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## First quantitative estimation of growing methane release from the East Siberian Arctic seas: from a single flare to vast seepage area

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Sustained release of methane (CH<sub>4</sub>) to the atmosphere from thawing Arctic permafrost may be a positive and significant feedback to climate warming. Atmospheric venting of CH<sub>4</sub> from the East Siberian Arctic Shelf (ESAS) was recently reported to be on par with flux from the Arctic tundra; however, the future scale of these releases remains unclear. Here, based on results of our 12 years observations, we show that CH<sub>4</sub> emissions from this shelf to be determined by the state of subsea permafrost degradation. Below we consider dramatically growing release from the area located out of known fault zones.

First time, we observed CH<sub>4</sub> emissions from this single flare in 2007 in the ESAS mid-shelf. During 2014-2018 we revisited this area several times aiming to investigate quantitatively changing CH<sub>4</sub> ebullition. The data show transformation of a single CH<sub>4</sub> flare in a significant seepage area. CH<sub>4</sub> emissions from this area emerge from largely thawed sediments via strong flare-like ebullition, producing fluxes that are orders of magnitude greater than fluxes observed in background areas underlain by largely frozen sediments. We suggest that progression of subsea permafrost thawing is much faster not only downward, but also laterally which could result in a significant increase in CH<sub>4</sub> emissions from the ESAS.

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