



The features of methane fluxes in the western and eastern Arctic A review. Part I

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Abstract Резюме [Rus PDF](#)

The article provides a review of the modern researches on methane content and its emissions into the atmosphere in the Arctic region. We discussed various methane sources and summarized the certain existing data of its origins as well as driving forces of the methane upward and lateral migration. The greenhouse gas flux of methane from the Arctic marginal seas plays a significant climatic, geopolitical, and social role, but remains one of the most debated topics in ocean sciences. The Arctic seas are presented today in the literature both as a threat of a global ecological catastrophe due to methane emissions, and as sources of gigantic deposits of the fossil carbon, including coal, permafrost strata, oilgas and gas hydrates storages, rivers runoff, and as the most sensitive indicator of regular (evolutionary) processes of climate change. Large amounts of organic matter are stored in permafrost on land and under the sea that have been partly and further will be degraded to CO₂ and CH₄. Reviewed studies suggested that the Arctic is a substantial source of CH₄ to the atmosphere (between 32 and 112 Tg(CH₄) yr⁻¹), primarily because of the large area of wetlands throughout the region. A recent assessment of the Arctic region identified thousands of gigatonnes (1 Gt = 10¹⁵ g) of stored carbon, including unresearched deposits of methane, stored within permafrost and as gas hydrate. We concluded that methane sources and the pathways of its transportation in sediments and into the water column of the Arctic seas are characterized by the extreme ambiguity of existing estimates, due to the complexity of natural gas genesis and its migration mechanisms (diffusion, filtration, bubble gas fluxes). These differences illustrate that we currently cannot predict changes of the methane emissions from the Arctic, as too many unknowns and too large uncertainties persist. Although release of CH₄ to the ocean and atmosphere has become a topic of discussion, the region remains sparingly explored. Submarine permafrost is still poorly studied, mainly due to the lack of direct observations. Objective assessment of the methane distribution and dynamics of its oxidation patterns in sediments and water column in the Arctic seas requires further studies based on the integrated marine expeditions, remote sensing and onland gas monitoring stations. Authors are experienced in methane flux and resources research in Arctic region since 1976th. The study is one of the important topic for planning of future research in the Arctic region, since Russian Federation will be in charge of International Arctic Council (a high level intergovernmental forum) for 2021–2023.

Keywords

methane, climate change, gas hydrate, permafrost, microbial methane turnover, microbial methane oxidation, seismo-tectonic pathways, methane emission, Arctic seas

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