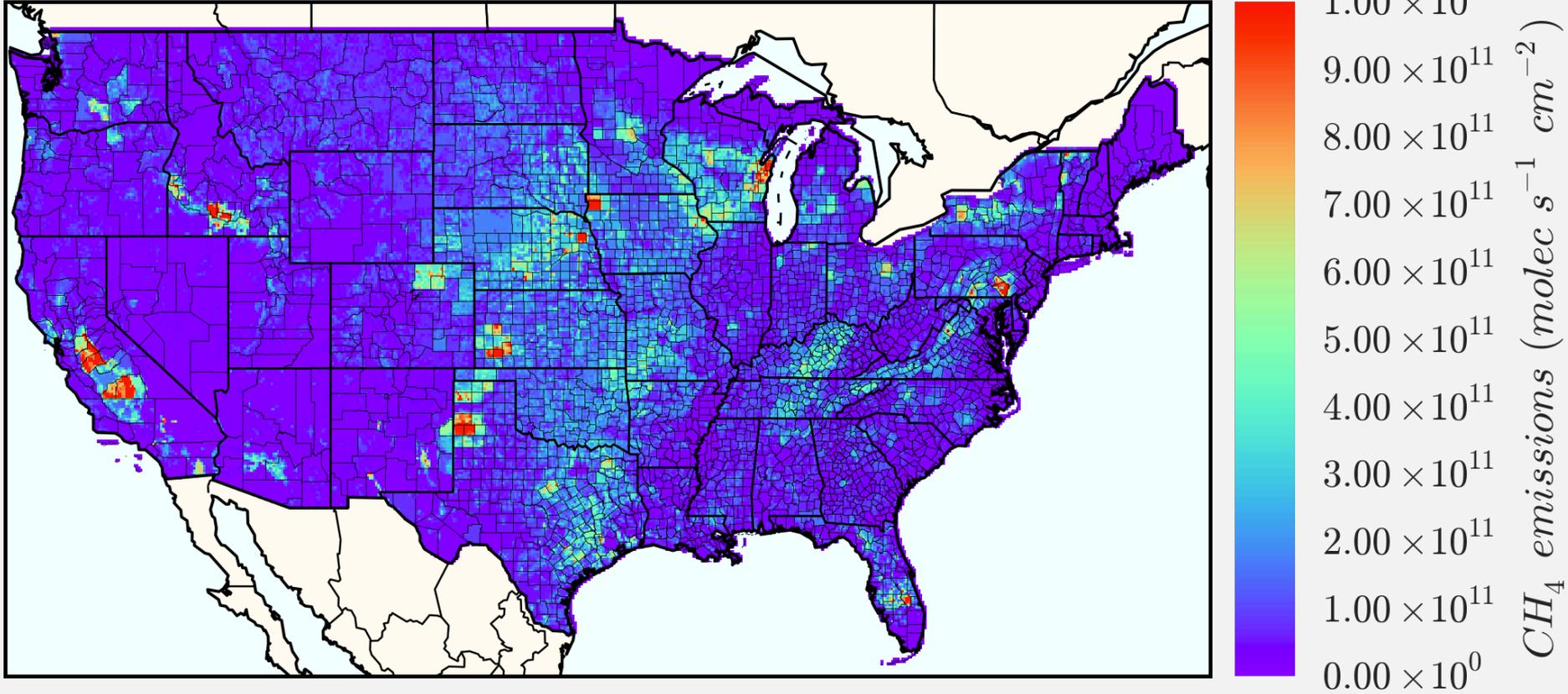


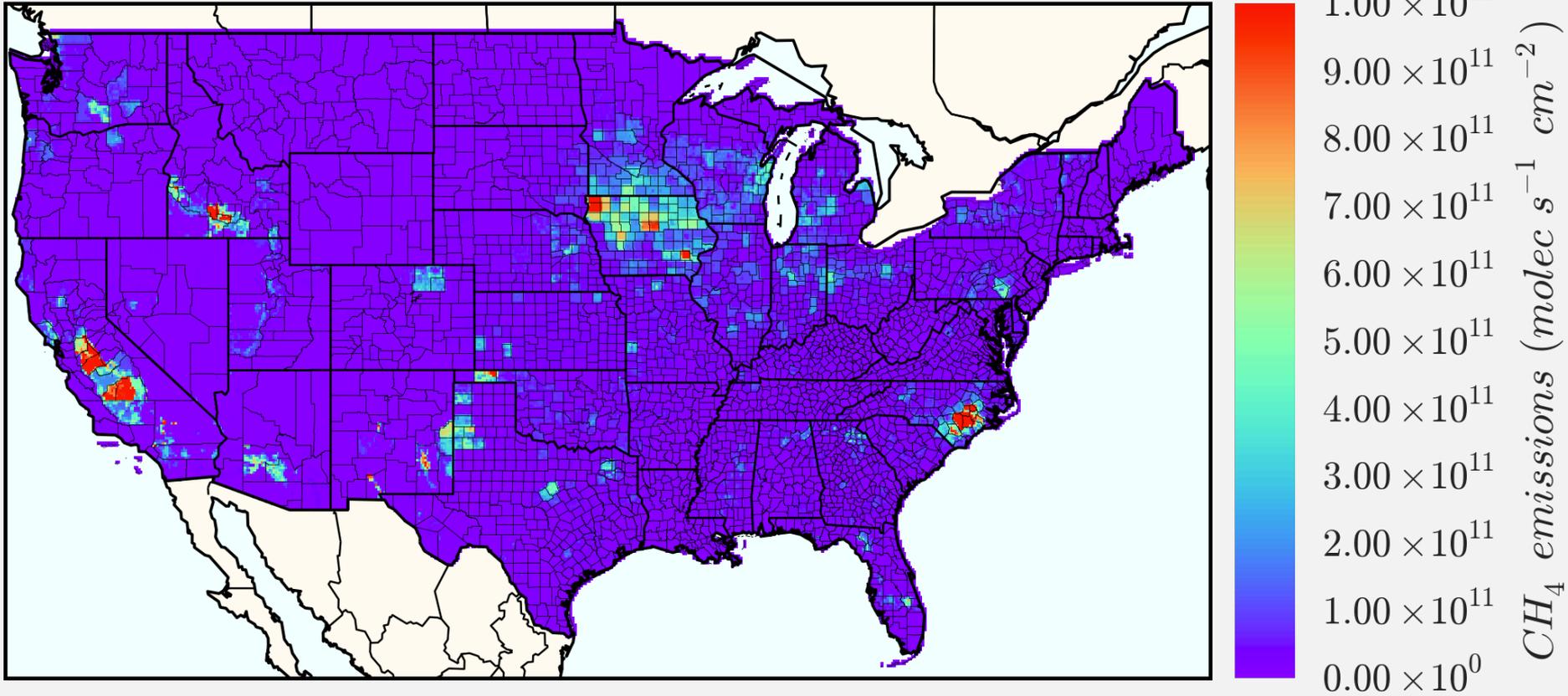
Seasonal cycle based on the temperature dependence of manure emissions

