

The Cryosphere Discuss., referee comment RC1
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Comment on tc-2022-36

Justine Ramage (Referee)

Referee comment on "Accelerated mobilization of organic carbon from retrogressive thaw slumps on the northern Taymyr Peninsula" by Philipp Bernhard et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2022-36-RC1>, 2022

Dear authors,

General comments:

This is an in-depth study showing the increase in the number of abrupt thaw features (retrogressive thaw slumps) and associated mobilized carbon across a specific region in Siberia (Taimyr Peninsula). The originality of the paper is the use of SAR TanDEM-X data to identify such features and estimate volume loss as well as to include some optical imagery analysis to assess the number of RTSs after a heat wave event. The paper brings new insights into the impact of climate change on abrupt thaw events and their consequences on the carbon budget. The methods are clearly set and the results well described. I have one suggestion regarding the discussion (see below). The abstract and introduction's flows should be improved to ease the read, I also added a few minor comments below.

Introduction

L34: Ramage et al., 2017 is the wrong reference. I guess you want to refer to Ramage, J.L., Irrgang, A.M., Morgenstern, A. and Lantuit, H., 2018. Increasing coastal slump activity impacts the release of sediment and organic carbon into the Arctic Ocean. *Biogeosciences*, 15(5), pp.1483-1495.

L38-39: I would suggest expending on a few more reasons explaining their expansion

L43-44: this sentence is unclear and needs to be rewritten

L47: please add reference: Ramage, J. L., Irrgang, A. M., Herzsuh, U., Morgenstern, A., Couture, N., and Lantuit, H. (2017), Terrain controls on the occurrence of coastal retrogressive thaw slumps along the Yukon Coast, Canada, *J. Geophys. Res. Earth Surf.*, 122, 1619– 1634, doi:10.1002/2017JF004231.

L57: Do you mean "between Arctic regions"? Or did you forget to mention the region with which RTSs from the arctic region can be compared?

L62: please provide references to "a region that is known to be susceptible to thaw slumping".

L69: please repeat which periods are considered

L71-72: I find this terminology quite complex and I do not understand what you mean by "probability density function". I suggest you to simplify the methodology e.g "measure the change in RTSs areas and volumes"

L73: replace "an estimation" by "estimate"

L77: change "our study region" by "the study region"

Results

Technical -- Figure 7. a) show the Area to volume scaling relation and obtained fitting parameter.

Discussion:

Substantial organic carbon mobilization from RTSs: you mention that the landscape change is mostly driven by RTSs were re-initiating. The sediments that are remobilizing might have lower carbon content since part of it was already mobilized. How do you think that this re-initiation affects your estimates of carbon mobilization? I suggest adding a few

sentences on this. There are a few studies on carbon mobilization on stabilized and re-initialized RTS that you could use:

Cassidy, A.E., Christen, A. and Henry, G.H., 2017. Impacts of active retrogressive thaw slumps on vegetation, soil, and net ecosystem exchange of carbon dioxide in the Canadian High Arctic. *Arctic Science*, 3(2), pp.179-202.

Bröder, L., Keskitalo, K., Zolkos, S., Shakil, S., Tank, S.E., Kokelj, S.V., Tesi, T., Van Dongen, B.E., Haghypour, N., Eglinton, T.I. and Vonk, J.E., 2021. Preferential export of permafrost-derived organic matter as retrogressive thaw slumping intensifies. *Environmental Research Letters*, 16(5), p.054059.

Abbott, B.W. and Jones, J.B., 2015. Permafrost collapse alters soil carbon stocks, respiration, CH₄, and N₂O in upland tundra. *Global Change Biology*, 21(12), pp.4570-4587.

Thank you for your contribution in this field. I wish you the best with the remaining work.