

## CarbonTracker-CH<sub>4</sub> 2023: An Isotope-constrained Global Methane Inversion

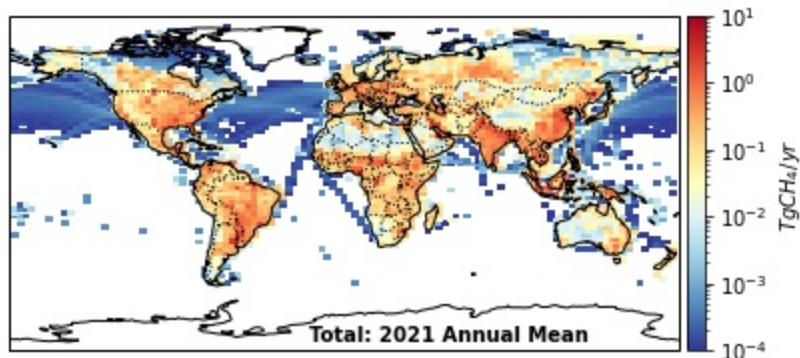
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Observations indicate accelerating growth of atmospheric CH<sub>4</sub>, creating a challenge for meeting the Global Methane Pledge that aims to achieve 30% cuts in emissions by 2030 and eliminate 0.2°C of warming by 2050. In addition, a recent United Nations Environment Programme (UNEP) report proposes that feasible CH<sub>4</sub> emission cuts could result in a 45% reduction in anthropogenic emissions, and avoid 0.3°C of warming by mid-century while having a positive impact on human health through air quality improvements. However, our understanding of the processes driving CH<sub>4</sub> growth in the atmosphere is incomplete, and we need to understand and be able to discriminate among contributions from chemical, natural and anthropogenic emissions and sinks. In particular, we need to be able to understand how global microbial emissions from both natural and anthropogenic sources are changing over time.

Measurements of the <sup>13</sup>C stable isotope of CH<sub>4</sub> could be useful for partitioning emissions between fossil fuel and microbial sources, and these measurements imply that recent increases in atmospheric growth are dominated by microbial sources, likely from a combination of anthropogenic and natural sources. Our new version of the CarbonTracker-CH<sub>4</sub> inverse modeling system uses the isotopic record as a constraint, and as a result global fossil fuel emissions are adjusted upwards while global microbial emissions are adjusted downwards. Our results also show how increases in microbial emissions, especially from the tropics and high northern latitudes have contributed the observed growth in atmospheric CH<sub>4</sub>. In this presentation we will highlight findings from CarbonTracker-CH<sub>4</sub> over 1998-2021, and we will discuss major uncertainties and future work.



**Figure 1.** Annual mean emissions for 2021 estimated by CarbonTracker-CH<sub>4</sub>