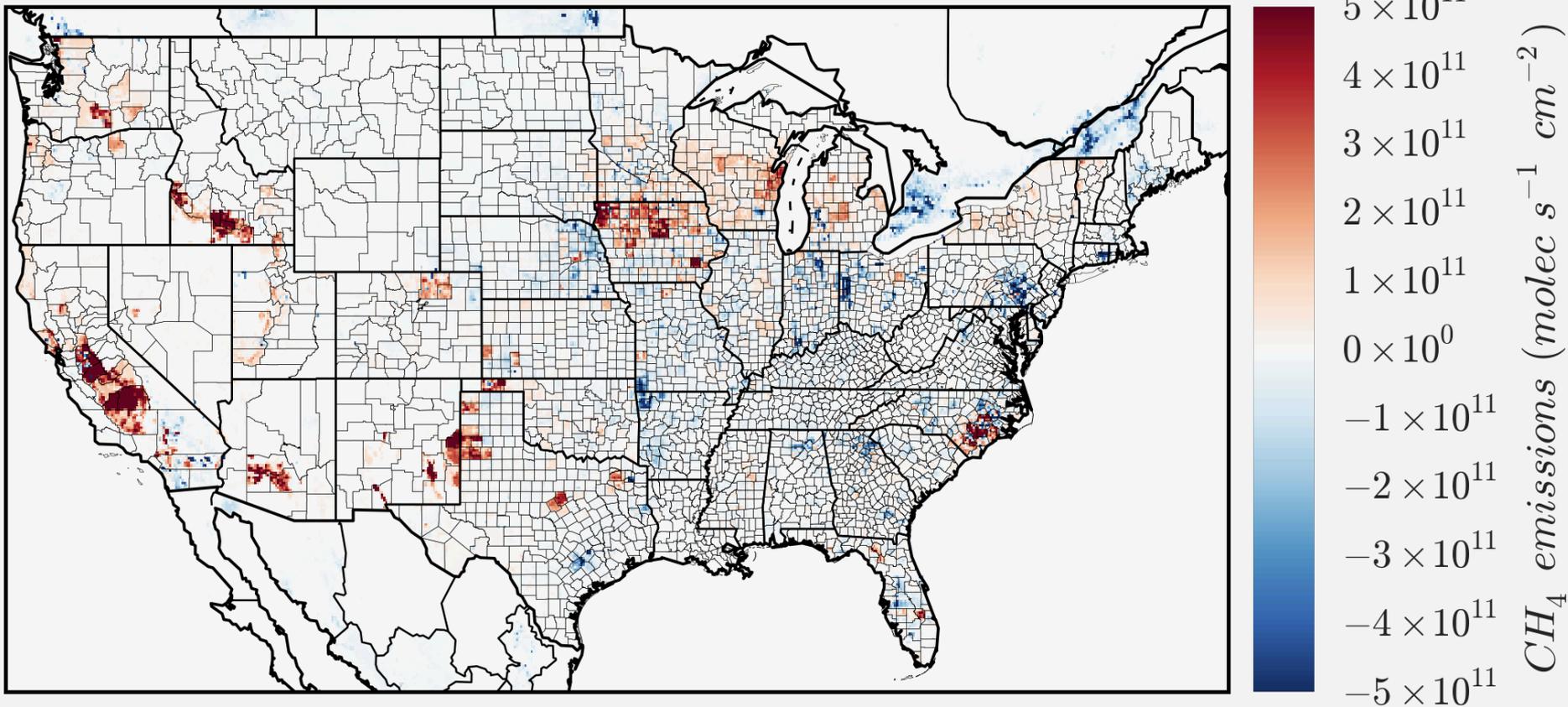
County-level CH₄



Grid-level CH₄

EPA CH₄ emissions from enteric fermentation for 2012

EPA CH₄ emissions from manure management for 2012

EPA–EDGAR V4.2 CH₄ emissions from manure management

Rice – Gridding strategy

State-level emissions from EPA



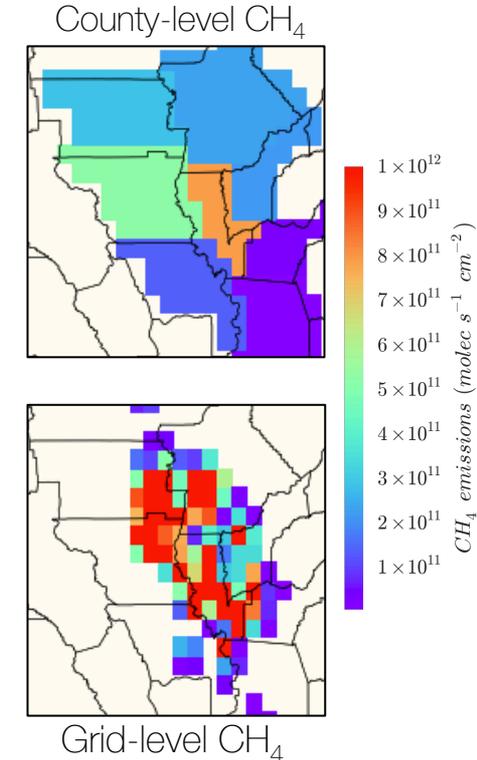
County-level emissions: USDA county rice harvested for 2012

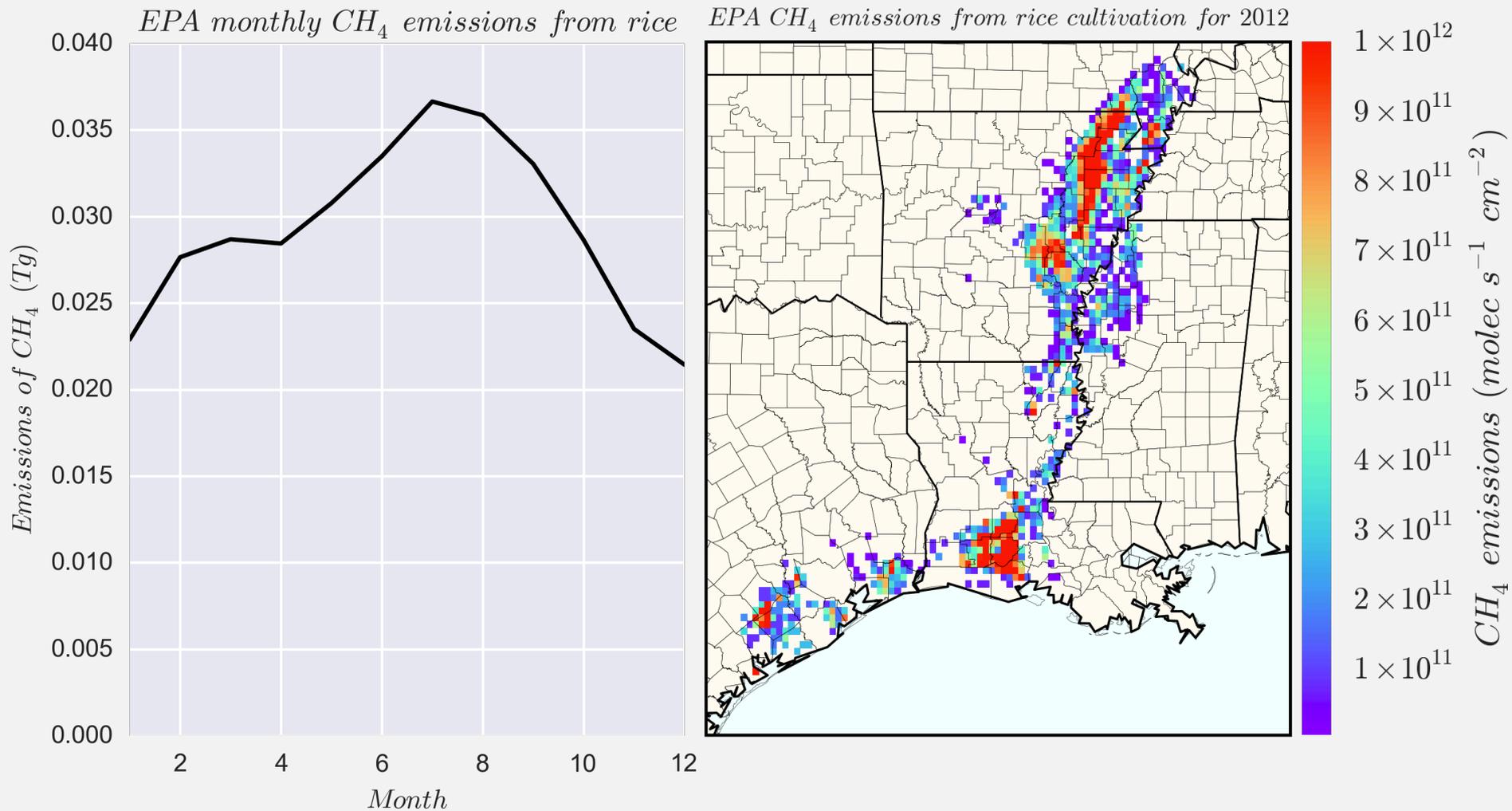


0.1° x 0.1° Grid emissions: the high resolution USDA Cropscape database



Seasonality based on respiration rates from ensemble of carbon models (MsTMIP)







