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Climate of the Past Discussions

# *Interactive comment on* "A complete representation of uncertainties in layer-counted paleoclimatic archives" *by* Niklas Boers et al.

**Anonymous Referee #2**

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This is an interesting contribution to enhancing our understanding of the chronological uncertainties of layer-counted fossil archives. Several sections need more clarification or expansion, and the interpretation and implications of the $\delta^{14}$C record need to be checked. Pending these changes I would recommend publication.

The potential for asymmetric errors in layer counting needs to be discussed. There is a probability of missing annual layers, and a different probability of falsely assuming layers are annual. How was this approached in NGRIP and Suigetsu, and how might this affect the errors and your analysis?

p8 lines 15–16, it could be mentioned that *if* for example a tephra were to be found in the Greenland ice cores or Suigetsu, and *if* this tephra could be reliably linked to a specific eruption independently dated elsewhere, then the age for that eruption could



be used to 'reset' the accumulated errors below and above that tephra layer. A big and unrealised 'if', but this would certainly help reducing the errors.

Abstract line 10 (also p4 line 1,3,5), the Suigetsu dataset is not presented as a calibration curve. It is a dataset that can contribute to a $^{14}$C calibration curve (and indeed forms part of the IntCal13 calibration curve). On p8 you correctly name the Suigetsu time-series as a comparison curve – please use this term instead of calibration curve throughout the manuscript. I would also disagree with your suggestion to start calibrating radiocarbon ages with Suigetsu. The IntCal curve remains the internationally ratified curve and remains recommended for calibration of $^{14}$C dates. It has more dates than just the Suigetsu ones, and it contains a model to derive calendar age and radiocarbon age uncertainties.

p3 line 31&33, do you really mean $\delta^{14}$C here, or rather $^{14}$C? The measurements are in $^{14}$C, and $\delta^{14}$C involves estimating the calendar timing and from this calculate atmospheric $^{14}$C concentration at a series of points in time. Therefore, $\delta^{14}$C values depend on the record's age-model (i.e. a given $^{14}$C age will result in a different $\delta^{14}$C value at a different calendar age *t*). Please clarify this in your manuscript. Also, is this time-dependency properly accounted for in Fig. 4B surely your $\delta^{14}$C clouds should be sloping?

p2 line 20–22, also p7 line 1 and p10 lines 1–2, this is not entirely new. Previous literature has developed approaches to visualise dating uncertainty of proxy records, e.g. Blaauw et al. 2007 (doi:0.1177/0959683607075857, Fig. 2), even though they do not include the uncertainties of proxy measurements. For absolute and relative errors in ice cores see also Figs 4 and 5 of Blaauw et al. 2010 (doi:10.1002/jqs.1330).

Details

p2 line 3, not all layered records are varves (e.g., trees, ice)

p2 line 19, what are bifurcation parameters? Needs more explanation for Climate of the Past readers, or alternatively left out

p5 line 14, what is a Riemann sum? Provide a reference or explain for Climate of the Past readers

Language p5 line 19, chosen

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