

ARTICLE

Supplementary material for

Reduced U.S. Methane Emissions during the COVID-19 Pandemic

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Table S1

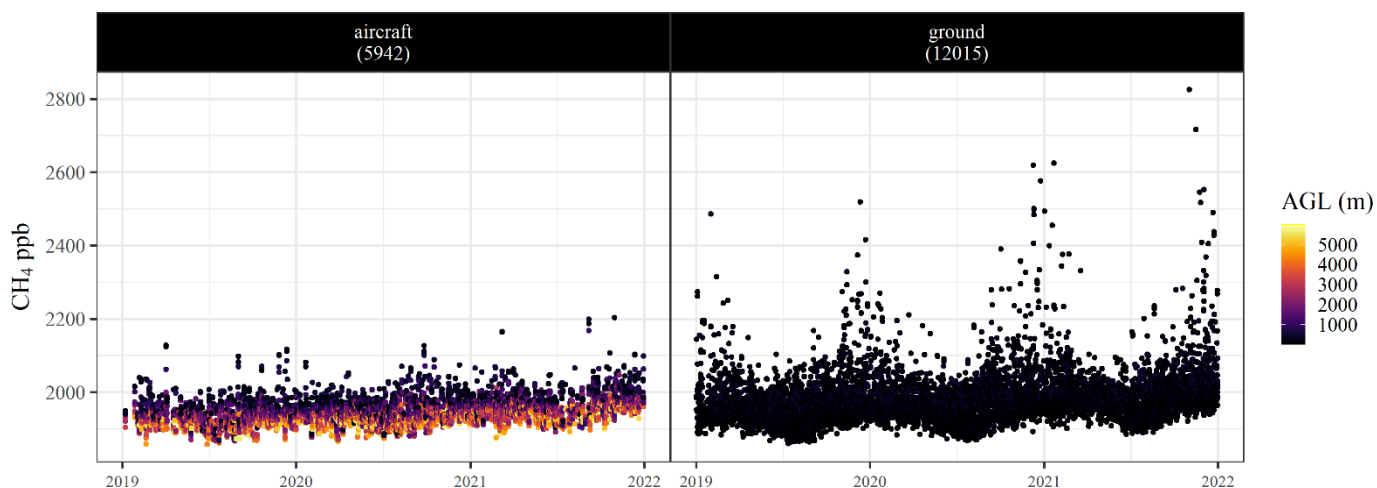


Figure S1. Assimilated methane observations from flasks collected at a) aircraft, b) ground sites.

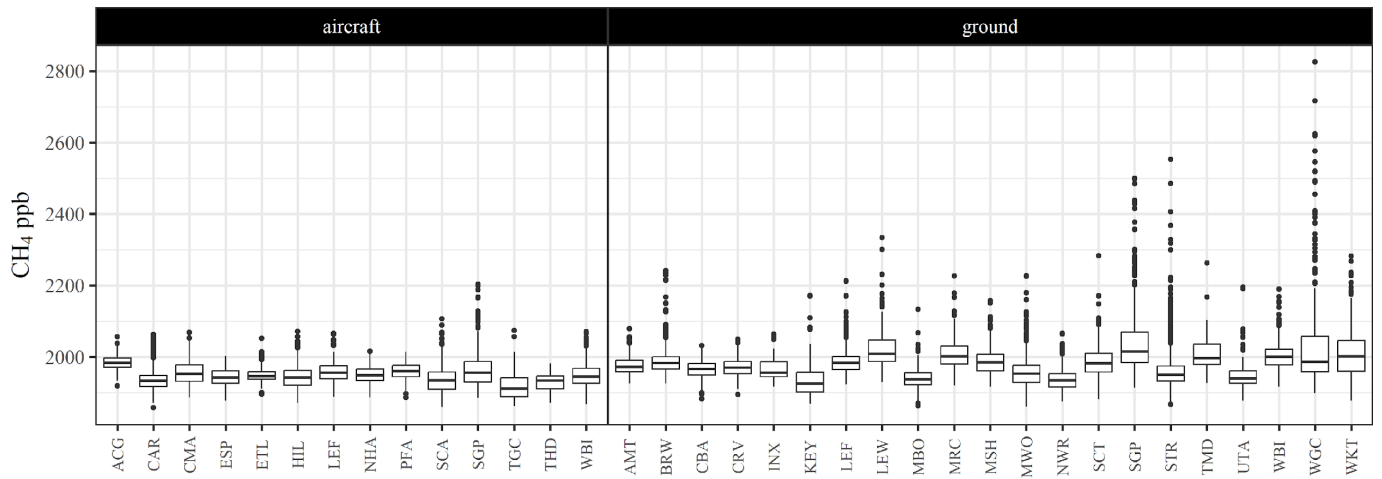


Figure S2. Boxplots of CH₄ observations for each surface and aircraft site.

