Enhanced nitrous oxide emissions found in field warming experiment in the Arctic

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The Arctic is warming rapidly, with projected temperature increases larger than anywhere else in the world. The Arctic regions are particularly important with respect to climate change, as permafrost soils store huge amounts of the Earth's soil carbon (C) and nitrogen (N). Warming of arctic soils and thawing of permafrost thus can have substantial consequences for the global climate, as the large C and N stores could be released to the atmosphere as the greenhouse gases carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O). The release of these heat-trapping gases, in turn, has the potential to further enhance climate warming.

The impact of warming on the release of CO2 and CH4 is currently a hot topic in numerous studies carried out in the Arctic. Previous research of the Biogeochemistry research group at the Department of Environmental and Biological Sciences, University of Eastern Finland, has shown, however, that arctic soils are further a relevant source of the strong greenhouse gas N2O - nearly 300 times more powerful than CO2 in warming the climate. The relevance of this finding, and a potentially even larger N2O release in a warming Arctic, is now being addressed by researchers of the same research group. These results are recently published in *Global Change Biology*—a leading journal in environmental science.

The study provides the first field-based evidence that arctic N2O emissions increase when the Arctic is warming; and that hampered plant growth plays a substantial role in regulating Arctic greenhouse gas

exchange. Besides the increased emissions of N2O, the authors observed significant increases in the seasonal release of CO2 and CH4 as a result of only a mild temperature increase, and dug deeply into the reason behind the observed changes by detailed soil and vegetation measurements. One of the major conclusions drawn from this study, with potential far-reaching implications, is that even mild air warming of less than 1°C is triggering greenhouse gas production at depth: enhanced input of labile organic substances from the soil surface, transported to deeper soil layers via leaching, greatly influences arctic greenhouse gas biogeochemistry. Since leaching processes as well as arctic N2O emissions are not yet well incorporated in Arctic biogeochemical climate models, they pose a challenge for future research.

More information: Carolina Voigt et al, Warming of subarctic tundra increases emissions of all three important greenhouse gases - carbon dioxide, methane and nitrous oxide, *Global Change Biology* (2016). DOI: 10.1111/gcb.13563

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