

Invited Speaker**Assessing the potential impact of subsea permafrost thaw on the Arctic Ocean carbon cycle and climate (1900-2300)**

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The Arctic is a key area of concern for carbon cycle-climate feedbacks. The rapidly warming Arctic hosts enormous, yet still poorly quantified amounts of carbon/methane that are held in thawing terrestrial and marine permafrost and associated methane hydrates. A major concern is that microbial activity in the thawing permafrost could generate carbon dioxide and methane emissions that would become sufficiently large to create a dangerous positive feedback loop in which emissions would further warm the climate, which, in turn, would accelerate permafrost thaw and release more greenhouse gases.

Yet, this potentially dangerous permafrost carbon-climate feedback currently remains one of the least quantified and most uncertain feedbacks within the climate system. In particular, carbon emissions from subsea permafrost- the relict permafrost that has been submerged by rising sea levels after the Last Glacial Maximum- remain largely unquantified and, thus, neglected in integrated assessment models and climate policy discussions.

Here, I illustrate how we developed, parametrized, and applied a fully integrated panarctic model framework including geophysical models of submarine permafrost with diagenetic models and Earth System models to track greenhouse gas production and emissions in/from thawing subsea permafrost and explore its impact on the Arctic Ocean and climate system. Model results indicate that substantial amounts of biogenic methane could be released from the Arctic shelf under the worst-case climate warming scenarios. However, effective climate mitigation strategies would prevent such large-scale emissions. Nevertheless, results also underscore that there are still significant uncertainties associated with these estimates.