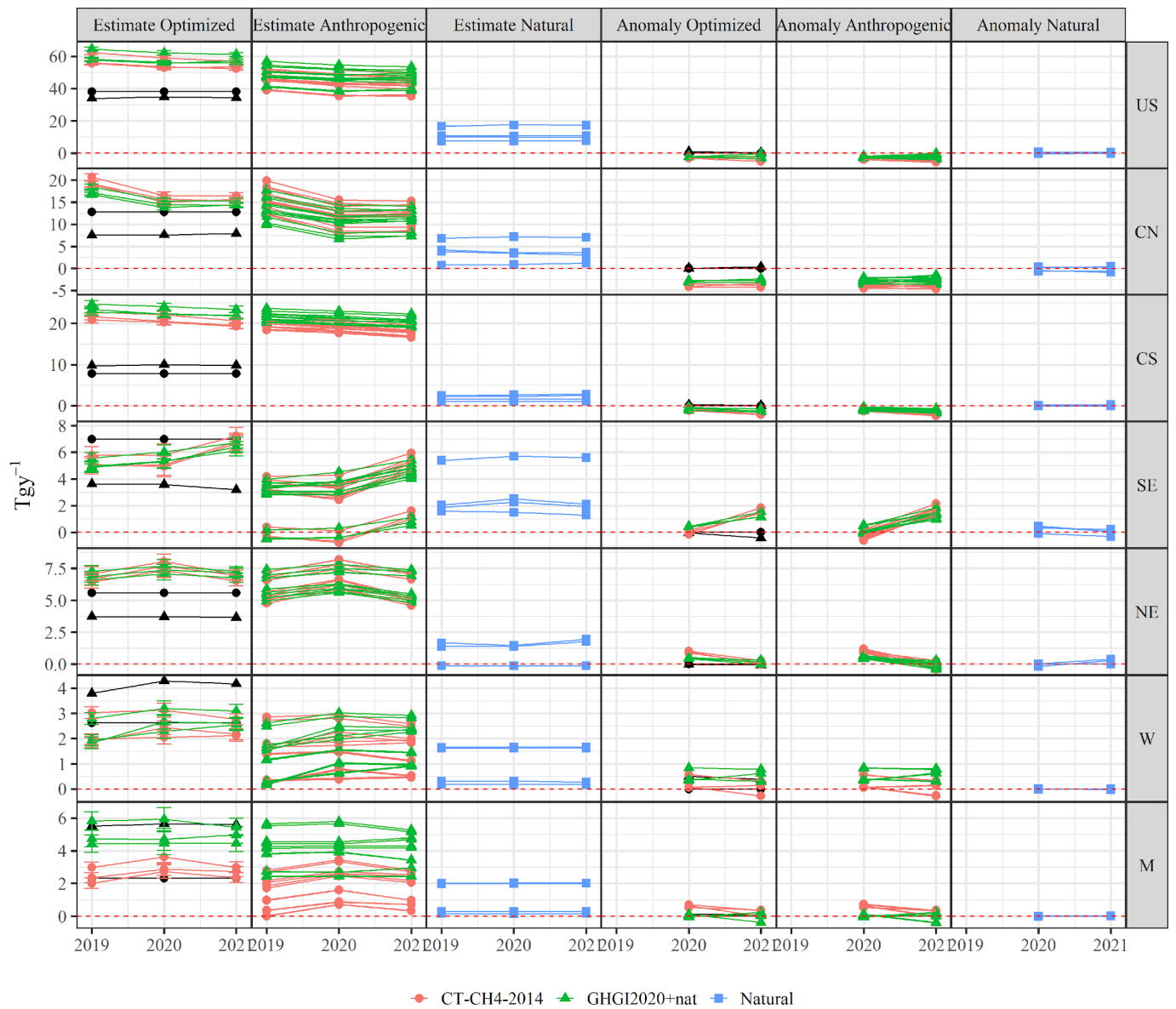


Figure S3. Estimation of optimized total, natural, and anthropogenic emissions, and their anomalies 2020-2019 and 2021-2019 in 2019, 2020 and 2021 (Tgy-1) over US and inner regions. The lines in color black indicate priors. CT-CH₄_2014 is CarbonTracker-CH₄ (Bruhwiler et

al., 2014) and GHGI2020+nat is US EPA's GHGI (Maasakkers et al., 2023; EPA, 2023) and natural emissions including wetlands (Hu et al., 2025).

