

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

Anonymous Referee #1

Received and published: 29 April 2011

This paper presents the first high resolution profiles of sodium, ammonium, dust and conductivity over the bottom part of the NorthGRIP ice core corresponding to the last interglacial period. From these measurements (especially dust and conductivity), the authors are able to deduce the thickness of the annual layer at the very bottom of the NorthGRIP ice core. This is very important since it permits to constraint the age model of this ice core for its deeper part.

In general, the paper is concise, well written and the method is clearly explained but I have several important concerns concerning the goal of the paper as well as some points in the discussion of the dating issue that are detailed below :

Part 4 : I had difficulties in following the explanation for the profile smoothing from line 26 of the page 754. So that it would be nice to write this section again more clearly.

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More specifically, it seems to me (if I understood correctly the text) that between line 12 and 25, the authors try to explain the differences between Holocene and Eemian data (Dust, conductivity, Na, NH₄) but do not manage in a simple way ; it seems that neither the effect of ice compression nor impurity diffusion explains the spectra. Then, they discuss separately the different data sets and draw different comparison (with glacial ice for dust for example). I had really difficulties in following the argumentation in this section as well as to see the conclusions of this section : what conclusions do the authors draw here ?

Part 5 : This part is more clearly explained but still, I have the feeling that the conclusions from this section is not clear. It seems to me that we do not learn new things from this part. We have information on different mean level of impurity or chemical species and Åñ so what Åž ? We are left with questions for what to do with this information. What is it useful for ?

Part 7 : In this part, I think that the authors should do an effort for discussing in more details the different ice core chronologies that are available for the NorthGRIP ice core as well as the uncertainties attached to that. In contrast with the authors' affirmation, there are large discrepancies (several kyrs) for MIS 5 between a chronology based on speleothem (Drysdale et al., 2007 ; Wang et al., 2008 ; Cheng et al., 2009) and a chronology based on the Antarctic EDC3 timescale (Capron et al., 2010). So it is not really possible to state that the NorthGRIP ss09sea is supported by these two very different chronologies. It would be nice if the authors could discuss more precisely the different chronologies, show a graph with the differences and try to conclude from their constraints if one timescales is better than the other. Probably, the constraints on the annual thickness is too low to choose between the two timescales but in this case, it should be stated more clearly and also recognize that ss09-sea is not in agreement with both speleothem constraints and EDC3 timescale.

Part 8 can probably be placed before part 7. Indeed, it seems to me that the most important potential conclusion of this paper is the dating issue.

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