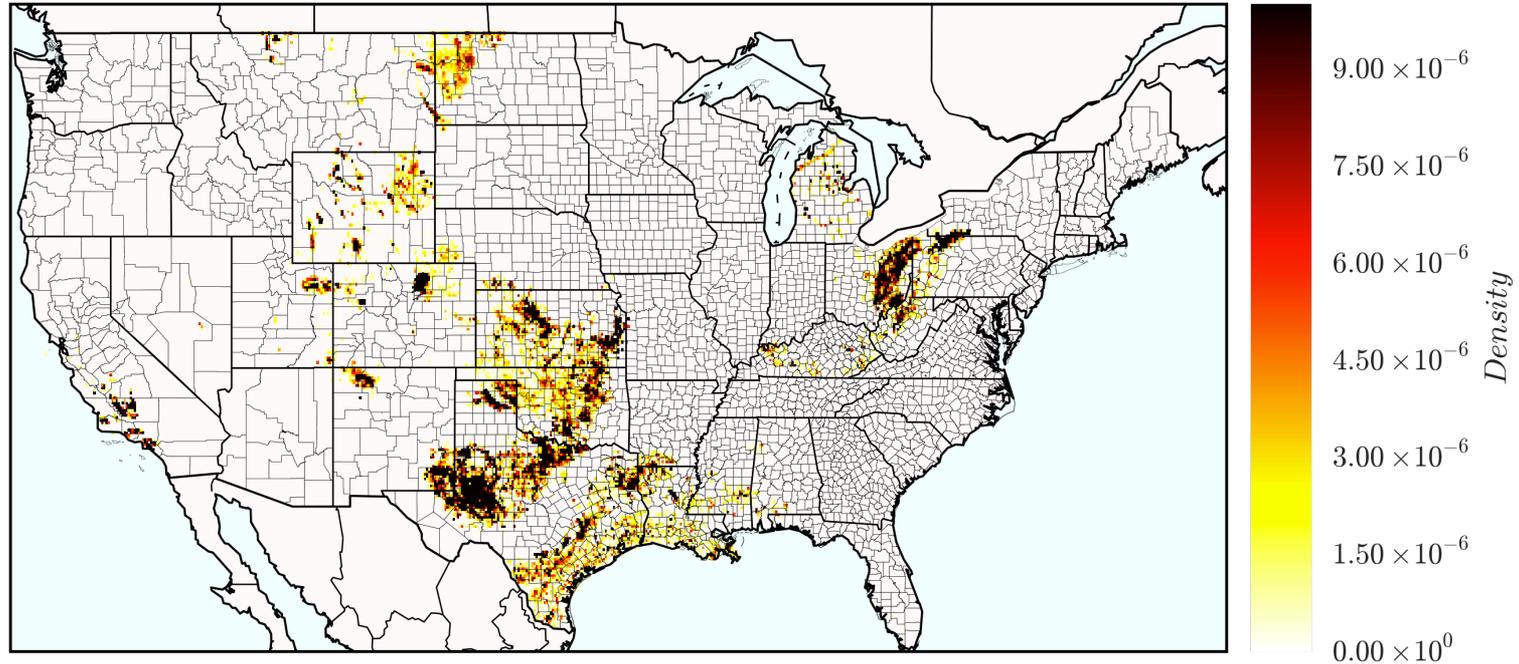
0.9 Tg Onshore production
0.6 Tg Offshore production

Petroleum

Petroleum systems – Gridding strategy

DrillingInfo monthly well-level production information & GHGRP data on refineries

