

Interactive comment on “Interpolation methods for Antarctic ice-core timescales: application to Byrd, Siple Dome and Law Dome ice cores” by T. J. Fudge et al.

Anonymous Referee #2

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This is a very interesting article that gives a quantification of errors induced by the interpolation methods. The paper is nicely written, but I would like to have more description of the ALT interpolation method, as it is the one used for the final tests. The time units should be uniformed (ka in figures and kyr in the text and captions). I encourage the authors to consider the following comments and recommend publication after minor revisions.

Comments:

P66 L26: GICC05 chronology should be cited with full references: Vinther et al., 2006, Rasmussen et al., 2006, Andersen et al., 2006 and Svensson et al., 2008.

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P67 L25: it is not really how Datice works. I propose to replace "among all timescales" by "among initial timescales and age constraints by taking into account their respective confidence intervals".

P67 L26: replace Talos Dome by TALDICE and add NGRIP. The references for the TALDICE-1a age scale are Buiron et al., 2011 and Schüpbach et al., 2011, not Stenni et al., 2011.

P68 first paragraph: please add a few sentences on the origin of ALT and why you tested this method.

P69 L2-4: your definition of the tie points is not clear. Are they taken on the gas or ice age scale? From the chronology file I see that it is the ice age corresponding to the depth in the table, but it is confusing due to the intervention of methane in your explanation.

P69 L27: the Bayesian approach allows the thinning, but also the accumulation rate and the lock-in depth to vary.

P70 L1-3: it is possible to use Datice with only one site considered. It will only consider the absolute age markers and the initial guess of accumulation, thinning function and lock-in depth to obtain a new chronology. This is what has been done for the TALDICE-1a chronology (Buiron et al., 2011, Schüpbach et al., 2011).

P74 L22-24: "the other interpolation methods overestimate the age because they yield smaller layer thicknesses at the older side of the interval" For me, the figure shows that the ages are underestimated, as the difference (WDC06A-7 – interpolation) is positive between 8-12 ka. Please check consistency between text and figures.

P75 L25-2: "if the age difference 500 yr from the closest tie-point is 50 yr...". This is not very clear. You should reformulate this example or keep only the next sentence that is more understandable for the rate of accumulating uncertainty.

P76: 1 sigma corresponds to 68%, not 67%. In Figure 5 caption you wrote 66%. Check

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consistency.

P77 L28: you wrote 200 yrs in the text, but it is 181 yrs in the Table. You should write 181 yrs also in the text for consistency.

P78 L9: the EDML1 timescale was published by Ruth et al., 2007, not Parrenin et al., 2007.

comment: the depth-age of tie-points for the test on WAIS are not directly consistent with the depth-age of tie-points in the EDML test. I mean that for WAIS you took ice ages that correspond to ages of methane events. For EDML you used the ice age at the same depth of methane events. To be consistent between your tests, you should have taken the EDML depth for ice ages equal to ages of methane events.

P78 L15-16: maybe add that this feature was also observed on the WDC06A-7 layer thickness at nearly the same time.

P78 L21-22: "Overall, the variation in annual-layer thickness between ALT and AICC2012 is about the same as among the three EDML timescales". Please explain more precisely.

P78 L27-28: did you test ALT with ages deduced from EDML1 or LD2010, to see if it reproduces the same behaviour after 10 ka and at 15 ka? I would like to see these results.

P80 L6: which interpolation step?

P80 L21-25: ages are different than the ones given in Table 4. Please correct this. Moreover, there is the same time span in-between tie-points at Law Dome and Siple Dome / Byrd, so it cannot be the main cause for a larger difference.

P81 L1-2: I suggest to include a comparative figure of water isotopes of WAIS, EDML and Byrd in the appendix to illustrate this point.

P81 L4: "shifted up to 150 yr", younger?

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P81 L7: "250 yr at 17.5 kyr", -250?

P81-82: twice "occurs" in the same sentence.

Appendix B:

P85 L10-18: I don't understand this paragraph, the B3 terms are not the ones associated with the ALT method? In that case ALT and ACCUM are reversed in lines 11 and 13. If I am not correct, this paragraph is not clear and should be revised.

P86 L9: replace "first" by "third", and I am not sure "deemphasizes" is proper English.

Tables and figures:

Table 1: precise that ages come from WDC06A-7 age scale. Moreover, check consistency between these points and the ones used for your tests. On the figures the lines do not necessarily correspond (obvious for the tie-point at 14 ka...)

Table 2: Average age bias

Table 3: missing units and the age scale from which the tie-points originate. You must precise that these ages are from AICC2012 and not from the other two EDML chronologies. You should also precise the uncertainty of the original chronology at these tie-points.

Table 4: missing units and "depth" and "ice age" lines of Low Dome are inverted.

Figure 1: standardisation of ka and kyr. You know that this can be updated with data on AICC2012 as NGRIP is part of it (available on Pangaea and ncdc databases).

Figure 5: 1 sigma is 68%, and not 67 or 66%.

Figure 7: precise the age difference. I suppose it is the age scale – ALT?

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