

## ***Interactive comment on “A first chronology for the East GRIP over the Holocene and last glacial termination” by Seyedhamidreza Mojtabavi et al.***

### **Anonymous Referee #2**

Received and published: 6 January 2020

Mojtabavi et al. present a first chronology for the EastGRIP ice core. The chronology extends to 15ka and is based on volcanic events identified with electrical measurements as well as three tephra layers. The work provides many useful methods and the chronology appears accurate; however, the paper is sloppily written. This is a methods heavy paper despite the technologies being mature. There is little other analysis in the manuscript beyond basic plots of annual layer thickness.

An initial timescale is a useful result. The authors describe the electrical measurements well, something that has not been done as part of recent papers. This may be because the methods have changed little from the papers of the 80s and 90s that describe

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them. Regardless, I found the discussions mostly useful. Timescale papers are often a challenge to write because they take lots of work, but little in the way of direct scientific conclusions come of the timescale alone – the papers that measure specific climate parameters which depend on the timescale get the high profile results. Thus, the lack of new insight is not necessarily a negative. However, I kept asking myself if the work presented is sufficient for a stand-alone publication, because in many ways it feels like an interim timescale – useful, but not needed to be published.

I reviewed previous ice-core timescale papers published in Climate of the Past to better understand the contribution of this manuscript relative to its peers. I compared to Winski et al. (2019) for SPICEcore, Rasmussen et al. (2013) for NEEM, and Sigl et al. (2016) and Buizert et al. (2015) for WAIS Divide. Each of these papers is quite different than this work. However, what stands out is that the larger scope of each of these manuscripts. Winski et al. is most comparable, being an ice-phase timescale only; however, it presents a timescale for the full ice core (55 ka), includes chemical in addition to electrical measurements, and provides annual layer interpolation for the Holocene although it does not provide any tephra analysis. Sigl et al. is also an ice-phase timescale only, but presents 31ka of annual layers that provides a reference chronology for all of Antarctica, if not all ice cores – it is clearly in a different class of both effort and impact. The Rasmussen et al. paper is more comparable being the most recent timescale published for a Greenlandic core. It develops an ice-phase timescale with similar methods to this manuscript, but does so for entirety of the non-folded core and also includes a gas timescale. There is a considerable analysis of the accumulation rate history from the core as well. Buizert et al. determine the gas timescale (and ice timescale for ages older than 31ka) and, because of the low delta-age, this work is a major improvement for Antarctic timescales. Thus, Mojtabavi et al. are considerably short of the benchmark set by previous timescale papers in Climate of the Past.

I am not sure, however, that a comparison to other papers is the appropriate metric.

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Or rather, I think the editor is better suited to make this call. I think my role is better limited to whether what is presented in the paper is useful. In this case, my question becomes: is this publication useful beyond what simply publishing the timescale and electrical data sets would be. And I believe it is, even if by only a little. There are 10 figures, but most are rather simple. Despite this, I found the text interesting and the detail useful, despite the sloppy writing.

Making electrical measurements of ~1400m of ice is time consuming and both the timescale and electrical measurements are undeniably useful. I wish the authors had described why they decided to truncate the timescale at 15ka. More EastGRIP ice has been drilled and more is left to be drilled. Is there a scientific reason for this? Or is it simply a logistical one – like a grant running out? I provide additional comments below and will leave the decision of whether this manuscript achieves the standards of Climate of the Past to the editor. But I will add that if the authors wish to add analysis, comparing the EastGRIP timescale to that predicted by the traced radar layers (Vallelonga et al., 2014; Christianson et al., 2014) used in site selection would be interesting and useful.

Detailed comments:

Introduction – the introduction is lacking a review of relevant literature and how timescales are being developed and used. With the exception of two Joughin references for NEGIS, every reference is for GICC05. This is not a full introduction. This should be a subsection on GICC05, with an actual introduction that is much broader in scope and discusses the work beyond this group's narrow niche. The lack of any GISP2 references regarding annual layer interpretation is also notable.

L11-12: I don't understand what this last sentence is trying to say

L14: The first sentence needs to be reworded. The grammar is not correct.

L15: What is the point of the second sentence? Which core? Why 25,000 years

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L23 – be specific about what EastGRIP will tell us about ice dynamics at the onset of NEGIS

L23 – be specific about the ages being investigated. "half way through the glacial period" is very vague

L28 – given that you stop this timescale at 15ka, is how the GICC05 is built beyond 14.7ka really very important?

L30: Sentence starting "The time scale" says nothing.

L32 – "back" is written twice

L36 – I don't think chemo-stratigraphic is a good abbreviation/conglomeration. Just say how they were synchronized

L38 – Use active voice

L40 – why only this time range? Ice from deeper has already been collected, and presumably measured

L42: NEEM should be defined on first usage. And do you ever define NGRIP?

L51: change "around" to "about". Around has spatial connotations which makes it confusing to use here.

2.1.2 – Isn't this just a repeat of the introduction?

L55 – why mention older parts of the GICC05 timescale – you are only going back to 15ka

L70 – "Dielectric profiling (DEP) has been introduced as a system for rapid dielectrical profiling. . .". The sloppiness of the writing needs to be addressed.

L71 – delete "recorded"

L78 – change "was" to "Were"

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L79 – you don't need "respectively"

L80 – provide the typical values so that the you can illustrate the variations are indeed slight

L82 – what offset?

L83-85 – this needs to be reworded for clarity

L85-85 – if these variations are slight, why spend so much time writing about them? Is this necessary?

L95-105 – This paragraph needs to be reworked. There are a lot of details here, many of which aren't actually needed for this work and that don't seem to have a real point. Yes, the free air capacitance matters for some things, but lay this out logically. And if the reader doesn't need to know this for this work, say it in a sentence rather than a paragraph.

L101 – there is no reason to cite an in prep paper here. You can just say that this is something that is or could be done in the future.

L109 – what is the unit here?

L132 – how much data total was not collected?

L138 – I don't think you really mean "calibrated". I think "adjusted" would be a fairer description

L156-160 – Why do this conversion if you are only going to say it's not correct and not important? Just stop the bad practice of reporting this as acidity, which is known to be wrong. Readers from outside our field may not quickly notice that the acidity is known to be not accurate.

L180-193. I understand what they authors are trying to get at here, but the wording is difficult to follow. This section needs to be rewritten.

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L195 – what is a "slight annual layer thickness variation"?

L197 – This paragraph needs to be rewritten as well. I don't understand how the depths and ages are being transferred among cores. Why is there an interpolation for each ice core bag? If you are interpolating between match points, is which bag the ice is part of irrelevant?

L200 – where do you discuss uncertainties based on linear and cubic spline interpolations?

L207 – what was the decision process for which tie points were kept and which were not?

L209-211 – This is not a sentence

L226 – I don't understand what you are trying to say here about getting ages with linear interpolation of EGRIP? How different? What is unrealistic? What is the correlation of recent annual accumulation rates between NGRIP and EGRIP? Is there a justification that the annual variability in NGRIP is appropriate to map to EGRIP? Why are you referencing Rasmussen et al. 2013?

L229 – rewrite this sentence

L236 – "supposedly" Cite a source for this information and write with precision.

Figure 9: The large changes in annual layer thickness variation over short periods are a bit concerning in some locations. Most notably, at ~13ka, where the annual layer thickness varies by a factor of 3 or so from 0.03m to 0.09m. This looks to me like a bad match in between two good matches. The authors need to more rigorously assess instances of abrupt layer thickness change.

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Interactive comment on Clim. Past Discuss., <https://doi.org/10.5194/cp-2019-143>, 2019.

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