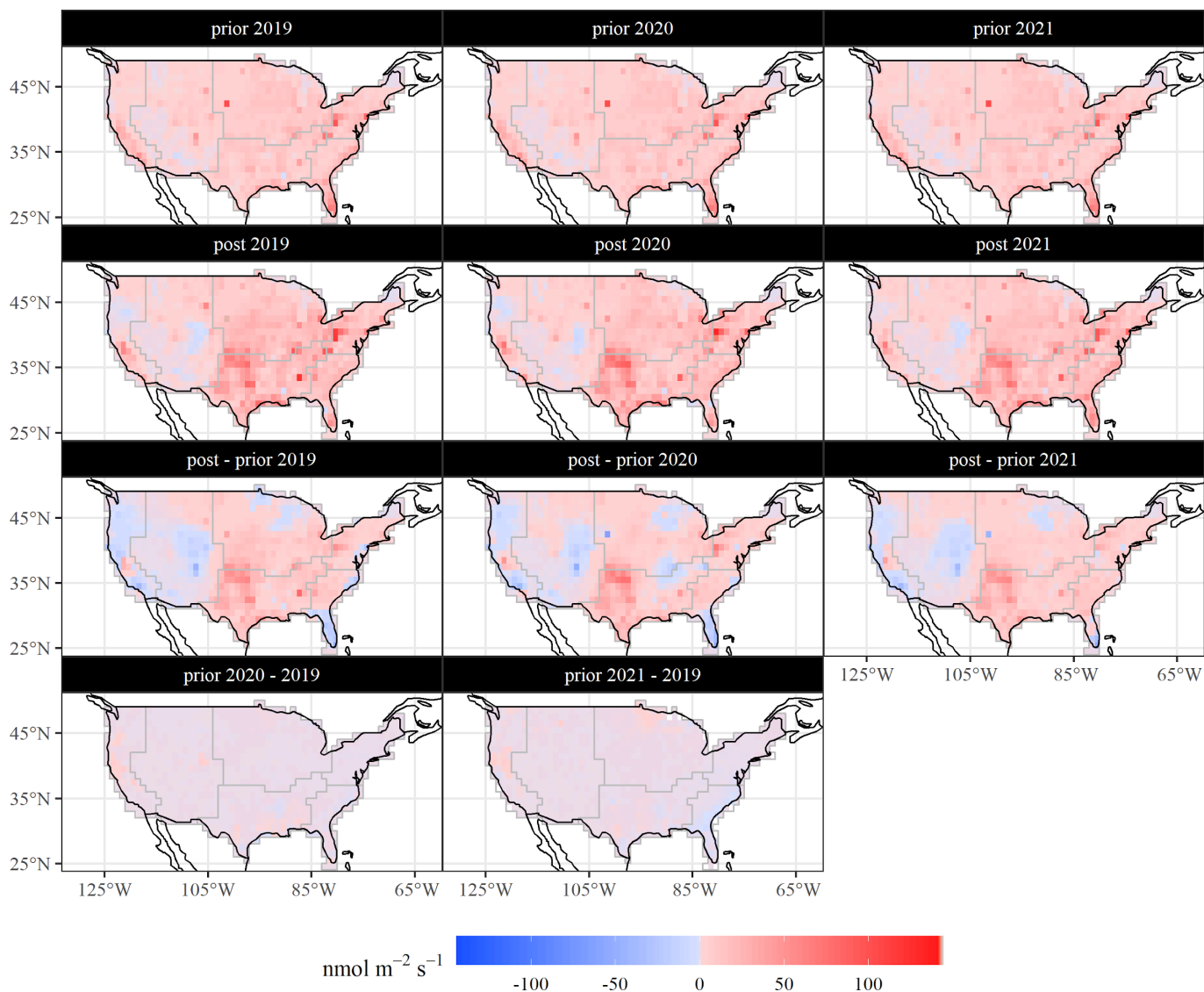


Figure S4. Mean methane fluxes (nmol m⁻² s⁻¹) by year from optimized posteriors (top row), priors and their difference by year. Also, mean anomaly of priors (bottom).

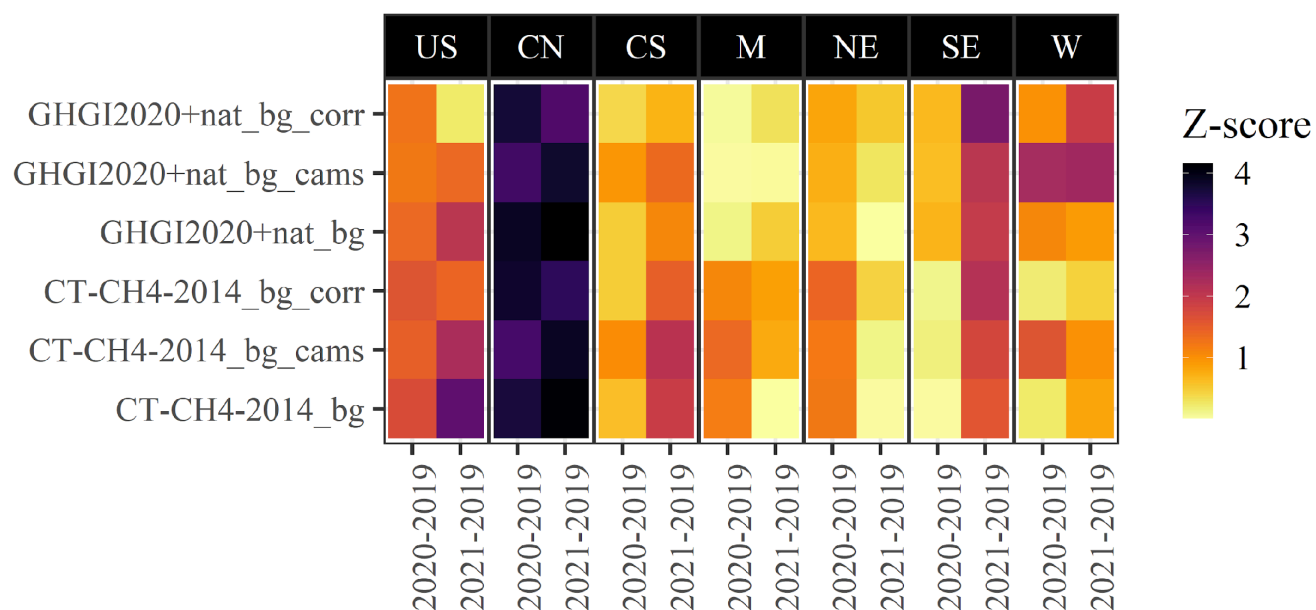


Figure S5. z-scores for to assess the difference between years for each ensemble member.