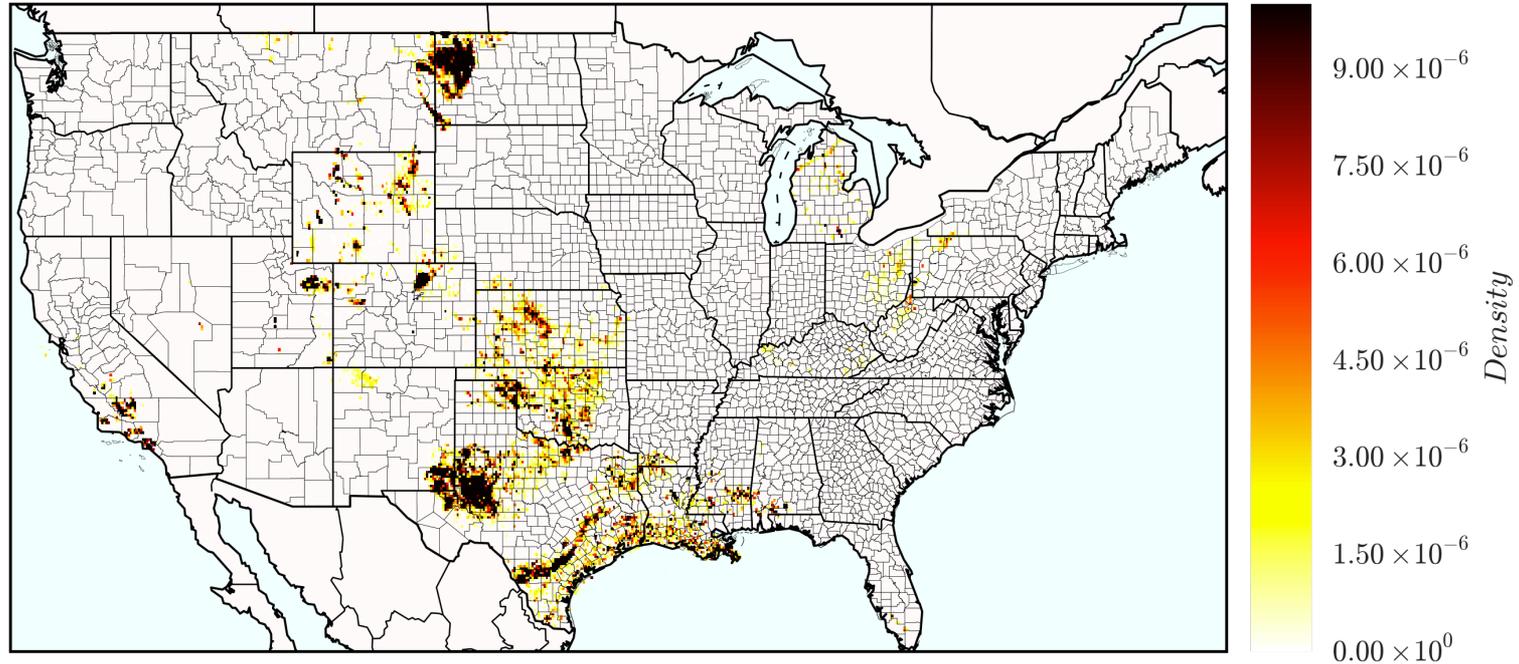
Oil well density for January 2012

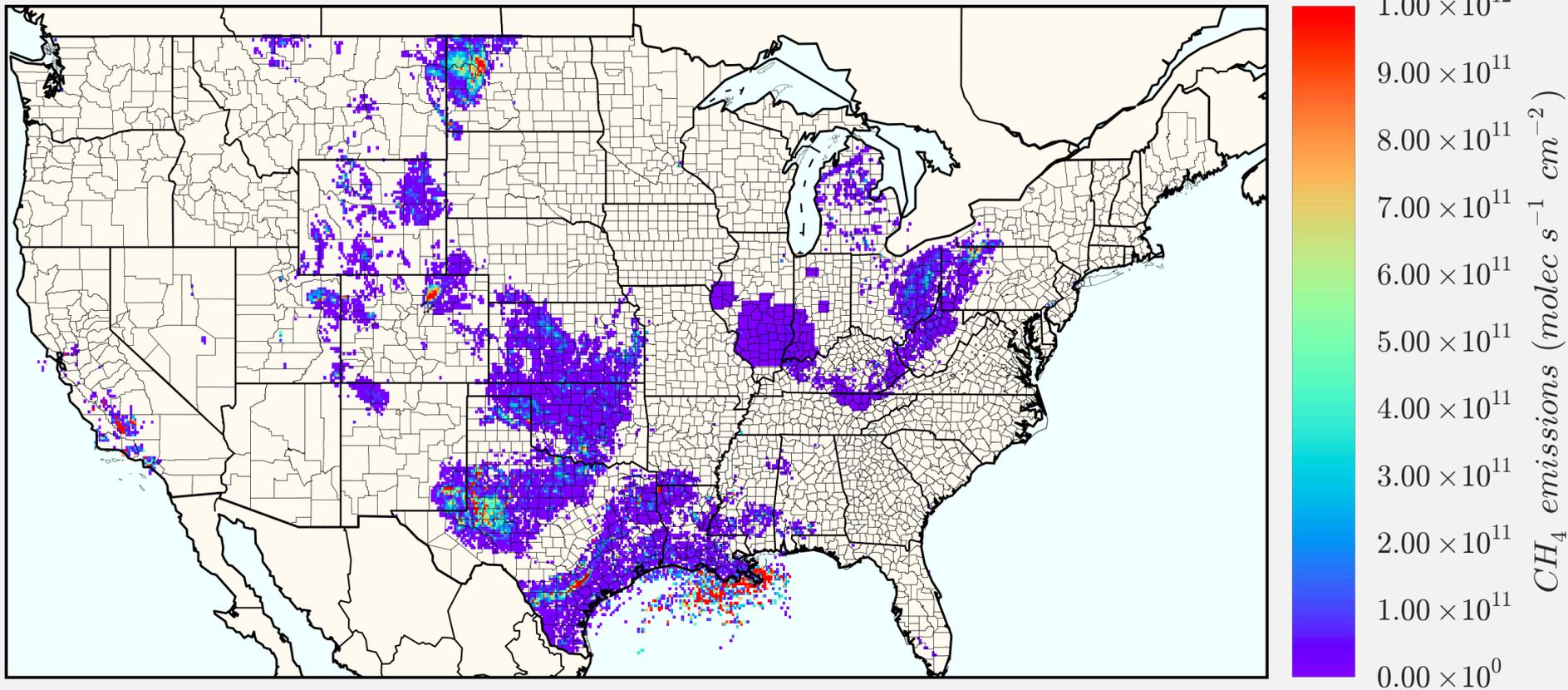


Petroleum systems – Gridding strategy

DrillingInfo monthly well-level production information & GHGRP data on refineries

Oil production density for January 2012



Preliminary EPA CH₄ emissions from petroleum systems 2012

An aerial photograph of a vast natural gas field. The landscape is a mix of brown and green, with numerous small structures and pipes scattered across the terrain. A prominent wellhead with a tall stack is visible in the lower center. The background shows a range of blue mountains under a clear sky.

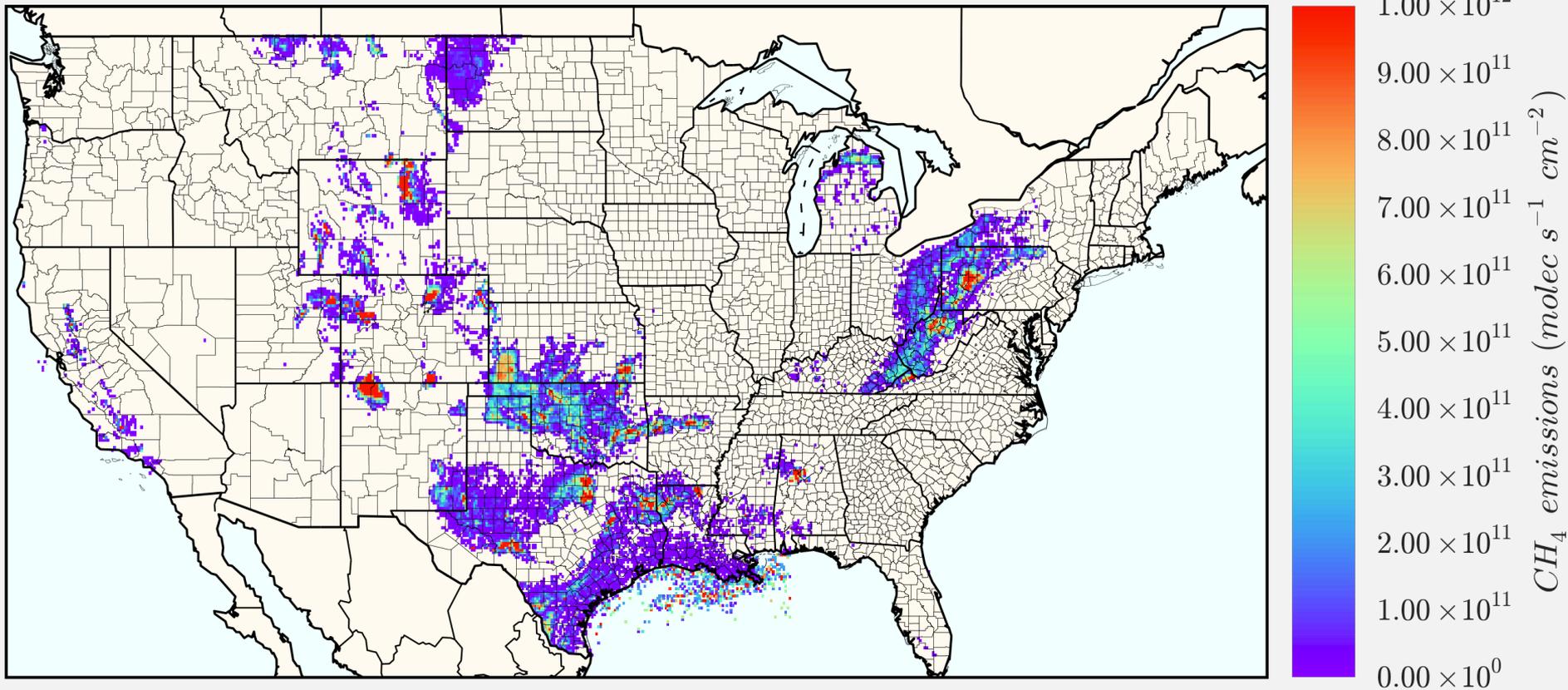
2.0 Tg Production
0.9 Tg Processing
2.1 Tg Transmission
1.2 Tg Distribution

