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Estimating the strength of the permafrost carbon feedback and implications for climate mitigation

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Given the large amount of carbon stored in permafrost soils and its potential for representing a strong source of carbon fluxes to the atmosphere after thaw, future projections of climate change should factor in contributions from this important carbon pool. We here present a study in which we put together current knowledge of permafrost and carbon dynamics based on observational evidence as well as on model simulation results to infer estimates of the size and timing of the permafrost carbon feedback. We do this in a coupled climate carbon-cycle modeling framework and run scenarios of future climate change for different Representative Concentration Pathways (RCPs) until year 2300. Given the computational efficiency of our model (MAGICC6) we can account for parameter uncertainties in an ensemble framework for inferring the full spread of model responses. Our simulation setting allows us to derive probabilistic estimates of future permafrost thaw and permafrost induced CO_2 and CH4 fluxes - together with estimates about additional warming as a result of permafrost degradation.

By comparing low (RCP2.6) versus high (RCP8.5) forcing scenarios we address the issue of what amount of additional greenhouse gases from the permafrost-carbon feedback can be avoided in a warmer world when global warming will be limited to 2°C.