The Cryosphere Discussions

The Cryosphere Discuss., referee comment RC1
https://doi.org/10.5194/tc-2022-120-RC1, 2022

Comment on tc-2022-120

Anonymous Referee #1

Referee comment on "The collapse of the Cordilleran–Laurentide ice saddle and early opening of the Mackenzie Valley, Northwest Territories, Canada, constrained by ^{10}Be exposure dating" by Benjamin J. Stoker et al., The Cryosphere Discuss., https://doi.org/10.5194/tc-2022-120-RC1, 2022

General comments

This is a well-crafted paper that presents new insights on the deglacial chronology of a vast area of the NW LIS and is constrained by a significant number of new surface exposure dates. The paper addresses relevant scientific questions within the scope of TC and is of high scientific quality, and the results are well supported using thorough methods and modelling. Substantial conclusions are reached – namely the authors propose meaningful modifications to ice margin retreat positions in an area clearly lacking dated material, and the results have a significant impact on ice retreat dynamics, the timing of ice-saddle collapse, meltwater delivery to the Arctic Ocean and contribution to sea level rise, and on the idea of an early opening of the IFC for peopling of North America.

The authors give proper credit to related work and clearly indicate their own original contribution. Model outputs and inputs, sensitivity analysis results for different GIA models, and description of model calculations provided in the text and Supplementary materials are complete and precise to allow their reproduction by fellow scientists. The overall presentation is well structured and clear; language is fluent and precise. The number and quality of figures is appropriate. Figure 6C is missing however. The references are generally appropriate. Several references cited in the text or in the figures are missing in the list, and some listed references do not appear in the text.

Overall a very good contribution that requires minor revisions outlined in the comments below. Specifically minor parts of the text and figures should be clarified and/or modified. Technical corrections are required or highly recommended.

Specific comments:

45: Clarify timing of persistent IFC from the earlier models. During entire last glaciation?

73: Boulders suited for TCN analysis should be large in size (>1 m) and stable. Some boulders from this study appear rather small and/or considerably embedded in sediments on Figure S2. Explain reasoning for choosing such small boulders and if exposure ages may have been affected by movement or exhumation – in methods section or caption of Figure S2.

134-135: Provide range of % change of the minimal impact of changes in atmospheric mass distribution on the exposure age from cited studies.

299 and Fig. 8: The two clusters of ages at the Cap Mountain summit site are not obvious on Fig. 8 and S6. They appear more like a spread. Clarify.

308: Is the change in the retreat pattern and style provided by the new TCN ages also supported by ice marginal landforms and/or changes in the glacial erosional record?

335: Provide reference for given radiocarbon dates (13.4 ± 0.17 cal ka BP).

447: It is difficult to see the ice lowering of 116-157 m versus 19-47 m on Fig. 5A. Can you point to these drops on the figure?

478-481: Consider adding underlined text for clarification: … is an earlier retreat of the NW LIS by about 1000 years around 63N in the central Mackenzie Mountains...

Figure 2: Outline of Fig. 7 represents Fig. 9; clarify if ages besides the red outlines represent mean values of various samples; grey lines difficult to differentiate from drainage; also where does the LGM (21.1 cal) limit appear – difference with "local LGM limit at 18.0 cal"?; consider adding "(two sigma range)" after "deglaciation ages".

Figure 3: Consider adding reference for ArcticDEM from Polar Geospatial Center.

Figure 4: Consider indicating location of Mackenzie Valley or River and locations of 6 studied sites.

Figure 5: Mention what are the red dots as well.

Figure 6: The 10Be versus elevation plot is entirely missing in C; add what are B-A and YD and the two vertical blue dashed lines.

Figure 7: Replace “points” by “lines” in caption of (A).

Figure 8: Delete one of the repeated “using the modelled age distribution output of” in caption.

Supplementary Document #1

- 14.2 cal ka: In fact, the ice margin north of ~65°N does not replicate that of Dalton et al. (2020). Explain the slight changes proposed.

- 13.5 cal ka: What is the basis for the changes of the ice margin position north of 65°N? Geomorphology, elevation, TCN dates?

Technical corrections:

46-47: In addition to what? There needs to be a link to previous sentence here.

60: Although Consider replacing by “However”.

62: Reference should be Dyke et al 2003 (as in list).

64: Consider adding “(Fig. 2)” after 65Ë□N.

137: effect

142: Missing Jones et al., 2017 in reference list. Unless it should be Jones et al. 2019.

162-163: Missing Small et al., 2020 in reference list.

184: Consider referring to Table S2 at the end of sentence.

186: Should be Table S2 and not S3 here.

190: Consider adding "at the Summer Island site" after located.

201: Consider adding "we" in …and so we do not refer…

211: Move bracket before "see" (see Gregoire et al., 2016)

284: Add "was" after Mackenzie Valley floor.

305: Add reference to Fig. 2 at end of sentence.

306: Figure 4 does not appear in order as cited in the text. First time this figure is mentioned.

388-89-90: Rephrase – difficult to grasp.

393: Consider adding "(Fig. 6)" at the end of the sentence (2016).

453: Add "in" after deglaciation.

460: Missing (Menounos et al., 2017; Corbett et al., 2019) references in list.

463: Missing Ivanovic et al 2017 and 2018 references in list.

465: in

521-22: Delete repeated reference.

528-29: Reference not found in text.

562: After Barbett, P.J., consider adding “and others”.

622-23: Reference not found in text.

660-663: Reference not found in text.

708-709: Delete repeated reference.

739: Incomplete reference?

Table 1: Missing Berto et al (2022) reference in list.

Figure S1: Add references for each named model in caption: Peltier et al., 2015; Lambeck et al., 2017; Gowan et al., 2021.

Figure S2: Provide size of chisel(s).

Figure S3: Borchers et al., 2015 is given as 2016 in list of references. Verify.

Table S1: Provide Peltier’s reference instead of ICE-6G in the headers (to be consistent with others); add “age” to all headers.