Universität Hamburg
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Dept. 2: Communications and Public Relations
Section 21: Media and Public Relations
Tel. +49 40 42838-2968
Fax +49 40 42838-2449
Email: medien@uni-hamburg.de

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Press release

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Thawing permafrost produces more methane than expected

In a seven-year laboratory study, Dr. Christian Knoblauch from Universität Hamburg's Center for Earth System Research and Sustainability (CEN) and an international team have shown, for the first time, that significantly more methane is produced by thawing permafrost than previously thought. The findings, published today in the journal Nature Climate Change, make it possible to better predict how much greenhouse gas could be released by the thawing of the Arctic permafrost.

Methane (CH4) is a potent greenhouse gas, which 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 forty-thousand-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.

What they found: 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."

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 soil scientist: "The permafrost soils of Northern Europe, Northern Asia and North America could produce up to one 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.

Article:

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

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Picture download:

https://www.cen.uni-hamburg.de/en/about-cen/news/1-news-2018/2018-03-19-tauender-permafrost.html

Media Contact:

Dr. Christian Knoblauch
Universität Hamburg
Center for Earth System Research and Sustainability (CEN)
+49 40 42838 2277
christian.knoblauch@uni-hamburg.de

Stephanie Janssen
Universität Hamburg
Center for Earth System Research and Sustainability (CEN)
Outreach
+49 40 42838 7596
stephanie.janssen@uni-hamburg.de

The Center for Earth System Research and Sustainability (CEN) is a central research center at Universität Hamburg. CEN links natural and social sciences to address overarching issues in climate, environmental, and earth system research.

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