

Interactive comment on “Annual layering in the NGRIP ice core during the Eemian” by A. Svensson et al.

Anonymous Referee #2

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This paper explores the possibility of annual layer counting of the deepest section of the NGRIP ice core. This is a continuation of the method developed to date the Holocene and Glacial period from this ice core and shows that some annual layers may still be preserved in ice from the last interglacial.

The paper is generally well written and presents some interesting data however I am sceptical that the dating approach is reliable enough to count individual years. Unfortunately I am not convinced by the methodology and therefore in its current form I do not think it is suitable for publication.

The authors show that ammonium has undergone significant diffusion over the 110kyr period making it too smoothed to detect annual layers. Sodium is also dampened and therefore the resulting annual layer counting, and subsequent conclusions about layer

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thickness, is based largely on two parameters. I am doubtful that dust and conductivity are good enough to independently count annual layers. Looking back at some of the figures from Rasmussen et al., (2006) ECM and dust are not very convincing during the Holocene. The figures published in that paper show several multi-peaks in dust while ECM is really not very well suited for identifying annual layers. These early studies were aided by multi-parameters to constrain the selection of years however this is not possible during the Eemian ice.

I think it is possible that some annual layers can still be identified during the Eemian. Indeed the periodicity of the wiggles in some sections is convincing, however the errors presented in this paper are not appropriate for this dataset. There are years which have been assigned as definite where there is no data (eg Fig 5) and sections where dating is based purely on conductivity (Fig S1) (which we know from the Holocene sections is probably not reliable). If the authors wish to persevere this dating method then I would urge them to assign a far greater error estimate. Using only two (and in some cases just one) parameters has to have a far greater error associated with it than the previously published multi-proxy approaches.

There is value in publishing data from this time period. Presenting small sections where annual layers may still be identified, comparing concentrations with Holocene values and exploring the diffusion and ice crystal effects are important in helping us understand the climate of the last interglacial. However, I am not comfortable with using this method to date the ice core or make conclusions about the annual layer thickness. Additional parameters are needed and a more realistic estimation of the error involved.

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