Estimates of changes in the methane emissions from subpolar regions of Northern Eurasia in XXI century

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The surface air temperature has been growing over land at high latitudes in the last few decades. This effect increases the permafrost temperature in some parts of the sub-Arctic region of Eurasia [1, 2]. In its turn, higher temperatures in the upper soil layers may lead to higher rates of decomposition of organic material and, consequently, to an increase in the greenhouse gases emission to the atmosphere from the soil [3]. A number of numerical experiments were conducted with a dynamical model of heat and moisture transfer in the soil forced by the RCP scenarios of anthropogenic impact. The areas where the soil temperature is to increase significantly (by more than 0.04 C/yr) in the 21st century were identified. The minimum trends (less than 0.01 C/yr) of soil temperature were obtained in the northern part of Eastern Siberia. According to the RCP 2.6 scenario, the thawed layer thickness increases by more than 1 m on the southern border of the permafrost in Western and Eastern Siberia as well as in the Tibet. The smallest increase in the thawed layer thickness is found for the north-western regions of central Siberia. For the most aggressive anthropogenic scenario RCP 8.5, the thawed layer thickness increases by more than 5 m in Western Siberia and the Baikal region. The increase in the thaw depth leads to the involvement of the organic matter conserved in permafrost to the global biogeochemical cycle.

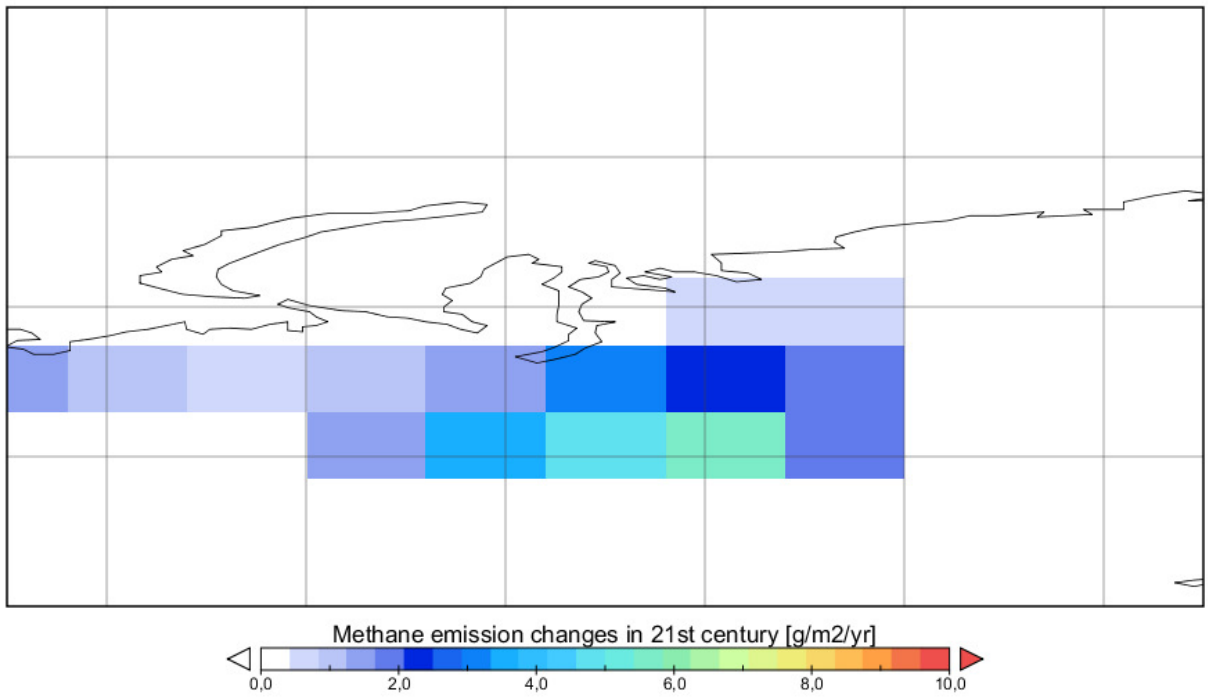

Fig.1 Changes in methane emission in the northern Siberia in the 21st century for the RCP 8.5 anthropogenic scenario.

A model of methane emission from wetlands, which takes into account the amount of soil carbon substrate in soil for the methane production [4-6], was used to estimate the changes in methane emissions from wetlands in Northern Eurasia in the 21st century under different scenarios of anthropogenic impact. For the most aggressive RCP 8.5 scenario of anthropogenic impact, the methane emissions more than tripled in this region; the largest increase in emissions (up to 10 mgCH4 / m2 / year) was obtained for the northern regions of Western Siberia (Fig. 1).

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