Table S1. P.value of the Mann-Whitney U test between differences 2020 and 2019 with 2019 by US region (R Core Team, 2024). The test was performed between ensemble members and periods for each region.

p.value	US	CN	CS	M	NE	SE	W
2020-2019	0.0313	0.0313	0.0313	0.0938	0.0313	0.1563	0.0313
2021-2019	0.0313	0.0313	0.0313	0.4375	0.1563	0.0313	0.0938

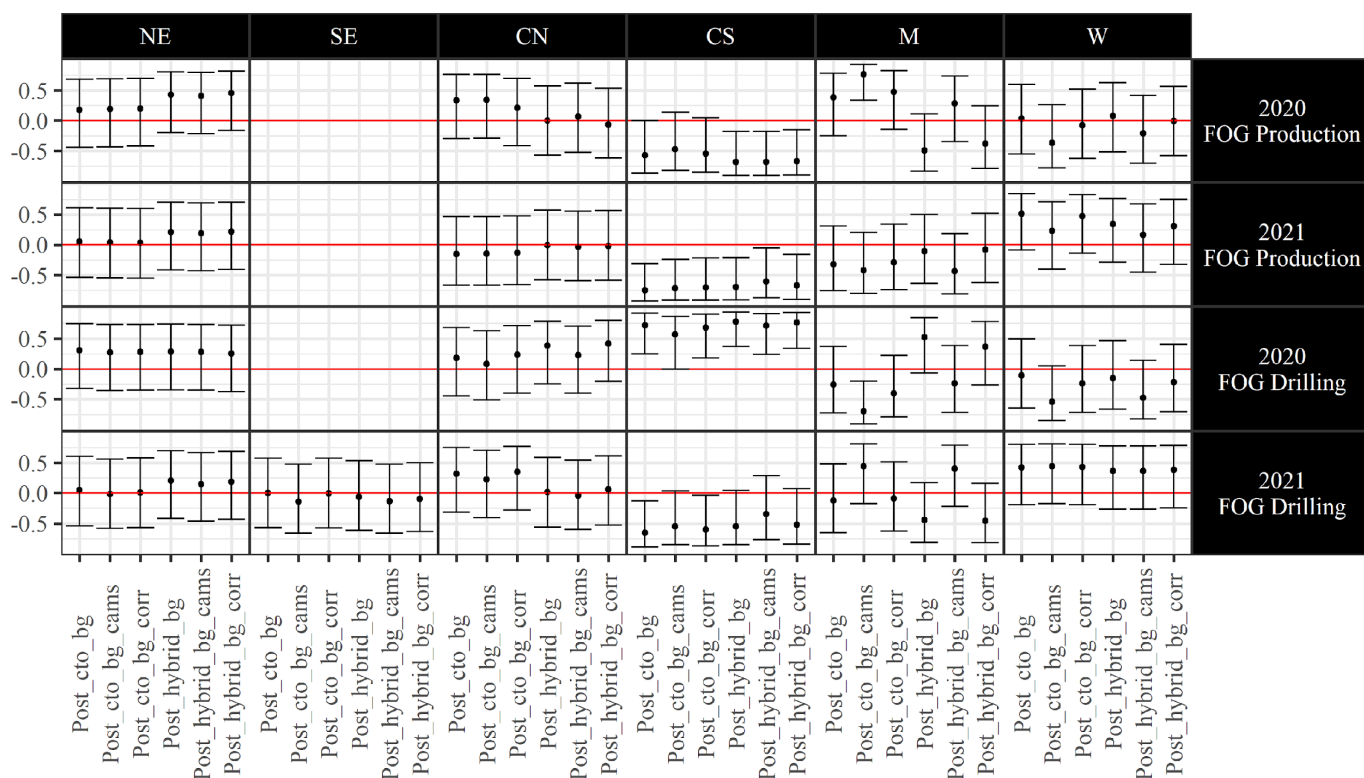


Figure S6. Correlation between posterior estimates and FOG emissions. Posterior emissions in the Central South are highly correlated with FOG drilling in 2020 for all ensemble members.

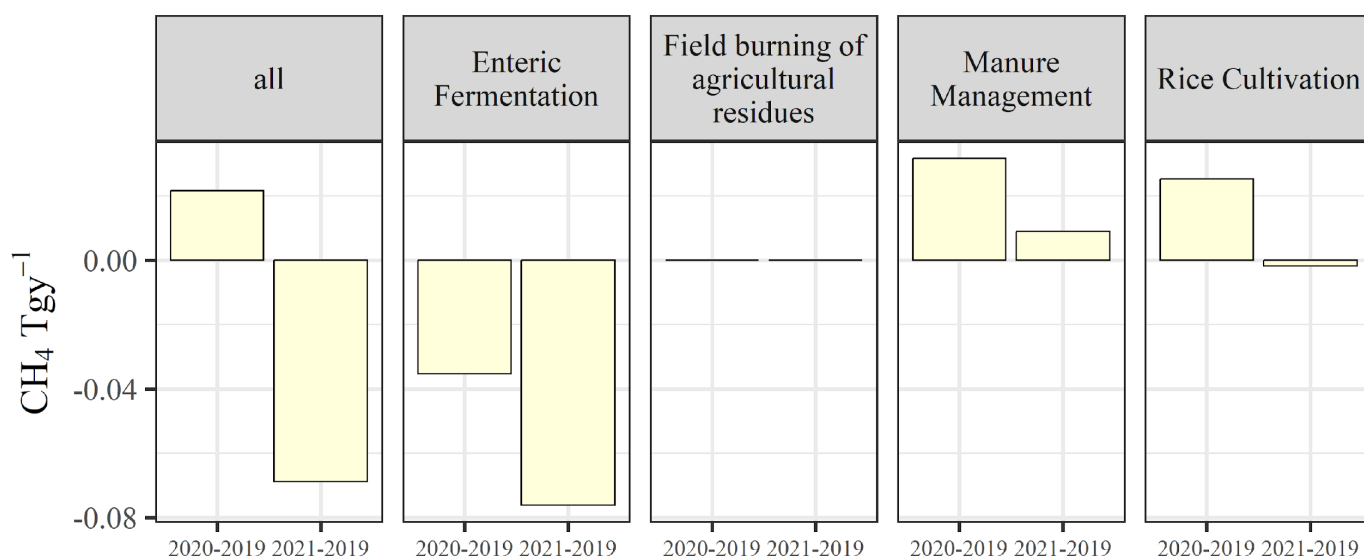


Figure S7. 2020-2019 and 2021-2019 methane anomalies in the agriculture sector (Tgy^{-1}) from US EPA (2024).

