



On the possible methane emissions from the East Siberian Arctic Seas

Valentina Malakhova and Elena Golubeva

Institute of Computational Mathematics and Mathematical Geophysics, SB RAS, Novosibirsk, Russian Federation
(malax@sscc.ru)

Global changes in the Arctic occur in the growth of average air temperatures, rapidly melting ice on land and sea, and underwater permafrost degradation. The extensive Arctic Shelf can play an important role in methane cycling because of the huge storage of organic matter buried in permafrost, which can be involved in the modern biogeochemical cycles under warming. The dissolved methane concentrations in the East Siberian Arctic Shelf water during summers of 2003 to 2008 show a widespread oversaturation in large spatial scales [1]. The horizontal and vertical methane distributions in the observational data indicate a sedimentary source which is likely associated with thawing of the underwater permafrost and release of gas from the shallow Arctic gas hydrate.

Based on the regional model the Arctic Ocean–North Atlantic, developed in ICMMG SB RAS [2], the variability of the Arctic Ocean water masses state was simulated for the period from 1948 to 2010. The model was driven by atmospheric data from the CORE-2 and NCEP/NCAR reanalysis. The analysis of the thermohaline characteristics of the East Siberia Shelf water in the model run showed the positive trend in the bottom temperature, which is in agreement with the observational data. Temperature increase of the bottom waters can lead to the thawing of the frozen bottom sediments and the release of additional amount of methane from gas hydrates.

Assuming the increase in the gas permeability of the perennial frozen sediment caused by climate change, the numerical simulation of the dissolved methane transport from the bottom reservoirs in the shelf water was performed. A three-dimensional mathematical model of the dissolved gas transport by the ocean currents with the parameterization of the oxidation process was used for the quantitative evaluation of the scale of a possible methane flux from the submarine sources. According to our numerical results obtained in the period from 2002 to 2010, the total methane emission in the eastern Arctic shelf waters can be estimated from 16 to 54 kilotons per year, which is two orders lower than the estimates given in [1].

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2. Golubeva E.N., Platov G.A. On improving the simulation of Atlantic Water circulation in the Arctic Ocean // *J.Geoph.Res.* - 2007. - Vol. 112. - C04S05. - doi:10.1029/2006JC003734.