I agree with the authors' updates to this manuscript based on the reviewer comments, which I think helped clarify and strengthen the authors' arguments. This a really, really nice paper with important implications for EAIS volume during the LGM and subsequent thinning rates which will be useful targets for future glaciological modeling efforts. Thanks for a fun read!

I do have some very minor technical corrections – just a few places where clarity could be further improved and some typos. Most of my suggestions are for the abstract, as I think it could be tightened up a bit so that it's easy for a potential reader to hone in on the important findings here. I provided concrete wording suggestions but of course the authors' should feel free to use different wording that is more consistent with their voice! All this being said, I think this work is ready for publication.

Thank you – we appreciate your kind words and helpful suggestions!

Abstract

Line 10 – Make clear at the beginning that this study is in the Grove Mtns so you can more easily refer to it later in the abstract: "…14C dating [at a site/from a nunatak] in the Grove Mountains, located on the edge of the East Antarctic Plateau and 380 km inland…"

We have altered the text to read "In this study, we present a surface-exposure chronology of past ice-thickness change derived from *in-situ* cosmogenic-^{14}C dating at a site in the Grove Mountains, located on the edge of the East Antarctic plateau, 380 km inland from the coastline in the Lambert Glacier-Amery Ice Shelf sector.".

Line 11 – I think this second sentence here is an important concept to include in the intro (as you do), but is unnecessary in the abstract.

We have removed this sentence.

Line 16 – "location dividing thicker vs. thinner ice" - I think the wording on Line 56 is slightly clearer, so you could update this to read "…the magnitude of these thickness changes and the transition point from thicker-than-present to thinner-than-present LGM ice are poorly constrained"

We have incorporated the suggested text.

Lines 17-27 –

"Geological reconstructions" to "bedrock erosion" – I suggest removing most of this background into and combining it with a description of the work presented in this paper.

"Here," to "gradual ice sheet thinning began ~16 ka" could be tightened up/reorganized a bit to provide a clearer description of your findings.

Together, these lines could look something like:

"Here, we reconstruct East Antarctic Ice Sheet (EAIS) thickness changes since the LGM at a nunatak in the Grove Mountains using *in situ* 14C, which circumvents the common issue of long-lived nuclide inheritance that leads to inaccurate records of LGM ice thickness. Samples between 1912 m a.s.l. and the modern ice margin (~1825 m a.s.l) yield 14C ages of X-X.

Samples at and above 1912 m a.s.l. have saturated 14C concentrations, implying exposure of the nunatak summit through the LGM. We therefore place the LGM ice surface in the Grove Mountains ~70 m higher than at present. The unsaturated samples below 1912 m a.s.l. indicate that gradual thinning began ~16 ka, with some (25-45%) post-LGM thinning recorded ~16-11 ka and most (55-75%) recorded during the Holocene. Ice sheet models…"

Note that I removed reviewer 3's suggestion to define saturation in the abstract – I'm not actually certain I agree that "saturation" is overly colloquial and I think the definition could go into the introduction instead (which I think you already have).

We have changed the sentences on lines 15-23 to "However, the magnitude of these thickness changes and the transition point from thicker-than-present to thinner-than-present LGM ice are poorly constrained. Here, we reconstruct changes in the thickness of the East Antarctic Ice Sheet since the LGM at a nunatak in the Grove Mountains using *in-situ* ^{14}, which circumvents the common issue of long-lived nuclide inheritance that leads to inaccurate records of LGM ice thickness. Samples between 1,912 m above sea level (a.s.l.) and the modern ice margin (~1,825 m a.s.l.) yield ^{14}C ages of 0.18

Other technical corrections

Line 94 – explicitly (but briefly) state here why this is it a key site?

We have added the following text to lines 87-90: "**The Grove Mountains are a key site for testing the location of this "hinge zone" as they lie close to the elevation of this feature identified in previous studies of the region (e.g., White *et al*., 2011a).**".

Line 92 - "how far inland ice was thicker" – you could instead use the term "hinge zone," which you've defined already defined really nicely.

We have replaced the text in question with "the position of the "hinge zone" in this region".

Lines 127-128 – maybe this is already stated above and I missed it, but could add the scatter in the 10Be and 26Al data as another line of evidence for inheritance.

We have changed the sentence on lines 125-128 to read "As neither plucking scars nor glacial striae were observed at the site (Lilly *et al*., 2010), indicating low or negligible rates of subglacial erosion, and because of the scatter observed in the ^{10}Be and ^{26}Al data from this site, we anticipate that the existing nuclide concentrations do not accurately record LGM ice thickness.".

Line 131 – rather than listing sample names in the text, could list them in Table 1.

We have removed the lists of sample names. We replaced the list on line 123 with "marked in **Table 1** with "(BR)" appended to the Sample ID".

Line 182 and Figure 2 caption – GR12 seems to be within uncertainty of (and actually, slightly younger than) GR01? I wonder if GR15 is really your only outlier? This is such a nice dataset!

We have changed the sentences on lines 183-185 to read "We suspect that the site of GR15 may have been covered by snow or other sediment, though we have not acquired any field evidence tot his effect. GR12 may instead not be an outlier, as its concentration lies within the uncertainty window of that of GR01.".

Figure 2 – if not too much a hassle, could you add a 2nd Y axis showing elevation relative to modern ice surface (i.e., GR12 would be ~0)? Also, a general comment that came up for me when looking at this figure – could point out somewhere more explicitly in the abstract that you narrowed the LGM ice thickness to a very small window (~70-85 m above present), which is amazing! I know you do in the discussion on lines 211-213, so it's also okay to just leave it there.

