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Mathematical modelling positive carbon-climate feedback: Permafrost methane emission case

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Problems of climate warming are under great attention last decades. In particular, it is interesting to estimate effects connected with methane emission and propagation in atmosphere since methane is a very dangerous greenhouse gas. A great attention is given to the problem on methane emission from Siberian tundra. In this region there are a number of small lakes producing methane. The methane emission is connected here, in particular, with existence of such lake system; these lakes slowly evolve in a complicated way. Thawing permafrost and the resulting decomposition of previously frozen organic carbon to methane is one of the most significant potential feedbacks from terrestrial ecosystems to the atmosphere in a changing climate. Methane emissions from tundra permafrost lakes can produce a significant positive feedback on climate change. In this abstract a new approach to modeling of methane emission from permafrost lakes is proposed. Here we focus our attention on a contribution of the Central Yakutia lakes into methane emission and methane concentration growth. In a new macroscopic approach we use mesoscale data (for example, an averaged radius of lakes). This approach does not require in situ measurements and results can be calculated using remote sensing data. In addition, the proposed method makes it possible to estimate the coefficient of positive feedback of the permafrost-climate system and to predict methane flux into the atmosphere. This project is described only the test's estimate, which we can receive on the basis of observational data and mathematical assumptions. As a result, we see that methane emission can precede both gradually and catastrophically. Thus, by incorporating this rigorous mathematical approach into different climate models, we can describe the positive feedback for permafrost-climate system in detail to come nearer to a theory of Arctic Armageddon.