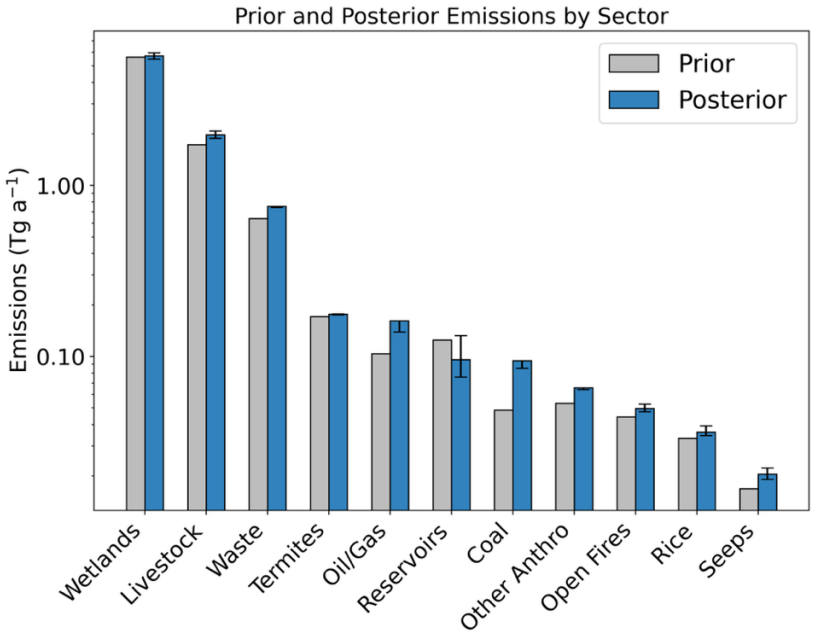

Figure S1: National methane emissions in Colombia by sector. Prior emissions are from inventories described in Table 1. Posterior emissions are from our base inversion of TROPOMI+GOSAT observations, with error bars representing the uncertainty range.