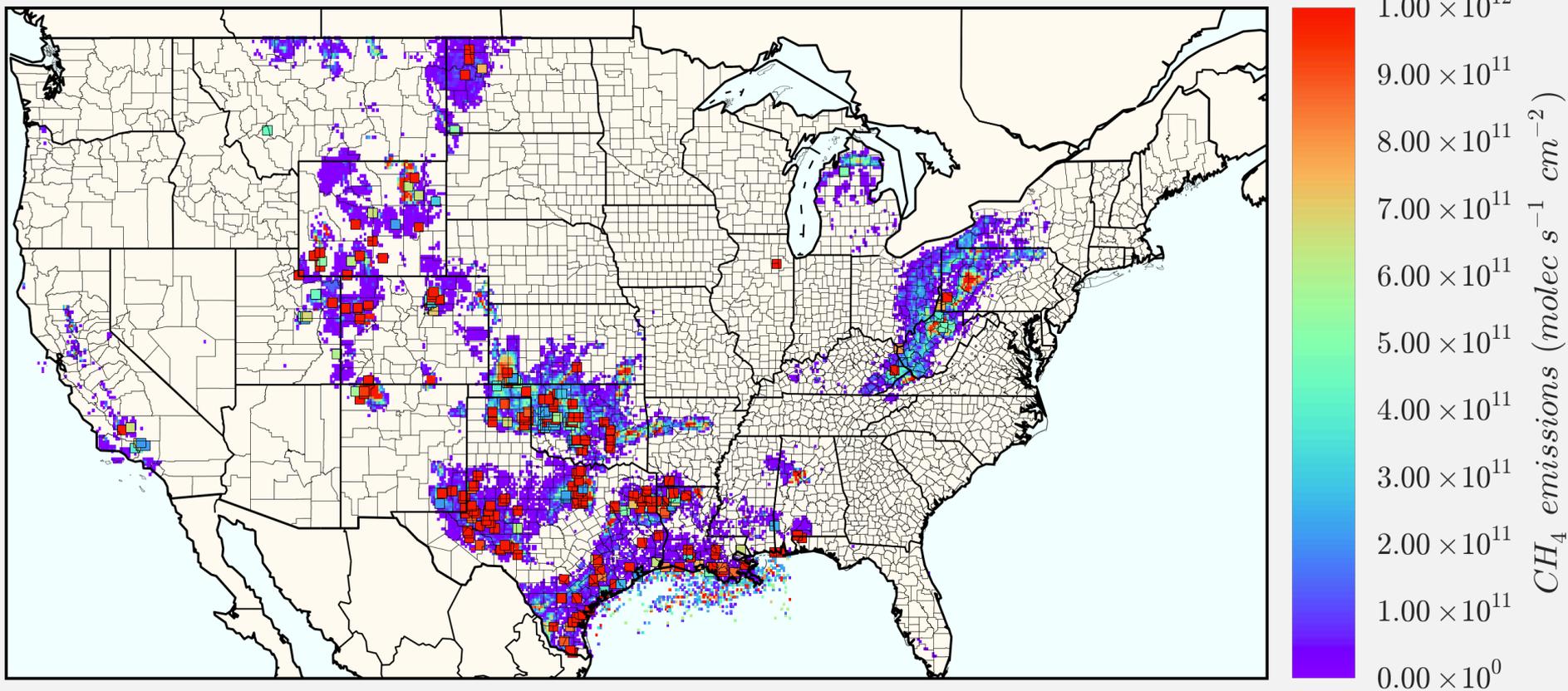
Natural Gas

Natural gas systems – Gridding strategy

Four stages associated with emissions:

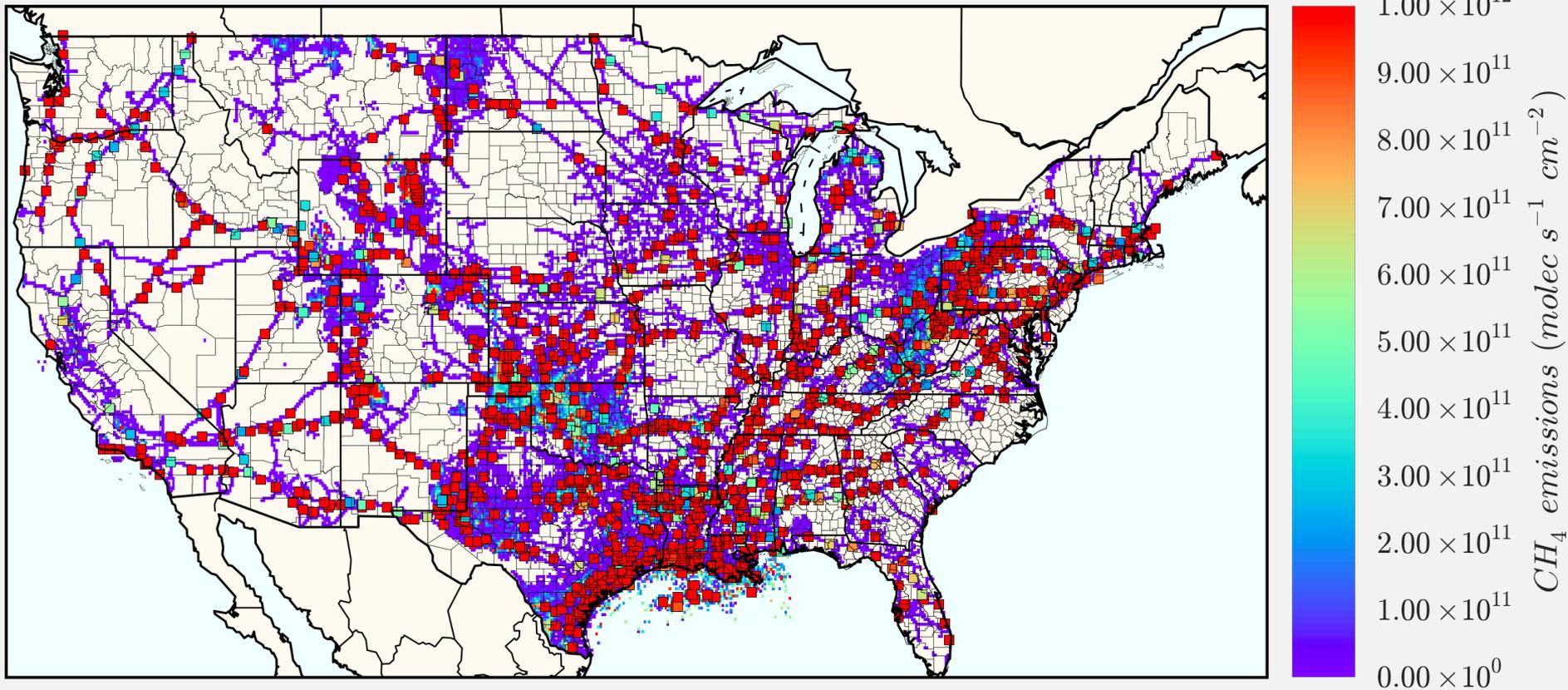
- Production: DrillingInfo monthly well-level data
- Processing: GHGRP & EIA processing plant capacities
- Transmission: Compressor stations, LNG terminals & storage, and pipelines
- Distribution: State-level PHMSA data combined with the 2010 US Census

Preliminary EPA CH₄ emissions from natural gas production

Preliminary EPA CH₄ emissions from natural gas production and processing

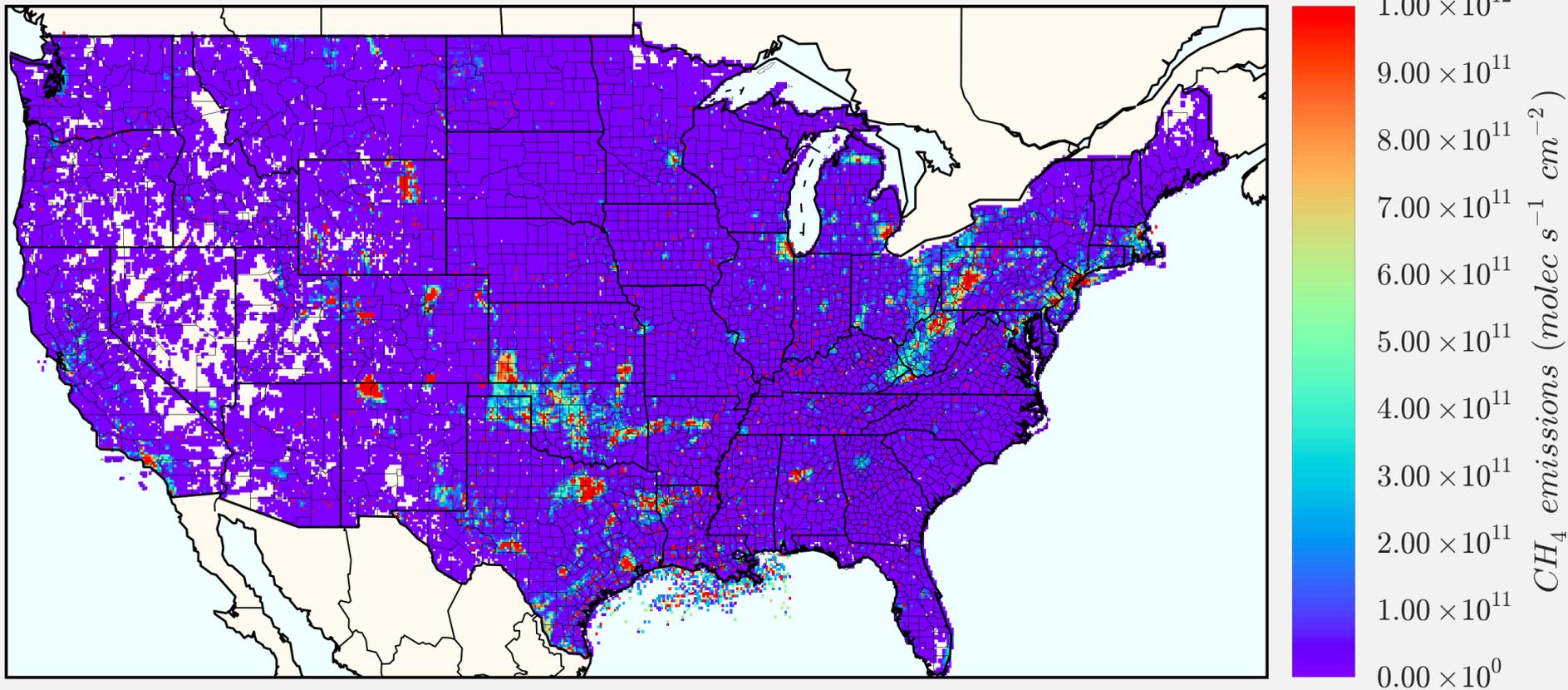
The squares show point sources pixels in the inventory

