

Second round of review comments on Watanabe et al. 2026

The authors have made beneficial clarifications about the definition of permafrost and “sherbet” used in the study and added greater detail about soil moisture changes. Updates to the manuscript have also made the paper easier to read. This paper now makes a valuable contribution to this policy relevant and interesting field of research, and the detailed explanation of the mechanism of permafrost hysteresis is particularly appreciated.

The manuscript is suitable for publication subject to the technical corrections listed below, plus a rewriting of the sentence in line 687, which draws unclear conclusions about carbon budgets.

Technical corrections:

Line 41: replace “turned” with “returning”.

Line 112: replace “simulates” with “simulation”.

Line 116: replace “grids” with “grid cells”.

Line 253: Koven et al. 2022 not in references.

Line 395: replace “no hysteresis” with “does not demonstrate hysteresis”.

Line 493-494: “This can be interpreted **as** the reduced specific heat making frozen (or half-frozen) soil to melt more easily...”

Line 533: presumably should be updated to “because **all the NH** permafrost has almost thawed...”

Line 538/Figure S6: How are these temperatures calculated? Presumably in PDGEM? I recommend adding a one-line explanation in the caption of Figure S6.

Figure 9: CH₄ is subscripted, CO₂ is not. Both should be subscripted.

Line 577: Why update the CO₂ projections? Should this not be changed to CH₄ projections, which are beyond the uncertainty range?

Line 686: Replace “at” with “below”.

Lines 687-9: The framing of this sentence is not accurate. The contribution to the global carbon budget from the permafrost emissions should also include emissions during the flat10 simulation. Portraying that the emissions in the NEC phase as a percentage of total emissions during the total positive and negatives emissions phases is the principal quantity to evaluate with respect to carbon budgets, as this sentence does currently, is potentially misleading. If you include the emissions that occur during the flat10 experiment up to the global warming level of the branching in addition to the emissions during the NEC simulation, the permafrost emissions would

clearly contribute a greater quantity to the carbon budget (and subsequent warming shown in fig S6) at greater warming levels. To make this conclusion more policy relevant, I recommend focusing on the net emissions (and temperature change) up to 2 degrees, and the committed emissions from returning from 2 degrees.