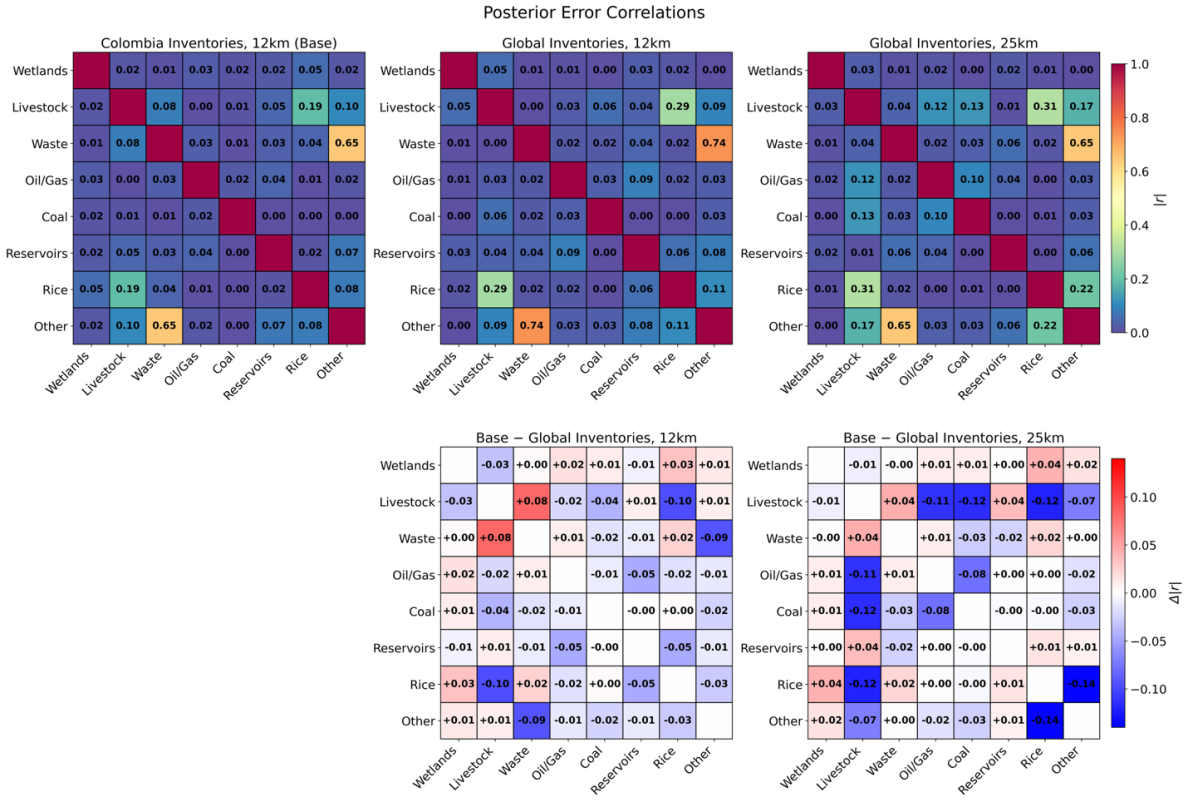

Figure S2: Posterior error correlations between methane source sectors for different prior inventories and model resolutions. Top panels show the magnitude of posterior error correlations (|r|) for inversions using (left) Colombia-specific inventories at ~12 km × 12 km resolution (the base inversion), (middle) global inventories at ~12 km × 12 km, and (right) global inventories at ~25 km × 25 km. Bottom panels show the difference in error correlations (Δ|r|) between the base inversion and those using global inventories.

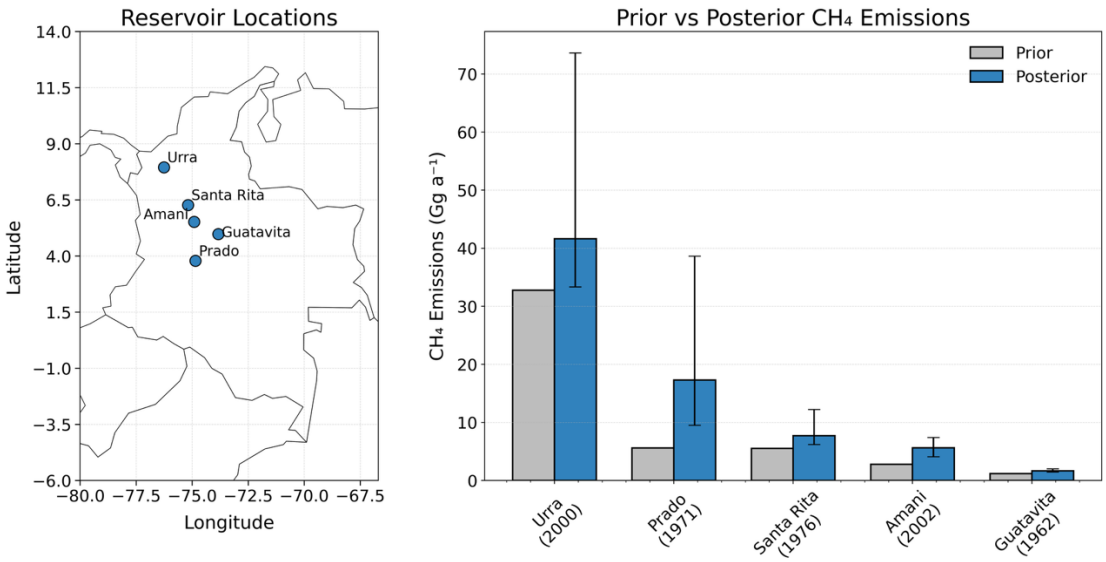

Figure S3: Prior and posterior methane emissions for the six Colombian reservoirs that show emission adjustments across all inversion ensemble members. The map (left) shows the locations of the selected reservoirs, and the bar chart (right) compares prior and posterior emissions for each reservoir, with error bars indicating the range across the ensemble. Reservoir names and construction years from the GDW database are shown along the x-axis.