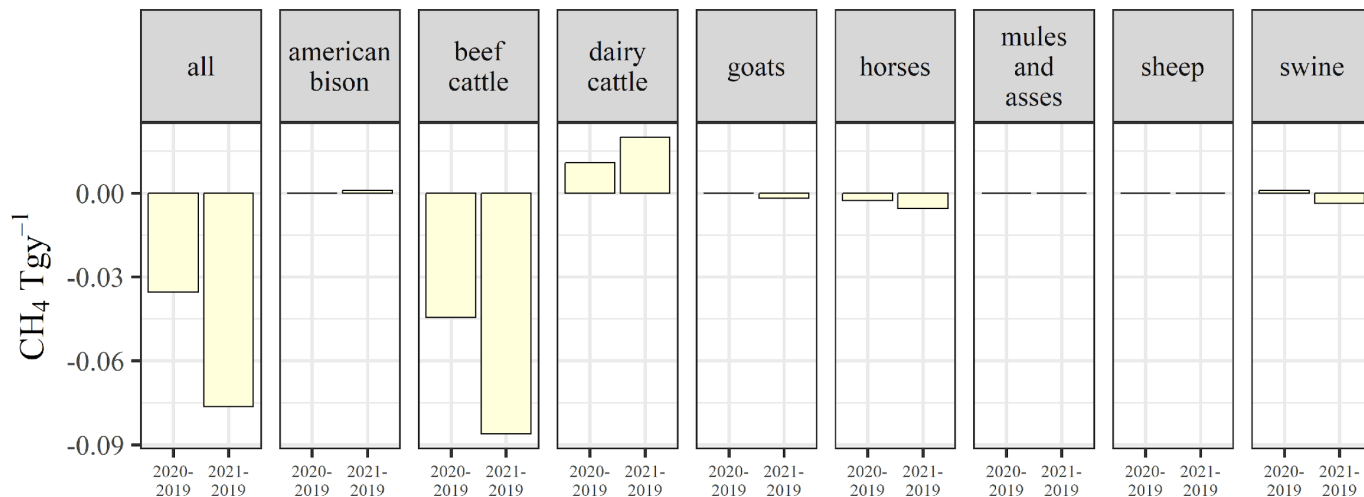


Figure S8. 2020-2019 and 2021-2019 CH₄ emission anomalies (Tgy⁻¹) for the enteric fermentation sub-category of the agriculture category in the EPA Inventory (2024).

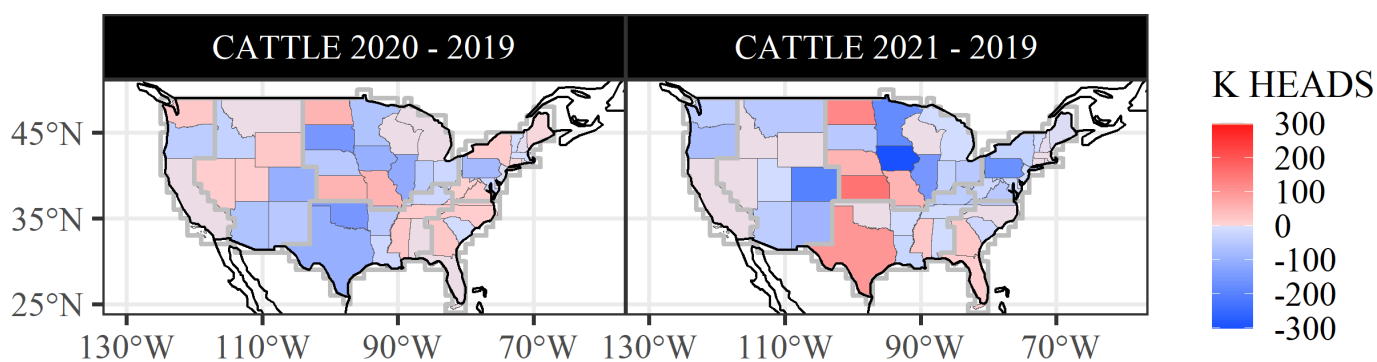


Figure S9. Differences in 2021 and 2020 with 2019 cattle head count in the U.S. (USDA, 2023).