We have added second y-axes to parts (**b**-**d**) of this figure showing elevations relative to the modern ice surface (here taken to be only the ice surface measured during the second sampling campaign).

Line 206 – add "all of" before "our samples"

We have added the suggested text to line 211.

Line 209 – "at least not long or deeply enough" – a bit confusing still. How about: "not sufficiently thick as to override the summit for a significant duration, although saturation doesn't preclude a short period (<x kyr) of cover or cover by thin (<10 m) ice"

We have changed the sentence on lines 212-218 to read "These results thus show that ice was thicker at the LGM than at present in the Grove Mountains but not sufficiently thick as to override the summit for a significant duration, though saturation precludes neither a short period (<3 kyr) of cover nor cover by thin (<10 m) ice (**Fig. 3**)." And moved **Fig. 3** and its caption up to lines 216 and 217-230, respectively.

Line 216 – "Up to 18 m of thinning" - separate into two sentences with 2nd being about glacial overshoot.

We have changed this sentence to read "Up to 18 m (21-29%) of thinning could have occurred before and up to 21 m (24-33%) during meltwater pulse 1a (MWP-1a; **Fig. 2d**), ~13.5-14.7 ka, assuming the mean exposure ages of GR04 and GR18 and a linear thinning history. The potential for glacial overshoot, whereby the glacier thins beyond its new equilibrium thickness and subsequently rethickens, however, makes these minimum estimates.

Line 239 – suggest rewording here and elsewhere from "covered shallowly" to "covered by thin ice" (see earlier suggestion)

We have changed the sentence on lines 259-261 to read "The summit of the nunatak was either not covered or only covered briefly ($\lesssim$1 kyr) or by thin ($\lesssim$10 m) ice enough for the two summit samples to become re-saturated with ^{14}C following re-exposure (**Fig. 3**)."

Figure 3 caption – "contours show C14 conc"? Without the sample concentrations on here, I think you need to explain this slightly differently because I was left looking for 14C concentrations – "Burial-history contour plot for a sample at 1912 m a.s.l in the Grove Mountains. Modeled glacial histories start at 50 ka with one episode of burial under >10 m of ice (no 14C production during burial). 14C concentrations in the sample are saturated at the model start"

What is the “lesser end” of the saturation window – I think I asked that before but I still don’t understand (closer to the grey zone, I guess? Could this maybe just be “The sample only remains saturated if burial durations longer than X kyr happened before the LGM”?).

“Sample GR21 plots off the bottom-left” – same as confusion about first sentence, above.

We have altered the first sentences of the caption to read: “**Burial-history contour plot for a sample at 1,912 m above sea level (a.s.l.) in the Grove Mountains. Modeled glacial histories start at 50 ka with one episode of burial under >10 m of ice. No ^{14}C is produced while buried. ^{14}C concentrations in the sample are saturated at model start.**”. We have changed “**lesser**” to “**lower-concentration**”. The mean age of GR21 is technically oversaturated, so it will not appear on this plot, which asymptotes to the mean saturation concentration at its bottom-left corner. GR21 will thus always plot off the boundary of this graph.

Line 265 – remind reader here what the previous LGM reconstructions based on longer lived nuclides suggest? Is lost track of this, although it looks like you come back to it below?

We have changed the sentence on lines 265-270 to read “While we cannot rule out the ticker-than-present ice at the Grove Mountains being an entirely localized phenomenon, we suggest based on the application of ^{14}C in this study and other Antarctic studies (e.g., White *et al*., 2011b; Fogwill *et al*., 2014; Nichols *et al*., 2019; Hillenbrand *et al*., 2021) that at least some previous reconstructions of LGM ice thickness based on longer-lived nuclides (e.g., ^{10}Be and ^{26}Al) which show either thickening or no thinning since the LGM away from the coast and fastest-flowing parts of East Antarctica may be inaccurate.”.

Line 269 – “that” should be “than”

We have corrected this typo.

Figure 4 – 2nd to last sentence probably unnecessary since you state this nicely already in the first sentence of the caption.

The first sentence of the caption notes that the figure is modified from **Fig. 1c**, but not explicitly that the lines have been straightened. Another reviewer requested that we note explicitly why we straightened the lines in this depiction, so we would prefer to leave it in, repetitious though it may be.

Line 308 – revise slightly for clarity “Our record suggests that ice in the Grove Mountains began thinning ~16 ka, ~2 kyr later than the [more coastal?] Prince Charles Mountains, though the timing of initial thinning at our site is broadly consistent with….”

We have added the suggested text.

Line 312 – CRONUS-Earth calculator sentence- this could go in methods. Just there state that all previously published ages presented here are recalculated using…

We have edited this sentence to read “Cosmogenic-exposure ages reported here from other studies were recalculated using the online exposure age calculator formerly known as the

CRONUS-Earth online exposure age calculator [hess.ess.washington.edu], as with our ^{14}C ages, using the primary ^{10}Be calibration dataset of Borchers *et al*., 2016.".

Line 314 – "Note, however" sentence could be – "Part of this discrepancy could be due to small amounts of 10Be and 26Al inheritance in the Prince Charles Mountain samples. Further work to measure *in situ* 14C in the Prince Charles Mountain samples would enable an evaluation of the degree of lead and lag…" (the last sentence of this paragraph isn't really necessary)

We have changed the sentences on lines 3190-323 to read "Part of this discrepancy could be due to inheritance in the samples from the PCMs. Further work to measure *in-situ* ^{14}C in samples from the PCMs would enable an evaluation of the degree of lead and lag between sites.".