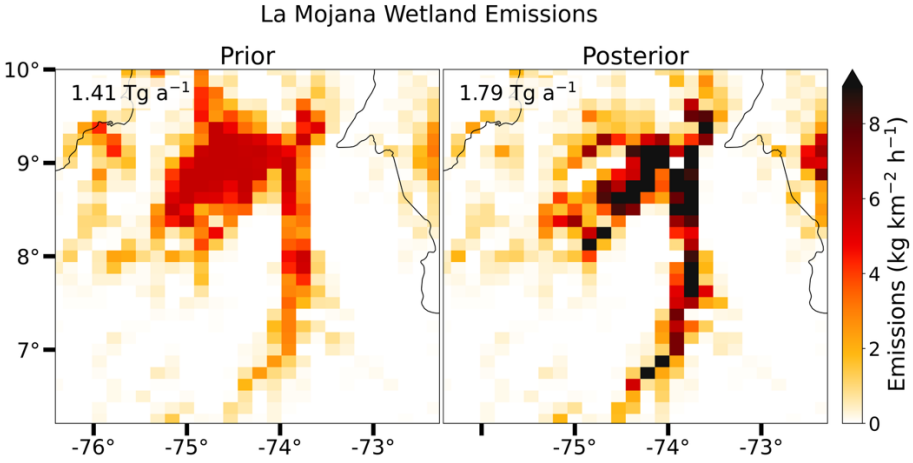

Figure S4: Prior and posterior wetland emissions from GLWD+LPJ over La Mojana wetland region. The total wetland emissions over the region are given inset.

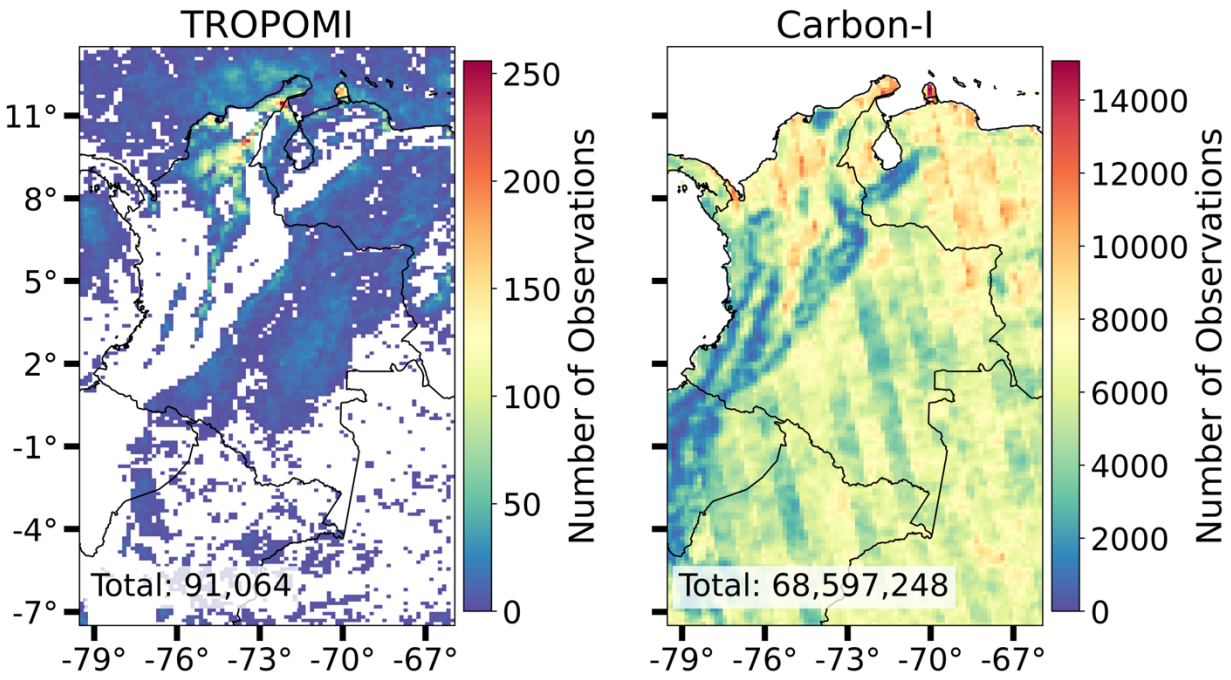

Figure S5: Atmospheric methane observations from TROPOMI (left) and projected Carbon-I data (right) over Colombia. Carbon-I is one of the finalist missions in NASA's Earth System Explorers program, with a planned launch around 2030. It is designed to carry a SWIR imaging spectrometer capable of retrieving CH_4 at 400-m pixel resolution and is specifically optimized to achieve cloud-cleared observations over tropical wetlands (Carbon-I Team, 2024). Projected successful observation densities for Carbon-I were generated by combining simulated satellite orbits with high-resolution cloud cover data to estimate retrieval availability (Frankenberg et al., 2024). The figure shows the number of valid observations on the 0.125° × 0.15625° inversion grid for the year 2023. Grid cells with fewer than one valid observation are shown in white. TROPOMI provides 91,064 total observations over Colombia, while Carbon-I is projected to provide over 83 million observations. The increased observational density and coverage from Carbon-I would enable stronger constraints on emissions across Colombia.