



Estimating the effect of the permafrost carbon feedback on carbon budgets using a perturbed parameter ensemble approach

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The permafrost carbon pool holds a mass of carbon over double that which was present in the pre-industrial atmosphere. As climate warms and permafrost thaws a fraction of this carbon is expected to be released to the atmosphere, increasing the atmospheric CO₂ concentration and producing a positive feedback to climate change. The Paris Agreement to limit climate warming is framed in terms of temperature targets that should be avoided, the 1.5° and 2.0°C targets. These targets can be translated into a cumulative total of fossil fuels that can be burned over all time compatible with the target – a ‘carbon budget’. The theoretical underpinning of carbon budgets relies on a compensation mechanism of oceanic origin. The land carbon pools play no fundamental role in the compensation mechanism. Thus the permafrost carbon feedback (and other land feedbacks) could have a non-linear effect on the final carbon budget. Here we use a perturbed parameter ensemble of an intermediate complexity climate model with temperature tracking to assess the likely effects of the permafrost carbon feedback on final carbon budgets.