Fifty-three experts weigh in on the global methane budget

June 27 2024, by Aaron Sidder

A scientist samples lake methane emissions in Sweden's Skogaryd Research Catchment. Credit: J. Lundin/Wikimedia Commons, CC BY-SA 4.0

Accurate estimates of atmospheric greenhouse gas levels are needed to understand and address the drivers of climate change. Of particular interest is atmospheric methane, which has increased in concentration by 160% since preindustrial times and accounted for 35% of warming from greenhouse gases from 2010 to 2019.

The Global Methane Budget (GMB) debuted in 2016 to track trends and estimates of both anthropogenic and natural methane emissions.

Updated in 2020, the GMB integrates research from top-down studies, which provide broad, regional-level pictures of methane sources and sinks, and bottom-up studies, which provide more detailed views of specific emissions sources. But uncertainties (quantitative estimations of error) in the data behind the GMB vary from sector to sector.

In an article published in *Earth's Future*, Judith Rosentreter and colleagues surveyed 53 methane experts, including both modelers and empiricists, to learn about the magnitude, distribution, and types of uncertainties in measurements of global methane sources and sinks.

The experts were asked to rate uncertainty levels related to various methane sources and sinks, such as wetlands, fossil fuels, and wildfires. They were also asked to share their personal confidence levels (a subjective measure ranging from "very low confidence" to "very high confidence," not referring to statistical confidence) for a range of both top-down and bottom-up methane emissions estimates from sectors such as fossil fuels, soil uptake, and agriculture and waste.

The experts ranked the GMB's "other natural sources" category as having both the highest uncertainty and lowest confidence, reflecting uncertainty in methane emissions data from sources such as fresh water, vegetation, and coastal and ocean areas, as well as in parameters for wetland models.

Confidence was particularly low in bottom-up estimates of these other sources. In addition to those results, about 67% of the experts surveyed felt that atmospheric methane will play a larger role in global warming by 2050.

The authors suggest that rather than labeling methane emissions as either natural or anthropogenic, emissions should be categorized along a gradient between the two. Using this method, they calculated that more than 76% of global methane emissions are either fully human caused or related to human influences—about 26% higher than anthropogenic contributions suggested by the 2020 GMB.

They also suggest ways to reduce uncertainty in the GMB, including further researching the role of permafrost thaw and extending methane observation networks to poorly monitored regions.

More information: Judith A. Rosentreter et al, Revisiting the Global Methane Cycle Through Expert Opinion, *Earth's Future* (2024). DOI: 10.1029/2023EF004234

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