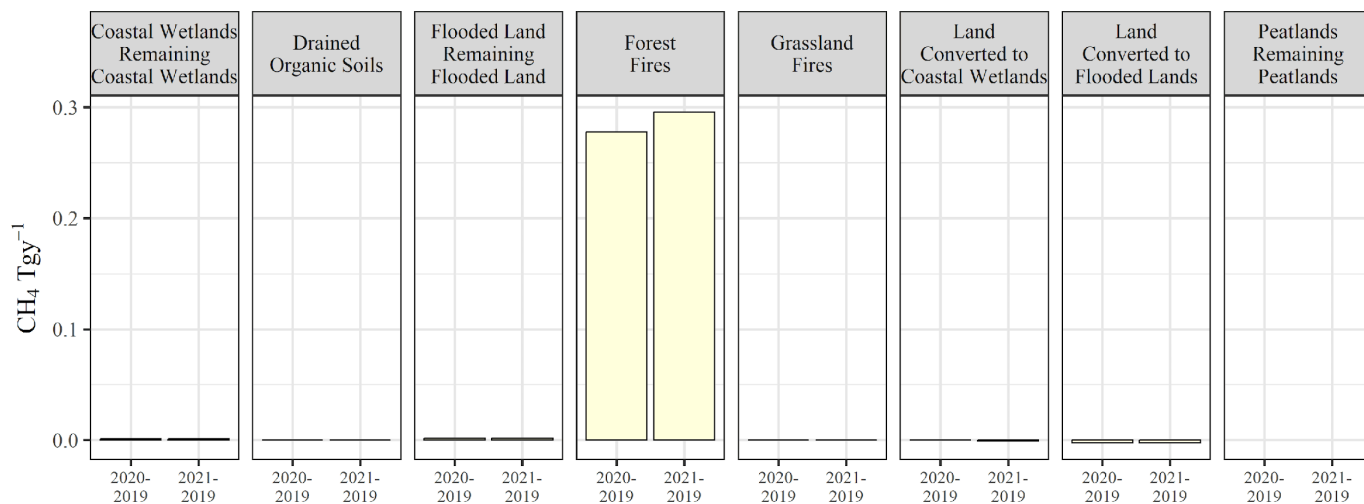


Figure S10. 2020-2019 and 2021-2019 CH₄ anomalies (Tgy⁻¹) in the land-use and land-use forestry sectors from US EPA (2024).

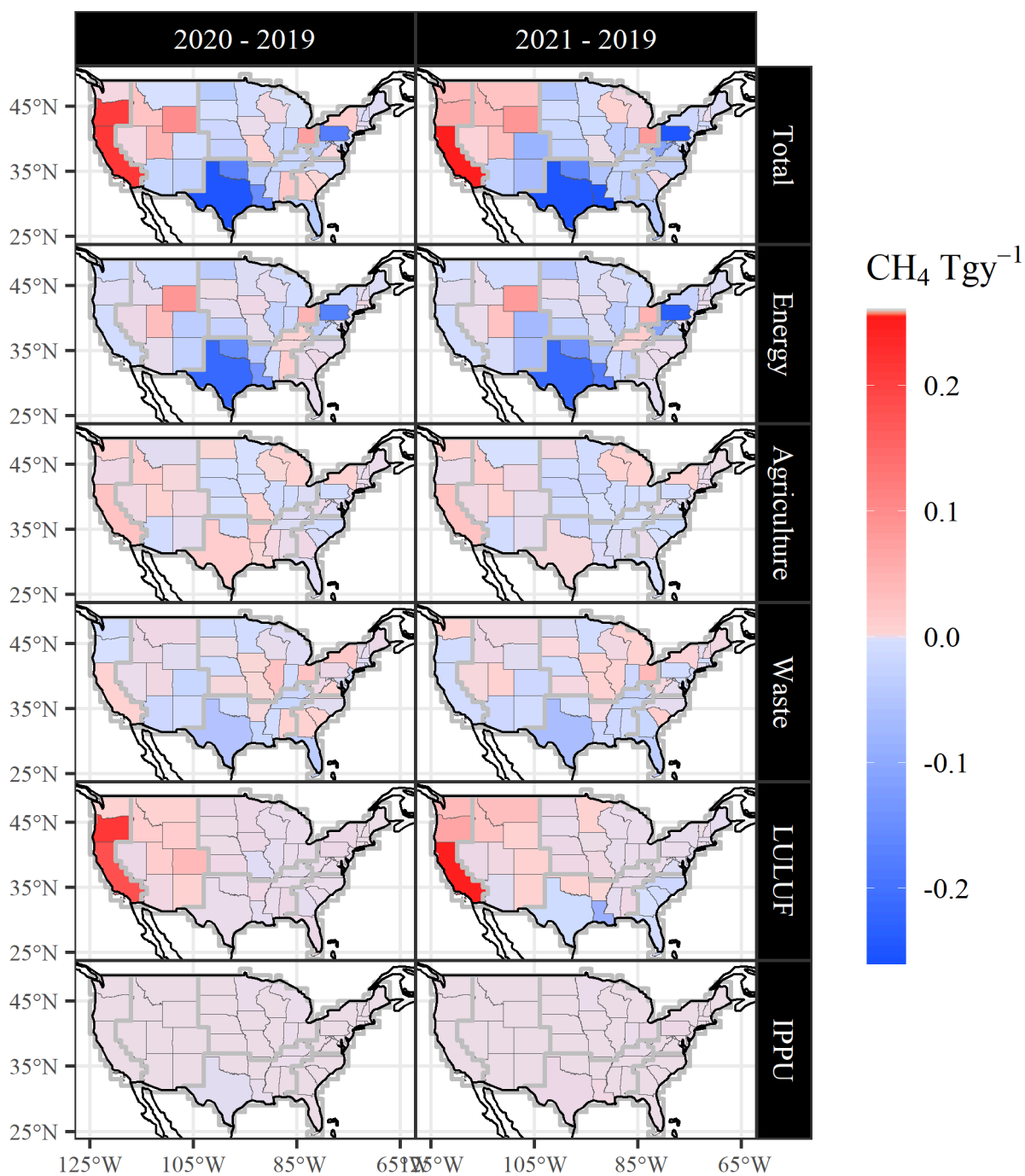


Figure S11. Difference of 2020-2019 CH₄ emissions (Tgy⁻¹) over the U.S. by state (U.S. EPA, 2023). LULUF refers to land-use, land-use change, and forestry and IPPU refers to industrial processes and product use.

