Climate of the Past Discussions

Clim. Past Discuss., referee comment RC3
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Comment on cp-2021-155

Anonymous Referee #3

Referee comment on "A multi-ice-core, annual-layer-counted Greenland ice-core chronology for the last 3800 years: GICC21" by Giulia Sinnl et al., Clim. Past Discuss., https://doi.org/10.5194/cp-2021-155-RC3, 2022

This is a fascinating and important account of the updating and synchronising the Greenland ice core time-scale over the most recent millennia. A few sections will have to be clarified. I agree with one of the other reviewers that it is important to give other researchers access to the underlying data. I also agree with the suggestion to stick to the b2k age-scale for nearly all ages mentioned in the text, instead of mixing them with BP and AD. Given the length and cover of the manuscript, a division into two papers (e.g., chapters 1-3 and chapters 4-5) is again an idea I would endorse.

Section 1.3 is important - however please describe more clearly that there is a hierarchy of uniqueness of these tie-points. If a tephra layer in the ice can be geochemically connected to a unique historical eruption (and/or to other dated sites), and if this layer is found and securely uniquely identified in the multiple ice cores, then this tephra layer forms a much more unique signal (and thus securly synchronous tiepoint) than if the volcanic eruptions are recorded as peaks in SO4, ECM or DEP; the latter peaks are replicated over the core and thus do NOT have unique IDs attached to them. When looked at in isolation, the latter peaks cannot be used as dates, but geochemically ID-ed tephra layers can. Are the shapes of peaks used in tying peaks, and if so, how?

In the same section, add some more references to tephra layers in ice cores, e.g. Abbott et al. 2021 CP doi:10.5194/cp-17-565-2021. It couldn't hurt to mention in this section already that tephra layer studies have thrown up surprises, in that some acid peaks were previously attributed to the wrong volcanic eruptions (e.g., Plunkett et al. 2021). For a wider context, please also cite Baillie 2008 (doi:10.1029/2008GL034755).

Lines 29/36, "synchronization/synchronized", please reword to "comparison/compared", as the current wording strongly implies adapting site chronologies by aligning/tuning their supposedly simultaneous peaks. Such tuning removes any independence between chronologies, and thus precludes the subsequent investigation of lead-lag dynamics (perhaps for wider context cite Blaauw 2012 doi:10.1016/j.quascirev.2010.11.012).

Such potential problems about the reliability of different peak identifications and alingments are make it more difficult me to properly evaluate the important Figure 2.

In Table 2, please outline which tephras have been positively and securely geochemically IDd in which core, and which matches instead rely on e.g. matching ECM peaks. For example, were Laki or Oraefajokull tephras geochemically identified in all of the used ice cores?

Has the the manual fine-tuning, including each decision been documented, quantified and motivated? Will the data be made available, including all high-res raw data and decisions? Could it be an idea to put the data on github, with version control and with information on decisions taken?

Details
44, processes which have occurred
48, drill sites
section 1.1, please reorder such that the current third paragraph goes between the current first and second one.
69, before diffusion becomes too large?
92, and thus for those tephra-free sections matching of the cores relies...
136-7, "attributed the massive Hekla 1104 CE eruption to a prominent ECM peak in GICC05", instead this should be: attributed a prominent ECM peak in GICC05 to the massive Hekla 1104 CE eruption
165, 15 volcanic
170, the results were not significant? Reword
174, The ages of volcanic eruptions are
202, 204, please also report the BCE ranges here as b2k
203, Bronk Ramsey et al. 2004
417, Owing to the close distance between the three ice cores, ...
646, but IntCal20 has more annual data during the Holocene than does IntCal13
853, droughts?

Fig 1b, remove comma at end description GRIP. In the caption also explain what CFA means (as this is only explained after Fig. 1 is first mentioned).

Beside Fig. 6, could you also show a Figure of the accumulation rates for each core based on the adapted time-scales? Are all resulting accumulation rates and their variability considered to be realistic?

Fig. 12b, for consistency, reword in-figure citations to, e.g., 'van der Plicht et al., 2020'