

Thawing permafrost produces more methane than expected

March 20 2018



Sampling at the Lena delta in Siberia. Credit: UHH/CEN/I.Preuss

Methane (CH_4) is a potent greenhouse gas that is roughly 30 times more

harmful to the climate than carbon dioxide (CO₂). Both gases are produced in thawing permafrost as dead animal and plant remains are decomposed. However, methane is only formed if no oxygen is available. Until now, it was assumed that larger amounts of greenhouse gases are formed when the ground was dry and well aerated—when oxygen was available. Christian Knoblauch and his colleagues have now demonstrated that water-saturated permafrost soils without oxygen can be twice as harmful to the climate as dry soils—which means the role of methane has been greatly underestimated.

Knoblauch has, for the first time, measured and quantified in the laboratory the long-term production of methane in thawing permafrost. The team had to wait for three years before the approximately 40,000 year-old samples from the Siberian Arctic finally produced methane. The team observed the permafrost for a total of seven years, an unprecedented long-term study.

They found that without oxygen, equal amounts of methane and CO₂ are produced. But since methane is a far more [potent greenhouse gas](#), it is more significant. Because [methane production](#) couldn't be measured, it was assumed that in the absence of oxygen only very small amounts of it can be formed. "It takes an extremely long time until stable methane-producing microorganisms develop in thawing permafrost," explains Knoblauch. "That's why it was so difficult to demonstrate methane production until now."

"By combining process-based and molecular-microbiological methods, our study shows for the first time that the methane-forming microorganisms in the thawing permafrost have significant influence on the greenhouse gas budget," adds co-author Susanne Liebner from the Helmholtz Center Potsdam—GFZ German Research Center for Geosciences.

The team has used the new data to improve a computer model that estimates how much [greenhouse gas](#) is produced in permafrost in the long term—and they've compiled a first forecasts. According to the scientists: The permafrost soils of Northern Europe, Northern Asia and North America could produce up to 1 gigaton of [methane](#) and 37 gigatons of [carbon dioxide](#) by 2100. But there are uncertainties. To what depth will the soil actually thaw by then? Will it be wet or dry? One thing, however, is certain: the [new data](#) will enable more accurate predictions about the impacts of thawing permafrost on our climate.

More information: Knoblauch C, Beer C, Liebner S, Grigoriev M N, Pfeiffer E-M (2018): Methane production as key to the greenhouse gas budget of thawing permafrost; *Nature Climate Change*, [DOI: 10.1038/s41558-018-0095-z](#)

Provided by Helmholtz Association of German Research Centres

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