Preliminary EPA CH₄ emissions from natural gas production, processing, and transmission

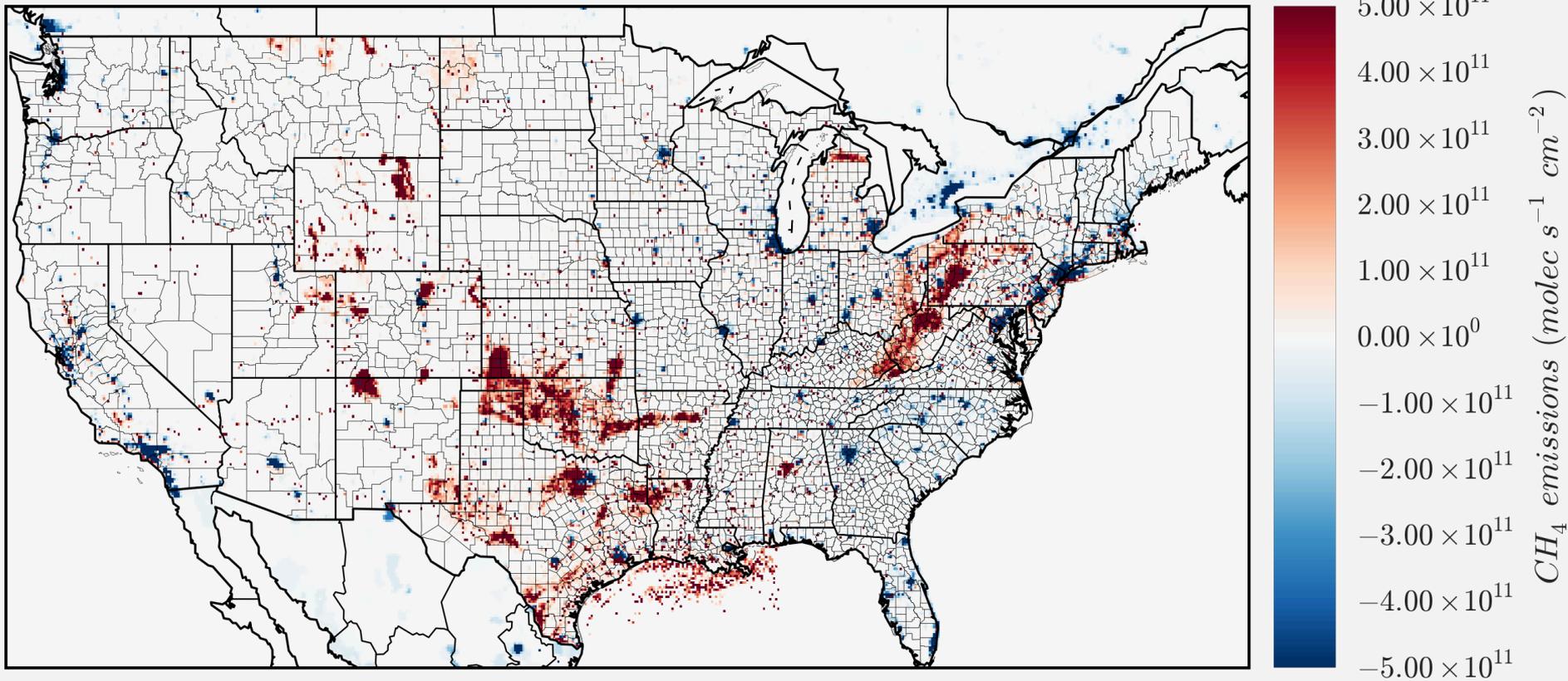


The squares show point sources pixels in the inventory

Preliminary EPA CH₄ emissions from natural gas production, processing, transmission, and distribution



Preliminary EPA [2012] – EDGAR v4.2 [2008] CH₄ emissions from natural gas systems



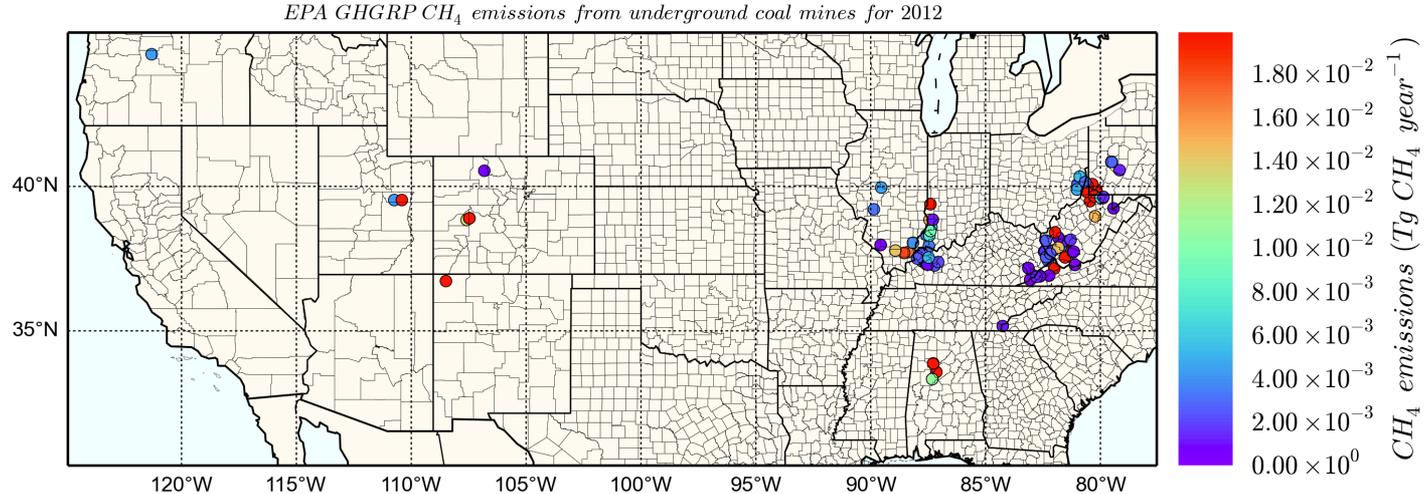
2.2 Tg Underground mining
0.5 Tg Surface mining
0.2 Tg Abandoned mines



