Anonymous Reviewer #2

Zolkos et al. present a detailed and high quality characterisation of running water chemistry in a sub-catchment of the Peel River. This work was to determine the effect of retrogressive thaw slump (RTS) on DIC sources and export. The research design, incorporating three transects at different spatial scales, is an interesting sampling approach. The dataset, including a large number of key variables, is also of very high quality. The research question is highly relevant to our understanding of the permafrost climate-feedback.

Thank you very much for the thoughtful and helpful comments.

While the design of the study is of high quality, I find that the discussion of the results needs some improvement.

I think the influence of thermokarst on fluvial inorganic carbon cycling and export is reflected in two aspects. One is the change in runoff, and the other is the change in DIC concentrations and sources. The authors have discussed the latter more clearly, but the former needs to be done further. In addition, the authors used the change in concentration and isotope of DIC to indicate the sulfuric acid carbonate weathering, but the sulfuric isotopic evidence may be the more direct one. Could they add this to further strength their conclusions?

We agree that thermokarst influences inorganic carbon cycling via changes in DIC concentrations and sources (e.g. Zolkos et al. 2018). However, discharge within thaw slumps is relatively small compared to the streams affected by slumps, so changes to runoff associated with slumping are likely to be negligible, yet we lack direct evidence for such an assertion. Also, thank you for the suggestion to consider sulfur isotopes as evidence of H_2SO_4 carbonate weathering. The sulfur isotopes we measured and reported in our 2018 GRL paper (Zolkos et al. 2018) do align with sulfate derived from sulfide oxidation. We now briefly consider this in our revised Discussion.

Zolkos, S., Tank, S. E., & Kokelj, S. V. (2018). Mineral Weathering and the Permafrost Carbon-Climate Feedback. Geophysical Research Letters, 45(18), 9623-9632.