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DECADAL PROGRESS IN QUANTITATIVE ESTIMATE OF METHANE FLUXES FROM THE EAST SIBERIAN ARCTIC SHELF

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Methane (CH_4) release from thawing Arctic subsea permafrost and from failing coastal hydrates are two climate-related mechanisms that could substantially change projected greenhouse gas forcing within this century. First attempt to assess atmospheric fluxes of CH_4 from the East Siberian Arctic Shelf (ESAS), where submerged permafrost is opening gas migration paths for long-preserved methane, was performed about ten years ago and was based on scarce measurements of dissolved methane obtained over the limited area of the ESAS in two subsequent summer expeditions. Estimate of diffusive fluxes was made using conventional parameterizations, which largely depend on wind speed, insignificant change in which affects diffusive fluxes from many folds to orders of magnitude. Besides, that first attempt did not include bubble-borne fluxes, which occurred to compose major component of methane fluxes from the ESAS. In order to achieve representative coverage of the study area and improve quality of our estimates, we extended the area of investigation from the near-shore zone to the outer shelf and developed a method of in-situ calibration of sonar data, which is based on combination of direct measurements of known fluxes emitted from the seafloor and reaching the sea surface using chambers put over the holes in the sea ice (in the near-shore zone). Based on results of decadal investigations, we show that rates of CH_4 emissions from the ESAS are determined by the current state of subsea permafrost in different areas of the ESAS. We suggest that the coastward progression of subsea permafrost thawing in a warming Arctic could potentially result in a 3-5 orders of magnitude increase in CH_4 emissions from the ESAS.