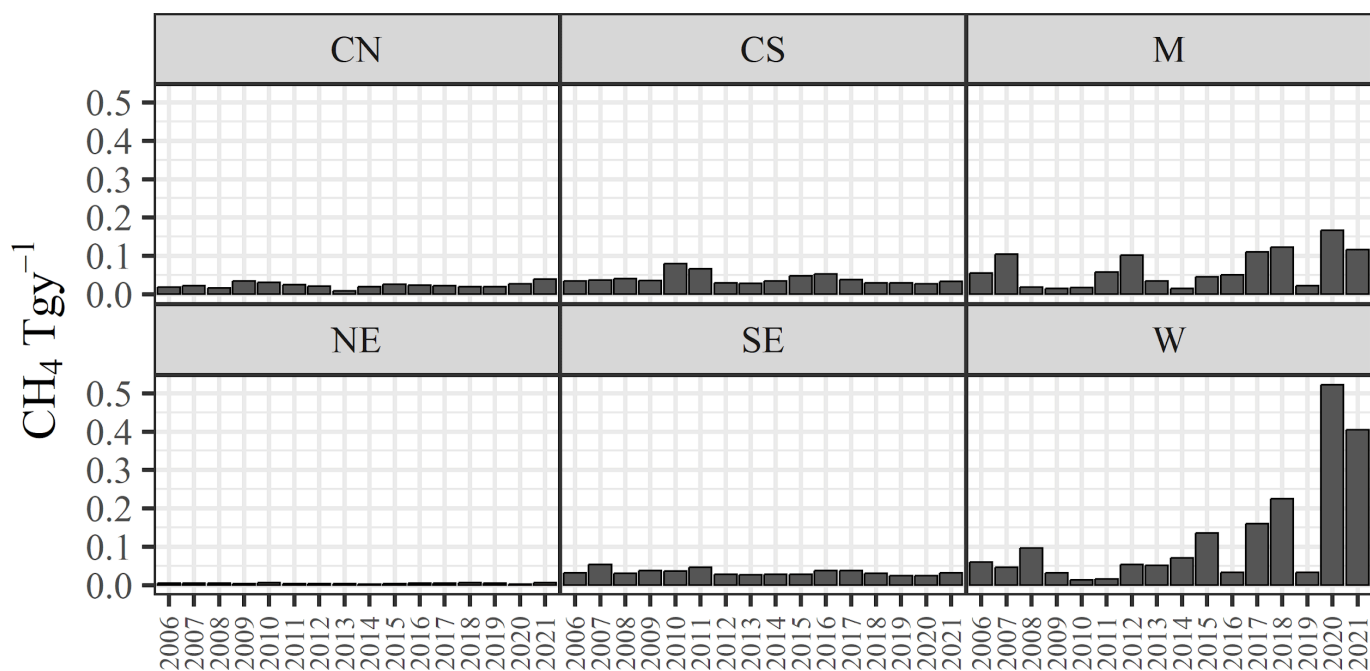


Figure S12. Time series of CH₄ emissions from the Global Fire Emissions Database (van Wess et al., 2022) in Tgy⁻¹.