Coal mining

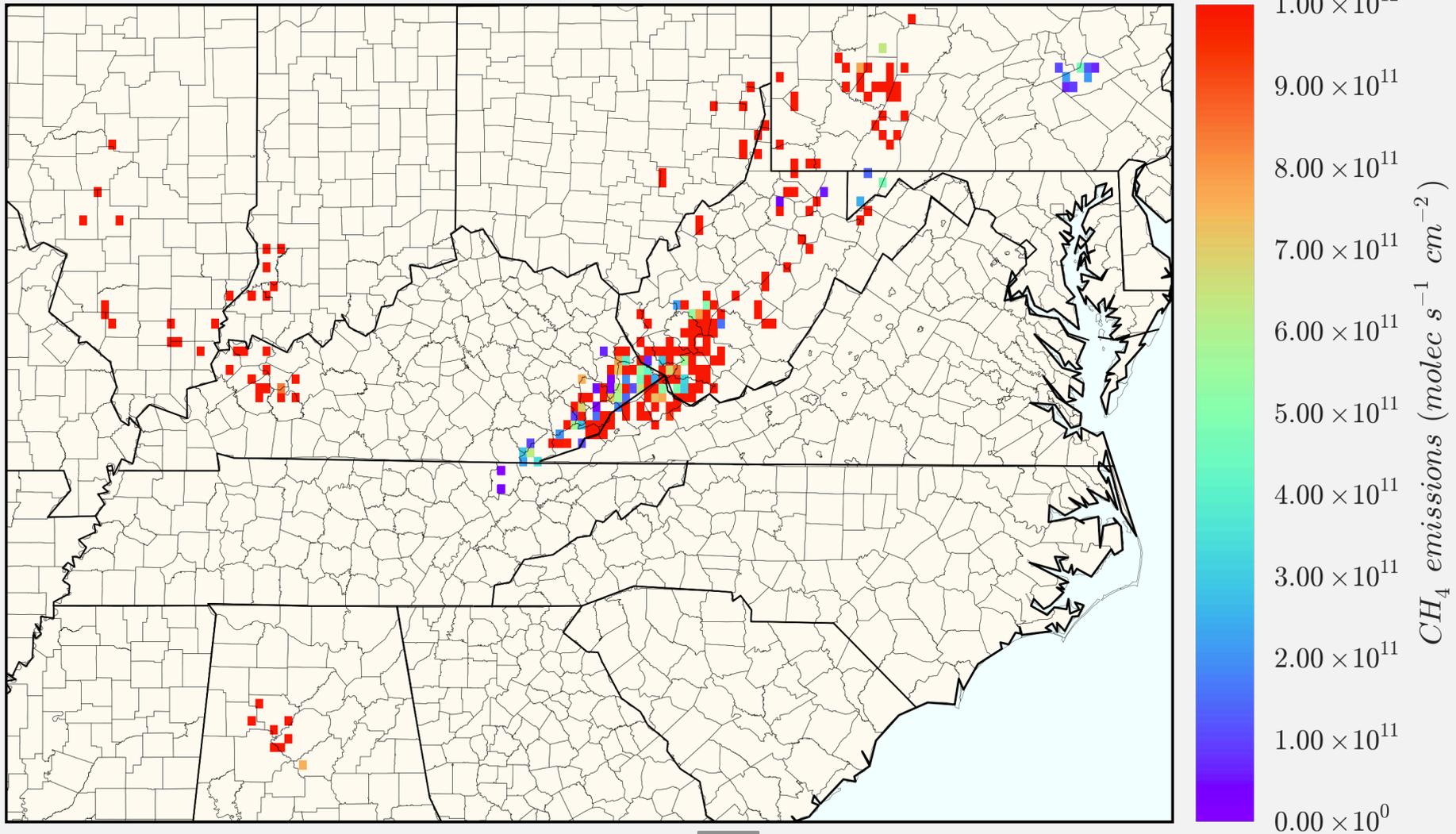
Coal mining – Gridding strategy

We incorporate GHGRP emissions for underground coal mines

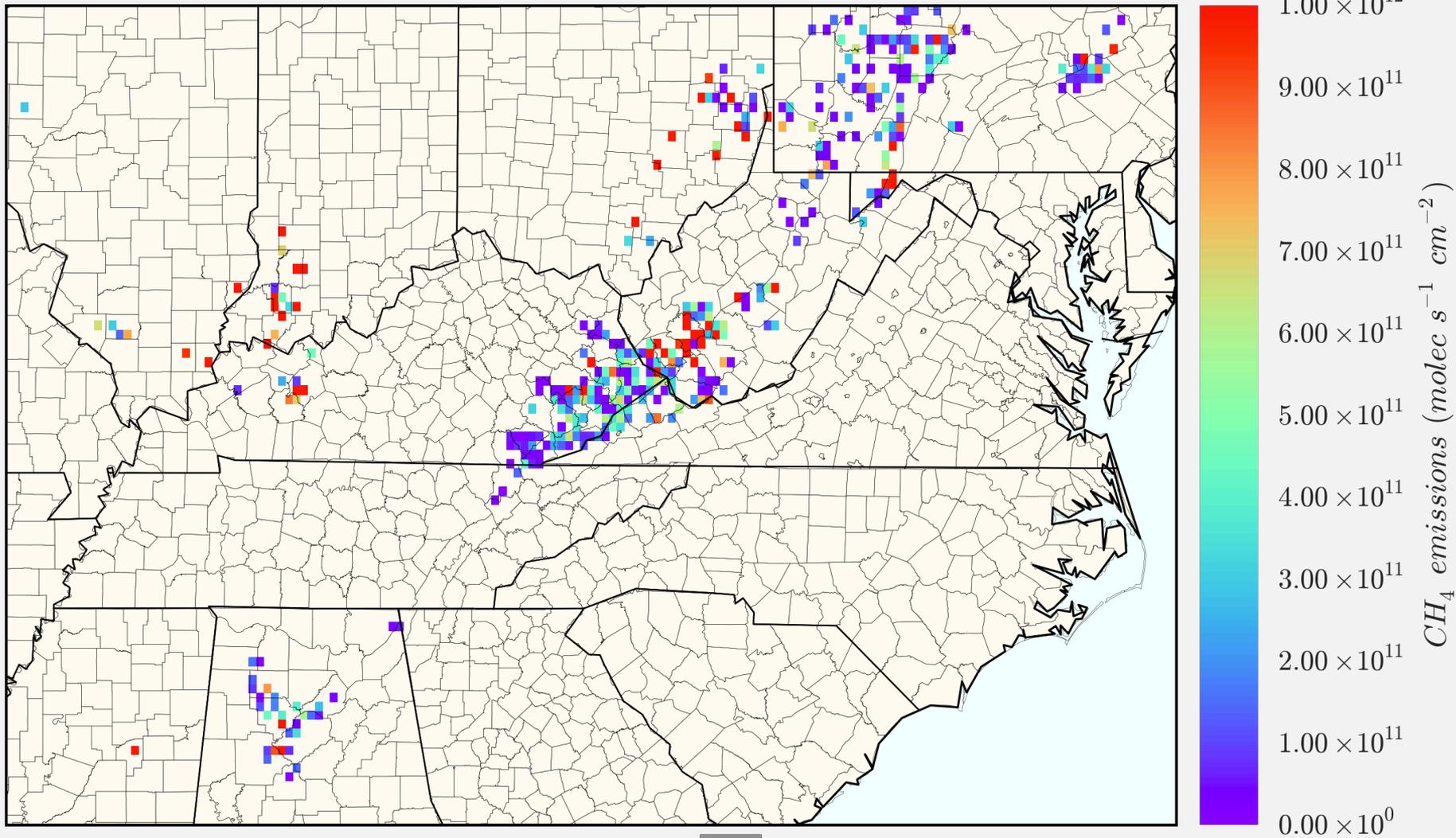


Emissions from non-reporting mines and post-mining are based on EIA 2012 production and basin-level emission factors

