

# Improved modelling of permafrost thaw strengthens case for more ambitious emission cuts to meet Paris targets

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## 1. What is happening to permafrost?

Permafrost – a perpetually frozen soil layer beneath the seasonally thawed surface layer – stores about one third of the world's soil carbon.

The Arctic is responding quickly to climate change, with air temperatures warming three times as fast as the global average. Arctic permafrost is thawing in some High Arctic regions almost a century earlier than some climate models projected.

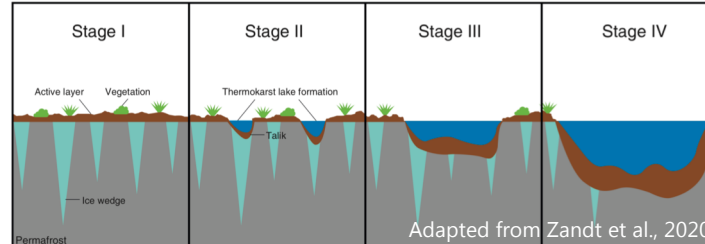
Abrupt thaw processes (see box 3) have accelerated landscape-scale changes over the past decades, exposing more soil carbon. These processes are not yet included in global climate models.

## 2. How much extra carbon could be released?

Abrupt thaw processes could, under moderate to high emissions scenarios, double the cumulative carbon emissions from permafrost thaw compared to gradual thaw alone by 2100 (this includes methane). The carbon emissions from permafrost regions could be even higher considering soil decomposition from root activity.

## 3. What is abrupt thaw of permafrost?

Thawed water bodies in the surface layer conduct heat into wedges of underlying ground ice, which melts, causing the surface above to collapse. This liberates previously frozen soil carbon at depth and creates a 'thermokarst' landscape of lakes, wetlands or thaw slumps.



Abrupt permafrost thaw processes cause ecosystem shifts to conditions that produce strong greenhouse gas emissions, particularly methane.



Thawing coastal permafrost in Arctic Canada with person for scale.

## 4. Key policy messages

- Emissions of greenhouse gases from permafrost could be larger than earlier projections because of abrupt thaw processes.
- Abrupt thaw effects could as much as double the emissions from permafrost thaw under moderate and high emissions scenarios.
- This may also apply to emissions scenarios consistent with 1.5°C or 2°C warming targets, which would impose tighter restrictions on remaining anthropogenic carbon emission budgets and impact climate negotiations.

### Source

This poster summarises an insight published in Pihl et al., (2021). 10 New Insights in Climate Science 2020 – a Horizon Scan, *Global Sustainability*, 4. <https://doi.org/10.1017/sus.2021.2>

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New Insights in  
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