We thank the reviewer for his careful and constructive comments and inputs. Here below are reported our answers to the questions raised by the referee starting with "Reply".

"Dating of an East Antarctic ice core (GV7) by high resolution chemical stratigraphies" Nardin et al. (2021)

Climate of the Past

Referee: Anders Svensson,

The manuscript is concerned with a layer-counted dating of the uppermost 197 m of an East Antarctic ice core named GV7. The core is previously dated by identification of volcanic reference horizons, so the contribution of the manuscript is the presentation of the high-resolution chemical records and the application of those for layer counting in between the volcanic reference horizons. An interesting outcome is the identification of a slight increase in accumulation over the last centuries, when the GV7 record is stacked with other cores.

Major comments

> The MS needs to be reworked concerning the language. Sections 1 and 2 are fairly readable, but section 3 is not concisely written, it is full of syntax issues, and it is often hard to follow the argumentation mostly due to the language, I believe. Sorry to be this bold, but the writing is not up to scientific standards and needs to be reworked. I'm not going to make a detailed list of all of the minor issues in this review, as I think it is not the task of the reviewer, but I'm happy to read the manuscript again in a revised form.

Reply: Thank you for your comments. English language will be checked all through the text aiming to improve its readability, with particular attention to Section 3.

> Since the layer counting is one of the main contributions of this MS, it is important that is done correctly. I have an issue with the numbers stated in Table 2: It says that the layer counting follows the method of Rasmussen et al., 2006, where 'uncertain' years are counted as ½ ± ½ year. Now in table 2, say for the interval 145.41-181.86 m depth, you have identified 188 certain and 12 uncertain layers. According to the Rasmussen counting approach this should lead to an interval duration of:
>
> 188 + ½ x 12 ± ½ x 12 years = 194 ± 6 years.
>
> In the table however, the duration of the interval is stated to be 200±6 years. How does this add up?

Reply: Thank you for the very insightful comment. The reviewer is right in stressing the discrepancy between what stated in the text (use of Rasmussen counting approach and evaluation of related uncertainty) and what reported in the Table. We thank the reviewer for spotting a mistake we made during the compilation of the Table. In fact, the number of uncertain layers was wrongly reported as the half of

what actually counted. We will revise Table 2 correcting the column “Uncertain Annual Layers” and, consequently the column “dating error Abs”.

> The ‘4-seasons’ approach taken in Figure 4 is interesting, but since you have fairly high sample resolution, wouldn’t it be possible to do a more detailed analysis similar to that done in Gfeller et al., 2014, Figure 9 (reference below)? I’m aware that you cannot assign a sample to every month, but you should be able to assign a precise age (in decimal years) to the center of each sample? When stacking over all years, you may then obtain a smooth curve (similar to Gfeller et al), that more precisely will tell you the seasonality of each impurity?

Reply: Thank you for your comment. We initially thought of using this approach, but although the temporal resolution of the core is relatively high, it is not sufficient to try a monthly or two-month resolution. For instance, the interval 1934-1933 CE is covered only by 4 samples. We used decimal years in order to plot the nssSO4 concentration records, but assigning an exact month to each ice layer would require a much higher resolution than the one we were able to provide using our decontamination procedure.

Detailed comments

> Please be consistent in the naming of the ice core. It is sometimes called GV7 (in the title) and sometimes GV7(B) (in the abstract). Use the same notation throughout the MS unless there are several different ice cores in play?

Reply: Thank you for your comment. The name GV7 refers both to the core and to the drilling site. To avoid confusion, the text was edited so that GV7(B) was used only when referring to the core itself, while the name GV7 for the site.

> In several places is mentioned ‘the first meters of the core’ when I think you mean ‘the upper meters of the core'?

Reply: Thank you for your comment, it was edited in the text of the MS

> l. 110-124: We need to know if there was a casing in the bore hole. It says that a 4 m liquid stand was ‘inserted inside’ (should probably be ‘added to’?) the bore hole, which improved the quality of the ice core. However, we also learn that the core was full of breaks and cracks filled with contaminating drill liquid, so would it have been better to use a higher liquid stand for the drilling?

Reply: Thank you for raising this critical point. No casing was used for the bore hole and this information will be added to the manuscript. Moreover, the addition of a 4m liquid stand appeared to be a fair compromise between working time and quality of the core at that time but we agree that a different choice could have been more rewarding.

> l. 125 onwards: It is stated that the isotopic analysis was done in 60 and 4 cm resolution, but I’m struggling to find out if that was also the resolution of the chemistry samples? This is important information that needs to be stated clearly.

Reply: Thank you for your comment. This information will be added to the text.

l. 278-298: Unless you are actually trying out those alternative dating methods and comparing the results, there seems to be no need to spend that much space to explain about them? 'We tried out alternative methods for layer counting (ref, ref, ref), but found that they were not suitable for our dataset for this or that reason'?

Reply: Thank you for your comment. The section will be edited as suggested, removing the methods that were tested but ultimately not used for the dating.

l. 312 onwards: You are discussing missing sections of the core. Could this be quantified, so we know how important it is and how long intervals/periods are missing?

Reply: Thank you for pointing this out. As discussed above, a section in Table 1 was added in order to display for each section of the core delimited by volcanic eruptions the amount (%) of missing core.

l. 328 onwards: Is layer thinning other than firnification taken into account here? Is flow-induced layer thinning important or can it be neglected?

Reply: Thank you for your comment. We took into consideration just the firnification thinning. The flow-induced layer thinning can be considered negligible for these reasons:

1. GV7 is located on the ice divide extending from the Oates Coast to Talos Dome

2. The ice velocity is very low (max 0.3 m yr-1, Frezzotti et al., 2007 JGR)

3. The ice thickness upstream GV7 is nearly constant, thus we expect nearly constant thinning function

Figure 2: Could you also mark where the Agung eruption is located in the profile?

Reply: Thank you for your comment, this figure will be edited and both eruptions will be marked.

Figure 3: Would be good to put an age scale or at last a few age markers in this figure similar to Figure 2. Could a similar figure be made for Agung or for any other eruptions?

Reply: Thank you for your comment; as pointed out before, this figure was removed and replaced with another one more detailed.

Figure 7: I find the break-point analysis very confusing as it does not demonstrate any coherence between the cores. Would a 50 yr smoothed curve applied to the three records not be easier to read?

Reply: the reviewer is perfectly right; our results show that there is no coherence between cores. We show that each core is representative of a different East Antarctic snow accumulation area: GV7 and Law Dome are coastal sites (~2000 km far away) whereas Talos Dome is representative of a middle plateau area (~250 km and ~2000 km far from GV7 and Law Dome, respectively). However, we will rewrite the paragraph in order to improve its readability.

Reference:

Gfeller, G., Fischer, H., Bigler, M., Schupbach, S., Leuenberger, D., and Mini, O.: Representativeness and seasonality of major ion records derived from NEEM firn cores, Cryosphere, 8, 1855-1870, 10.5194/tc-8-1855-2014, 2014.