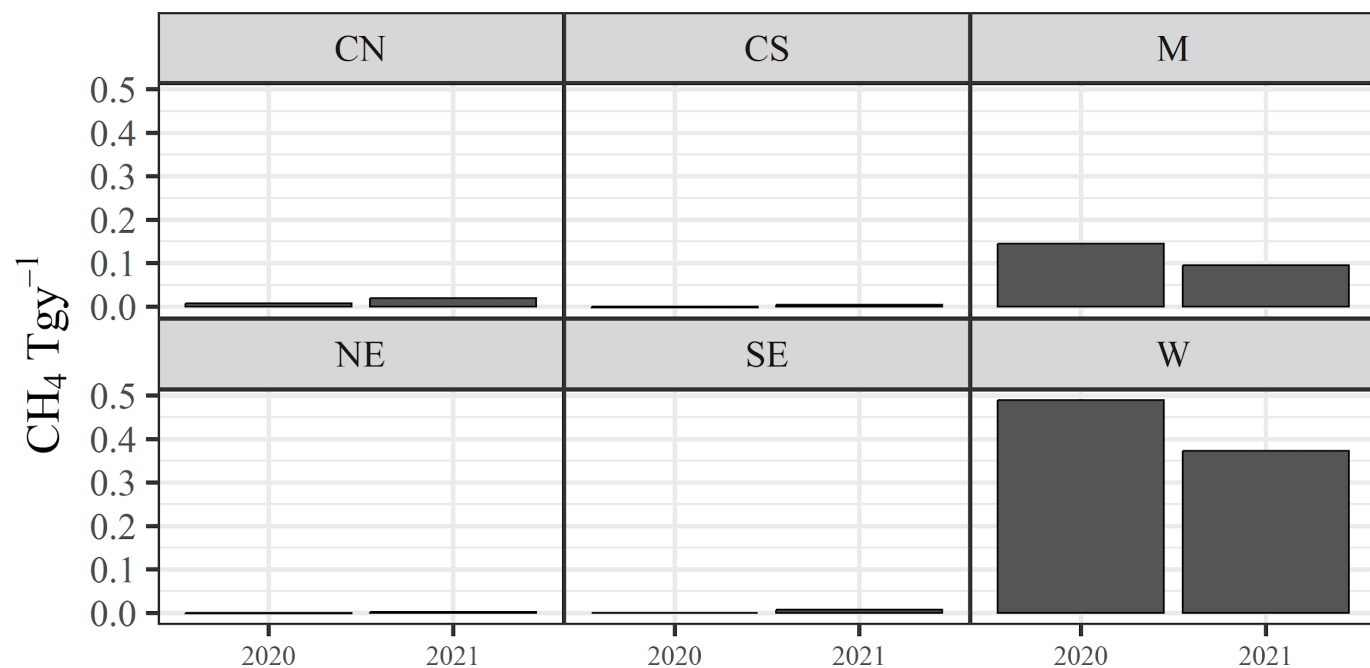


Figure S13. 2020-2019 and 2021-2019 CH₄ anomalies over U.S. regions from the Global Fire Emissions Database (van Wess et al., 2022) in Tgy⁻¹.

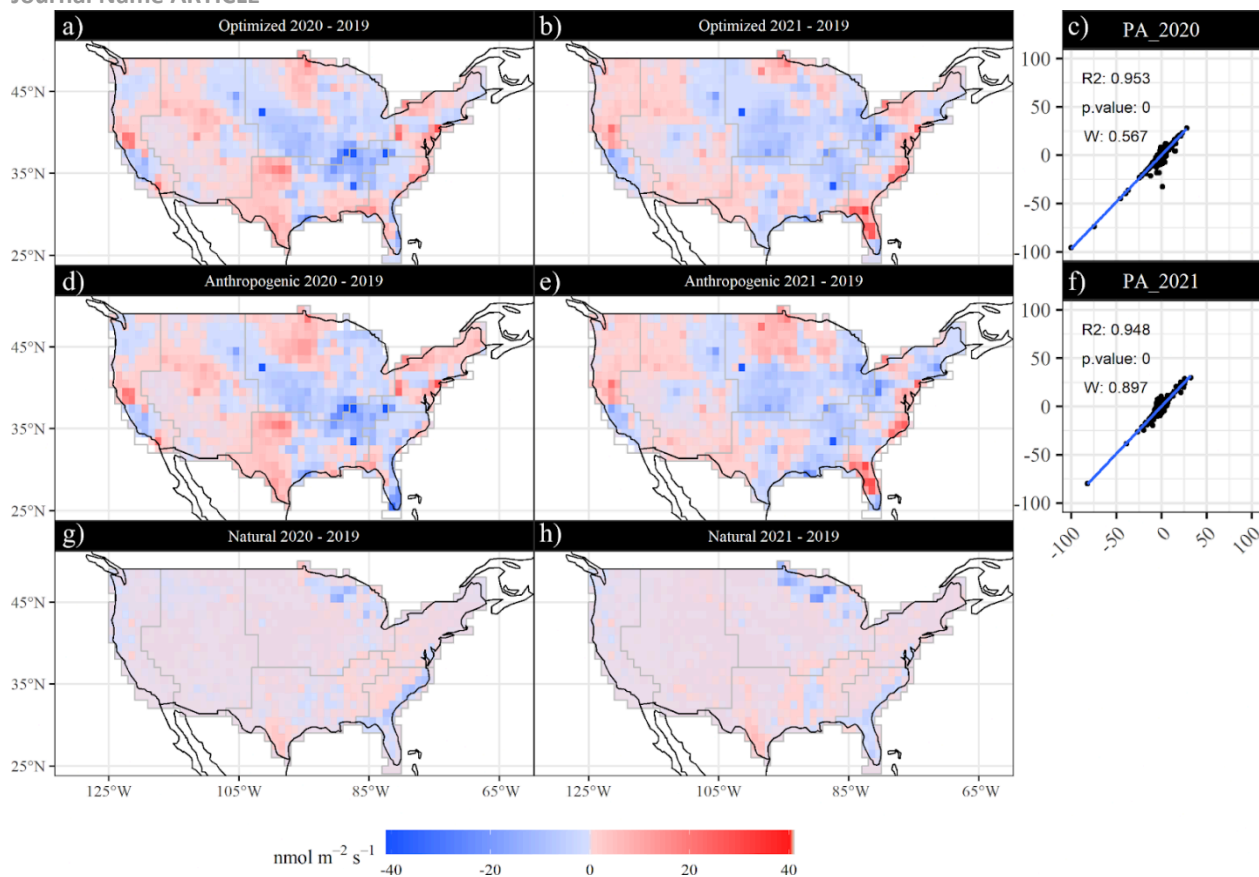


Figure S14. Optimized posterior (a and b) and anthropogenic (d and e) CH₄ fluxes as subtractions between mean posterior and natural (g and h) CH₄ fluxes (nmol m⁻² s⁻¹). Each panel represents the difference between 2020-2019 and 2021-2020. Panels c and f show correlations between values in panels a and d, and b and c, respectively. The correlation between the posterior and anthropogenic (PA) fluxes was closer to one and significant as the p-values are lower than 0.05. We also tested the difference, finding no significant difference, with every p-value from the Wilcoxon test higher than 0.05 (R Core Team, 2023).

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