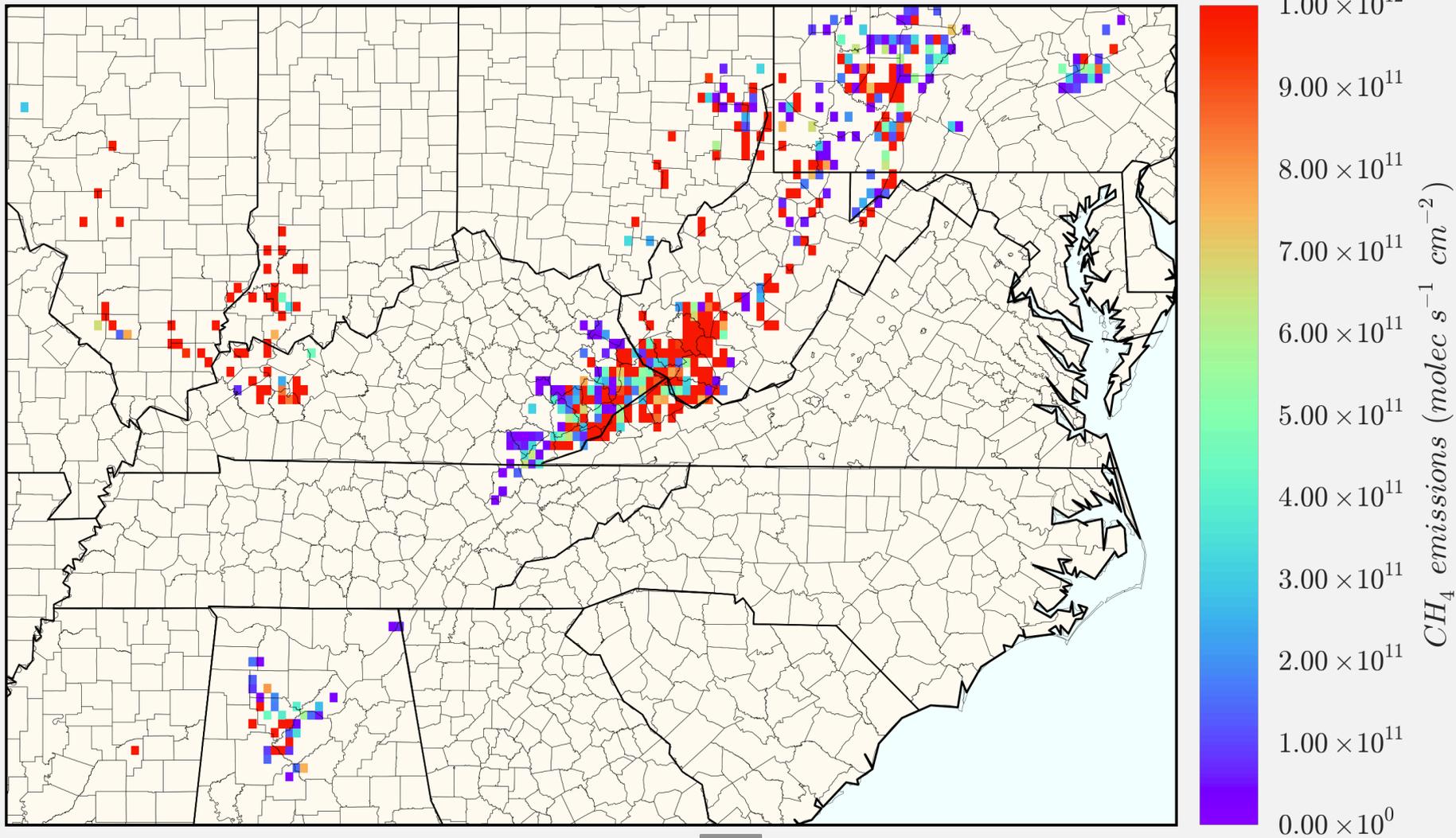
Preliminary EPA CH₄ emissions from underground coal mining in 2012



Preliminary EPA CH₄ emissions from surface coal mining in 2012



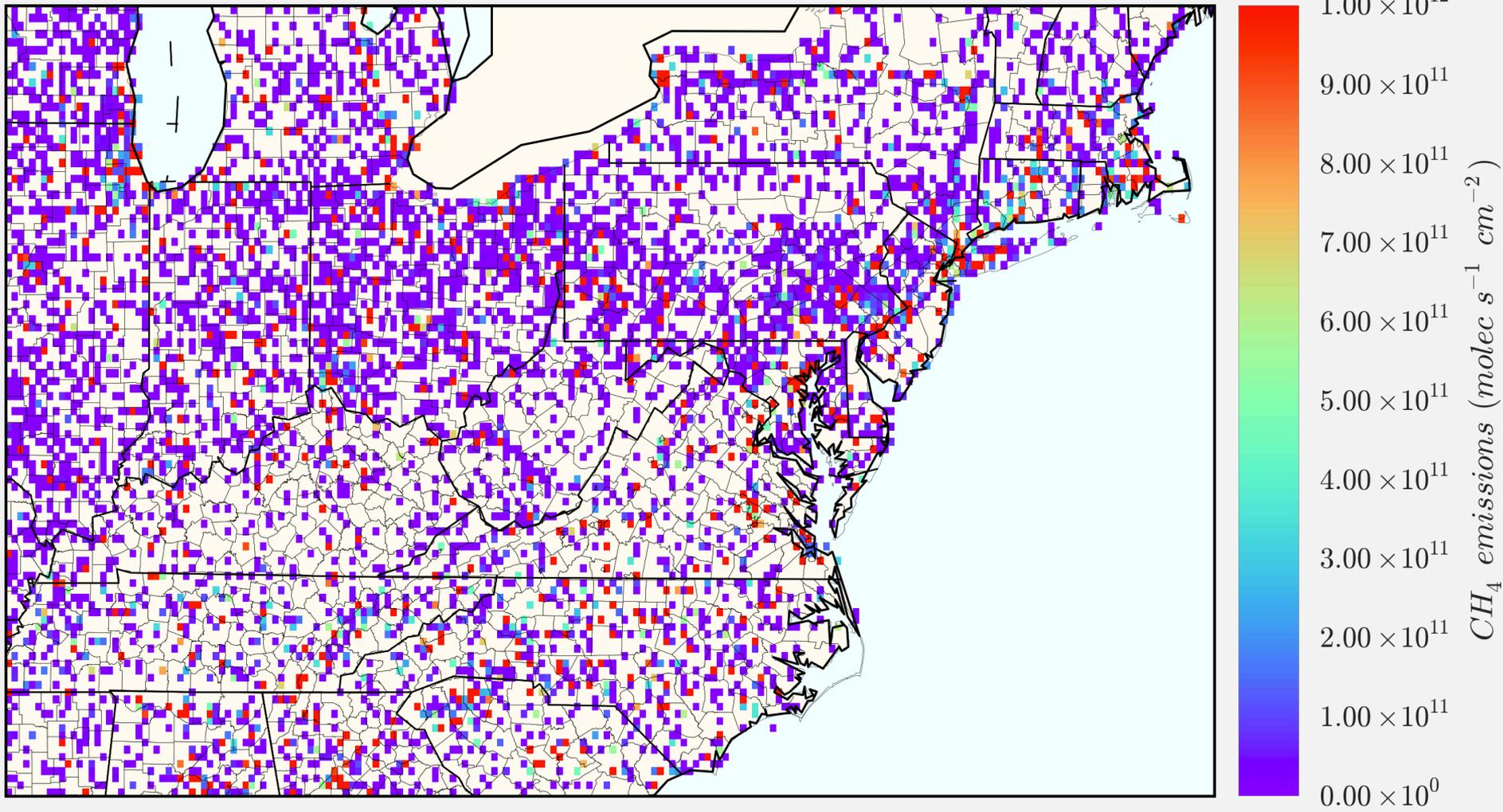
Preliminary EPA CH₄ emissions from coal mining in 2012



4.9 Tg Landfills
0.6 Tg Wastewater treatment
0.1 Tg Composting



Preliminary EPA CH_4 emissions from waste for 2012

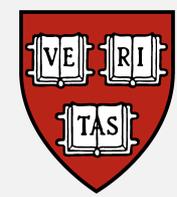


Outlook

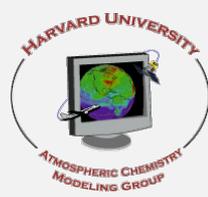
Finalize the gridded $0.1^\circ \times 0.1^\circ$ version of the EPA methane inventory for 2012 and make it publicly available this summer

Inventories for later years will be published as data becomes available

Use the inventory as basis for inversions of satellite data



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A gridded version of the EPA national methane inventory



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