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# Methane venting to the atmosphere from sediments

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Sustained release of methane to the atmosphere from thawing Arctic permafrost likely is a strong positive feedback to climate warming. A climate impact of Arctic methane releases is implied by past climate shifts and may play a role in the renewed growth of contemporary atmospheric methane. Observed Arctic warming in early 21st century is stronger than predicted by several degrees, which may accelerate thaw-release of methane. The East Siberian Arctic Shelf (ESAS, encompassing the Laptev, East Siberian and Russian part of the Chuckchi Seas) occupies an area of $2.1 \times 106$ km2, three times as great as terrestrial Siberian wetlands. It is a shallow seaward extension of the Siberian tundra that was flooded during the Holocene transgression 7-15 kyr ago. The ESAS sub-sea permafrost, (frozen sediments inter-layered with the flooded peatland) contains not only comparable amounts of carbon as still land-fast permafrost in the Siberian tundra, but also sequesters permafrost-related seabed deposits of CH4. Remobilization to the atmosphere of only a small fraction of the methane trapped in ESAS sediments could trigger abrupt climate warming.

Currently it is hypothesized that sub-sea permafrost acts as a lid retaining this shallow methane reservoir. However, estimates of ESAS methane emissions based on recent observations indicate the current atmospheric budget, which arises from gradual diffusion and ebullition, is on par with estimates of methane emissions from the entire World Ocean. Large transient emissions remain to be assessed; yet initial data suggest this component could increase significantly annual emissions. These study results show methane leakage from the shallow ESAS needs consideration in interactions between the biogeosphere and a warming Arctic climate.