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CO_2 emissions from world permafrost carbon stocks at global warming scenarios

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Major world permafrost carbon stocks, Eurasian and American, have been studied using a newly developed soil model. The model describes soil freezing/thawing and organic matter decomposition in the form of soil respiration and methanogenesis. The model have been validated against observations, its sensitivity to key parameters has been tested. Intense self-sustained carbon consumption has been shown to occur, with heat release accompanying soil respiration and methanogenesis being critical at certain range of climate conditions. Oxygen availability for soil respiration is an important limiting factor for the permafrost thawing — soil respiration feedback.

Carbon dioxide and methane emissions are calculated for the extremely rich in carbon Yedoma Ice Complex region in the Northeastern Siberia, in response to a rapid step-wise warming. Carbon consumption appears to be moderate due to cold climatic conditions. Various transient climate change scenarios are to be used with the soil model to compute CO_2 emissions from main Eurasian and American permafrost carbon stocks: Eastern and Western Siberia, Northern Canada, and Alaska.