Climate of the Past Discussions

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Comment on cp-2021-44

Anders Svensson (Referee)

Referee comment on "Dating of the GV7 East Antarctic ice core by high-resolution chemical records and focus on the accumulation rate variability in the last millennium" by Raffaello Nardin et al., Clim. Past Discuss., https://doi.org/10.5194/cp-2021-44-RC2, 2021

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.

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?

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?

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?

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

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?

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.

l. 232: When you say 'dust', do you mean tephra or volcanic ash particles?

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'?

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?

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

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

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?

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?

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.