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Impact of climate feedback on the energy/economic system: impacts of permafrost thawing under low emissions scenarios.

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In this study we are focusing on the largest single feedback processes examined by AR5: Permafrost thawing. We examine the impacts on the energy–economic system of the emissions of carbon dioxide from permafrost under climate change. Permafrost is a large reservoir of carbon held in frozen soil of high latitude land. The thawing of permafrost in a warmer climate will exert a positive feedback through the additional release of carbon dioxide; permafrost feedbacks are shown to exhibit substantial dependence to specific warming level pathways. We implement a very recently publish formulation of permafrost feedback which is a scenario dependent function derived from explicit modelling of permafrost with different land surface schemes and regional climate change patterns from Burke et al. 2017. The socio-economic model used throughout this study is TIAM-UCL. This is a 16 region global optimisation integrated assessment model with a strong focus on the energy system. We study the permafrost feedback outcomes on emission levels, carbon prices and energy system changes under the 2°C global target from the Paris Agreement and different climate and permafrost sensitivities.
We find that, even under a low emissions scenario limiting warming to below 2°C over the century, the thawing of permafrost may have a considerable impact on the economics and technological choices of mitigation. In the worst case scenario, when the climate and the permafrost both present strong sensitivities to carbon emissions and warming respectively, the carbon budget over the century can drop by almost 4% resulting in a 30% rise in carbon prices.